

Yosemite National Park

National Park Service
U.S. Department of the Interior



Tuolumne Wild and Scenic River Final Comprehensive Management Plan and Environmental Impact Statement

Volume Two

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Chapter 9: Affected Environment and Environmental Consequences

Introduction

Focus of the Analysis

The National Environmental Policy Act (NEPA) requires documented disclosure of the projected environmental consequences of a proposed federal action and of the reasonable alternatives to that action (including no action). This disclosure must clearly identify any adverse environmental effects on the human environment that cannot be avoided should the proposed action be implemented. Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to take into account the effects of their undertakings on historic properties. National Park Service (NPS) management policies and cultural resource management guidelines call for the consideration of historic properties in planning proposals. In compliance with these laws and policies, this chapter of the *Final Tuolumne River Plan/EIS* identifies and describes the natural and cultural resources and values that could be affected by the alternatives presented in volume 1, “Chapter 8: Alternatives for River Management” and evaluates and compares the potential consequences of the alternatives. Guidance for this analysis is provided by regulations published by the Council on Environmental Quality (CEQ) (40 *Code of Federal Regulations* [CFR] 1500), NPS Director’s Order (DO) 12 (“Conservation Planning, Environmental Impact Analysis, and Decision-making”), and the Advisory Council on Historic Preservation (ACHP).

The following analysis topics are either discussed in detail in this chapter or dismissed from further consideration for reasons explained in the next few pages.

Analysis Topics

Natural Resources

- Geology, Geohazards, and Soils
- Hydrology, Water Quality, and Floodplains
- Wetlands
- Vegetation
- Wildlife
- Special Status Species
- Lightscapes
- Soundscapes
- Air Quality

Sociocultural Resources

- Scenic Resources
- Visitor Experience
- Wilderness
- Park Operations and Facilities
- Transportation
- Energy Consumption and Climate Change
- Socioeconomics

Historic Properties

- Historic Buildings, Structures, and Cultural Landscapes
- Archeological Resources
- American Indian Traditional Cultural Resources

Resource Topics Dismissed from Detailed Analysis

To ensure that particular components of the human environment are always considered during preparation of an environmental impact statement, the CEQ developed a list of mandatory topics that must be considered if they would potentially be affected by one or more of the planning alternatives. Items on that list that were considered but dismissed are discussed below.

Environmental Justice

Environmental justice analyses determine whether a proposed action would have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations, per Executive Order 12898. The NPS and other federal agencies have determined that a disproportionately high and adverse effect on minority and low-income populations means an adverse effect that (1) is predominately borne by a minority population and/or a low-income population, or (2) will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population.

Potential adverse effects identified in an environmental justice analysis include air, noise, and water pollution; soil contamination; destruction or diminution of aesthetic values; destruction or disruption of community cohesion and economic vitality; displacement of public and private facilities and services; increased traffic congestion; and exclusion or separation of minority or low-income populations from the broader community. Of particular concern is the effect on property acquisition and displacement of people.

No aspect of any alternative in the *Final Tuolumne River Plan/EIS* would result in disproportionately high and adverse human health or environmental effects on minority populations or low-income populations. Any restriction on travel, lodging accommodations, or access to any area of the park that might result from this plan would be equally applied to all visitors, regardless of race or socioeconomic standing. The one exception to this policy is that use by traditionally associated American Indian tribes and groups is and would continue to be managed independently of general public recreational use. Effects on traditionally associated tribes are assessed as part of this environmental impact statement (see “American Indian Traditional Cultural Resources” analysis topic, below).

Although levels of park employee housing in various areas may be affected by decisions made under the *Tuolumne River Plan*, employee housing decisions are not expected to result in destruction or disruption of community cohesion and economic vitality, displacement of public and private facilities and services, increased traffic congestion, and/or exclusion or separation of minority or low-income populations from the broader community.

Prime and Unique Agricultural Lands

There are no agricultural lands within Yosemite National Park; therefore, no further discussion of this topic is necessary. Also, no alternative in this environmental impact statement would have any direct or indirect effects on downstream agricultural lands.

Public Health and Safety

Public health and safety is not presented as a separate topic in this environmental impact statement. Instead, park-related public health and safety issues are adequately addressed under other analysis topics, such as water quality and park operations and facilities.

Land Use

Land use within the Tuolumne River corridor is managed under a variety of federal laws, NPS policies, and Yosemite National Park policies and plans. The following laws and policies direct land use in the Tuolumne River corridor: The National Park Service Organic Act, the Yosemite National Park enabling legislation, the Wild and Scenic Rivers Act (WSRA), and the Wilderness Act. These all call for the conservation and preservation of the natural, cultural and scenic features of the park, while providing for public use and enjoyment of the area. NPS management policies (NPS 2006g) and associated DOs direct management of natural and cultural resources, wilderness, and visitor use; the policies also address development of visitor and park facilities. The *Tuolumne River Plan* complies with all these laws and policies.

None of the alternatives presented in this environmental impact statement would fundamentally affect land use within the Tuolumne River corridor. Under each of the alternatives, opportunities for both day and overnight recreational use would be retained. The character of the recreational use would differ under the various alternatives (for example, visitors would need to be more self-sufficient under alternative 1). However, all of the alternatives would continue existing land use under guidance of the laws, policies, and plans listed above. The changes in the character of recreational use that would occur under some alternatives are addressed under the “Visitor Experience” analysis topic, below.

Museum Collections and Objects

The Yosemite Museum collection is not presented as a separate topic because the *Tuolumne River Plan* does not specifically call for any data collection activities. Future projects undertaken in the river corridor or in the Tuolumne Meadows area could require data collection. Any effect from these projects on the Yosemite Museum collection would be addressed within project-specific compliance documents.

Organization of this Chapter

Descriptions of the affected environment and the environmental consequences of the alternatives are combined in this single chapter to help focus the discussions and make it easier to understand the differences among the alternatives in terms of their impacts on specific resources and values. For each analysis topic, a concise description of the resource or value that could be affected is followed by a comparison of effects of the no-action and action alternatives. Where appropriate, these discussions are subdivided into wild or scenic river segments (see “How the Analysis is Organized,” below) followed by a conclusion of impacts corridorwide. Analyses of cumulative impacts are also presented for each analysis topic.

After the affected environment and environmental consequences discussions, the impacts of each alternative are summarized, and each alternative is further described in terms of unavoidable adverse effects across all analysis topics, irreversible and irretrievable commitments of resources, and the relationship between short-term uses of the environment and long-term productivity.

How the Analysis is Organized

In this chapter, the analysis of management actions and their environmental consequences is organized by river segment and classification where appropriate (see table 3-1 and figure 3-1 in chapter 3) because the management guidance under the WSRA differs for *wild segments* and *scenic segments*. The discussion of the wild segments (segments 1, 2, 5, and 7, see table 3-1) encompasses the Lyell Fork, Upper Dana Fork, Grand Canyon, and Poopenaut Valley segments. Almost all lands and waters in these segments are also designated Wilderness. The one exception is the Glen Aulin High Sierra Camp in the Grand Canyon segment, which is a potential wilderness addition.

The discussion of the scenic segments (segments 3, 4, and 6, see table 3-1) includes the Tioga Road corridor in the Lower Dana Fork segment, Tuolumne Meadows in the Tuolumne Meadows segment, and the dam

administrative site in the Below O'Shaughnessy Dam segment. All these segments contain some lands that are included in designated Wilderness, and those areas will be managed the same as the wild segments.

General Approach to Impact Analysis

Evaluating Impacts under the National Environmental Policy Act

NPS guidelines for NEPA analysis call for evaluating environmental consequences based on context, duration, intensity, and type, and whether the impacts are direct, indirect, or cumulative. The following guidelines are applicable to all the analysis topics except historic properties, which are evaluated using guidelines developed for the implementation of the NHPA (see below).

Context: The context considers whether the impact would be local or regional. For the purposes of this analysis, local impacts would be those that occur in the immediate vicinity of an action or in a nearby area indirectly affected by the action, unless specifically noted otherwise in the environmental consequences discussion for individual resource topics.

Duration: The duration of an impact is noted as either short term or long term in nature. Short-term impacts are typically associated with construction-related actions and could last up to two years unless otherwise noted. Long-term impacts are those that would typically last longer than two years unless otherwise noted.

Intensity: The intensity of an impact, whether it is negligible, minor, moderate, or major, is included in the conclusions of impact for each resource topic considered in this document.

Type: The type of impact refers to whether the impact is considered beneficial or adverse. Beneficial impacts would improve resource conditions. Adverse impacts would deplete or negatively alter resources.

Evaluating Impacts under the National Historic Preservation Act

Any prehistoric or historic building, structure, object, site, or district that is included in, or is eligible for inclusion in, the National Register of Historic Places (NRHP) is termed a *historic property* and is managed for protection under the NHPA. Types of historic properties include archeological sites, historic sites, archeological and historic districts, cultural landscapes, and traditional cultural properties. These resources may also be considered under the Archeological Resources Protection Act, the Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act, and Executive Order 13007 (Indian Sacred Sites).

Section 106 of the NHPA requires the federal agency to take into account the effects of its undertakings on historic properties and to provide the ACHP a reasonable opportunity to comment. Section 106 also applies to properties not formally determined eligible, but which may meet eligibility requirements for the NRHP and are therefore treated as eligible until a determination can be made.

National Historic Preservation Act Determinations of Effect

Conventional terms used by the NPS to measure the context, duration, intensity, and type of impact as part of NEPA analysis are not valid for assessing effects on historic properties under NHPA standards. Because the effect on a historic property is measured by the status of the historic property's eligibility for listing in the NRHP, the negligible, minor, moderate, and major degrees do not apply. Either a historic property maintains the characteristics making it eligible for listing in the NRHP, or it does not.

The ACHP has issued regulations for the implementation of section 106, entitled *Protection of Historic Properties* (36 CFR 800). ACHP regulations discuss the following types of effect:

No Historic Properties Affected: When there are no historic properties present, or the action will have no effect on historic properties, the action is said to have *no effect* on historic properties.

No Adverse Effect: *No adverse effect* occurs when there will be an effect on a historic property, but the action will not alter characteristics that make the property eligible for inclusion in the NRHP in a way that would diminish the integrity of the property.

Adverse Effect: *An adverse effect* occurs when an action will alter, directly or indirectly, any of the characteristics of a historic property that qualify it for inclusion in the NRHP, in a way that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative.

The regulations allow an agency, such as the park, to defer both the identification of historic properties (that is, the identification of whether or not a resource is eligible for the NRHP) and the effects assessment through the development of a programmatic agreement. The agreement may also stipulate additional terms, such as reporting criteria, monitoring, and dispute resolution. Yosemite National Park's section 106 review process is augmented by national and park-specific programmatic agreements among the NPS, the ACHP, and the National Council of Historic Preservation Officers or the California state historic preservation officer (SHPO) (NPS, ACHP, and NCSHPO 2008; NPS, SHPO, and ACHP 1999). Both agreements are included in appendix D.

Resolving Adverse Effects on Historic Properties

An adverse effect under section 106 of the NHPA can be resolved with a good faith effort to consider whether and how to avoid, reduce, or mitigate the effect. This could be done by modifying the undertaking; imposing certain mitigation conditions, such as photo documentation; treating historic buildings, structures, and landscapes in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*; or other measures negotiated in consultation with the California SHPO, traditionally associated American Indian tribes and groups, and the public. These measures would be documented in a memorandum of agreement or a NEPA decision document. The park-specific 1999 programmatic agreement and the NPS 2008 nationwide programmatic agreement, both included in appendix D, stipulate standard mitigation measures that can be used to address adverse effects on historic properties. Among others, these measures include recordation, salvage, interpretation, and NRHP reevaluation. Archeological resources that may be discovered are proposed to be treated using the *Archeological Synthesis and Revised Research Design* (Hull and Moratto 1999). These mitigation measures may not, however, address adverse effects on all historic properties, especially those that are American Indian places of significance.

Special Requirements for Protecting National Historic Landmarks

The ACHP regulations also discuss special requirements for protecting national historic landmarks (36 CFR § 800.10). Parsons Memorial Lodge is a national historic landmark in Tuolumne Meadows that would be subject to this rule. National historic landmarks are afforded special consideration in planning efforts to minimize harm. This statutory requirement stems from section 110(f) of the NHPA.

Environmental Consequences Methodologies

In accordance with the ACHP regulations implementing section 106, effects on historic properties were identified and evaluated using the following methodologies:

- Use a working (proposed) area of potential effect, defined below. The proposal for this area was made by the park in its letter to SHPO of April 2008.
- Identify cultural resources present in the area of potential effects that were either listed, eligible for listing, or otherwise treated as eligible for listing in the NRHP.

- Apply the criteria of adverse effect to affected cultural resources to the best extent possible given the current understanding of the plan.
- Consider ways to avoid or minimize adverse effects.

Area of Potential Effect for this Plan

As defined under the ACHP regulations at 36 CFR 800.16(d), the area of potential effect means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. For the *Tuolumne River Plan*, the proposed area is composed of the Tuolumne Wild and Scenic River corridor in Yosemite National Park (see figure 1-1 in chapter 1) and also includes the full extent of the Tuolumne Meadows Historic District, which lies partially outside the corridor (see figure 9-11 in this chapter under Historic Properties). If effects on historic properties are identified outside this working boundary, then the area of potential effects will be modified to include the affected properties.

Historic Properties Analyzed for this Plan

Historic properties that could potentially be affected by the *Tuolumne River Plan* include several NRHP-eligible historic districts: Tuolumne Meadows Historic District, the Soda Springs Historic District (encompassed in the larger Tuolumne Meadows Historic District), the portion of the Tioga Road Historic District within the boundary of the Tuolumne Meadows Historic District, and the Glen Aulin Historic District; historic buildings and structures that are individually listed on the NRHP, including Parsons Memorial Lodge National Historic Landmark; individual historic buildings, structures, and features in designated Wilderness and below O'Shaughnessy Dam that are potentially eligible for inclusion in the NRHP; archeological resources that have been evaluated for the NRHP, including the Tuolumne Meadows Archeological District; archeological resources whose values are as yet unknown; and cultural resources of significance to American Indians.

Cumulative Impacts

The environmental consequences sections also include a discussion of the *cumulative impacts*, which considers the *Tuolumne River Plan* in the context of other past, current, or proposed projects in the area. A cumulative impact is described in regulations developed by the CEQ (CEQ regulation 1508.7), as follows:

A "Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Appendix L contains the list of past, present, and reasonably foreseeable actions included in the cumulative impacts analysis. These cumulative actions are evaluated in conjunction with the impacts of an alternative to determine whether they would have any additive effects on a particular resource or value.

General guidance and methodologies for the cumulative impacts analysis in this document follow those published by the CEQ (CEQ 1997). Cumulative impacts have been analyzed for each alternative and are included under each analysis topic. The methodology for defining the context, intensity, duration, and type of cumulative impacts is the same as that described for evaluating impacts under the NEPA, above.

Impairment

In addition to determining the environmental consequences of the alternatives, *NPS Management Policies 2006* (NPS 2006g) and NPS DO-12 require analysis of potential effects to determine if actions would impair park resources and values. The evaluation of impairment will be included with the record of decision for this plan.

Mitigation

The NPS places a strong emphasis on avoidance, minimization, and mitigation of impacts to help ensure that the activities associated with the *Tuolumne River Plan* will protect park resources and the quality of the visitor experience. Mitigation measures include the following types of actions:

- **Avoid** conducting management activities that would adversely affect the resource.
- **Minimize** the type, duration, or intensity of the impact on an affected resource.
- **Repair** localized damage to the affected resource immediately after an adverse impact.
- **Rehabilitate** an affected resource with a combination of additional management activities.
- **Compensate** a major long-term adverse direct impact through additional strategies designed to improve an affected resource to the degree practicable.
- **Recover** important scientific or other data that may be lost from archaeological sites.

Specific mitigation measures that would occur prior to, during, and after construction under all action alternatives are described in “Appendix O: Mitigation Measures Common to All Action Alternatives.”

Analysis Topics: Natural Resources

Geology, Geohazards, and Soils

Affected Environment

Geology

Yosemite National Park occupies approximately 1,170 square miles within the central portion of the Sierra Nevada, the highest and most continuous mountain range in California. Granitic rock dominates a significant portion of the Sierra Nevada. About 100 million years ago, magma slowly migrated toward the earth's surface and began to cool, forming very large subsurface bodies of solidified granitic rock known as batholiths.

Between 100 million years ago and 65 million years ago, a long period of uplift and erosion began in the Sierra Nevada. Erosion removed the overlying rocks and exposed the underlying granitic batholith. Eroded material was transported westward and filled the present-day Central Valley with deposits that are tens of thousands of feet thick. About 15 million years ago, the relief of the Sierra Nevada in the Yosemite region had rolling upland topography and a lower elevation than the present-day range. Volcanic activity, prevalent in the northern Sierra Nevada from about 38 to 10 million years ago, deposited ash, filled valleys, buried streams, and altered river courses.

Mountain-building activity was reactivated about 25 to 15 million years ago, uplifting and tilting the Sierra Nevada to form its relatively gentle western slope and the more dramatic, steep eastern slopes. The uplift increased the gradients of the rivers and resulted in deeply incised river valleys.

Between 2 million and 20,000 years ago, snow and ice accumulated as glaciers at the higher alpine elevations began to move westward down the mountain valleys. At least three major glacial periods occurred during the ice age in the Sierra Nevada: the Pre-Tahoe (oldest), the Tahoe (intermediate), and the Tioga (youngest). The downslope movement of the ice masses cut and sculpted the valleys, cirques, and other glacially formed landforms throughout the Yosemite region and the Sierra Nevada.

The depositional and erosional glacial features viewed today in Yosemite and within the Tuolumne River corridor are primarily the result of the Tioga glacial event, although the cumulative effects of the previous glaciations are responsible for the overall shape and character of the region. The Tioga was the last glacial

event, beginning as late as 60,000 years ago, when the climate cooled sufficiently to allow small glaciers to form on erosional features sculpted by earlier glaciers. Throughout this period in the Yosemite area, the ice field grew and pushed fingers of ice into the major drainages on the west slopes, until it reached its maximum extent about 20,000 years ago (Huber 1989). The longest glacier in the Yosemite area extended down the Grand Canyon of the Tuolumne, to just beyond Poopenaut Valley. When this glacier receded, it left behind features such as glacial erratics, glacial till, moraines, domes, kettle ponds, U-shaped valleys, glacially carved hanging valleys, and other glacial features that have become part of a unique landscape along the Tuolumne River corridor and adjacent areas.

Soils

Soils of the Yosemite region are primarily derived from underlying granitic bedrock and are of similar chemical and mineralogical composition. Except for meadow soils, most high country soils developed in glacial material (glacial soils) or developed in place from bedrock (residual soils). Extensive areas above 6,000 feet are covered by glacial moraine material, a mixture of fine sand, glacial flour, and various-sized pebbles and boulders. Alluvial soils (fine-grained soils deposited by flowing water) developed along streams through erosion and deposition and tend to have sorted horizons of sandy material. Various areas of the river corridor have meadow soils consisting of accumulated clays, silts, and organic debris that are subjected to occasional flooding.

Within the river corridor, topography is the most important factor contributing to soil differentiation since it influences the separation and distribution of rock and soil particles, surface runoff, and groundwater levels.

Wild Segments: Lyell Fork and Upper Dana Fork

Both the Lyell and Dana Forks of the Tuolumne River originate at approximately 11,500 feet, with the Lyell Fork descending from Lyell Glacier and the Dana Fork from snowfields at the watershed divide. Between 9,500 and 11,500 feet, these forks flow through an area characterized by barren rock outcrops, rock rubble, and reworked glacial materials from past glacial events that are typically found in glacially scoured mountain valleys. Slopes tend to be greater than 30%.

Between 8,000 and 9,500 feet, topography tends to be gently sloping (slopes less than 15%), and soils near the meandering river experience seasonal flooding and/or periods of seasonally high groundwater. These long low-gradient reaches along much of the Lyell Fork, the lower Dana Fork, and the main stem through Tuolumne Meadows, are conducive to the accumulation of the clays, silts, and organic debris that characterize meadow soils. Much of the meadow area consists of recently glaciated granitic bedrock overlain by 1–2 meters (approximately 3 to 6 feet) of alluvial sand and gravel topped with 30–40 centimeters (approximately 12–16 inches) of organic, carbon-rich meadow soil.

Impacts on soils along the Lyell and Dana Forks would be generally limited to trail corridors. Impacts along trails may include soil compaction and loosening of the trail tread, which could lead to increased soil erosion. In addition, recent research (Ballenger et al. 2010j) quantified threats to the integrity of meadows in the park related to high levels of recreational pack stock grazing. This study, which included meadows in Lyell Canyon, observed significantly higher levels of bare ground in meadows with high levels of documented pack stock use, compared with meadows with low stock use and no stock use. Additional documented impacts on soils in pack stock use areas of Lyell Canyon included roll pits, exacerbated streambank erosion, and hoofpunching in wet meadow areas.

Scenic Segments: Tuolumne Meadows and Lower Dana Fork

Based on initial assessments of soils in the Tuolumne Meadows area completed by the National Resources Conservation Service (NRCS), meadow soils are comprised of sandy loams, loamy sands, and silt loams, with some component of volcanic ash or glacial till (Jones & Stokes 2002). Tuolumne Meadows also has isolated

areas of rock outcrop and small areas of steeper slopes (greater than 30%) that are dominated by gravels, rock rubble, and reworked glacial materials from past glacial events (NRCS 2006).

A hydric soils list has not been completed for the Tuolumne Meadows area, but features indicating prolonged inundation or saturation during the growing season have been observed in many areas (NPS, Buhler et al. 2010e). A 2006 study (Cooper et al. 2006) of the organic matter content of soils at Tuolumne Meadows found that content ranged from 12 to 18% in wet meadow plant communities and approximately 7% in upland and border areas dominated by lodgepole pine and upland plant species. Initial investigations indicate that the high organic content of these soils and the low belowground plant production may suggest that the existing vegetation did not form these soils (Cooper et al. 2006).

The organic carbon-rich soils that developed under these conditions are highly productive, contributing to the diverse subalpine meadow and riparian habitats described below under “Vegetation.” While these soils may be highly productive, they are also susceptible to compaction from use, which adversely affects their ability to support native vegetative cover. Compacted soils also reduce the ability of surface water to infiltrate soil, thus increasing the risk of erosion by accelerating runoff.

Studies on effects of historic human activities on meadow hydrology, meadow soils, and meadow vegetation in Tuolumne Meadows are ongoing. Recent research (Holmquist and Schmidt-Gengenbach 2008; Cooper et al. 2006) into the causes of meadow vegetation change points to foot traffic in popular visitor use areas, development activity (e.g., ditching associated with road construction and the introduction of nonnative fill), and possibly the effects of 19th century livestock grazing. These effects are described more fully under “Vegetation,” below. Disturbed hydrologic processes associated with the channeling of surface flow at ditches, incised channels, and formal and informal trail corridors has altered scour and sediment deposition dynamics and created numerous headcuts that have exposed soils (NPS, Buhler et al. 2010e). The loss of fine-grained, organic, carbon-rich soils noted by Cooper and others in 2006 also affects the water retention capacity of meadow soils, thus leading to further drying of the meadows (Lowry and Loheide 2010). The effects of disturbed hydrologic processes on the meadow system are discussed more fully under “Hydrology,” below.

In addition, trampling has resulted in a high proportion of bare ground and compacted soils near high use areas of the meadows. The meadow areas adjacent to these high-use areas are characterized by a high proportion of bare ground, dead or damaged vegetation, and compacted soils. Compacted soils and bare soil exposure may also contribute to the lodgepole pine encroachment apparent in Tuolumne Meadows (Vale and Vale 1994; Buhler et al. 2010e). The suspected causes of conifer encroachment at Tuolumne Meadows are discussed more fully under “Vegetation,” below.

Wild Segment: Grand Canyon of the Tuolumne

Upon leaving the western margin of Tuolumne Meadows at 8,600 feet, the river begins a steep descent over cascades and steps and enters the Grand Canyon of the Tuolumne. At approximately 7,500 feet, a large river terrace at Glen Aulin includes an alluvial zone at the confluence of Conness Creek and shallow, mineral, non-hydric soils. The National Resource Conservation Service classified soils in the Glen Aulin area as mineral, relatively shallow, and non-hydric (NPS, Elliot 2006d, NRCS 2006). However, a 2006 wetland survey at Glen Aulin found hydric soil characteristics at wetland areas. Two of these wetland areas exhibit impacts from foot traffic and pack stock use, including soil compaction and denuded vegetation (NPS, Elliot 2006d).

Beyond Glen Aulin, the Grand Canyon is characterized by steep (30% and greater) slopes dominated by rock walls, outcrops, rock rubble, boulders, and reworked glacial materials. Small areas of the canyon bottom contain soils that support areas of riparian growth, particularly in the Pate Valley area. Below the Grand Canyon of the Tuolumne, the river enters Hetch Hetchy Reservoir at approximately 3,800 feet.

Scenic Segment: Below O'Shaughnessy Dam

The river corridor immediately below O'Shaughnessy Dam is characterized by steep rocky outcrops and rock walls with slopes ranging between 30% and 100%. In areas where slopes are less than 30%, soils are dominated by boulders, rock rubble, and reworked glacial materials from past glacial events.

Wild Segment: Poopenaut Valley

Continuing downstream, the river passes through a glacially carved U-shaped valley (Poopenaut Valley), where gentler slopes (less than 30%) consist of valley soils that are seasonally flooded and/or experience seasonally high groundwater levels. From Poopenaut Valley to the western park boundary at approximately 2,800 feet, the river corridor transitions to a V-shaped canyon with steep slopes (greater than 30%) dominated by rock walls, outcrops, rock rubble, boulders, and reworked glacial materials. This transition zone from a U-shaped valley to a more incised V-shaped canyon farther downstream contributes to the valley's seasonal flooding.

Hydrologic and related geologic processes (e.g., soil deposition) below O'Shaughnessy Dam have been altered by the presence of the dam. Assessments at Poopenaut Valley (a low-elevation meadow/riparian area located downstream of the dam) indicate that it has been largely spared the severe impacts seen downstream of other dams because of several factors unique to this setting, such as a low overall gradient and a downstream bedrock constriction that promotes floodplain inundation (NPS, Stock et al. 2007k; also see "Hydrology," below). The NPS is working with a consortium of individuals and groups, including the San Francisco Public Utilities Commission (SFPUC), the Stanislaus National Forest, and the U.S. Fish and Wildlife Service (USFWS), to research the impacts of the dam on ecological conditions downstream. The goal of the research is to inform releases from the dam that would more closely mimic natural flows for the benefit of river-dependent ecosystems.

Earthquakes

The Tuolumne River flows through geologically active areas, where geologic and hydrologic forces continue to shape the landform. Geologic hazards associated with these forces, such as earthquakes and rockfalls, present potentially harmful conditions to visitors, personnel, and facilities in Yosemite National Park.

The portion of the Sierra Nevada range in Yosemite National Park is not considered an area of particularly high seismic activity. No active or potentially active faults have been identified in the mountain region of the park (CDMG 1997). However, Yosemite can undergo seismic shaking associated with earthquakes on fault zones on the east and west margins of the Sierra Nevada range, as it has done in the past. These fault zones include the volcanically active area in the Mono Craters-Long Valley Caldera area to the east, and the various faults within the Owens Valley fault zone, also to the east (CDMG 1996).

The Mono Lake fault is located within the Mono Craters-Long Valley Caldera region on the eastern side of the Sierra. Since 1980, this area has experienced considerable seismic activity. Earthquakes have been attributed to movement on the Mono Lake fault (Sierra Nevada frontal fault) and movement associated with resurgent volcanic activity of the Long Valley Caldera. The Mono Craters last erupted 600 years ago. A 5.7 magnitude earthquake on the Mono Lake fault in October 1990 was felt as far west as Sacramento and the San Francisco Bay Area and caused landslides and rockfalls at Tioga Pass and on the Big Oak Flat Road (McNutt et al. 1991). In September 2004, a swarm of earthquakes, with two greater than magnitude 5, occurred in the Adobe Hills north of Long Valley and just east of Mono Lake; the epicenter of the swarm was in the vicinity of the Hunton Valley fault system (CISN 2004).

The Owens Valley fault, located approximately 50 miles south and slightly east of the Tuolumne Meadows area, has experienced movement within the last 200 years, and the California Geological Survey considers this fault active (CDMG, Hart 1997). The most notable earthquake felt in Yosemite National Park was the Owens Valley earthquake of March 26, 1872. The Owens Valley earthquake is estimated to have had a magnitude of 7.6

(USGS, Ellsworth 1990). This earthquake reportedly caused damage in Sacramento and San Joaquin Valleys and caused significant rockfalls in Yosemite Valley area.

Although earthquakes that are felt by people in Yosemite National Park are relatively infrequent, they have occurred in the past and will likely occur in the future. Ground shaking typically is expressed in terms of peak ground acceleration as a percent of 1 g (g is acceleration due to gravity, or 980 centimeters [32 feet] per second squared). The peak accelerations estimated in the Yosemite National Park region of the Sierra Nevada are between 0.1 and 0.2 g (CDMG, Peterson et al. 1999). Most people would likely feel this range of ground shaking, but structural damage would be negligible to slight in buildings constructed according to modern building standards.

Rockfall

Rockfall is used as a generic term to refer to all slope movement processes, including rockfall, rockslide, debris slide, debris flow, debris slump, and earth slump. Rocks have become dislodged and fallen off the sheer granite cliffs throughout the geologic history of Yosemite. Rockfalls can displace extremely large and catastrophic volumes of rock and can be caused by such processes as precipitation-induced stress, climate-related expansion and contraction of rock, seismic shaking, or exfoliation.

Expansion and contraction caused by alternating freezing and thawing of water in the cracks of Yosemite's cliffs weaken its structure and result in periodic rockfalls. Rockfalls have created steep talus (angular rock fragments) slopes at the base of some steep rock walls within portions of the Tuolumne River corridor.

Most rockfalls are associated with triggering events such as earthquakes, rainstorms, or periods of warming that produce a rapid melting of snow. The magnitude and proximity of the earthquake, intensity and duration of the rainfall, thickness of the snowpack, and pattern of warming all influence the triggering of rockfalls. However, some rockfalls occur without a direct correlation to an obvious event and are probably associated with gradual stress release and exfoliation of the granitic rocks (USGS, Wieczorek et al. 1998).

Local topography in the Tuolumne Meadows area is such that rockfalls do not present a safety concern to visitors in this area. Rockfalls are more common in portions of the Tuolumne River corridor that contain steep rock walls, such as the Grand Canyon of the Tuolumne.

Environmental Consequences Methodology

The potential for impacts on geologic features as a result of this planning effort is considered negligible to nonexistent; therefore, these impacts are not evaluated.

The potential for earthquakes and rockfall events is ever-present and unavoidable throughout Yosemite National Park. Because the highest use in the river corridor occurs in areas of low-relief topography (Tuolumne Meadows, Lyell Canyon, and Glen Aulin), the risk of injury or facility damage is considered negligible, with the potential exception of trail segments through the Grand Canyon area where trail corridors pass beneath steep canyon walls. However, because of its remote location, there is only occasional foot traffic and little or no pack stock use in the canyon, so this risk to public health and safety would remain very low.

Actions proposed under the action alternatives would not affect the incidence or effects of earthquakes or rockfall events in the river corridor. It is assumed that facility design would conform to seismic and structural standards. Therefore, the impacts on the risk to public safety or facilities posed by geologic hazards are not evaluated.

This impact assessment instead considers the potential impact of visitor and administrative activities on soils. Potential impacts for each alternative were evaluated in terms of the context, intensity, and duration, as well as whether the impacts were considered to be beneficial or adverse to soils, or to public or facility safety.

Context: The context of the impact considers whether the impact would be local or regional. With best management practices in place, the impact would be detectable only within the vicinity of the proposed action. Thus, the setting or area within which impacts are analyzed would be local.

Duration: Duration of soils impacts are characterized as short term or long term. Short-term impacts could be restored when project construction is completed and would last 20 years or less. Long-term impacts would last over 20 years.

Intensity: Negligible effects on soils, such as excavation or removal of topsoil, would not occur or would be so slight as to be immeasurable. Minor effects on soils would be detectable. If mitigation is needed to offset adverse effects, it would be relatively simple to implement. Moderate effects on soils would be readily apparent. Mitigation would probably be necessary to offset adverse impacts. Major effects on soils would be readily apparent and would substantially change the soil characteristics of the area. Extensive mitigation would probably be necessary to offset adverse impacts, and its success could not be guaranteed.

Type: Impacts are considered adverse if implementation of an alternative would result in removal of native soils, soil profile mixing, and/or soil compaction, erosion, or contamination. Impacts are considered beneficial if implementation of an alternative would restore native soils, reduce soil erosion, decompact soils, or reduce existing soil contamination.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of current condition and management, as described in chapter 8 and under “Affected Environment,” above.

Wild Segments

Impacts on soils in wilderness, primarily soil compaction and potential soil erosion, are generally found along trail corridors, although site-specific impacts from occasional informal campsites and campfires do occur. The highest concentration of disturbance associated with foot traffic and pack stock use on formal and informal trail corridors occurs closer to the developed areas at Tuolumne Meadows and along the Tioga Road corridor. Impacts on soils that have been documented in pack stock use areas of Lyell Canyon would continue.

Existing impacts on soils at Glen Aulin include a fragmented wetland community at the existing corral and denuded vegetation at a section of riverbank adjacent to the camp that is accessed by pack stock and visitors.

Hydrologic and related geologic processes below O’Shaughnessy Dam would continue to be altered by the presence of the dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam intended to more closely mimic natural flows for the benefit of river-dependent ecosystems.

Scenic Segments

Impacts on soils from historic development activities noted under “Affected Environment,” above, would continue; many of these impacts may be exacerbated by ongoing disruptions to hydrologic processes (e.g., headcuts resulting from channelized flow, discussed in more detail under “Hydrology,” below). In addition, impacts on soils at Tuolumne Meadows associated with trampling in high use areas would continue. High concentrations of foot traffic are adjacent to the store and grill and public fuel station, at the Parsons Memorial Lodge trailhead, around the Soda Springs and Pothole Dome areas, at the Cathedral Peaks trailhead, along the Tioga Road corridor, and along the banks of the river.

Conclusion

Corridorwide, soils in wild segments would generally remain undisturbed, with localized adverse impacts along trail corridors, particularly near high-use areas such as Tuolumne Meadows and Tioga Road and at camping

and pack stock grazing areas in Lyell Canyon. Impacts on soils at Glen Aulin include denuded areas near the High Sierra Camp; these impacts would continue to be local, long term, minor, and adverse. In the scenic segments at Tuolumne Meadows, impacts on meadow soils from historic development, disrupted hydrologic processes, and ongoing use would continue; these impacts would be local, long term, moderate, and adverse.

Natural hydrologic and related geologic processes in wild segment and scenic segment below O'Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Cumulative Impacts

The past development of facilities and their associated use have disturbed soils primarily outside of designated Wilderness, at Tuolumne Meadows and Glen Aulin. The NPS routinely performs actions to mitigate impacts on soils in site-specific areas (e.g., restoration of wilderness campsites). The development of facilities over time in the river corridor has also increased the risk to public safety from geohazards, but this risk is generally very low. None of the projects considered in "Appendix L: Cumulative Plans and Projects," would affect the risk to public safety resulting from geologic hazards.

The following recently completed actions from the projects listed in appendix L would have affected soils in or near the planning area:

- the project to restore disturbed areas at the Tuolumne Meadows Lodge, which included site drainage improvements and native plant restoration
- the Gaylor Pit lead abatement project, which removed lead-contaminated soils at Gaylor Pit
- projects to survey the Tuolumne Meadows service station for soil gas and to replace the Tuolumne Meadows Lodge water line, which caused short-term disturbance to soils in the project areas, primarily from trenching and excavation
- the project to remove informal trails at Tuolumne Meadows, which helps restore natural soil forming processes and reduce soil compaction at site-specific locations
- the project to delineate the route to Cathedral Lake will restrict impacts to a formal trail corridor

The following current and/or reasonably foreseeable future actions, projects, and plans could have a cumulative effect on soils in the river corridor:

- The projects to improve the parkwide communications data network, improve the Tuolumne Meadows water treatment system, and make modifications to the Tuolumne Meadows concessioner stable corral; the Tioga trailheads project; implementation of the *Scenic Vista Management Plan*; and implementation of the *Fire Management Plan* would result in site-specific, short-term impacts on soils from vegetation management activities or installation of new infrastructure in the Tuolumne Meadows area.
- Implementation of the upcoming *Wilderness Stewardship Plan* and the upcoming *High-Elevation Aquatic Ecosystem Recovery and Stewardship Plan* would have beneficial impacts on soils through management intended to maintain or restore natural processes in the Tuolumne River watershed.

In combination with the cumulative plans and projects above, soils under the no-action alternative would remain generally undisturbed in designated Wilderness areas, with local adverse impacts along trail corridors, particularly near high-use areas such as Tioga Road, and at pack stock camp and grazing areas in Lyell Canyon. At Tuolumne Meadows, impacts of individual facilities and use would continue to result in a local long-term moderate adverse effect on soils. At Glen Aulin, ongoing foot- and stock-related impacts would result in localized long-term minor adverse impacts on soils.

Environmental Consequences Common to Alternatives 1–4

Many of the impacts on soils would be common to all the action alternatives, and are presented below but are not repeated under each alternative.

Wild Segments

Natural hydrologic and related geologic processes in river segments below O'Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Scenic Segments

Impacts on soils from historic development activities and use (e.g., soil compaction at high use areas) would be treated through a combination of site-specific restoration, where facilities would be removed and their sites restored to natural conditions, and implementation of a comprehensive ecological restoration program for the subalpine meadows.

The implementation of the ecological restoration program would be expected to have a long-term beneficial impact on soils throughout the meadows by restoring hydrologic processes that influence soil moisture. This would ultimately support more natural soil deposition dynamics, the removal of nonnative fill, soil decompaction in areas currently affected by roadside parking and heavy visitor use (including areas affected by informal trails), and restoration of vegetation that supports the development of organic carbon-rich soils.

Construction impacts would be minimized by limiting the area of disturbance, salvaging existing soils for use as backfill, and implementing best management practices (see appendix O) that would reduce the potential for soil erosion and transport, and minimize contamination from construction equipment.

Environmental Consequences of Alternative 1

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 1 on geology, geohazards, and soils are described below.

Wild Segments

Under alternative 1, lowered use levels in wilderness, elimination of concessioner stock day rides, elimination of most commercial use (with the exception of a small amount of concessioner stock use for resupply of High Sierra Camps outside the corridor) and elimination of the Glen Aulin High Sierra Camp would reduce impacts on and adjacent to trails radiating outward from Tuolumne Meadows and Tioga Road. In addition, elimination of commercial pack stock use in the river corridor would allow for additional restoration in meadow and riparian areas in upper Lyell Canyon previously affected by pack stock use.

The removal and natural resource restoration of the Glen Aulin High Sierra Camp would address current impacts on soils associated with this facility, including a denuded wetlands area near the corral, trails, facilities, and a denuded riverbank area, thereby resulting in a long-term beneficial impact on soils.

Scenic Segments

Locations of site-specific restoration activity under alternative 1 would include the Tuolumne Meadows Lodge, public fuel station, the store and grill complex, the campground A-loop road, the wastewater treatment ponds, a portion of NPS housing at Bug Camp, the Cathedral Lakes and Parsons Memorial Lodge trailheads, roadside parking along Tioga Road, and informal trails at multiple locations. The majority of these restoration areas are adjacent to meadow and riparian resources that are currently being affected by visitor use. In these areas, decompacting soil, recontouring, improving drainage, revegetating, and placing deterrents would have a beneficial impact by removing the source of impacts, reducing unnatural exposure of soils (which affects

moisture content and risk of erosion), restoring permeability, and restoring the hydrologic and biologic processes that support soil formation and deposition dynamics.

In the short term, alternative 1 construction activities would disturb soils through trenching, grading, and excavation associated with removing facilities, improving drainage, and restoring vegetation. Under alternative 1, new development in upland areas would include construction of relocated parking, a new trail corridor, and administrative facilities south of Tioga Road in previously disturbed areas. These include the existing visitor center/Road Camp parking area, the current location of the store and grill, the Lemberg Dome parking area, and the Dog Lake/John Muir Trail trailhead near Bug Camp. Adverse impacts on soils in these areas would include grading, trenching, excavation, and installation of an impermeable surface for parking and installation of new housing.

Conclusion

Under alternative 1, soils in wild segments would generally remain undisturbed, with localized exceptions. There would be a local long-term moderate beneficial impact on soils along trail corridors from lower use levels, elimination of concessioner stock day rides, and elimination of commercial and most administrative pack stock from Tuolumne Meadows. There would be a local long-term moderate beneficial impact in upper Lyell Canyon where commercial pack stock use would be discontinued. At Glen Aulin, removal of the High Sierra Camp and restoration activity would result in local long-term moderate beneficial impacts in areas currently affected by facilities and foot and pack stock traffic.

At scenic segments in the Tuolumne Meadows area, there would be a local, long-term, moderate, beneficial impact on meadow soils from soil decompaction, removal of nonnative fill, restoration of hydrologic processes, and restoration of native vegetation associated with removal of facilities and from the implementation of a comprehensive ecological restoration program. There would be local short-term and long-term minor to moderate adverse impacts on soils from construction of facilities in more resilient locations to replace those removed from more sensitive meadow and riparian areas.

Natural hydrologic and related geologic processes in river segments below O'Shaughnessy Dam would remain altered. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on soil resources in combination with alternative 1 are the same as those listed under the no-action alternative.

Local, short-term, adverse impacts on soils could result from construction activities associated with some of the past, current, and reasonably foreseeable actions planned or approved within the park. There would be local long-term beneficial impacts resulting from the restoration of informal trails at Tuolumne Meadows, in addition to what is proposed in this plan. In combination with cumulative plans and projects, alternative 1 would result in short-term minor to moderate adverse impact on soils due to plan implementation, but a long-term moderate beneficial impact on soils from substantially lowered use levels and the extensive amount of ecological restoration proposed at Tuolumne Meadows, affected areas of Lyell Canyon, and at Glen Aulin.

Environmental Consequences of Alternative 2

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 2 on geology, geohazards, and soils are described below.

Wild Segments

With visitor use levels potentially higher under alternative 2 than existing conditions, impacts on soils on and adjacent to trails radiating outward from Tuolumne Meadows and Tioga Road would continue. However, reductions in concessioner stock day rides would have a beneficial impact along trails through Lyell Canyon and between Tuolumne Meadows and Glen Aulin by lowering pack stock use and the associated potential for soil compaction and soil erosion. In addition, the regulation on the timing, amount, and location of commercial pack stock use in Lyell Canyon would have a beneficial impact on soils by reducing the potential for specific stock-related impacts, such as hoofpunching in wet meadows, roll pits, and accelerated erosion along streambanks.

At Glen Aulin, natural resource restoration at wetlands and a section of riverbank currently affected by foot traffic and pack stock use would have beneficial impact on soils. Short-term adverse impacts on primarily surface soils would likely occur during removal of the Glen Aulin High Sierra Camp structures. In the long term, conversion of the area to a seasonal camp (with no permanent structures except waste facilities) and associated restoration activities would have a beneficial impact on soils.

Limited recreational boating between Tuolumne Meadows and Pate Valley would impact riverbanks and adjacent riparian areas where boaters put in below Tuolumne Meadows, portage around waterfalls in the Grand Canyon, and take out in Pate Valley. However, these impacts would be minimal because use would be restricted by the existing limits of the overnight wilderness trailhead quota system, the short boating season, and by the skill level required to boat on this stretch of the river.

Scenic Segments

Locations of site-specific restoration activity under alternative 2 would include riparian areas at Tuolumne Meadows Lodge and the campground A-loop road, concessioner employee housing behind the store and grill, the Cathedral Lakes and Parsons Memorial Lodge trailheads, roadside parking along Tioga Road, and informal trails at multiple locations. In these areas, soil decompacting, recontouring, drainage improvements, revegetation, and placing deterrents would have beneficial impacts by removing the source of impacts, reducing unnatural exposure of soils (which affects moisture content and risk of erosion), restoring permeability, and restoring the hydrologic and biologic processes that support soil formation and deposition dynamics.

In the short term, restoration activities would disturb soils through trenching, grading, and excavation associated with removal of facilities, drainage improvements, and vegetation restoration. Under alternative 2, new development in upland areas would include construction of relocated parking, new trail corridors, and administrative facilities in previously disturbed as well as undisturbed areas. These activities would take place at Pothole Dome, an undeveloped area west of Unicorn Creek, the existing visitor center/Road Camp parking and administrative area, the current location of the store and grill, the Lumbert Dome parking area, Gaylor Pit, and the Dog Lake/John Muir Trail trailhead near Bug Camp. Adverse impacts on soils due to construction in upland areas would include grading, trenching, excavation, and installation of an impermeable surface for parking and administrative facilities.

A new trail corridor is also proposed through the meadows to connect visitor services to Parsons Memorial Lodge. The alignment of this trail will be determined during future site design; however, it is assumed that the new trail would involve adverse impacts on meadow soils.

Conclusion

Soils in wild segments would generally remain undisturbed under alternative 2, with localized exceptions. There would be a local long-term minor beneficial impact on soils along trail corridors due to reduced concessioner and commercial stock use. There would be a local long-term moderate beneficial impact in upper Lyell Canyon where camping, grazing, and access routes would be designated in more resilient locations. At

Glen Aulin, removal of the High Sierra Camp (replaced with a seasonal camp) and restoration activity would result in local, long-term, minor to moderate, beneficial impacts in areas currently affected by permanent facilities. There would be minimal impact from recreational boating in the Grand Canyon of the Tuolumne due to very limited use.

At scenic segments in the Tuolumne Meadows area, there would also be a local, long-term, moderate, beneficial impact on soils from decompaction, removal of nonnative fill, restoration of hydrologic processes, and restoration of native vegetation where facilities would be removed from sensitive meadow/riparian areas, as well as from the implementation of a comprehensive ecological restoration program. There would be local short-term and long-term minor to moderate adverse impacts on soils from construction of parking and other facilities in resilient soils to replace those removed from more sensitive soils in meadow and riparian areas.

Natural hydrologic and related geologic processes in river segments below O'Shaughnessy Dam would remain altered under alternative 2. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on soil resources in combination with alternative 2 are the same as those listed under the no-action alternative.

Local, short-term, adverse impacts on soils could result from construction activities associated with some of the past, current, and reasonably foreseeable actions planned or approved within the park. There would be local long-term beneficial impacts resulting from the restoration of informal trails at Tuolumne Meadows, in addition to what is proposed in this plan. In combination with cumulative plans and projects, alternative 2 would result in short-term minor to moderate adverse impact on soils due to project implementation, but a long-term moderate beneficial impact on soils due to the extensive amount of ecological restoration proposed at Tuolumne Meadows, affected areas of Lyell Canyon, and at Glen Aulin.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on geology, geohazards, and soils are described below.

Wild Segments

Lower use levels, achieved through a reduction in day use levels at Tuolumne Meadows and the elimination of concessioner stock day rides, would have a beneficial impact along trails radiating outward from Tuolumne Meadows and Tioga Road, particularly through Lyell Canyon and between Tuolumne Meadows and Glen Aulin, by reducing the potential for soil compaction and soil erosion. In addition, regulating the timing, amount, and location of commercial pack stock use in Lyell Canyon would have a beneficial impact on soils by reducing the potential for specific stock-related impacts, such as hoofpunching in wet meadows, roll pits, and accelerated erosion along streambanks.

At Glen Aulin, natural resource restoration at wetlands and a section of riverbank currently affected by foot traffic and pack stock use would have a local long-term minor beneficial impact on soils.

Scenic Segments

Locations of site-specific restoration activity under alternative 3 would include approximately half of the employee and guest cabin area at Tuolumne Meadows Lodge, riparian areas at the campground A-loop, concessioner employee housing behind the store and grill, the Cathedral Lakes trailhead, roadside parking along Tioga Road, and informal trails at multiple locations. In these areas, soil decompaction, recontouring,

drainage improvements, revegetation, and placement of natural barriers would have beneficial impacts by removing the source of impacts, reducing unnatural exposure of soils (which affects moisture content and risk of erosion), restoring permeability, and restoring the hydrologic and biologic processes that support soil formation and deposition dynamics.

In the short term, restoration activities would disturb soils through trenching, grading, and excavation associated with removing facilities, improving drainage, and restoring vegetation. Under alternative 3, new development in upland areas would include construction of new (relocated) parking spaces, a new trail corridor, and administrative facilities south of Tioga Road in previously disturbed as well as undisturbed areas. These activities would be at Pothole Dome, an undisturbed area north of the road leading to Tuolumne Meadows Lodge, the existing visitor center/Road Camp parking and administrative area, the current location of the store and grill, the Lembert Dome parking area, and the Dog Lake/John Muir Trail trailhead near Bug Camp. Adverse impacts on soils in these areas would consist of grading, trenching, excavation, and the installation of an impermeable surface for parking and administrative facilities.

Conclusion

Under alternative 3, soils in wild segments would generally remain undisturbed, with localized exceptions. There would be a local long-term minor beneficial impact on soils along trail corridors from reduced foot traffic and reduced concessioner and commercial stock use. There would be a local long-term moderate beneficial impact on soils in upper Lyell Canyon where camping and pack stock grazing and access routes would be designated in more resilient locations. At Glen Aulin, natural resource restoration at wetlands and a denuded section of riverbank would result in a local long-term minor beneficial impact on soils.

At scenic segments in the Tuolumne Meadows area, there would also be a local long-term moderate beneficial impact on soils from decompaction, removal of nonnative fill, restoration of hydrologic processes, and restoration of native vegetation where facilities would be removed from sensitive meadow/riparian areas, and from the implementation of a comprehensive ecological restoration program. There would be local short-term and long-term minor adverse impacts on soils from the construction of new facilities in more resilient soils to replace roadside parking and housing removed from more sensitive soils near meadow and riparian areas.

Natural hydrologic and related geologic processes in river segments below O'Shaughnessy Dam would remain altered. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on soil resources in combination with alternative 3 are the same as those listed under the no-action alternative.

Local short-term adverse impacts on soils could result from construction activities associated with some of the past, current, and reasonably foreseeable actions planned or approved within the park. There would be local long-term beneficial impacts resulting from eliminating informal trails and restoring the meadows at Tuolumne Meadows, in addition to what is proposed in this *Tuolumne River Plan*. In combination with cumulative plans and projects, alternative 3 would result in short-term, minor to moderate, adverse impact on soils due to plan implementation but a long-term moderate beneficial impact on soils primarily from the extensive amount of ecological restoration proposed at Tuolumne Meadows, affected areas of Lyell Canyon, and at Glen Aulin.

Environmental Consequences of Alternative 4 (Preferred)

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 4 on geology, geohazards, and soils are described below.

Wild Segments

Elimination of concessioner stock day rides would reduce impacts on and adjacent to trails radiating outward from Tuolumne Meadows and Tioga Road. In addition, the proposed regulation on the timing, amount, and location of commercial pack stock use in Lyell Canyon would have a beneficial impact by reducing the potential for specific stock-related impacts on soils, such as hoofpunching in wet meadows, roll pits, and accelerated erosion along streambanks.

At Glen Aulin, natural resource restoration at wetlands and a section of riverbank currently affected by foot traffic and pack stock use would have a local, long-term, minor, beneficial impact on soils.

Limited recreational boating between Tuolumne Meadows and Pate Valley would impact riverbanks and adjacent riparian areas where boaters put in below Tuolumne Meadows, portage around waterfalls in the Grand Canyon, and take out in Pate Valley. However, these impacts would be minimal because use would be restricted by the existing limits of the overnight wilderness trailhead quota system, the short boating season, and by the skill level required to boat on this stretch of the river.

Scenic Segments

Locations of site-specific restoration activity under alternative 4 would include riparian areas at Tuolumne Meadows Lodge and the campground A loop, concessioner employee housing behind the store and grill, the Cathedral Lakes and Parsons Memorial Lodge trailhead, roadside parking along Tioga Road, and informal trails at multiple locations. In these areas, soil decompaction, recontouring, drainage improvements, revegetation, and placement of deterrents would have beneficial impacts. These measures would remove the source of impacts, thus reducing unnatural exposure of soils (which affects moisture content and risk of erosion), restoring permeability, and restoring the hydrologic and biologic processes that support soil formation and deposition dynamics.

In the short term, restoration activities would disturb soils through trenching, grading, and excavation associated with removal of facilities, drainage improvements, and vegetation restoration. In addition, new development in upland areas would involve construction of relocated parking, widening the road to the concessioner stable to accommodate additional parking, a new trail corridor, and relocated administrative facilities in previously disturbed as well as undisturbed areas. These activities would be at Pothole Dome, the existing visitor center/Road Camp parking and administrative area, an undeveloped area west of Unicorn Creek, the current location of the store and grill, the Lembert Dome parking area, Gaylor Pit, and the Dog Lake/John Muir Trail trailhead near Bug Camp. Adverse impacts on soils in these areas would include grading, trenching, excavation, and installation of an impermeable surface for parking and administrative facilities.

Conclusion

Under alternative 4, soils in wild segments would generally remain undisturbed, with localized exceptions. There would be a local long-term minor to moderate beneficial impact on soils along trail corridors in wilderness as a result of reduced pack stock use. There would be a local, long-term, moderate, beneficial impact in upper Lyell Canyon where camping and pack stock grazing and access routes would be designated in more resilient soil locations. At Glen Aulin, natural resource restoration at wetlands and a denuded section of riverbank would result in a local long-term minor beneficial impact on soils. There would be minimal impact from recreational boating in the Grand Canyon of the Tuolumne due to very limited use.

At scenic segments in the Tuolumne Meadows area, there would be a local long-term moderate beneficial impact on meadow soils from decompaction, removal of nonnative fill, restoration of hydrologic processes, and restoration of native vegetation associated with removal of facilities and the implementation of a comprehensive ecological restoration program. There would be local short-term and long-term minor to

moderate adverse impacts from construction of facilities in previously disturbed areas of resilient soils to replace roadside parking and other facilities removed from more sensitive soils in meadow and riparian areas.

Natural hydrologic and related geologic processes in river segments below O'Shaughnessy Dam would remain altered. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on soil resources in combination with alternative 4 are the same as those listed under the no-action alternative.

Local short-term adverse impacts on soils could result from construction activities associated with some of the past, current, and reasonably foreseeable actions planned or approved within the park. There would be local long-term beneficial impacts resulting from the restoration of informal trails at Tuolumne Meadows, in addition to what is proposed in this plan. In combination with cumulative plans and projects, alternative 4 would result in short-term minor to moderate adverse impact on soils resulting from plan implementation, but a long-term moderate beneficial impact on soils due primarily to the extensive amount of ecological restoration proposed at Tuolumne Meadows, at affected areas of Lyell Canyon, and at Glen Aulin.

Hydrology, Water Quality, and Floodplains

Affected Environment

Hydrology

The Tuolumne River has two principal sources: Mount Lyell and Mount Dana. Mount Lyell, at 13,114 feet in elevation, is the highest peak in Yosemite. The Lyell Fork flow appears from under the Lyell Glacier on the mountain's north face, at about the 11,500-foot elevation. The Lyell Fork contributes the larger runoff of the two sources tributaries, contributing 60%. The Dana Fork, which drains the west-facing slopes of 13,054-foot-high Mount Dana contributes 40% of runoff. The confluence of these two forks form the main stem just upstream from the highway bridge in the center of the Tuolumne Meadows complex of meadows. The Tuolumne River continues through Tuolumne Meadows and the associated developed area at an elevation of 8,600 feet. West of Tuolumne Meadows, the river begins its steep westward descent through the Grand Canyon of the Tuolumne and enters Hetch Hetchy Reservoir (still within the park, but not part of the Tuolumne Wild and Scenic River) at an elevation of about 3,800 feet. Hetch Hetchy Reservoir is dammed by the 430-foot-tall O'Shaughnessy Dam and has a storage capacity of 360,360 acre-feet. At O'Shaughnessy Dam, water is diverted through Canyon Tunnel to the Kirkwood Powerhouse. Water that is not diverted continues downstream in the Tuolumne River, reaching the park boundary about 6 miles downstream, at an elevation of approximately 2,800 feet.

The total drainage area contributing to the Tuolumne River above Hetch Hetchy Reservoir is approximately 459 square miles (1,189 square kilometers). Data records of Tuolumne River discharges into Hetch Hetchy Reservoir from the fall of 1982 to 2002 show that there is considerable variability from one year to the next. During the 1982–2002 period, the greatest water year annual discharge into Hetch Hetchy was about 539 billion gallons (2.04 billion cubic meters) in 1983, while the least was about 108 billion gallons (0.41 billion cubic meters) in 1987. The periods from 1983 to 1986 and 1995 to 1998 were relatively wet (averaging 354 and 380 billion gallons, respectively), while the periods from 1987 to 1994 and 2000 to 2002 were relatively dry (averaging 161 and 186 billion gallons, respectively), indicating that wet and dry conditions can occur over multiyear spells (Lundquist et al. 2005).

The drainage area contributing to the Tuolumne River at the point where it flows under the Tioga Road bridge in Tuolumne Meadows is about 71.8 square miles (186 square kilometers), with about 42.8 square miles (111 square kilometers) draining through the Lyell Fork and 29 square miles (75 square kilometers) through the Dana Fork. Early in the melt season, the Lyell and Dana Forks contribute 60% and 40% of the flow, respectively, proportions comparable to their relative drainage areas. By mid-summer, when snow cover decreases, the Lyell Fork contributes a greater fraction (66–75%) of the total flow into Tuolumne Meadows. Measured discharges during the summer of 2002–2005 varied between approximately 179 and 38 cubic feet per second on the Lyell Fork and between 170 and 39 cubic feet per second on the Dana Fork, with greater volumes occurring in early summer when snowmelt is high (Lundquist et al. 2005).

Hydrology at Tuolumne Meadows

The center of administrative and visitor use on the Tuolumne River within Yosemite National Park is at Tuolumne Meadows. The NPS initiated studies during the summer of 2006 to investigate the surface and groundwater hydrology of the Tuolumne Meadows area. Although these initial studies were somewhat inconclusive, data suggest that in mid to late summer, surface water appears to recharge groundwater in the meadows, but the opposite may be true earlier in the melt season (Cooper et al. 2006). Additional hydrologic studies have been initiated at Tuolumne Meadows, with the results expected in 2013.

The Tioga Road, which runs east to west along the southern edge of Tuolumne Meadows, was evaluated in 2006 to determine what effect it might have on the hydrology of the adjacent meadows. The study, which was conducted in response to concerns about possible effects of Tioga Road on water flow and vegetation (Cooper et al. 2006), found no evidence that the road blocks, intercepts, or alters the natural flow paths or groundwater elevations. Impacts of the Tioga Road on the hydrology of Tuolumne Meadows were found to be few and of limited extent, and were mostly localized interruptions to the seasonal sheet flow across the meadows posed by inadequate Tioga Road culverts. There are approximately 35 culverts in the section of Tioga Road at Tuolumne Meadows, where surface water flows from the southern slopes to the meadows. As part of their 2006 study, Cooper and others observed that culverts were clogged with vegetation and sediment in 12 locations, and signs of ponding water south of the road were observed in 23 locations. Ponding is much more frequent near the eastern end of the meadow, where culverts are spaced farther apart. This is also where the campground, gas station, store, and other infrastructure, coupled with lower gradient surface slopes, further interrupt water flow.

Culverts force previously dispersed runoff into localized channels, and downcutting of these channels has occurred downstream of many of the culverts, particularly in the west end of the meadow. This downcutting in localized channels lowers the groundwater table and deprives the higher elevations of sheet flow inundation (Cooper et al. 2006). Headcuts are other features that occur when sheet flow is concentrated and channeled at high velocity, thus increasing scour and altering sedimentation dynamics. Like downcut channels, headcuts lower the adjacent water table and limit sheet flow across the meadow. Many of the Tioga Road culverts were installed lower or higher than the surface level of the meadow, which exacerbates downcutting, headcutting, and ponding. The resulting changes in meadow hydrology influence vegetation changes within the meadow communities (NPS, Buhler et al. 2010e).

In addition, pack stock and foot travel have widened and gullied historic roadbeds and formal and informal trails. These trails, along with historic drainage ditches, incised channels, and areas barren of vegetation, tend to intercept sheet flows across the meadow; this concentrates nutrients and limits the infiltration of storm water and snowmelt, thus affecting soil moisture and groundwater (NPS, Buhler et al. 2010e). In particular, the section of the historic Great Sierra Wagon Road (also known as the Old Tioga Road) from the visitor center to Parsons Memorial Lodge (now a trail) and the section from Parsons Memorial Lodge to Lumbert Dome (currently used by maintenance vehicles) include raised roadbeds edged with ditches that empty into culverts.

The damming action of the roadbeds, combined with the headcuts, vegetation loss, and incised channels associated with the ditches and culverts, interrupts the natural surface flow of water throughout the meadow (NPS, Buhler et al. 2010e).

The section of the historic Great Sierra Wagon Road between Tuolumne Meadows Lodge and Lembert Dome (now a trail) is likewise affecting the hydrology of the meadow. Its proximity to the Tioga Road and the Tuolumne River, combined with the sandy substrate, has led to deep channeling, heavy erosion, headcuts, and sediment transport into the river. Sheet flow coming off Lembert Dome is channeled through culverts, along the deeply rutted trail toward the river. This channeling action diverts water from the meadow areas and exacerbates erosion in the already deep ruts (NPS, Buhler et al. 2010e). Numerous lateral headcuts and several informal trails leading to the main trail intensify the channeling effects through the local terrain. Because the historic roadway is so deep and sandy in certain sections, it is difficult to walk on, so visitors and pack stock walk on the edge of the trail, which promotes more vegetation loss and further widens the incised trail (NPS, Noon and Martin 2010d).

NPS staff and researchers observed apparent absence of willow and extensive riverbank erosion along the Tuolumne River as it flows through Tuolumne Meadows. This triggered a recent study (Cooper et al. 2006). Cooper and others (2006) found that the banks of the Tuolumne River are eroding on outside meanders without accompanying riparian vegetation (primarily willow) recruitment on the complementary point bar, likely resulting in channel widening. Geomorphic changes such as channel widening could affect groundwater levels critical to meadow habitats.

Channel widening produces a shallower channel with a lower river stage for any given flow volume and a concurrent drop of the water table associated with the river (Cooper et al. 2006, Loheide and Booth 2010). Because wet meadows form where a shallow water table during the summer fulfills the water requirements of this groundwater-dependent ecosystem (Loheide et al. 2009), a drop in the water table could adversely affect wet meadow vegetation. A wider, shallower channel can also influence the magnitude and frequency of overbank flow and associated sheet flow processes (NPS, Buhler et al. 2010e).

Willows along the riverbank serve an important role in preventing river widening. Riverside willows, abundant along the river in Tuolumne Meadows in 1867 (Cooper et al. 2006), appear to have diminished greatly. The lack of willow establishment on sandbars and riverbanks allows water to flow unimpeded, thus increasing velocity and altering scour and deposition relationships (NPS, Buhler et al. 2010e). Cooper and others (2006) suggest that heavy browsing of willow seedlings by deer may be limiting willow recruitment on river bars, which are normally an ideal environment for willows to establish, and are currently conducting a detailed study of willows to understand what factors limit willow establishment and persistence in the study area.

Hydrology below O'Shaughnessy Dam

Natural river flows and hydrologic processes below Hetch Hetchy Reservoir have been altered by the O'Shaughnessy Dam. Specifically, the dam has influenced the magnitude, timing, duration, frequency, and rate of change of the hydrologic regime (NPS, Stock et al. 2007i, quoting McBain and Trush 2007). However, assessments at Poopenaut Valley (a low-elevation meadow/riparian area located downstream of the dam) indicate that it has been largely spared the severe impacts seen downstream of other dams because of several factors unique to this setting, such as a low overall gradient and a downstream bedrock constriction that promotes floodplain inundation (NPS, Stock et al. 2007i).

In 1985 and 1987 the City and County of San Francisco and the Secretary of the Interior entered into amendments to their 1961 agreement requiring minimum in-stream flow releases below O'Shaughnessy Dam and further study of habitat conditions in the river to Early Intake. The flow requirements adopted in the amended agreement focused primarily on maintaining habitat for trout, a species that is not believed to be

native to the Tuolumne River within Yosemite National Park. Current minimum flow releases vary from month to month and year to year, depending on precipitation amounts and other seasonal issues and are regularly monitored and reported on by Hetch Hetchy Water and Power (McGurk 2008a).

In 2006, the SFPUC adopted a policy that establishes a management direction to protect and rehabilitate ecosystems affected by dam operations, within the context of meeting the water supply, power generation, water quality, and minimum in-stream flow requirements that were established in 1985. The policy adopted in 2006 also directs that in-stream flow releases should mimic to the extent feasible the variation of the seasonal hydrology in order to sustain aquatic and riparian ecosystems.

The NPS, in collaboration with the SFPUC, the Stanislaus National Forest, and the USFWS, is conducting research to determine the effects of water temperature and flow regime on ecological conditions downstream of the dam. This effort, known as the Upper Tuolumne River Ecosystem Project, will ultimately provide informed recommendations for water releases from the dam that would provide maximum ecological benefits to the river-dependent ecosystems located between the O'Shaughnessy Dam in Yosemite National Park and the Early Intake in the Stanislaus National Forest. Draft recommendations have been reviewed by stakeholders, but final recommendations have not been completed.

Infrastructure in the River Corridor

Between late May and late October, water is taken from the Dana Fork just east of Tuolumne Meadows Lodge by way of a low cement diversion to support seasonal visitor and operational uses in Tuolumne Meadows. Water is also taken from the river at the Glen Aulin High Sierra Camp through an intake pipe placed in the river upstream of the camp. These withdrawals are described in greater detail under "Water Usage," below.

There are at least eight bridges that cross the Tuolumne River within the wild and scenic river corridor (an additional bridge, a one-lane vehicle bridge at O'Shaughnessy Dam, is outside the river corridor). These include the Tioga Road bridge at Tuolumne Meadows, and seven footbridges: one crossing the upper Lyell Fork near the middle base camp, Twin Bridges near Tuolumne Meadows, a Dana Fork bridge, a footbridge just south of Parsons Memorial Lodge, another "twin bridges" above Glen Aulin, a footbridge at Glen Aulin, and a bridge in Pate Valley. Three tributary bridges are very near the river corridor on Rafferty Creek just outside of Tuolumne Meadows, and along Conness and Return Creeks in the Grand Canyon reach.

The abutments of Tioga Road bridge in Tuolumne Meadows might be causing the river channel to back up during periods of high flows (NPS, Roche et al. 2006a; NPS, Noon and Martin 2010d). The Tioga Road bridge has a 400-foot-long approach constructed of fill that bisects the wetland floodplain into two separate areas. The transfer of waters downstream across the right bank floodplain is essentially eliminated, thus forcing overbank flows back through the constricted bridge opening and increasing the hydraulic pressure on the bridge (NPS, Noon and Martin 2010d). This condition could eventually degrade the riverbanks and compromise the structural integrity of the bridge.

After flooding in 1997, a short section of boulder riprap and large logs were placed along the Lyell Fork to harden the riverbank and protect the Tuolumne Meadows campground A-loop road. Riprap can be effective in protecting infrastructure from further flood exposure, but it decreases the free flow of the river, compromises channel morphology, and alters scour and deposition dynamics (NPS, Buhler et al. 2010e).

Water Usage

The Dana Fork of the Tuolumne River provides the domestic water supply for all visitor and administrative uses at Tuolumne Meadows. For a complete description of the water intake system at Tuolumne Meadows, see the "Park Operations" section later in this chapter.

NPS records indicate that between 5 and 6 million gallons of water are diverted from the Dana Fork from mid-May through late October each year (times vary each year depending upon when the Tioga Road is opened and closed). Water is used for various NPS and concessioner functions at Tuolumne Meadows, including visitor services (e.g., the campgrounds, NPS and concessioner employee housing, lodging, store, and stables).

From the concrete diversion, water is gravity-fed to a water treatment system located just north of Tuolumne Meadows Lodge; from there the water is distributed to visitor service and administrative areas throughout the meadows via underground pipes. Water use at specific facilities (with the exception of the treated water tank) is not metered; therefore, it is not possible to determine use at discrete visitor service or administrative locations. Leaking underground pipes that are part of the aging water delivery system in Tuolumne Meadows are suspected of losing a currently unknown amount of treated water.

Although water withdrawals from the Dana Fork are not metered, the tank that supplies treated water to Tuolumne Meadows is metered. The amount of water withdrawn from the water tank from 2007-2012 is summarized in table 9-1, below.

Table 9-1.
Summary of Daily Water Usage at Tuolumne Meadows, 2007-2012

Summary of Daily Water Use, as measured at Tuolumne Meadows water tank					
2008	Minimum	Maximum	Average	Standard Deviation	98th Percentile ^a
June	8,900.0	65,100.0	30,460.0	10,890.2	54,660.0
July	23,000.0	69,600.0	44,200.0	9,523.3	64,980.0
August	28,200.0	64,300.0	46,506.5	7,275.8	60,940.0
September	15,300.0	56,700.0	37,180.0	8,235.3	52,466.0
October	0.0	25,300.0	13,200.0	8,721.6	24,952.0
2009	Minimum	Maximum	Average	Standard Deviation	98th Percentile ^a
May	9,000.0	38,300.0	19,966.7	10,911.0	50,250.0
June	15,800.0	46,600.0	27,666.7	9,588.0	45,208.0
July	41,700.0	58,900.0	47,851.6	4,864.4	57,760.0
August	34,900.0	59,600.0	45,267.7	7,015.3	57,740.0
September	19,600.0	54,600.0	32,946.7	7,894.2	50,250.0
October	11,000.0	59,500.0	24,090.9	13,976.9	54,860.0
2010	Minimum	Maximum	Average	Standard Deviation	98th Percentile ^a
June	27,500.0	37,900.0	33,214.3	3,970.1	37,852.0
July	22,600.0	63,900.0	47,551.6	8,893.4	61,440.0
August	26,900.0	52,500.0	44,106.5	5,607.6	51,780.0
September	15,500.0	61,800.0	37,433.3	10,378.4	61,336.0
October	10,900.0	45,500.0	29,072.7	13,690.8	45,480.0
2011	Minimum	Maximum	Average	Standard Deviation	98th Percentile ^a
July	19,000.0	71,000.0	46,561.1	11,246.0	66,818.0
Aug	32,900.0	72,600.0	48,529.0	8,088.1	65,640.0
September	19,900.0	66,700.0	37,593.3	9,645.0	62,060.0
October	14,000.0	38,100.0	24,190.0	7,883.4	37,380.0
2012	Minimum	Maximum	Average	Standard Deviation	98th Percentile ^a
May	11,100.0	51,900.0	31,441.7	13,577.6	50,734.0
June	17,900.0	46,900.0	34,086.7	6,987.5	45,450.0
July	36,600.0	55,800.0	43,909.7	4,687.6	54,540.0
August	30,300.0	47,800.0	39,164.5	4,425.0	46,000.0
September	10,600.0	44,000.0	27,750.0	7,368.1	42,318.0
October	10,700.0	26,000.0	16,710.0	5,113.0	25,280.0

^a The 98th percentile is used as the maximum water use figure in order to eliminate rare spikes in the dataset. Please see below and chapter 5, "Free Flow, Condition Assessment, Current Condition" for an explanation of why this measure was chosen.

The average water withdrawal from the tanks at Tuolumne Meadows during peak use times in July and August from 2007 to 2012 is 45,000 to 46,000 gallons per day. The highest withdrawals recorded in the five-year period ending in 2012 were 72,600 gallons on August 21, 2011 and 71,000 gallons on July 27, 2011. However, these appear to be relatively rare spikes in use; water withdrawals on the 20th and 22nd of August were 32,900 and 36,400 gallons, respectively and on the 26th and 28th of July were 24,800 gallons and 58,700 gallons, respectively. For this reason, the 98th percentile amount is used to compare maximum water withdrawals by month during the period examined (see chapter 5, under “Free Flow, Condition Assessment, Current Condition” for additional information).

Although visitation decreased very slightly in 2012 compared with 2010 and 2011 (see table 9-11 in the “Visitor Experience” section, below), there was comparatively larger decrease in water use in 2012 compared with two previous years. This reduction could reflect the success of a 2012 effort to educate visitors and employees about the importance of water conservation.

Although the water usage for the Tuolumne Meadows area has been relatively consistent year to year, the water supply from the Dana Fork varies dramatically, from over 4 million cubic meters per day (1.05 billion gallons per day) during peak runoff in the spring and early summer, to less than 7,500 cubic meters per day (1.98 million gallons per day) during the fall. During the early summer, water withdrawals for use in the Tuolumne Meadows area are less than 1 percent of discharge. However, the lowest measured discharge on record for the Dana Fork is 7,300 cubic meters per day (1.92 million gallons per day) on September 17, 2002. Given this, Cooper and others (2006) estimate that during a particularly dry year, the extreme lower limit of flow would be about 2,400 cubic meters per day (about 650,000 gallons per day). Park staff observed this condition during August 2007 and August 2008. At this very low flow, August water withdrawals would be approximately 10% of the Dana Fork discharge.

Ongoing periods of drought and the subsequent effect on water availability is one of several determining factors limiting overall use and development in Tuolumne Meadows. A recently completed study (Waddle and Holmquist 2013) concludes that withdrawals at or less than current levels are likely to have a minimal impact on downstream habitat, so long as the lower limit of flow remains at about 2,400 cubic meters per day and the timing and duration of these flows remains relatively unchanged. However, the study notes that in light of climate change, which may lead to a longer low-flow duration occurring earlier in the summer, continuous river flow monitoring is warranted to determine whether reevaluation of withdrawal levels might become necessary in the future.

In 1993, attempts were made to look for and develop groundwater as a viable water supply for the Tuolumne Meadows area (HRS Consultants 1994). Optimal areas for well locations were identified (some were eliminated because they were located in designated Wilderness), and two test wells were drilled in the vicinity of the Tuolumne Meadows campground. Both test wells were drilled to a total depth of 400 feet below the surface, were considered dry holes, and were subsequently plugged and abandoned. However, one groundwater production well does exist in the vicinity of Ranger Camp that serves the needs of winter rangers.

NPS records indicate that approximately 60,000 to 70,000 gallons per year (typically June through September) of water are taken from the Tuolumne River to support operations at the Glen Aulin High Sierra Camp, located approximately 6 miles downstream of the Tuolumne Meadows area. To mitigate the risks to water quality posed by the limited size of the camp’s leach mound (see “Water Quality,” below), water restrictions have been imposed at the camp that limit water withdrawals to 600 gallons per day. Potable water is supplied to the adjacent backpacker camp, and untreated water is supplied to the camp’s corrals.

Water Quality

Water quality in the Tuolumne River corridor is exceptionally high. During the late spring and summer, water quality is monitored for nutrients (total dissolved nitrogen, nitrate and nitrite, total phosphorous, and total dissolved phosphorous), *Escherichia coli* (*E. coli*), and total petroleum hydrocarbons. Associated field data collected with each water quality sample include water temperature, specific conductivity, dissolved oxygen, and pH. Results from 2006 to 2010 indicate that no samples exceeded water quality standards established by the NPS (NPS 2006p, 2008i, and 2011e). Data from several of these years were used to establish park-specific standards, and all these standards require water quality far superior to existing state and federal U.S. Environmental Protection Agency (USEPA) standards.

Based on 2010 monitoring results, water quality in the Tuolumne River corridor remains excellent and well within state water quality standards. That is, nutrient and *E. coli* concentrations are not significantly (at the 95% confidence level) different from conditions from 2005 to 2007, when the baseline data were collected (NPS 2009k). Water quality remains low in dissolved nutrients, with low conductance, adequate dissolved oxygen, and pH in the range expected for granitic watersheds.

Because water quality in the Hetch Hetchy Reservoir is critical to the water supply for San Francisco, the 1913 Raker Act grants the city provisions to protect the Hetch Hetchy watershed, including requirements for the treatment or disposal of sewage and garbage, restrictions on bathing, the washing of clothes or cooking utensils, and providing water for stock or any other activity that in any way could pollute the watershed (SFPUC 2008). Water quality data collected by the NPS and the SFPUC from 2006 to 2012 show that the water quality of the Hetch Hetchy water supply remains exceptional.

A water quality study conducted from 2001 to 2003 (Atwill et al. 2008) examined fecal loading and protozoal (*Cryptosporidium* spp. and *Giardia* spp.) shedding by pack stock based at the concessioner and NPS stables in Tuolumne Meadows to determine the risk of waterborne contamination. The researchers examined pack stock manure at the stables and along the trails from Tuolumne Meadows to Glen Aulin, Vogelsang, and Sunrise High Sierra Camps and found very low numbers of pack stock infected with *Cryptosporidium* and *Giardia* (less than 1% and 3.1%, respectively, averaged over three summers). The study suggests that concentrations of (on average) 12 to 23 *Cryptosporidium* spp. oocysts and approximately 48,000 *Giardia duodenalis* cysts were deposited per 1,000 feet of trail in Tuolumne Meadows (on the trails servicing the High Sierra Camps only) during the study, with highly variable amounts of *G. duodenalis* cysts deposited from one year to the next and from animal to animal. While the study suggests that stock-associated waterborne contamination was of low concern, the study authors provided some recommendations to protect water quality. For example, because most manure occurs within the first 0.25 mile of trails from stable operations, they recommended that trails be patrolled and manure removed from watercourses in these areas. This management practice is ongoing.

The NPS has addressed several issues related to water quality at Tuolumne Meadows and Glen Aulin High Sierra Camp to limit or reduce threats to Tuolumne River water quality (NPS 2007w; NPS 2009f; SFPUC 2007 – 2012). Notable projects, many of which were funded by the San Francisco Public Utilities Commission, are listed below:

- 1990: Increased funding by the City and County of San Francisco to protect water quality through an increased number of patrol staff, trail repairs, and out-of-bounds campsite removal.
- 1990: Manure removal from trails near Glen Aulin and Tuolumne stables begins.
- 1991: Four 1,000-gallon underground storage tanks removed at the Tuolumne Meadows ranger station.
- 1991: Tuolumne Meadows wastewater ponds relined.
- 1993: Aboveground fuel tanks installed for NPS operations.

- 1995: Glen Aulin corral moved away from the river.
- 1995: Designated campsites and communal fire sites implemented in Glen Aulin backpacker campground.
- 1995-1997: Sewer lines replaced throughout Tuolumne Meadows.
- 1997: Repairs made to the leach mound at Glen Aulin.
- 1997: Underground tank removed at Tuolumne Meadows service station.
- 1998: New comfort station installed at Lembert Dome.
- 1998: Sewer line to Tuolumne Meadows wastewater treatment plant installed.
- 2001: Tuolumne Meadows sewer line repaired.
- 2002: Water restrictions limiting discharge from the Glen Aulin High Sierra Camp to 700 gallons per day put in place.
- 2003: NPS conducts water quality monitoring on the Lyell Fork (near McClure Creek and at Twin Bridges), as well as on the Tuolumne River.
- 2003: Drainage improvements completed at Tuolumne Meadows concessioner and NPS stables. Removal of manure from these facilities initiated at the end of the season.
- 2005: A five-year watershed protection plan established to maintain the filtration exemption for the City and County of San Francisco.
- 2005: Tuolumne Meadows service station remediation takes place.
- 2005: Tuolumne Meadows lower sewage pond liner repaired.
- 2007: Tuolumne Meadows wastewater treatment plant facility required upgrade was made.
- 2008: Drainage improvements implemented for concessioner and NPS stables at Tuolumne Meadows.
- 2008: Hetch Hetchy corral drainage improvement takes place.
- 2010: Water restrictions limiting discharge from the Glen Aulin High Sierra Camp to 600 gallons per day put in place.
- 2010: Five-year memorandum of agreement between the NPS and the SFPUC updated, replacing the 2005 watershed protection plan (NPS agreement number G8802100109).
- 2012: Concessioner corral at Tuolumne Meadows modified to mitigate water quality concerns created by the corral's proximity to a watercourse leading to Dog Creek and the Tuolumne River.

Although water quality remains exceptional, some potential localized risks to water quality remain in the Tuolumne River corridor. According to the 2012 survey of conditions related to the Hetch Hetchy water supply conducted by the SFPUC (SFPUC 2012), the potential for water quality concerns exists, given certain circumstances, at the Tuolumne Meadows wastewater treatment plant facilities and sprayfield, the two wastewater line crossings of the Tuolumne River, the sewage system at Glen Aulin, the NPS and concessioner stables, and the “little blue slide” road cut near the Dana Fork. In addition, very localized one-time incidents can impact water quality, such as motor vehicle accidents, but these are addressed through park operations, outside the scope of this plan.

While the NPS operates in compliance with Central Valley Regional Water Quality Control Board permits, the water and wastewater treatment facilities at Tuolumne Meadows do not meet current standards. The water treatment system is scheduled to be upgraded in 2014. A potential for displacement of wastewater from the treatment ponds in Tuolumne Meadows poses a risk to water quality, as does the potential for saturation of the

sprayfield (SFPUC 2012). The park has corrected past impacts associated with leakage from the wastewater line that runs beneath the river and meadow from the wastewater treatment plant to the wastewater ponds by installing a new line. However, the potential for future impacts cannot be totally eliminated as long as the line remains beneath the river and meadow. A second wastewater line crossing of the river occurs at the Tioga Road bridge, posing a similar threat to water quality, although this line crosses over, not beneath, the river.

At Glen Aulin High Sierra Camp, the NPS found the leach mound to be over capacity to adequately treat previous levels of wastewater. The leach mound failed four times between 1996 and 2004, prompting water use restrictions that currently cap use at a maximum 600 gallons per day. Water conservation measures to achieve this reduction in water use have been implemented, including installation of low-flow toilets, elimination of guest showers, elimination of towel and linen service, conversion to disposable tableware, and menu revisions that conserve water. The NPS has also required other measures to reduce pack trips, with menu revisions again being one example. These measures have successfully avoided any subsequent leach mound failure; however, a potential risk to water quality remains due to the minimally sized leach mound and the potential for flooding of the wastewater mound.

As noted previously, the water treatment system for the domestic water supply at Tuolumne Meadows is operating within permitted state regulations; however, this system does not meet current state regulations. This system is scheduled to be upgraded by 2014, separate from this *Tuolumne River Plan*.

Silt washed from the unstable road cut near the Dana Fork (see below) affects the quality of the Tuolumne Meadows public water supply, as the intake is a short distance downstream from the cut. Road cuts can have a substantial effect on water quality, especially in high-elevation glacial till found in the upper reaches of the Tuolumne River watershed, where extreme weather, coupled with sparse vegetation, accelerates the erosion process. At the “little blue slide” site, under-snow winter runoff, spring runoff, summer storms, and emerging groundwater are continually depositing silt into the Dana Fork of the Tuolumne River and undermining larger boulders that fall onto Tioga Road. Silt washed from the fill slope below the road blankets the bottom of the river and affects the quality of the Tuolumne Meadows public water supply. According to the park’s hydrologist and specialists from the NPS Water Resources Division, the cut has destabilized the slope both above and below the road and will not stabilize naturally without intervention (NPS, Noon and Martin 2010i).

Impacts on water quality from the fuel facilities at Tuolumne Meadows have been corrected and mitigated (SFPUC 2009); however, the potential for future impacts cannot be totally eliminated as long as fuel facilities remain. Two vapor-extraction cleanup projects associated with older buried tanks are ongoing. In addition, the public fuel station is required to operate according to all applicable state laws and best management practices, including having a spill prevention and countermeasures plan.

Floodplains

Floodplains play a necessary role in the overall adjustment of a river system. They influence the hydrology of the basin and also serve as temporary storage areas for sediment eroded from the watershed. Periodic flooding provides sediment and nutrients that are essential for the aquatic and vegetative health of floodplains. Floodplains are features that are both the products of the river environment and important functional parts of the system. Humanmade structures, such as bridges and buildings, placed within floodplains can impede natural flow, cause damage to structures during periods of flooding, and put people at risk of injury or death during flood events. Because of the potential for adverse impacts associated with the occupancy and modification of floodplains, they receive special consideration under Executive Order (EO) 11988, *Floodplain Management*.

Large floodplains along portions of the Lyell Fork, Tuolumne and Dana Meadows, and in Poopenaut Valley have helped create extensive wetland/meadow complexes in these areas. In other portions of the Tuolumne

River corridor, in particular in the Grand Canyon of the Tuolumne and below Poopenaut Valley to the western park boundary, river gradients are steep. In these and similar areas, floodplains are quite narrow (and in some places virtually nonexistent due to steep canyon walls) and typically confined to narrow strips on each side of the river that support pockets or small areas of riparian habitat.

In 2006, the NPS conducted a study (NPS, Roche et al. 2006a) to determine the 100-year floodplain and the ordinary high-water mark in developed areas at Tuolumne Meadows, the Glen Aulin High Sierra Camp, and the Tuolumne Meadows Lodge. A 100-year flood is defined as one which has a 1% probability of occurrence in any given year. Areas containing development that would be inundated during the modeled 100-year flood include parts of the Tuolumne Meadows campground, the Tuolumne Meadows store and grill and associated employee cabins, employee cabins at the Tuolumne Meadows Lodge, and several structures in the Glen Aulin High Sierra Camp (see figures 9-1 and 9-2). Also, in the modeled 100-year flood event, the Tioga Road bridge and its associated approach levees create a backwater that appears to cause flooding in the area of the Tuolumne Meadows store and campground office (see “Infrastructure in the River Corridor,” above). A small portion of the utility road between Lembert Dome and Parsons Memorial Lodge would also be inundated, as shown in figure 9-1 (NPS, Roche et al. 2006a).

Given that a flood of this magnitude would most likely occur in winter or spring, when few people are in the Tuolumne River corridor, the potential risk to human safety is low. There is a greater risk to infrastructure in the floodplain, including the Tioga Road bridge and associated sewer line, and several trail bridges in the affected area (NPS, Roche et al. 2006a).

Existing development below the ordinary high-water mark (defined by a line on the shore established by the normal fluctuations of water) in the river corridor includes the Tioga Road bridge and several trail bridges (figure 9-1; also see figure 8-3). Other development within 50 to 100 feet of the ordinary high-water mark includes the Tuolumne Meadows Lodge and employee cabins, 21 campground A-loop campsites, the access road into the Tuolumne Meadows campground, and a short segment of the Tioga Road near the existing wastewater treatment plant (NPS, Roche et al. 2006a).

Notable Hydrologic Features in the River Corridor

A glaciated landscape combined with a long, steep elevation drop of 4,600 feet over 24 river miles creates an unusually long stretch of stairstep river morphology through the Grand Canyon of the Tuolumne, with many spectacular cascades and waterfalls. Specific features include Waterwheel, Tuolumne, California, and LeConte Falls, and White Cascades. These features are most prominent during high-velocity, high-volume flows from snowmelt and runoff during spring and early summer.

While the Lyell Glacier itself is not a part of the Tuolumne River corridor, it is an important hydrological feature contributing to flows in the Tuolumne River. The retreat of the Lyell Glacier, resulting in the probable loss of meltwater flows in the upper Lyell Fork, poses a challenge for land managers. Due to forces external to the park, there is little direct action that can be taken aside from monitoring changes and trying to predict what those changes will mean downstream.

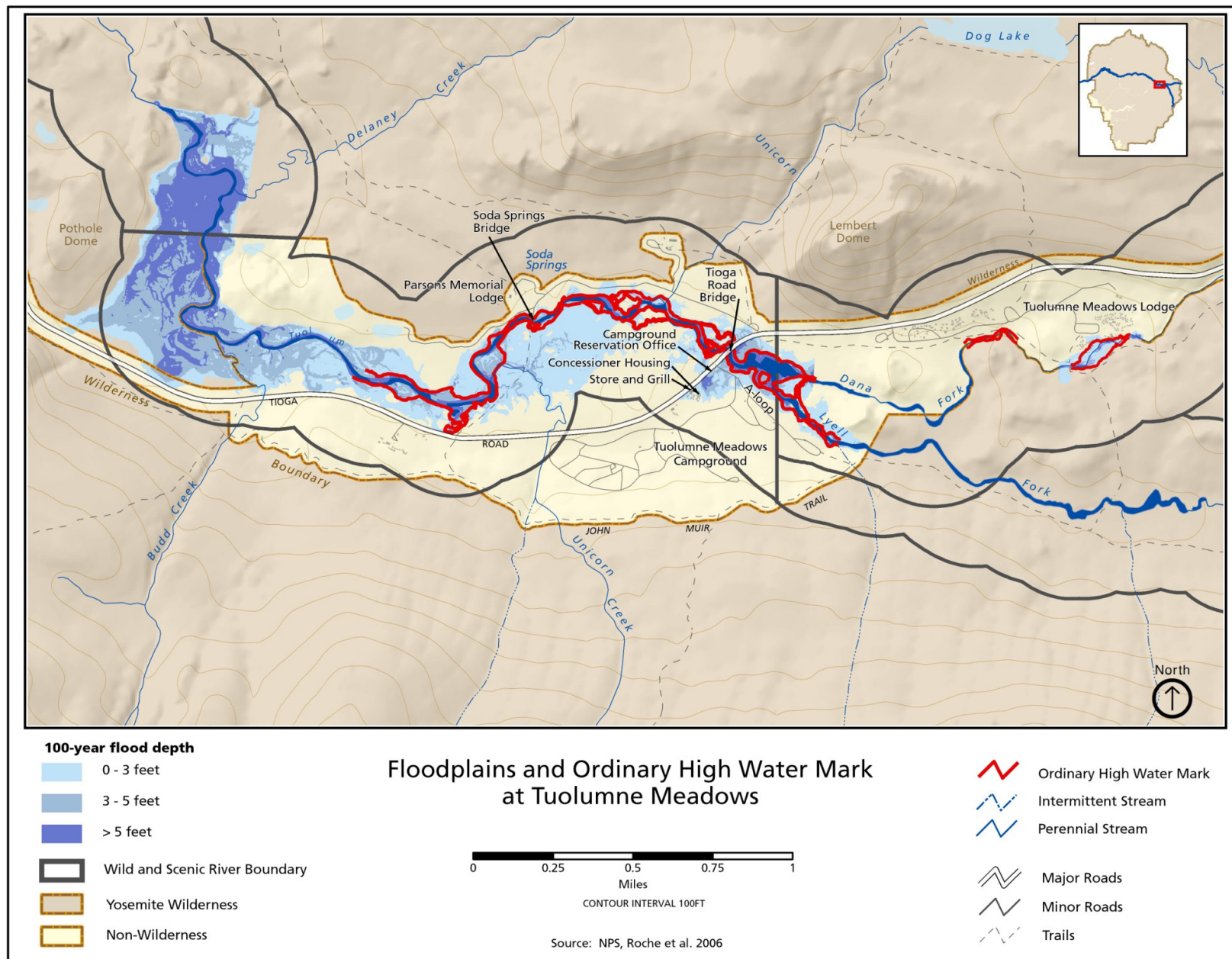


Figure 9-1. 100-Year Floodplain and Ordinary High-Water Mark at Tuolumne Meadows.

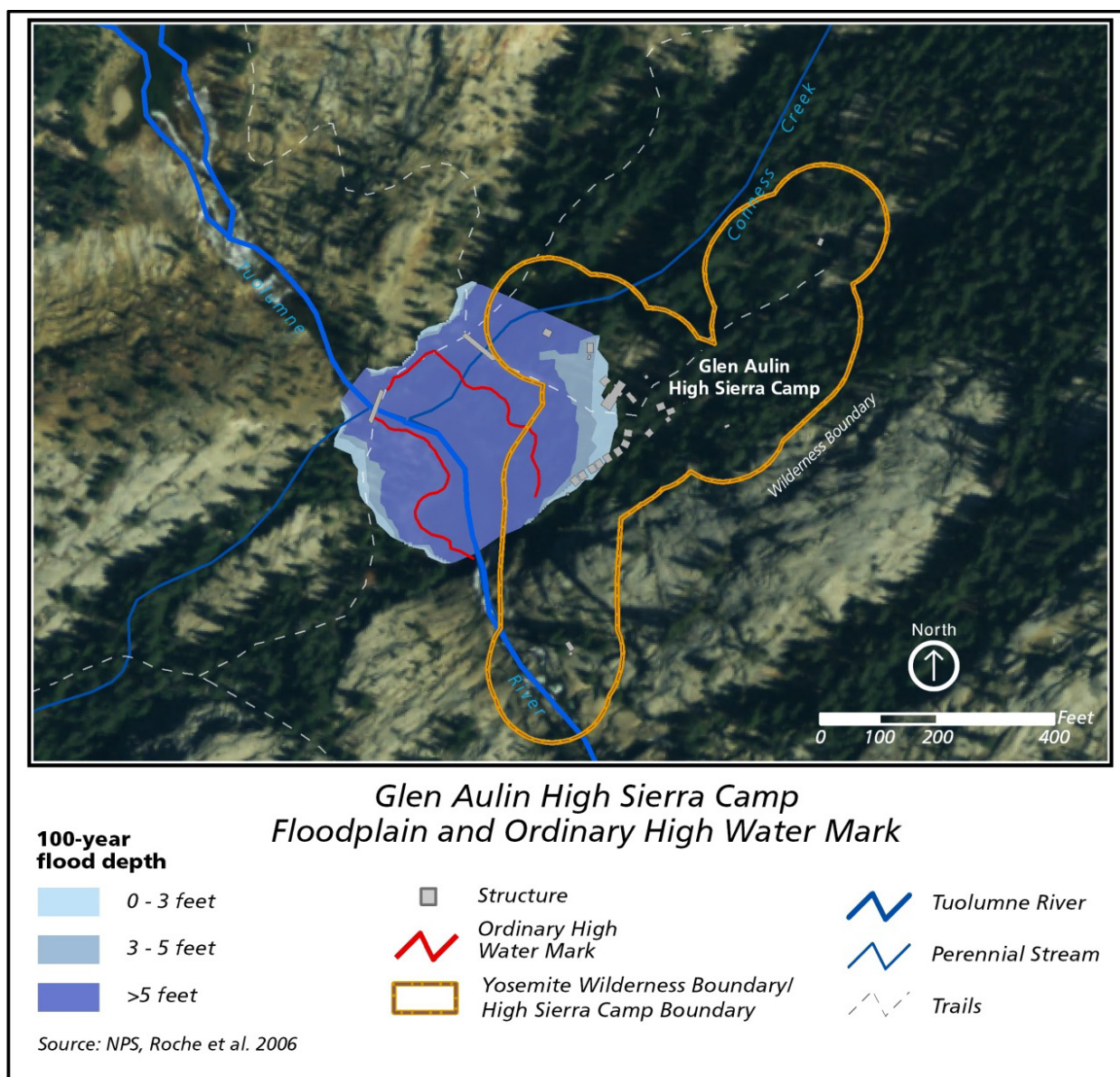


Figure 9-2. 100-Year Floodplain and Ordinary High-Water Mark at Glen Aulin.

Environmental Consequences Methodology

This impact assessment focuses on what effects visitors and facilities would have under each of the alternatives identified in chapter 8 on the hydrology of the Tuolumne River, including water quality and floodplains. Potential impacts for each alternative were evaluated in terms of the context, intensity, and duration, as well as whether the impacts were considered to be beneficial or adverse to Tuolumne River hydrology. In the case of water quality, impacts were considered in comparison to water quality standards for the Tuolumne River established by the NPS (see chapter 5).

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts would be those that occur in the vicinity of the proposed action. Regional impacts would be impacts on the entire river corridor within Yosemite National Park.

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts would not be detectable and would have no discernible effect on hydrology. Minor impacts would be slightly detectable but not expected to have an overall effect on hydrology. Moderate impacts

would be clearly detectable and could have an appreciable effect on hydrology. Major impacts would have a substantial, highly noticeable effect on hydrology.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration and would be associated with transitional activities, such as facility construction. A long-term impact would have an effect on the hydrology that would remain beyond transitional activities, in this case more than five years. For example, removing a potential source of contamination from the river corridor would have a long-term effect on water quality.

Type: Impacts were evaluated in terms of whether they would be beneficial or adverse to hydrology. Beneficial impacts would protect and/or improve elements of hydrology, such as water quality. Adverse impacts would negatively alter the river's hydrology.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of current condition and management, as described in chapter 8 and "Affected Environment," above.

Wild Segments

Water Quality

Continuation of current wilderness management policies, including protection of natural processes, visitor education with an emphasis on Leave-No-Trace practices, and restrictions on amounts and locations of overnight use, would continue to protect water quality and flow regimes within wild segments of the Tuolumne River corridor. With ongoing monitoring, water quality and clarity would be expected to remain high and within standards established by the NPS.

Current visitor and administrative uses would continue at the Glen Aulin High Sierra Camp under the no-action alternative. Risks to water quality posed by the camp's leach mound would continue to be mitigated by limiting water usage at the camp to 600 gallons per day and by continuing existing monitoring. The leach mound would remain a risk to water quality; needed upgrades to the sewage system at the camp would not be addressed.

Hydrologic Processes

Hydrologic processes below O'Shaughnessy Dam would continue to be altered by the presence of the dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam intended to more closely mimic natural flows for the benefit of river-dependent ecosystems.

Floodplains

Existing development within the 100-year floodplain at the Glen Aulin High Sierra Camp would remain.

Scenic Segments

Water Quality

Overall, river water quality and clarity would be expected to remain high and within existing standards established by the NPS. Needed comprehensive upgrades to aging water and wastewater facilities and other actions to reduce or eliminate risks to water quality would continue to be addressed on a case-by-case basis and in emergency situations. Some risks to water quality would remain. Risks to water quality would be caused by aging wastewater treatment facilities at Tuolumne Meadows, stable operations, fuel tanks, and the "little blue slide" road cut near the Dana Fork. Risks would continue to be mitigated by ongoing efforts such as manure removal from corrals and trails and water quality monitoring. Conditions would continue to be observed by SFPUC and NPS staff. Silt associated with the "little blue slide" road cut near the Dana Fork would be expected to continue to have a localized effect on water quality.

Hydrologic Processes

Disruptions to hydrologic processes at Tuolumne Meadows resulting from past facility development and other historic modifications to the meadows, as well as intense visitor use in certain locations, would continue. The NPS would continue to research the causes of altered hydrologic processes and the severity of their impacts.

Existing water withdrawals from the Tuolumne River between late May and late October to support seasonal visitor and operational uses in Tuolumne Meadows would continue. It appears that current water withdrawals have only a minimal impact on downstream ecosystem communities (Waddle and Holmquist 2013; NPS, Noon and Martin 2010i).

Based on water use data from 2007-2012, water use during the peak months of July and August averages approximately 45,000 to 46,000 gallons per day, with maximum peak usage (in 2011) of approximately 65,600 gallons per day (please see the “Affected Environment” section, above, or chapter 5 under “Free Flowing Condition, Condition Assessment, Current Condition” for an explanation of how peak water usage was determined.) Future water restrictions might be needed to protect downstream habitats if visitor use increased or if the duration or intensity of low-flow periods increased as a result of climate change.

Hydrologic processes below O’Shaughnessy Dam (including the 1-mile scenic segment downstream of the dam) would continue to be altered by the presence of the dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam intended to more closely mimic natural flows for the benefit of river-dependent ecosystems.

Floodplains

Existing development within the 100-year floodplain would remain. The Tioga Road bridge would continue to alter natural surface flow during flood events. A 150-foot-long section of riprap installed to protect the campground A-loop road would continue to restrict natural river flows through this area.

Conclusion

Under the no-action alternative, water quality and clarity would remain exceptional throughout the river corridor with ongoing monitoring and management. At Tuolumne Meadows and Glen Aulin, ongoing uses and associated facilities, including aging wastewater treatment facilities, would have the potential to cause local short-term moderate adverse impacts on water quality; however, ongoing mitigation efforts would reduce the impact of this risk to minor and adverse. Existing pack stock use would have the potential to cause local short-term minor adverse impacts on water quality along trails and near campsites and grazing areas in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail to Glen Aulin. Ongoing mitigation efforts to reduce this risk at Tuolumne Meadows would continue.

Natural hydrologic processes would remain unaffected in the majority of the river corridor. At Tuolumne Meadows, existing disruptions to hydrologic processes from past facility development and other historic modifications to the meadows, as well as intense visitor use in certain locations, would remain, resulting in a local long-term moderate adverse impact on the hydrology of the subalpine meadow system at that location.

Water withdrawals to support domestic needs at Tuolumne Meadows and Glen Aulin would continue, with local long-term negligible adverse impacts on downstream ecological communities. Future water restrictions might be needed to protect downstream habitats if visitor use increased or if the duration or intensity of low-flow periods increased as a result of climate change.

Natural hydrologic processes below O’Shaughnessy Dam would remain altered by the dam, which is outside of the planning area. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Development within the 100-year floodplain at Tuolumne Meadows and at Glen Aulin would have a local minor adverse impact on natural flows at those locations.

Cumulative Impacts

The past development of facilities and their associated use have caused localized disturbance to hydrologic processes at Tuolumne Meadows, Glen Aulin, and below O'Shaughnessy Dam. A number of projects have either been implemented or are underway to mitigate these adverse effects. Below O'Shaughnessy Dam, interagency research is ongoing to inform the timing, duration, and magnitude of flows that will reduce the effects of dam operations on downstream habitats. At Tuolumne Meadows and Glen Aulin, the NPS has implemented several actions to mitigate impacts on hydrology, particularly risks to water quality. In addition to the list of recently completed actions to protect water quality listed in "Affected Environment," above, the following recently completed actions from the projects listed in appendix L have had beneficial impacts on water quality and/or hydrologic processes:

- The Gaylor Pit Lead Abatement project removed a potential source of environmental lead contamination less than 0.25 mile from the Dana Fork just east of Tuolumne Meadows.
- The Restoration of Disturbed Areas at Tuolumne Meadows Lodge project included site drainage improvements and restoration activity in proximity to the Dana Fork in Tuolumne Meadows.
- A project to remove informal trails at Tuolumne Meadows decompacted soils along those trail corridors, improving hydrologic processes in the meadows at a very local scale.

Current and/or reasonably foreseeable future actions, activities, projects, and plans that could have a cumulative effect on hydrologic resources include the following:

- Implementation of the upcoming *Wilderness Stewardship Plan* and the upcoming *High-Elevation Aquatic Ecosystem Recovery and Stewardship Plan* would have a beneficial impact on hydrologic resources through management intended to maintain or restore natural processes and protect water quality throughout the Tuolumne River watershed.
- Modifications at the Tuolumne Meadows concessioner stable would mitigate potential risks to water quality identified by the SFPUC in 2009 and 2012.
- A regulatory upgrade to the Tuolumne Meadows water treatment facility (scheduled for 2014) and ongoing improvements to the Tuolumne Meadows water treatment system would help the NPS stay within regulatory requirements for water supply at Tuolumne Meadows.

In combination with the cumulative plans and projects, the no-action alternative would result in local long-term minor adverse impacts on water quality at site-specific locations along trail corridors; local long-term moderate adverse impacts on hydrologic processes at Tuolumne Meadows; and local long-term minor adverse impacts on natural flow within the 100-year floodplain at Glen Aulin and Tuolumne Meadows.

Environmental Consequences Common to Alternatives 1–4

Many of the impacts on water quality and free flow would be common to all the action alternatives and are presented below but not repeated under each alternative.

Wild Segments

As under the no-action alternative, continuation of current wilderness management policies would continue to protect water quality and flow regimes within wild segments of the Tuolumne River corridor.

Water Quality

Water quality and clarity would be expected to remain high and within standards established by the NPS (see chapter 5).

Hydrologic Processes

Hydrologic processes below O'Shaughnessy Dam would continue to be altered by the presence of the dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam intended to more closely mimic natural flows for the benefit of river-dependent ecosystems.

Scenic Segments

Water Quality

Water quality and clarity would be expected to remain high and within standards established by the NPS (see chapter 5) as part of the *Tuolumne River Plan*.

Improvements to the wastewater treatment and disposal facilities throughout Tuolumne Meadows, including an assessment of current wastewater lines at the campground, replacement of utility lines, and conversion of the skier's pit toilet to a vault toilet, would reduce the risk to water quality posed by aging utilities. New, improved, or enlarged parking areas would be constructed to minimize stormwater runoff (see appendix O, Mitigation Measures).

Stabilization of the "little blue slide" road cut near the Dana Fork would greatly reduce the amount of sediment entering the river at that location, and reduce associated risks to water quality.

Hydrologic Processes

The implementation of the ecological restoration program, as described in chapters 5 and 7, would include several intensive actions to restore hydrologic processes in both developed and undeveloped portions of Tuolumne Meadows (see appendix H), including disruptions caused by informal trails, old roadbeds, ditches, and artificial channels. Repair or replacement of culverts along Tioga Road and drainage structures along portions of the Great Sierra Wagon Road would restore, to the extent possible, natural sheet flow at those locations. Restoration of riparian communities along riverbanks would reduce unnatural erosion and deposition and allow the river to meander more naturally across the floodplain. Implemented over time, and informed by relevant research, these actions would be expected to improve the natural hydrologic connectivity between the river and the meadows.

Under all alternatives, the NPS would conduct long-term monitoring of river flows and cap water withdrawals at no more than 10% of lowest flows. To remain within this management standard, alternatives 1–4 may implement water conservation measures, such as replacing leaking water lines, installing low-flow fixtures, installing systems to reuse gray water or systems to catch rainwater, as needed. This would maintain flow at a level protective of wetted habitat downstream. As noted in chapter 5, if long-term monitoring detects a future decrease in river flows associated with natural cycles or climate change, those findings will trigger further decreases in water withdrawals for domestic use at Tuolumne Meadows, including reductions in the types and levels of visitor services, if necessary.

Improvements to the water delivery system would help reduce the demand for water withdrawals from the Dana Fork. The causeway and Tioga Road bridge in Tuolumne Meadows would be improved to mitigate structural problems that cause the river channel to back up during periods of high flows. However, as noted in chapter 8, because it is not yet known how the bridges and causeway would be modified to better accommodate surface hydrology, these actions would require additional evaluation in a separate compliance effort.

In addition, removing an approximately 150-foot-long section of boulder riprap at the Tuolumne Meadows campground A-loop road would enhance the river's natural flow at that location.

As under the no-action alternative, hydrologic processes below O'Shaughnessy Dam (including the 1-mile scenic segment immediately downstream of the dam) would continue to be altered by the presence of the dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam intended to more closely mimic natural flows for the benefit of river-dependent ecosystems.

Environmental Consequences of Alternative 1

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 1 on hydrology, water quality, and floodplains are described below.

Wild Segments

Water Quality

The removal of the Glen Aulin High Sierra Camp would remove risks to water quality associated with this facility.

Hydrologic Processes

The removal of the Glen Aulin High Sierra Camp would remove the water withdrawal requirement from this area.

Floodplains

With the exception of trails and bridges, alternative 1 would also remove all infrastructure from the 100-year floodplain at Glen Aulin.

Scenic Segments

Water Quality

Replacing the wastewater ponds and sprayfields with new facilities on the south side of Tioga Road, where they would no longer pose a risk to the meadow and river, would eliminate risks to water quality associated with the existing facilities. Similarly, removing the public fuel station would eliminate the risk to water quality posed by the existing underground fuel tanks.

Substantial reductions in administrative pack stock use and stable operations would reduce but not eliminate the risks to water quality associated with these activities. Ongoing monitoring and best management practices (e.g., manure removal) would be needed to protect water quality near the stables.

Hydrologic Processes

The estimated demand for water to support facilities at Tuolumne Meadows would average approximately 30,000 gallons per day, with maximum use at an estimated 41,000 gallons per day during the peak season, as a result of decreases in day and overnight use levels. This level of water withdrawal would be expected to remain well within the standard of no more than 10% of low flow, even if natural cycles or climate change led to longer low-flow durations occurring earlier in the summer. This would reduce the potential for impacts on downstream ecological communities and would avoid the need to introduce additional water conservation measures in the future.

Alternative 1 would remove the concessioner employee housing behind the store and grill, the employee and guest tents near the river at Tuolumne Meadows Lodge, and all the A-loop campsites, which would help restore localized surface flows at those locations. The additional removal of all commercial services on the eastern end of the meadow might reduce the likelihood of ponding at that location as a result of improved surface flow.

Construction of new facilities in upland areas south of Tioga Road would alter surface hydrology by removing vegetation and installing impervious surfaces. This disruption could be mitigated to some degree with the installation of site drainage facilities (e.g., culverts) to channel flow from upland areas, across Tioga Road to the meadows. In addition, use of best management practices would be needed to mitigate impacts and protect water quality during construction activity (see appendix O).

Floodplains

No new development would occur within the 100-year floodplain. The NPS would remove most facilities from the 100-year floodplain under alternative 1, including portions of the Tuolumne Meadows Lodge complex, the campground A-loop road and campsites, the campground entrance road, and the store and grill and associated facilities. Removal of facilities from the floodplain would improve natural surface flow during high-water events. Facilities remaining in the floodplain would include Tioga Road, the Tioga Road bridge, trails, and a parking area at the existing location of the store and grill. Proposed improvements to the Tioga Road bridge would improve natural surface flows at these locations during high-water events. Since major flood events are most likely to occur when there is no vehicle access to Tuolumne Meadows area (winter and early spring), the risk to life and property from high-water events would be very low.

Conclusion

With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 1. The removal of the Glen Aulin High Sierra Camp, the relocation and replacement of wastewater treatment facilities in Tuolumne Meadows, upgraded water and wastewater systems at Tuolumne Meadows, the removal of the public fuel facility at Tuolumne Meadows, and the stabilization of the road cut near the Dana Fork would result in a local long-term moderate beneficial impact on water quality.

Reductions in stock use along trail corridors due to the elimination of concessioner day rides and commercial use would result in a local long-term minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail from Tuolumne Meadows to Glen Aulin.

A reduction in water withdrawals to an average of about 30,000 gallons per day, with maximum levels at approximately 41,000 gallons per day during peak season for domestic needs at Tuolumne Meadows would result in a local long-term minor beneficial impact on streamflow and associated downstream ecological communities, and would avoid the need to introduce additional water restrictions in the future.

Natural hydrologic processes would remain unaffected in the vast majority of the river corridor. Implementation of the ecological restoration program at Tuolumne Meadows, in conjunction with removal of many facilities, would result in a local long-term moderate beneficial impact on hydrologic processes.

There would be no new development in the 100-year floodplain of the river. The majority of facilities would be removed from the 100-year floodplain of the river at Tuolumne Meadows, and all facilities would be removed from the 100-year floodplain at Glen Aulin. This would result in a local long-term minor to moderate beneficial impact on natural flows at those locations.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on hydrologic resources in combination with alternative 1 are the same as those listed earlier under the no-action alternative.

In combination with the cumulative plans and projects, alternative 1 would result in a local long-term minor beneficial impact on water quality at site-specific locations along trail corridors and local long-term moderate beneficial impact on water quality at Tuolumne Meadows and Glen Aulin. There would be a local long-term moderate beneficial cumulative impact on hydrologic processes at Tuolumne Meadows and Glen Aulin.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on hydrology, water quality, and floodplains are described below.

Wild Segments

Water Quality

Limited recreational boating between Tuolumne Meadows and Pate Valley under alternative 2 would not have an impact on water quality because this action would not increase the number of people in the river corridor (boaters would be required to obtain a wilderness permit) and this type of use would be minimal.

The wastewater treatment facilities at the Glen Aulin High Sierra Camp would be removed and use of the camp’s leach mound would be discontinued, thus reducing existing risks to water quality at the camp. There is no anticipated impact on risk to water quality from the proposed use of the area as a seasonal outfitter camp, provided that water collection, treatment, and disposal are performed in accordance with NPS DO-83, “NPS Public Health Guidelines.” The water line would be removed; water would be collected by hand either using buckets or water filters. Construction of a composting toilet for camp guests and replacement of the backpacker campground composting toilet would also mitigate some existing risks to water quality.

Hydrologic Processes

Water withdrawals for use at the seasonal outfitter camp under alternative 2 would be reduced and the infrastructure associated with water collection, treatment and disposal would be removed, with the exception of the leach mound. The leach mound would remain in place and would be restored by natural processes. The new composting toilet for guests and temporary facilities for collection and disposal of wastewater would eliminate the risk to water quality posed by the existing leach mound (the leach mound would no longer be used).

Floodplains

With the exception of trails and bridges, alternative 2 would also remove all permanent infrastructure from the 100-year floodplain at Glen Aulin. Seasonal structures are not expected to interfere with natural flows because they would be erected after peak spring snowmelt.

Scenic Segments

Water Quality

In order to stay within management standards, water withdrawals and the corresponding wastewater treatment load at Tuolumne Meadows would be capped at 65,000 gallons per day, or 10% of low flow, whichever is less.

An upgrade and redesign of the wastewater treatment plant to meet contemporary California codes would include tertiary treatment of wastewater, which would greatly reduce the risk to water quality from potential failure of the existing wastewater line under the meadows. An upgrade and redesign of the wastewater treatment ponds and sprayfield at their current location for a capacity of 65,000 gallons per day would reduce, but not eliminate, water quality risks at that location. Such risks would also be lowered by the possible removal of the wastewater treatment ponds, an action that might be made possible by conversion to tertiary treatment (which may eliminate the need for the ponds); however, as noted in chapter 8, this option would require additional environmental review and is therefore not further analyzed.

The public fuel station would remain in alternative 2; ongoing monitoring would be needed to assess water quality risks at this location.

Reductions in concessioner pack stock use and associated stable operations (due to the reduced number of concessioner day rides and discontinued deliveries of wood to the Glen Aulin High Sierra Camp) might slightly

reduce the risks to water quality at the concessioner stable by reducing the amount of pack stock and decreasing the number of pack stock trips originating in Tuolumne Meadows. Ongoing monitoring and best management practices (e.g., manure removal) would still be needed to protect water quality at this location.

Hydrologic Processes

The estimated demand for water to support domestic use at Tuolumne Meadows would increase to an estimated average of 50,000 gallons per day under alternative 2 to accommodate additional campground sites and additional employee housing. In order to remain within the management standard of withdrawals of no more than 10% of low flow or 65,000 gallons per day, a more intensive management effort would be required under alternative 2 than alternatives 1, 3, and 4, including water metering, replacement of inefficient fixtures, and educational programs. Additional water storage capacity might be needed. If monitoring indicated low-flow starting earlier in the summer, alternative 2 would have the greatest potential of all the action alternatives to require reductions in service (as described in chapter 5), including reducing the capacities at the Tuolumne Meadows Lodge and/or campground, to ensure that the level of water consumption remained protective of river flows.

Alternative 2 would remove the concessioner employee housing behind the store and grill, the employee and guest tents near the river at Tuolumne Meadows Lodge, and the campground A-loop campsites nearest the river. These actions would reduce the number of facilities in meadow or riparian areas and help restore surface flows at those locations.

Construction of new or expanded facilities in upland areas south of Tioga Road, including a new consolidated NPS and concessioner stable, a new picnic and parking area, and expanded housing and parking, would alter surface hydrology in those locations by removing vegetation and installing an impervious surface. This disruption could be mitigated to some degree with the installation of site drainage facilities (e.g., culverts) to channel flow from upland areas across Tioga Road to the meadows. In addition, use of best management practices would be needed to mitigate impacts and protect water quality during construction activity (see appendix O).

Floodplains

With the exception of a new trail corridor originating from the visitor services area (the current location of the store and grill) to Parsons Memorial Lodge, new development would occur outside of the 100-year floodplain. In addition, alternative 2 would remove facilities from ordinary high-water areas and the 100-year floodplain, including the tent cabins at Tuolumne Meadows Lodge and some campground A-loop campsites; however, the majority of existing development within the 100-year floodplain would remain.

Since major flood events are most likely to occur when there is no vehicle access to Tuolumne Meadows area (winter and early spring), the risk to life and property from high-water events would remain very low.

Conclusion

With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 2. Upgraded water and wastewater treatment facilities at Tuolumne Meadows, and the stabilization of the road cut near the Dana Fork, would result in local long-term minor beneficial impacts on water quality. Retention of the public fuel station and stables facilities at a reduced capacity would require ongoing monitoring and mitigation to minimize risks to water quality. There would be a local long-term minor beneficial impact from discontinuing of leach mound use and installing a new composting toilet at Glen Aulin. There would be no impact on water quality resulting from the introduction of recreational boating.

Reductions in stock use along trail corridors from the reductions in concessioner day rides and commercial stock use would result in a local long-term negligible to minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail from Tuolumne Meadows to Glen Aulin.

An increase in water withdrawals to an estimated average of about 50,000 gallons per day for domestic needs at Tuolumne Meadows would result in a local long-term negligible adverse impact on stream flow and associated downstream ecological communities. Because water withdrawals would be capped at a level that is approximately the same as current peak water use, water conservation measures would be needed immediately upon plan implementation, and additional water storage capacity may be needed to stay within the proposed management standard of withdrawing no more than 10% of low flow, or 65,000 gallons per day maximum (see chapter 5). Of all the action alternatives, alternative 2 would have the greatest potential for requiring reductions in service during periods of low flow to ensure that the level of water consumption remained protective of river flows.

Natural hydrologic processes would remain unaffected in the majority of the river corridor. Implementation of the ecological restoration program at Tuolumne Meadows, in conjunction with removal of infrastructure from meadow and riparian areas, would result in a local long-term moderate beneficial impact on hydrologic processes. Installation of new or expanded facilities, including a new trail corridor at Tuolumne Meadows and facilities south of Tioga Road, would have a local long-term minor adverse impact on hydrologic processes.

With the exception of a proposed trail corridor at Tuolumne Meadows, new development under alternative 2 would occur outside of the 100-year floodplain. Some development closest to the river would be removed from the 100-year floodplain at Tuolumne Meadows and all permanent facilities would be removed from the 100-year floodplain at Glen Aulin, resulting in a local long-term minor beneficial impact on natural flows at those locations.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on hydrologic resources in combination with alternative 2 are the same as those listed under the no-action alternative.

In combination with cumulative plans and projects, alternative 2 would result in local long-term minor beneficial impacts on water quality at site-specific locations along trail corridors and local long-term minor beneficial impact on water quality at Tuolumne Meadows and Glen Aulin. There would be a local long-term moderate beneficial cumulative impact on hydrologic processes, including hydrologic processes at Tuolumne Meadows.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on hydrology, water quality, and floodplains are described below.

Wild Segments

Water Quality

At Glen Aulin High Sierra Camp, replacing flush toilets with a composting toilet and slightly reducing the guest capacity at the camp would help mitigate the risk posed by the current leach mound system. However, the risk of future failure or flooding of the leach mound would remain.

Hydrologic Processes

Water withdrawals for use at the Glen Aulin High Sierra Camp would continue to be restricted to 600 gallons per day.

Floodplains

Portions of the Glen Aulin High Sierra Camp would remain within the 100-year floodplain of the river.

Scenic Segments

Water Quality

An upgrade and redesign of the wastewater treatment plant to meet contemporary California codes would include tertiary treatment of wastewater, which would greatly reduce the risk to water quality from potential failure of the existing wastewater line under the meadows. An upgrade and redesign of the wastewater treatment ponds and sprayfield at their current location for a capacity of 61,000 gallons per day would reduce, but not eliminate, water quality risks at that location. Such risks would also be lowered by the possible removal of the wastewater treatment ponds, an action that might be made possible by conversion to tertiary treatment (which may eliminate the need for the ponds); however, as noted in chapter 8, this option would require additional environmental review and is therefore not further analyzed.

Removal of the public fuel station would eliminate the risk to water quality posed by the existing underground fuel tanks. The risk to water quality associated with the wastewater line crossing underneath the Tioga Road bridge over the Tuolumne River would remain.

Reductions in concessioner pack stock use and associated stable operations (due to the reduced number of concessioner day rides and the elimination of some services, including meal-only service, at the Glen Aulin High Sierra Camp) would reduce the risks to water quality at the concessioner stable by reducing the amount of pack stock and decreasing the number of pack stock trips originating in Tuolumne Meadows. Ongoing monitoring and best management practices (e.g., manure removal) under alternative 3 would still be needed to protect water quality at this location.

Hydrologic Processes

The estimated demand for water to support facilities at Tuolumne Meadows would average approximately 42,000 gallons per day, with maximum use at an estimated 61,000 gallons per day during the peak season, as a result of the reductions in overnight lodging at Tuolumne Meadows Lodge and reductions in the overall number of employees at Tuolumne Meadows. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow unless climate change led to longer low-flow durations occurring earlier in the summer. Additional water storage capacity and additional water restrictions may be needed in very low flow years to maintain water withdrawals at a level that minimizes impacts on downstream ecosystems.

Alternative 3 would remove the concessioner employee housing behind the store and grill, the employee housing at Tuolumne Meadows Lodge, and one half of the guest tents at Tuolumne Meadows Lodge. Removing these structures would help restore surface flows in those habitats.

Construction of expanded parking facilities south of Tioga Road and housing facilities north of Tuolumne Meadows Lodge would alter surface hydrology in upland areas by removing vegetation and installing an impervious surface. This disruption could be mitigated to some degree with the installation of site drainage facilities (e.g., culverts) to channel flow from upland areas to the river and/or meadows. In addition, use of best management practices would be needed to mitigate impacts and protect water quality during construction activity (see appendix O).

Floodplains

No new development would occur within the 100-year floodplain. Under alternative 3, the NPS would remove some facilities from ordinary high water areas and the 100-year floodplain, including guest and employee tent cabins at Tuolumne Meadows Lodge; however, the majority of existing development within the floodplain would remain at Tuolumne Meadows and Glen Aulin. Because major flood events are most likely to occur when there is no vehicle access to Tuolumne Meadows area (winter and early spring), the risk to life and property from high-water events would remain very low.

Conclusion

With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 3. Upgraded wastewater treatment facilities at Tuolumne Meadows, the removal of the public fuel facility at Tuolumne Meadows, and the stabilization of the road cut near the Dana Fork would result in local long-term minor beneficial impacts on water quality. Retention of the stables facilities (at a reduced capacity) would require ongoing monitoring and mitigation to minimize risks to water quality. There would be a local long-term negligible to minor beneficial impact on water quality from installing a new composting toilet at Glen Aulin.

Reductions in stock use along trails with the decrease in concessioner day rides and commercial pack stock use would result in a local long-term negligible to minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail from Tuolumne Meadows to Glen Aulin.

A slight decrease in water withdrawals to an estimated average of about 42,000 gallons per day for domestic needs at Tuolumne Meadows would result in a local long-term negligible beneficial impact on stream flow and associated downstream ecological communities. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow. Additional water storage capacity and additional water restrictions may be needed in very low flow years.

Natural hydrologic processes would remain unaffected in the majority of the river corridor under alternative 3. Implementation of the ecological restoration program at Tuolumne Meadows, in conjunction with removal of infrastructure from meadow and riparian areas, would result in a local long-term moderate beneficial impact on hydrologic processes. Installation of new or expanded facilities south of Tioga Road would have a local long-term minor adverse impact on hydrologic processes.

New development would occur outside of the 100-year floodplain. Most structures at Glen Aulin High Sierra Camp within the 100-year floodplain would remain. Some development closest to the river would be removed from the 100-year floodplain at Tuolumne Meadows, resulting in a local long-term negligible beneficial impact on natural flows.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on hydrologic resources combined with alternative 3 are the same as those listed under alternative 1.

In combination with cumulative plans and projects, alternative 3 would result in local long-term minor beneficial impacts on water quality at site-specific locations along trail corridors and local long-term minor beneficial impact on water quality at Tuolumne Meadows and Glen Aulin. There would be a local long-term moderate beneficial cumulative impact on hydrologic processes, including hydrologic processes at Tuolumne Meadows.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on hydrology, water quality, and floodplains are described below.

Wild Segments

Water Quality

Limited recreational boating between Tuolumne Meadows and Pate Valley under alternative 4 would not have an impact on water quality because this action would not increase the number of people in the river corridor (boaters would be required to obtain a wilderness permit) and this type of use would be minimal.

At Glen Aulin High Sierra Camp, risks to water quality would be reduced by decreasing water withdrawals to 500 gallons per day, which would mitigate some of the risk posed by limited capacity of the current leach mound system. Reductions in water use would be achieved by replacing flush toilets with composting toilets, and reducing the High Sierra Camp guest capacity. The composting toilets would be installed outside the floodplain and emptied at the end of each season in order to avoid risks to water quality.

The risk of future failure or flooding of the leach mound would remain. However, eliminating the flush toilets would convert the leach mound to gray water only, which would greatly reduce the risk to water quality at the camp by eliminating human waste from the wastewater treatment system.

In addition, the reductions in pack stock used to resupply the camp would reduce the risk to water quality on trails leading to the camp and at the camp’s corrals.

Hydrologic Processes

Environmental consequences related to hydrologic processes under alternative 4 would be the same as those described in the “Environmental Consequences Common to Alternatives 1–4” subsection above.

Floodplains

One employee cabin would be relocated away from Conness Creek, out of the 100-year floodplain. With the exception of the employee cabin, existing infrastructure would remain within the 100-year floodplain of the river. The proposed composting toilet for guests and employees would be installed outside the 100-year floodplain.

Scenic Segments

Water Quality

An upgrade and redesign of the wastewater treatment plant to meet contemporary California codes would include tertiary treatment of wastewater, which would greatly reduce the risk to water quality from potential failure of the existing wastewater line under the meadows. An upgrade and redesign of the wastewater treatment ponds and sprayfield at their current location for a capacity of 65,000 gallons per day would reduce, but not eliminate, water quality risks at that location. Such risks would also be lowered by the possible removal of the wastewater treatment ponds, an action that might be made possible by conversion to tertiary treatment (which may eliminate the need for the ponds); however, as noted in chapter 8, this option would require additional environmental review and is therefore not further analyzed.

Removal of the public fuel station would eliminate the risk to water quality posed by the existing fuel tanks; however, a new employee fuel station near the wastewater treatment plant would introduce risks in a new location, although the risk posed by small above-ground tanks in an upland area is less than the risk posed by the existing large underground tanks adjacent to the meadow. The risk to water quality associated with the wastewater line crossing underneath the Tioga Road bridge over the Tuolumne River would remain.

Reduced concessioner pack stock use and an associated reduction in the combined NPS/concessioner stable operations at Tuolumne Meadows (due to elimination of concessioner day rides into wilderness and reduced numbers of pack stock used to supply Glen Aulin High Sierra Camp) would help reduce localized risks to water quality at the current location of the concessioner stable and along stock use trails in Tuolumne Meadows. Ongoing monitoring and best management practices (e.g., manure removal) would still be needed to protect water quality at the consolidated combined stable area (the current location of the concessioner stable).

Hydrologic Processes

Estimated average water demand for domestic use at Tuolumne Meadows would slightly increase to an average of approximately 47,000 gallons per day, with peak use levels capped at 65,000 gallons per day. Based on the success of water conservation efforts at Tuolumne Meadows during the summer of 2012, and the installation of more efficient fixtures at proposed new housing and visitor facilities, this level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow unless monitoring indicated longer low-flow durations occurring earlier in the summer. Additional water storage capacity, additional water conservation measures, and possibly reductions in service might be needed in low-flow years to maintain water withdrawals at a level that minimizes impacts on downstream ecosystems.

Alternative 4 would remove the concessioner employee housing behind the store and grill and at the lodge, the three guest tent cabins nearest the river at Tuolumne Meadows Lodge, and the 21 A-loop campsites within 100 feet of the river, helping restore surface flows in those habitats. The additional removal of the NPS stable from its current site would help restore surface flows into the nearby meadow.

Construction of expanded facilities south of Tioga Road would alter surface hydrology in upland areas by removing vegetation and installing an impervious surface. This disruption could be mitigated to some degree with the installation of site drainage facilities (e.g., culverts) to channel flow from upland areas, across Tioga Road, and to the meadows. In addition, use of best management practices would be needed to mitigate impacts and protect water quality during construction activity (see appendix O).

Floodplains

No new development would occur within the 100-year floodplain. Under alternative 4, the NPS would relocate several facilities from ordinary high-water areas and the 100-year floodplain, including the concessioner employee housing behind the store and grill, three guest cabins and all employee tent cabins at Tuolumne Meadows Lodge, the campground entrance road, and 21 A-loop campsites. Remaining development in the 100-year floodplain would include the Tioga Road, bridges, trails, a portion of Tuolumne Meadows Lodge, and the campground A-loop road and remaining A-loop campsites.

Conclusion

With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 4. Upgraded wastewater treatment facilities at Tuolumne Meadows, the removal of the public fuel facility at Tuolumne Meadows, the consolidation of stables operations, and the stabilization of the road cut near the Dana Fork would result in local long-term minor beneficial impact on water quality. There would be a local long-term minor beneficial impact on water quality from reducing water withdrawals and installing of a new composting toilet at Glen Aulin. There would be no impact on hydrologic processes, water quality, or floodplains from the introduction of recreational boating.

Substantial reductions in pack stock use along trail corridors, the elimination of concessioner day rides, and additional regulations concerning the location and amount of commercial pack stock use would result in a local long-term minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stable operations, and along the trail from Tuolumne Meadows to Glen Aulin.

An increase in water withdrawals to an average of approximately 47,000 gallons per day for domestic needs at Tuolumne Meadows would result in a local long-term negligible adverse impact on stream flow and downstream ecological communities. Because water withdrawals would be capped at a level that is approximately the same as current peak water use, water conservation measures, including reduced levels of service, and additional storage capacity might be needed during periods of low flow to stay within the standard of withdrawing no more than 10% of low flow, or 65,000 gallons per day maximum (see chapter 5). Reductions in service are not likely under current hydrologic conditions, but might be necessary in the future if low flows increase in duration or intensity.

Natural hydrologic processes would remain unaffected in the majority of the river corridor under alternative 4. The proposed ecological restoration activities, in conjunction with removal of infrastructure from the floodplain and meadow and riparian areas, would result in a local long-term moderate beneficial impact on hydrologic processes at Tuolumne Meadows. Installation of new or expanded facilities south of Tioga Road would have a local long-term minor adverse impact on hydrologic processes.

New development would occur outside of the 100-year floodplain. One employee cabin would be relocated out of the 100-year floodplain at Glen Aulin High Sierra Camp. Approximately one-half of the development currently within the 100-year floodplain at Tuolumne Meadows would be removed, resulting in a local minor to moderate beneficial impact on natural flows at those locations.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on hydrologic resources in combination with alternative 4 are the same as those listed under alternative 1.

In combination with cumulative plans and projects, alternative 4 would result in local, long-term, minor, beneficial impacts on water quality in wilderness and local long-term moderate beneficial impact on water quality at Tuolumne Meadows and Glen Aulin. There would be a local long-term moderate beneficial cumulative impact on hydrologic processes at Tuolumne Meadows.

Wetlands

Affected Environment

Wetlands are ecologically productive habitats that support a rich array of both plant and animal life. They sustain a great variety of hydrologic and ecological functions vital to ecosystem integrity. These functions include flood abatement, sediment retention, groundwater recharge, nutrient capture, and a supporting environment for high levels of plant and animal diversity. Wetlands are highly sensitive to human impacts. Because they provide disproportionately important services relative to their area, disturbance to or modification of even small wetland areas induces effects that are proportionally greater than elsewhere in an ecosystem (Graber 1996). Therefore, wetlands receive special protection under EO 11990, “Protection of Wetlands,” and section 404 of the Clean Water Act.

Section 404 of the Clean Water Act assigns regulatory jurisdiction over “waters of the United States” (of which wetlands are a subset) to the U.S. Army Corps of Engineers (USACE). Wetland determinations and delineations are conducted according to the USACE *Wetlands Delineation Manual* (Environmental Laboratory 1987). Under section 404 of the Clean Water Act, the USACE has jurisdiction over wetlands and waters of the U.S. in the Tuolumne River corridor.

The NPS classifies and maps wetlands using a system created by the USFWS, which is often referred to as the Cowardin classification system (USFWS, Cowardin et al. 1979). Wetlands, as defined by the USFWS, are

transitional lands between terrestrial and aquatic systems, where the water table is usually at or near the surface or the land is covered by shallow water (USFWS, Cowardin et al. 1979). For purposes of this classification, wetlands must have one or more of the following attributes:

- The land supports predominantly hydrophytes, at least periodically. Hydrophytes are plants that grow in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.
- The substrate is predominantly undrained hydric soils. Hydric soils are wet long enough to periodically produce anaerobic conditions.
- The substrate is saturated with water or covered by shallow water at some time during the growing season of each year (USFWS, Cowardin et al. 1979).

Wetlands data presented in this section are descriptive, including actual extent (location on the ground and acreage) for each segment of the Tuolumne Wild and Scenic River within Yosemite National Park and adjacent meadow areas that comprise the Tuolumne Meadows complex. The intent is to provide general descriptions, functions, and values of wetland and water-dependent communities within the Tuolumne River corridor and all of Tuolumne Meadows.

All wetlands within the Tuolumne River corridor fall into one of three system types: riverine (rivers, creeks, and streams), palustrine (shallow ponds, marshes, swamps, and sloughs), or lacustrine (lakes and deep ponds). The lacustrine wetland class represents wetlands and deepwater habitats that are situated in topographic depressions or dammed river channels; that lack trees, shrubs, and emergent mosses and lichens over 60% of their area; and that are greater than 8 hectares in size (20 acres). Similar habitats totaling less than 8 hectares are also included in the lacustrine system if a bedrock shoreline feature makes up all or part of the boundary.

The riverine and palustrine wetland classes represent community characteristics that can be described as riparian. The riparian zone may be best described as the zone of direct interaction between land and water (Swanson et al. 1982, Gregory et al. 1991, Cushing et al. 2006); this zone consists of the plant community adjacent to a river or stream channel that serves as the interface between the river and the surrounding meadows, floodplain, and upland plant communities. Riparian areas are characterized by a combination of high species diversity, high species density, and high productivity.

Using the Cowardin classification system, specific wetlands and deepwater classes within the Tuolumne River corridor consist of the following subclasses:

- *Riverine upper perennial* – main channels of the Tuolumne River
- *Riverine lower perennial* – main channels of the Tuolumne River
- *Riverine intermittent* – intermittent tributaries to the Tuolumne River
- *Palustrine emergent* – emergent wetland (marsh, meadow) habitat along the Tuolumne River subject to various flooding regimes
- *Palustrine forested* – riparian forest habitat along the Tuolumne River subject to various flooding regimes
- *Palustrine scrub shrub* – riparian scrub (e.g., willow) habitat along the Tuolumne River and its tributaries subject to various flooding regimes
- *Lacustrine limnetic* – naturally occurring deep-water lakes along the Tuolumne River
- *Lacustrine littoral* – wetland habitats adjacent to deep-water lakes and reservoirs along the Tuolumne River

The information used to describe wetlands in the river corridor is a compilation of data generated through the National Wetlands Inventory (USFWS 1996), Yosemite National Park vegetation mapping efforts, and wetland

surveys conducted at Tuolumne Meadows (Jones & Stokes 2002), Glen Aulin (NPS, Elliot 2006d) and Poopenaut Valley (NPS, Buhler and Santina 2007l). National Wetlands Inventory data were used to describe wetlands in the Tuolumne River corridor in areas where delineation data were not available (i.e., outside of Tuolumne Meadows, Glen Aulin, and Poopenaut Valley). Where National Wetlands Inventory data and park wetland survey data were unavailable, the park referenced vegetation data generated by Yosemite National Park staff and the Wildlife Habitat Relationship Model (CDFG 2007b) were used. Vegetation classes from that model were converted to National Wetlands Inventory classes using a methodology developed by De Becker and Sweet (CDFG 1988).

Description of Wetlands in the Tuolumne River Corridor

There are wetlands in every segment of the Tuolumne Wild and Scenic River corridor. The classes and extent of wetlands outside of Tuolumne Meadows and Glen Aulin are summarized in table 9-2. Wetlands at Tuolumne Meadows and Glen Aulin are summarized below in tables 9-3 and 9-4 and mapped in figures 9-3 and 9-4.

Although there have been no formal wetland delineations in the river corridor performed outside of Tuolumne Meadows, Glen Aulin, or Poopenaut Valley, NPS vegetation data indicate that there is wetland vegetation directly adjacent to the Tioga Road corridor east of Tuolumne Meadows, near existing trail corridors in wilderness between Tuolumne Meadows and Glen Aulin, on the Dana Fork, and in Lyell Canyon. A survey of disturbance associated with pack stock use in Lyell Canyon found disturbance in high-use areas with wetland characteristics, including wet meadows and streambanks. Impacts on areas with wetland characteristics were associated with trampling, such as hoofpunching, which is most likely to occur in wet meadow or riparian soils (NPS, Ballenger et al. 2010j; NPS, Abbe and Ballenger 2012). Wetlands are found only sporadically along trail corridors in the wilderness area between Tuolumne Meadows and Hetch Hetchy Reservoir.

Table 9-2.
Classes and Areal Extent of Wetlands in the Tuolumne River Corridor, Excluding Tuolumne Meadows and Glen Aulin

Wildlife Habitat Relationship Model Name	Wetland Class Cowardin Class	Area per Wild and Scenic River Segment (in acres)				
		Upper and Lower Dana Fork	Lyell Fork	Grand Canyon	Below O'Shaughnessy Dam	Poopenaut Valley
Riverine	Riverine	6.1	7.0	269.6	11.8	75.8
Lacustrine	Lacustrine	5.6	14.9	0.4	0	0
Wet meadow	Palustrine	247.6	403.5	139.8	0	33.8
Freshwater emergent wetland	Riverine: lower perennial emergent wetland; Lacustrine: littoral; Palustrine: emergent wetland	1.8	0.8	0	0	0
Montane riparian	Palustrine: forested wetland	100.4	114.2	76.9	0	7.4

Source: USFWS 1996

In the river corridor below Hetch Hetchy Reservoir, O'Shaughnessy Dam regulates the magnitude, timing, duration, frequency, and rate of change of the hydrologic regime. While the specific impacts of flow regulations by O'Shaughnessy Dam on Poopenaut Valley wetlands and meadows are not completely understood, it is likely that observed conifer encroachment into the Tuolumne River channel is related to flow regulations (NPS, Buhler and Santina 2007l; NPS, Stock et al. 2009). The NPS is collaborating with the SFPUC and other stakeholders to develop a new in-stream flow management plan for O'Shaughnessy Dam, which will include a long-term monitoring effort to track potential changes resulting from improved in-stream flow management and increase understanding of flow regulation effects on wetlands and meadows in the Poopenaut Valley.

Tuolumne Meadows

A 2001 wetland delineation at Tuolumne Meadows, including portions of the developed area outside of the wild and scenic river corridor, found a total of 277.7 acres of palustrine wetland and 28.7 acres of riverine

wetlands in the Tuolumne Meadows area (Jones & Stokes 2002). The classes of wetlands and riverine habitat found at Tuolumne Meadows are summarized in table 9-3 and are illustrated in figure 9-3.

Table 9-3.
Classes and Areal Extent of Wetlands in Tuolumne Meadows

Wetland Type	Cowardin Class	Description	Area (Acres)
Freshwater emergent wetland (including wet meadow)	Palustrine emergent	Herbaceous marsh, fen, swale, or wet meadow	201.8
Freshwater forested wetland	Palustrine forested	Forested swamp	38.8
Freshwater shrub wetland	Palustrine scrub-shrub	Shrub bog or wetland	32.7
Freshwater pond (wastewater treatment ponds)	Palustrine unconsolidated bottom	Pond	4.6
Riverine lower perennial, rock	Riverine wetland	Low-gradient rock-bottomed river	2.7
Riverine lower perennial, unconsolidated	Riverine wetland	Low-gradient stone-bottomed river	16.1
Riverine lower perennial, shore	Riverine wetland	Low-gradient stone-covered shore	7.8
Riverine upper perennial, rock	Riverine wetland	High-gradient rock-bottomed river	0.7
Riverine upper perennial, unconsolidated	Riverine wetland	High-gradient stone-bottomed river	0.6

Source: Jones & Stokes 2002

The 2001 wetland delineation (Jones & Stokes 2002) notes the following characteristics of palustrine wetlands at Tuolumne Meadows:

- Palustrine emergent wetlands, the most extensive class of wetland habitat in the Tuolumne Meadows area, were found in large open expanses of the meadows and in small openings beneath the adjacent forest canopy (see figure 9-3). These wetlands are characterized by a relatively dense layer of herbaceous vegetation. The most common type of emergent wetlands at Tuolumne Meadows are dominated by a mixture of grasses, sedges, and forbs and are found on level to gently sloping surfaces. Sedge-dominated wetlands are less abundant and found in swales and other topographic depressions.
- Palustrine forested wetlands, the second-most extensive class of wetland habitat at Tuolumne Meadows, are characterized by an overstory of lodgepole pine and an understory of grasses, forbs, and some sedges. The forested wetlands occur adjacent to perennial and intermittent streams, and in topographic depressions.
- Palustrine scrub-shrub wetlands at Tuolumne Meadows are characterized by a dense shrub layer dominated by willows or dwarf blueberry, and an understory of grass, forbs, and sedges. Willow-dominated scrub-shrub wetlands are found immediately adjacent to the Tuolumne River and its tributaries. Scrub-shrub wetlands dominated by dwarf blueberry are found between Tioga Road and the Tuolumne River; they are not found immediately adjacent to the river or its tributaries.
- Palustrine unconsolidated bottom habitat is only found at two locations: a small glacial pond on the northwestern side of Tuolumne Meadows, and a small depression near Tioga Road.

In addition, Jones & Stokes (2002) notes that all six classes of riverine habitat at Tuolumne Meadows are confined to the active channels of the Tuolumne River, its tributaries, and other intermittent streams in the area. The riverine lower perennial bottom types and lower perennial unconsolidated shore constitutes most of the Tuolumne River channel and along reaches of the Dana and Lyell Forks. The riverine upper perennial bottom types are found on the upper reaches of the Dana Fork (at Tuolumne Meadows). Riverine intermittent streambed habitat consists of small intermittent drainages to the north and south of Tuolumne Meadows (Jones & Stokes 2002).

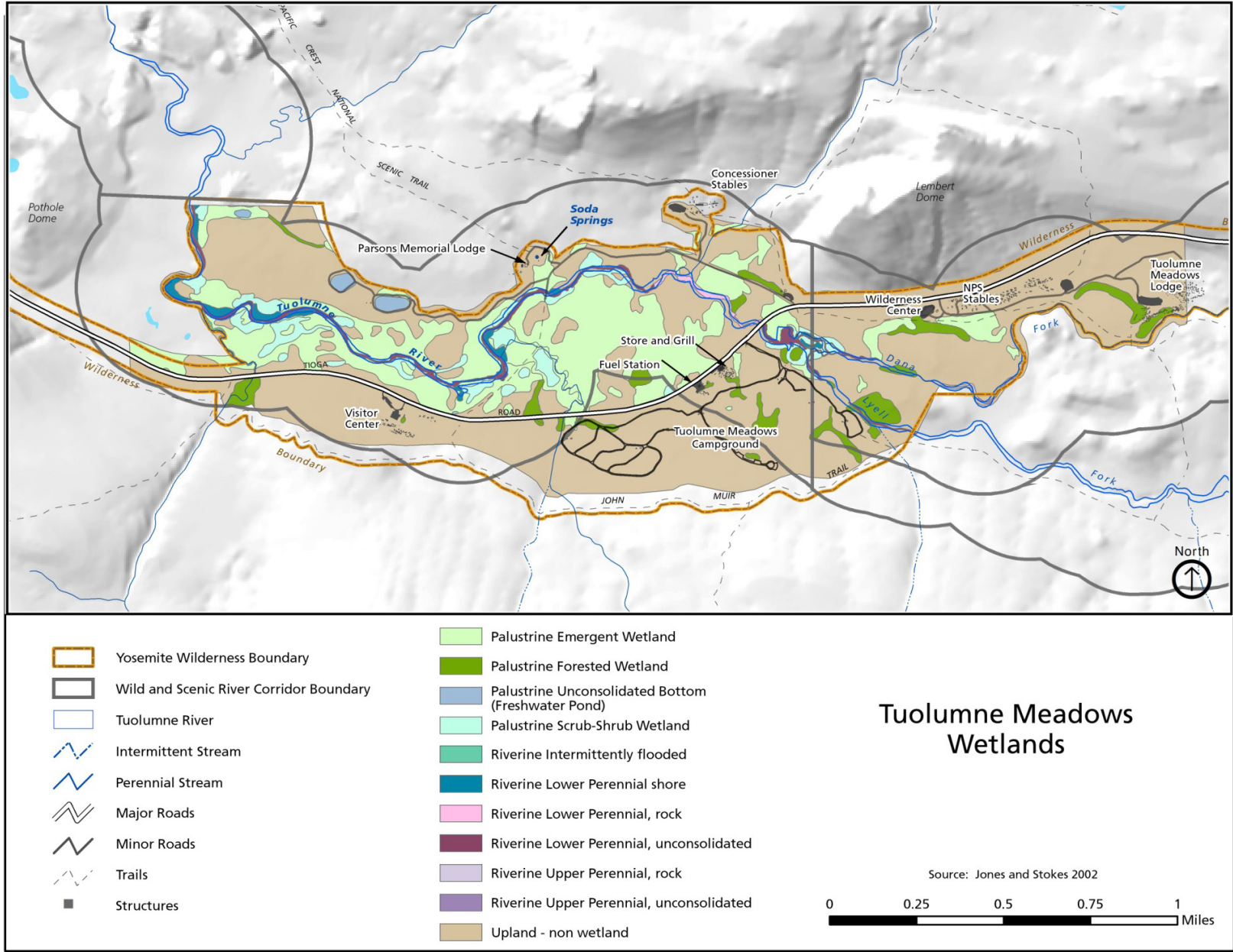


Figure 9-3. Wetlands at Tuolumne Meadows.

Wetland disturbance noted during the 2001 wetland delineation at Tuolumne Meadows included the impacts associated with the construction and use of existing roads and trails, including soil compaction, vegetation removal and disturbance, and altered surface hydrology (Jones & Stokes 2002). In addition, wetland habitat adjacent to Tioga Road had been disturbed by foot traffic and roadside parking (Jones & Stokes 2002). Emergent and forested wetlands were the primary classes of wetlands affected by these impacts. Generally, these impacts on wetlands extend beyond the footprint of the road or trail.

Park staff have noted high concentrations of informal trails in locations adjacent to wetlands, including the Tioga Road corridor in general, the Cathedral Lakes parking area, the Parsons Memorial Lodge trailhead east of the visitor center, the store and grill area, across the meadow from the store to Parsons Memorial Lodge, around the Soda Springs area, and along the banks of the river. Specific impacts on wetlands include denuded wetland meadow vegetation along the Lyell Fork near the campground A-loop road, denuded riparian areas adjacent to Tuolumne Meadows Lodge, soil compaction and erosion at roadside parking areas that are adjacent to wetlands, and the loss of willows along the riverbank at the western end of the meadow (NPS, Buhler et al. 2010e).

Jones & Stokes (2002) also notes that developed facilities at Tuolumne Meadows may occur in areas that previously supported wetland habitat. The public fuel station, store and grill, and campground are all located immediately adjacent to existing forested wetland habitat, have gently sloping topography, and contain scattered pockets of hydrophytic vegetation (vegetation that thrives in saturated conditions). It is not known if the existing topography and vegetation in these areas are indicative of past conditions, or if the development activities themselves altered the natural topography and vegetation. The study authors suggest that it is reasonable to assume that these developed areas at one time supported forested wetlands similar to those that exist in adjacent areas (Jones & Stokes 2002).

Glen Aulin

Wetlands near Glen Aulin, at the eastern end of the Grand Canyon of the Tuolumne where Conness Creek drains into the Tuolumne River, are classified as palustrine forested and palustrine scrub-shrub (see table 9-4 and figure 9-4).

Table 9-4.
Classes and Areal Extent of Wetlands at Glen Aulin

Wetland Type	Cowardin Class	Description	Area (Acres)
Freshwater forested wetland	Palustrine forested	Forested swamp	1.4
Freshwater shrub wetland	Palustrine shrub	Shrub bog or wetland	32.7
Riverine intermittent streambed	Riverine wetland	Exhibits flowing water for only part of the year.	not applicable
Riverine upper perennial, rock	Riverine wetland	High gradient rock-bottomed river	0.7
Riverine upper perennial, unconsolidated	Riverine wetland	High gradient stone-bottomed river	0.6

Source: NPS, Elliot 2006d

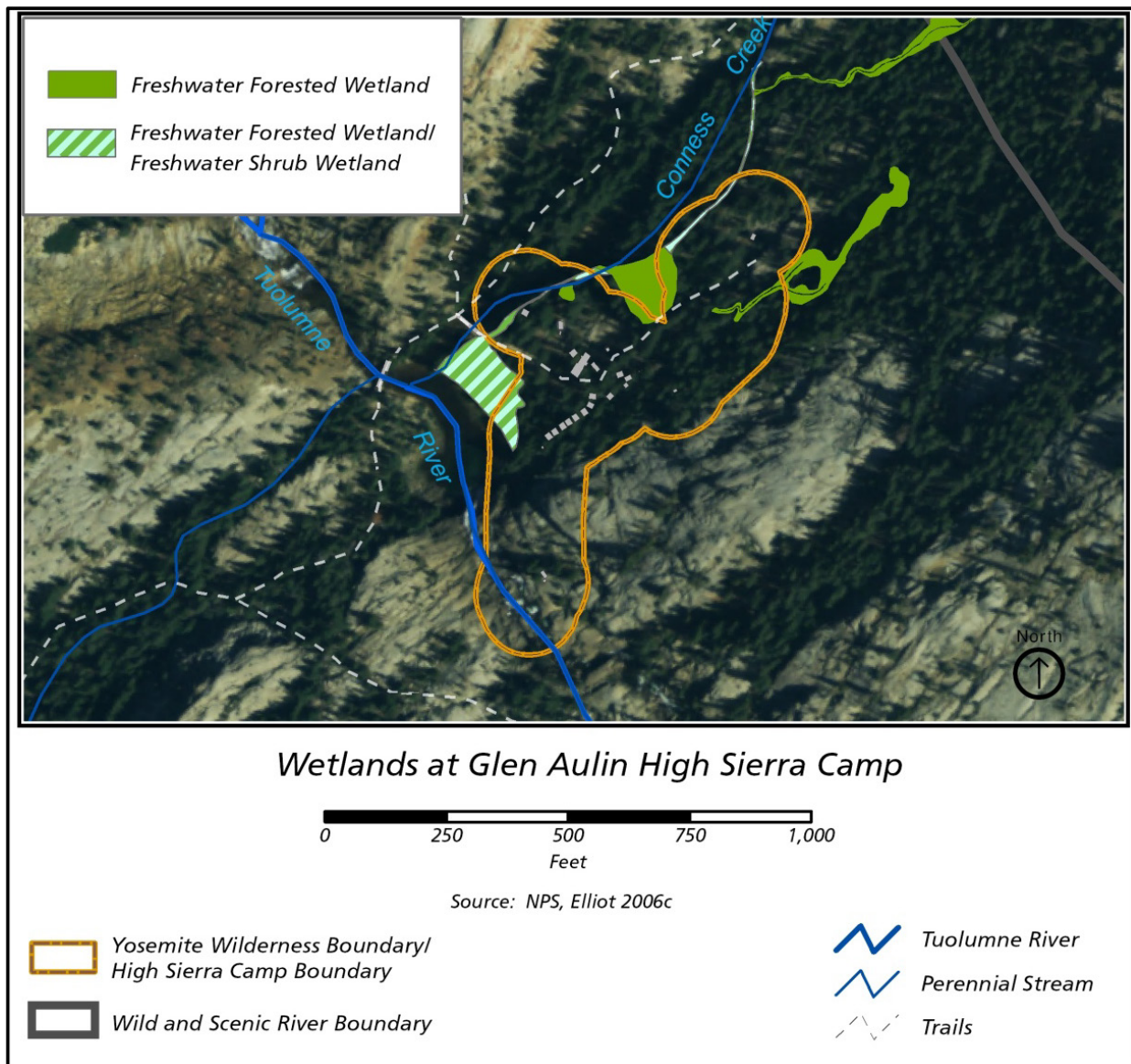


Figure 9-4. Wetlands at Glen Aulin.

Riverine areas include upper perennial rock bottom and upper perennial unconsolidated bottom in the Tuolumne River at Glen Aulin, upper perennial rock bottom at Conness Creek, and intermittent streambed habitat at two unnamed streams.

Two locations at Glen Aulin exhibit disturbance. One of these locations is a historic corral adjacent to one of the wetland areas on a granite terrace above the campground; it appears that the wetland there at one time was contiguous with the disturbed area defined by the corral, which is now denuded of vegetation. The other location showing disturbance (with potential for classification as an atypical situation) is adjacent to Conness Creek, where a heavily used trail bisects a wetland area that at one time may have been connected by surface flow (NPS, Elliot 2006d).

In addition, the leach mound at Glen Aulin High Sierra Camp is currently operating at capacity and poses a risk to the water quality of the wetlands between the camp and Conness Creek.

Environmental Consequences Methodology

Proposed management actions under each alternative were evaluated in terms of the context, intensity, and duration of the impacts, as defined below, and whether the impacts were considered to be beneficial or adverse to the natural environment. Generally, the methodology for natural resource impact assessment follows direction provided in the CEQ regulations, section 1508.27.

Context: The context of the impact considers whether the impact would be local or regional. For this analysis, all impacts are considered to be localized to individual wetlands or to connected wetlands within the immediate area.

Intensity: The intensity of the impact considers effects of an action on the size, integrity, and connectivity of wetlands. These designations are used to describe both beneficial and adverse impacts. Negligible impacts would not result in a detectable impact on wetland size, integrity, or connectivity. Minor impacts would be detectable and would result in a change in wetland size, integrity, or connectivity. If mitigation is needed to offset adverse impacts, it would be relatively simple to implement. Moderate impacts would be clearly detectable and sufficient to cause a change in wetland size, integrity, or connectivity. Mitigation would be needed to offset adverse impacts. Major impacts would be substantial and highly noticeable, with the potential for landscape-scale changes in the distribution, quantity, or integrity of wetlands.

Duration: A short-term impact would have an immediate effect on wetlands but would not cause long-term impacts on wetland size, integrity, or connectivity. Short-term impacts are normally associated with transitional types of activities, such as facility construction. A long-term impact would have an effect that would remain beyond transitional activities. A long-term adverse impact would lead to a permanent loss of wetlands as exhibited by a decline in wetland indicator species abundance, viability, and/or survival.

Type: The type of impact considers whether the impact would be beneficial or adverse. Impacts are considered beneficial if an action causes no detrimental effect and results in an increase in the size, integrity, or connectivity of wetlands. Impacts are considered adverse if they degrade the size, integrity, or connectivity of wetlands.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of current condition and management, as described under chapter 8 and “Affected Environment,” above.

Wild Segments

Continuation of current wilderness management policies, including protection of natural processes, visitor education, and restrictions on amounts and locations of overnight use, would continue to protect wetlands in the Tuolumne River corridor.

Site-specific impacts from foot traffic and pack stock use, such as soil compaction and vegetation disturbance, would continue to occur along trail corridors, primarily above Tuolumne Meadows along the Lyell Fork and on the trail between Tuolumne Meadows and Glen Aulin. As described in the ‘Affected Environment’ section above, existing pack stock disturbance to wetlands in meadow areas and along riverbanks would continue in Lyell Canyon.

Current visitor and administrative uses would continue at Glen Aulin under this alternative. Existing impacts on wetlands at the corral and along a heavily used trail at the High Sierra Camp, described in the ‘Affected Environment,’ above, would continue. The camp’s leach mound would continue to operate at capacity, thus posing a risk to wetlands between the camp and Conness Creek.

Any impacts in the wild segment between Tuolumne Meadows and Hetch Hetchy Reservoir would continue to be local, minor, and primarily caused by foot traffic. Wetlands below the reservoir at Poopenaut Valley would remain undisturbed, with the exception of altered hydrologic processes caused by controlled releases of water at O'Shaughnessy Dam. It is not clear what effect the dam has had on wetlands at Poopenaut Valley; the NPS is in the process of developing and implementing a long-term monitoring program to better understand and quantify the effects of O'Shaughnessy Dam on downstream ecosystems.

Scenic Segments

Current visitor and administrative uses would continue at Tuolumne Meadows under the no-action alternative. Informal trails would continue to pose potential risks to adjacent wetlands near the Tioga Road corridor in general, the Cathedral Lakes parking area, the Parsons Memorial Lodge trailhead east of the visitor center, the store and grill area, across the meadow from the store to Parsons Memorial Lodge, around the Soda Springs area, and along the banks of the river. Existing impacts on wetlands would continue to include denuded wetland meadow vegetation along the Lyell Fork near the campground A-loop road, denuded riparian areas adjacent to Tuolumne Meadows Lodge, soil compaction and erosion at roadside parking areas adjacent to wetlands, and the loss of willows along the riverbank at the western end of the meadow.

Scenic Segment

The condition of riverine wetlands in the Below O'Shaughnessy Dam segment, which begins 0.25 mile downstream of the dam, has not been formally evaluated. As noted for the Poopenaut Valley segment above under "Wild Segments," it is not clear what effect the dam has had on wetlands downstream; the NPS has implemented a long-term monitoring program to better understand and quantify the effects of O'Shaughnessy Dam on downstream ecosystems.

Conclusion

Under the no-action alternative, wetlands in wild segments would overall remain undisturbed, with site-specific adverse impacts associated with trail use above Tuolumne Meadows, along the lower Dana Fork, and in Lyell Canyon. Local long-term moderate adverse impacts on wetlands would continue to occur at pack stock camp and grazing areas in Lyell Canyon. At Glen Aulin, vegetation impacts associated with pack stock and foot traffic would result in local long-term minor to moderate adverse impacts on wetlands. Wetlands downstream of O'Shaughnessy Dam would remain undisturbed by visitor use; however, the effect of the dam on downstream ecosystems is not yet known and is being studied.

At Tuolumne Meadows, the impacts of use along road and trail corridors as well as high-use locations would continue to result in local long-term moderate adverse impacts on wetlands.

Cumulative Impacts

Past projects that contributed to adverse impacts on wetlands include the construction, modification, and expansion of roads, trails, and facilities at Tuolumne Meadows and construction of facilities at Glen Aulin High Sierra Camp. The NPS has undertaken site-by-site actions to mitigate these impacts, such as actions at Soda Springs, where surrounding wet soils and vegetation are highly susceptible to adverse effects of compaction and trampling. These impacts have been addressed through habitat restoration work over the past decade, but adverse effects continue (NPS, Buhler et al. 2010e). In addition to the actions that the NPS routinely performs (e.g., restoration of wilderness campsites), the following recently completed actions from the cumulative plans and projects list (in appendix L) had beneficial impacts on wetlands in the project area:

- Restoration of Disturbed Areas at Tuolumne Meadows Lodge project, which included site drainage improvements and native plant restoration.

Current and/or reasonably foreseeable future actions, projects, and plans that could have a cumulative effect on native plant communities include:

- Implementation of the Improve Parkwide Communications Data Network project and Tuolumne Meadows water treatment system improvements may result in site-specific, short-term impacts on wetlands from construction, although best management practices would be expected to reduce any impacts from minor to negligible.
- Implementation of the upcoming *Wilderness Stewardship Plan* and the upcoming *High-Elevation Aquatic Ecosystem Recovery and Stewardship Plan* would have beneficial impacts on native plant communities through management intended to maintain or restore natural processes in the Tuolumne River watershed.

In combination with these cumulative plans and projects, the no-action alternative would result in the same impacts as noted under “Conclusion,” above. The cumulative plans and projects would not have a substantial impact on wetlands in the river corridor.

Environmental Consequences Common to Alternatives 1–4

Many of the impacts on wetlands would be common to all the action alternatives and are presented below, but are not repeated under each alternative.

Wild Segments

Continuation of current wilderness management policies, including protection of natural processes, visitor education, and restrictions on amounts and locations of overnight use, would continue to protect wetlands in the Tuolumne River corridor. Wetlands in wilderness would remain generally undisturbed, with site-specific exceptions associated with foot traffic and pack stock use along trail corridors. Establishment of two designated stock campsites and re-routing designated stock routes to more resilient locations in portions of Lyell Canyon would require a wetlands delineation prior to project implementation.

As in the no-action alternative, wetlands at Poopenaut Valley would remain undisturbed, with the exception of altered hydrologic processes caused by controlled releases of water at O’Shaughnessy Dam. It is not clear what effect the dam has had on wetlands at Poopenaut Valley; the NPS is in the process of developing and implementing a long-term monitoring program to better understand and quantify the effects of O’Shaughnessy Dam on downstream ecosystems.

Scenic Segments

Long-Term Impacts

Implementation of the ecological restoration program, described in chapters 5 and 8, would include restoration of wetlands in undeveloped areas of Tuolumne Meadows that have been affected by trampling, the introduction of nonnative fill, and historic drainage efforts. These actions would be expected to mitigate the impacts on hydrologic surface flows caused by roads and trails and greatly improve the conditions needed (including a high water table) for reestablishment and/or long-term stability of wetlands.

Informal trails would be restored to natural conditions throughout Tuolumne Meadows, including high-use locations along Tioga Road with adjacent wetlands (e.g., Cathedral Lakes trailhead), trails radiating outward from the store and grill area, the Soda Springs area, and along the river, resulting in beneficial impacts on wetland communities at those locations. Rerouting some formal trails outside of wetlands would have beneficial impacts because it would reduce soil compaction and vegetation trampling that results from the creation of informal trails adjacent to muddy or flooded formal trails. There would also be a beneficial impact from proposed delineation and hydrological improvements along remaining formal trails (some of which are aligned through wetland areas) to prevent trampling vegetation and compacting soils beyond the footprint of the trail. In total, the ecological restoration program would restore approximately 17.9 acres of palustrine

emergent wetlands, 0.8 acre of palustrine forested wetlands, 1.3 acres of palustrine scrub-shrub wetlands, and 1.1 acres of riverine wetlands.

Short-Term Impacts of Construction

Potential short-term impacts on wetlands during construction periods would include soil disturbance and compaction, which could temporarily decrease groundwater infiltration, but this is not likely to cause more than a short-term, minor impact on wetland hydrology. Any dewatering activities and water runoff from impermeable surfaces could cause sediment-laden and/or contaminated water to enter wetlands areas or tributaries to the Tuolumne River. However, implementing standard mitigation measures described in appendix O, as well as following avoidance procedures, would mitigate adverse impacts.

As with the no-action alternative, wetlands in the scenic segment below O'Shaughnessy Dam would remain undisturbed, with the exception of altered hydrologic processes caused by controlled releases of water at O'Shaughnessy Dam. As noted above under "Wild Segments" for Poopenaut Valley, it is not clear what effect the dam has had on wetlands downstream of the dam; the NPS is in the process of developing and implementing a long-term monitoring program to better understand and quantify the effects of O'Shaughnessy Dam on downstream ecosystems.

Environmental Consequences of Alternative 1

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 1 on wetlands are described below.

Wild Segments

Reducing and managing day use levels in wilderness through a trailhead quota system, similar to the overnight quota system currently in place, would reduce impacts from foot traffic on trails radiating outward from Tuolumne Meadows and Tioga Road. The elimination of all commercial pack stock use in wilderness, coupled with elimination of concessioner stock day rides, would have a beneficial impact on meadow areas that would likely be classified as wetlands in Lyell Canyon, primarily through reduced use on trail corridors and restoring pack stock grazing and camping areas to natural conditions.

Removal and restoration of the Glen Aulin High Sierra Camp under alternative 1 would eliminate pack stock use at the camp and substantially reduce foot traffic (the backpacker camp would remain). This would allow wetlands to be restored that are currently disturbed by the corral and a trail corridor. Elimination of the camp would also remove the risk to wetlands currently posed by the undersized leach mound. Any impacts in wilderness areas between Glen Aulin and Hetch Hetchy Reservoir would continue to be local, negligible to minor, and primarily related to foot traffic on trails.

Scenic Segments

Alternative 1 would result in the removal of all commercial facilities and some associated administrative facilities in areas that are located adjacent to wetlands, including the Tuolumne Meadows Lodge, the public fuel station, the store and grill complex, the road to the concessioner stable, and roadside parking along Tioga Road. The Cathedral Lakes and Parsons Memorial Lodge trailheads would be relocated away from sensitive resources. These actions would result in the restoration of approximately 3.36 acres of palustrine emergent wetlands, 4.82 acres of palustrine forested wetlands, 1.92 acres of palustrine scrub-shrub wetlands, 4.0 acres of palustrine unconsolidated bottom wetlands, and 1.5 acres of riverine unconsolidated bottom wetlands.

Removal of the Tuolumne Meadows campground A-loop campsites and the campground A-loop road would increase opportunities for revegetation and restoration of a 2.77-acre forested wetland that is currently bisected by the A-loop road. In addition, removal of the campground A-loop road would also decrease the potential for

impact on several emergent, forested, and scrub-shrub wetlands that occur between the campground and the Lyell Fork.

Tioga Road would continue to run along the southern edge of Tuolumne Meadows, and some segments of secondary roads and formal trails would continue to cross wetland areas (e.g., the trail to Parsons Memorial Lodge east of the visitor center). Some of the eliminated roadside parking and administrative facilities would be replaced by expanded facilities in upland areas where wetlands are present. Specifically, there is a potential for adverse impacts on a 0.1-acre palustrine forested wetland located in the Road Camp area and approximately 0.4 acre of a 1.6-acre palustrine forested wetland adjacent to the Lembert Dome parking area. New development to accommodate a campground redesign would occur in an area with an approximately 2.5-acre palustrine forested wetland. In general, expanded development in these areas could increase fragmentation of wetlands and could expose wetland communities to an increased potential for trampling. These impacts would be minimized with avoidance and the implementation of standard mitigation measures during construction (see appendix O).

Conclusion

Under alternative 1, wetlands in wild segments would overall remain undisturbed with localized exceptions. The reductions in day use foot traffic, a substantial reduction in concessioner stock use, and the elimination of commercial use in the corridor would result in local long-term moderate beneficial impacts on wetlands along trails between Tuolumne Meadows and Glen Aulin, and between Tuolumne Meadows and Lyell Canyon. In addition, the elimination of commercial pack stock use would allow restoration of wetlands in pack stock grazing and camping areas in Lyell Canyon.

The removal of Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact to a 0.5-acre palustrine forested wetland currently affected by foot and stock traffic at the camp, as well as eliminate risks to wetlands posed by the current wastewater treatment system. Wetlands below O'Shaughnessy Dam would remain undisturbed, with the exception of altered hydrologic processes caused by the dam.

In the scenic segments at Tuolumne Meadows, the implementation of a comprehensive ecological restoration program under alternative 1, in combination with extensive site-specific restoration where facilities are removed or relocated and where informal trails are restored to natural conditions, would allow for restoration of natural hydrology and revegetation of approximately 36.7 acres of wetlands. These restoration actions would result in a local, long-term, moderate, beneficial impact on wetlands.

Construction of relocated parking and administrative facilities at Road Camp and at Lembert Dome, and new development to accommodate a campground redesign would have a potential local long-term minor adverse impact on 3 acres of palustrine forested wetlands. Adhering proposed mitigation measures and avoidance of wetlands where possible would minimize short-term and long-term impacts at these locations.

Cumulative Projects

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on wetlands in combination with alternative 1 are the same as those listed under the no-action alternative.

In combination with the cumulative plans and projects listed under the no-action alternative and above, restoration actions under alternative 1 would result in local long-term moderate beneficial impacts on wetlands in the river corridor. There is a potential for a cumulative local short-term negligible to minor adverse impact on wetlands at Tuolumne Meadows from proposed construction activities.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on wetlands are described below.

Wild Segments

In upper Lyell Canyon, the proposal to regulate the timing of commercial pack stock use by tying opening dates to meadow conditions would reduce stock-related impacts in wetlands such as hoofpunching, which is more likely to occur early in the season when soils are wet. In addition, the formal designation of campsites and grazing areas away from wetland areas, and the restrictions on grazing-nights, would result in beneficial impacts by restoring previously used sites and concentrating disturbance in less-sensitive areas. Reductions in commercial use, both foot traffic and pack stock trips, on trails between Tuolumne Meadows and the Glen Aulin High Sierra Camp would have a minor beneficial impact on the few wetlands found near trail corridors.

The leach mound at Glen Aulin High Sierra Camp would no longer be used, thereby eliminating the risk posed by the undersized mound on wetlands near Conness Creek. The trail that currently bisects a wetland at the camp would be relocated, and 0.5 acre of disturbed wetland would be restored.

Any impacts on wetlands in wilderness areas between Glen Aulin and Hetch Hetchy Reservoir or below O’Shaughnessy Dam would continue to be local, negligible to minor, and primarily related to foot traffic on trails. However, the proposal to allow limited recreational boating between Tuolumne Meadows and Pate Valley would potentially affect a 3.23-acre wetland at Pate Valley, near the intersection of a trail where boaters would be required to take out and hike gear out of the canyon. The NPS would avoid this wetland when siting the boating takeout.

Scenic Segments

Alternative 2 would result in the relocation of administrative and visitor facilities away from areas that are located immediately adjacent to wetlands, including employee and guest tent cabins at Tuolumne Meadows Lodge and concessioner employee housing behind the store and grill complex, the Cathedral Lakes and Parsons Memorial Lodge trailheads, and roadside parking along Tioga Road. These actions would result in restoration of approximately 0.6 acre of palustrine forested wetlands. Relocation of campground A-loop campsites nearest the river would not be expected to have an appreciable impact on wetlands.

There would also be a beneficial impact from better wayfinding and delineation of formal trails (some of which are aligned through wetland areas) to prevent trampling of vegetation and compaction of soils beyond the footprint of the trail.

Tioga Road would continue to run along the southern edge of Tuolumne Meadows, and some segments of secondary roads and formal trails would continue to cross wetland areas (e.g., the trail to Parsons Memorial Lodge east of the visitor center). Some of the eliminated roadside parking and relocated administrative facilities would be replaced by expanded facilities in upland areas where wetlands are present. Specifically, there is a potential for adverse impacts on a 1.6-acre palustrine forested wetland adjacent to the Lember Dome parking area and a 0.37-acre wetland between the public fuel station and the store and grill area. New development to accommodate a campground redesign would occur in an area with approximately 2.5 acres of forested wetland. Development in these areas could increase fragmentation of wetlands and could expose wetland communities to an increased potential for trampling. These impacts would be minimized with avoidance and the implementation of mitigation measures (see appendix O) during construction. (The short-term impacts of construction would be common to alternatives 1–4 and are described in that section, above).

The formalization of parking at Pothole Dome would occur at a location where an existing informal trail from the road into wetland areas would be restored. Additional visitor use management (e.g., physical barriers and

signs) would help avoid new impacts on adjacent wetlands. In addition, alternative 2 proposes a new trail corridor from the location of the store and grill to Parsons Memorial Lodge. The alignment, proposed construction method, and final width for this trail would be determined through future planning and design. Elevating the trail through the meadow using a boardwalk or other materials that would allow subsurface flow would minimize potential adverse impacts.

Conclusion

Overall, under alternative 2, wetlands in wild segments would remain undisturbed, with localized exceptions. Proposed regulation of the timing, location, and amount of pack stock use in Lyell Canyon would result in a local, long-term, minor to moderate, beneficial impact on wetlands in those areas. Restoration of a 0.5-acre palustrine reforested wetland at Glen Aulin High Sierra Camp and discontinuing use of the camp's leach mound would result in a local long-term moderate beneficial impact on wetlands.

Limited recreational boating would introduce the potential for a local long-term minor adverse impact on a 3.23-acre wetland in Pate Valley (located in the Grand Canyon wild segment) near a trail junction where boaters would be required to hike out. The NPS would avoid this wetland when siting the boating takeout. Wetlands below O'Shaughnessy Dam would remain undisturbed, with the exception of altered hydrologic processes caused by the dam.

In Tuolumne Meadows, implementation of a comprehensive ecological restoration program, in combination with site-specific restoration where facilities are removed or relocated and informal trails are restored, would allow for restoration of natural hydrology and revegetation of approximately 21.7 acres of wetlands under alternative 2. These restoration actions would result in a local long-term moderate beneficial impact on wetlands.

Construction of relocated parking and facilities, and new development to accommodate a campground redesign, would have the potential to affect approximately 4.4 acres of adjacent palustrine forested wetlands. Adherence to proposed mitigation measures in appendix O and avoidance of wetlands where possible would reduce the potential short-term and long-term impacts on wetlands to minor and adverse. In addition, the proposed new trail between the store and grill and Parsons Memorial Lodge would likely pass through multiple wetlands. The alignment of this trail would be determined through future site design; an elevated path would help minimize the potential adverse impact.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on wetlands in combination with alternative 2 are the same as those listed under alternative 1.

In combination with cumulative plans and projects, restoration actions under alternative 2 would result in a long-term moderate beneficial impact on wetlands in the Tuolumne River corridor. There is a potential for a cumulative local short-term negligible to minor adverse impact on wetlands at Tuolumne Meadows from proposed construction activities.

Environmental Consequences of Alternative 3

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 3 on wetlands are described below.

Wild Segments

In upper Lyell Canyon, the proposal to regulate the timing of commercial pack stock use by tying opening dates to meadow conditions would reduce stock-related impacts on wetlands such as hoofpunching, which is more likely to occur early in the season when soils are wet. In addition, the formal designation of campsites and

grazing areas away from wetland areas along with reduced grazing-nights would result in beneficial impacts by restoring previously used sites and concentrating disturbance in less-sensitive areas. Reductions in commercial use, both foot traffic and pack stock trips, on trails between Tuolumne Meadows and the Glen Aulin High Sierra Camp would have a minor beneficial impact on the few wetlands found near trail corridors.

The leach mound at Glen Aulin High Sierra Camp would continue to operate near capacity under alternative 3, resulting in little or no change to the risk posed by the undersized mound on wetlands near Conness Creek. The trail that currently bisects a wetland at the camp would be relocated, and 0.5 acre of disturbed wetland would be restored.

Any impacts on wetlands in wilderness areas between Glen Aulin and Hetch Hetchy Reservoir would continue to be very local, negligible to minor, and primarily related to foot traffic on trails.

Scenic Segments

Alternative 3 would result in the relocation of administrative and visitor facilities from areas that are located immediately adjacent to wetlands, including employee and visitor tent cabins at Tuolumne Meadows Lodge and concessioner employee housing behind the store and grill complex, the Cathedral Lakes and Parsons Memorial Lodge trailheads, and roadside parking along Tioga Road. These actions would result in restoration of 0.6 acre of palustrine forested wetlands.

There would also be a beneficial impact from better delineation of formal trails (some of which are aligned through wetland areas) to prevent trampling of vegetation and compaction of soils beyond the footprint of the trail.

Tioga Road would continue to run along the southern edge of Tuolumne Meadows, and some segments of secondary roads and formal trails would continue to cross wetland areas (e.g., the portion of the Great Sierra Wagon Road that serves as a trail to Parsons Memorial Lodge). None of the proposed development to accommodate relocated parking and administrative facilities would occur adjacent to wetland areas.

Conclusion

Under alternative 3, wetlands in wild segments would overall remain undisturbed, with localized exceptions. Proposed regulation of the timing, location, and amount of pack stock in Lyell Canyon would result in a local long-term minor to moderate beneficial impact on wetlands in these areas. Restoration of a 0.5-acre palustrine reforested wetland at Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact on wetlands. The leach mound at the High Sierra Camp would continue to operate at capacity, thus posing a risk to wetlands between the mound and Conness Creek. Wetlands below O'Shaughnessy Dam would remain undisturbed, with the exception of altered hydrologic processes caused by the dam.

In the scenic segments at Tuolumne Meadows, the implementation of a comprehensive ecological restoration program, in combination with extensive site-specific restoration where facilities are removed or relocated and where informal trails are restored to natural conditions, would allow for restoration of natural hydrology and revegetation of approximately 21.7 acres of wetlands. These restoration actions would result in a local long-term moderate beneficial impact on wetlands. There would be no new adverse impacts on wetlands from the relocation of parking, visitor, or administrative facilities at Tuolumne Meadows.

New development to accommodate a campground redesign under alternative 3 would have the potential to affect approximately 5.3 acres of forested wetlands in an already disturbed area. Adherence to proposed mitigation measures described in appendix O and avoidance of wetlands where possible would reduce potential short-term and long-term impacts to minor and adverse.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on wetlands in combination with alternative 3 are the same as those listed under alternative 1.

In combination with cumulative plans and projects, alternative 3 would result in a long-term moderate beneficial impact on wetlands corridorwide. There is a potential for a cumulative local short-term negligible adverse impact on wetlands at Tuolumne Meadows from proposed construction activities.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on wetlands are described below.

Wild Segments

In upper Lyell Canyon, the proposal to regulate the timing of commercial pack stock use by tying opening dates to meadow conditions would reduce stock-related impacts in wetlands such as hoofpunching, which is more likely to occur early in the season when soils are wet. In addition, the formal designation of campsites and grazing areas away from wetland areas, and reduced grazing-nights, would result in beneficial impacts through restoring previously used sites and concentrating disturbance in less sensitive areas. Significant reductions in commercial use, both foot traffic and pack stock trips, on trails between Tuolumne Meadows and the Glen Aulin High Sierra Camp and trails between Tuolumne Meadows and Young Lakes would have a minor beneficial impact on the few wetlands found near trail corridors.

Water usage at Glen Aulin High Sierra Camp would be reduced by approximately 100 gallons per day under alternative 4, and the elimination of flush toilets would convert the existing wastewater treatment system to gray water only. These actions would reduce the risk posed by the undersized leach mound on wetlands near Conness Creek. In addition, an employee cabin near Conness Creek would be relocated away from riparian and wetland areas, the trail that currently bisects a wetland at the camp would be relocated, and 0.5 acre of disturbed wetland would be restored.

The proposal to allow limited recreational boating between Tuolumne Meadows and Pate Valley would potentially affect a 3.23-acre wetland at Pate Valley, near the intersection of a trail where boaters would be required to take out and hike gear out of the canyon. The NPS would avoid this wetland when siting the boating takeout.

Scenic Segments

Alternative 4 would result in the relocation of administrative and visitor facilities in areas that are located immediately adjacent to wetlands, including employee and guest tent cabins at Tuolumne Meadows Lodge and concessioner employee housing behind the store and grill complex, the Cathedral Lakes and Parsons Memorial Lodge trailheads, and roadside parking along Tioga Road. These actions would result in restoration of approximately 0.8 acre of palustrine forested wetlands. Relocation of campground A-loop campsites nearest the river would not be expected to have an appreciable impact on wetlands.

There would also be a beneficial impact from better wayfinding and delineation along formal trails (some of which are aligned through wetland areas) to prevent trampling of vegetation and compaction of soils beyond the footprint of the trail.

Tioga Road would continue to run along the southern edge of Tuolumne Meadows, and some segments of secondary roads and formal trails would continue to cross wetland areas (e.g., the portion of the Great Sierra Wagon Road that serves as a trail to Parsons Memorial Lodge). New development to accommodate a campground redesign would occur in an area with approximately 5.3 acres of forested wetlands. These

wetlands are already within the footprint of the campground; further development would increase fragmentation of wetlands and expose wetlands communities to an increased potential for trampling. These impacts would be minimized with avoidance and the implementation of mitigation measures (see appendix O).

Conclusion

Under alternative 4, wetlands in wild segments would overall remain undisturbed, with localized exceptions. Proposed regulation of the timing, location, and amount of pack stock in Lyell Canyon would result in a local long-term minor to moderate beneficial impact on wetlands in these areas. Greatly reduced packstock use on the trails between Tuolumne Meadows and Glen Aulin and Tuolumne Meadows to Young Lakes would have a long term, minor beneficial impact on the few wetlands found along those trail corridors. Restoration of a 0.5-acre palustrine reforested wetland at Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact on wetlands. Reduced water use at the High Sierra camp and converting the wastewater treatment system to gray water only would result in a local long-term minor to moderate beneficial impact by reducing the risk of overflow at the camp's leach mound.

Limited recreational boating would introduce the potential for a local long-term minor adverse impact on a 3.23-acre wetland in Pate Valley (located in the Grand Canyon wild segment) near a trail junction where boaters would be required to hike out. The NPS would avoid this wetland when siting the boating takeout. Wetlands at Poopenaut Valley would remain undisturbed, with the exception of altered hydrologic processes caused by O'Shaughnessy Dam.

In the scenic segments at Tuolumne Meadows, the implementation of a comprehensive ecological restoration program, in combination with extensive site-specific restoration where facilities are removed and informal trails are restored, would allow for restoration of natural hydrology and revegetation of approximately 21.9 acres of wetlands. These restoration actions would result in a local long-term moderate beneficial impact on wetlands.

New development to accommodate a campground redesign would have the potential to affect approximately 5.3 acres of forested wetlands in an already disturbed location. Adherence to proposed mitigation measures in appendix O and avoidance of wetlands where possible would reduce potential short-term and long-term impacts to minor and adverse.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative effect on wetlands in combination with alternative 4 are the same as those listed under alternative 1.

In combination with cumulative plans and projects, alternative 4 would result in a long-term moderate beneficial impact on wetlands corridorwide. There is a potential for a cumulative local short-term negligible to minor adverse impact on wetlands at site-specific locations in Tuolumne Meadows from proposed construction activities.

Vegetation

Affected Environment

Overview

As the Tuolumne River descends from its headwaters at an elevation of over 11,500 feet to the western park boundary at less than 3,000 feet, it passes through five major vegetative communities: alpine, subalpine, upper montane, lower montane, and foothill woodlands. The topography of the river corridor alternates between areas with low gradients, slow velocities, and wide floodplains (such as the reaches through Dana, Lyell, and Tuolumne Meadows and at Poopenaut Valley) and areas with very steep gradients, high velocities, and no floodplains (such as the reach through the Grand Canyon of the Tuolumne).

Alpine and Subalpine Areas

Wild Segments: Lyell Fork, Upper Dana Fork

Scenic Segments: Lower Dana Fork, Tuolumne Meadows

The alpine zone (generally above tree line, or approximately 10,000 to 11,500 feet in elevation) and the subalpine zone (approximately 8,000 to 10,000 feet in elevation) are characterized by long, severe winters and brief, cool summers. Vegetation in alpine areas consists of herbaceous or shrubby plants that are often miniaturized and are interspersed along barren areas of granitic domes and ledges (van Wagtendonk and Coho 1986). Recent special status plant surveys conducted in alpine areas of the river corridor found evidence that populations of special status species were intact, although these populations are highly vulnerable to the impacts of climate change (NPS, Acree et al. 2007o). Based on this evidence, it is likely that the alpine habitat in the Tuolumne River corridor is undisturbed.

In the subalpine zone, upland coniferous forests are relatively open and exposed and become denser along river and stream channels. Trees in this zone range between 10 and 70 feet in height and are typically long-lived. Coniferous species include lodgepole pine (*Pinus contorta* var. *murrayana*), whitebark pine (*Pinus albicaulis*), and several shrub species. Sierra juniper (*Juniperus occidentalis*) occurs with lodgepole pine in rocky soils of southern and western exposures. A narrow band of mountain hemlock (*Tsuga mertensiana*) occurs on north-facing slopes. Forest understory is naturally sparse and ranges from barren rock to sparse shrubs and grasses. Typical understory plants include gooseberry (*Ribes* spp.), lupine (*Lupinus* spp.), groundsel (*Senecio* spp.), mountain heather (*Phyllodoce breweri*), and bluegrass (*Poa* spp.). Riparian species often intergrade with coniferous forest at or near the river's upper banks.

As the river descends and the gradient becomes gentler, aspens (*Populus* spp.) and willows (*Salix* spp.) are more prevalent. Willows generally colonize where sandbars collect at the margins of or within the river channel, where they provide important nesting habitat for many birds and cover for other wildlife. Highly diverse meadow and riparian willow communities (e.g., Dana Meadows) are especially important foraging areas for special status bat species.

Subalpine meadow vegetation with pockets of subalpine forest dominated by lodgepole pine extends from upper Lyell Canyon and Dana Meadows through Tuolumne Meadows. Subalpine meadow vegetation is comprised of various bunch grasses (Keeler-Wolf 2001), dominated by perennial graminoids (grasses and grass-like plants such as sedges and rushes), which reflect the relatively short growing season of the middle and high elevations. Key genera include *Carex*, *Deschampsia*, *Calamagrostis*, *Juncus*, *Danthonia*, and *Eleocharis*. At Tuolumne Meadows, the most widespread associations are Sierra false needlegrass (*Ptilagrostis kingii*) and shorthair sedge (*Carex filifolia*) herbaceous vegetation. Associations characterized by Brewer's reedgrass (*Calamagrostis breweri*) alone or with co-dominant species alpine aster (*Aster alpigenus*) and dwarf bilberry (*Vaccinium caespitosum*) are also prevalent. Mountain sagebrush (*Artemisia tridentata*) and shorthair sedge shrublands are common in drier areas of the meadow, particularly to the north (NPS, Ballenger et al. 2010j).

Subalpine meadows in the river corridor retain a high degree of biodiversity overall; however, several recent studies (cited below) document changes in their ecological integrity at specific locations, particularly at Tuolumne Meadows and in Lyell Canyon.

Lyell Canyon

In comparison to Tuolumne Meadows (see below), the subalpine meadows along the Lyell Fork of the Tuolumne receive much less use, and use is for the most part restricted to trail corridors, camping areas, and grazing areas. Lyell Canyon is a very popular backpacking destination as well as a popular destination for commercial pack stock use. The park concessioner also uses packstock on a portion of the Lyell Canyon trail to resupply Vogelsang High Sierra Camp, which is outside of the river corridor. The influence of pack stock on plant community assemblages and hydrology of these meadows in Lyell Canyon is under investigation, but preliminary research indicates a local, measurable impact on plant community assemblages along riverbanks and in subalpine meadows in Lyell Canyon as a result of the influence of pack stock grazing (NPS, Ballenger et al. 2010j; NPS, Abbe and Ballenger 2012). In particular, meadows in upper Lyell Canyon, which receive some of the highest amounts of pack stock use of all subalpine meadows in the park, have been found to have more bare ground and stock disturbance features (roll pits, intensively grazed areas, manure, and trampled areas) than other comparable meadows. The plant community composition appears to differ from other, similar meadows in the park, having a higher forb to graminoid ratio, which indicates that sod-forming grasses and sedges may have been affected. In addition, impacts on riparian vegetation along the Lyell Fork appear to be resulting in channel widening. According to the park resource management staff, these impacts may be the result of pack stock use and/or historic grazing.

Tuolumne Meadows

Tuolumne Meadows is the center of visitor and administrative use in the Tuolumne River corridor. Although productivity of these subalpine riparian and meadow areas remains high, several recent studies document changes in the ecological integrity of the meadows, exemplified by expanding areas of barren ground, atypical plant species, conifer encroachment, and diminished willow vegetation along riverbanks (NPS, Buhler et al. 2010e; Cooper et al. 2006). Researchers suspect that a disruption of ecological processes resulting from historic development and use, coupled with the emerging stress of more frequent periods of low precipitation, is being exacerbated by foot traffic and pack stock use in sensitive meadow habitats, heavy browsing by deer of the few remaining willows, and a high level of ground disturbance by gophers and voles (Cooper et al. 2006; NPS, Ballenger et al. 2010j; NPS, Abbe and Ballenger 2012). While studies continue, currently there are no simple explanations for these findings of instability in particular meadows and riparian areas in the region. However, the cumulative impacts of these past, present, and emerging stresses have the potential to change the long-term productivity of the meadows. The more recent studies and their findings are summarized below.

Meadow Hydrology: The NPS initiated studies during the summer of 2006 to investigate the surface and groundwater hydrology of the Tuolumne Meadows area. Although these initial studies were somewhat inconclusive, data suggest that in the mid to late summer, surface water appears to recharge groundwater in the meadows, while the opposite may be true earlier in the melt season (Cooper et al. 2006). Because wet meadows form where a shallow water table during the summer fulfills the water requirements of this groundwater-dependent ecosystem (Loheide et al. 2009), a drop in the water table associated with a disruption in surface water flows could adversely affect wet meadow vegetation. For more information on recent hydrologic studies, please see the “Hydrology” section earlier in this chapter.

Riverbank Vegetation: Riverbanks in Tuolumne Meadows, particularly on the west end of the meadow, have little to no vegetation and are characterized by extensive erosion and riverbank loss (NPS, Buhler et al. 2010e). In general, vegetation along riverbanks, particularly woody species, slows the velocity of water and associated scour while promoting sediment accretion (NPS, Buhler et al. 2010e quoting Mitsch and Gosselink 2007).

Willows would be expected to typically occur in much greater density in subalpine meadows, where they are very effective at anchoring soils and stabilizing eroding riverbanks. Historic photographs of the Tuolumne River indicate that abundant willow stands were present along the river in 1867 (Cooper et al. 2006). Since then, the cover of willows along the riverbank has diminished, and new willows have difficulty establishing on sandbars and riverbanks. Existing willows in Tuolumne Meadows are heavily browsed, precocious (flowering on the previous season's stems), or have no reproductive structures at all.

As part of the assessment of historical and modern influences on vegetation, Cooper and others (2006) suggest that heavy browsing of willow seedlings by deer may be limiting willow recruitment on river bars, which are normally an ideal establishment environment for willow, and recommends a detailed study of willows to understand what factors limit willow establishment and persistence in the study area. This vegetation loss and the subsequent riverbank erosion are probably the result of multiple factors and may be exacerbated by visitor trampling (NPS, Buhler et al. 2010e).

Vegetation Composition: As reported by Cooper and others (2006), several lines of evidence indicate that livestock grazing in the late 1800s has had lasting impacts on the vegetation of Tuolumne Meadows. First, and most broadly, the main vegetation types in Tuolumne Meadows all have a much higher percentage of bare soil than would be expected for an area with an intact wet meadow hydrologic regime. Intense grazing and hoofpunching can destroy the underground network of rhizomes that supports sod-forming plants, and their reestablishment is an extremely slow process. When a rhizomatous sod layer is broken apart, the loose, bare ground is susceptible to erosion and invasion by nonmeadow plants. Shallow-rooted annuals dominate these disturbance patches, and lodgepole pine seedlings are common. The high organic content of these soils and low belowground plant production suggests that the existing vegetation could not have formed these soils. Thus, the modern vegetation is likely the product of intensive historic disturbances from which it has not recovered. The only recent large-scale disturbance was grazing by cattle and sheep from the 1860s to 1891. Cooper and others (2006) further suggest that the natural reestablishment of perennial meadow vegetation could take centuries, or, if the damage is perpetuated by constant vole and pocket gopher activity, willow browsing by deer, and other factors, the meadow could be locked in an altered state of vegetation composition and soil-forming processes. This shift in vegetation may contribute to conifer encroachment because pines easily invade the large areas of bare and moist mineral soil on which there is little or no biotic competition (Cooper et al. 2006).

An additional study (NPS, Ballenger et al. 2010j) examined meadow vegetation, bare ground, and other metrics in Tuolumne Meadows and compared them with eight similar subalpine meadows in the park. The study found that while the dominant plant communities in Tuolumne Meadows were consistent with the eight other subalpine meadows, specific vegetation and habitat attributes related to biological integrity were different at Tuolumne Meadows. In particular, bare ground levels and the ratio of forb to graminoid species (which may indicate vegetation change) were higher in Tuolumne Meadows than in most of the other meadows. Tuolumne Meadows was the only meadow surveyed with areas dominated by mountain sagebrush, which the study authors suspect might be indicative of past grazing-related disturbance. In addition, the authors also found that mammal burrowing activity did not vary greatly between Tuolumne Meadows and the other subalpine meadows used for comparison (NPS, Ballenger et al. 2010j).

Conifer Encroachment: Subalpine meadows appear to be shrinking in size because of encroachment by lodgepole pine, which has been linked to periods of low precipitation and low year-to-year variability in moisture conditions (Millar et al. 2004; NPS, Nelson and Colwell 2008f). Although Tioga Road was previously suspected to be a cause of lodgepole pine invasion along the southern margin of Tuolumne Meadows due to its potential to disturb surface flows entering the meadow, subsequent research indicates the cause is more likely the more general meadow disturbance described above, which provides bare ground that is essential for past

and ongoing tree establishment (Cooper et al. 2006). Conifer encroachment may also be a result of climatic change coupled with past disturbances to ecological processes (Cooper et al. 2006; Millar et al. 2004). Human trampling may also contribute to encroachment by lodgepole pines (Holmquist and Schmidt-Gengenbach 2008 quoting Vale and Vale 1994). While the NPS removed conifer saplings from the meadow for many decades, the NPS discontinued mechanical removal of conifer saplings at Tuolumne Meadows in 2010, pending completion of ongoing studies that could provide site-specific insight into the issue.

Sensitivity to Pack Stock and Foot Traffic. Certain reaches of the Tuolumne River that experience high levels of visitor use are devoid of vegetation. Holmquist and Schmidt-Gengenbach (2008) found that the meadow system is highly susceptible to, and slow to recover from, impacts on measured characteristics of vegetation, soils, and invertebrate fauna, which include denuded vegetation and compacted soils. Areas of concentrated visitor use, including trailheads and visitor facility sites, are experiencing localized meadow habitat disturbance associated with increasingly heavy foot traffic (NPS, Buhler et al. 2010e). Areas that exhibit these types of impacts are found throughout the meadows but are especially evident in areas near popular attractions, such as Soda Springs, Pothole Dome, Lumbert Dome, and locations along the banks of the Tuolumne River.

Issues associated with pack stock on trails and at stock staging areas include vegetation trampling, soil loss from erosion, vegetation loss, and potential water quality issues from manure and dust. The locations in Tuolumne Meadows that exhibit these types of impacts include the Glen Aulin trail (including a portion of the trail that passes very close to Soda Springs), the Young Lakes trail and the trail to Lyell Canyon.

Resource management projects are conducted routinely to repair site-specific impacts on meadow and riparian areas. In order to accomplish comprehensive restoration of the entire meadow ecosystem, the NPS is overseeing research to understand meadow processes and the most effective ways to restore vegetation composition, belowground biomass, soil-forming processes and the stability of meadow vegetation (Cooper et al. 2006). Future research into the composition of historic vegetation is likely to entail analysis of soil seed banks, plant macrofossils and phytoliths (microscopic pieces of plants that are resistant to decay and can identify historic plant species), organic matter content, soil carbon, and plant productivity. Ongoing research will also help to further understand the effects of pocket gophers, voles, and deer on the establishment and growth of perennial plants typical of wet meadows (NPS, Noon and Martin 2010i).

Non-native Plant Species

Non-native plant surveys in high-elevation portions of the Tuolumne River watershed are relatively few and incomplete. However, reports of spotted knapweed (*Centaurea maculosa*) at 7,500 feet in Inyo National Forest and yellow toadflax (*Linaria vulgaris*) at 9,000 feet in elevation indicate that high elevation areas are still vulnerable to the introduction of highly invasive plant species. The primary vectors for transmission of non-native plants are pack stock as well as human foot traffic along trail corridors, and vehicles in more developed areas.

Based on limited survey and incidental observations, there is a relatively low level of occurrence of non-native plant species in the Tuolumne Meadows area. Observed non-native species at Tuolumne Meadows include rescue grass (*Bromus cartharticus*), smooth brome (*Bromus inermis*), Shephard's purse (*Capsella bursa-pastoris*), intermediate wheatgrass (*Elymus hispidus*), Italian ryegrass (*Festuca perennis*), hairy rupturewort (*Herniaria hirsute*), annual bluegrass (*Poa annua*), Kentucky bluegrass (*Poa pratensis*), red sand spurrey (*Spergularia rubria*), white clover (*Trifolium repens*) and fairly extensive areas of common dandelion (*Taraxacum officinale*). Cheat grass (*Bromus tectorum*) and yellow star thistle (*Centaurea solstitialis*) have also been documented in the Tuolumne area.

Survey and treatment of common dandelion began in 2010 but no treatment of cheat grass currently occurs. The NPS is expanding its non-native plant survey of the Tuolumne area in order to determine the extent and

number of non-native plant species and develop recommendations for effective treatment. Survey and treatment methods will follow those outlined in the park's *Invasive Plant Management Plan Update* (2010) (see appendix L).

Upper and Lower Montane Areas

Wild Segment: Grand Canyon of the Tuolumne

Higher elevation habitat above and just below the entrance to the Grand Canyon of the Tuolumne, between 6,500 feet to 8,000 feet, typically contains mixed conifer species, such as lodgepole pine, western white pine (*Pinus monticola*), western juniper (*Juniperus occidentalis*), and Jeffrey pine (*Pinus jeffreyi*), which occur on exposed granitic ridges. Glen Aulin, at approximately 7,500 feet in elevation, is dominated by lodgepole pine and occasional mountain hemlock. Understory species include Indian paintbrush (*Castilleja culbertsonii*), Brewer's cinquefoil (*Potentilla breweri*), little elephant's head (*Pedicularis attolens*), small blacktip ragwort (*Senecio lugens*), and a variety of forbs.

As elevation decreases below 6,500 feet, these species eventually give way to ponderosa pine (*Pinus ponderosa*), incense cedar (*Calocedrus decurrens*), and sugar pine (*Pinus lambertiana*). Several deciduous tree types and numerous shrubs populate these lower elevational reaches. Because of the dramatic topography of the Grand Canyon, soil and aspect, rather than elevation, begin to play a more dominant role in determining vegetation types. North-facing slopes contain mixed conifer species, as do the canyon rims. But in the canyon bottom and on south-facing slopes below 4,000 feet, chaparral and oak species of the Sierra foothills are more predominant. Groves of aspen and lodgepole pines occur where moist soil conditions persist. Elevation differences between the canyon bottom and rim, plus the influence of sunlight on predominantly north- or south-facing slopes, result in overlap between these communities, especially at lower elevations. At Pate Valley, at the confluence with Morrison Creek, the canyon walls open and localized conditions support black oaks (*Quercus kelloggii*), incense cedar, Jeffrey pines, and white firs (*Abies concolor*). As the river descends in elevation and flows toward Hetch Hetchy Reservoir, grey pine (*Pinus sabiniana*), canyon live oak (*Quercus chrysolepis*), and blue oak (*Quercus douglasii*) become more prevalent. Manzanita (*Archostaphylos viscida* ssp. *mariposa*) and ceanothus (*Ceanothus integerrimus*) characterize the understory.

At the canyon bottom, vegetation is limited to small islands and patches and is mostly riparian and palustrine (occurring along the river channel).

Non-native Plant Species

Non- native plant surveys in the Tuolumne River watershed are relatively few and incomplete. Non-native plants documented at Glen Aulin High Sierra Camp include annual bluegrass, Kentucky bluegrass, white clover, and common dandelion. In addition, there is a fairly large infestation of velvet grass (*Holcus lanatus*) at Pate Valley. The park is addressing non-native plant species as part of its natural resources management program; see Appendix L: Cumulative Projects for more information.

Lower Montane and Foothill Communities

Scenic Segment: Below O'Shaughnessy Dam

Steeper slopes below O'Shaughnessy Dam support dry chaparral woodlands consisting of manzanita and ceanothus beneath live oaks and grey pines. The dam and immediate environs are not within the wild and scenic river corridor; approximately 0.25 to 0.5 mile downstream, where the corridor resumes, the riparian zone is narrow and discontinuous, frequently overlapping with other plant community types due to seasonal high water and numerous rock bluffs.

Wild Segment: Poopenaut Valley

Upon entering Poopenaut Valley, the river enters a wide floodplain area and riparian vegetation is continuous, giving way to meadow communities above the river's banks. Riparian communities are among the most productive and biologically diverse at this elevation and include stands of white alder (*Alnus rhombifolia*), willow, black cottonwood (*Populus trichocarpa*), shrubs, sedges, and rushes, along with unusual hanging ponds and seasonal pools. For much of the 20th century, areas such as these elsewhere in the Sierra Nevada were among the most affected because of their proximity to water and the effects of development and livestock grazing. Due to its relative inaccessibility and protection within Yosemite National Park, the Poopenaut Valley area has escaped much of this influence and is today one of the few undeveloped low-elevation meadow/wetland complexes in the region.

Natural river flows and hydrologic processes below Hetch Hetchy Reservoir have been influenced by the O'Shaughnessy Dam. The dam has been documented to have influenced the magnitude, timing, duration, frequency, and rate of change of the hydrologic regime (McBain and Trush 2007). A 2007 study documenting impacts of the dam downstream found evidence that the dam altered water tables, soils, and vegetation communities, including meadows (NPS, Stock et al. 2007i). The NPS is in the process of developing and implementing a long-term monitoring program to better understand and quantify the effects of O'Shaughnessy Dam on the hydrologic processes that support riparian, wetland, and upland plant communities in the Poopenaut Valley area.

Wetland and upland meadows comprise most of the valley floor, with relatively extensive (compared to other shoreline areas downstream of the dam) riparian vegetation adjacent to the river and tributary streams. A comparison of photos taken in 1915 and 2007 shows that most of the areas functioning as meadows in 1915 appear relatively intact in 2007, and geomorphic features such as the prominent sand bar on the north side of the river appear relatively unchanged (NPS, Stock et al. 2007i). Several wetland areas in Poopenaut Valley exhibit an unusual assemblage of plants, and certain upland areas exhibit hydric soils and some hydrophytic vegetation, which suggests that wetlands were more extensive in the past (NPS, Stock et al. 2007i). A 2007 wetland delineation at Poopenaut Valley indicates that there may be riparian encroachment associated with low, regulated flows (NPS, Buhler and Santina 2007l). There has been some encroachment of conifers into meadows.

The research conducted by Stock and others (NPS, Stock et al. 2007i) suggests that some wetland areas might be transitioning to drier upland habitat due to lowering groundwater levels in the meadows, while riparian areas downstream of the dam appear to have expanded, thus creating more habitat for riparian birds and other wildlife. The degree to which these changes have been influenced by dam operations is currently being studied, as are the fluctuations of bird populations in Poopenaut Valley, to determine whether they are caused by natural interannual variation or population declines (NPS, Stock et al. 2007i). The overarching goal of these studies is to provide information that dam operators can use to make decisions about dam releases that will be most beneficial to maintaining, and even enhancing, ecosystems downstream of the dam. Improvements to the downstream environments may be made in the short term by science-based management of water releases (NPS, Stock et al. 2007i).

Additional research initiated in 2007 on minimum flow requirements downstream of the dam will help NPS managers understand the natural resource requirements of this riparian area.

Non-native Plant Species

As noted above, non-native plant surveys in the Tuolumne River watershed are relatively few and incomplete. The most notable infestation of non-native plants below O'Shaughnessy Dam is Himalayan blackberry (*Rubus armeniacus*), which is a high-priority species for invasive plant management. The park is addressing non-native

plant species as part of its natural resources management program; see Appendix L: Cumulative Projects for more information.

Environmental Consequences Methodology

For the purposes of this impact assessment, vegetation in the Tuolumne River corridor was associated with three community types: riparian communities, meadow communities, and upland communities. These communities can be very generally described as follows:

Riparian: Riparian communities are contiguous to and affected by surface and subsurface hydrologic features, with distinctly different vegetative species or more vigorous growth forms than those in adjacent areas, and are usually transitional between wetland and upland communities.

Meadow: In the Sierra Nevada, meadow communities occur as treeless expanses with shallow water tables within montane coniferous forests and in level or gently sloping terrain above tree line.

Upland: Upland areas include land that is at a higher elevation than meadows or stream terrace.

The species associated with riparian, meadow, and upland communities throughout the Tuolumne River corridor are noted above, under “Affected Environment.”

In addition, the impact assessment for vegetation was based on the assumptions listed below.

- The greater the size of a biotic community and the stronger its links to neighboring communities, the more valuable it is to the integrity and maintenance of biotic (living organism) processes. Development may potentially limit the size of a community and/or fragment and disassociate communities from each other.
- New development would increase human presence and increase the potential for disturbance in the area of the development. However, it is important to recognize that, in some cases, development serves to concentrate visitor impact and reduce disturbance associated with dispersal of the same number of visitors. “Containment” of disturbance within a designated area may preserve the integrity of vegetation resources.
- Development and activities near sensitive habitats might adversely affect adjacent natural communities. Modifications of a river channel may cause channel instability and shifting, increased bank erosion, and changes in flood-flow elevations. The presence of well-vegetated banks and a sufficient buffer from the riverbank protects the integrity of the river channel and shore.
- Disturbance in or near a river and its tributaries may reduce the productive capabilities of associated natural communities. Modifications to river form (including those that would constrain the river from migrating or changing course), soil compaction, loss of riparian vegetation, removal of woody debris, and accelerated erosion and sediment transport influence important habitat characteristics such as riffle/pool complexes, substrate type, location, and cover. These physical aspects often determine the composition of vegetative and aquatic communities. Modifications that prohibit surface or subsurface water flows into meadow and wetland habitats may cause instability in these habitats.
- The lack of a sufficiently high water table in meadows allows invasive plants to outcompete native vegetation and may encourage conifer encroachment, which threatens meadow communities.
- Ecological restoration of native vegetation communities would involve some short-term adverse impacts (e.g., soil disturbance) but over time may successfully replicate natural processes.

Limited winter activities in the corridor would have no impact on vegetation communities, which are typically dormant during the winter months. In addition, there are no proposed actions that would change winter activities or impact vegetation in areas that are accessible in winter. Therefore, the analysis is focused on impacts on vegetation outside of the winter season.

Proposed management actions under each alternative were evaluated in terms of the context, intensity, and duration of the impacts, as defined below, and whether the impacts were considered to be beneficial or adverse to the natural environment. Generally, the methodology for natural resource impact assessment follows direction provided by the CEQ regulations (*CFR* 40:1508.27).

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts on vegetation communities are considered to be within the vicinity of the proposed action. Regional impacts are human-caused and would affect vegetation on a corridorwide scale or affect areas outside of the Tuolumne River corridor.

Intensity: The intensity of an impact on vegetation is a measure of perceptible changes in native plant community size, continuity, or integrity. Impact intensity is characterized as negligible, minor, moderate, or major. Negligible impacts would cause no measurable or perceptible changes in native plant community size, continuity, or integrity. Minor impacts would be measurable or perceptible but localized within an isolated area, and the overall viability of the native plant community would not be affected. Moderate impacts would cause a measurable and perceptible change in the native plant community (e.g., size, continuity, or integrity); however, the impact would remain local and could be reversed. Major impacts would be substantial and highly noticeable and could be permanent in their impacts on native plant community size, diversity, continuity, or integrity.

Duration: The duration of an impact is the time required for native plant communities to recover from the implementation of an alternative. The duration of impact is characterized as short term or long term. A short-term impact would have an immediate effect on the size, continuity, or integrity of native plant communities and is usually associated with transitional types of activities, such as facility construction. In general, short-term impacts on vegetation are those that would last up to 20 years after implementation of an alternative. Long-term impacts would lead to a loss in the size, continuity, or integrity of native plant communities. In general, long-term impacts would last longer than 20 years after implementation of an alternative.

Type: Impacts are considered adverse if implementation of an alternative would reduce the size, continuity, or integrity of a native plant community. Impacts are considered beneficial if implementation of an alternative would increase the size, continuity, or integrity of a native plant community.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current condition and management, as described under chapter 8 and “Affected Environment,” above.

Wild Segments

Continuation of current wilderness management, including protection of natural processes, visitor education with an emphasis on Leave-No-Trace practices, and restrictions on amounts and locations of overnight use, would protect native plant communities. The NPS would continue efforts to remove inappropriate fire rings and campsites and to restore social trails. Site-specific impacts on native plant communities in wilderness areas from foot and stock traffic would continue along major trails in the corridor (e.g., the John Muir Trail/Pacific Crest Trail) and at the pack stock camps and grazing areas in upper Lyell Canyon. Because most trail use in the corridor originates in Tuolumne Meadows and the Tioga Road corridor, impacts would generally be more apparent along trail corridors radiating outward from these areas down toward Glen Aulin or up through Lyell Canyon. The NPS would continue to document and treat non-native plant species throughout the river corridor.

Existing impacts on vegetation at Glen Aulin include a fragmented wetland community at the existing corral and denuded vegetation at a section of riverbank adjacent to the camp that is accessed by stock and visitors. In

addition, aging wastewater treatment utilities, including a leach mound that is currently operating at capacity, present localized risks to water quality and associated riparian vegetation.

Trail use in the canyon communities between Glen Aulin and Hetch Hetchy Reservoir is far less common, and pack stock use in this area is nearly nonexistent. Impacts on vegetation in these wilderness areas would be associated with occasional foot traffic and, infrequently, fire rings and the construction of informal campsites too close to watercourses.

Lower-elevation native vegetation communities below O’Shaughnessy Dam would continue to be sustained by natural ecological processes, with the exception of disrupted hydrologic processes caused by the dam. The NPS would continue to participate in collaborative research to mitigate these disruptions through science-based management of water releases intended to more closely mimic natural flows.

Scenic Segments

The evidence of change in ecological integrity of the meadow and riparian system at Tuolumne Meadows noted in the “Affected Environment” section above, such as high levels of bare ground, altered vegetation, denuded vegetation, and conifer encroachment, would continue to be studied. Vegetation management activities in and around Tuolumne Meadows would be planned and implemented on a case-by-case basis, but the comprehensive ecological restoration program discussed in chapter 5 and detailed in appendix H would not be implemented under the no-action alternative. In the past, typical case-by-case treatments have included reducing or diverting use away from affected or sensitive areas.

Figure 9-5 provides an overview of vegetation types at Tuolumne Meadows. Table 9-5 provides an overview of habitat types in the vicinity of existing infrastructure in Tuolumne Meadows (see figure 8-2 in chapter 8 for a reference to the Tuolumne Meadows site plan numbers).

Table 9-5.
Summary of Habitat Types at Existing Visitor Service and Administrative Areas in Tuolumne Meadows

Site Plan Number (see figure 8-2)	Facility Location	Vegetation Type
1	Pothole Dome	Upland with adjacent meadow
2	Tioga Road	Upland and meadow/wet meadow
3	Cathedral Lakes trailhead	Upland with adjacent wet meadow
4	Wastewater ponds/sprayfield	Upland
5	Undeveloped area east of Budd Creek	Upland with adjacent meadow
6	Visitors center, Road Camp, and administrative areas	Upland
7	Wastewater treatment plant	Upland
8	Parsons Memorial Lodge and Soda Springs	Upland with adjacent meadow
9	Undeveloped area west of Unicorn Creek	Upland
10	Tuolumne Meadows campground A loop	Upland, riparian, and adjacent wet meadow
10	Tuolumne Meadows campground B–G loops	Upland, with riparian area adjacent to Unicorn Creek
11	Store/grill, mountaineering school, public fuel station, and concessioner employee housing	Upland and adjacent wet meadow
12	Concessioner stable	Sparsely vegetated with adjacent wet meadow
13	Lembert Dome parking	Sparsely vegetated with adjacent wet meadow
14	Great Sierra Wagon Road trail	Upland and meadow
15	Wilderness center, ranger station, NPS stable	Upland with adjacent meadow/wet meadow
16	Ranger Camp	Upland with adjacent meadow/wet meadow
17	NPS housing at Bug Camp, John Muir Trail/Pacific Crest Trail trailhead parking	Upland
18	Tuolumne Meadows Lodge	Upland
19	Water treatment facility	Upland
20	Gaylor Pit	Upland

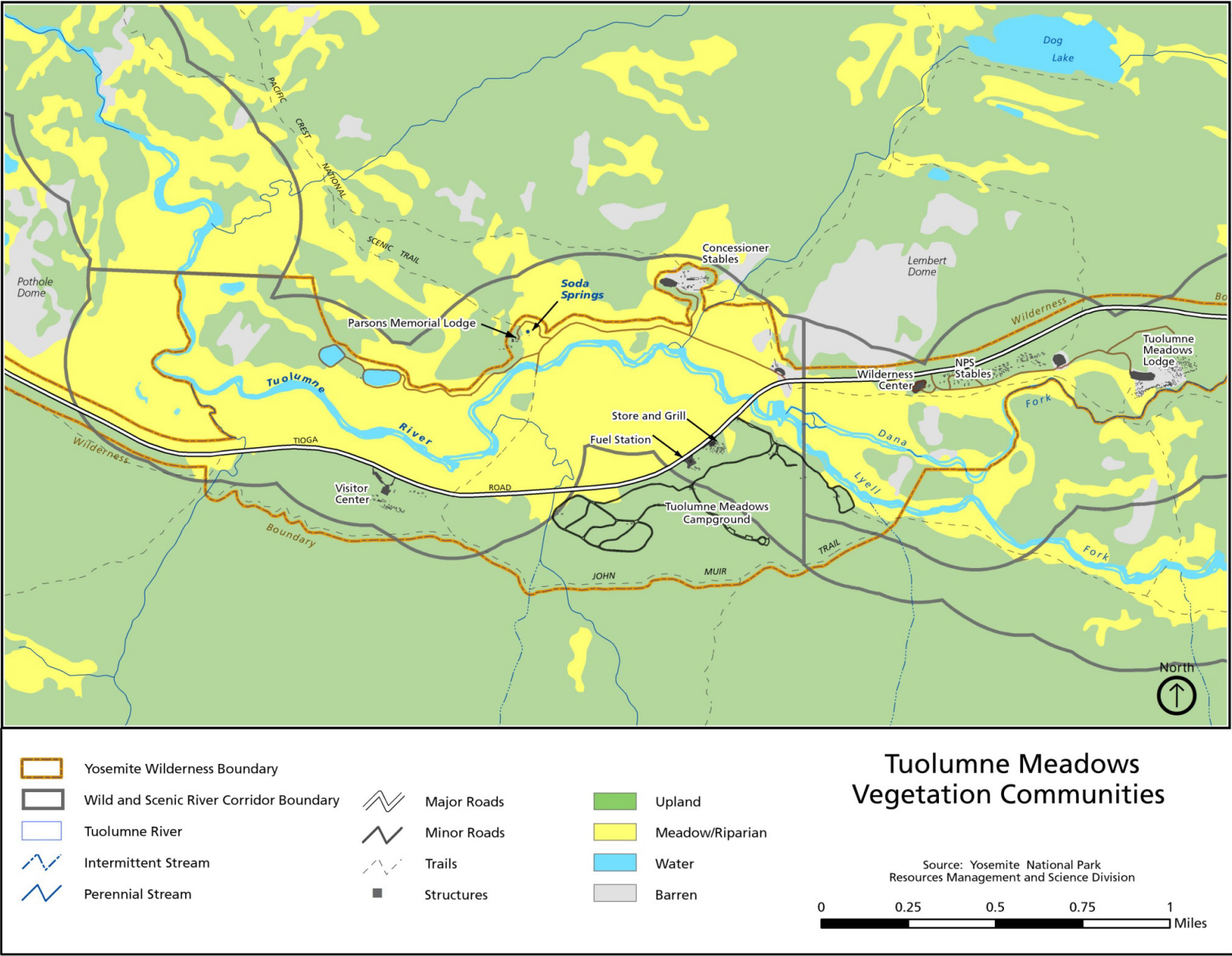


Figure 9-5. Vegetation Types at Tuolumne Meadows.

Much of the existing visitor and administrative infrastructure at Tuolumne Meadows (e.g., visitor service facilities, utilities, formal parking areas, employee housing) is located in resilient upland areas; however, many of these facilities are adjacent to sensitive meadow and riparian communities. Members of park staff have noted that impacts on vegetation radiate outward from existing facilities, particularly along formal and an increasing number of informal trails. High concentrations of informal trails occur adjacent to the store and grill and the public fuel station, at the Parsons Memorial Lodge trailhead, around the Soda Springs area, at the Cathedral Peaks trailhead, along the Tioga Road corridor, and along the banks of the river. Impacts associated with informal trails include dead or damaged vegetation, increased bare ground, compacted soils, soil erosion, and disrupted hydrologic functions (NPS, Buhler et al. 2010e; Holmquist and Schmidt-Gengenbach 2008; Holmquist and Schmidt-Gengenbach 2004). Notable impacts that may be exacerbated by trampling include denuded wet meadow areas along the Lyell Fork near the campground A loop, denuded riparian areas adjacent to the Tuolumne Meadows Lodge, soil compaction and erosion at roadside informal parking areas, and the loss of willows and subsequent riverbank erosion at the western end of the meadow (NPS, Buhler et al. 2010e). The NPS would continue to document and treat non-native plant species throughout the river corridor. These conditions and impacts would continue under the no-action alternative.

In addition to Tioga Road, secondary roads leading to Lumbert Dome, the concessioner stable, and Parsons Memorial Lodge, and segments of the Great Sierra Wagon Road (now used as trails) would continue to adversely affect meadow and riparian vegetation, primarily through fragmentation and the localized interruption of hydrologic (surface) flow to nearby meadow or riparian areas. The risk of overflow at the aging wastewater treatment pond and sprayfield poses a risk to adjacent meadow vegetation.

Scenic Segment

As noted under “Wild Segments,” above, native vegetation communities below O’Shaughnessy Dam would continue to be sustained by natural ecological processes, with the exception of disrupted hydrologic processes caused by the dam. The NPS would continue to participate in collaborative research to mitigate these disruptions through science-based management of water releases intended to more closely mimic natural flows.

Conclusion

Under the no-action alternative, native plant communities in wild segments of the Tuolumne Wild and Scenic River would remain largely undisturbed. However, very localized losses of natural community structure, diversity, and productivity associated with foot travel and stock use along trail corridors, particularly near high-use areas would remain. Local long-term moderate adverse impacts on native plant communities would continue to occur at pack stock camps and grazing areas in Lyell Canyon. At Glen Aulin, vegetation impacts associated with current use at the camp would result in local long-term minor to moderate adverse impacts on wetland and riparian communities.

In the scenic segments at Tuolumne Meadows, the cause of change to the ecological integrity of the subalpine meadow system would continue to be studied, but no comprehensive restoration program would be implemented under the no-action alternative. Ongoing impacts related to disrupted hydrologic processes, historic development, and ongoing use would continue to result in the localized loss of natural community structure, diversity, and productivity in meadow and riparian communities, resulting in a local long-term moderate adverse impact on these sensitive resources.

Natural hydrologic processes that support vegetation in wild and scenic segments below O’Shaughnessy Dam would remain altered by the dam, which is outside of the planning area. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.

Cumulative Impacts

Past actions that would have contributed to adverse cumulative impacts on native plant communities in the river corridor include the construction and maintenance of visitor and administrative facilities at Tuolumne Meadows and Glen Aulin, historic uses such as sheep grazing (before, and very briefly after federal protections were imposed in 1891), road construction and maintenance, construction of the O'Shaughnessy Dam and associated infrastructure, and routine maintenance activities corridorwide, such as trail maintenance.

In addition to the actions that the NPS routinely performs in wilderness areas (e.g., restoration of campsites), the following recently completed actions from the cumulative plans and projects list (see appendix L), had beneficial impacts on native plant communities:

- Project to restore disturbed areas at Tuolumne Meadows Lodge, which included site drainage improvements and native plant restoration.

Current and/or reasonably foreseeable future actions, projects, and plans that could have a cumulative impact on native plant communities in combination with the no-action alternative include:

- Pate Valley and Yosemite Valley invasive velvet grass control project, which addresses populations of a newly established highly invasive plant species from the Tuolumne River corridor.
- Implementation of the project to improve the parkwide communications data network, Tuolumne Meadows water treatment system improvements, the *Scenic Vista Management Plan*, and the *Fire Management Plan* would result in site-specific impacts from thinning or selective removal of vegetation.
- Implementation of the upcoming *Wilderness Stewardship Plan*, the *Invasive Plant Management Plan Update*, and the upcoming *High-Elevation Aquatic Ecosystem Recovery and Stewardship Plan* would have beneficial impacts on native plant communities through management intended to maintain or restore natural processes in the Tuolumne River watershed.
- Informal trail restoration at Tuolumne Meadows would have beneficial impacts on native plant communities by removing foot traffic from sensitive locations and restoring native vegetation.

In combination with the cumulative plans and projects, under the no-action alternative native plant communities in wilderness would remain undisturbed, with local long-term minor to moderate adverse impacts on native plant communities at pack stock camps and grazing areas in Lyell Canyon. At Tuolumne Meadows, impacts of individual facilities and their associated uses would continue to result in a local long-term moderate adverse impact on adjacent meadow and riparian communities, although several restoration actions that will improve conditions for re-establishment of native vegetation were either recently completed or are underway. At Glen Aulin, ongoing foot- and stock-related impacts would result in local long-term minor to moderate adverse impacts on wetland and riparian communities.

Environmental Consequences Common to Alternatives 1–4

Many of the impacts on vegetation would be common to all the action alternatives, and are presented below but not repeated under each alternative.

Wild Segments

There would be little difference among the alternatives in impacts below Glen Aulin. The canyon, riparian, and aquatic communities between Glen Aulin and Hetch Hetchy Reservoir and lower-elevation plant communities below O'Shaughnessy Dam would remain undisturbed with very localized, site-specific exceptions. Impacts would be minimal and associated with occasional foot traffic, fire rings, and the construction of informal campsites.

As under the no-action alternative, lower-elevation native vegetation communities below O'Shaughnessy Dam would continue to be sustained by natural ecological processes, with the exception of disrupted hydrologic processes caused by the dam. The NPS would continue to participate in collaborative research to mitigate these disruptions through science-based management of water releases intended to more closely mimic natural flows.

Displacement of commercial pack stock use caused by the elimination or regulation of such use in the river corridor might displace this use to other areas of the park, where it might cause new impacts on native vegetation communities, particularly sensitive vegetation communities like meadows that are currently infrequently used. Displacement of commercial hiking groups would not have as great a potential impact on vegetation elsewhere in the park because hiking groups have access to a wider range of resilient trails and destinations than do pack stock users.

Scenic Segments

Vegetation Management

Relocating facilities out of meadow and riparian areas, eliminating informal parking, restoring informal trails, and delineating formal parking areas, trailheads, and trails would be part of a comprehensive strategy to reduce existing adverse impacts on meadow and riparian vegetation under alternatives 1–4. Existing natural resource management actions, such as removal of nonnative invasive plants, would continue.

Ecological Restoration Program

The implementation of the ecological restoration program for the Tuolumne River corridor, as described in chapters 5 and 8, would include several intensive actions to restore hydrologic processes and native plant communities in both developed and undeveloped portions of the meadows (see appendix H). These actions would result in beneficial impacts on adjacent meadows from the restoration of surface and subsurface hydrologic flow, removal of nonnative fill, and restoration of vegetation. The program would also include actions to restore riparian communities, particularly willows, along riverbanks to reduce unnatural erosion and deposition and allow the river to meander more naturally across the floodplain. In addition, a small (approximately 150-foot-long) section of riprap along the Lyell Fork would be removed and the riparian area restored. Overall, the ecological restoration program would restore approximately 167 acres of meadow and riparian habitat at Tuolumne Meadows.

Ongoing research would continue to determine the cause and intensity of impacts associated with changes in subalpine meadow vegetation at Tuolumne Meadows. Implemented over time and informed by relevant research, the actions in the ecological restoration program would be expected to greatly improve the natural hydrologic connectivity between the river and the meadows and possibly restore Tuolumne Meadows to a more naturally functioning subalpine meadow ecosystem.

Tioga Road would continue to run along the southern edge of Tuolumne Meadows, and some segments of secondary roads and trails would continue to cross meadow areas. However, actions included in the ecological restoration program for Tuolumne Meadows would be expected to mitigate the impacts on hydrologic surface flows caused by these roads and trails and to improve conditions (including the high water table) needed for reestablishment and/or long-term stability of meadow vegetation.

As noted under “Wild Segments,” above, native vegetation communities below O'Shaughnessy Dam would continue to be sustained by natural ecological processes, with the exception of disrupted hydrologic processes caused by the dam. The NPS would continue to participate in collaborative research to mitigate these disruptions through science-based management of water releases intended to more closely mimic natural flows.

Short-Term Impacts of Construction

The impacts of construction activities on native plant communities could include vegetation damage or removal, and the potential introduction and spread of invasive nonnative species. Vegetation that is removed would not substantially fragment existing native vegetation communities, reduce species diversity, or substantially reduce the overall size or quality of native plant communities at Tuolumne Meadows because new construction would primarily occur in or adjacent to previously disturbed locations or in more resilient, upland habitat. New parking areas and paths might require the removal of some trees; tree removal would be minimized through site design, and, if possible, older trees and snags would be retained for habitat. Implementation of best management practices (see appendix O) would reduce potential adverse impacts to a minor intensity.

Environmental Consequences of Alternative 1

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 1 on vegetation are described below.

Wild Segments

Current wilderness management policies described under the no-action alternative would continue under alternative 1. Native plant communities in wilderness would remain undisturbed, with site-specific exceptions from foot traffic and very occasional administrative stock use along trail corridors.

Reducing and managing day use levels in wilderness through implementation of a new standard for encounters on trails, lower than that prescribed in chapter 5 (an average of four encounters per hour on the Glen Aulin trail and Lyell Canyon trail and an average of two encounters per hour from the Rogers Creek crossing through the Grand Canyon of the Tuolumne), lowering use levels at Tuolumne Meadows, and eliminating concessioner stock day rides and nearly all commercial stock use in wilderness portions of the corridor would reduce the potential for impacts associated with foot traffic and stock use on trails radiating outward from Tuolumne Meadows and Tioga Road, including the potential for introduction or spread of non-native species. Subalpine and riparian communities in upper Lyell Canyon would also benefit from restoration in areas previously affected by pack stock use (e.g., camps and grazing areas) and reduced threats to water quality.

The closure of the Glen Aulin High Sierra Camp and the reduction in day users at Glen Aulin (due to reduced parking availability at Tuolumne Meadows and the elimination of concessioner stock day rides) would substantially reduce the potential for adverse impacts from foot traffic and pack stock use along trails leading from Tuolumne Meadows to the Waterwheel Falls area. Removal and restoration of the Glen Aulin High Sierra Camp would eliminate risks to water quality associated with the camp, reduce the potential for introduction or spread of non-native species, and allow for recovery of the wetland and riparian vegetation currently affected by pack stock and foot traffic.

Scenic Segment

Alternative 1 would result in the removal of all commercial facilities and some associated administrative facilities, including the Tuolumne Meadows Lodge, the public fuel station, the store and grill complex, and a portion of the NPS housing at Bug Camp. The Cathedral Lakes and Parsons Memorial Lodge trailheads would be removed and the areas restored to natural conditions, and parking in undesignated areas would be prohibited. Associated beneficial impacts would include reduced fragmentation and disturbance of meadow and riparian areas; increased opportunities for revegetation and restoration; enhanced connectivity between upland, meadow, and riparian areas; and the potential recovery of adjacent meadow and riparian areas from the effects of trampling, including compaction and vegetation loss.

Removal of the wastewater treatment ponds and associated infrastructure would increase opportunities for revegetation by native upland species and decrease risks to water quality in meadow areas below the ponds.

Removal of the Tuolumne Meadows campground A-loop campsites and the campground A-loop road would increase opportunities for revegetation and restoration of riparian habitat. In addition, restoration of the many informal trails along the riverbank at the campground A loop would encourage reestablishment of native riparian vegetation.

Elimination of concessioner stock day rides would reduce impacts on native plant communities associated with stock use (primarily trampling and the potential introduction of non-native species) at Tuolumne Meadows, both near the concessioner stable and along stock use trails. Private stock use, NPS administrative use, and a small amount of concessioner stock use would remain.

Overall, these actions under alternative 1 would restore approximately 40.9 acres of meadow and riparian habitat and approximately 24.9 acres of upland habitat at Tuolumne Meadows (in addition to the approximately 167 acres of meadow and riparian habitat that would be restored under the ecological restoration program [see “Environmental Consequences Common to Alternatives 1–4,” above]). The implementation of the ecological restoration program and the site-specific restoration proposed under alternative 1, in conjunction with a reduction in visitor use and associated stress on recovering habitats, would be expected to achieve and maintain the proposed protective standard for unfragmented expanses of meadow habitat (see chapter 5).

Some of the eliminated roadside parking would be replaced by new formal parking in more resilient upland communities, adjacent to existing developed areas south of Tioga Road. Localized adverse impacts on primarily previously disturbed upland communities would occur at the existing visitor center/Road Camp parking area, the current location of the store and grill, the Lumbert Dome parking area, and the Dog Lake/John Muir Trail trailhead near Bug Camp. In general, expanded development in these upland areas would increase fragmentation and could expose adjacent native plant communities to the increased potential for trampling and introductions of non-native species. However, the adverse impacts of relocating parking to upland areas would be relatively minor compared with the impacts associated with leaving informal parking in its current location in or adjacent to more sensitive habitats.

In addition, the lowered use levels at Tuolumne Meadows, and corresponding reduced numbers of designated parking spaces, might displace some visitors to other locations along Tioga Road, particularly on peak days such as weekends. This could increase undesignated roadside parking outside the river corridor and lead to new impacts on native subalpine vegetation communities along the road outside the river corridor.

The campground redesign would minimize the existing impact of indiscriminate vehicle travel and parking within the existing boundary of the campground. New development to accommodate the campground redesign would likely result in disturbance to upland habitat, as well as the introduction of vehicle traffic to a previously undisturbed location.

A new trail connection between the location of the current visitor center and the Cathedral Lakes trail would pass through upland vegetation; the impact of a footpath in this relatively resilient location would be minor.

Overall, relocation of facilities and associated new development under alternative 1 would result in up to 38.4 acres of disturbance in upland habitat.

Conclusion

Under alternative 1, native plant communities in wild segments would overall remain undisturbed. Site-specific impacts associated with foot traffic and stock use would be much fewer and less intense than the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term moderate beneficial impact on natural community structure, diversity, and productivity in the Tuolumne River corridor.

Displacement of commercial pack stock use to other areas of the park might cause new impacts on native vegetation communities in wilderness areas that are currently infrequently used.

The removal of Glen Aulin High Sierra Camp would result in a local, long-term, moderate, beneficial impact on native wetland and riparian communities currently affected by foot and stock traffic at the camp.

In the scenic segments at Tuolumne Meadows, the implementation of a comprehensive ecological restoration program and extensive site-specific restoration of previously disturbed sites, in conjunction with a reduction in visitor use, would result in a local long-term major beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term minor to moderate adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 1 would result in approximately 207.9 acres of restored meadow and riparian communities, 24.9 acres of restored upland communities, and up to 38.4 acres of disturbance to native upland communities in scenic segments. In addition, with substantially lowered use levels at Tuolumne Meadows, there is an increased potential for parking in undesignated locations outside the plan boundary that could cause new impacts on native vegetation communities along Tioga Road.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on vegetation resources in combination with alternative 1 are the same as those listed under the no-action alternative.

In combination with cumulative plans and projects, alternative 1 would result in long-term moderate beneficial impacts on native vegetation and short-term minor adverse impacts on upland vegetation at Tuolumne Meadows.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on vegetation are described below.

Wild Segments

Under alternative 2, current wilderness management policies described earlier under the no-action alternative would continue. Native plant communities in wilderness would remain undisturbed, with site-specific exceptions from foot traffic and pack stock use along trail corridors.

The reduction in concessioner stock day rides and the implementation of a new standard for encounters on trails (see chapter 5) would reduce the potential for impacts associated with foot traffic and pack stock use on trails radiating outward from Tuolumne Meadows and Tioga Road into wilderness. In upper Lyell Canyon, the subalpine meadow and riparian communities would benefit from regulations addressing opening dates, grazing-nights, access routes, campsites, and grazing areas, implemented to protect these sensitive habitats. This would reduce the potential for impacts (such as vegetation damage and loss, soil compaction, introduction of non-native species, and erosion) by concentrating disturbance in less-sensitive areas and limiting use based on meadow conditions. Previously affected areas would be restored to natural conditions. Meadow and riparian

communities would benefit to a lesser extent from restrictions on commercial stock use related to the “determination of extent necessary” in appendix C, since maximum use levels would be approximately the same as existing conditions. However, these restrictions would cap the amount of commercial stock use in wild segments of the corridor, which would limit the potential for new impacts.

At Glen Aulin, removal of permanent facilities at the High Sierra Camp and use of the site as a seasonal outfitter camp would reduce the potential for impacts on native vegetation communities in the area by allowing natural processes to prevail during most of the year. The seasonal camp and backpacker campground would continue to have some impact on native vegetation, such as trampling and compaction. In addition, the new composting toilet for guests and replacement in-kind of the composting toilet at the backpacker campground would mitigate some existing risks to water quality and associated riparian habitat. Natural resource restoration at wetlands and a section of riverbank currently affected by foot traffic and pack stock use would have a beneficial impact on wetland vegetation.

Limited recreational boating between Tuolumne Meadows and Pate Valley would have a short-term impact on riparian vegetation where boaters would put in below Tuolumne Meadows, portage around waterfalls in the Grand Canyon, and take out in Pate Valley. However, these impacts would be minimal because use would be restricted by the existing limits of the overnight wilderness trailhead quota system, the short boating season, and by the skill level required to boat on this stretch of the river. To avoid the introduction of non-native species, boaters would be required to ensure that their boats are clean (mud free) and dry before entering the park, and boats would need to be drained of residual water (see appendix O for mitigation measures related to boating).

Scenic Segment

The majority of commercial and administrative facilities would remain under alternative 2. Facilities located within or directly adjacent to meadow and riparian communities would be removed, including the employee and visitor tent cabins nearest to the river at Tuolumne Meadows Lodge and the concessioner employee housing behind the store and grill. The Cathedral Lakes and Parsons Memorial Lodge trailheads would be removed and the areas restored to natural conditions, and roadside parking would be removed from Tioga Road and the road to Tuolumne Meadows Lodge. Restoration activities in these locations would reduce disturbance and fragmentation of meadow and riparian areas; increase opportunities for revegetation and restoration; enhance connectivity between upland, meadow, and riparian areas; and enable the recovery of adjacent meadow and riparian areas from the effects of trampling, including compaction and vegetation loss.

Upgrading the wastewater treatment ponds and associated infrastructure would decrease risks to water quality in meadow areas below the ponds.

Removal of the Tuolumne Meadows campground A-loop campsites nearest to the river would increase opportunities for revegetation and restoration of riparian vegetation on the Lyell Fork.

Overall, these actions would restore approximately 3.4 acres of meadow and riparian habitat and approximately 4.5 acres of upland habitat at Tuolumne Meadows (in addition to the approximately 167 acres of meadow and riparian habitat that would be restored under the ecological restoration program [see “Environmental Consequences Common to Alternatives 1–4,” above]). The implementation of the ecological restoration program and the site-specific restoration proposed under alternative 2, in conjunction with the consolidation of visitor use in more resilient locations, including delineation or fencing along formal trails to protect adjacent vegetation and soils, would be expected to achieve and maintain the proposed protective standard for unfragmented expanses of meadow habitat (see chapter 5).

New development in previously undisturbed upland communities would consist of formal parking areas near Pothole Dome and at an area west of Unicorn Creek, and a new consolidated stables operation between Budd Creek and Road Camp. New development in these upland areas would increase fragmentation and could disturb hydrologic connectivity between upland, meadow, and riparian areas and expose adjacent sensitive resources (e.g., wet meadow vegetation near Pothole Dome) to the effects of trampling. Parking and administrative facilities would also be expanded in previously disturbed upland communities at the existing visitor center/Road Camp parking area, the current location of the store and grill, the Lember Dome parking area, and the Dog Lake/John Muir Trail trailhead near Bug Camp. However, the adverse impacts of relocating parking and other facilities to upland areas would be relatively minor compared with the impacts associated with leaving parking and facilities in their current location in or adjacent to sensitive habitats.

The campground redesign would minimize the existing impact of indiscriminate vehicle travel and parking within the existing boundary of the campground. New development to accommodate the campground redesign (including additional walk-in campsites) would likely result in disturbance to upland habitat, as well as the introduction of vehicle traffic to a previously undisturbed location.

A new trail connection between the location of the current visitor center and the Cathedral Lakes trail would pass through upland vegetation; the impact of a footpath in this relatively resilient location would be minor. Additionally under alternative 2, a new formal trail from the existing store and grill area across the meadows to Parsons Memorial Lodge would likely pass through meadow and wet meadow vegetation. The alignment, proposed construction method, and final width for this trail would be determined through future planning and design. Elevating the trail through the meadow could minimize potential adverse impacts.

Overall, relocation of facilities and associated new development would result in up to 39.9 acres of disturbance in upland habitat.

In addition, the NPS would provide increased amounts of designated parking and allow for higher use levels under alternative 2. However, if visitor use continues to increase over time, some visitors might be displaced to other locations along Tioga Road outside the Tuolumne Meadows area, particularly on peak days such as weekends. This could increase undesignated roadside parking outside the plan boundary and result in new impacts on native subalpine vegetation communities along the road corridor.

Conclusion

Under alternative 2, native plant communities in wild segments of the Tuolumne River corridor would overall remain undisturbed with very localized exceptions. The introduction of recreational boating could result in very localized impacts on riparian vegetation at put-in, portage, and take-out locations; however very limited use and proposed mitigation measures (appendix O) would minimize this impact. Site-specific impacts associated with stock use would be less intense than the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term minor beneficial impact on natural community structure, diversity, and productivity in the river corridor.

At Glen Aulin, removal of permanent structures (with the exception of composting toilets), a reduction in risk to water quality, and site-specific restoration of wetlands at the High Sierra Camp would result in a local long-term moderate beneficial impact on native vegetation in the area.

In the scenic segments at Tuolumne Meadows, the implementation of a comprehensive ecological restoration program and site-specific restoration of previously disturbed sites, in conjunction with the consolidation of visitor use in more resilient locations, would result in a local long-term moderate beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term

minor to moderate adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 2 would result in approximately 170.4 acres of restored meadow and riparian communities, 4.5 acres of restored upland communities, and up to 39.9 acres of disturbance to native upland communities in scenic segments.

Although alternative 2 would increase designated parking at Tuolumne Meadows and allow higher use levels, if visitor use continued to increase, there would be an increased potential for parking in undesignated locations outside the plan boundary, which could cause new impacts on native vegetation communities along Tioga Road.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on vegetation resources, in combination with alternative 2, are the same as those listed under the no-action alternative.

In combination with cumulative plans and projects, alternative 2 would result in long-term moderate beneficial impacts on native vegetation and short-term minor adverse impacts on upland vegetation at Tuolumne Meadows.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on vegetation are described below.

Wild Segments

Current wilderness management policies described under the no-action alternative would continue under alternative 3. Native plant communities in wilderness would remain undisturbed, with site-specific exceptions from foot traffic and pack stock use along trail corridors.

Reducing and managing day use levels in wilderness through implementation of a new standard for encounters on trails (see chapter 5) and lowered use levels at Tuolumne Meadows, in combination with the reduction of concessioner stock day rides, would reduce the potential for impacts associated with foot traffic and stock use on trails radiating outward from Tuolumne Meadows and Tioga Road into wilderness. In upper Lyell Canyon, the subalpine meadow and riparian communities would benefit from restrictions on commercial stock use and from regulations addressing opening dates, grazing-nights, access routes, campsites, and grazing areas, implemented to protect these sensitive habitats. This would reduce the potential for impacts (such as vegetation damage and loss, soil compaction, introduction of non-native species, and erosion) by concentrating disturbance in less sensitive areas and limiting use based on meadow conditions. Previously affected areas would be restored to natural conditions.

At Glen Aulin, the replacement of the guest flush toilet with a composting toilet at the High Sierra Camp and the replacement in-kind of the composting toilet at the backpacker campground would reduce existing risks to water quality and associated riparian habitat by reducing water demand at the camp and reducing the amount of human waste in the leach mound. Natural resource restoration at wetlands and at a section of riverbank currently affected by foot traffic and pack stock use would have a beneficial impact on wetland vegetation.

Scenic Segment

Almost all commercial and administrative facilities would remain under alternative 3. Facilities located within or directly adjacent to meadow and riparian communities would be removed, including the employee cabins and approximately half of the guest tent cabins at Tuolumne Meadows Lodge, the public fuel station, and the concessioner employee housing behind the store and grill. The NPS would remove and restore the Cathedral

Lakes trailhead and remove roadside parking from Tioga Road and the road to the Tuolumne Meadows Lodge. Restoration activities in these locations would reduce disturbance and fragmentation of meadow and riparian areas, increase opportunities for revegetation and restoration, enhance connectivity between upland, meadow, and riparian areas, and enable the recovery of adjacent meadow and riparian areas from the impacts of trampling, including compaction and vegetation loss.

Upgrading the wastewater treatment ponds and associated infrastructure would decrease risks to water quality in meadows below the ponds.

Overall, these actions would restore approximately 3.8 acres of meadow and riparian habitat and approximately 4.85 acres of upland habitat at Tuolumne Meadows (in addition to the approximately 167 acres of meadow and riparian habitat that would be restored under the ecological restoration program [see “Environmental Consequences Common to Alternatives 1–4,” above]). The implementation of the ecological restoration program and the site-specific restoration proposed under alternative 3, in conjunction with reducing visitor use, would be expected to achieve and maintain the proposed protective standard for unfragmented expanses of meadow habitat (see chapter 5).

New development in previously undisturbed upland communities under alternative 3 would include a formal parking area near Pothole Dome and a new employee housing area north of the road leading to Tuolumne Meadows Lodge (west of the water treatment facility). Parking and administrative facilities would also be expanded in previously disturbed upland communities at the existing visitor center parking area, the current location of the store and grill, the Lumbert Dome parking area, and the Dog Lake/John Muir Trail trailhead near Bug Camp. New development in these upland areas would increase fragmentation; could disturb hydrologic connectivity between upland, meadow, and riparian areas; and could expose adjacent sensitive resources (e.g., wet meadow vegetation near Pothole Dome) to the impacts of trampling. However, the adverse impacts of relocating parking and other facilities to upland areas would be relatively minor compared with the impacts associated with leaving these facilities in their current location in or adjacent to sensitive habitats.

The Tuolumne Meadows campground redesign would minimize the existing impact of indiscriminate vehicle travel and parking within the existing boundary of the campground. New development to accommodate the campground redesign would likely result in disturbance to upland habitat and introduce vehicle traffic to a previously undisturbed location.

A new trail connection between the location of the current visitor center and the Cathedral Lakes trail would pass through upland vegetation; the impact of a footpath in this relatively resilient location would be minor.

Overall, relocation of facilities and associated new development would result in up to 11.2 acres of disturbance in upland habitats.

In addition, the NPS would provide increased amounts of designated parking under alternative 3, but lower use levels at Tuolumne Meadows. Some visitors might be displaced to other locations along Tioga Road outside the Tuolumne Meadows area, particularly on peak days such as weekends. This could increase undesignated roadside parking outside the river corridor and cause new impacts on native subalpine vegetation communities along the road corridor.

Conclusion

Under alternative 3, native plant communities in wild segments of the Tuolumne River corridor would overall remain undisturbed, with very localized exceptions. Site-specific impacts associated with foot traffic and stock use would be less intense than the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term minor beneficial impact on natural community structure, diversity, and productivity in the river corridor.

Although alternative 3 would increase designated parking at Tuolumne Meadows, there would be increased potential for parking in undesignated locations outside the plan boundary, which could result in new impacts on native vegetation communities along Tioga Road.

Because of the reduction in risk to water quality and site-specific restoration of wetlands at the Glen Aulin High Sierra Camp under alternative 3, there would be a local long-term minor to moderate beneficial impact on native wetland and riparian communities at the camp.

In the scenic segments at Tuolumne Meadows, the implementation of a comprehensive ecological restoration program and site-specific restoration of previously disturbed sites in conjunction with a reduction in visitor use would result in a local long-term moderate beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term minor adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 3 would result in approximately 170.8 acres of restored meadow and riparian communities, 4.85 acres of restored upland communities, and up to 11.2 acres of disturbance to native upland communities in scenic segments.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on vegetation resources in combination with alternative 3 are the same as those listed under the no-action alternative.

In combination with cumulative plans and projects, alternative 3 would result in long-term moderate beneficial impacts on native vegetation and short-term minor adverse impacts on upland vegetation at Tuolumne Meadows.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on vegetation are described below.

Wild Segments

Current wilderness management policies described under the no-action alternative would continue under alternative 4. Native plant communities in wilderness would remain undisturbed, with site-specific exceptions from foot traffic and pack stock use along trail corridors.

Managing day use levels in wilderness through implementation of new standards for encounters on trails (see chapter 5), in combination with the elimination of concessioner stock day rides and restrictions on the amount of pack stock used to supply Glen Aulin High Sierra Camp, would reduce the potential for impacts associated with foot traffic and stock use on trails radiating outward into wilderness from Tuolumne Meadows and Tioga Road, particularly the Glen Aulin trail and the Young Lakes trail. In upper Lyell Canyon, the subalpine meadow and riparian communities would benefit from regulations addressing opening dates, grazing-nights, access routes, campsites, and grazing areas, implemented to protect these sensitive habitats. This would reduce the

potential for impacts (such as vegetation damage and loss, soil compaction, introduction of non-native species, and erosion) by concentrating disturbance in less-sensitive areas and limiting use based on meadow conditions. Previously affected areas would be restored to natural conditions. Meadow and riparian communities would benefit to a lesser extent from restrictions on commercial stock use related to the “determination of extent necessary” in appendix C, since use would be at levels that are approximately the same as existing conditions. However, these restrictions would cap the amount of commercial stock use in wild segments of the corridor, which would limit the potential for new impacts.

At Glen Aulin, the replacement of all flush toilets with composting toilets at the High Sierra Camp and the replacement in-kind of the composting toilet at the backpacker campground would reduce existing risks to water quality and associated riparian habitat by reducing water use and converting the wastewater system to gray water only. Natural resource restoration at wetlands and a section of riverbank currently affected by foot traffic and pack stock use would have a beneficial impact on wetland vegetation.

Limited recreational boating between Tuolumne Meadows and Pate Valley would have a short-term impact on riparian vegetation where boaters would put in below Tuolumne Meadows, portage around waterfalls in the Grand Canyon, and take out in Pate Valley. However, these impacts would be minimal because use would be restricted by the existing limits of the overnight wilderness trailhead quota system, the short boating season, and by the skill level required to boat on this stretch of the river. To avoid the introduction of non-native species, boaters would be required to ensure that their boats are clean (mud free) and dry before entering the park, and boats would need to be drained of residual water (see appendix O for mitigation measures specific to recreational boating).

Scenic Segments

The majority of commercial services and administrative facilities would remain under alternative 4. Facilities located within or directly adjacent to meadow and riparian communities would be relocated, including all employee cabins and three visitor tent cabins nearest the river at the Tuolumne Meadows Lodge and the concessioner employee housing behind the store and grill. The Cathedral Lakes trailhead would be relocated and the existing trailhead restored, and roadside parking would be removed from Tioga Road and the road to the Tuolumne Meadows Lodge. Restoration activities in these locations would reduce disturbance and fragmentation of meadow and riparian areas; increase opportunities for revegetation and restoration; enhance connectivity between upland, meadow, and riparian areas; and enable the recovery of adjacent meadow and riparian areas from the impacts of trampling.

Upgrading the wastewater treatment ponds and associated infrastructure would decrease risks to water quality in meadow areas below the ponds. (As noted in chapter 8, the possibility of removing the wastewater treatment ponds is an action that would be explored in a subsequent environmental compliance process, if the technology is available to upgrade the existing treatment process to tertiary treatment.) Removing the 21 A-loop campsites within 100 feet of the river and realigning the campground A-loop road would increase opportunities for revegetation and restoration of riparian vegetation on the Lyell Fork. Eliminating concessioner stock day rides and reducing pack stock use on the Glen Aulin trail would reduce impacts on native plant communities associated with stock use (primarily trampling and the introduction of non-native species) at Tuolumne Meadows, both near the concessioner stable and along stock use trails.

Overall, these actions would restore approximately 3.6 acres of meadow and riparian habitat and 2.9 acres of upland habitat at Tuolumne Meadows (in addition to the approximately 167 acres of meadow and riparian habitat that would be restored under the ecological restoration program [see “Environmental Consequences Common to Alternatives 1–4,” above]). The implementation of the ecological restoration program and the site-specific restoration proposed under alternative 4, in conjunction with reducing and consolidating visitor use in more resilient locations, including delineation or fencing along formal trails to protect adjacent vegetation and

soils, would be expected to achieve and maintain the proposed protective standard for unfragmented expanses of meadow habitat (see chapter 5).

New development in previously undisturbed upland communities under alternative 4 to replace facilities relocated away from sensitive habitat would include a new visitor contact station, picnic area, and formal parking in an area west of Unicorn Creek; and a new concessioner housing area north of Tuolumne Meadows Lodge. New development in these areas could disturb hydrologic connectivity between upland, meadow, and riparian areas and could expose adjacent sensitive resources (e.g., Unicorn Creek) to the impacts of trampling. Parking and administrative facilities would also be formalized at Pothole Dome and expanded in previously disturbed upland communities at the existing visitor center parking area, the road to the concessioner stable, the existing wilderness center area, and the Dog Lake/John Muir Trail trailhead near Bug Camp. However, the adverse impacts of relocating parking and other facilities to upland areas would be relatively minor compared with the impacts associated with leaving facilities in their current location in or adjacent to sensitive habitats.

The Tuolumne Meadows campground redesign would minimize the existing impact of indiscriminate vehicle travel and parking within the existing boundary of the campground. New development to accommodate the campground redesign would likely result in disturbance to upland habitat and introduce vehicle traffic to a previously undisturbed location within the campground.

New trail connections between the new Cathedral Lakes trailhead and the Cathedral Lakes trail; the new visitor contact station and the existing formal trail to Parsons Memorial Lodge from Tioga Road; the new visitor contact station and the Cathedral Lakes trail; the campground and the John Muir Trail, and the new visitor contact station and the store/grill area (along the south side of Tioga Road) would pass through primarily upland vegetation; the impact of footpaths in these relatively resilient locations would be minor.

Overall, relocation of facilities and associated new development would result in up to 28.1 acres of disturbance in upland habitats. In addition, although the NPS would provide increased amounts of designated parking areas under alternative 4, use levels would be slightly more than under existing conditions. If the demand for visitor use continues to increase, some visitors might be displaced to other locations along Tioga Road, particularly on peak days. This could increase undesignated roadside parking outside the plan boundary and cause new impacts on native subalpine vegetation communities along the road corridor.

Conclusion

Under alternative 4, native plant communities in wild segments of the Tuolumne River corridor would overall remain undisturbed, with localized exceptions. The introduction of recreational boating could result in localized impacts on riparian vegetation at put-in, portage, and take-out locations; however very limited use and proposed mitigation measures (appendix O) would minimize this impact. Site-specific impacts associated with foot traffic and stock use along trail corridors would be considerably reduced compared to the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term minor to moderate beneficial impact on natural community structure, diversity, and productivity in the river corridor.

Although alternative 4 would increase designated parking at Tuolumne Meadows, if the demand for visitor use continued to increase, there would be a greater potential for parking in undesignated locations outside the plan boundary, which could cause new impacts on native vegetation communities along Tioga Road.

A reduction in risks to water quality and site-specific restoration of wetlands at the Glen Aulin High Sierra Camp would result in a local long-term minor to moderate beneficial impact on native wetland and riparian communities at the camp.

In the scenic segments at Tuolumne Meadows, implementing a comprehensive ecological restoration program and site-specific restoration of previously disturbed sites, in conjunction with reducing and consolidating visitor use in more resilient locations, would result in a local long-term moderate beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term minor to moderate adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 4 would result in approximately 170.6 acres of restored meadow and riparian communities, 2.9 acres of restored upland communities, and up to 28.1 acres of disturbance to native upland communities in scenic segments.

Cumulative Impacts

The past, current, and reasonably foreseeable plans and projects listed in appendix L that could have a cumulative impact on vegetation resources in combination with alternative 4 are the same as those listed under the no-action alternative.

In combination with cumulative plans and projects, alternative 4 would result in long-term moderate beneficial impacts on native vegetation and short-term minor adverse impacts on upland vegetation at Tuolumne Meadows.

Wildlife

Affected Environment

Overview

Yosemite National Park is one of the largest and least fragmented habitat blocks in the Sierra Nevada. The Tuolumne River corridor plays an essential ecological role in linking habitats across the park's landscape and elevation gradients. In particular, the diversity and structural complexity of riparian habitat types make them centers of high biodiversity (Rundel and Stuner 1998). Both terrestrial and aquatic species depend on riparian ecosystems for their year-round availability of water, nutrients, food source, and organic matter. Highly productive and diverse, riparian and aquatic systems (including meadows) are the most affected areas in the Sierra Nevada (UC Davis 1996). Declining spatial extent and deterioration of riparian and wet meadow ecosystems is occurring throughout California at an alarming rate (UC Davis 1996). While riparian and meadow ecosystems occupy relatively little land area in Yosemite National Park, they represent the most biologically diverse areas and, because of their vulnerability, are priorities for ecological restoration (NPS, Hall 1997b).

Table 9-6 lists the representative plant and wildlife species in each of the habitat types throughout the river corridor. Following table 9-6, wildlife are further described by geographic area.

Table 9-6.
Summary of California Wildlife Habitat Relationship Types in the Tuolumne River Corridor

Habitat Type	Dominant Plant Species	Typical Wildlife Species	Amount of Corridor in Habitat type	Area (Acres)
Lodgepole pine	Lodgepole pine, aspen, mountain hemlock	Western terrestrial garter snake, northern alligator lizard, northern goshawk, American robin, black swift, red-tailed hawk, white-throated swift, Williamson's sapsucker, olive-sided flycatcher, mountain chickadee, pine siskin, deer mouse, long-tailed vole, coyote, ermine, long-tailed weasel, American badger, black bear	41.6%	7,661
Montane hardwood	Canyon live oak, black oak, Douglas-fir, California laurel	Red-tailed hawk, American kestrel, flammulated owl, red-breasted sapsucker, Steller's jay, northern flicker, white-throated swift, big brown bat, California ground squirrel, deer mouse, brush mouse, coyote, gray fox, long-tailed weasel, badger, striped skunk, black bear.	17.3%	3,180
Barren	Lichens, mosses	Rosy finch, American pipit, rock wren, common raven, Belding's ground squirrel, American pika, yellow-bellied marmot	11.6%	2,138
Wet meadow	Sedge species, rush species, tufted hairgrass	California newt, American pipit, chipping sparrow, common nighthawk, house wren, northern pygmy owl, rough-winged swallow, California kingsnake, sharp-tailed snake, Belding's ground squirrel, coyote, black bear	7.8%	1,435
Sierran mixed conifer	Douglas-fir, sugar pine, ponderosa pine	Western fence lizard, northern alligator lizard, band-tailed pigeon, barn swallow, dark-eyed junco, green-tailed towhee, northern flicker, Townsend's solitaire, Botta's pocket gopher, ermine, golden-mantled ground squirrel, long-tailed weasel, black bear	4.7%	869
Subalpine conifer	Engelmann spruce, subalpine fir, mountain hemlock	Clark's nutcracker, Cassin's finch, ruby-crowned kinglet, white-crowned sparrow, porcupine, bushy-tailed woodrat, heather vole, deer mouse, black bear	2.3%	426
Jeffrey pine	Jeffrey pine, sugar pine, lodgepole pine, white fir, red fir, incense-cedar	Sagebrush lizard, Pacific tree frog, red-tailed hawk, golden eagle, olive-sided flycatcher, western wood-pewee, Steller's jay, bushy-tailed woodrat, golden-mantled ground squirrel, striped skunk, black bear, coyote, gray fox, ermine	2.2%	408
Riverine	Water moss, algae, duckweed	California newt, Pacific tree frog, western pond turtle, widgeon, spotted sandpiper, common goldeneye, common raven, mallard, northern river otter, mink, black bear	2.2%	401
Montane riparian	White alder, black cottonwood, willow	Pacific tree frog, sharp-tailed snake, red-tailed hawk, mountain quail, western screech owl, long-eared owl, belted kingfisher, cliff swallow, black phoebe, American dipper, song sparrow, mink, mountain beaver, western mastiff bat, black bear	1.9%	341
Montane chaparral	Huckleberry oak, Sierra chinquapin, whitethorn ceanothus, Fremont silktassel, bitter cherry	Gilbert's skink, southern alligator lizard, red-tailed hawk, California quail, bushtit, barn swallow, ruby-crowned kinglet, California ground squirrel, Botta's pocket gopher, coyote, California pocket mouse, badger, striped skunk, black bear	1.8%	326
Juniper	Western juniper, Jeffrey pine, sagebrush	Sagebrush lizard, western rattlesnake, American kestrel, Say's phoebe, rock wren, common raven, white-breasted nuthatch, Townsend's solitaire, pinion mouse, black-tailed jackrabbit, bushy-tailed woodrat, coyote, mule deer.	1.6%	292
Blue oak – foothill pine	Foothill pine, blue oak, interior live oak	Gilbert's skink, western fence lizard, crow, Anna's hummingbird, black-throated grey warbler, cedar waxwing, Cooper's hawk, Lawrence's goldfinch, fringed myotis, grey fox	1.4%	255
Ponderosa pine	Ponderosa pine, incense-cedar, Douglas-fir, white fir, canyon live oak, black oak, Jeffrey pine, sugar pine	Western fence lizard, western rattlesnake, sharp-shinned hawk, American kestrel, acorn woodpecker, violet-green swallow, barn swallow, yellow warbler, chipping sparrow, California ground squirrel, mountain pocket gopher, coyote, badger, striped skunk, black bear	<1%	163
Red fir	Red fir	Western terrestrial garter snake, northern alligator lizard, red-tailed hawk, golden eagle, black swift, olive-sided flycatcher, red-breasted sapsucker, golden-mantled ground squirrel, deer mouse, bushy-tailed woodrat, coyote, long-tailed weasel, black bear	<1%	129
Aspen	Aspen, willows, alders	Calliope hummingbird, dusky flycatcher, house wren, red-naped sapsucker, Wilson's warbler, Botta's pocket gopher, mule deer, western jumping mouse	<1%	90
Mixed chaparral	Scrub oak, ceanothus species, manzanita species	Common kingsnake, striped racer, western rattlesnake, Anna's hummingbird, ash-throated flycatcher, common poorwill, rufous-crowned sparrow, turkey vulture, western screech owl, golden-mantled ground squirrel, coyote, black bear	<1%	69

Habitat Type	Dominant Plant Species	Typical Wildlife Species	Amount of Corridor in Habitat type	Area (Acres)
Alpine dwarf shrub	Goldenweed, mountain heather	Western terrestrial garter snake, Cassin's finch, dark-eyed junco, peregrine falcon, rufous hummingbird, pine grosbeak, turkey vulture	<1%	63
Annual grassland	Wild oats, soft chess, brome species	Pacific tree frog, western spadefoot, gopher snake, racer, black phoebe, great blue heron, great horned owl, mallard, big brown bat, broad-footed mole, brush rabbit, pinon mouse	<1%	52
White fir	White fir, Douglas fir, sugar pine	Western fence lizard, American kestrel, band-tailed pigeon, black swift, fox sparrow, northern flicker, sharp-shinned hawk, Townsend's solitaire, violet-green swallow, big brown bat, gray fox, black bear	<1%	40
Lacustrine	Algae, sedges	Western pond turtle, western aquatic garter snake, eared grebe, great blue heron, bufflehead, spotted sandpiper, Northern river otter, little brown myotis bat, merganser	<1%	37
Montane hardwood-conifer	Douglas-fir, incense-cedar, ponderosa pine, black oak, big-leaf maple	Western fence lizard, northern alligator lizard, sharp-shinned hawk, Cooper's hawk, calliope hummingbird, red-breasted sapsucker, olive-sided flycatcher, big brown bat, coyote, grey fox, long-tailed weasel, badger, striped skunk, black bear	<1%	12
Fresh emergent wetland	Cattail, bulrush, redroot nutgrass	California newt, western aquatic garter snake, green-winged teal, osprey, red-winged blackbird, song sparrow, northern river otter, striped skunk.	<1%	5

Alpine Habitat

Wild Segments: Lyell Fork and Upper Dana Fork

Alpine habitat in the upper reaches of the Dana and Lyell Forks is important for numerous animal species, including migratory birds, amphibians, and small mammals. Mammals found in these habitat areas include Inyo shrew (*Sorex tenellus*), Mount Lyell shrew (*Sorex lyelli*), American pika (*Ochotona princeps*), yellow-bellied marmot (*Marmota flaviventer sierrae*), alpine chipmunk (*Eutamias alpinus*), mountain lion (*Felis concolor*), mule deer (*Odocoileus hemionus*), and Belding's ground squirrel (*Citellus beldingi*). Bighorn sheep (*Ovis canadensis sierrae*) herds may still use areas within the Tuolumne River corridor at the very highest reaches of the watershed (see the "Special Status Species" section, below). Birds include the common raven (*Corvus corax*), rock wren (*Salpinctes obsoletus*), Sierra Nevada rosy finch (*Leucosticte tephrocotis dawsoni*), and the American pipit (*Anthus ubescens*). Special status reptiles and amphibians include the Mount Lyell salamander (*Hydromantes platycephalus*) (see "Special Status Species" section, below).

Subalpine Habitat

Wild Segments: Lyell Fork and Upper Dana Fork

Scenic Segments: Lower Dana Fork and Tuolumne Meadows

The exceptional diversity of river-related habitat types in the subalpine meadows at Tuolumne Meadows and along the Dana Fork and the Lyell Fork is especially important to wildlife, and the importance of these systems to the productivity and diversity of wildlife throughout the entire river corridor cannot be overstated. Meadow systems provide critical breeding and foraging habitat for a suite of animal species, including invertebrates, which represent the largest taxon (group) of wildlife found in the Tuolumne River corridor and which form the foundation for higher level food chain interactions. The meadow invertebrate assemblage at Tuolumne Meadows has been found to be remarkably diverse, with relatively low dominance of any one form (Holmquist and Schmidt-Gengenbach 2008).

A number of bird and bat species use habitats in and around Tuolumne Meadows and Dana Meadows: the black-backed woodpecker (*Picoides arcticus*), brown creeper (*Certhia americana*), mountain chickadee (*Poecile gambeli*), and great horned owl (*Bubo virginianus*) are forest species that use such areas for nesting. Spotted bats (*Euderma maculatum*) have been detected feeding on the rich insect life of the meadows (Pierson and Rainey 1993), and the violet green swallow (*Tachycineta thalassina*) uses the meadows for foraging.

Mule deer (*Odocoileus hemionus*) take advantage of the cover provided by montane meadow vegetation by hiding their fawns under the dense herbaceous canopy. Deer are commonly seen summer residents in the Tuolumne Meadows and Dana Meadows area. Sierra mountain beavers (*Aplodontia rufa californica*), gray bushy-tailed woodrats (*Neotoma cinerea*), and Sierra white-tailed jack rabbits (*Lepus townsendii sierrae*) take advantage of the high water table and moist vegetation. Small mammals, such as golden-mantled ground squirrels (*Spermophilus lateralis*), mountain pocket gophers (*Thomomys* sp.), and voles (*Microtus montanus*) feed on both aboveground and belowground meadow vegetation, and play a significant role in decomposition through soil mixing. Pacific tree frogs (*Pseudacris regilla*) and water shrews frequent the moist vegetation edging stream channels. Reptiles such as the northern alligator lizard (*Elgaria coerulea*) might be present. Mammals such as black bear (*Ursus americanus*), river otter (*Lontra Canadensis*), mule deer, and mountain lion use this area as a migration and travel corridor between the high country in summer and lower elevations during winter as they follow seasonal availability of food sources or movements of prey.

During the summer, Tuolumne Meadows receives the greatest amount of visitor use in the corridor and is consequently the most altered by human disturbance. Meadow invertebrates are especially sensitive to fragmentation by trail corridors, with declines in species abundance and diversity observed as much as two meters away from trailbeds in seemingly undisturbed vegetation (Holmquist and Schmidt-Gengenbach 2004). Species adapted to human disturbance, such as black bear, Douglas squirrel (*Tamiasciurus douglasii*), Belding's ground squirrel, and mule deer, remain relatively common. With the closure of Tioga Road each year from late fall to late spring, other species undoubtedly frequent this area.

As noted in the "Vegetation" section above, changes in the ecological integrity of Tuolumne Meadows are evidenced by a much higher occurrence of bare ground and a difference in the types of meadow vegetation from what would be expected for an area with an intact wet meadow hydrologic regime (NPS, Buhler et al. 2010e; Cooper et al. 2006; Millar et al. 2004). Researchers suspect that a disruption of ecological processes resulting from historic development and use, coupled with the emerging stress of more frequent periods of low precipitation, is being exacerbated by changes in meadow hydrology, foot traffic, and possibly disturbance by wildlife (NPS, Buhler et al. 2010e; Cooper et al. 2006). Research is warranted to further understand the effects of pocket gophers, voles and deer on the establishment and growth of perennial plants typical of wet meadows (NPS, Noon and Martin 2010i).

Non-native, brown-headed cowbirds (*Molothrus ater*) have increased in the Sierra Nevada (Laymon 1987) and threaten native bird species. Cowbirds are nest parasites that lay their eggs in the nests of other birds, usually songbirds. The cowbird eggs hatch before the eggs of the host species, and the larger, more vigorous cowbird young then either eject the eggs or young of the host species or outcompete the host's young for food. This parasitism can have a devastating effect on the population of some songbird species. The spread of cowbirds has been associated with human disturbance and activities, especially areas frequented by stock use, such as stables, corrals, campgrounds, and residential areas (Laymon 1987).

Brown-headed cowbirds are found in Yosemite from El Portal to above Tuolumne Meadows, where their presence is facilitated by humans and livestock. The magnitude of the impact of brown-headed cowbirds on native species at higher elevations is unclear. Some research indicates that their impact decreases with elevation, due to the differences in reproductive timing between cowbirds and native species. Nonetheless, the adaptation of cowbirds to parasitism of high-elevation bird species is possible; in summer of 2009, NPS staff noted cowbirds in the stock use areas of upper Lyell Canyon. This indicates that the threat to native birds might be extending into remote backcountry areas. The NPS will continue to investigate the effects of brown-headed cowbirds throughout the park.

Canyon Habitat

Wild Segment: Grand Canyon

The river-dependent habitat types, such as pools, riffles, and steep cliffs, between Tuolumne Meadows (elevation 8,600 feet) and Hetch Hetchy Reservoir (elevation 3,800 feet) support a diverse assemblage of species, including special status bird and bat species. At least two bat species, the spotted bat (*Eudermma maculatum*) and greater western mastiff bat (*Eumops perotis californicus*), have been located throughout the canyon at Pate Valley and closer to Hetch Hetchy Reservoir (Pierson and Rainey 1998). Birds sighted along this section of the river include the bald eagle (*Haliaeetus leucocephalus*), American peregrine falcon (*Falco peregrines anatum*), osprey (*Pandion haliaetus* [Siegel and DeSante 2002]), and California spotted owl (*Strix occidentalis occidentalis* [Moritz 2007]). Amphibians and reptiles observed here include the Pacific tree frog, western fence lizard (*Sceloporus occidentalis*), Sierra gartersnake (*Thamnophis couchii*), and western rattlesnake (*Crotalus viridis helleri*) (Moritz 2007). Mammals such as black bear, mule deer, and mountain lion use this area as a migration and travel corridor between the high country in summer and lower elevations during winter as they follow seasonal availability of food sources or movements of prey. River otter (*Lutra canadensis*) have also been sighted in the Grand Canyon.

Lower-Elevation Habitat

Scenic Segment: Administrative Area below O'Shaughnessy Dam

Wild Segment: Poopenaut Valley

The largely undisturbed, low-elevation, riparian and meadow communities in Poopenaut Valley provide habitat for an exceptionally diverse assemblage of bird species and bat species, including special status species (for both birds and bats). Amphibian and reptile diversity is especially high in these lower elevation zones. Surveys conducted by NPS staff between 2008 and 2010 documented 2 amphibian species and 8 reptile species in Poopenaut Valley, including Western pond turtle (*Actinemys marmorata*), a California species of special concern. These same river surveys documented 5 amphibian species and 14 reptile species between the O'Shaughnessy Dam and the Early Intake Diversion Dam (located outside of the park's western boundary), including two California species of special concern, the Western pond turtle and the foothill yellow-legged frog (*Rana boylei*). However, foothill yellow-legged frogs have not been detected within park boundaries.

Bird species are numerous throughout this section of river. Recent sightings include ash-throated flycatcher (*Myiarchus cinerascens*), Bullock's oriole (*Icterus bullockii*), Lawrence's goldfinch (*Carduelis lawrencei*), northern rough-winged swallow (*Stelgidopteryx serripennis*), pied-billed grebe (*Podilymbus podiceps*), and oak titmouse (*Baeolophus inornatus*) (Siegel and DeSante 2002; Moritz 2007). Mammals frequently reported are black bear and mountain lion (Moritz 2007) as well as several bat species. Preliminary results from a 2011 survey show an impressive diversity of bats and indicate that 16 out of the 17 bat species documented in the park occur in Poopenaut Valley, including the California spotted bat, the Western mastiff bat, and the Townsend's big-eared bat (*Corynorhinus townsendii*).

Despite an altered hydrologic regime resulting from the presence of O'Shaughnessy Dam, riparian and meadow habitat types in Poopenaut Valley continue to provide important habitat for a variety of plant and animal species, many of them sensitive indicators of habitat quality (NPS, Stock et al. 2007i). Initial studies suggest that because of several factors unique to its setting (e.g., a low overall gradient, a downstream bedrock construction that promotes floodplain inundation, upslope glacial moraines that contribute sediment to the river), Poopenaut Valley and its ecosystems have largely been spared the severe impacts seen downstream of other dams. In addition, due to its relative inaccessibility and protection within Yosemite National Park, the Poopenaut Valley area is one of the few undeveloped riparian and meadow ecosystems at this elevation in the region.

As noted above, brown-headed cowbirds have increased in the Sierra Nevada (Laymon 1987), and their presence threatens native bird species. Their nest parasitism can have a devastating effect on the population of some songbird species and may be partially responsible for the apparent disappearance of willow flycatchers (*Empidonax traillii*) from areas below O'Shaughnessy Dam.

Environmental Consequences Methodology

Impact assessments for wildlife rely substantially on professional judgment supported by the best available science, including written reports, existing data sets, peer-reviewed scientific publications, and relevant past studies.

Four primary parameters are used to evaluate impacts: (1) the amount, distribution, and integrity of wildlife habitat; (2) the integrity of habitat (including past disturbance); (3) the relative importance of habitat; and (4) the potential for disturbance from human presence. Impacts on the native plant communities and hydrologic processes that support wildlife habitat are assessed under "Vegetation" and "Hydrology," above. Analysis was based on the assumptions listed below.

- The greater the size of a biotic community and the stronger its links to neighboring communities, the more valuable it is to the integrity and maintenance of biotic processes. Development may potentially limit the size of a community and/or fragment and disassociate communities from each other.
- The more developed areas become, the less valuable they are as wildlife habitat. New development would increase human presence and increase the potential for disturbance in the area of the development. The potential for negative wildlife interactions (such as human injury from wildlife and the introduction of unnatural food sources) also would increase. The removal of development from an area would increase the value of the habitat. However, it is important to recognize that in some cases, development serves to concentrate visitor impact and reduce disturbance associated with dispersal of the same number of visitors. "Containment" of disturbance within a designated area may preserve integrity of habitat and prove more valuable to wildlife.
- The effects of human food and garbage on the behavior, distribution, and abundance of wildlife species would continue in existing developments and begin in new developments.
- Disturbance in or near a river and its tributaries may reduce the productive capabilities of associated natural communities. Modifications to river form (including those that would constrain the river from migrating or changing course), soil compaction, loss of riparian vegetation, removal of woody debris, and accelerated erosion and sediment transport influence important habitat characteristics, such as riffle/pool complexes, substrate type, location, and cover. These physical aspects often determine the composition of vegetative and aquatic communities. Modifications that prohibit surface or subsurface water flows into meadow and wetland habitats may cause instability in these habitats.
- Roads are generally barriers to wildlife and fragment habitat.
- Noise and light pollution negatively affect wildlife species.
- Development and impacts in riparian zones may influence critical water quality elements such as water temperature, suspended sediments, and nutrients. These elements interact in complex ways in aquatic systems and directly and indirectly influence patterns of growth, reproduction, and migration of aquatic organisms.
- Ecological restoration of native communities would involve some short-term adverse impacts (e.g., smoke from prescribed burning) but over time can successfully replicate natural processes.

Proposed management actions under each alternative were evaluated in terms of the context, intensity, and duration of the impacts, as defined below, and whether the impacts were considered to be beneficial or adverse to the natural environment. Generally, the methodology for natural resource impact assessment follows direction provided by the CEQ (CFR 40:1508.27).

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts on wildlife or plants are those that occur within or adjacent to the Tuolumne River corridor. Regional impacts are impacts within the park and outside of the park in similar habitat types in the Sierra Nevada. Context suggests that certain impacts depend upon the setting of the proposed action. For instance, impacts that reduce the value of the Tuolumne River in providing connectivity between habitat types could be minor if such connections are abundant in a given region, moderate or major if they are not.

Intensity: The intensity of the impact considers effects of an action on the size and integrity of native habitats, diversity, and species populations. These designations are used to describe both beneficial and adverse impacts. Negligible impacts would have no measurable or perceptible changes on wildlife habitat or populations. Minor impacts would be localized within a relatively small area, and the impacts on the integrity of animal populations would not be expected to have an overall effect on natural community structure. Without further impacts, negative effects may be reversed and habitat quality would recover. Moderate impacts would be clearly detectable on wildlife habitat and populations and would be sufficient to cause a change in the abundance, distribution, quantity, or integrity of species; community ecology (e.g., the numbers of different kinds of species present); or natural processes (e.g., hydrology). Major impacts would be substantial and highly noticeable, with the potential for permanent landscape-scale changes in the distribution, quantity, or integrity of species; community ecology; and natural processes.

Duration: A short-term impact would have an immediate effect on native habitat, diversity, and native populations, but would not cause long-term declines in populations or diversity. Short-term impacts are normally associated with transitional types of activities, such as facility construction. Long-term impacts would lead to a loss of native habitat, diversity, and species populations, as exhibited by a decline in species abundance, viability, and/or survival.

Type: The type of impact considers whether the impact would be beneficial or adverse. Impacts are considered beneficial if an action would cause no detrimental effect and would increase the size or integrity of species populations or habitat components; reduce disturbance to native ecosystem processes; increase native species richness or diversity; or otherwise increase native habitat quantity or quality. Impacts are considered adverse if they would decrease the size, integrity, or diversity of native habitat.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current wildlife condition and management, as described under chapter 8 and “Affected Environment,” above.

Wild Segments

Continuation of current wilderness policies, including protection of natural processes, visitor education with an emphasis on Leave-No-Trace practices, and restrictions on amounts and locations of overnight use, would protect intact natural habitats, including the distribution, numbers, population composition, and interaction of native species. Overall, habitat in wilderness would remain undisturbed under the no-action alternative, with site-specific exceptions associated with trail corridors. Habitat in predominantly untrailed alpine areas would remain undisturbed. In subalpine areas, site-specific impacts would result from foot and stock traffic along trail corridors radiating outward from Tuolumne Meadows and Tioga Road, and at pack stock camps and grazing areas in upper Lyell Canyon. Disturbances from these human activities include noise, human presence, stock presence, and disturbance to habitat components such as vegetation trampling, soil compaction, and manure

deposition by pack stock. Disturbance would be more apparent closer to Tioga Road and Tuolumne Meadows, where visitors can access wilderness more readily; impacts in these areas (e.g., Dana Meadows) may be regional for wildlife because the subalpine meadow system is critical foraging and breeding habitat for a number of species.

Disturbance at Glen Aulin would include noise, artificial light, human presence, and the presence of human food and garbage. Fragmentation of a wetland by the existing corral and trail, as well as threats to water quality from aging utilities and a leach mound currently operating at capacity, would have adverse impacts on associated riparian habitats. In addition, wildlife that use this section of the river as part of an important migration and travel corridor, such as black bear and mule deer, would be affected by habitat fragmentation.

Canyon habitat between Tuolumne Meadows and Glen Aulin, and between Glen Aulin and Hetch Hetchy Reservoir, is intact overall, with minor site-specific exceptions along trail corridors. Trail use in the canyon communities below Glen Aulin and beyond Waterwheel Falls is far less common than above Glen Aulin, and pack stock use in this area is nearly nonexistent. Impacts in these wilderness areas would be very minor and associated with occasional noise, human presence, and some modification to habitat from vegetation loss and soil compaction along trail corridors.

Lower-elevation communities below O'Shaughnessy Dam would remain largely undisturbed. Where the river corridor begins, approximately 0.25 mile downstream of the dam, there might be disturbance from noise, automobile traffic, and human presence; however, most of these activities would be limited to the small portion of the Hetch Hetchy Road that traverses the corridor.

Habitat at Poopenaut Valley is generally considered intact (although the impact of controlled dam releases on ecosystems downstream is not yet fully understood). There is only occasional human presence in this area and no pack stock use. Ongoing monitoring indicates that NPS efforts to remove inappropriate fire rings and campsites and restore social trails are resulting in fewer impacts from human use in these areas.

Scenic Segments

As noted in the "Affected Environment," above, Tuolumne Meadows receives the greatest amount of visitor use in the corridor and is consequently the most altered by human disturbance. These disturbances would be expected to continue under the no-action alternative, and would include noise, artificial light, human presence, human food and garbage, vehicle traffic, fragmentation of habitat, and modification of habitat components such as native soils and plant communities. The majority of visitor and administrative infrastructure at Tuolumne Meadows (e.g., visitor services, utilities, formal parking areas, employee housing) would continue to adversely affect subalpine habitat through fragmentation and the imposition of barriers to wildlife movements.

Day use in Tuolumne Meadows would be expected to continue to increase without any additional management controls. Increasing use levels have been accompanied by increases in roadside shoulder parking, informal trails, and intensive use at popular destinations such as Soda Springs. This trend would be expected to continue. These activities result in vegetation trampling, soil compaction, and erosion, and diminish the quality of meadow and riparian habitat near areas experiencing high use.

Impacts on subalpine meadow habitat in this area would continue to affect wildlife species that rely on the subalpine meadow ecosystem for foraging, breeding, nesting, and other uses by reducing the quality of habitat. This potentially forces species to find suitable habitat elsewhere in the region.

Wildlife management would continue to include bear awareness information for visitors and facilities such as bear boxes in the campgrounds and bear-resistant dumpsters throughout developed areas; these measures would continue to discourage foraging by bears and reduce the number of human-wildlife conflicts in this area.

Measures already in place to protect sensitive species and habitats, such as efforts to monitor and reduce noise and light pollution, would continue.

Conclusion

Under the no-action alternative, the continuation of current wilderness policies in wild segments of the Tuolumne River corridor would protect intact natural habitats, including the distribution, numbers, population composition, and interaction of native species. Species and habitat in predominantly untrailed alpine areas would remain undisturbed. In subalpine areas, habitat would remain overall undisturbed, with site-specific exceptions associated with trail corridors used by hikers and pack stock. These impacts would be minor and most evident closer to high-use areas such as Tuolumne Meadows. At Glen Aulin High Sierra Camp, habitat fragmentation and human disturbance would have minor adverse impacts on wildlife species, particularly those who use this area as a migration corridor. Between Glen Aulin and Hetch Hetchy Reservoir, and below O'Shaughnessy Dam, there would be local short-term negligible to minor adverse impacts on species and habitats due to occasional foot traffic and camping in these relatively remote areas.

At scenic segments near Tuolumne Meadows, human disturbance at developed areas, diminished habitat, and fragmented habitat would continue to cause local long-term minor to moderate adverse impacts on wildlife species. This impact may be regional because the subalpine meadow system in these segments is a critical foraging and breeding area.

Cumulative Impacts

Past actions that would have contributed to adverse cumulative impacts on wildlife along the Tuolumne River include the construction and maintenance of visitor and administrative facilities at Tuolumne Meadows, Glen Aulin, and along the Tioga Road corridor.

The following recently completed actions from the cumulative projects list in appendix L would have had beneficial impacts on wildlife:

- The project to restore disturbed areas at the Tuolumne Meadows Lodge, which included site drainage improvements and native plant restoration.
- Various water quality improvement projects, as noted in the “Hydrology” affected environment section and in appendix M.

The following current and/or reasonably foreseeable future actions, projects, and plans could have a cumulative effect on wildlife:

- Projects to improve the parkwide communications data network and to improve the Tuolumne Meadows water treatment system could result in short-term impacts from thinning or selective removal of vegetation.
- The *Scenic Vista Management Plan* and *Fire Management Plan* could result in short-term impacts from thinning or selective removal of vegetation.
- Implementation of the upcoming *Wilderness Stewardship Plan* and the *High-Elevation Aquatic Ecosystem Recovery and Stewardship Plan* would result in beneficial impact on habitat in the Tuolumne River corridor through restoration activity.

Environmental Consequences Common to Alternatives 1–4

Wild Segments

Canyon habitat between Tuolumne Meadows and Hetch Hetchy Reservoir would remain undisturbed with the exception of very localized, minor disturbances, such as occasional noise, human presence, and some modification to habitat from vegetation loss and soil compaction along trail corridors.

As under the no-action alternative, lower-elevation communities below O'Shaughnessy Dam would remain largely undisturbed. Habitat would remain intact (although the impact of controlled dam releases on ecosystems downstream is not yet fully understood), with only occasional human presence in this area and no pack stock use. There would be minor amounts of disturbance from human presence associated with the Hetch Hetchy Road and upstream dam operations. Ongoing monitoring efforts to remove inappropriate fire rings and campsites and restore social trails in the Poopenaut Valley area would continue to benefit species and habitats.

Scenic Segments

Wildlife management would continue to include bear awareness information for visitors and facilities such as bear boxes in the campgrounds and bear-resistant dumpsters throughout developed areas. These measures would continue to discourage foraging by bears and reduce the number of human-wildlife conflicts in this area. Measures already in place to protect sensitive species and habitats, such as reducing noise and light pollution, would continue.

In all action alternatives, new designated parking areas and associated administrative facilities would be relocated south of Tioga Road. Construction south of Tioga Road in upland habitat would require removal of trees, including removal of potentially occupied habitats, such as mature conifer and hardwood trees, hollowed-out trees, or snags. This could affect breeding bats or birds by removing nests or roosts and could result in the harassment of adults from active nests or roosting sites located in the vicinity. Tree removal would be minimized through site design, and, if possible, older trees and snags would be retained for habitat. In addition, surveying potential habitat prior to construction would minimize potential impacts on nesting or roosting species.

Demolition and ecological restoration activities could disturb wildlife in meadow areas, and these activities in combination with new construction could disturb wildlife in upland areas. This disturbance would be local and short term. Demolition or removal of existing buildings and associated infrastructure would generate noise and ground vibrations, disturb habitat, and create other disturbances associated with human presence. Use of heavy equipment would create the potential for injury or death of small species. These activities could cause wildlife to relocate or avoid the area and could cause breeding birds to abandon their nests or avoid using the immediate area. The implementation of mitigation measures, such as surveying potential habitat prior to construction (especially during important breeding seasons) and minimizing or avoiding noise and visual disturbances to wildlife, would reduce the intensity of the impacts.

Environmental Consequences of Alternative 1

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 1 on wildlife are described below.

Wild Segments

Wilderness management policies described under the no-action alternative would continue with alternative 1. Overall, habitat in alpine and subalpine wilderness areas would remain undisturbed, with site-specific impacts from foot traffic along trail corridors radiating outward from Tuolumne Meadows and Tioga Road. Eliminating concessioner stock day rides, reducing concessioner pack stock use, eliminating commercial pack stock use, and the overall reduction in use levels would have a beneficial impact on wildlife by reducing disturbance associated with foot traffic and eliminating many of the impacts related to pack stock (e.g., manure and impacts on native vegetation near campsites and grazing areas), particularly in upper Lyell Canyon. This could also deter brown-headed cowbirds from establishing a greater presence in Lyell Canyon and Glen Aulin.

Removal and restoration of the Glen Aulin High Sierra Camp would have beneficial impacts for wildlife, including a substantial reduction in disturbance associated with noise, human food, and garbage; elimination of

artificial light; elimination of the camp's corral; and a reduction in habitat fragmentation. It would also remove much of the foot traffic and all of the pack stock traffic associated with the camp.

Scenic Segments

Removal of commercial and associated administrative facilities, informal trails, and roadside parking under alternative 1 would result in large areas of restored habitat, particularly high-value riparian and meadow habitat. In addition, implementation of a comprehensive ecological restoration program, as described in chapters 5 and 7 and in appendix H, would enhance habitat for wildlife by reducing fragmentation, restoring native vegetation, and improving hydrologic function (see "Vegetation" and "Hydrology" resource topics earlier in this chapter). In addition, removing overnight accommodations, eliminating commercial services, and substantially lowering day and overnight use levels would reduce noise disturbance, artificial light, and sources of human food and garbage. Near-elimination of concessioner stock use would also reduce stock-related disturbance at the concessioner stable and along trail corridors at Tuolumne Meadows, including noise, vegetation loss on trails, and risks to water-quality associated with manure. Additionally, a combined stables operation and significantly reduced stock use could deter brown-headed cowbirds from establishing a greater presence at Tuolumne Meadows.

In order to remove parking and facilities from more sensitive meadow and riparian habitat, construction of replacement facilities would occur in previously disturbed upland areas south of Tioga Road. There would also be two new trails constructed: one through upland habitat south of Tioga Road and another from the current store and grill area to the John Muir Trail. These trails would cause minor disturbance to wildlife from habitat fragmentation and increased human presence in these areas.

Conclusion

Under alternative 1, wildlife species and habitat in predominantly untrailed alpine areas would remain undisturbed. Subalpine habitat in wilderness would remain overall undisturbed with site-specific exceptions, generally confined to trail corridors and where wilderness borders high-use areas. Reductions in concessioner pack stock use, elimination of concessioner day rides, elimination of commercial pack stock use, and overall lower use levels would have a local and potentially regional long-term moderate beneficial impact on wildlife by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road.

Eliminating pack stock use areas in Lyell Canyon and removing the Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact on wildlife species and habitat. Canyon and lower-elevation habitat between Glen Aulin and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain undisturbed, with the exception of local negligible adverse impacts from disturbances such as occasional noise, human presence, and very minor modification to habitat from vegetation loss and soil compaction along trail corridors.

In scenic segments at Tuolumne Meadows, there would be local and regional long-term moderate beneficial impacts on wildlife resources from implementation of an ecological restoration program, and extensive site-specific restoration where facilities would be removed from high-value meadow and riparian areas. There would be local short-term minor adverse impacts associated with ecological restoration activities and local short-term and long-term adverse impacts resulting from facility construction.

Cumulative Impacts

The effects of past, current, and reasonably foreseeable future actions in combination with alternative 1 would be the same as under the no-action alternative, with the following exception:

Considered in conjunction with cumulative projects and plans, alternative 1 would have a local and regional long-term moderate beneficial impact on wildlife corridorwide, in particular with the proposed reductions in

use levels corridorwide and implementation of a comprehensive ecological restoration program. However, the cumulative effect of multiple construction activities at Tuolumne Meadows and along the Tioga Road corridor would be likely to adversely affect wildlife species in the short term. Mitigation measures would be used to offset these impacts. Although the disturbance would be temporary, species mortality, loss of reproductive potential, or abandonment of breeding sites would have an adverse impact on local bird and bat populations in particular.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on wildlife are described below.

Wild Segments

Current wilderness management policies described under the no-action alternative would continue with alternative 2. Overall, habitat in alpine and subalpine wilderness areas would remain undisturbed, with site-specific impacts from foot and pack stock traffic along trail corridors radiating outward from Tuolumne Meadows and Tioga Road. The reduction in concessioner stock day rides and reductions in commercial pack stock use would have local and potentially regional, minor, beneficial impacts on wildlife by reducing impacts (e.g., noise, human presence, stock presence) and disturbance to habitat components (e.g., vegetation trampling, soil compaction, and risks to water quality). Increased regulation on the timing, location, and amount of commercial pack stock use in Lyell Canyon would have a moderate, beneficial impact on species and meadow/riparian habitat through early season closures, formal designation of access routes, and relocation of use to less sensitive locations.

Disturbance at Glen Aulin would continue to include noise, artificial light, human presence, the presence of human food and garbage, and habitat fragmentation for species that use this section of the river as a migration and travel corridor. Restoration of wetland areas currently fragmented by the existing corral and trail would have a beneficial impact on small areas of wetland and riparian habitat.

Recreational boating between Tuolumne Meadows and Pate Valley would not be expected to have more than a negligible, adverse impact on wildlife because this use would be extremely limited. To avoid the introduction of non-native species, such as invasive mussels, boaters would be required to ensure that boats are clean (mud free) and dry before entering the park, and boats would need to be drained of residual water as a provision of obtaining a boating permit (see appendix O, “Mitigation Measures”).

Scenic Segments

Under alternative 2, site-specific restoration where facilities are relocated away from high-value habitat (e.g., relocation of the Cathedral Lakes trailhead and relocation of roadside parking along Tioga Road) would provide localized, beneficial impacts on wildlife habitat. Additionally, a combined stables operation and significantly reduced stock use could deter brown-headed cowbirds from establishing a greater presence at Tuolumne Meadows.

The primary beneficial impact on habitat would result from implementation of a comprehensive ecological restoration program as described in chapters 5 and 8, which would result in large areas of restored, naturally functioning habitat, particularly high-value riparian and meadow communities (also see the “Vegetation” and “Hydrology” sections earlier in this chapter). Retention of overnight accommodations, commercial services, and potentially higher use levels than existing levels would perpetuate noise disturbance, artificial light, and sources of human food and garbage in the Tuolumne Meadows area, similar to conditions under the no-action alternative.

In order to remove parking and facilities from more sensitive meadow and riparian habitat and to improve visitor services, new construction for replacement facilities would occur in previously disturbed and undisturbed upland areas at Road Camp, an area south of Tioga Road near the existing wastewater treatment plant (for a consolidated stable operation), an area south of Tioga Road near Unicorn Creek (for parking), the Dog Lake/John Muir Trail parking area, the Lembert Dome parking area, and Gaylor Pit (for concessioner housing). The NPS would construct new trails through upland habitat south of Tioga Road and from the location of the store and grill, through the meadow, to Parsons Memorial Lodge. There would also be an expansion of the existing campground into previously undisturbed upland habitat. New development in upland areas would further fragment habitat and increase human presence and, in some cases, vehicle traffic. Constructing a trail from the commercial services area to Parsons Memorial Lodge would adversely impact sensitive meadow communities through fragmentation, soil compaction, vegetation loss, and an increased potential for trampling.

Conclusion

Under alternative 2, wildlife species and habitat in predominantly untrailed alpine areas would remain undisturbed. Subalpine habitat in wilderness would remain overall undisturbed with site-specific exceptions, generally confined to trail corridors and where wilderness borders high-use areas. Reducing concessioner stock day rides and reducing commercial stock use would have a local and potentially regional long-term minor beneficial impact on wildlife habitat by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road.

There would be a local long-term moderate beneficial impact on wildlife species and habitat resulting from increased regulation on the timing and location of pack stock use in upper Lyell Canyon. Restoration activities at Glen Aulin High Sierra Camp would have a local long-term minor beneficial impact from reduced risks to water quality and associated riparian habitat.

Canyon habitat between Glen Aulin and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain undisturbed with the exception of local negligible adverse impacts from disturbances such as occasional noise, human presence, and very minor modification to habitat from vegetation loss and soil compaction along trail corridors. Limited recreational boating in the Grand Canyon would have a local long-term negligible adverse impact on wildlife.

In scenic segments of the river corridor at Tuolumne Meadows, there would be a local and regional long-term moderate beneficial impact on wildlife resources from the implementation of an ecological restoration program and site-specific restoration in high-value meadow and riparian areas. However, although many informal trails would be removed from the meadows, constructing a new trail through the meadow from the store and grill to Parsons Memorial Lodge would introduce a local long-term minor impact on subalpine meadow habitat. There would be local short-term minor adverse impacts associated with ecological restoration activities and local short-term and long-term adverse minor impacts resulting from facility construction in upland areas.

Cumulative Impacts

The effects of past, current, and reasonably foreseeable future actions in combination with alternative 2 would be the same as under the no-action alternative, with the following exception:

Considered in conjunction with cumulative projects and plans, alternative 2 would have a local and regional long-term moderate beneficial impact on wildlife corridorwide, particularly with managing use levels at Tuolumne Meadows and implementing a comprehensive ecological restoration program. However, the cumulative effect of multiple construction activities at Tuolumne Meadows and along the Tioga Road corridor would be likely to adversely affect wildlife species in the short term. Mitigation measures (appendix O) would be used to offset these impacts. Although the disturbance would be temporary, species mortality, loss of

reproductive potential, or abandonment of breeding sites would have an adverse impact on local bird and bat populations in particular.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on wildlife are described below.

Wild Segments

Current wilderness management policies described under the no-action alternative would continue with alternative 3. Overall, habitat in alpine and subalpine wilderness areas would remain undisturbed, with site-specific impacts from foot and pack stock traffic along trail corridors radiating outward from Tuolumne Meadows and Tioga Road. The reduction in concessioner pack stock use (due to lowered use at the Glen Aulin High Sierra Camp), reduction in concessioner stock day rides, reductions in commercial pack stock use, and lowered visitor use levels would have local and potentially regional, minor to moderate, beneficial impacts on wildlife by reducing impacts such as noise, human presence, stock presence, and disturbance to habitat components such as vegetation trampling, soil compaction, and risks to water quality. Increased regulation on the timing, location, and amount of commercial pack stock use in Lyell Canyon would have a moderate beneficial impact on wildlife species and meadow/riparian habitat through early season closures, formal designation of access routes, and relocation of use to less sensitive locations. Significant reductions in stock use could deter brown-headed cowbirds from establishing a greater presence in Lyell Canyon and at Glen Aulin.

Disturbance at Glen Aulin would continue to include noise, artificial light, human presence, the presence of human food and garbage, and fragmentation for species that use this section of the river as a migration and travel corridor. The restoration of wetland areas currently fragmented by the existing corral and trail would have a beneficial impact on small areas of wetland and riparian habitat.

Scenic Segments

Under alternative 3, site-specific restoration where facilities are relocated away from high-value habitat (e.g., relocation of the Cathedral Lakes trailhead, public fuel station, relocation of roadside parking along Tioga Road) would provide localized beneficial impacts on wildlife habitat. The primary beneficial impact on habitat would result from implementation of a comprehensive ecological restoration program as described in chapters 5 and 8, which would result in large areas of restored, naturally functioning habitat, particularly high-value riparian and meadow communities (also see the “Vegetation” and “Hydrology” sections earlier in this chapter). Retaining overnight accommodations and commercial services would perpetuate noise disturbance, artificial light, and sources of human food and garbage in the Tuolumne Meadows area; however, decreased day and overnight use levels would likely reduce the amount of noise disturbance in the area.

To remove parking and facilities from more sensitive meadow and riparian habitat, there would be new construction of replacement facilities in previously disturbed and undisturbed upland areas at Road Camp, the Dog Lake/John Muir Trail parking area, the Lembert Dome parking area, and a new housing area north of Tuolumne Meadows Lodge. There would also be a new trail constructed through upland habitat south of Tioga Road and an expansion of the existing campground footprint into previously undisturbed upland habitat. New development would further fragment habitat and increase human presence and, in some cases, vehicle traffic.

Conclusion

Under alternative 3, wildlife species and habitat in predominantly untrailed alpine areas would remain undisturbed. Subalpine habitat in wilderness would remain overall undisturbed with site-specific exceptions, generally confined to trail corridors and where wilderness borders high-use areas. Reductions in concessioner pack stock use and stock day rides, reductions in commercial stock use, and overall lower visitor use levels would have a local and potentially regional long-term minor to moderate beneficial impact on wildlife habitat

by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road.

There would be a local long-term moderate beneficial impact on wildlife species and habitat resulting from increased regulation on the timing and location of pack stock use in upper Lyell Canyon. Restoration activities at Glen Aulin High Sierra Camp would have a local long-term minor beneficial impact from reduced risks to water quality and associated riparian habitat.

Canyon and lower-elevation habitat between Glen Aulin and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain undisturbed, with the exception of local negligible adverse impacts from disturbances such as occasional noise, human presence, and very minor modification to habitat from vegetation loss and soil compaction along trail corridors.

In scenic segments of the river corridor at Tuolumne Meadows, there would be a local and regional long-term moderate beneficial impact on wildlife resources from implementing an ecological restoration program and site-specific restoration in high-value meadow and riparian areas. There would be local short-term minor adverse impacts associated with ecological restoration activities and local short-term and long-term adverse impacts resulting from facility construction.

Cumulative Impacts

The effects of past, current, and reasonably foreseeable future actions in combination with alternative 3 would be the same as under the no-action alternative, with the following exception:

Considered in conjunction with cumulative projects and plans, alternative 3 would have a local and regional long-term moderate beneficial impact on wildlife corridorwide with management of use levels at Tuolumne Meadows and implementation of a comprehensive ecological restoration program. However, the cumulative effect of multiple construction activities at Tuolumne Meadows and along the Tioga Road corridor would be likely to adversely affect wildlife species in the short term. Mitigation measures would be needed to offset these impacts. Although the disturbance would be temporary, species mortality, loss of reproductive potential, or abandonment of breeding sites would have an adverse impact on local bird and bat populations in particular.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on wildlife are described below.

Wild Segments

Current wilderness management policies described under the no-action alternative would continue with alternative 4. Overall, habitat in alpine and subalpine wilderness areas would remain undisturbed, with site-specific impacts from foot and pack stock traffic along trail corridors radiating outward from Tuolumne Meadows and Tioga Road. The reduction in concessioner pack stock use (due to proposed limitations on packstock use to resupply Glen Aulin High Sierra Camp), elimination of concessioner stock day rides, and restrictions on commercial pack stock use during peak use periods would have local and potentially regional, minor to moderate, beneficial impacts on wildlife by reducing impacts (e.g., noise, human presence, stock presence) and disturbance to habitat components (e.g., vegetation trampling, soil compaction, and risks to water quality) in the river corridor. Significant reductions in stock use could also deter brown-headed cowbirds from establishing a greater presence in Lyell Canyon and Glen Aulin. Increased regulation on the timing, location, and amount of commercial pack stock use in Lyell Canyon would have a moderate beneficial impact on species and meadow/riparian habitat through early season closures, formal designation of access routes, and relocation of use to less sensitive locations.

Canyon habitat between Tuolumne Meadows and Hetch Hetchy Reservoir would remain undisturbed, with the exception of very localized, minor disturbances such as occasional noise, human presence, and some modification to habitat from vegetation loss and soil compaction along trail corridors. Disturbance at Glen Aulin would continue to include noise, artificial light, human presence, the presence of human food and garbage, and habitat fragmentation for species that use this section of the river as a migration and travel corridor. Replacing the camp's flush toilets with composting toilets and converting the camp's wastewater system to gray water only would have a beneficial impact on wildlife by reducing helicopter use at the camp (helicopters are used to haul sludge from the current wastewater treatment system) and reducing the risk to water quality and associated riparian habitat. Restoring wetland areas currently fragmented by the existing corral and trail would have a beneficial impact on small areas of wetland and riparian habitat.

Recreational boating between Tuolumne Meadows and Pate Valley would not be expected to have more than a negligible adverse impact on wildlife because this use would be extremely limited. To avoid the introduction of non-native species such as invasive mussels, boaters would be required to ensure that boats are clean (mud free) and dry before entering the park, and boats would need to be drained of residual water as a provision of obtaining a boating permit (see appendix O, "Mitigation Measures").

Scenic Segments

Under alternative 4, site-specific restoration where facilities are relocated away from high-value habitat (e.g., relocation of the Cathedral Lakes trailhead and relocation of roadside parking along Tioga Road) would provide localized, beneficial impacts on wildlife habitat. Additionally, the elimination of concessioner stock day rides originating at the meadows and a reduced/combined stables operation could deter brown-headed cowbirds from establishing a greater presence at Tuolumne Meadows.

The primary beneficial impact on habitat would result from implementation of a comprehensive ecological restoration program as described in chapters 5 and 8, which would result in large areas of restored, naturally functioning habitat, particularly high-value riparian and meadow communities (also see the "Vegetation" and "Hydrology" sections earlier in this chapter). Retaining overnight accommodations and commercial services would perpetuate noise disturbance, artificial light, and sources of human food and garbage in the Tuolumne Meadows area.

To remove parking and facilities from more sensitive meadow and riparian habitat and to improve and consolidate visitor services, new construction of replacement facilities would occur in previously disturbed and undisturbed upland areas at Road Camp, at a location south of Tioga Road near Unicorn Creek (for the new visitor contact station, picnic area, and parking), the Lembert Dome parking area, the road from Lembert Dome to the concessioner stable, the Dog Lake/John Muir Trail parking area, an area north of Tuolumne Meadows Lodge (for relocated concessioner employee housing, and Gaylor Pit (for campsites)). There would also be a new trail constructed through upland habitat south of Tioga Road and an expansion of the existing campground footprint into previously undisturbed upland habitat. New development would further fragment habitat and would increase human presence and, in some cases, vehicle traffic.

Conclusion

Under alternative 4, wildlife species and habitat in predominantly untrailed alpine areas would remain undisturbed. Subalpine habitat in wilderness would remain undisturbed overall, with site-specific exceptions generally confined to trail corridors and where wilderness borders high use areas. Reducing concessioner pack stock use and eliminating concessioner stock day rides would have a local and potentially regional long-term minor to moderate beneficial impact on wildlife habitat by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road.

There would be a local long-term moderate beneficial impact on wildlife species and habitat resulting from increased regulation on the timing, amount, and location of pack stock use in upper Lyell Canyon. Restoration activities at Glen Aulin High Sierra Camp and conversion to a gray water-only wastewater treatment system would have a local long-term minor beneficial impact from reduced risks to water quality and associated riparian habitat.

Canyon and lower-elevation habitat between Glen Aulin and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain undisturbed under alternative 4, with the exception of local negligible adverse impacts from disturbances such as occasional noise, human presence, and very minor modifications to habitat from vegetation loss and soil compaction along trail corridors. Limited recreational boating in the Grand Canyon would have a local long-term negligible adverse impact on wildlife.

In scenic segments of the river corridor at Tuolumne Meadows, there would be local and regional long-term moderate, beneficial impacts on wildlife resources from implementation of an ecological restoration program, and site-specific restoration where facilities are removed from high-value meadow and riparian areas. There would be local, short-term, minor, adverse impacts associated with ecological restoration activities and local, short-term and long-term adverse impacts resulting from facility construction.

Cumulative Impacts

The effects of past, current, and reasonably foreseeable future actions in combination with alternative 4 would be the same as under the no-action alternative, with the following exception:

Considered in conjunction with cumulative projects and plans, alternative 4 would have a local and regional, long-term, moderate, beneficial impact on wildlife corridorwide, in particular with managing use levels at Tuolumne Meadows and implementing a comprehensive ecological restoration program. However, the cumulative effect of multiple construction activities at Tuolumne Meadows and along the Tioga Road corridor would be likely to adversely affect wildlife species in the short term. Mitigation measures would be needed to offset these impacts. Although the disturbances would be temporary, species mortality, loss of reproductive potential, or abandonment of breeding sites would have an adverse impact on local bird and bat populations in particular.

Special Status Species

Overview

The USFWS and the State of California Department of Fish and Game (CDFW) classify threatened, endangered, or rare species of plants and animals as those that have undergone serious national, state, or local declines and that may be threatened with extinction if not otherwise protected. Species that are being monitored because they are undergoing noticeable declines or are threatened by significant loss of habitat, but are not protected by law, may be categorized as rare or sensitive.

Federal and state regulations, including section 7 of the 1973 Endangered Species Act, CEQ regulations, as well as NPS *Management Policies 2006* (NPS 2006g), require all federal agencies to conduct an impacts analysis and consult with the USFWS to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or their designated critical habitat.

The Endangered Species Act, as amended, requires that the USFWS propose species for endangered or threatened if the agency has sufficient information on their biological status and threats. If a proposed listing regulation is precluded by other higher priority listing activities, the agency needs to designate them as 'candidate species.' Candidate species have no legal status and are accorded no legal protection under the Endangered Species Act (50 CFR 402.12). However, the USFWS encourages conservation of these species

because they are by definition species that may warrant future protection under the act, and it is pertinent to the USFWS mission to protect at-risk species before they decline to the point where they need formal protection.

In addition, CEQ regulations for implementing NEPA (CFR 40:1508.27) also require considering whether the action may violate federal, state, or local law or requirements imposed for the protection of the environment. For this reason, species listed under the California Endangered Species Act or accorded special status by the CDFW (i.e., considered rare or sensitive and monitored by the California Natural Diversity Database) are included in this analysis.

Yosemite National Park recognizes state and local rare and sensitive plant species, and in addition maintains its own list of park sensitive plant species. These species include those that may have extremely limited distributions, represent relict populations from past climatic or topographic conditions, have unique adaptations to local conditions (endemics), may be at the extreme extent of their range in the park, or may be listed by the California Native Plant Society or the California Natural Diversity Database as rare or sensitive. Park sensitive species are included in this analysis because they could be affected (due to proximity to human-use zones or susceptibility of individual plants or populations to loss from natural or unnatural events), and their existence is considered when evaluating consequences for any proposed management action.

Affected Environment

Special Status Wildlife Species

For the purposes of this analysis, special status wildlife species are defined as those that are listed by the USFWS as endangered, threatened, proposed, or candidate; or, listed by the State of California as endangered, threatened, candidate, species of special concern, fully protected, or bird species of special concern.

Based on this broad information and professional judgment on the part of park staff, the NPS prepared a list of those special status wildlife species that could possibly occur within the boundaries of the park. Park staff then reduced the list to only those special status species that are known to occur, or have the potential to occur, in the *Tuolumne River Plan* planning area and that could be affected by actions proposed in the alternatives (table 9-7).

Federal Special Status Species

The NPS initiated consultation with the USFWS on June 22, 2006, through a notice of intent to prepare an environmental impact statement for the *Tuolumne River Plan*. Updated species lists were obtained from the Fish and Wildlife Service on December 1, 2009, February 4, 2010, and April 22, 2013. On April 24, 2013 the Fish and Wildlife Service proposed two species for listing under the Endangered Species Act that potentially occur in the project area: the Sierra Nevada yellow-legged frog (*Rana sierrae*) and the Yosemite toad (*Anaxyrus canorus*). The agency also proposed critical habitat for these species within the Tuolumne River corridor.

Based on these lists and professional judgment by the park staff, six federally listed threatened, endangered, proposed, or candidate species are known to occur or have the potential to occur in the project vicinity: one invertebrate species, three amphibian species, and two mammal species (see table 9-7). The NPS will conference and/or consult as appropriate with the U.S. Fish and Wildlife Service to ensure that NPS actions in the *Final Tuolumne River Plan/EIS* adhere to any special management requirements for these species. The NPS will obtain updated lists of federally endangered or threatened species prior to project implementation of the *Final Tuolumne River Plan/EIS*.

Federally Designated Critical Habitat

Section 3 of the Endangered Species Act defines critical habitat as follows:

- (1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features;
 - (a) essential to the conservation of the species; and
 - (b) which may require special management considerations or protection; and
- (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Critical habitat receives protection under section 7 of the act through the requirement that federal agencies ensure that, in consultation with the USFWS, any action that is authorized, funded, or carried out is not likely to result in the destruction or adverse modification of critical habitat.

The USFWS has designated critical habitat for the Sierra Nevada bighorn sheep (*Ovis canadensis sierrae*) on the crest of the Sierra Nevada above Lyell Canyon and in the upper reaches of the Dana Fork of the Tuolumne River. The *Final Tuolumne River Plan/EIS* does not propose any actions within designated critical habitat for the Sierra Nevada bighorn sheep.

On April 25, 2013 the USFWS published a notice in the *Federal Register* that included a proposal to designate critical habitat for the Sierra Nevada yellow-legged frog and Yosemite toad in a portion of the Sierra Nevada that includes the Tuolumne Wild and Scenic River corridor. The proposed Sierra Nevada yellow-legged frog critical habitat would include most of Tuolumne Meadows, and the proposed Yosemite toad critical habitat would include the portions of the river corridor from the upper reaches of the Lyell and Dana Forks, through Tuolumne Meadows, to a point approximately 2 miles upriver from Glen Aulin.

The NPS will conference and/or consult as appropriate with the USFWS to ensure that NPS actions in the *Final Tuolumne River Plan/EIS* adhere to any special management requirements for these species. In addition, the NPS will obtain the final designation of critical habitat for these species prior to project implementation of the *Final Tuolumne River Plan/EIS*. Please see the discussions below for a description of habitat requirements for these species.

State of California Special Status Species

Of the 35 special status wildlife species that are known or have the potential to occur in the planning area, 34 are listed by the State of California as endangered, threatened, candidate, or a species of special concern. This includes all 5 species of amphibians, 1 reptile species, 14 bird species, and 14 mammals, as presented in table 9-7.

Table 9-7.
Special Status Wildlife with Potential to Occur in the Planning Area

Species	Federal – ESA ^a	State- CESA ^b
AMPHIBIANS		
Mount Lyell salamander (<i>Hydromantes platycephalus</i>)		CSC
Yosemite toad (<i>Anaxyrus canorus</i>)	FPT	CSC
California red-legged frog (<i>Rana aurora draytonii</i>)	FT	CSC
Foothill yellow-legged frog (<i>Rana boylei</i>)		CSC
Sierra Nevada yellow-legged frog (<i>Rana sierrae</i>)	FPE	CT
REPTILES		
Northwestern pond turtle (<i>Actinemys marmorata</i>)		CSC
BIRDS		
Harlequin duck (<i>Histrionicus histrionicus</i>)		CSC, BSSC
Northern goshawk (<i>Accipiter gentilis</i>)		CSC, BSSC
Northern harrier (<i>Circus cyaneus</i>)		CSC, BSSC
Golden eagle (<i>Aquila chrysaetos</i>)		CFP
Bald eagle (<i>Haliaeetus leucocephalus</i>)		CE, CFP
Peregrine falcon (<i>Falco peregrinus</i>)		CFP
Long-eared owl (<i>Asio otus</i>)		CSC, BSSC
Great gray owl (<i>Strix nebulosa</i>)		CE
California spotted owl (<i>Strix occidentalis occidentalis</i>)		CSC, BSSC
Vaux's swift (<i>Chaetura vauxi</i>)		CSC, BSSC
Black swift (<i>Cyseloides niger</i>)		CSC, BSSC
Olive-sided flycatcher (<i>Contopus cooperi</i>)		CSC, BSSC
Willow flycatcher (<i>Empidonax trailii</i>)		CE
Yellow warbler (<i>Dendroica petechia</i>)		CSC, BSSC
MAMMALS		
Mount Lyell shrew (<i>Sorex lyelli</i>)		CSC
Pallid bat (<i>Antrozous pallidus</i>)		CSC
Townsend's big-eared bat (<i>Corynorhinus townsendii</i>)		CSC
Spotted bat (<i>Euderma maculatum</i>)		CSC
Western red bat (<i>Lasiurus blossevillei</i>)		CSC
Western mastiff bat (<i>Eumops perotis</i>)		CSC
Sierra Nevada snowshoe hare (<i>Lepus americanus tahoensis</i>)		CSC
Western white-tailed jackrabbit (<i>Lepus townsendii townsendii</i>)		CSC
Sierra Nevada mountain beaver (<i>Aplodontia rufa californica</i>)		CSC
Sierra Nevada red fox (<i>Vulpes vulpes necator</i>)		CT
California wolverine (<i>Gulo gulo</i>)		CT
Pacific fisher (<i>Martes pennanti</i>)	FC	CSC
American badger (<i>Taxidea taxus</i>)		CSC
Sierra Nevada bighorn sheep (<i>Ovis canadensis sierrae</i>)	FE	CE, CFP

Source: Yosemite National Park Resources Management and Science Division

a USFWS administered Endangered Species Act

b CDFW administered California Endangered Species Act

FE – Federal Endangered

FT – Federal Threatened

FPE – Federal Proposed Endangered

FPT – Federal Proposed Threatened

FC – Federal Candidate

CE – California Endangered

CT – California Threatened

CFP – California Fully Protected Species

CSC – California Species of Concern

BSSC – California Bird Species of Special Concern

Invertebrates

Invertebrates comprise the largest and most diverse category of animal life in the park. Although very little is known of their diversity and distribution throughout the river corridor, their importance in maintaining ecosystem processes and integrity cannot be overstated. A federally threatened species, the Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is only found in the vicinity of their host plant, the elderberry (*Sambucus* species), such as the Mexican elderberry (*Sambucus mexicana*). Although the Valley elderberry longhorn beetle has never been documented within the Tuolumne River corridor within Yosemite National Park, Mexican elderberry has been documented in Poopenaut Valley. However, the Valley elderberry beetle is only known to occur up to 3,000 feet in elevation, which is below the elevation of Poopenaut Valley. There is little or no suitable habitat from Poopenaut Valley to the park boundary due to the steep canyon terrain. Therefore, this species is not expected in the Tuolumne River corridor and is not considered further in this analysis.

Fish

Three special status fish species have been provided by the USFWS for consideration in this planning effort: the Paiute cutthroat trout (*Oncorhynchus clarki seleniris*), the Central Valley steelhead (*Oncorhynchus mykiss*), and the delta smelt (*Hypomesus transpacificus*). Yosemite National Park is not within the range of these species, nor have any of these species ever been documented in the Tuolumne River corridor in Yosemite National Park. Fish are not believed to be native above Preston Falls, which is located on the Tuolumne River outside of the park's western boundary. The fish that are present in the Tuolumne River within the park are believed to be present because of historic fish stocking. The earliest record of fish stocking in the Tuolumne River was in 1878 (Wallis 1952). Therefore, these species are not analyzed as part of this plan.

Reptiles and Amphibians

Six special status amphibian species and three special status reptile species have been considered in this planning effort. Two of the reptile species, the northern sagebrush lizard (*Sceloporus graciosus graciosus*) and the federally listed giant garter snake (*Thamnophis gigas*) do not occur within Yosemite National Park. Therefore, these species are not considered further in this analysis. One federally listed amphibian species, the California tiger salamander (*Ambystoma californiense*), does not occur in Yosemite National Park and is therefore not considered further in this analysis.

California red-legged frog: There are several historical sites in Yosemite National Park where the federally threatened California red-legged frog (*Rana aurora draytonii*) used to occur within the vicinity of the Tuolumne River. These sites represent the highest elevation documented records for the California red-legged frog in the Sierra Nevada. The small number of historic sites reflects the limited habitat available for California red-legged frogs. This species primarily uses ponds for breeding and rarely occurs above 3,500 feet. No California red-legged frogs have been documented in the park for several decades, and the frog is believed to be extirpated. Nonnative bullfrogs (*Lithobates catesbeiana*) occur at the sites that used to support California red-legged frogs, and the presence of this nonnative, voracious predator likely contributed to the loss of this species within the park. Because the California red-legged frog is not known to occur in the Tuolumne River corridor, it is not considered in this analysis.

Foothill yellow-legged frog: Foothill yellow-legged frogs (*Rana boylei*) are a California species of special concern. They occupy streams and adjacent terrestrial habitats during their seasonal life history. Stream hydrology, especially the predictable seasonal variation in flow, with winter precipitation and summer drought, has had a strong influence on foothill yellow-legged frog life history adaptations. Adults breed and larvae rear in low-flow habitats, and larvae are not known to overwinter. Juveniles and adults occupy stream-margin habitats (Lind et al. 1996). Only one record exists for foothill yellow-legged frogs for Yosemite National Park, and that record is from a sighting on the Merced River submitted in 1948. Survey efforts for foothill yellow-legged frogs

along the Tuolumne River have been conducted annually since 2008. These surveys have failed to detect the species within the park; however, the species has been documented by these survey efforts just outside of the park boundary. A small population of foothill yellow-legged frog has been detected about 5 miles downstream of the park boundary, near Early Intake. The lack of records partly reflects the limited habitat available for foothill yellow-legged frogs within the park. Data on potential declines implicate water diversions and developments as a primary threat to this species. Water development and diversions are prominent risks because they result in permanent hydrological changes that chronically impinge on several aspects of the foothill yellow-legged frog's life history (Lind et al. 1996). The lack of records of foothill yellow-legged frogs might also be due in part to the management of flows from the O'Shaughnessy Dam.

Modeling conducted as part of the Upper Tuolumne River Ecosystem Project suggests pre-dam hydrologic conditions in the "Hetch Hetchy Reach" (between O'Shaughnessy Dam and Kirkwood Powerhouse) were not conducive to foothill yellow-legged frog reproduction, due to naturally variable high magnitude snowmelt runoff that delayed onset of breeding and alternately scoured and desiccated egg masses. Flow regulation by O'Shaughnessy Dam has likely facilitated limited colonization due to steady summer baseflows and reductions in snowmelt flood magnitude and frequency. Restoring habitat for the foothill yellow-legged frog is among the priorities addressed in flow recommendations being developed by the Upper Tuolumne River Ecosystem Project, a project that includes NPS collaboration.

Sierra Nevada yellow-legged frog: The Sierra Nevada yellow-legged frog (*Rana sierrae*), one of two species included in the mountain yellow-legged frog species complex, was proposed for listing as a federally endangered species under the Endangered Species Act on April 25, 2013. In February 2012, the California Fish and Game Commission determined the species warrants listing as a state-threatened species.

The Sierra Nevada yellow-legged frog occupies aquatic habitats for almost all of their seasonal life history; they breed, tadpoles develop, and they overwinter in lakes and ponds or low-flowing streams and use flowing water to move between sites. The species is rarely found more than a few feet from water. Because it overwinters in water and has a multiyear tadpole phase, the Sierra Nevada yellow-legged frog requires waters that are deep enough to not freeze solid in the winter and not dry out during the summer.

The Sierra Nevada yellow-legged frog was once the most abundant amphibian in the Sierra Nevada. This species is highly aquatic and has a multiyear tadpole stage that allows them to breed successfully in the cold water bodies typical of the high-elevation portions of this mountain range. The majority of their range is in federally designated Wilderness. Despite the fact that most of their habitat is fully protected, these frogs have disappeared from more than 93% of their historic range during the past several decades (Vredenburg et al. 2010), and the majority of remaining populations are much smaller in numbers (Knapp 2005). Two primary factors have been identified as contributing to the severe decline of the frog: impacts from introduced nonnative fish, and *Chytridiomycosis*, an infectious disease caused by amphibian chytrid fungus, *Batrachochytrium dendrobatidis* (Bd). As a consequence of the decline, these frogs have gone from being one of the most abundant vertebrate species in the Sierra Nevada to one that is considered critically endangered. The decline of the Sierra Nevada yellow-legged frog throughout its range has likely had a substantial impact on the health of the aquatic ecosystems where it formerly occurred. The frog in its natural abundance played a critical role as both predator (Vredenburg 2000; Pope and Matthews 2001) and prey (Feldman and Wilkinson 2000; Matthews et al. 2002; Knapp 2005) and had an important role in ecosystems structure and function (Whiles et al. 2006).

Historically, there were a number of populations of Sierra Nevada yellow-legged frogs within the Tuolumne River corridor. Surveys for Sierra Nevada yellow-legged frog were conducted at Tuolumne Meadows in 2000, 2001, and 2012 with no detections. The most recent documentation of this species within the Tuolumne

Meadows segment of the river corridor was in 1995. There was one additional sighting of a Sierra Nevada yellow-legged frog outside of the Tuolumne River corridor along Delaney Creek (near Pothole Dome) in 1999.

Even though the NPS believes Tuolumne Meadows is not high quality habitat for this species, surveys would be conducted for Sierra Nevada yellow-legged frogs prior to any project implementation in the Tuolumne Meadows area, including implementation of the *Tuolumne River Plan*, due to their historical presence.

Yosemite toad: The Yosemite toad (*Anaxyrus canorus*) was proposed for listing as a federally threatened species under the Endangered Species Act on April 25, 2013. It is also a California species of special concern. Yosemite toads have been recorded in a broad range of high montane, subalpine, and alpine habitats, including wet meadows, lakes, ponds, and shallow spring channels. The Yosemite toad is most commonly found, however, in shallow warm-water areas, including standing and flowing water in wet meadows, small permanent and ephemeral ponds, and flooded shallow grassy areas and meadows adjacent to lakes (Karlstrom 1962). Wet meadow habitat is the focal aspect for Yosemite toads.

The Yosemite toad was once a common species found in wet meadows in the Sierra Nevada and Yosemite National Park. Approximately one-third of the historic range of this species occurs in Yosemite. Historically, the toad ranged from 6,400 to 11,300 feet in elevation in Yosemite (Karlstrom 1962). Today, the toad is known to occur in approximately 163 sites in Yosemite between the elevations of 7,000 and 11,500 feet. It is estimated that the Yosemite toad has disappeared from between 47 percent and 79 percent of the sites that it previously occupied (Jennings and Hayes 1994; Jennings 1996; Drost and Fellers 1994, 1996). Remaining populations appear more scattered across the landscape and consist of a small number of breeding adults (Kagarise Sherman and Morton 1993). Multiple factors, individually and likely through a variety of complex interactions, may be contributing to the species' decline. Climate change, pathogens, air pollution, pack stock grazing, ultraviolet radiation, introduction of non-native fish, recreational activities, infrastructure (roads and trails), and drought are among the many risk factors that have been identified as potentially affecting this species and its habitat. Because of their historic abundance, the Yosemite toad appears to be an important link in energy and nutrient cycling between wet meadows, lakes, and adjacent terrestrial ecosystems. Therefore, loss of the Yosemite toad could affect food webs and nutrient cycling, with potentially significant and important consequences for selected Sierra Nevada high-elevation ecosystems, especially aquatic habitats associated with wet meadows. Historically, the Yosemite toad occurred in and around Tuolumne Meadows and a number of other sites within the Tuolumne River corridor.

Today, Yosemite toads are known to occur at approximately 17 sites within the Tuolumne River corridor. In 2012, surveys were conducted for Yosemite toads in the greater Tuolumne Meadows area. One meadow adjacent to the Tuolumne Meadows ranger station (in the Lower Dana Fork segment) had Yosemite toad tadpoles. Yosemite toads were not documented in the Tuolumne Meadows segment of the river corridor. The last documentation of a Yosemite toad in the Tuolumne Meadows segment was one animal in 2010 and, prior to that, one animal in 1995.

Due to the presence of Yosemite toads in the project area, surveys would be conducted for Yosemite toads prior to any project implementation in the Tuolumne Meadows area, including implementation of the *Tuolumne River Plan*.

Mount Lyell salamander: The Mount Lyell salamander (*Hydromantes platycephalus*) inhabits high-elevation (6,890 to 12,140 feet) snowmelt seep and waterfall habitat throughout the Sierra Nevada (Rovito 2009). There are also several populations of Mount Lyell Salamanders at lower elevations in Yosemite Valley (3,900 to 4,265 feet). This species is a California species of special concern; however, there is no evidence to suggest that there have been recent changes to the population densities or range of this species. Mount Lyell salamander populations are considered relatively secure in the park (CDFG 2007b), and populations were documented

along the Lyell Fork as part of a 2002–2004 resurvey of the historic Grinnell-Storer vertebrate transect (Moritz 2007); the species was discovered accidentally in 1915 during the original Grinnell-Storer surveys.

Western pond turtle: The western pond turtle (*Actinemys marmorata*), a California species of special concern, has been documented in the Tuolumne River corridor below O'Shaughnessy Dam. Pond turtles use deep, slow-flowing pools with underwater cover and emergent basking sites, warm water, or both. Managed flows resulting from dams have been found to affect pond turtles by increasing the amount of deep water, promoting formation of undercut banks, and compromising habitat suitability by eliminating slow-flowing water and lowering water temperatures (Reese and Welsh 1998). Western pond turtle populations are likely affected by cold water releases from O'Shaughnessy Dam. However, turtle populations have been found to be in good condition (i.e. multiple age classes, good available habitat) in the areas where they occur, including perched ponds not affected by regulated flows in the Poopenaut Valley, and in slack water habitats downstream of Preston Falls, outside the park boundary. Improving habitat for this species is among the priorities for the flow recommendations being developed through the Upper Tuolumne River Ecosystem Project. Changes in releases to more closely mimic natural hydrology (particularly lower magnitude summer baseflows) should benefit the species. Their most common predators include raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), and coyotes (*Canis latrans*), although one of the largest threats western pond turtles face currently are the predation of hatchlings by introduced, nonnative bullfrogs.

Birds

A total of 14 special status bird species are found throughout the Tuolumne River corridor, either as residents or migrants (table 9-7). Two of these species, the bald eagle and the American peregrine falcon, have been removed from the federal endangered species list. Both species have shown encouraging signs of recovery throughout their ranges and were delisted by the USFWS. The bald eagle was delisted on August 8, 2007, and the peregrine falcon was delisted on August 25, 1999. Bald eagles are occasionally seen in the Tuolumne River corridor. They are regularly seen during the winter in El Portal (in the Merced River corridor), and there is a known nest at Lake Eleanor. Peregrines are not common to the river corridor, but a nesting pair was recently found along the river below Hetch Hetchy Reservoir.

Great gray owls are listed as endangered by the state of California. From 2007–2010 and again in 2013, the NPS conducted parkwide surveys to determine the abundance, distribution, and habitat suitability for the great gray owl. Preferred habitat of this species is montane meadows surrounded by red or white fir forests, ranging in elevation from approximately 4,000 to 8,000 feet in elevation. In 2012, a nest was found in a large lodgepole pine snag at about 7,000 feet in elevation outside the Tuolumne River corridor. Human development and activities, including noise and light, and automobile traffic, may impact great gray owl presence, foraging success, and reproductive success both inside and outside Yosemite (Wildman 1992, Maurer 1999). Disturbance to great gray owls from recreational activities has also been identified as a potential negative factor (Wildman 1992).

Willow flycatchers (*Empidonax traillii*), listed as endangered by the state of California, historically occurred within the river corridor at Poopenaut Valley. However, a recent survey located no nesting pairs throughout the park, possibly reflecting a sharp decline of this species (Siegel et al. 2008). Willow flycatchers were discovered along the river corridor during a 1998–2000 survey (Siegel and DeSante 2002). Formerly abundant in willow thickets and riparian areas, willow flycatcher numbers have declined throughout the Sierra Nevada due to destruction of habitat from grazing and development, nest predation, and degradation of neotropical wintering grounds.

Other species found throughout the Tuolumne River corridor include northern goshawk (*Accipiter gentilis*) and California spotted owl (*Strix occidentalis occidentalis*) (Siegel and DeSante 2002).

Mammals

The river corridor supports habitat for 14 special status mammal species, including five bat species. Only one of these mammal species, the Sierra Nevada bighorn sheep, is federally listed. The Pacific fisher (*Martes pennati pacifica*) is a candidate for federal listing. The Sierra Nevada red fox (*Vulpes vulpes necator*), American pine marten (*Martes americana sierrae*), and California wolverine (*Gulo gulo luteus*) are listed by the State of California, although the last confirmed report of a California wolverine in the state was in the 1920s.

Sierra Nevada bighorn sheep: Sierra Nevada bighorn sheep inhabit the highest alpine elevations of the Sierra Nevada and forage for sparse grasses and other alpine plants. Bighorns may possibly use areas within the Tuolumne River corridor at the very highest reaches of the watershed. The USFWS has designated critical habitat for the Sierra Nevada bighorn sheep on the crest of the Sierra Nevada, including an area above Lyell Canyon and the upper reaches of the Dana Fork of the Tuolumne River.

Bighorn sheep population declines began with the arrival of gold miners in the 1850s and domestic sheep soon thereafter. Although miners killed large numbers of this species for food, the most persistent threat to bighorn sheep was (and still is) exposure to diseases by domestic sheep. Population declines of bighorns were so dramatic in the mid-1800s that they were granted full protection by the State of California as early as 1882. Despite this protection, the remnant herds continued to dwindle, until only two populations remained in 1979 with a total of only 125 animals. As part of an interagency effort to reverse this decline, 38 bighorns were introduced near Tioga Pass in 1986. By 2000, only 20 bighorns remained in this Yosemite herd.

The recovery of the bighorns continues to be an interagency effort with CDFW, U.S. Forest Service, USFWS, and the NPS. Recovery has been slow but successful, with the current count of bighorns at approximately 400, of which the Yosemite herd totals about 40 individuals. Stressors continue to include disease spread from domestic sheep and, more recently, mountain lion predation. The Yosemite population is gradually increasing with good survival, lamb production, and augmentation through biologists moving some sheep from more southern populations.

Pacific fisher: The Pacific fisher has declined to roughly 50% of its historical range in California and only two native populations remain today—one around the western California/Oregon border, and one in the southern Sierra Nevada. Yosemite National Park represents the northern boundary of the small southern Sierra Nevada population, which is estimated to be 260 to 320 individuals. This population is threatened by low reproductive capacity, reduced genetic diversity, and ongoing habitat loss (NPS 2010d). Currently, the Pacific fisher is classified by the USFWS as a candidate for listing under the Endangered Species Act.

Surveys for Pacific fisher were conducted between 2009-2011 to determine their distribution, abundance, and northern range limit. All 22 fisher detections were in the southern portion of the park. The study concluded that fishers do not currently occupy suitable habitat north of the Merced River (Cline 2013). These findings were further supported by 2012 camera surveys in Tuolumne Meadows, in which there were no detections of fisher. Based on these recent findings, the NPS believes that Tuolumne Meadows does not represent suitable habitat for Pacific fisher and additional surveys for them are not necessary.

Other mammals of special concern: Within Yosemite National Park, American pine marten and Sierra Nevada red fox are found in or near the Tuolumne River corridor, although rarely. The Tioga Pass area (along the currently designated Dana Fork of the Tuolumne River) lies within the historic range of optimal habitat for wolverines, but no animals have been sighted for many years. Historic habitat for the Sierra Nevada red fox is also found near Tioga Pass, but intensive trapping during the end of the 19th century greatly decreased fox numbers. In general, the fox is considered exceedingly rare and the USFWS is currently considering the species as a candidate for listing under the Endangered Species Act.

In 2010, US Forest Service biologists discovered a small population of the Sierra Nevada red fox in the Sonora Pass area of the Stanislaus National Forest, north of Yosemite National Park. This was the first sighting in the Yosemite region since 1991, when an individual fox was photographed near Tioga Pass. In 2012, camera surveys at Tuolumne Meadows did not detect Sierra Nevada red fox. However, recent surveys by the US Forest Service and the CDFW have documented the presence of Sierra Nevada red fox adjacent to the park's northern boundary at Dorothy Lake. This detection was one of many that resulted in an estimated population size of 20 breeding individuals. Habitat models suggest up to 50% of the population could be undiscovered within the park. Thus, even though there are no documented sightings of Sierra Nevada red fox in Tuolumne River corridor, the NPS would conduct surveys for Sierra Nevada red fox prior to any project implementation in the Tuolumne Meadows area, including implementation of the *Tuolumne River Plan*.

Other species that are considered of special concern include five species of bats (see table 9-7), the Mount Lyell shrew, the Sierra Nevada snowshoe hare (*Lepus americanus tahoensis*), the western white-tailed hare (*Lepus townsendii townsendii*), and the Sierra Nevada mountain beaver (*Aplodontia rufa California*). Although little is known of specific habitat requirements for many of the bats, all five species depend on riparian areas and meadows for foraging and might be found within the Tuolumne River corridor. Spotted bats (*Euderma maculatum*) and greater western mastiff bats (*Eumops perotis californicus*) have been observed at Tuolumne Meadows and near Hetch Hetchy Reservoir (Pierson and Rainey 1998). Mountain beavers were recently located along the Lyell Fork of the Tuolumne River and near Tuolumne Meadows (Moritz 2007).

Special Status Plants

Botanical surveys have discovered no federally listed or state-listed plants within the Tuolumne River corridor in Yosemite National Park (NPS, Acree et al. 2007o). Therefore, for the purposes of this analysis, special status plant species are park sensitive plant species. Park sensitive plant species are those that have no federal or state status but have extremely limited distributions in the park and might represent relict populations from past climatic or topographic conditions, may be at the extreme extent of their range in the park, or might represent changes in species genetics. These species may be included on lists such as the California Native Plant Society Inventory of Rare and Endangered Plants. The special status plant species known to occur in the planning area are listed in table 9-8.

A total of 44 special status plant species have been documented in the Tuolumne River corridor. Twelve of the special status plant species in the Tuolumne River corridor are endemic to California. Ten of the California endemics found in the river corridor are endemic to the Sierra Nevada. One of the 44 special status plant species, three-square bulrush (*Schoenoplectus pungens*), had not been documented in Yosemite National Park prior to the 2006 field survey. Seven of the 44 special status species were known from other locations in the park prior to the 2006 survey, but 2006 was the first time they were documented in the Tuolumne River corridor. Ten of the special status plants are found only in the Tuolumne River corridor and are not known from other places in Yosemite National Park. One additional *Carex* (sedge) species awaits expert identification confirmation and is a potential new species for California (NPS, Acree et al. 2007o).

The 2006 field survey (NPS, Acree et al. 2007o) found special status plant species in 139 separate populations. The populations were well-distributed along the river corridor (excluding the land surrounding Hetch Hetchy Reservoir, which was not studied in the survey).

Table 9-8.
Special Status Plant Species Known to Occur in the Planning Area

Species	Park Status	Other Status ^a	Habitat
Lemmon's wild-ginger (<i>Asarum lemmonii</i>)	PSS		Shady wet location in the High Sierra Nevada. Elevation range of 3,500 -6,250 feet)
Alpine spiny rattlesnake (<i>Astragalus kentrophyta</i>)	PSS		Alpine boulder and rock field, subalpine coniferous forest
Sierra bolandra (<i>Bolandra californica</i>)	PSS	CNDDDB: G3/S3 CNPS: 4.3	Seeps, rock faces, streamsides
Watershield (<i>Brasenia schreberi</i>)	PSS		Wetlands-riparian between 0 and 7000 feet elevation.
Thread-leaved beakseed (<i>Bulbostylis capillaris</i>)	PSS	CNDDDB: G5/S3 CNPS: 4.2	Meadows, moist glaciated granite slabs; mixed conifer zone
Mono hot springs evening primrose (<i>Camissonia sierrae</i> ssp. <i>alticola</i>)	PSS	CNDDDB: G3T2/S2 CNPS: 1B.2	Lower montane coniferous forest, upper montane coniferous forest /granitic, gravel and sand pans.
Buxbaum's sedge (<i>Carex buxbaumii</i>)	PSS	CNDDDB: G5/S3 CNPS: 4.2	Margins of perennial ponds, springs
Silvery sedge (<i>Carex canescens</i>)	PSS		Wetlands and meadows of red fir, lodgepole and subalpine forest between 3,500 and 10,500 feet
Arctic sedge (<i>Carex capitata</i>)	PSS		Wet locations of boreal forests and mountain meadows in alpine climates
Congdon's sedge (<i>Carex congdonii</i>)	PSS	CNDDDB: G3/S3 CNPS: 4.3	Alpine boulder and rock field, subalpine coniferous forest
Sedge (<i>Carex fissuricola</i>)	PSS		Inhabits wetland/ riparian and meadows in red fir and subalpine forest
Suksdorf's dodder, mountain dodder (<i>Cuscuta suksdorfii</i>)	PSS		Mineral spring affected areas and snowmelt meadows with sparse low vegetation
Subalpine fireweed (<i>Epilobium howellii</i>)	PSS	CNDDDB: G4/S4 CNPS: 4.3	Subalpine coniferous forest, meadow borders, vernal moist swales and openings in mesic forest
Nude buckwheat (<i>Eriogonum nudum</i> var. <i>scapigerum</i>)	PSS		Wetlands and non-wetlands between 9,842 and 12,467 feet.
Davidson's fritillary (<i>Fritillaria pinetorum</i>)	PSS	CNDDDB: G4/S3 CNPS: 4.3	Open forest and partially shaded forest floor, subalpine zone
Northern manna grass (<i>Glyceria borealis</i>)	PSS		Meadows
California sunflower (<i>Helianthus californicus</i>)	PSS		Wet meadows and streambanks, mixed conifer zone
Mare's-tail (<i>Hippuris vulgaris</i>)	PSS		Wetlands
Western quillwort (<i>Isoetes occidentalis</i>)	PSS		Lakes, ponds
False pimpernel (<i>Lindernia dubia</i> var. <i>anagallidea</i>)	PSS		Along borders of marshes, ponds, mudflats
Slender lupine (<i>Lupinus gracilentus</i>)	PSS	CNDDDB: G2/S2 CNPS: 1B.3	Stream margins and riparian zones under sparse canopy of <i>Pinus contorta</i>
Yosemite tarweed (<i>Jensia yosemitana</i>)	PSS	CNDDDB: G2G3/S2S3 CNPS: 3.2	Vernally moist benches on granite
Slender-stemmed monkeyflower (<i>Mimulus filicaulis</i>)	PSS	CNDDDB: G2/S2 CNPS: 1B.2	Moist, sandy or gravelly areas; chaparral/oak-woodland and mixed conifer zones
Cut-leaved monkeyflower (<i>Mimulus laciniatus</i>)	PSS	CNDDDB: G3/S3 CNPS: 4.3	Mossy wet seeps, wet benches, streambanks; mixed conifer and montane zones
Yellow-lip pansy monkeyflower (<i>Mimulus pulchellus</i>)	PSS	CNDDDB: G2G3/S2S3 CNPS: 1B.2	Moist meadows and vernal moist, open, sandy benches and depressions; chaparral/oak-woodland and mixed conifer zones
Alpine sandwort (<i>Minuartia obtusiloba</i>)	PSS	CNDDDB: G5/S3 CNPS: 4.3	Alpine boulder and rock field, alpine dwarf scrub, subalpine coniferous forest
California bog asphodel (<i>Narthecium californicum</i>)	PSS		Seeps, bogs, and moist turf near waterfalls; mixed conifer, montane and subalpine zones
Forget-me-not popcorn flower (<i>Plagiobothrys myosotoides</i>)	PSS	CNDDDB: G4Q/S3 CNPS: 4.3	Sandy soils in foothill woodland, on granite sand of benches and balds

Species	Park Status	Other Status ^a	Habitat
Sierra podistera (<i>Podistera nevadensis</i>)	PSS	CNDDb: G3/S3 CNPS: 4.3	Alpine boulder and rock field
Nuttall's pondweed (<i>Potamogeton epihydrus</i> ssp. <i>nuttallii</i>)	PSS	CNDDb: G5/S2 CNPS: 2.2	Ponds, lake margins, slow-moving streams, tanks in meadows
Widgeonweed (<i>Ruppia maritima</i>)	PSS		Coastal salt marshes, freshwater wetland and riparian areas
Booth's willow (<i>Salix boothii</i>)	PSS		Moist mountain habitat
Snow willow (<i>Salix reticulata</i> var. <i>nivalis</i>)	PSS	CNDDb: G5/S1 CNPS: 2.3	Alpine dwarf scrub
Yosemite bulrush (<i>Trichophorum clementis</i>)	PSS	CNPS: CBR	Damp meadows; subalpine and alpine zones
Three-square bulrush (<i>Schoenoplectus pungens</i>)	PSS		Backwater areas of streams, ponds, reservoirs, and lake fringes
Swaying bulrush (<i>Schoenoplectus subterminalis</i>)	PSS	CNDDb: G4G5/S2S3 CNPS: 2.3	Marshes, swamps, lake margins; montane forest
Western ladies tresses (<i>Spiranthes porrifolia</i>)	PSS		Inhabits redwood, mixed evergreen, yellow pine and red fir forest between 0 and 8,000 feet in elevation
American waterawlwort (<i>Subularia aquatica</i> var. <i>americana</i>)	PSS	CNDDb: G5T5/S4 CNPS: 4.3	Upper montane coniferous forest/ lake margins
Western tofieldia (<i>Tofieldia occidentalis</i>)	PSS		Wetland/ riparian and meadow zones of yellow pine and Douglas-fir forest
Seaside arrowgrass (<i>Triglochin maritima</i>)	PSS		Saline and alkaline marshes and mudflats, mineral springs
Marsh arrowgrass (<i>Triglochin palustris</i>)	PSS	CNDDb: G5/S2 CNPS: 2.3	Saline and alkaline marshes and mudflats, mineral springs
Giant trillium (<i>Trillium angustipetalum</i>)	PSS		Forests, woodlands, chaparral, and riparian zones.

Sources: Endangered, Threatened, and Rare Plants of California, California Natural Diversity Database, CDFW Biogeographic Branch, 2009.
 Yosemite National Park sensitive species list, Wildlife Branch, Resources Management & Science, Yosemite NP.
 California Native Plant Society, Inventory of Rare and Endangered Plants.

a Key to "Other Status" codes:

CNDDb: X (with modifier below) = California Natural Diversity Database Global Ranking
 (A rank of "G" reflects the condition of the entire species)

- G1 = Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
- G2 = Imperiled—At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
- G3 = Vulnerable—At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
- G4 = Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
- G5 = Secure—Common; widespread and abundant.
- "T" modifier reflects the condition of the subspecies or variety (i.e., G2T1)
- "Q" modifier implies taxonomic questions

CNPS: X (with modifier below) = California Native Plant Society, California Rare Plant Rank

- 1A. Presumed extinct in California
- 1B. Rare or Endangered in California and elsewhere
- 2. Rare or Endangered in California, more common elsewhere
- 3. Plants for which we need more information - Review list
- 4. Plants of limited distribution - Watch list
- Threat Code extensions
- .1 - Seriously endangered in California
- .2 - Fairly endangered in California
- .3 - Not very endangered in California
- Yosemite National Park
- PSS -Park Special Status species

CNDDb: X (with modifier below) = California Natural Diversity Database State Ranking

- S1 = Critically Imperiled—Critically imperiled in the state because of extreme rarity (often five or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.
- S2 = Imperiled—Imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
- S3 = Vulnerable—Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
- S4 = Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
- S5 = Secure—Common, widespread, and abundant in the state.

The 2006 field survey also found that the habitat for nearly all the special status plant species in the Tuolumne River corridor was undisturbed, with the exception of a few discrete populations that were disturbed due to foot traffic in the Grand Canyon of the Tuolumne, and impacts from stock use in Lyell Canyon. Many populations are close to existing trails and are subject to the potential effects of foot traffic, pack stock use, and trail maintenance.

Special status species associated with mineral springs in Lyell Canyon include marsh arrow-grass (*Triglochin palustris*), seaside arrow-grass (*Triglochin maritime*), Suksdorf's dodder (*Cuscuta suksdorfii*), and Buxbaum's sedge (*Carex buxbaumii*). This specialized habitat is considered undisturbed (NPS, Acree et al. 2007o). However, because Soda Springs is a major visitor attraction, the surrounding wet soils and vegetation are highly susceptible to adverse effects of compaction and trampling. These impacts were greatly reduced by habitat restoration work over the past decade, but adverse effects continue (NPS, Buhler et al. 2010e).

The majority of the special status plants are found in riparian zones, meadows, and seasonally flooded ponds and oxbows associated with the Tuolumne River. Protection of special status plant species in the river corridor is dependent upon the processes that sustain their habitat, such as hydrologic processes that govern surface and groundwater flows, overbank flooding, and river meandering. While existing habitats for special status plants are in relatively good condition, threats such as diminished regional air quality and climate change are becoming important factors, especially with resultant changes in fire frequency and intensity, and in interannual weather patterns (Moore et al. 2005). Continued existence of special status species depends on vigilant efforts to study, understand, and protect these important components of the diversity of Yosemite National Park.

Environmental Consequences Methodology

The impact evaluation for special status species is based on the following: (1) the known or likely occurrence of a species or its preferred habitat in the vicinity of the planning area; (2) the direct physical loss or adverse modification of habitat; (3) the effective loss of habitat (through avoidance or abandonment) caused by construction activity or noise, or species sensitivity to human disturbance.

The impact on listed or candidate species are analyzed in accordance with USFWS guidelines. Federal agencies must consult with the USFWS to ensure their actions would not jeopardize the continued existence of any federally listed or proposed threatened or endangered species, or adversely modify designated or proposed critical habitat (Endangered Species Act, section 7(a) (2)). If listed species or their critical habitat are present, the federal agency must determine if the action would have “no effect,” “may effect, not likely to adversely affect,” or “may effect, likely to adversely affect” those species or their habitat. The NPS makes the determination of effect for the alternatives following guidance outlined in the *Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conference Activities* (USFWS and NMFS 1998). The following guidance is used to determine impacts, regardless of whether the species is protected under the Endangered Species Act; listed or identified as sensitive by the state; or identified as sensitive by the park, another federal agency (e.g., Bureau of Land Management or U.S. Forest Service), or a local agency.

- **No Effect:** The project (or action) is located outside suitable habitat and there would be no disturbance or other direct, indirect, or cumulative impacts on the species. The action would not affect the listed species or its designated critical habitat (USFWS and NMFS 1998).
- **May Affect, Not Likely to Adversely Affect:** The project (or action) occurs in suitable habitat or results in indirect impacts on the species, but the effect on the species is likely to be entirely beneficial, discountable, or insignificant. The action may pose effects on listed species or designated critical habitat, but given circumstances or mitigation conditions, the effects may be discounted, insignificant, or completely

beneficial. Insignificant effects would not result in ‘take’ [defined as to kill, harm or harass].

Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects or (2) expect discountable effects to occur (USFWS and NMFS 1998).

- *May Affect, Likely to Adversely Affect:* The project (or action) would have an adverse effect on a listed species as a direct, indirect, or cumulative result of the proposed action or its interrelated or interdependent actions and the effect is not discountable, insignificant, or beneficial (USFWS and NMFS 1998).

In addition, the impacts on special status species were evaluated in terms of the NEPA and NPS DO 12 considerations of the context, duration, intensity, and type of impacts, as defined below.

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts on wildlife or plants are those that occur within or adjacent to the Tuolumne River corridor. Regional impacts are impacts within the park and outside of the park in similar habitat types in the Sierra Nevada. Context suggests that certain impacts depend on the setting of the proposed action. For example, impacts that reduce the connectivity between habitat types could be minor if such connections are abundant in a given region, but the impact would be moderate or major if not.

Intensity: A negligible impact means that special status species would not be affected, or effects would not be measurable. A minor impact would be detectable; both short-term and long-term impacts could potentially affect breeding success and habitat availability. Mitigation measures would be sufficient to offset minor adverse effects. A moderate impact would be readily apparent and result in the reduction or expansion of potential habitat required to meet the requisite life needs of one or more species. Mitigation would be required to offset moderate adverse impacts. A major impact would be readily apparent and result in the direct or indirect gain or loss of occupied breeding sites, ‘take’ [defined as to kill, harm, or harass] of individuals, or changes to habitat that affect the potential for site occupancy or reproductive potential. Extensive mitigation would be necessary to offset adverse effects, and mitigation success could not be guaranteed.

Duration: A short-term impact would have an immediate effect on native habitat, diversity, and native populations but would not cause long-term declines in populations or diversity. Short-term impacts are normally associated with transitional types of activities, such as facility construction. Long-term adverse impacts would lead to a loss of native habitat, diversity, and species populations, as exhibited by a decline in species abundance, viability, and/or survival.

Type: Impacts can be adverse or beneficial. Adverse impacts are those that alter the range, location, number, or population of a species or its habitat. Beneficial impacts would improve one or more of these characteristics.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current special status species condition and management, as described under chapter 8 and “Affected Environment,” above.

Wild Segments

Continuation of current wilderness management, including protection of natural processes, visitor education with an emphasis on Leave-No-Trace practices, and restrictions on amounts and locations of overnight use, would protect native plant communities and associated special status species habitat. The NPS would continue efforts to monitor use, eliminate inappropriate uses (e.g., informal trails), and restore affected sites to natural conditions. Overall, habitat for special status wildlife and plant species in wilderness would remain undisturbed, with site-specific exceptions noted below. The designated critical habitat for Sierra Nevada bighorn sheep would remain untrailed and undisturbed.

In Lyell Canyon and along the Dana Fork, habitat for special status species in upland areas and above tree line (e.g., habitat for Mt. Lyell salamander and other species) would be expected to remain undisturbed. Site-specific impacts on habitat would result from foot and stock traffic along formal and informal trail routes radiating outward from Tuolumne Meadows and Tioga Road into subalpine meadow areas, and at the pack stock camps and grazing areas in upper Lyell Canyon. These impacts would include trampling, compaction, and possibly streambank erosion (NPS, Ballenger et al. 2009f). These impacts would result in some localized loss of natural vegetation community structure, diversity, and productivity, particularly in subalpine meadow areas that are critical foraging and breeding habitat for special status wildlife (e.g., Sierra Nevada mountain beaver).

A 2006 rare plant survey (NPS, Acree et al. 2007o) found a discrete population of rare plants that was disturbed by pack stock use in Lyell Canyon; this impact would be expected to continue. Other rare plant populations found in the Dana and Lyell segments were undisturbed, including the habitat for special status plant species at springs at Lyell Canyon.

There are no special status plant species in the vicinity of the Glen Aulin High Sierra Camp. Special status wildlife might be affected by habitat fragmentation and the imposition of unnatural barriers to movement. The existing leach mound at the camp might present localized risks to water quality and associated habitats.

Special status species and habitat between Tuolumne Meadows and Hetch Hetchy Reservoir and lower-elevation communities below O'Shaughnessy Dam would remain relatively undisturbed, with very localized site-specific exceptions. At least two special status bat species, the spotted bat and greater western mastiff bat, have been located throughout the canyon at Pate Valley and closer to Hetch Hetchy Reservoir (Pierson and Rainey 1998). Bald eagles, American peregrine falcons (Siegel and DeSante 2002), and California spotted owls (Moritz 2007) have also been reported along this section of river. Habitat for these species would remain undisturbed; impacts in this area, particularly in the Grand Canyon, would be associated with occasional foot traffic. Below O'Shaughnessy Dam, habitat for some special status wildlife (e.g., willow flycatchers) and plant species would remain relatively undisturbed. Habitat for special status species such as the western pond turtle would continue to be disturbed by the diversion of water and regulated flows. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam that would protect and improve habitat for special status species downstream of the dam.

Scenic Segments

During the summer, the extensive subalpine meadow and riparian complex radiating outward from Tuolumne Meadows is the most heavily visited and accessed portion of the river corridor. Much of the existing visitor and administrative infrastructure at Tuolumne Meadows is located in resilient upland areas; however, many of these facilities are adjacent to sensitive meadow and riparian communities as well as populations of rare plants (e.g., Buxbaum's sedge, mare's-tail, three-square bulrush). Rare plant populations are found throughout the developed area at Tuolumne Meadows, particularly at the campground and at Soda Springs. These rare plant populations are adjacent to high visitor use areas and trails (NPS, Acree et al. 2007o).

Existing impacts on the subalpine meadow and riparian habitat at Tuolumne Meadows, the extent and cause of which are currently under investigation, include altered, damaged, or denuded vegetation, compacted soils, and disrupted hydrologic processes. The results of recent research into the underlying causes of these impacts are discussed extensively under "Hydrology" and "Vegetation," above. The meadows provide critical breeding and foraging habitat for several special status wildlife species, such as the Yosemite toad, Sierra Nevada mountain beaver, western white-tailed jackrabbit, northern goshawk, and western mastiff bats. Under the no-action alternative, existing impacts on suitable habitat in this area would continue to affect wildlife species that rely on the subalpine meadow ecosystem for foraging, breeding, nesting, and other uses by reducing the quality of habitat, potentially extirpating species from the area. If current visitor use trends continue, increasing use of the

Tuolumne Meadows area could affect the distribution and abundance of other special status species that could occur in the meadows, such as the Sierra Nevada mountain beaver and western white-tailed jackrabbit. In addition, habitat alteration and increasing visitor use could potentially affect the distribution and abundance of prey species for special status wildlife, such as the northern goshawk.

Conclusion

Under the no-action alternative, special status species and habitat, including federally designated critical habitat, would overall remain undisturbed. There would be local minor site-specific impacts on habitat for special status wildlife and plant species associated with trail corridors radiating outward from Tuolumne Meadows and Tioga Road and at pack stock use areas in Lyell Canyon.

Canyon, riparian, and aquatic species and habitat in between Tuolumne Meadows and Hetch Hetchy Reservoir would remain relatively undisturbed. Below O'Shaughnessy Dam, some special status species habitat would continue to be disturbed by the diversion of water and regulated flows. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.

In the scenic segments of the river corridor at Tuolumne Meadows, the no-action alternative would likely adversely affect special status species due to the ongoing changes in ecological integrity of the subalpine meadow system. The cause of this change would continue to be studied. The NPS would continue to protect special status species under existing resource management programs. However, under the no-action alternative there would be an overall local and regional long-term minor adverse impact on special status species due to existing habitat alteration and the potential for increasing visitor use to further disturb plant and wildlife populations.

Cumulative Impacts

Past actions that would have contributed to adverse cumulative impacts on special status species habitat in the river corridor include the construction and maintenance of visitor and administrative facilities at Tuolumne Meadows, Glen Aulin, and along the Tioga Road corridor.

The following recently completed actions from the cumulative projects list in appendix L had beneficial impacts on special status species:

- project to restore disturbed areas at the Tuolumne Meadows Lodge, which included site drainage improvements and native plant restoration
- project to control invasive velvet grass in Pate Valley and Yosemite Valley, which removed populations of a newly established highly invasive plant species from the Tuolumne River corridor
- various water quality improvement projects, as noted in the "Hydrology" affected environment section and in appendix L

The following current and/or reasonably foreseeable future actions, projects, and plans could have a cumulative effect on special status species in combination with the no-action alternative:

- Projects to improve the parkwide communications data network and to improve the Tuolumne Meadows water treatment system could result in short-term impacts from thinning or selective removal of vegetation.
- The *Scenic Vista Management Plan* and *Fire Management Plan* could result in short-term impacts from thinning or selective removal of vegetation.
- Implementation of the High Elevation Aquatic Ecosystem Recovery and Stewardship Plan would direct specific actions for the management of selected high-elevation aquatic ecosystems. The plan would focus on protecting species such as the Yosemite toad and the Sierra Nevada yellow-legged frog, with the intent of

restoring these species to formerly occupied sites that may include locations within the Tuolumne River corridor.

Environmental Consequences Common to Alternatives 1–4

Wild Segments

Under all action alternatives, wilderness management policies described under the no-action alternative would continue. Overall, special status species habitat would remain undisturbed, with site-specific impacts on habitat from foot traffic along trail corridors radiating outward from Tuolumne Meadows and Tioga Road. The designated critical habitat for Sierra Nevada bighorn sheep would remain untraveled and undisturbed.

Rare plant populations in wild segments would overall remain undisturbed, including the habitat for special status plant species at springs in Lyell Canyon. Either a reduction in or elimination of pack stock use in Lyell Canyon (depending on the alternative) would likely benefit the rare plant population along a trail corridor that is currently characterized by pack stock use.

As under the no-action alternative, special status species and their habitat between Tuolumne Meadows and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain undisturbed, with the exception of special status wildlife species (such as the western pond turtle) that have been disturbed by the diversion of water and regulated flows below O'Shaughnessy Dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam that would protect and improve habitat for special status species downstream of the dam.

Scenic Segments

The primary beneficial impact on special status species under alternatives 1–4 would result from implementation of a comprehensive ecological restoration program, as described in chapters 5 and 8. Ecological restoration would result in beneficial impacts on the subalpine meadow ecosystem from the restoration of surface and subsurface hydrologic flows and the restoration of vegetation, including riparian vegetation. Restoration would help protect and restore habitat for amphibian species such as the Yosemite toad in the greater Tuolumne Meadows area. The meadows provide critical breeding and foraging habitat for several special status animal species, such as the Sierra Nevada mountain beaver, western white-tailed jackrabbit, northern goshawk, and western mastiff bat. Restoration of suitable habitat in this area would have a beneficial impact on species that rely on the subalpine meadow ecosystem for foraging, breeding, and nesting (primarily mammals and birds) by improving habitat quality and decreasing fragmentation. In addition, the program would include measures for protecting special status plant species at Soda Springs.

Construction activities at Tuolumne Meadows under all of the action alternatives could disturb special status wildlife habitat in both meadow and upland areas, where facilities are removed and restored as well as where new facilities are constructed. Demolition or removal of existing buildings and associated infrastructure would generate noise and ground vibrations, disturb habitat, and create other disturbances associated with human presence.

As noted in the “Wildlife” section above, use of heavy equipment would create the potential for wildlife injuries or death, specifically for small wildlife. These activities could cause wildlife to relocate or avoid the area and cause breeding birds to abandon their nests or avoid using the immediate area. New parking areas and paths may require removal of some trees; removal of potentially occupied habitats such as mature conifer and hardwood trees, hollowed-out trees, or snags could affect breeding bats or birds by removing nests or roosts. This could result in the harassment of adults from active nests or roosting sites located in the vicinity. Tree removal would be minimized through site design, and, if possible, older trees and snags would be retained for habitat. Although the disturbance would be temporary, species mortality, loss of reproductive potential, or abandonment of breeding sites would have an adverse impact on local special status bird, and bat populations

in particular. With the implementation of mitigation measures such as surveying potential habitat prior to construction (especially during important breeding seasons), noise and visual disturbances to special status wildlife would be minimized or avoided.

Vegetation that is removed under all action alternatives would not substantially fragment existing native vegetation communities, reduce species diversity, or substantially reduce the overall size or quality of native plant communities at Tuolumne Meadows because new construction would primarily occur in or adjacent to previously disturbed locations or in more resilient, upland habitat.

The NPS would conduct surveys for special status bird and mammal species with the potential to occur in areas where habitat disturbance could occur during project implementation, including surveys at Tuolumne Meadows for the Sierra Nevada yellow-legged frog and Yosemite toad (proposed for listing under the Endangered Species Act), the Sierra Nevada red fox (a candidate for listing under the act), and the great gray owl (a state of California endangered species) (see appendix O).

In general, special status plant species will be avoided during construction activities. The new development to accommodate proposed alterations at the Tuolumne Meadows campground would occur near several populations of rare plants. To avoid impacts on rare plants, the NPS would need to apply mitigation measures (see appendix O) such as preconstruction surveys.

Environmental Consequences of Alternative 1

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 1 on special status species are described below.

Wild Segments

Under alternative 1, the elimination of concessioner stock day rides, reductions in concessioner pack stock use, elimination of commercial pack stock use, and the overall reduction in use levels would have a beneficial impact on habitat by reducing disturbance associated with foot traffic and eliminating many of the impacts related to pack stock (e.g., manure and impacts on native vegetation near pack stock camps and grazing areas), particularly in upper Lyell Canyon.

Improved habitat and reduced disturbance would benefit special status wildlife that use meadow riparian areas along the Dana Fork and Lyell Fork, including bats, the Sierra Nevada mountain beaver, and the Sierra Nevada snowshoe hare.

Removal and restoration of Glen Aulin High Sierra Camp would eliminate risks to water quality associated with the camp and reduce habitat fragmentation in this portion of an important wildlife migration corridor.

Scenic Segments

Commercial services and facilities and some associated administrative facilities would be removed under alternative 1, along with informal trails and unsanctioned roadside parking. Site-specific restoration activities in these locations would reduce habitat fragmentation and disturbance, increase opportunities for revegetation and restoration of special status species habitat, and enable the recovery of adjacent meadow and riparian areas from the effects of trampling, including compaction and vegetation loss. In addition, eliminating concession stock day rides would reduce impacts (primarily trampling) on native plant communities associated with stock use at Tuolumne Meadows, both near the concessioner stable and along stock use trails.

New or expanded formal parking areas would be placed within or adjacent to existing developed areas in upland vegetation communities south of Tioga Road. Any new development to accommodate a campground redesign would likely result in the loss of upland habitat and could increase access to undisturbed habitats.

The combination of reduced visitor use and extensive natural resource restoration (improving habitat quality and decreasing fragmentation) would have a beneficial impact on special status species that rely on the meadow and riparian area at Tuolumne Meadows for breeding, foraging, nesting, and other uses.

Conclusion

Special status species and habitat in wild segments, including federally designated critical habitat, would overall remain undisturbed under alternative 1. Reductions in foot traffic and pack stock use would result in overall beneficial impacts on special status species habitat along trail corridors radiating out from Tuolumne Meadows and Tioga Road, and in particular upper Lyell Canyon. As with the no-action alternative, special status species habitat in wilderness between Tuolumne Meadows and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain relatively undisturbed, with the exception of species that may be affected by altered hydrological processes downstream of the dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.

In the scenic segments at Tuolumne Meadows, implementation of a comprehensive ecological restoration program to restore natural processes to the subalpine meadow, in combination with much lower use levels and extensive site-specific restoration, would result in local long-term moderate beneficial impacts on special status species habitat. There would be a local short-term and long-term minor adverse impact on upland communities where existing parking and facilities would be relocated from more sensitive areas. Special status plants would be avoided during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife. Therefore, alternative 1 may affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.

Cumulative Impacts

The list of past, current, and reasonably foreseeable future actions with the potential for a cumulative impact on special status species would be the same in combination with alternative 1 as described for the no-action alternative.

Considered in conjunction with cumulative projects and plans, the long-term impact of alternative 1 on special status species populations corridorwide would be beneficial, in particular at Tuolumne Meadows where implementation of a comprehensive ecological restoration program would help restore suitable habitat for a number of special status species, including the Yosemite toad and the Sierra Nevada yellow-legged frog. The cumulative impact of multiple construction activities at Tuolumne Meadows and along the Tioga Road corridor would have the potential to adversely affect special status wildlife species. Mitigation measures (see appendix O) such as surveys prior to construction would be needed to offset these impacts. Although the disturbance would be temporary, species mortality, loss of reproductive potential, or abandonment of breeding sites would have an adverse impact on local special status bird and bat populations in particular.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on special status species are described below.

Wild Segments

The reduction of concessioner stock day rides in wilderness would have a beneficial impact on subalpine and riparian habitat along trails radiating outward from Tuolumne Meadows and Tioga Road. Special status wildlife species habitat would be improved by reducing impacts such as noise, human presence, and stock presence, and by reducing disturbance (e.g., vegetation trampling and soil compaction) to habitat components. In addition, the proposal to regulate the timing, amount, and location of commercial pack stock use in upper Lyell Canyon would also improve habitat by consolidating use in more resilient locations and restoring meadow and

riparian areas previously affected by stock use. These actions might benefit special status mammals that use meadow riparian areas, such as bats, the Sierra Nevada mountain beaver, and the Sierra Nevada snowshoe hare.

Removal of the aging water collection and treatment system and proposed wetland restoration at Glen Aulin High Sierra Camp would reduce risks to water quality and improve associated riparian habitat. Although the permanent camp structures would be removed under alternative 2, continued use of a seasonal camp in this location would result in minor impacts from habitat fragmentation (the same as with the no-action alternative).

The NPS does not expect recreational boating between Tuolumne Meadows and Pate Valley to affect special status species because this use would be extremely limited.

Scenic Segments

The majority of the existing commercial administrative facilities would remain under alternative 2, although some facilities would be consolidated and relocated away from sensitive meadow and riparian areas. Informal trails throughout the developed area at Tuolumne Meadows and unsanctioned roadside parking along Tioga Road would be removed. Site-specific restoration activities in these locations would reduce fragmentation and disturbance, increase opportunities for revegetation and restoration of habitat, and enable the recovery of adjacent meadow and riparian areas from the effects of trampling, including compaction and vegetation loss.

Under alternative 2, a new formal trail is proposed from the existing store and grill area across the meadows to Parsons Memorial Lodge. The alignment and construction requirements of the proposed trail would be determined during the design phase of this project; however, it is assumed that it would cross sensitive meadow habitat and potentially fragment a portion of the meadow. Populations of rare plants would be avoided by the final alignment of the trail and during construction activities.

To accommodate facilities relocated from more sensitive habitats, new development in previously undisturbed upland communities would include formal parking areas near Pothole Dome, an area west of Unicorn Creek, and a new consolidated stables operation between Budd Creek and Road Camp. New development to accommodate campground expansion and redesign would likely result in disturbance of previously undisturbed upland habitat. In addition, a new trail connection south of Tioga Road would pass through upland vegetation. New development in these upland areas would increase fragmentation and expose habitat to the effects of trampling. Construction in these areas would require removal of trees, including removal of potentially occupied habitats such as mature conifer and hardwood trees, hollowed out trees, or snags. This could affect special status bats or birds by removing nests or roosts and could result in the harassment of adults from active nests or roosting sites located in the vicinity. Tree removal would be minimized through site design, and, if possible, older trees and snags would be retained for habitat. Surveying potential habitat prior to construction would minimize potential impacts on nesting or roosting species.

Conclusion

Special status species and habitat in wild segments, including federally designated critical habitat, would overall remain undisturbed under alternative 2. Reductions in concessioner stock use and additional regulations concerning commercial stock use would result in overall beneficial impacts on special status species habitat along trail corridors radiating outward from Tuolumne Meadows and Tioga Road, and in upper Lyell Canyon. The NPS does not expect recreational boating between Tuolumne Meadows and Pate Valley to affect special status species because this use would be extremely limited.

As with the no-action alternative, special status species habitat in wilderness between Tuolumne Meadows and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain relatively undisturbed, with local, site-specific exceptions along trail corridors. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.

In scenic segments at Tuolumne Meadows, implementation of a comprehensive ecological restoration program to restore natural processes to the subalpine meadow, in combination with consolidated visitor use and site-specific restoration, would result in a local long-term moderate beneficial impact on special status species habitat. There would be a local short-term and long-term minor adverse impact on upland communities where existing parking and facilities would be relocated from more sensitive areas. Special status plants would be avoided during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife. Therefore, alternative 2 may affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.

Cumulative Impacts

The cumulative impact of past, current, and reasonably foreseeable future actions in combination with alternative 2 would be the same as described for alternative 1.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on special status species are described below.

Wild Segments

The reduction in concessioner pack stock use (due to lowered use at Glen Aulin High Sierra Camp), reduction in concessioner stock day rides, and lowered day use levels at Tuolumne Meadows would have a beneficial impact on subalpine and riparian communities along trails radiating outward from Tuolumne Meadows and Tioga Road. Special status wildlife species habitat would be improved by reducing impacts such as noise, human presence, and stock presence, and by reducing disturbance (e.g., vegetation trampling and soil compaction) to habitat components. In addition, the proposal to regulate the timing, amount, and location of commercial pack stock use in upper Lyell Canyon would also improve habitat by consolidating use in more resilient locations and restoring meadow and riparian areas previously affected by stock use. These actions may benefit special status mammals that use meadow riparian areas, such as bats, the Sierra Nevada mountain beaver, and the Sierra Nevada snowshoe hare.

At Glen Aulin High Sierra Camp, replacing the aging water collection and treatment system and proposed wetland restoration would reduce risks to water quality and improve associated riparian habitat. Minor impacts due to habitat fragmentation noted in the no-action alternative would continue under alternative 3.

Scenic Segments

Commercial administrative facilities would remain under alternative 3, although some facilities would be relocated away from sensitive meadow and riparian areas. Informal trails throughout the developed area at Tuolumne Meadows and unsanctioned roadside parking along Tioga Road would be removed. Site-specific restoration activities in these locations would reduce fragmentation and disturbance, increase opportunities for revegetation and restoration of special status species habitat, and enable the recovery of adjacent meadow/riparian areas from the effects of trampling, including compaction and vegetation loss.

To accommodate facilities relocated from more sensitive habitats, new development in previously undisturbed upland communities would consist of formal parking areas near Pothole Dome and a new employee housing area north of the road leading to Tuolumne Meadows Lodge (west of the water treatment facility). In addition, a new trail connection south of Tioga Road would pass through upland vegetation. New development in these upland areas could increase habitat fragmentation and expose habitat to the effects of trampling. Construction in these areas would also require the removal of trees, including removal of potentially occupied habitats such as mature conifer and hardwood trees, hollowed out trees, or snags. This could affect special status bats or birds by removing nests or roosts and could result in the harassment of adults at active nests or roosting sites

located in the vicinity. Tree removal would be minimized through site design, and, if possible, older trees and snags would be retained for habitat. Surveying potential habitat prior to construction would minimize potential impacts on nesting or roosting species.

Conclusion

Under alternative 3, special status species and habitat in wild segments, including federally designated critical habitat, would overall remain undisturbed. Reductions in concessioner stock use and additional regulations concerning commercial stock use would result in overall beneficial impacts on special status species habitat along trail corridors radiating outward from Tuolumne Meadows and Tioga Road, and in upper Lyell Canyon. As under the no-action alternative, special status species habitat in wilderness between Tuolumne Meadows and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain relatively undisturbed under alternative 3, with local, site-specific exceptions along trail corridors. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.

In scenic segments at Tuolumne Meadows, implementation of a comprehensive ecological restoration program to restore natural processes to the subalpine meadow, in combination with managed visitor use levels and site-specific restoration, would result in a local long-term moderate beneficial impact on special status species habitat. There would be a local short-term and long-term minor adverse impact on upland communities where existing parking and facilities would be relocated from more sensitive areas. Special status plants would be avoided during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife. Therefore, alternative 3 might affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.

Cumulative Impacts

The cumulative impact of past, current, and reasonably foreseeable future actions, in combination with alternative 3, would be the same as described for the no-action alternative.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on special status species are described below.

Wild Segments

The reduction in concessioner pack stock use (due to lowered use at Glen Aulin High Sierra Camp) and elimination of concessioner stock day rides would have a beneficial impact on subalpine and riparian communities along trails radiating outward from Tuolumne Meadows and Tioga Road. Special status wildlife species habitat would be improved by reducing impacts (e.g., noise, human presence, stock presence) and reducing disturbance to habitat components (e.g., vegetation trampling, soil compaction). In addition, the proposal to regulate the timing, amount, and location of commercial pack stock use in upper Lyell Canyon would also improve habitat by consolidating use in more resilient locations and restoring meadow and riparian areas previously affected by stock use. These actions may benefit special status mammals that use meadow riparian areas, such as bats, the Sierra Nevada mountain beaver, and the Sierra Nevada snowshoe hare.

Special status species would benefit to a lesser extent from restrictions on commercial stock use related to the “determination of extent necessary” in appendix C, since use would be at levels that are approximately the same as existing conditions. However, these restrictions would cap the amount of commercial stock use in wild segments of the corridor, which would limit the potential for new impacts.

Replacement of all flush toilets with composting toilets at the High Sierra Camp, and the replacement of the composting toilet at the backpacker campground would reduce existing risks to water quality and associated

riparian habitat by reducing water use and converting the wastewater system to gray water only. In addition, the proposed wetland restoration at Glen Aulin High Sierra Camp would improve associated riparian habitat. Minor impacts resulting from habitat fragmentation noted in the no-action alternative would continue under alternative 4.

The NPS does not expect recreational boating between Tuolumne Meadows and Pate Valley to affect special status species because this use would be extremely limited.

Scenic Segments

Most commercial and administrative facilities would remain under alternative 4, although some facilities would be relocated away from sensitive meadow and riparian areas. Informal trails throughout the developed area at Tuolumne Meadows and unsanctioned roadside parking along Tioga Road would be removed and restored to natural conditions. Site-specific restoration activities in these locations would reduce fragmentation and disturbance, increase opportunities for revegetation and restoration of special status species habitat, and enable the recovery of adjacent meadow and riparian areas from the effects of trampling, including compaction and vegetation loss.

Redevelopment in previously disturbed upland communities would include a formalized parking area near Pothole Dome. New development in upland areas adjacent to already disturbed areas would include expanded parking at Road Camp, expanded parking at the Dog Lake/Bug Camp parking area, and expanded roadside parking between Lembert Dome and the concessioner stable. New development in undisturbed upland areas would include a new visitor contact station south of Tioga Road, and a portion of the Tuolumne Meadows campground redesign. In addition, a new trail connection south of Tioga Road would pass through upland vegetation. New development in upland areas could increase habitat fragmentation, expose habitat to the effects of trampling, and require removal of trees that could potentially be occupied habitats, such as mature conifer and hardwood trees, hollowed out trees, or snags. This could affect breeding bats or birds by removing nests or roosts and result in the harassment of adults at active nests or roosting sites located in the vicinity. Tree removal would be minimized through site design, and, if possible, older trees and snags would be retained for their habitat value. In addition, surveying potential habitat prior to construction to determine whether there are any active nests or roosts would minimize potential impacts on some species.

Conclusion

Special status species and habitat in wild segments, including federally designated and proposed designated critical habitat, would overall remain undisturbed under alternative 4. Managed visitor use levels, reductions in concessioner stock use, and additional regulations concerning commercial stock use would result in beneficial impacts on special status species habitat along trail corridors radiating outward from Tuolumne Meadows and Tioga Road, and in upper Lyell Canyon. The NPS does not expect recreational boating between Tuolumne Meadows and Pate Valley to affect special status species because this use would be extremely limited.

As with the no-action alternative, special status species habitat in wilderness between Tuolumne Meadows and Hetch Hetchy Reservoir and below O'Shaughnessy Dam would remain relatively undisturbed with local, site-specific exceptions along trail corridors. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.

In scenic segments of the river corridor at Tuolumne Meadows, implementing a comprehensive ecological restoration strategy to restore natural processes to the subalpine meadow, in combination with consolidated visitor use, managed visitor use levels, and site-specific restoration, would result in a local long-term moderate beneficial impact on special status species habitat, including proposed critical habitat for two amphibian species. There would be a local short-term and long-term minor adverse impact on upland habitat where existing parking and facilities would be relocated from more sensitive areas. Special status plants would avoided

during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife and plants. Therefore, alternative 4 may affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.

Cumulative Impacts

The cumulative impact of past, current, and reasonably foreseeable future actions in combination with alternative 4 would be the same as under alternative 1.

Lightscapes

Affected Environment

The national park system includes some of the few places where pristine views of the night sky remain. The enjoyment and appreciation of these natural lightscapes are dependent on many factors, including the weather, clarity of the air, and amount of light pollution present. Light pollution is of particular concern in national parks; nearly every park in the national park system is affected by some level of artificial light in the night sky (NPS, Duriscoe 2005c). Nationwide, the glare and 'sky glow' from urban areas are encroaching upon dark skies in areas normally considered remote, including the Sierra Nevada (NPS 2006i).

The NPS considers natural lightscapes as an intrinsic natural and cultural value of all parks, and the protection of lightscapes has been added to the responsibilities of park managers.

Recognizing the roles that light and dark periods and darkness play in natural resource processes and the evolution of species, the Service will protect natural darkness and other components of the natural lightscape in parks. (NPS 2006g)

While natural lightscapes are recognized as a critical component of ecological processes, the night sky is also considered a critical part of cultural heritage in national parks, and in at least one case, the night sky has been designated by a state legislature as an endangered historic resource (Rogers and Sovic 2001). In addition, night sky visibility is an important aesthetic component of wilderness values. The 1964 Wilderness Act cites the importance of access to 'primitive and unconfined' recreation and the opportunities for personal development that such experiences provide. For many, pristine night skies are considered an integral part of that experience (NPS, Duriscoe 2001).

The Sierra Nevada Inventory and Monitoring Network, a group of four national parks that share regional research and monitoring efforts, has identified night sky quality as a vital sign, or a physical or biological element of a park, that represents overall condition or are particularly valuable attributes (NPS 2007j).

Measuring Dark Night Skies in Yosemite National Park

In 2001, a model developed jointly by the NPS and the National Oceanic and Atmospheric Administration was used to evaluate the effects of light pollution on areas administered by the NPS for the purpose of protecting night sky visibility. This was a nationwide model that built upon previous efforts to distinguish the effects of artificial sky glow from cities and naturally occurring sky glow (e.g., moonlight). The results were calibrated by comparing the expected amount of light pollution for various locations with actual observations. According to the results of this model, about two-thirds of Yosemite National Park is at near pristine conditions for dark night skies, while in the remaining one-third of the park, primarily the western portion of the park, light pollution is diminishing night sky quality (Albers and Duriscoe 2001).

The model was not calibrated to a level that would distinguish among segments of the Tuolumne River corridor, but generally this would equate to near pristine conditions for the Lyell, Dana, and Tuolumne

Meadows segments, and then gradual light intrusion as the corridor heads westward down the Grand Canyon of the Tuolumne towards Hetch Hetchy Reservoir and the western park boundary.

In order to effectively manage night skies as a resource in parks, the NPS Night Sky Team was formed in 2000 to measure and inventory night skies in parks across the nation. The Night Sky Team has developed a system for measuring sky brightness to quantify the source and severity of light pollution. This system, developed with the assistance from professional astronomers and the International Dark-sky Association, uses a research-grade digital camera to capture the entire sky with a series of images. Since the development of this system, inventories of night sky quality have been conducted at several parks; these night sky baseline assessments are intended to form “the foundation for a monitoring program to detect long-term changes, provide scientifically sound data for park stewardship, and track this park feature that has scenic, ecological, and cultural implications” (NPS, Duriscoe 2005c; NPS 2007h).

In August and September 2005, the Night Sky Team took sky quality measurements in Yosemite National Park from Sentinel Dome, located west of Glacier Point on the rim of Yosemite Valley, and Pothole Dome, on the west end of Tuolumne Meadows. The results of visual observation and measurements indicate that artificial light seen from Sentinel Dome is significantly brighter than Pothole Dome. The Night Sky Team assessment indicated that sources of light pollution at both Sentinel Dome and Pothole Dome include Fresno, the Modesto/Stockton/Sacramento area, and the Reno/Carson City area. However, overall, the view from Pothole Dome is considered ‘very dark’, with near pristine conditions, while the darkest part of the sky at Sentinel Dome was 0.2-0.3 orders of magnitude brighter (NPS, Duriscoe 2005c; NPS 2007h).

Lighting Guidelines

While the majority of light pollution seen in national parks radiates from population centers outside park boundaries, the NPS recognizes that artificial lighting within parks may have a detrimental effect on natural lightscapes as well. In order to achieve the dual goal of providing for visitor safety and manage for natural lightscapes, NPS management policies directs parks to do the following:

- Restrict the use of artificial lighting in parks to those areas where security, basic human safety, and specific cultural resource requirements must be met.
- Use minimal-impact lighting techniques.
- Shield the use of artificial lighting where necessary to prevent the disruption of the night sky, natural cave processes, physiological processes of living organisms, and similar natural processes (NPS 2007h).

Yosemite National Park is actively working with the park concessioner to develop, refine, and implement lighting guidelines for the park. These guidelines are intended to balance the safety and security of employees and visitors, universal accessibility, and the scientific and aesthetic importance of the natural lightscape that the NPS is obligated to protect.

The focus of the current parkwide lighting guidelines includes Yosemite Valley and other heavily used portions of the park; there are no lighting guidelines specific to the Tuolumne River corridor. These guidelines divide the park into frontcountry areas, where visitor services are concentrated, and backcountry areas, which are managed and maintained as natural areas and visitors have to assume a certain degree of risk and responsibility for their own safety. Frontcountry areas are lighted for safety, security, and accessibility. Backcountry areas might have electric lighting but only as determined on a case-by-case basis by the NPS (Pacific Lightworks 2007). In areas where artificial lighting is present, lighting guidelines are intended to prevent both light pollution and light trespass, primarily using structural means to control light and cast light downward. As a secondary measure, power limits (in the form of low lamp wattage) are set on all lamp types to minimize inadvertent light trespass or pollution (Benya 2000; Pacific Lightworks 2007).

Guiding principles for lighting in frontcountry areas, such as Tuolumne Meadows include the following:

- Warranting– Light only where needed.
- Controls – Light only when needed.
- Shielding – Direct light downward.
- Spectrum – Select lamp color that minimizes negative impacts.
- Intensity – Use the minimum amount of light necessary.
- Efficiency – Select the most energy efficacious lamp and fixture.

Environmental Consequences Methodology

The lightscapes impact assessment involves the identification and qualitative description of the types and characteristics of actions proposed under each alternative that could affect the dark night skies of the Tuolumne River corridor. The examination of effects is limited to sources of light within the park. Such characteristics of light would include the location of facilities, operational features that produce light, and how the light would be distributed over the landscape.

Although sky glow radiating from population centers on either side of the Sierra Nevada affects dark night skies in the river corridor, the alternatives presented in this environmental impact statement would have no effect on the regional sources of this impact; therefore, it is not addressed under the environmental consequences section below. As stated under “Affected Environment,” above, sky glow is more evident in the lower reaches of the river corridor, closer to the major population centers in California. Growth in the region would be expected to increase this adverse effect on lightscapes in the river corridor.

The lightscapes impact assessment evaluates how the three basic types of changes of the plan noted above would affect the dark night skies in the Tuolumne River corridor. Impacts were evaluated in terms of their context, intensity, and duration, and whether the impacts were considered to be beneficial or adverse.

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts would be those that occur within Yosemite National Park or impacts specific to the river corridor. In considering lightscape impacts, it was assumed that the impacts would be consistently local.

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts are effects considered not detectable and that would have no discernible effect on the ambient environment. Minor impacts are those that would be slightly detectable but not expected to have an overall effect on those conditions. Moderate impacts would be clearly detectable and could have an appreciable effect. Major impacts would have a substantial, highly noticeable influence on the ambient environment.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration or transitory in effect, such as light from passing vehicles. A long-term impact would have a permanent effect on the ambient environment.

Type: Impacts are evaluated in terms of whether they would be beneficial or adverse to the ambient environment. Beneficial impacts would reduce associated levels of light, while adverse impacts would have the opposite effect.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current condition and management, as described under chapter 8 and “Affected Environment,” above.

Wild Segments

The continuation of current park wilderness policies, including limits on amounts and locations of overnight use, would result in lightscapes dominated by sources of natural light and dark night skies in the more than 90 percent of the Tuolumne River corridor that is congressionally designated Wilderness. As stated under the “Affected Environment,” above, lightscapes along the Lyell and Dana segments are considered to be near pristine; below Tuolumne Meadows, night skies are affected by sky glow.

In-park sources of light pollution in wilderness would include the occasional campfire, light sources from adjacent nonwilderness areas (principally Tuolumne Meadows), and vehicle headlights from nearby roads (primarily Tioga Road). Along almost all of the Lyell Fork and the upper Dana Fork, sources of artificial light pollution would be limited to campfires and flashlights. Along the lower Dana Fork, vehicle headlights along Tioga Road and administrative roads, combined with artificial light sources in parking areas, at the Tuolumne Lodge, and in housing and administrative areas, would continue to affect lightscapes in the adjacent wilderness areas. The Grand Canyon segment would be generally unaffected by in-park sources of light pollution other than campfires and flashlights; however, artificial light sources at the Glen Aulin High Sierra Camp would continue to have an impact on adjacent wilderness areas. The only in-park sources of artificial light in the wilderness below Hetch Hetchy Reservoir would be a very occasional campfire.

At Glen Aulin, natural lightscapes would remain predominant. Artificial light sources associated with the operation of the camp (e.g., propane lights) and campfires would continue to affect local lightscapes during the summer.

Scenic Segments

Night skies in the Tuolumne Meadows area are considered near pristine. Under the no-action alternative, lightscapes in portions of the meadows would be affected by a combination of vehicle headlights emanating from the Tioga Road and administrative roads; limited artificial lighting at employee housing areas, facilities that would require lighting for safety and security (e.g., the wastewater treatment facility); Tuolumne Meadows Lodge; and campfires in the campground. The in-park sources of artificial light would be primarily confined to the upland areas south of the meadows and would be designed in accordance with the *Yosemite Exterior Lighting Guidelines* (NPS 2008j). However, vehicle lights would have a relatively widespread impact due to the expanse of the meadows; this particular impact would be most intense immediately adjacent to the Tioga Road and parking areas. These in-park sources of light pollution would continue to affect the lightscape of the Tuolumne Meadows area during the summer season.

At the administrative area below the O’Shaughnessy Dam, artificial light associated with dam-related facilities would continue to affect dark night skies in the area.

With the exception of the administrative area below O’Shaughnessy Dam, vehicle access and most overnight use in the corridor occurs during the summer (approximately June to October); therefore, the impacts of in-park artificial light would only occur during that period.

Conclusion

Under the no-action alternative, lightscapes in designated Wilderness areas would continue to be dominated by sources of natural light and dark night skies. In-park sources of light pollution, including occasional campfires, vehicle headlights, and artificial lighting in Tuolumne Meadows and Glen Aulin, would have a local long-term negligible to minor adverse impact on lightscapes in wild segments, primarily in areas near roads and other facilities.

In Tuolumne Meadows, Glen Aulin, and the administrative area below O’Shaughnessy Dam, lightscapes would continue to be shaped by a combination of limited lighting at administrative facilities and visitor service areas,

vehicle headlights along the Tioga Road and administrative roads, and campfires in campgrounds. Overall, in-park sources of light in scenic segments would continue to have a local long-term minor adverse impact on lightscapes.

Cumulative Impacts

No past, current, or reasonably foreseeable cumulative actions are planned or approved within the park that, in combination with the no-action alternative, would affect lightscapes in the vicinity of the Tuolumne River corridor. The corridor would continue to be affected by light pollution generated outside park boundaries.

Environmental Consequences of Alternative 1

Wild Segments

As in the no-action alternative, the continuation of current park wilderness policies, including limits on amounts and locations of overnight use, would result in lightscapes dominated by sources of natural light and dark night skies. Lightscapes along the Lyell and Dana segments would remain near pristine; below Tuolumne Meadows night skies would continue to be affected by sky glow.

The elimination of sources of artificial light associated with Tuolumne Meadows Lodge, some employee housing, and administrative facilities at Tuolumne Meadows and the elimination of the Glen Aulin High Sierra Camp would almost eliminate the impact on lightscapes in the adjacent wilderness. The only remaining impact would be caused by vehicle headlights visible in wilderness along the lower Dana Fork and light caused by campfires. The only in-park sources of artificial light in the wilderness below Hetch Hetchy Reservoir would be a very occasional campfire.

Alternative 1 would result in the elimination of nearly all in-park sources of artificial light in the Glen Aulin area, except for the backpacker campground, thereby reducing the overall effect of artificial lighting on the local lightscape.

Scenic Segments

In Tuolumne Meadows, alternative 1 would result in the elimination of nearly all in-park sources of artificial light in the Tuolumne Meadows area, except for vehicle corridors, the campground (at a reduced capacity), remaining employee housing areas, and remaining facilities that would require lighting for safety and security (e.g., the wastewater treatment facility). Demolition, restoration, and construction activities could have short-term adverse impacts on lightscapes; these activities would be conducted during daylight, and any dust would likely disperse or settle during the night. Construction impacts would be expected intermittently throughout the lifetime of the *Tuolumne River Plan*. Night skies in Tuolumne Meadows would still be considered near pristine; however, compared to the no-action alternative, alternative 1 would substantially reduce in-park artificial sources of light and the overall effect of artificial lighting on the lightscape during the summer season.

At the administrative area below the O'Shaughnessy Dam, artificial light associated with dam-related facilities would continue to affect dark night skies.

As with the no-action alternative, with the exception of the administrative area below O'Shaughnessy Dam, vehicle access and most overnight use in the corridor would only occur during the summer (approximately June to October); therefore, the impacts of in-park artificial light would only occur during that period.

Conclusion

Under alternative 1, lightscapes in designated Wilderness areas would continue to be dominated by sources of natural light and dark night skies. Adverse impacts on lightscapes in the lower Dana Fork wilderness area would be reduced by the elimination of sources of artificial light from Tuolumne Meadows, resulting in a local

long-term moderate beneficial impact. Some in-park sources of light pollution, including occasional campfires and vehicle headlights, would continue in wilderness, primarily in areas near roads and other facilities.

In Tuolumne Meadows and Glen Aulin, the elimination of the majority of artificial light sources would reduce the effect of in-park sources of artificial light. In the administrative area below O'Shaughnessy Dam, lightscapes would continue to be shaped by limited lighting at administrative facilities. This would result in a local long-term minor beneficial impact on lightscapes in scenic segments.

Cumulative Impacts

No past, current, or reasonably foreseeable cumulative actions are planned or approved within the park that would affect lightscapes in the vicinity of the Tuolumne River corridor in combination with alternative 1. The river corridor would continue to be affected by light pollution generated outside park boundaries.

Environmental Consequences Common to Alternatives 2–4

The impacts on lightscapes under alternative 2, 3, or 4 would be essentially the same; therefore, these action alternatives are addressed collectively, below.

Wild Segments

As in the no-action alternative, the continuation of current park wilderness policies, including limits on amounts and locations of overnight use, would result in lightscapes dominated by sources of natural light and dark night skies. Lightscapes along the Lyell Fork and Upper Dana Fork segments of the river corridor would remain near pristine; to the west of Tuolumne Meadows, night skies would continue to be affected by some sky glow.

In-park sources of light pollution in wilderness would include the occasional campfire, light sources from adjacent nonwilderness areas (principally Tuolumne Meadows), and vehicle headlights from nearby roads (primarily Tioga Road). Along almost all of the Lyell Fork and the upper Dana Fork, sources of artificial light pollution would remain limited to campfires and flashlights. Along the lower Dana Fork, vehicle headlights along Tioga Road and administrative roads, combined with artificial light sources in parking areas, at the Tuolumne Lodge, and in housing and administrative areas would continue to affect lightscapes in the adjacent wilderness areas. The Grand Canyon segment would remain generally unaffected by in-park sources of light pollution other than campfires and flashlights. Natural lightscapes would remain predominant at Glen Aulin. Implementation of alternative 2, 3, or 4 would result in continued sources of artificial light associated with the operation of the camp (e.g., propane lights), and campfires. The only in-park sources of artificial light in the wilderness below Hetch Hetchy Reservoir would be a very occasional campfire.

Scenic Segments

Alternative 2, 3, or 4 would result in either the consolidation or relocation of some in-park sources of artificial light within the Tuolumne Meadows area; however, these actions would not be expected to have a substantial effect on lightscapes. The in-park sources of artificial light would be primarily confined to the upland areas south of the meadows and would be designed in accordance with the *Yosemite Exterior Lighting Guidelines* (NPS 2008j). As with the no-action alternative, lightscapes in portions of the meadows would be affected by a combination of vehicle headlights emanating from the Tioga Road and administrative roads, limited artificial lighting at employee housing areas, facilities that would require lighting for safety and security (e.g., the wastewater treatment facility), Tuolumne Meadows Lodge, and campfires in the campground. Vehicle lights would continue to have a relatively widespread impact due to the expanse of the meadows, with impacts the most intense immediately adjacent to the Tioga Road and parking areas. Demolition, restoration, and construction activities would have a short-term, negligible, adverse impact on lightscapes; these activities would be conducted during daylight, and any dust would likely disperse or settle during the night. Construction impacts would be expected intermittently throughout the lifetime of the approved *Tuolumne River Plan*. Night

skies in the Tuolumne Meadows area would remain ‘near pristine’ with implementation of any action alternative.

At the administrative area below the O’Shaughnessy Dam, artificial light associated with dam-related facilities would continue to affect dark night skies.

As with the no-action alternative, with the exception of the administrative area below O’Shaughnessy Dam, vehicle access and most overnight use in the corridor would only occur during the summer (approximately June-October) under alternative 2, 3, or 4; therefore, the impacts of in-park artificial light would only occur during the summer with implementation of any of these alternatives.

Conclusion

Implementation of alternative 2, 3, or 4 would result in lightscares in designated Wilderness areas that would continue to be dominated by sources of natural light and dark night skies. In-park sources of light pollution, including occasional campfires, vehicle headlights, and artificial lighting in Tuolumne Meadows and Glen Aulin, would have long-term negligible adverse impacts on lightscares in wilderness, primarily in areas near roads and other facilities.

In Tuolumne Meadows and the administrative area below O’Shaughnessy Dam, lightscares would continue to be shaped by a combination of limited lighting at administrative facilities and visitor service areas, vehicle headlights along the Tioga Road and administrative roads, and campfires in campgrounds. With implementation of alternative 2, 3, or 4, in-park sources of light would continue to have a local long-term minor adverse impact on lightscares.

Cumulative Impacts

No past, current, or reasonably foreseeable cumulative actions are planned or approved within the park that would affect lightscares in the vicinity of the Tuolumne River corridor. The corridor would continue to be affected by light pollution generated outside park boundaries.

Soundscapes

Affected Environment

Soundscapes include all of the sounds in the environment, both human-caused and natural. By definition, ‘noise’ is human-caused sound that is considered unpleasant and unwanted. Depending on the situation, not all human-caused sound may be noise. For instance, if a person works in an office, sounds from printers, copiers, and keyboards are generally acceptable and not considered unpleasant or unwanted. By comparison, when people are in a wilderness area, there is an expectation of a more natural experience with very little or no human-caused sound. In these situations, any human-caused sound would probably be considered noise. The desired natural sounds would be referred to as natural quiet, a term used to describe ambient (outdoor) natural sounds in the absence of human intrusion.

The natural sounds adjacent to the Tuolumne River in Yosemite National Park include the movement of the river itself, the thundering of waterfalls in spring and early summer, the wind in the trees, the sometimes forceful movement of wind in the canyons, the rustling of grasses and willows, birdsong and chatter, coyote howls, the hush of a snow-covered landscape, and the echo of thunder over the mountains.

Protecting these natural sounds is important both to the visitor experience and the ecological integrity of natural resources in the Tuolumne River corridor. Wild places provide visitors refuge from noise, where they can instead become attuned to the historic and natural character of the High Sierra wilderness. Natural soundscapes are also important to wildlife: birds use sound to define territories, attract mates, and even navigate dense forest canopies, while other animal species use sound to keep track of predators and prey.

National Park Service Standards and Regulations

NPS management policies direct parks to “preserve, to the greatest extent possible, the natural soundscapes of parks.” This includes restoring soundscapes to natural conditions if they have become degraded by unnatural sound (noise) and protecting natural soundscapes from unacceptable impacts. It is up to park managers to decide what constitutes acceptable or unacceptable impacts on natural soundscapes, while recognizing that “frequencies, magnitudes, and durations of acceptable levels of unnatural sound will vary throughout a park, being generally greater in developed areas” (NPS 2006g).

NPS *Director’s Order 47: Soundscape Preservation and Noise Management* (DO-47) addresses the problem of excessive or inappropriate noise levels, and directs park managers to do the following:

- Measure baseline acoustic conditions.
- Determine which existing or proposed human-caused sounds are consistent with park purposes.
- Set acoustic management goals and objectives based on those purposes.
- Determine which noise sources are affecting the park and need to be addressed.

DO-47 requires park managers to evaluate and address noise generated in the park and also noise sources generated by other federal agencies and to

...constructively engage with those responsible for other noise sources that impact parks to explore what can be done to better protect parks. In this regard, the Service will give appropriate recognition and weight to the vital missions of other government agencies, such as the Federal Aviation Administration (FAA) and the military services, and respect the rights of park neighbors.
(NPS 2000g)

The current interpretation of these soundscape policies is that the NPS must protect natural sound environments, but also address what might be appropriate levels of human-generated sound in light of why a park was established. For instance, some human sounds may be entirely appropriate for the purposes of interpretation and increased understanding of park resources, such as interpretive talks or American Indian traditional cultural practices (NPS 2007n).

Soundscape management is also addressed in NPS management policies:

Using appropriate management planning, superintendents will identify what levels and types of unnatural sound constitute acceptable impacts on park natural soundscapes. The frequencies, magnitudes, and durations of acceptable levels of unnatural sound will vary throughout a park, being generally greater in developed areas. (NPS 2006g, section 4.9)

At Yosemite National Park, the 1980 *Yosemite General Management Plan* does not specifically address soundscapes within the Tuolumne River corridor, although it does call for the NPS to limit unnatural sources of sound to the greatest extent possible. The NPS Natural Sounds and Night Skies Division works servicewide to assist park managers with applied research programs to protect natural sounds (as well as dark night skies, addressed under “Lightscapes,” above).

Existing Sources of Noise in the Tuolumne River Corridor

In 2006, Newman and others conducted a study to identify the types of sounds heard by park visitors during their visit to Tuolumne Meadows. Participants were asked to listen for three minutes at key visitor use sites that represented subalpine acoustical zones: at Twin Bridges and at an area between Lembert Dome and Parsons Memorial Lodge. These zones are composed of a diversity of natural and humanmade sounds. Visitor perceptions of those sounds and the frequency with which each of the sounds were heard were recorded.

Sounds associated with the natural landscape were rated as pleasing and acceptable, while some human-caused or mechanical sounds were rated as annoying and unacceptable. The less intrusive humanmade sounds were rated as neutral. The study revealed that visitors heard the following sounds: aircraft, vehicle engines, loud children, water, wind, bird song, bird chatter, people walking, and people talking (table 9-9). The most frequently heard sounds were natural: water, wind, and birdsong and chatter. The most frequently heard unnatural sounds were high-altitude aircraft overflights, followed by human voices, “walking sounds,” and vehicle noise.

Aircraft

As part of an aircraft overflight report to Congress in 1994, the NPS conducted a visitor use survey to determine the effects of aircraft noise on the visitor experience. Of the visitors surveyed, 55% reported hearing aircraft sometime during their visit. The report notes that recognition of noise from aircraft was highly variable from location to location and that impacts were greater when visitors removed themselves from automotive transportation and areas where other visitors were present. In Yosemite, a majority of the complaints came from wilderness trail users (NPS 1994a).

The 1994 study found that aircraft were audible at Soda Springs more than 50% of the time during measurements conducted 12 times over one to three days (for a total measurement time of about six hours at each site) (NPS 1994a). Similar results were found in 2006 when 51% of visitors reported hearing aircraft noise. Because aircraft noise was also considered to be “annoying and unacceptable,” the authors of this study recommended that addressing aircraft sounds should be considered as a first priority for NPS management consideration (Newman et al. 2006). The NPS addresses aircraft noise at a national level, through the Natural Sounds and Night Skies Division.

Motor Vehicles and Human Activity

Corridorwide, motor vehicle noise is generated by visitor, NPS, and concessioner vehicles along the Tioga Road and Hetch Hetchy Road. In Tuolumne Meadows, motor vehicle noise is associated with areas of concentrated visitor and administrative use, including Tioga Road, the visitor center, Tuolumne Meadows campground, Tuolumne Meadows Lodge, the wilderness center, NPS and concessioner stables, the Tuolumne Meadows store and public fuel station, Bug Camp, and Ranger Camp. Noise from motor vehicles is loudest immediately adjacent to roads and parking areas, but due to generally low levels of natural sound in the background, motor vehicle noise may be audible a long distance from roads. Other noises associated with human activities in the Tuolumne River corridor include human voices, stock, sounds associated with administrative activities (e.g., radios or chainsaws), and other activities (e.g., lodging, camping, and housing).

Atmospheric conditions (e.g., wind, temperature, humidity, rain, or snow) and topography (e.g., the bowl shape of Tuolumne Meadows or the granite walls in Lyell Canyon) can significantly affect the presence or absence of noise in the Tuolumne River corridor. In general, noise would be expected to be louder in areas where human activities are concentrated and where sound reverberates between natural features, such as canyon walls. The frequency, volume, and source of these noises vary dramatically by season, with the highest levels of noise expected during periods when the Tioga Road is open and accessible by motor vehicles.

Noise can affect an animal’s physiology and behavior, and if it becomes a chronic stress, noise can be injurious to an animal’s energy budget, reproductive success, and long-term survival (Radle 1998; Stone 2000; Brumm 2004). Road noise specifically has been implicated in the disturbance of several bird species and resulted in decreased densities of breeding pairs in the vicinity of roads (Krause 2001).

Public comment on the *Draft Tuolumne River Plan/EIS* indicated that motorcycle noise impacts visitors and is a safety issue for some (i.e., climbers). The NPS Natural Sounds and Night Skies Division is developing an education and outreach effort to help parks communicate the importance of protecting park soundscapes in

terms of ecological integrity and visitor experience and, specifically, the effects of excessive motorcycle noise. In anticipation of this effort, a packet of educational materials and tools are being developed, independent of this planning effort, for the motorcycle riding community, park visitors, and the general public.

Sound Level Measurements in the Tuolumne River Corridor

During the 2006 study, 24% of respondents reported hearing motor vehicle sounds. These noises were rated as slightly annoying and slightly unacceptable. Consequently, the authors of the study recommended that these sounds be considered second priority for management behind aircraft sounds (Newman et al. 2006).

Other sounds commonly reported by visitors included water, wind, bird song, bird chatter, walking sounds, voices, and loud children. Of these, only loud children, heard by 12% of visitors, was considered annoying (table 9-9).

Table 9-9.
Types, Frequencies, and Ratings of Sounds Heard at Visitor Use Sites in Tuolumne Meadows

Sound	Frequency	Rating
Aircraft jets	33%	Annoying, unacceptable
Aircraft unknown	18%	Annoying, unacceptable
Vehicle engine	24%	Slightly annoying, slightly unacceptable
Loud children	12%	Annoying, neutral
Water	78%	Pleasing, acceptable
Wind	74%	Pleasing, acceptable
Bird song	72%	Pleasing, acceptable
Bird chatter	57%	Pleasing, acceptable
Walking sounds	68%	Neutral
Voices	67%	Neutral

Source: Newman et al. 2006

Environmental Consequences Methodology

The methodology for evaluating impacts on soundscapes was adapted from those provided by the Natural Sounds Program Office of the NPS (NPS 2007n). The soundscapes impact assessment involves the identification and qualitative description of the types, characteristics, and sources of actions proposed under each alternative that could affect the ambient acoustic environment. For most sound sources, such characteristics would include the location and movement of the source, its operational features that produce sound, and how the sound would be distributed over time (NPS 2007m). Impacts are described as potential changes in the existing soundscape resulting from the proposed actions, as compared to existing conditions (NPS 2007n).

The analysis of effects to soundscapes is qualitative, with professional judgment applied to reach reasonable conclusions as to the context, intensity, and duration of potential impacts.

Impact Assessment Definitions

The soundscapes impact assessment evaluates how the three basic types of changes of the plan noted above would affect the ambient acoustic environment in the corridor. Impacts were evaluated in terms of their context, intensity, and duration, and whether the impacts were considered to be beneficial or adverse.

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts would be those that occur within the vicinity of the proposed action. In considering soundscape impacts, it was assumed that the impacts would be consistently local.

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts would be undetectable and would have no discernible effect on the ambient

environment. Minor impacts would be slightly detectable but not expected to have an overall effect on those conditions. Moderate impacts would be clearly detectable and could have an appreciable effect. Major impacts would have a substantial, highly noticeable influence on the ambient environment.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration or transitory in effect, such as construction noise or noise from passing motor vehicles. A long-term impact would have a permanent effect on the ambient environment, such as ongoing noise from stationary sources like generators.

Type: Impacts are evaluated in terms of whether they would be beneficial or adverse to the ambient environment. Beneficial impacts would reduce associated levels of noise, while adverse impacts would have the opposite effect.

Due to the relatively limited amount of visitor and administrative use and the nearly complete absence of motorized uses in the corridor during the winter (with the exception of emergency administrative use), natural soundscapes are as intact as possible, given the park's purpose. With the exception of the administrative area below O'Shaughnessy Dam, motor vehicle access and most overnight use in the corridor occurs from approximately May to November; therefore, the impacts of in-park unnatural sound would only occur during that period.

Environmental Consequences of the No-Action Alternative

Wild Segments

The continuation of current park wilderness policies under the no-action alternative, including limits on amounts and locations of overnight use and minimum-requirement management practices, would result in soundscapes dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice or sound made by stock in the more than 90% of the river corridor that is congressionally designated Wilderness. High-altitude aircraft overflights would continue to be the primary source of adverse impacts on natural soundscapes in wilderness areas. Aircraft noise would be discernible year-round.

Some impacts on natural soundscapes are expected in areas of concentrated use near Tioga Road in comparison to more natural settings in the designated Wilderness. In-park sources of unnatural sound in wilderness that affect the natural soundscape would generally include the occasional human voice, sounds from stock, or administrative activities (e.g., trail maintenance). In wilderness areas close to the Tioga Road and Tuolumne Meadows, human-caused sound could also include motor vehicle and equipment noise and more apparent sounds of visitor and administrative activity.

At Glen Aulin, natural sounds predominate, but some impacts on soundscapes include the sounds of stock on trails and at the corrals, the sounds associated with overnight use at the High Sierra Camp and backpackers campground (e.g., human voices), and administrative activities such as facility maintenance and the facility's generators (one generator is used in early morning and evening for wastewater treatment; the other generator is used very rarely as a backup for an emergency water system). Helicopters occasionally land at a bluff above the camp to support operation of the camp, fire management, or search and rescue, with resulting adverse impacts on the natural soundscape.

In wilderness areas close to Glen Aulin, human sound associated with use of the camp and relatively high levels of day use affect the natural soundscape.

Scenic Segment

In Tuolumne Meadows, the results of the 2006 study discussed under "Affected Environment," above (Newman et al. 2006), suggest that natural soundscapes would remain dominant in the meadows, even at

popular destinations, but that noise would remain a common occurrence. High-altitude aircraft overflights, which are outside of the control and jurisdiction of the NPS, would continue to be the primary source of adverse impacts on natural soundscapes in Tuolumne Meadows.

In-park sources of unnatural sound would be motor vehicle noise along the Tioga Road and administrative roads, and other human-caused sounds (e.g., voices and activity) close to visitor service and administrative areas, the campground, and popular destinations, such as the Soda Springs complex. Although the most common human-caused noises (walking sounds and voices) were rated ‘neutral’ for annoyance and acceptability, human activity in areas of concentrated use would have an adverse impact on natural soundscapes. In areas where motor vehicle or equipment noise was also evident, there would be additional adverse impacts.

At the administrative area below the O’Shaughnessy Dam, natural sounds are dominant, with some intrusion associated with administrative activity, primarily along roads in the corridor. Human-caused sounds, such as voices, are occasional. These soundscape conditions would continue under the no-action alternative.

Conclusion

Under the no-action alternative, soundscapes in designated Wilderness would continue to be dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice or sound made by stock. High-altitude aircraft overflights would continue to be the primary source of adverse impacts on natural soundscapes in both wilderness and nonwilderness areas in the Tuolumne River corridor. In wilderness areas close to the Tioga Road and Tuolumne Meadows, human-caused sound could also include motor vehicle and equipment noise and more apparent sounds of visitor and administrative activity. Overall this results in a local short-term moderate adverse impact in wild segments of the corridor.

In developed areas at Tuolumne Meadows, Glen Aulin, and the administrative area below O’Shaughnessy Dam, the effects of human-caused sounds adjacent to Tioga Road and Hetch Hetchy Road, along major trails, at popular destinations, and in visitor service and administrative areas would continue to have local short-term minor to moderate adverse impacts under the no-action alternative. Management actions would be passive, with little mitigation towards reducing human-caused sounds.

Cumulative Impacts

Short-term adverse impacts on ambient noise levels could result from construction activities associated with some of the current and reasonably foreseeable actions planned or approved within the park (see appendix L) in combination with the no-action alternative, including the projects to improve the communication data network and to rehabilitate Tioga Road, both of which would involve construction activities along Tioga Road in Tuolumne Meadows. The adverse impacts from these construction activities would be local and short term in nature and primarily related to construction-generated motor vehicle traffic and operation of equipment near Tioga Road. Although limited to daytime, construction noise would be noticeable to visitors and, at site-specific locations, could dominate the ambient environment during periods of heavy equipment use or grading and demolition. Cumulative noise generated by these construction actions would result in a local short-term moderate adverse impact on soundscapes.

Nearby work that could contribute to increased motor vehicle traffic and corresponding impacts on soundscapes are the Tioga Road trailheads project and the *Tenaya Lake Area Plan*. Past construction projects in the vicinity of the Tuolumne River corridor would not have a cumulative impact in combination with the no-action alternative because impacts on soundscapes were temporary in nature and have since ended.

As noted in the affected environment, the NPS is addressing two sources of noise that impact the river corridor – aircraft overflights and motorcycle noise-- as part of a national effort to address natural soundscapes. The results of these national level efforts could result in long-term, minor to major beneficial impacts.

Environmental Consequences of Alternative 1

Wild Segments

As in the no-action alternative, the continuation of current park wilderness policies, including limits on amounts and locations of overnight use and minimum-requirement management practices, would result in soundscapes dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice or sound made by stock.

High-altitude aircraft overflights, which are outside of the control and jurisdiction of the NPS, would continue to be the primary source of adverse impacts on natural soundscapes in wilderness areas.

In-park sources of unnatural sound in wilderness that affect the natural soundscape would generally include the occasional human voice or administrative activities (e.g., trail maintenance). The elimination of concessioner stock use day rides, reduced concessioner pack stock use in support of High Sierra Camp operations, and elimination of commercial stock use in wilderness would reduce the level of noise associated with stock. As with the no-action alternative, wilderness areas close to the Tioga Road and Tuolumne Meadows would still have some human-caused sounds including motor vehicle and equipment noise under alternative 1.

Wilderness areas close to Tuolumne Meadows and Glen Aulin would no longer be affected by unnatural sounds associated with concentrated visitor and administrative use in those areas because the majority of development would be removed and visitor use would be limited and dispersed. The closure of the Glen Aulin High Sierra Camp would eliminate the unnatural sounds associated with the operation of the camp. Wilderness use of the Glen Aulin area would continue, along with the sounds of human voices and trail maintenance activities. Helicopter use associated with the operation of the Glen Aulin High Sierra Camp would be discontinued.

Scenic Segment

Soundscapes at Tuolumne Meadows would continue to be affected by aircraft noise, motor vehicle noise along Tioga Road, and other human-caused sounds (e.g., voices), although there would be fewer sources of noise due to the elimination of commercial services, associated housing areas, and substantial reductions in pack stock use under alternative 1.

The volume of through-traffic would remain the same as with the no-action alternative. The impacts of motor vehicle noise and human-caused sounds would continue to be greatest south of Tioga Road in concentrated use areas, including the campgrounds, the visitor contact station, and administrative areas. Unnatural sounds in these locations would continue to affect the natural soundscape; however, the extent of this impact would be considerably reduced under alternative 1 compared to the no-action alternative.

Some sources of human-caused sounds in this area may be entirely appropriate for its role as an outpost for wilderness experience. Continued monitoring would assist the NPS in determining if noise is approaching undesirable levels and whether to adjust administrative uses, enforce existing noise-related regulations, or develop new regulations in response. High-altitude aircraft overflights, which are outside of the control and jurisdiction of the NPS, would continue to be the primary source of adverse impacts on natural soundscapes in wilderness areas.

Demolition, restoration, and construction activities could have short-term adverse impacts on soundscapes; these activities would be conducted during the daylight and would be expected intermittently throughout the

lifetime of the *Tuolumne River Plan*. The type of noise generated during the demolition and construction activities would include the operation of heavy equipment, voices of construction workers, and noise associated with material haul vehicles; these noises could affect nearby recreational users, employees, and wildlife. Noise effects in the construction area would vary depending on a number of factors, such as the number and types of equipment in operation on a given day, equipment usage rates, the level of background noise in the area, and the distance between sensitive uses and demolition and construction activities. Although limited to the daylight hours, construction noise would be noticeable to visitors and, at site-specific locations, could dominate the ambient environment during periods of heavy equipment use or grading and demolition.

At the administrative area below the O'Shaughnessy Dam, natural sounds would remain dominant, with some intrusion associated with administrative activity, primarily along roads in the corridor.

Conclusion

With implementation of alternative 1, soundscapes in wild segments would continue to be dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice. Effects of in-park sources of noise on soundscapes in designated Wilderness would be negligible except in wilderness areas near Tioga Road in the Tuolumne Meadows and Lower Dana Fork segments, or along Hetch Hetchy Road, where motor vehicle noise would continue. Effects of in-park sources of noise in the Tuolumne Meadows area would be reduced with the elimination of commercial services and associated administrative uses.

Overall, alternative 1 would result in a local long-term minor to moderate beneficial impact on natural soundscapes, when compared with the no-action alternative. High-altitude aircraft overflights, which are out of the control and jurisdiction of the NPS, would continue to be the primary source of adverse impacts on natural soundscapes in both wilderness and nonwilderness areas in the Tuolumne River corridor.

Cumulative Impacts

Cumulative impacts under alternative 1 would be the same as described for the no-action alternative. In conjunction with construction and demolition activities proposed under alternative 1, cumulative noise generated by these planned construction activities would result in a local short-term minor to moderate adverse impact on soundscapes.

Environmental Consequences of Alternatives 2–4

The impacts on soundscapes under alternative 2, 3, or 4 would be essentially the same; they would only differ slightly in the distribution of noise sources at Tuolumne Meadows. Therefore, these alternatives are addressed collectively, below.

Wild Segments

As with the no action alternative, the continuation of current park wilderness policies, including limits on amounts and locations of overnight use and minimum-requirement management practices, would result in soundscapes dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice or sounds made by pack stock. High-altitude aircraft overflights would continue to be the primary source of adverse impacts on natural soundscapes in wilderness areas. Aircraft noise would be discernible year-round.

In-park sources of unnatural sound in wilderness would continue to affect the natural soundscape, including the occasional human voice, sounds from stock, or administrative activities (e.g., trail maintenance). In wilderness areas close to the Tioga Road (including the length of the Dana Fork) and Tuolumne Meadows, human-caused sound, including motor vehicle and equipment noise and more apparent sounds of visitor and administrative activity, would continue.

As with the no-action alternative, natural sounds would continue to predominate at Glen Aulin, with impacts on soundscapes that would include the sounds of stock on trails and at the corrals, sounds associated with overnight use at the High Sierra Camp and backpackers campground (e.g., human voices), and administrative activities (e.g., facility maintenance, although the generators would be removed in alternative 2). Helicopter use in support of operations at Glen Aulin High Sierra Camp, fire management, or search and rescue would continue to have adverse impacts on the natural soundscape, although this impact would be decreased under alternatives 2 and 4, as most helicopter use in support of the High Sierra Camp would be eliminated.

With implementation of alternative 2, 3, or 4, short-term increases in construction staff, associated stock support, and helicopter transport of materials would be expected during construction activities. These noises could adversely affect nearby recreational users, employees, and wildlife.

Scenic Segments

With implementation of alternative 2, 3, or 4, natural soundscapes, would remain dominant in the meadows, even at popular destinations, but noise would remain a common occurrence. Human activity in areas of concentrated use would continue to affect natural soundscapes, and in areas where motor vehicle or equipment noise was also evident, additional adverse impacts would be expected.

In-park sources of unnatural sound would remain generally the same under alternative 2, 3, or 4 as with the no-action alternative, although the location of some noises might shift from one location to another (e.g., as a result of the consolidation of uses to areas south of Tioga Road under any of these action alternatives). Primary sources of unnatural sound would continue to be motor vehicle noise along Tioga Road and administrative roads, and other human-caused sounds (e.g., voices and activity) close to visitor service and administrative areas, the campground, and popular destinations, such as the Soda Springs complex. The alternatives would slightly increase or decrease the amount of vehicles stopping in the Tuolumne Meadows area due to the variations in parking availability and public transit allowed under alternatives 2, 3, and 4. For instance, the potential for up to three additional 45-passenger regional transit buses per day traveling Tioga Road in alternative 4 could increase motor vehicle noise at the meadows for very short periods of time. The magnitude of this impact would depend on the time of day the buses were traveling the road (e.g., based on NPS staff observations, motor vehicle noise at the meadows is more noticeable in the early morning than at midday). However, since these alternatives would not alter the overall traffic volume or limit the types of vehicles traveling Tioga Road, the localized differences among the alternatives, with regards to motor vehicle noise, would be slight.

Sources of human-caused sounds in the Tuolumne Meadows area and along Tioga Road might be entirely appropriate to its use as a frontcountry visitor service and staging area along a trans-Sierra highway. Monitoring would allow the NPS to determine if noise was approaching undesirable levels and to adjust administrative uses, enforce existing noise-related regulations, or develop new noise-related regulations in response. High-altitude aircraft overflights, which the NPS is addressing at a national level, would continue to be the primary source of adverse impacts on natural soundscapes in wilderness areas.

The type of noise generated during the demolition and construction activities would include the operation of heavy equipment, voices of construction workers, and noise associated with material haul vehicles; these noises could affect nearby recreational users, employees, and wildlife. Noise effects in the construction area would vary depending on a number of factors, such as the number and types of equipment in operation on a given day, equipment usage rates, the level of background noise in the area, and the distance between sensitive uses and demolition and construction activities. Although these activities would be limited to daylight, construction noise would be noticeable to visitors and, at site-specific locations, could dominate the ambient environment during periods of heavy equipment use or grading and demolition.

At the administrative area below the O'Shaughnessy Dam, natural sounds are and would continue to be dominant under alternative 2, 3, or 4, with some intrusion associated with administrative activity, primarily along roads in the corridor. Human-caused sounds, such as voices, would be occasional.

Conclusion

With implementation of alternative 2, 3, or 4, soundscapes in wild segments of the Tuolumne River corridor would continue to be dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice or sound made by stock. Effects of in-park sources of noise on soundscapes in designated Wilderness would be negligible except in wilderness areas near Tioga Road in the Tuolumne Meadows and Lower Dana Fork segments, or along Hetch Hetchy Road, where motor vehicle noise would continue.

In Tuolumne Meadows and the administrative area below O'Shaughnessy Dam, the effects of human-caused sounds adjacent to roads, along major trails, at popular destinations, and in visitor service and administrative areas would continue to affect natural soundscapes. However, some human-caused noise is considered entirely appropriate for realizing the purpose of frontcountry locations. Construction-related noise during project implementation would result in local short-term minor to moderate adverse impacts.

Overall, alternative 2, 3, or 4 would result in a local long-term negligible adverse impact compared with the no-action alternative and local short-term minor to moderate adverse impacts due to construction and demolition activity. High-altitude aircraft overflights, which are out of the control and jurisdiction of the NPS, would continue to be the primary source of adverse impacts on natural soundscapes in both wilderness and nonwilderness areas in the river corridor.

Cumulative Impacts

Cumulative impacts under either alternatives 2, 3, or 4 would be the same as described for the no-action alternative. In conjunction with construction and demolition activities proposed under these action alternatives, cumulative noise generated by the planned construction activities would result in a local short-term minor to moderate adverse impact on soundscapes.

Air Quality

Affected Environment

Overview

Air quality is determined by several factors, including the location of air pollution sources, the types and amounts of air pollutants emitted, and the interaction between atmospheric conditions (such as wind speed and direction) and the physical landscape.

Air quality on the western slope of the Sierra Nevada is tied to atmospheric conditions that funnel air pollutants from the Central Valley of California up west-facing canyons to higher elevations. This mechanism for pollutant transport is strongest in summer, nearly nonexistent in winter, and more pronounced in the southern portion of the Sierra Nevada range.

Generally, levels of fine particles (suspended particular matter [PM]-2.5) and ozone measured in the Tuolumne River corridor and vicinity meet federal standards. However, large wildfires and air stagnation in summer can periodically result in elevated ozone and fine particle levels, even at higher elevations. Below 8000 feet, ozone in the Tuolumne River corridor may be as bad as or worse than in the Central Valley to the west. This is because the more gentle, regional westerly slope winds generated by the rising topography of the Sierra Nevada foothills provides enough wind, even on some of the most stagnant days, to cause pollutants from the Central Valley to

the west to drift into the Sierra Nevada mountains. Lower level transport due to vigorous canyon winds can aid and enhance this regional effect.

Meadow environments appear to be an exception to this rule for ozone, likely because flat topography traps descending cold air at night, creating a shallow inversion layer that isolates air near the ground from elevated ozone pollution in the free air aloft. Ozone measurements in Yosemite Valley, the meadows east of Tenaya Lake, Dana Meadows, and Tuolumne Meadows show that these flat mountain meadow environments tend to have low nighttime ozone, recover rapidly from high ozone levels during the day, and have lower overall ozone as a result.

These types of areas also often contain prime camping sites and are very sensitive to accumulations of fine particles from campfire smoke, which gets trapped beneath the same shallow inversion layer that protects the areas from ozone in the air aloft (Burley and Ray 2007). NPS data show that because of campground smoke, air quality in Tuolumne Meadows campground is not exceptionally clean with respect to fine particles. In fact, levels of fine particles exceed state guidelines for smoke exposures for sensitive individuals a significant fraction of the time. This impact, however, appears to be unique to very large campgrounds like Tuolumne Meadows campground and is likely limited to the area immediately surrounding the campground, though “downcanyon” impacts could theoretically occur. The rest of the meadow complex, especially above the campground, likely sees little impact.

Federal and State Ambient Air Quality Standards

The 1970 Clean Air Act (42 *United States Code* [USC] 7401 et seq.) requires the USEPA to establish national ambient air quality standards (NAAQS) and to periodically reassess whether these standards are adequate to protect public health and the national welfare, including those resources and values associated with national parks and wilderness areas. The NAAQS set thresholds for ‘criteria pollutants,’ including ozone, carbon monoxide, nitrogen oxides, sulfur dioxide, suspended particulate matter (PM-10 and PM-2.5), and lead.

Under the 1988 California Clean Air Act, the California Air Resources Board has also adopted standards for these criteria pollutants (called California Ambient Air Quality Standards, or CAAQS) and applies additional standards for pollutants that are not currently included in the national standards. The federal and state ambient standards differ in some cases; in general, the California standards are more stringent, particularly for ozone and PM-10. Both the USEPA and the California Air Resources Board classify air basins in California as in either *attainment* or *nonattainment* with their respective standards. A status of *attainment* means that both NAAQS and CAAQS have been met; *nonattainment* status indicates that either or both standards have been exceeded; and *unclassified* status indicates that data collected were not sufficient to make a determination. An area is in nonattainment with federal standards if a primary NAAQS has been exceeded more than three discontinuous times in three years in a given area. An area is in nonattainment with state standards if a CAAQS has been exceeded more than once in 3 years.

The federal government delegates the inventory of all criteria pollutants to the state, which inventories emissions and regulates the emissions of primary pollutants in order to perform this regulatory function and assess air quality under the NAAQS and CAAQS. Some of these standards contain both primary standards for human health and secondary standards for more indirect (e.g., ecological) endpoints, including acidification and eutrophication of lakes. The NPS assists the State of California by measuring concentrations of pollutants and monitoring ecological endpoints to help evaluate the efficacy of secondary NAAQS and CAAQS. California is divided into air basins that are defined in part by their meteorological and topographic characteristics. The air quality of all air basins in California is routinely monitored using both federal and state air quality standards. The Tuolumne River corridor is located within Tuolumne County, near the southern end of the Mountain Counties Air Basin.

Table 9-10 presents the federal and California ambient air quality standards and attainment status for Tuolumne County. As of 2012 (the most recent data available), Tuolumne County is designated as in nonattainment status for state ozone standards. Tuolumne County is in *attainment* with or *unclassified* for all NAAQS, as shown in table 9-10.

Table 9-10.
California and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards ^a Concentration	Federal Standards ^b (Primary ^c)	Federal Standards ^b (Secondary ^d)	Tuolumne County Attainment Status ^e
Ozone	1 hour	0.09 ppm (180 µg/m ³)	-	Same as primary standard	<i>nonattainment (state)</i> <i>unclassified (federal)</i>
	8 hour (2006)	0.070 ppm (137 µg/m ³)	0.075 ppm (147 µg/m ³)		
	8 hour (1997)	--	0.08 ppm		<i>attainment</i>
Respirable particulate matter (PM-10)	24 hour	50 µg/m ³	150 µg/m ³	Same as primary standard	<i>unclassified</i>
	Annual arithmetic mean	20 µg/m ³	-		
Fine particulate matter (PM-2.5)	24 hour	No separate state standard	35 µg/m ³	Same as primary standard	<i>unclassified</i>
	Annual arithmetic mean	12 µg/m ³	12 µg/m ³	15 µg/m ³	
Carbon monoxide	8 hour	9.0 ppm (10 mg/m ³)	9.0 ppm (10 mg/m ³)	None	<i>attainment</i>
	1 hour	20 ppm (23 mg/m ³)	35.0 ppm (10 mg/m ³)		
Nitrogen dioxide	Annual arithmetic mean	0.030 ppm (56 µg/m ³)	0.053 ppm (100 µg/m ³)	Same as primary standard	<i>attainment</i>
	1 hour	0.18ppm (338 µg/m ³)	100 ppb		
Sulfur dioxide	24 hour	0.04 ppm (105 µg/m ³)		-	<i>attainment</i>
	3 hour	-	-	0.5 ppm (1,300 µg/m ³)	<i>attainment</i>
	1 hour	0.25 ppm (655 µg/m ³)	75 ppb	-	<i>attainment</i>
Lead	Rolling 3-month average		0.15 µg/m ³	Same as primary standard	
	30-day average	1.5 µg/m ³	-	-	<i>attainment</i>
	Calendar quarter	-	1.5 µg/m ³	Same as primary standard	<i>attainment</i>
Visibility-reducing particles	8 hour	Extinction coefficient of 0.23 per kilometer – visibility of 10 miles or more due to particles when relative humidity is less than 70%.	No federal standards	No federal standards	<i>unclassified</i>
Sulfates	24 hour	25 µg/m ³	No federal standards	No federal standards	<i>attainment</i>
Hydrogen sulfide	1 hour	0.03 ppm (42 µg/m ³)	No federal standards	No federal standards	<i>unclassified</i>

Source: CARB 2013a, USEPA 2012, USEPA2013a, and USEPA 2013b.

Abbreviations: µg/m = micrograms per meter; mg/m = milligrams per meter; ppm = parts per million

a California standards for ozone, carbon monoxide, sulfur dioxide (1 and 24 hour), nitrogen dioxide, PM-10 and PM-2.5, and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded.

b Federal standards (other than ozone, PM, and those based on annual averages or arithmetic means) are not to be exceeded more than once per year. For clarification on when and how the ozone and PM standards are exceeded, please see <http://epa.gov/air/criteria.html>.

c National primary standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

d National secondary standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

e A status of *attainment* means that both NAAQS and CAAQS have been met; *nonattainment* status indicates that either or both standards have been exceeded, and *unclassified* status indicates that data collected were not sufficient to make a determination. An area is in nonattainment with federal standards if a primary NAAQS has been exceeded more than three discontinuous times in three years in a given area. An area is in nonattainment with state standards if a CAAQS has been exceeded more than once in 3 years.

General Conformity Rule

Under the 1990 amendment to the Clean Air Act (section 176(c) (4)), a general conformity rule was established to ensure that actions taken by federal agencies in nonattainment areas conform to state goals for the attainment and maintenance of the NAAQS. In 1993, the USEPA published guidance on this rule that assists federal agencies in determining whether a conformity determination is required, and if so, how to make such a determination (US EPA 1993). As of 2013, Tuolumne County is not subject to the general conformity rule because it is in attainment with or unclassified for NAAQS.

Mandatory Class I Federal Areas

In addition to specific requirements for federal and state nonattainment areas for ambient air quality standards, the federal Clean Air Act includes specific provisions to prevent deterioration of air quality in national parks. In a 1977 amendment to the act, Congress designated Yosemite National Park, along with 155 other national parks, wilderness areas and national wildlife refuges as mandatory class I federal areas. (Clean Air Act, subpart 2, Section 169A (a) (1)). The class I designation gives federal land managers the responsibility for protecting “air quality related values” in class I areas from the adverse impacts of new or modified sources of emissions. Vegetation, visibility, water quality, wildlife, historic and prehistoric structures and objects, cultural landscapes, and most other elements of a park environment are sensitive to air pollution and are considered by the NPS to be air quality-related values.

In 1999, the USEPA published a regional haze rule to guide the preparation of state regional haze plans to improve air quality and reduce haze in class I federal areas. The rule sets a nationwide goal of achieving visibility in class I areas that reflect natural conditions by 2064. To meet this requirement, the California Air Resources Board released the draft *California Regional Haze Plan* in December 2008 that details the baseline conditions of individual class I areas, including Yosemite National Park, and sets a path toward achieving interim, ‘reasonable progress goals’ statewide by 2018 (CARB 2008).

National Park Service Air Quality Plans and Policies

Under the Organic Act and Clean Air Act, the NPS has a responsibility to protect air quality in parks to (1) preserve natural resources and systems; (2) preserve cultural resources; and (3) sustain visitor enjoyment, human health, and scenic vistas. According to the NPS management policies, the NPS is obligated to “promote and pursue measures to protect [air quality related] values from the adverse impacts of air pollution” (NPS 2006g).

It is also NPS policy that internal activities at parks must comply with all applicable federal, state, and local air pollution laws and regulations (NPS 2004a). In order to meet these goals, parks may be required to obtain air quality permits before conducting activities, such as prescribed burning, that emit pollutants. Likewise, operating permits may be required for some emission sources, such as wastewater treatment facilities. In cases of doubt as to the impacts of existing or potential air pollution on park resources, the NPS would err on the side of protecting air quality and related values for future generations (NPS 2006g).

At Yosemite National Park, the 1980 *Yosemite General Management Plan* does not specifically address air quality within the Tuolumne River corridor, although it does call for the NPS to limit unnatural sources of air pollution to the greatest extent possible.

Air Quality Monitoring at Yosemite National Park

The NPS is an active participant in several air quality monitoring networks that provide real-time data in and around Yosemite National Park. Three permanent monitoring locations are in the Merced River watershed; the remainder are outside of park boundaries. There are no permanent air pollution monitoring stations in the Tuolumne River corridor, although several temporary monitors have gathered data in the watershed. The NPS and its partners continue to deploy these monitors as needed.

The NPS air quality monitoring program collects information on pollutants that affect visibility, human health, vegetation, water resources, soils, and historic buildings and structures. The NPS measures progress toward improving park air quality by examining trends for key air quality indicators, including:

- visibility, which affects how well and far visitors see
- atmospheric deposition, which affects ecological health through acidification and fertilization of soil and surface waters
- ozone, which affects human health and vegetation

Among the trends the NPS has identified nationwide, the air quality monitoring program has found that (1) visibility is impaired to some degree at every park; (2) high elevation ecosystems in the Sierra Nevada and high elevations in the western U.S. are the most sensitive to atmospheric deposition; and (3) field surveys have documented vegetation injury due to ground-level ozone in several parks, including Yosemite (NPS 2002a).

Based on long-term monitoring data, the trend for visibility, atmospheric deposition, and ozone at Yosemite appear to be stable; however, air quality conditions at the park are of significant concern, particularly nitrogen deposition and ozone (NPS 2009a).

In addition, air pollution is one of several ‘vital signs’ that are monitored to provide information on the status and trends of ecosystems at national parks in the Sierra Nevada, including Yosemite National Park. Vital signs are measurable indicators of biological and physical processes that provide insight into the condition of an ecosystem. As a result of evidence that points to impacts on vegetation and hydrologic resources caused by atmospheric deposition, air pollution is named as one of the five most significant stressors affecting parks in the Sierra Nevada (UC Davis 1996).

Emission Sources

Primary pollutants are those emitted directly to the atmosphere; secondary pollutants are not directly emitted but are formed when primary pollutants react in the atmosphere. An example of a secondary pollutant is ozone, which is formed when hydrocarbons and nitrogen oxides combine in the presence of sunlight.

According to the NPS Air Resources Division, primary air emission sources within national parks may include:

- *stationary sources* – fossil fuel-fired heating equipment, generators, fuel storage tanks, and wastewater treatment plants
- *area sources* – woodstoves and fireplaces, campfires, and wildfires and prescribed burning
- *mobile sources* – motor vehicles operated by visitors, tour operators, NPS and concessioner employees, and some equipment (EA Engineering 2003)

In the Tuolumne River corridor specifically, these sources may include exhaust from NPS, visitor, and concessioner vehicles traveling Tioga Road, Hetch Hetchy Road, and administrative roads; campfires at Tuolumne Meadows campground; propane-fired systems at the Tuolumne Meadows Lodge and the store and grill; woodstove heating in lodging and employee housing; wastewater treatment at Tuolumne Meadows; mobile gas-powered equipment; and prescribed and wildland fire.

In particular, wildfires appear to have a marked seasonal effect on levels of particulate matter in Yosemite National Park. A 2002 air quality study conducted in the park concluded that the majority of fine particles that obscured visibility near Yosemite Valley may have originated from wildfires in other parts of the U.S. (McMeeking et al. 2006). In addition, long-term data analysis has indicated a seasonal trend in fine particle concentrations, with peaks in the summer and early fall. This particulate matter is thought to be the dominant contributor to diminished visibility during these periods (McMeeking et al. 2006). In addition, the California

Air Resources Board identifies wildfires as the primary source of natural air pollution emissions for Tuolumne County (CARB 2009).

As noted in the “Overview” section, monitoring data from 2007 and 2009 that quantify fine particle levels in Tuolumne Meadows campground suggest that campfire or other evening sources of smoke affect local air quality at levels that may be unhealthy for sensitive groups, including individuals with pulmonary or cardiovascular diseases, the elderly, and children (Lipsett et al. 2008). Though air quality may be at these levels for several hours, the short duration of these nighttime “spikes” in air quality means that the standards are usually only exceeded when wildland fire smoke combines with the campfire impact. In general, these exceedances of the standards occur for one to three hours, except during periods of the most intense wildfire smoke.

All of these sources may contribute to human health effects, primarily from inhalation of particulate matter, which may interfere with the respiratory tract or introduce matter that is inherently toxic due to chemical or physical characteristics (e.g., particulate matter from diesel exhaust). On-site staff and recreational users at developed areas in the Tuolumne River corridor would be the closest sensitive receptors in the planning area.

Environmental Consequences Methodology

The air quality impact assessment involved identifying and qualitatively describing the types of actions under the various alternatives that could affect air quality, corresponding emissions sources and pollutants, and relative source strengths. Based on the relative source strengths, a qualitative assessment was performed to determine the potential for higher pollutant emissions or concentrations, which takes into account the frequency, magnitude, duration, location, and reversibility of the potential impact. Regional pollutant transport issues are evaluated in the context of regional cumulative impacts.

With the possible exception of wildland fire, local sources of emissions would have minimal effect on regional emissions, particularly during the summer season when regional emissions may meet or exceed federal and state standards. Local emissions sources include stationary, area, and mobile sources in and around Tuolumne Meadows, the Tioga Road, and at the administrative area below O’Shaughnessy Dam. As noted in the affected environment, the closest sensitive receptors in the planning area would be on-site staff and recreational users at developed areas in the Tuolumne River corridor. As also noted in the affected environment above, fine particulate emissions at Tuolumne Meadows campground are of particular concern for sensitive population groups. The temporary duration of use at Tuolumne Meadows and along the Tioga Road would limit the overall effect of motor vehicle emissions to when the Tioga Road is open, generally June through October.

Emissions from wildland and prescribed fires would continue to be controlled through implementation of smoke management policies in the park’s *Fire Management Plan* (NPS 2004d). These policies are intended to minimize impacts on air quality from prescribed burning within the park and region. It should be noted that while wildland fire drives the largest and most intense exceedances of particulate matter standards in the river corridor, at Tuolumne Meadows, the baseline levels of particulate emissions are already occasionally high in the campground vicinity. However, the alternatives do not address campfire regulations at Tuolumne Meadows, nor do the potential emissions from the campground vary significantly among the alternatives.

Several assumptions were integrated into this assessment:

- This plan would not affect the smoke management policies in the *Fire Management Plan*.
- This plan would not create campfire regulations specific to Tuolumne Meadows.
- The NPS would continue to ensure that all stationary emissions sources under its control or under the control of its concessioners comply with applicable air district rules and regulations.

- The NPS would continue to participate in the regional air quality planning processes for ozone and visibility impairment and would continue to review applications for new or modified major stationary sources upwind of the park, pursuant to Prevention of Significant Deterioration regulations.
- The NPS would comply with the USEPA general conformity rule for any future actions that would occur within Tuolumne County, which is part of Mountain Counties Air Basin.

The analysis of effects is qualitative, and professional judgment was applied to reach reasonable conclusions as to the context, intensity, and duration of potential impacts.

The air quality impact assessment of the plan evaluated how types of changes would affect air pollutant emissions and concentrations. Air quality impacts were evaluated in terms of their context, intensity, and duration, and whether the impacts were considered to be beneficial or adverse.

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts would be those that occur within Yosemite National Park or impacts specific to the Tuolumne River corridor. Regional impacts would be those related to the Mountain Counties Air Basin. With respect to air quality issues, both local and regional perspectives are relevant.

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts were effects considered not detectable and that would have no discernible effect on air quality. Minor impacts were those that would be present but not expected to have an overall effect on those conditions. Moderate impacts would be clearly detectable and could have an appreciable effect. Major impacts would have a substantial, highly noticeable influence on local or regional air quality.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration and would be associated with transitional types of impacts. A long-term impact would have a permanent effect on air quality.

Type: Impacts were evaluated in terms of whether they would be beneficial or adverse to air quality. Beneficial air quality impacts would reduce emissions or lower concentrations, and adverse impacts would have the opposite effect.

Environmental Consequences of the No-Action Alternative

Wild Segments

Air quality is nearly intact for the majority of designated Wilderness areas in the Tuolumne River corridor, with the exception of prescribed or wildland fires or the very occasional campfire. Under the no-action alternative, emissions from prescribed burning would continue to be controlled through implementation of smoke management policies in the 2004 *Fire Management Plan*.

Impacts from in-park emissions (e.g., motor vehicles) would be more apparent in areas where designated Wilderness is close to road corridors and concentrations of visitor and administrative services. For example, air quality along the Dana Fork (as it is currently designated, along Tioga Road) is generally good but would continue to be adversely affected by a combination of motor vehicle emissions along the Tioga Road and administrative roads, and stationary sources associated with Tuolumne Meadows Lodge and administrative facilities (e.g., propane storage, woodstoves).

At Glen Aulin, local impacts on air quality include campfires, woodstoves, two generators (one of which is used daily, the other is used rarely) and the occasional maintenance activity. Emissions from prescribed burning would continue to be controlled through implementation of smoke management policies in the 2004 *Fire Management Plan*.

Scenic Segment

Current levels of use, and therefore current levels of emissions, are expected to continue under the no-action alternative at Tuolumne Meadows. Air quality in and around the meadows (including portions of the Dana Fork) would remain generally good during the day, while smoke near the campground would have an adverse impact on air quality at night. Local sources of emissions would include mobile sources, such as motor vehicles along Tioga Road and administrative roads; stationary sources associated with visitor services, administrative facilities, and utilities (e.g., generators, wastewater treatment ponds and sprayfield, propane storage tanks); and area sources (e.g., smoke from campfires and prescribed fires).

Impacts on air quality from motor vehicle emissions would be short term and adverse in locations where motor vehicles can be left idling, such as formal and informal parking areas, visitor service areas, and administrative areas. Idling motor vehicles could temporarily increase the concentration of pollutants in the immediate vicinity, depending on air movement associated with weather conditions. Such emissions would be short term, local, and quickly dispersed, depending on weather patterns. Based on 2009, 2010, and 2011 transportation data, traffic volumes on Tioga Road are increasing. The composition of motor vehicle emissions would remain subject to state and federal emissions control standards and programs. For the foreseeable future, motor vehicle fleet turnover, cleaner-burning fuels, improved technologies, and stricter state and federal standards would be expected to decrease emissions. The overall impact of mobile sources of emissions would remain approximately the same under the no-action alternative as under existing conditions.

The effect on air quality from existing stationary sources, such as fuel storage systems and generators, would be greatest immediately adjacent to the emission source, including employee housing areas, visitor service areas (e.g., store and grill), wastewater treatment ponds and sprayfield, and the public fuel station. Emissions from stationary sources would continue to be regulated, as appropriate, through applicable Tuolumne County Air Pollution Control District regulations. In the long term, replacing dated equipment, such as generators with newer, more energy-efficient models to meet NPS sustainability goals, would result in beneficial impacts.

Area emissions would continue to affect air quality and visibility within Tuolumne Meadows under certain meteorological conditions. For example, particulate matter resulting from burning wood could remain near ground level during temperature inversions. Campfires, woodstoves, and fireplaces would continue to be subject to park regulations. These emissions sources would remain consistent with existing conditions, described under the “Affected Environment” section above, and campfire or other evening sources of smoke would continue to affect local air quality at levels that may be unhealthy for sensitive groups, including individuals with pulmonary or cardiovascular diseases, the elderly, and children. Emissions from prescribed burning would continue to be controlled through implementation of smoke management policies in the 2004 *Fire Management Plan*.

Air quality at the administrative area below O’Shaughnessy Dam would continue to be affected by a combination of regional sources and locally generated emissions. Local sources of emissions would include mobile sources, such as motor vehicle exhaust along administrative roads, stationary sources associated with administrative facilities and utilities (e.g., generators), and area sources (e.g., campfires at the nearby campground, prescribed fires).

Mobile sources of emissions would include automobiles and trucks; roads in this portion of the river corridor are open year-round. However, motor vehicle use in this area is relatively light. In general, the impacts on air quality from stationary sources downstream of the dam would be associated with regular maintenance-related activities, resulting in short-term, local increases in emissions of particulate matter. Emissions from local stationary sources would continue to be regulated through applicable Tuolumne County Air Pollution Control District regulations. Area emissions would include campfires from a backpackers’ campground located adjacent to the river corridor and prescribed or wildland fire.

Conclusion

Under the no-action alternative, wild segments would continue to be largely free of effects from local emissions, with the exception of prescribed and wildland fires, but would be subject to regional emissions trends. The continuation of existing conditions would be expected to have local long-term negligible to minor adverse impacts on air quality in wilderness.

In scenic segments, air quality would remain generally good but would continue to be adversely affected by a combination of regional sources and locally generated emissions. Local sources of emissions would contribute to air pollution; however, overall impacts on air quality would be local and minor, with the notable exception of fine particulates at the Tuolumne Meadows campground, which might affect local air quality at levels that are unhealthy for sensitive groups. Pollution from these local sources would be generated primarily during the summer when air quality in the area is also most affected by regional sources.

Cumulative Impacts

Past actions in the Tuolumne River corridor that may have had negligible long-term impacts on air quality include recent restoration work at Tuolumne Meadows Lodge and upgrades to the wastewater treatment system, which may have affected fuel consumption and fugitive dust emissions.

Short-term adverse impacts on air quality in the river corridor would result from construction activities associated with some of the current and reasonably foreseeable actions planned or approved within the park, in combination with the no-action alternative, including the Communication Data Network project, which would involve construction activities along Tioga Road in Tuolumne Meadows. The Tioga Road Rehabilitation Project, Tioga Trailheads Project, and *Tenaya Lake Area Plan* could contribute to increased motor vehicle traffic and corresponding emissions. The intensity of the adverse impacts from these nearby projects would be negligible to minor, depending on the intensity of truck trips generated along Tioga Road from simultaneously occurring construction actions. Evaporative emissions from resurfacing the road and particulate matter from demolition and construction would have adverse impacts on nearby sensitive receptors.

In addition, wildland fires in the park, managed in accordance with the 2004 *Fire Management Plan*, could adversely impact local and regional air quality. The adverse impacts of these activities would be local and short term in nature.

Although cumulative growth in the region would tend to adversely affect air quality, implementation of ongoing state and federal mobile-source control programs would ameliorate this effect to some degree. The Tuolumne River corridor would continue to be subject to regional emissions trends for the foreseeable future, including impacts on air quality and visibility.

Overall, cumulative plans and projects in combination with the no-action alternative would result in local and regional short-term and long-term minor adverse impacts on air quality.

Environmental Consequences Common to Alternatives 1–4

Wild Segments

Under any of the action alternatives, air quality would remain nearly intact for the majority of designated Wilderness areas in the Tuolumne River corridor. These areas would continue to be largely free of effects from local emissions, with the exception of effects from prescribed and wildland fire and from motor vehicles and stationary sources in and near road corridors adjacent to wilderness. Wilderness areas would remain subject to regional emissions trends. None of the action alternatives would have an effect on regional emissions trends.

Scenic Segments

Short-term Impacts of Construction in the Tuolumne Meadows Area

Air quality effects associated with demolition or rehabilitation of existing structures and construction of new facilities under any of the action alternatives would include temporary engine and dust emissions from a variety of sources. These activities could generate substantial amounts of dust, including PM-10 (primarily fugitive dust from demolition activities and emissions from the operation of heavy-duty equipment). Dust emissions would vary from day to day, depending on the level and type of activity, soils, and weather conditions. Emissions generated from construction and demolition activities would also include worker commute trips as well as truck trips to haul debris materials from the Tuolumne Meadows area to appropriate recycling facilities or reuse sites and to supply the site with new construction materials. Both mobile and stationary equipment would generate emissions that include ozone precursors, carbon monoxide, and PM-2.5 (criteria air pollutants), as well as toxic air contaminants from use of diesel-powered equipment. Toxic air contaminants are less pervasive in the atmosphere than criteria air pollutants, but they are linked to short-term (acute) and long-term (chronic or carcinogenic) adverse human health effects. Toxic air contaminants do not have corresponding ambient air quality standards.

Due to the remoteness of the Tuolumne Meadows area, it is possible that a portable batch hot-mix asphalt plant would be required to provide the asphalt necessary for parking lot construction, which would result in evaporative emissions. Alternatively, asphalt could be trucked into the park from a batch plant located outside the park. Batch hot-mix asphalt plants typically involve aggregate storage and handling, rotary drying (typically oil-fired), screening, and mixing. They emit particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, and volatile organic compounds and would result in a minor to moderate, local, short-term effect on air quality in the vicinity of their use. Other evaporative emissions would result from the use of sealants and chemicals for new or expanded parking areas.

As construction would only occur when the Tioga Road is open, the potential for construction-related emissions and diesel particulates to adversely affect local air quality under any of the action alternatives would be temporary in duration. Construction would not affect air quality during the majority of the year when Tioga Road was closed. Because construction would coincide with periods of heaviest visitor and administrative use, sensitive receptors could be exposed to locally high concentrations of demolition or construction emissions. The impacts from the use of motorized equipment in areas of wilderness zoning would be subject to mitigation measures related to emissions listed in appendix O.

Long-Term Impacts in the Tuolumne Meadows Area

The NPS assumes that mobile sources of emissions along Tioga Road would remain the same under any of the action alternatives as under the no-action alternative. The *Tuolumne River Plan* would not affect the amount of through-traffic on Tioga Road. The composition of motor vehicle emissions would remain subject to state and federal emissions control standards and programs. For the foreseeable future, motor vehicle fleet turnover, cleaner burning fuels, improved technologies, and stricter state and federal standards would be expected to decrease emissions.

As with the no-action alternative, area emissions under any of the action alternatives, including particulate matter from burning wood, would continue to affect air quality and visibility within Tuolumne Meadows under certain meteorological conditions, notably temperature inversions. Campfires, woodstoves, and fireplaces would continue to be subject to existing park regulations. Unless use was reduced, smoke from such fires would continue to affect local air quality at levels that might be unhealthy for sensitive groups, including individuals with pulmonary or cardiovascular diseases, the elderly, and children. Emissions from prescribed burning would continue to be controlled through implementation of smoke management policies in the 2004 *Fire Management Plan*.

Long-Term Impacts below O'Shaughnessy Dam

Air quality at the administrative area below O'Shaughnessy Dam would continue to be affected by a combination of regional sources and locally generated emissions. Local sources of emissions would include mobile sources, such as motor vehicle exhaust along administrative roads, stationary sources associated with administrative facilities and utilities (e.g., generators), and area sources (e.g., campfires at the nearby campground and prescribed fires).

Mobile sources of emissions would include automobiles and trucks; roads in this portion of the river corridor are open year-round. However, motor vehicle use in this area is relatively light. In general, the impacts on air quality from stationary sources downstream of the dam would be associated with regular maintenance-related activities, resulting in short-term, local increases in emissions of particulate matter. Emissions from local stationary sources would continue to be regulated through applicable Tuolumne County Air Pollution Control District regulations. Area emissions would include campfires from a backpackers' campground located adjacent to the river corridor and prescribed or wildland fire.

Environmental Consequences of Alternative 1

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 1 on air quality are described below.

Wild Segments

Closure of the Glen Aulin High Sierra Camp would eliminate the impacts on air quality associated with the camp, including campfires, woodstoves, generator use and occasional administrative activities. However, the backpackers campground would remain, leaving a local source of area emissions from campfires and a composting toilet.

Scenic Segments

Under alternative 1, stationary sources associated with visitor services and utilities would be removed, including the wastewater treatment ponds and sprayfields; fuel sources serving the housing, administrative, and lodging complex at Tuolumne Meadows Lodge; fuel sources serving the Tuolumne Meadows store and grill; and the public fuel station. Emissions from remaining local stationary sources, including administrative fuel tanks and remaining employee housing, would continue to be regulated as appropriate through applicable Tuolumne County Air Pollution Control District regulations.

The elimination of most visitor services, including shuttle bus service, a reduction in parking availability, the removal of Tuolumne Meadows Lodge and associated administrative areas, the removal of informal roadside parking along Tioga Road, and the removal of motor vehicle access to the Soda Springs complex and the existing wastewater treatment ponds, would result in a corresponding reduction or elimination of motor vehicle emissions at these locations.

Emissions from campfires and woodstoves would be expected to decrease somewhat due to the elimination of lodging, reduced employee housing, and reduced number of campsites under alternative 1. This would have a beneficial impact on air quality from reductions in fine particulates during evening hours.

Conclusion

Under alternative 1, wild segments would continue to be largely free of effects from local emissions, with the exception of prescribed and wildland fires, but would be subject to regional emissions trends. This would result in a local long-term negligible to minor adverse impact on air quality in wilderness. The removal of the Glen Aulin High Sierra Camp would result in a local minor to moderate beneficial impact.

In scenic segments of the river corridor, Tuolumne Meadows would be subject to emissions from construction-related activities during the summer season, resulting in a local short-term minor to moderate adverse impact. Impacts on air quality at Tuolumne Meadows under alternative 1 would be similar to the no-action alternative with the following exceptions: (1) the elimination of shuttle bus service, the substantial reduction in motor vehicles parking at the meadows, the elimination of commercial services and overnight use, reductions in campsite numbers, and the removal of the public fuel station would result in a local long-term moderate beneficial impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would result in a local long-term minor beneficial impact on air quality.

Cumulative Impacts

The past, present, and reasonably foreseeable plans and projects that may have a cumulative impact on air quality in the river corridor in combination with alternative 1 would be the same as described for the no-action alternative. Short-term adverse impacts on air quality in the corridor could result from construction activities associated with some of the current and reasonably foreseeable actions planned or approved within the park. If alternative 1 were to be implemented at the same time as the current or reasonably foreseeable plans and projects above, short-term adverse impacts on air quality would increase in intensity but would remain local. In combination with the cumulative plans and projects listed in appendix L, alternative 1 would result in both local short-term minor adverse impacts on air quality due to construction-related activity and local long-term negligible to minor impacts on air quality.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on air quality are described below.

Wild Segments

At Glen Aulin, the impacts on air quality under alternative 2 would be the same as under the no-action alternative, with the following exception: Because permanent lodging would be removed, woodstoves and generators would no longer be used at the High Sierra Camp, thus resulting in a local beneficial impact on air quality.

Scenic Segments

Alternative 2 would closely approximate existing conditions for local emissions sources at Tuolumne Meadows because the existing uses would remain. Air quality in and around the meadows (including portions of the Dana Fork) would remain generally good, with the notable exception of emissions generated by campfires at the campground in the evening.

There would be a likelihood of motor vehicle emissions at locations where there could be idling motor vehicles, such as the new day use area near Unicorn Creek and expanded administrative facilities at Road Camp. Informal roadside parking would be eliminated along Tioga Road and the road leading to Tuolumne Meadows Lodge. Under alternative 2, many informal parking areas would be relocated to new or expanded formal parking areas south of Tioga Road.

Existing stationary emissions sources would remain in place or would be relocated within the Tuolumne Meadows area. Stationary sources associated with the wastewater treatment ponds and sprayfield utilities would be removed. The overall effect on air quality from existing stationary sources under alternative 2, such as fuel storage systems and generators, would be the same as under the no-action alternative. Emissions from stationary sources would continue to be regulated, as appropriate, through applicable Tuolumne County Air Pollution Control District regulations. In the long term, the replacement of dated equipment such as generators

with newer, more energy-efficient models to meet NPS sustainability goals would be expected to result in beneficial impacts.

The addition of campsites at Tuolumne Meadows campground could result in an increase in particulate matter from campfires under alternative 2.

Conclusion

Under alternative 2, wild segments would continue to be largely free of effects from local emissions except for prescribed and wildland fires, but would be subject to regional emissions trends. This would result in a local long-term negligible to minor adverse impact on air quality in wilderness. At Glen Aulin, the elimination of woodstoves would reduce area emissions sources, resulting in a local long-term minor beneficial impact.

In scenic segments of the Tuolumne River corridor, Tuolumne Meadows would be subject to emissions from construction-related activities during the summer season, resulting in a local short-term minor to moderate adverse impact. Impacts on air quality at Tuolumne Meadows under alternative 2 would be similar to the no-action alternative with the following exceptions: (1) the increased number of campsites might increase fine particulate emissions at the Tuolumne Meadows campground (where local emissions already reach levels that are unhealthy for sensitive groups), resulting in a local, long-term, minor, adverse impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would be expected to result in a local long-term minor beneficial impact on air quality.

Cumulative Impacts

The past, present, and reasonably foreseeable plans and projects that may have a cumulative impact on air quality in the Tuolumne River corridor in combination with alternative 2 would be the same as described for the no-action alternative. Short-term adverse impacts on air quality in the corridor could result from construction activities associated with some of the current and reasonably foreseeable actions planned or approved within the park. If alternative 2 were to be implemented at the same time as the current or reasonably foreseeable plans and projects above, short-term adverse impacts on air quality would increase in intensity but would remain local. In combination with the cumulative plans and projects listed in appendix L, alternative 2 would result in both local short-term minor adverse impacts on air quality due to construction-related activity and local long-term negligible beneficial impacts on air quality.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on air quality are described below.

Wild Segments

At Glen Aulin, the impacts on air quality under alternative 3 would be the same as under the no-action alternative except that woodstoves would no longer be used at the High Sierra Camp, resulting in a beneficial impact on local air quality.

Scenic Segments

Under alternative 3, air quality in and around Tuolumne Meadows area (including portions of the Dana Fork) would continue to be adversely affected by a combination of regional sources and locally generated emissions, although there would be fewer local emissions under this alternative with the reduction in overnight use and housing at Tuolumne Meadows Lodge. Air quality in and around the meadows (including portions of the Dana Fork) would remain generally good, with the notable exception of emissions generated by campfires at the Tuolumne Meadows campground in the evening.

Motor vehicle emissions would be possible at locations where there could be idling vehicles, such as the new or expanded parking and administrative use areas south of Tioga Road. Informal roadside parking would be eliminated along Tioga Road and the road leading to Tuolumne Meadows Lodge. Under alternative 3, some informal parking would be relocated to new or expanded formal parking areas south of Tioga Road. The proposed addition of shuttle bus stops at key attractions and the increased frequency of shuttles would reduce the number of motor vehicle trips within the meadows area.

Existing stationary emissions sources would remain in place or would be relocated within the Tuolumne Meadows area. The overall effect on air quality from existing stationary sources under alternative 3 would be consistent with the no-action alternative except that the public fuel station would be removed. Emissions from stationary sources would continue to be regulated, as appropriate, through applicable Tuolumne County Air Pollution Control District regulations. In the long term, the replacement of dated equipment, such as generators, with newer, more energy-efficient models to meet NPS sustainability goals would be expected to result in beneficial impacts.

Conclusion

Under alternative 3, wild segments of the Tuolumne River corridor would continue to be largely free of effects from local emissions, with the exception of prescribed and wildland fires, but would be subject to regional emissions trends. This would result in a local long-term negligible to minor adverse impact on air quality in wilderness. At Glen Aulin, the elimination of woodstoves would reduce area emissions sources, resulting in a local long-term minor beneficial impact.

In scenic segments of the river corridor, Tuolumne Meadows would be subject to emissions from construction-related activities during the summer season, resulting in a local short-term minor to moderate adverse impact. Impacts on air quality at Tuolumne Meadows under alternative 3 would be similar to under the no-action alternative with the following exceptions: (1) the proposed changes to shuttle circulation and frequency, the overall reduction in vehicles parking at the meadows, the reduction in overnight use, and the removal of the public fuel station would result in a local long-term minor to moderate beneficial impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would result in a local long-term minor beneficial impact on air quality.

Cumulative Impacts

The past, present, and reasonably foreseeable plans and projects that may have a cumulative impact on air quality in the river corridor in combination with alternative 3 would be the same as described above for the no-action alternative. Short-term adverse impacts on air quality in the Tuolumne River corridor could result from construction activities associated with some of the current and reasonably foreseeable actions planned or approved within the park. If alternative 3 were to be implemented at the same time as the current or reasonably foreseeable plans and projects in appendix L, short-term adverse impacts on air quality would increase in intensity but would remain local. In combination with the cumulative plans and projects listed in appendix L, alternative 3 would result in both local short-term minor adverse impacts on air quality due to construction-related activity and local long-term minor to moderate beneficial impacts on air quality due to reductions in overnight use and removal of the public fuel station.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on air quality are described below.

Wild Segments

At Glen Aulin, the impacts on air quality would be the same under alternative 4 as under the no-action alternative except that woodstoves would no longer be used at the High Sierra Camp, resulting in a beneficial impact on local air quality.

Scenic Segments

Alternative 4 would closely approximate existing conditions for local emissions sources at Tuolumne Meadows, as most existing uses would remain. Air quality in and around the meadows (including portions of the Dana Fork) would remain generally good, with the notable exception of emissions generated by campfires at the campground in the evening.

Motor vehicle emissions would be possible at locations where there could be idling vehicles, such as the new or expanded parking and administrative use areas south of Tioga Road. Informal roadside parking would be eliminated along Tioga Road and the road leading to Tuolumne Meadows Lodge. Under alternative 4, some informal parking would be relocated to new or expanded formal parking areas south of Tioga Road. The proposed addition of shuttle bus stops at key attractions, the consolidation of visitor facilities and provision of new trail connections between attraction sites, and the increased frequency of shuttles would reduce the number of vehicle trips within the meadows area. The potential increase in regional transit buses (from one per day to up to four per day, depending on demand) would have a negligible impact on overall vehicle trips on Tioga Road through the planning area, but would increase the potential for idling vehicle emissions at transit stops.

Existing stationary emissions sources would remain in place or would be relocated within the Tuolumne Meadows area. The overall effect on air quality from existing stationary sources under alternative 4 would be consistent with the no-action alternative except that the public fuel station would be removed. Emissions from stationary sources would continue to be regulated, as appropriate, through applicable Tuolumne County Air Pollution Control District regulations. In the long term, the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would be expected to result in beneficial impacts.

Conclusion

Under alternative 4, wild segments would continue to be largely free of effects from local emissions, with the exception of prescribed and wildland fires, but would be subject to regional emissions trends. The continuation of existing conditions would be expected to have local long-term negligible to minor adverse impacts on air quality in wilderness. At Glen Aulin, the elimination of woodstoves would reduce area emissions sources, resulting in a local long-term minor beneficial impact.

In scenic segments of the river corridor, there would be a local short-term minor adverse impact at Tuolumne Meadows due to emissions from construction-related activities and a potential increase in the number of regional transit buses. Impacts on air quality at Tuolumne Meadows would be similar to the no-action alternative with the following exceptions: (1) the proposed changes to shuttle circulation and frequency, the reduction of commercial services, and the removal of the public fuel station would result in a local long-term minor beneficial impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would result in a local long-term minor beneficial impact on air quality.

Cumulative Impacts

The past, present, and reasonably foreseeable plans and projects that may have a cumulative impact on air quality in the river corridor in combination with alternative 4 would be the same as described for the no-action alternative. Short-term adverse impacts on air quality in the corridor could result from construction activities

associated with some of the current and reasonably foreseeable actions planned or approved within the park. If alternative 4 was implemented at the same time as the current or reasonably foreseeable plans and projects listed in appendix L, short-term adverse impacts on air quality would increase in intensity but would remain local. In combination with the cumulative plans and projects listed in appendix L, alternative 4 would result in both local short-term minor adverse impacts on air quality due to construction-related activity and local long-term minor beneficial impacts on air quality.

Analysis Topics: Sociocultural Resources

Scenic Resources

Affected Environment

Yosemite National Park is an icon of scenic grandeur. When set aside in 1864, Yosemite Valley and Mariposa Grove were the first scenic natural areas in the United States protected for public benefit and appreciation of the scenic landscape. Scenic quality is a core value embedded in legislation that established the NPS in 1916.

Federal areas known as national parks. . . which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment for future generations. (National Park Service Organic Act 1916)

An important consideration during the development of Yosemite National Park was ensuring that park visitors would be able to experience the park's scenic wonders. For example, roads were aligned, buildings were sited, and trails were constructed to allow visitors visual access to outstanding scenic vistas. In the Tuolumne River corridor, the Tioga Road east of Cathedral Creek was completed in 1934 and aligned to take advantage of views through the adjacent trees and other natural features. Many park visitors' (87%) primary purpose when visiting the park is to take a scenic drive (Littlejohn et al. 2005).

The park's 1980 *Yosemite General Management Plan* specifies the following management objectives to preserve, protect, and restore scenic resources:

- Identify the major scenic resources and the places from which they are viewed.
- Provide for the preservation or protection of existing scenic resource and viewing stations.
- Provide for historic views through vista clearing.
- Permit only those levels and types of use that are compatible with the preservation or protection of the scenic resources and with the quality of the viewing experience.

The *Scenic Vista Management Plan* (NPS 2010k) is tiered from the general management plan and provides an inventory of 181 potential vista points throughout the park, outside of wilderness and chiefly along the major roads. The plan outlines a programmatic framework for prioritizing and prescribing the work to be completed at each of the viewpoints necessary to obtain a desirable vista. The 2011 finding of no significant impact (FONSI) for the *Scenic Vista Management Plan* stipulates that the final determination of vista points for the Tuolumne Wild and Scenic River corridor would be deferred to the comprehensive river management plan. A description of the proposed vista points for the *Tuolumne River Plan* are summarized below and further detailed in appendix I.

Scenic Overview

Lyell Canyon and the Upper Dana Fork (Wild Segments: Lyell Fork and Upper Dana Fork)

The headwaters of the Tuolumne River flow from the Lyell Fork, which stems from the Lyell and McClure glaciers, and the Dana Fork, which descends from the alpine slopes of Mount Dana.

The scenery along the Lyell Fork through Lyell Canyon becomes more spectacular around every bend in the trail. Views of the meandering, glass-like river as it winds through the meadows create a vivid foreground to the rocky outcrops of the Kuna Crest (including Kuna Creek falls) to the east and Amelia Earhart Peak to the west. Spectacular views in this U-shaped river valley include mountain peaks, ridgelines, and the largest glacier on the western flank of the Sierra Nevada. Specific views from the bed and banks of the Lyell Fork include Mount Lyell, Lyell Glacier, Lyell Canyon, Kuna Crest, the cascades at Kuna Creek, and the meandering Lyell Fork through extensive alpine and subalpine meadows. Ephemeral wildflower displays enhance these views.

Views from the Dana Fork encompass glacially carved mountains and ridgelines and alpine and subalpine meadows. Specific views from the bed and banks of the Dana Fork include the Kuna Crest, Mount Dana, Mount Gibbs, and the meandering Dana Fork through Dana Meadows. In both Tuolumne Meadows (see below) and Dana Meadows, the low-relief topography of the meadows allows for impressive views with dramatic weather and summer wildflower displays.

Tuolumne Meadows and the Tioga Road Corridor (Scenic Segments: Tuolumne Meadows and Lower Dana Fork)

The Lyell and Dana Forks converge at Tuolumne Meadows, where the river flows through a string of expansive subalpine meadows. As seen from Tuolumne Meadows (8,600 feet in elevation), the Tuolumne appears to be a peaceful sleeper of a river, meandering quietly through its meadow channel or sweeping in ripples over the granite river bottom. At the edge of meadows, vegetation changes to a predominantly lodgepole pine forest, scattered with Jeffrey, western white, and whitebark pines. Above this forest rise the vast and often snow-covered granite peaks, ridges, and domes that ring the meadow.

There are numerous breathtaking views from roads, trails, and developed areas in Tuolumne Meadows (which is the primary developed area in the river corridor). This is due to the low topography of the expansive meadows, the proximity of the river to viewpoints, and the clear meadow edges framed by the glacially carved domes and rugged mountain slopes. Specific views from the bed and banks of the river include Lumbert, Pothole, and Fairview Domes; the Kuna Crest; Mount Dana; Mount Gibbs; Cathedral Peak and Unicorn Peak; Juniper Ridge; and the river meandering through subalpine meadows. Views from Tioga Road are particularly important for the many visitors who drive through without stopping because this is possibly their only contact with a high Sierra meadow.

Expansive views are afforded by the natural vegetation patterns at Tuolumne Meadows and, to some extent, by design. For much of the park's history, views into and away from the meadows were maintained and occasionally expanded by the mechanical removal of encroaching lodgepole pines. After 1930, the siting of all development in these river segments was guided by the principle of not obstructing or competing with the naturally occurring views and vistas. Reducing human visual impacts was a key reason for realigning the Tioga Road (in the 1930s) out of the meadow and eliminating all camping within the meadow. Building locations and circulation patterns were designed to take advantage of the scenic opportunities of this landscape, while remaining as unobtrusive as possible (NPS 2007t).

The built environment at Tuolumne Meadows remains relatively unchanged since the river was designated wild and scenic. There are both permanent and semi-permanent structures in relatively small clusters tucked into the lodgepole forest at the edge of the meadows. Views into and away from Tuolumne Meadows are being encroached upon by roadside parking, which has increased since the 1997 flood destroyed the Cathedral Lakes

parking area. Lodgepole pines are also encroaching into views; the cause of conifer encroachment into subalpine meadows is being investigated (see “Vegetation” resource topic earlier in this chapter).

The meadow’s low topography, high elevation, and subdued artificial light make this one of the best locations to observe the night sky in Yosemite’s frontcountry. Visitors need only walk a relatively short distance from the road and developed areas at night to experience an unimpaired celestial display. Sources of artificial light at Tuolumne Meadows are still very low (NPS, Duriscoe 2005c). Draft outdoor lighting guidelines have been developed to protect night skies in Tuolumne Meadows from artificial light associated with visitor and administrative activities (NPS 2011f).

Grand Canyon of the Tuolumne (Wild Segment: Grand Canyon)

The trail leading from Tuolumne Meadows to Glen Aulin and beyond, through the Grand Canyon of the Tuolumne, provides the opportunity to view some of the wildest segments of the river along its dramatic canyon descent. From Tuolumne Meadows, the river flows over shelves of rock, in stairstep fashion, creating what seems like an endless chain of waterfalls plunging into the steep and rugged gorge below. Visitors who travel the upper portion of the Grand Canyon segment are rewarded with spectacular views of domes, a deeply glaciated valley, narrow hanging valleys, and staircase waterfalls. These water features include Tuolumne Fall; LeConte, California, and Waterwheel Falls; and White Cascades. Farther downstream in the canyon, the spectacular views include steep canyon walls, the untrailed Muir Gorge, hanging valleys, and cascades of falling water that extend for miles.

At Glen Aulin, located near the upper portion of the canyon, some infrastructure associated with the High Sierra Camp is visible from the river corridor, including a utility shed with a small solar panel and water pipes. Other facilities at Glen Aulin include about a dozen off-white-colored tents, a dining hall, two restroom buildings, several sheds, a large fire ring, and other camp equipment and structures. The tent platforms for the guest cabins and dining room are neatly aligned in an arc facing southwest.

Administrative Area Below Hetch Hetchy Reservoir (Scenic Segment: Below O’Shaughnessy Dam)

Below O’Shaughnessy Dam is a 1-mile-long segment that begins approximately 500 feet downstream of the dam and ends where the wilderness boundary crosses the river. It includes a portion of an administrative road and some structures associated with the operation of the dam. The narrow canyon below O’Shaughnessy Dam has steep slopes and numerous rock bluffs. The area supports dry chaparral woodland of manzanita and ceanothus beneath live oaks and grey pines.

Poopenaut Valley to Western Park Boundary (Wild Segment: Poopenaut Valley)

Downstream of the administrative area, the Tuolumne River flows through primarily untrailed wilderness to the park’s western boundary, with stunning views of verdant meadows, a glacially carved bedrock valley, large river pools, dramatic canyon walls, and a constricted slot canyon.

Poopenaut Valley is a broad, low-gradient valley approximately 5.5 km (3.5 miles) downstream of O’Shaughnessy Dam. It is an ecologically diverse and productive area. Poopenaut Valley is one of the few undeveloped and largely undisturbed low-elevation riparian/meadow/wetland complexes in the region.

Summary of Recent Scenic Analyses in the Tuolumne River Corridor

Visual Resource Management System Baseline Studies

Yosemite National Park has adopted the Visual Resource Management system (VRM), developed by the U.S. Forest Service (USFS) (USFS 1995) and further refined by the U.S. Bureau of Land Management (BLM), to assess the scenic character of a landscape and predict the effects of management actions upon that landscape (see chapter 5).

As noted in chapter 5, there are typically three steps for the VRM system: (1) taking inventory of the existing landscape, (2) assigning management classes, and (3) conducting a contrast analysis. The inventory is done to ensure that existing conditions are acceptable and to develop a baseline for future comparison. Management classes are assigned in consideration of all resource values; these determine the acceptable level of visual change for each management class. In the contrast analysis, the degree of contrast of a management action as compared to the native landscape is quantitatively assessed.

During the inventory stage, landscapes are classified into one of four classes, with class I being most protective/most wild and class IV being most accommodating to a variety of human change. As noted in chapter 5, the results of the inventory indicate that wild segments of the Tuolumne River corridor are meeting class I objectives, and scenic segments meet class II objectives:

- **VRM Class I objectives:** Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention (BLM 2007a, b, c).
- **VRM class II objectives:** Retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape (BLM 2007).

The VRM system has been modified for use in the *Tuolumne River Plan* as follows:

- Wild and scenic river segments classified as wild generally correspond to VRM class I objectives: Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention (BLM 2007c).
- Wild and scenic river segments classified as scenic generally correspond to VRM class II objectives: Retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape (BLM 2007c).

Identification of Outstandingly Remarkable Viewpoints and Vista Management Workplans

As mentioned above, final identification of vista points in the Tuolumne River corridor managed by the *Scenic Vista Management Plan* has been deferred to the *Tuolumne River Plan*. In 2011, the NPS identified the following eight viewpoints for contributing to outstandingly remarkable scenic values in the Tuolumne Meadows area (figure 9-6).

- Tioga Road – Mount Dana and Mount Gibbs, view facing east, overlooking a pond and meandering Tuolumne River (note that this viewpoint is outside of the Tuolumne River corridor)
- Tioga Road, Mount Dana viewpoint – view looking east at the river meandering through Dana Meadows, with the Sierra crest in the background
- Tioga Road, Dana Fork interpretive viewpoint – view looking west down through the glaciated river valley along the Dana Fork, with distant views of the granite peaks
- Tioga Road, near the “little blue slide” road cut – view overlooking Lyell Canyon and the Kuna Crest
- Lumbert Dome, near the parking area – view looking west to Unicorn Peak

- Tioga Road, Parsons Memorial Lodge trailhead – view looking west toward Pothole Dome and river, with Fairview Dome in the background
- Tioga Road, near the Pothole Dome parking area – view looking east over Tuolumne Meadows to Lumbert Dome (note that this viewpoint is outside of the Tuolumne River corridor)
- Parsons Memorial Lodge doorway – view looking south across the meadow and river to Unicorn Peak

These vista points differ from the vista points identified for the Tuolumne River area in the *Scenic Vista Management Plan* (NPS 2010k). Within Tuolumne Meadows, several of these points were also inventoried for VRM baseline studies. Viewpoints located outside the corridor were included because their views are largely inside the corridor.

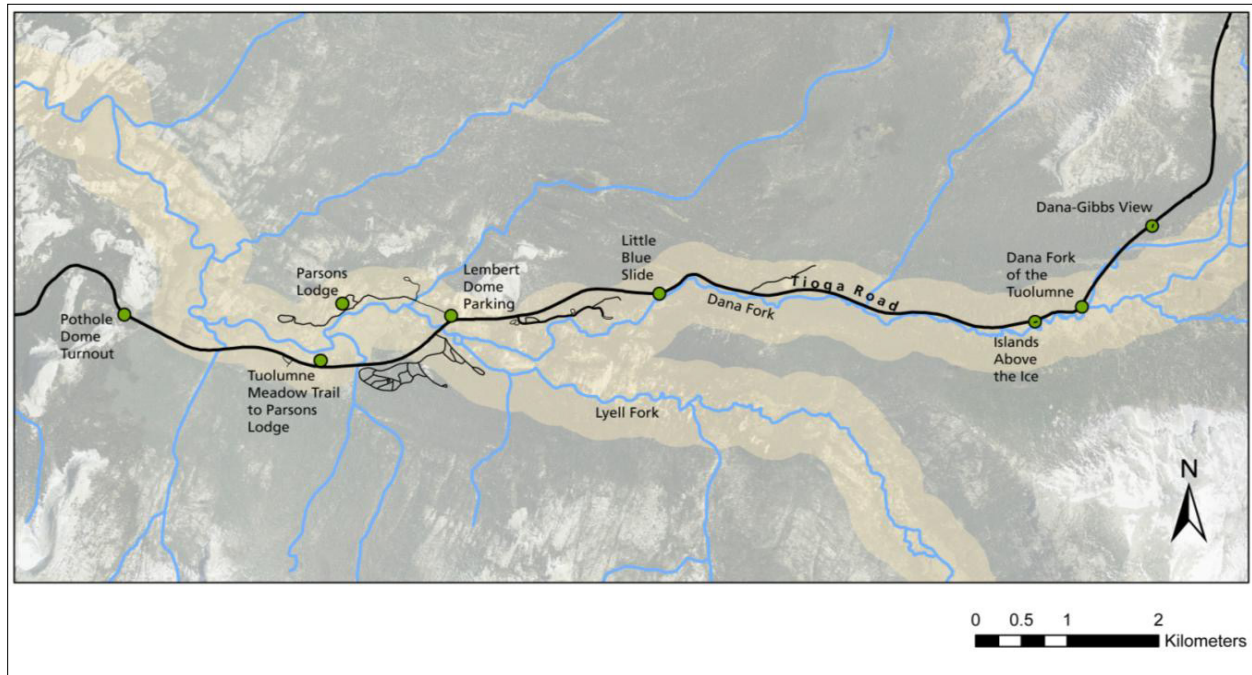


Figure 9-6. Scenic Vista Points Identified in the *Scenic Vista Management Plan*.

Park staff developed work plans for each of the above viewpoints to be prepared if vista management is adopted under the chosen alternative. A detailed description of each viewpoint and work plans are attached as appendix I. Each work plan provides a baseline for managing and maintaining these sites while protecting any sensitive resources. Specifically, the work plans provide:

- a description of the viewpoint (its specific location), including photos
- ecological considerations, particularly as they pertain to the outstandingly remarkable values of the Tuolumne River
- a summary of the work to be performed, if vista management is part of the selected alternative
- a schematic depicting the work area, which has been compared to site analysis maps prepared for this *Tuolumne River Plan* (i.e., archeological sites, wetlands and meadows, rare plants, etc.)

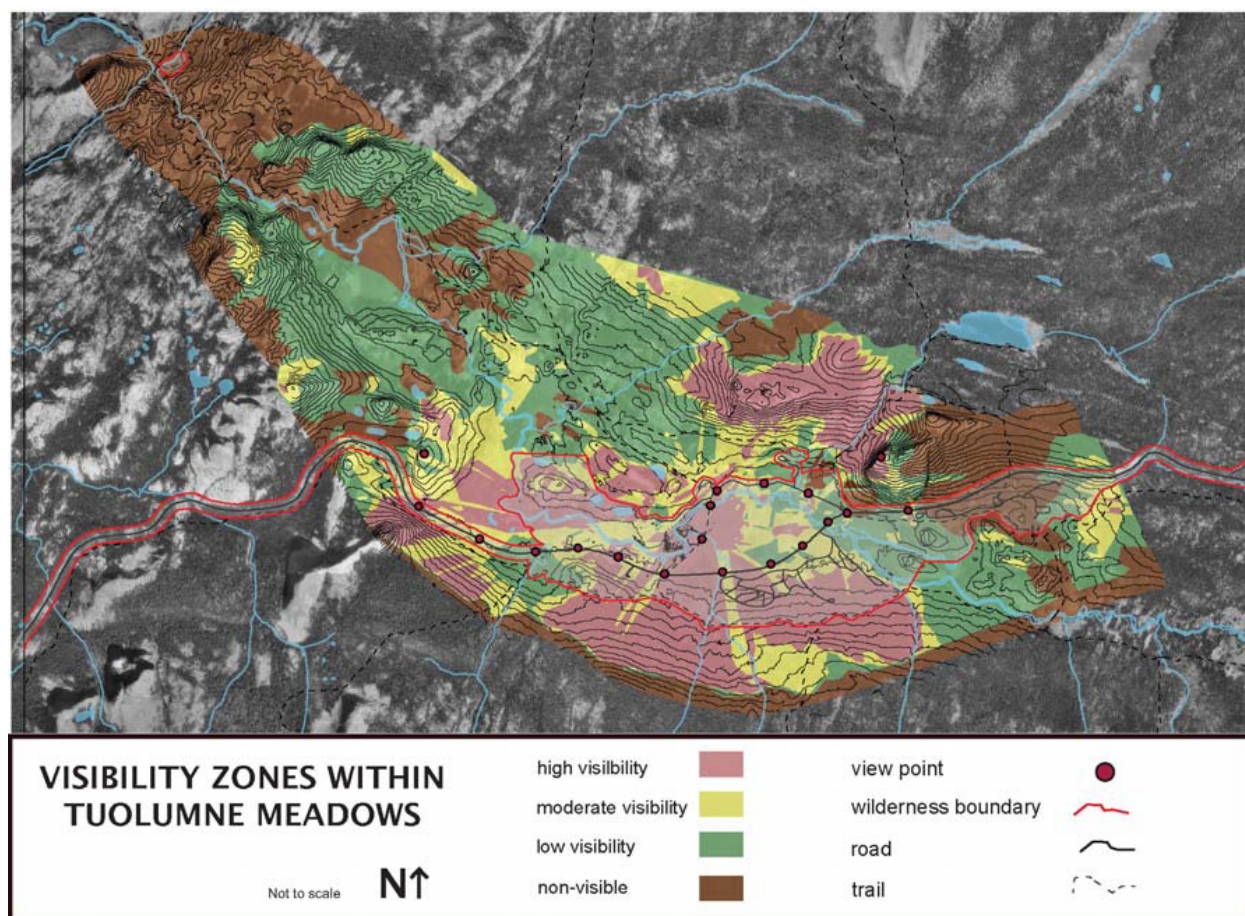
As noted previously, an adaptation of the VRM system developed by the USFS (USFS 1995) and further refined by the BLM (BLM 2007a, b, c) will be used to monitor all three scenic outstandingly remarkable values. The scenic outstandingly remarkable value monitoring program will consist of (1) a contrast analysis for any new proposed structures and/or modifications of existing structures, (2) periodic on-the-ground monitoring, and (3) actions taken when specific triggers are reached.

2007 National Park Service Scenic Analysis

Additional work conducted in support of the *Tuolumne River Plan* includes “A Scenic Analysis of Tuolumne Meadows” (NPS, Torgerson and Schaible 2007o). This document identifies a range of visually sensitive areas within the Tuolumne Meadows landscape and recommends planning and design guidelines for the potential addition of new development to the Tuolumne Meadows area.

The study analyzed views from the 19 most common areas from which visitors experience the scenery of the Tuolumne Meadows landscape. Twelve of these viewpoints are along Tioga Road, which is the primary means by which most visitors visually experience Tuolumne Meadows. Another five of these viewpoints are along the segment of Great Sierra Wagon Road, now a trail, leading across the meadow to Soda Springs and Parsons Memorial Lodge, which is the major trail from which people experience Tuolumne Meadows at a relaxed pace as they walk, hike, or ride horses across the meadow. The other two viewpoints are the top of Lemberg Dome and the top of Pothole Dome.

Using these viewpoints, the Tuolumne Meadows area was categorized into four visibility categories (figure 9-7): (1) nonvisible (potentially good locations for structures or features that would detract from the scenic character), (2) low visibility (also potentially good locations for development if it was camouflaged or screened), (3) moderate visibility (areas where new development should be minimized or carefully designed to mitigate visual impacts), and (4) high visibility (areas where new development should be avoided unless absolutely necessary). The study also determined that the existing form, alignment, widths, cross-sections, colors, and patterns of Tioga Road and the Great Sierra Wagon Road are important parts of the visual and historic integrity of the area.



Source: NPS, Torgerson and Schaible 2007o

Figure 9-7. Visibility Zones within Tuolumne Meadows.

Contrast Analysis

“Contrast” refers to the difference between the 12 key components of a landscape (form, line, texture, and color of the landscape’s vegetation, of its land and water, and of its existing structures) and the same components of a structure. The lower the contrast between the existing landscape and a proposed structure, the more the structure can be said to blend into (not distract from) and therefore preserve the surrounding landscape and its VRM landscape class rating.

The NPS will perform a contrast analysis for all new structures and/or modifications of existing structures proposed within the Tuolumne River corridor (see figure 9-8). The contrast analysis will analyze whether the proposed structure or modification will harmonize with the class I or class II landscapes in which they will be located. For each of the 12 key components, contrast will be rated from high (3 points) to none (0 points). This could result in a contrast rating as high as 36, if the structure is rated as having a strong contrast in all categories. Within the wild segments of the river corridor, contrast ratings must not exceed a total value of 4, with no strong contrasts evident. For scenic segments, contrast ratings must not exceed a total value of 12, again with no strong contrasts evident. If a structure with an excessive contrast rating was constructed, it would cause the VRM class rating for that segment to fall to the next lower level (i.e., from class II to class III), representing an adverse impact. To prevent this from occurring, if a proposed structure is found to exceed the specified contrast rating for that segment, it will be revised to fall within that contrast rating.

		FEATURES		
		Land and Water Body	Vegetation	Other Structures
		Strong (3 pt.) Moderate (2 pt.) Weak (1 pt.) None (0 pt.)	Strong (3 pt.) Moderate (2 pt.) Weak (1 pt.) None (0 pt.)	Strong (3 pt.) Moderate (2 pt.) Weak (1 pt.) None (0 pt.)
ELEMENTS	Form			
	Line			
	Color			
	Texture			

Figure 9-8. Sample Contrast Analysis Rating Sheet.

Environmental Consequences Methodology

Since the vast majority of proposed actions that might affect scenic resources would occur in the Tuolumne Meadows area, this analysis is primarily focused on the Tuolumne Meadows and Lower Dana Fork segments of the Tuolumne River corridor.

It is not possible to evaluate every location that might be visually affected by proposed actions. Therefore, consistent with the VRM methodology adopted by the NPS (see ‘Affected Environment,’ above), the NPS has identified key observation points for the most visible aspect of proposed actions at viewing locations that embody the visual experience at Tuolumne Meadows. The following key observation points were selected from the studies outlined above and field reconnaissance by planning team members to identify other vista points commonly used by park visitors today. As applicable, the following key observation points are used to assess the potential visual impacts of actions proposed in this *Final Tuolumne River Plan/EIS*:

- Pothole Dome parking area
- Pothole Dome
- Cathedral Lakes trailhead
- West of existing visitor center
- Parsons Memorial Lodge trailhead

- Parsons Memorial Lodge
- East of Parsons Memorial Lodge
- Parsons Memorial Lodge footbridge (also known as Soda Springs footbridge)
- Tioga Road bridge

As noted in the “Affected Environment” section above, there are typically three steps for the VRM system: inventory of the existing landscape, assignment of management classes, and contrast analysis. The inventory is done to ensure that existing conditions are acceptable and to develop a baseline for future comparison. The results of this baseline inventory are included with the no-action alternative description for comparative purposes.

To be consistent with the scenic river segment classification at Tuolumne Meadows, this analysis also assumes that any future new development would be modest in scale and within the established capacities of the *Tuolumne River Plan*. New NPS and concessioner employee housing would meet regulations established by the federal Occupational Safety and Health Administration (29 CFR 1910.142) and NPS standards. In addition, this analysis assumes designs would follow guidelines specifically developed for the Tuolumne River corridor and included in appendix K, and that all new proposed structures would be subject to a VRM contrast analysis (chapter 5).

Potential impacts on the visibility zones established by the NPS in 2007 (NPS, Torgerson and Schaible 2007o) are also considered in this analysis.

As outlined in chapter 5, the NPS will monitor scenic segments every four years to ensure that any recommended mitigations and actions are within the management class rating. Monitoring of wild segments will occur only when needed, as impacts in these segments are unlikely because of WSRA restrictions on facility construction.

Professional judgment was applied to reach reasonable conclusions as to the context, intensity, and duration of potential impacts.

Context: For the purposes of this analysis, only local impacts are considered. This includes impacts from proposed actions that would be visible within the viewsheds of key observation points (above).

Intensity: Using established inventory values from the key observation points, in scenic areas negligible impacts would be actions resulting in no change in contrast rating, and minor impacts would occur when an action results in a change of up to six points in contrast rating. Moderate impacts would result if there was a change in up to 12 points in contrast rating. A major impact would occur if the action resulted in a contrast rating that exceeded the allowed rating for its segment classification.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary, usually due to construction, restoration, or demolition activities. A long-term impact would have a permanent and continual effect.

Type: Impacts are evaluated in terms of whether they would be beneficial or adverse over existing baseline conditions established at key observation points.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current condition and management, as described under chapter 8 and the “Affected Environment” above.

Wild Segments

Wild segments would continue to meet VRM class I objectives. Views in wild segments would continue to be dynamic and subject to change resulting from natural changes in vegetation, geologic features, or climate. Wilderness management, which allows the natural scenery to evolve in response to ecological processes and through the use of natural and prescribed fires, would protect the features that contribute to the views in wild segments along the Lyell and Dana Forks, through the Grand Canyon of the Tuolumne, and below Hetch Hetchy Reservoir.

Infrastructure associated with the Glen Aulin High Sierra Camp, including a utility shed with a small solar panel and water pipes, would remain visible from some locations in the river corridor. The structures associated with the camp would remain visible from a few locations along the trail through this area.

Scenic Segments

As noted above, scenic resources in the Tuolumne Meadows area currently meet VRM class II objectives. The visual landscape character of Tuolumne Meadows would remain that of a natural subalpine meadow interspersed with stands of lodgepole pines. The predominantly open meadows would continue to provide for a remarkable series of visual experiences, including unobstructed viewing of the craggy Sierra Nevada horizon line, sightings of the meandering river and the native flora and fauna, watching dramatic weather formations roll in, and stargazing. The mechanical removal of conifers from Tuolumne Meadows, which helped maintain scenic vistas in the past, would not continue under the no-action alternative and would not be resumed unless ongoing research indicated that it should be part of a comprehensive ecological restoration program.

Under the no-action alternative, the developed portion of Tuolumne Meadows would generally retain the character of a rustic outpost at the edge of the High Sierra wilderness. Most development in the Tuolumne Meadows area would remain situated south of Tioga Road in well-defined clusters along the meadow’s southern margins in a way that minimizes the impact on the scenic resources of Tuolumne Meadows. Most existing facilities, particularly those at the east end of the area, are in nonvisible or low-visibility zones. The wastewater treatment ponds are in a high-visibility zone. The campground lies in high- and moderate-visibility zones, as do the Road Camp housing and maintenance area and the wastewater treatment plant. The store and grill and public fuel station are in moderate- and low-visibility zones. The scenic analysis conducted in 2007 concluded that “development in Tuolumne Meadows imposes a minimal degree of visual intrusion, and has not changed overall since the time of designation” (NPS, Torgerson and Schaible 2007o).

Views into and away from Tuolumne Meadows are being affected by roadside parking, which has increased since the 1997 flood destroyed the Cathedral Lakes parking area and as visitor use numbers have increased parkwide. In addition, lodgepole pines are encroaching into views, as noted in the *Scenic Vista Management Plan* and workplans developed for scenic vista management in appendix I.

2011 Evaluation of Key Observation Points at Tuolumne Meadows

In 2011, NPS employees conducted an existing conditions inventory to establish a baseline description at key observation points in the Tuolumne Meadows area. Scenic contrast rating worksheets were completed at each location. Each work sheet documented the landscape and management class for the area, including the following:

- landscape character notes (i.e., landform/water, vegetation and structures) and elements (i.e., form, line, color, and texture)

- landscape scoring (i.e., landform, vegetation, water, color, influence of adjacent scenery, scarcity, cultural modification)
- A determination of use volume and attitude of visitors

Based on the existing conditions inventory done in October 2011, the Tuolumne Meadows area easily met the description of VRM class II. Observers noted that the road and the cars parked alongside it detracted from the view, but were impressed at the area's variety of forest and meadow openings, the presence of the river, the unique mountain horizon, and the overall richness of the landscape in the meadows.

Additional Observations

Sources of artificial light at Tuolumne Meadows are still very low (NPS, Duriscoe 2005c). Draft outdoor lighting guidelines have been developed to protect night skies in Tuolumne Meadows from artificial light associated with visitor and administrative activities (NPS 2011f). The cultural landscape at Tuolumne Meadows includes historic roads and turnouts that provide access to views.

Conclusion

Under the no-action alternative, wild segments of the river corridor would meet VRM class I objectives. Local long-term negligible adverse impacts on the natural scenery associated with the visibility of facilities at the Glen Aulin High Sierra Camp would remain.

Scenic resources in Tuolumne Meadows area would meet VRM class II objectives. Most development would remain south of Tioga Road, thus minimizing the impact on the scenic resources of Tuolumne Meadows. Localized concerns along the Tioga Road view corridor associated with roadside parking would remain. Overall, outstanding scenery and viewing opportunities would be retained throughout the river corridor. However, given the lack of iconic scenic vista management in scenic segments (along roadsides), there would be long-term moderate adverse impacts on iconic views and visitor viewing opportunities.

Cumulative Impacts

Cumulative impacts on scenic resources are based on analysis of past, present, and reasonably foreseeable actions in Yosemite National Park, in combination with potential effects of this alternative.

The park's *Scenic Vista Management Plan* provides a systematic program for documenting, protecting, and reestablishing important viewpoints and vistas throughout the park outside of designated Wilderness. The 2011 finding of no significant impact for that plan stipulates that the identification and management of vista points for the Tuolumne and Merced River corridors will be deferred to the comprehensive river management plans. Additionally, the park's *Fire Management Plan* calls for the use of fire management practices to restore natural resource areas and maintain open vistas.

The no-action alternative may not adequately protect the scenery in the Tuolumne River corridor because there would be no management of scenic vista management along roadsides. Localized long-term minor adverse impacts along the Tioga Road view corridor associated with roadside parking and lodgepole pines encroaching into views from traditional scenic vistas would remain.

Environmental Consequences Common to Alternatives 1–4

Wild Segments

Wild segments of the Tuolumne River corridor would continue to meet VRM class I objectives under any of the action alternatives. As with the no-action alternative, views in wild segments would continue to be dynamic and subject to change from the natural changes in vegetation, geologic features, or climate. Wilderness management, which allows the natural scenery to evolve in response to ecological processes and through the use of natural and prescribed fires, would protect the features that contribute to the views along the Lyell and

Dana Forks, through the Grand Canyon of the Tuolumne, and below Hetch Hetchy Reservoir. Monitoring of wild segments would occur only when needed.

Scenic Segment

Under any of the action alternatives, scenic segments of the Tuolumne River corridor would continue to meet VRM class II objectives. As with the no-action alternative, the predominantly open meadows would continue to provide for a remarkable series of visual experiences from key observation points, including unobstructed viewing of the craggy Sierra Nevada horizon line, sightings of the meandering river and the native flora and fauna, watching dramatic weather formations roll in from the west, and stargazing.

The ecological restoration program would be expected to greatly improve views of the meadows from several key observation points by removing informal trails, reducing the amount of bare soil visible in the meadows, and restoring meadow vegetation. In addition, the elimination of roadside parking (with the exception of a few designated turnouts) from Tioga Road and the road to Tuolumne Meadows Lodge would remove a highly visible intrusion into scenic views from most key observation points. The linear view corridors following Tioga Road and the Great Sierra Wagon Road trail from Tioga Road to Parsons Memorial Lodge would be preserved in their current alignments, thus retaining key historic scenic vistas.

The removal of conifer seedlings from Tuolumne Meadows to protect historic views and vistas would be discontinued, with the result that the landscape character could be locally altered over time if lodgepole pine continued to move into the meadows. In addition, short-term activities to remove infrastructure, construct or remove facilities, and restore ecological conditions would result in temporary intrusions into views.

Under all action alternatives, facilities would be redesigned, relocated, or constructed in ways intended to retain the rustic, dispersed character of development. Most development in the Tuolumne Meadows area would remain situated south of Tioga Road in well-defined clusters along the meadow's southern margins in a way that minimizes the impact on the scenic resources of Tuolumne Meadows. All new structures would be subject to VRM contrast analysis during the design phase of construction planning. Overall monitoring of scenic segments would take place every four years to ensure that any recommended mitigations and actions are within the VRM class II management objectives.

Environmental Consequences of Alternative 1

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 1 on scenic resources are described below.

Wild Segments

Under alternative 1, natural scenery in the Glen Aulin vicinity would be improved by removing all High Sierra Camp facilities and restoring the camp to natural conditions. Construction and management activities to remove infrastructure and restore natural conditions would result in temporary intrusions into views.

Scenic Segment

A substantial portion of the facilities and infrastructure at Tuolumne Meadows would be removed under alternative 1, and the development footprint would be considerably reduced compared to existing conditions. Some facilities that would remain would require alterations to meet current building codes and public health and safety regulations. Most notably, this would include converting employee tent cabins to hard-sided structures, which could change the character of these facilities to less temporary and more permanent components of the landscape. Most housing would be in nonvisible or low-visibility zones, although the new housing at Road Camp would be in a moderate-visibility zone.

The Road Camp housing and maintenance area, the campground, and the wastewater treatment plant would remain in high- or moderate-visibility zones. New wastewater treatment facilities on the south side of Tioga Road would be sited in high- and moderate-visibility zones; however, this effect would be offset by the removal of the existing wastewater treatment ponds from a high-visibility zone and an area that is visible from outstanding vista points.

No vegetation management to restore or enhance scenic vistas in nonwilderness areas along Tioga Road would occur under alternative 1. Scenery would be shaped by natural ecological processes, and vegetation might encroach into views from key observation points as well as some of the scenic vista points identified in appendix I. As most visitors experience the scenery from the road, this would be an adverse impact on the visual resource.

Roadside parking would be eliminated from the road to the concessioner stable as well as along Tioga Road and the road to Tuolumne Meadows Lodge, thus removing the additional intrusions visible from most key observation points.

Conclusion

Overall, alternative 1 would have a local long-term minor to moderate beneficial impact on scenic resources in the Tuolumne River corridor.

Wild segments of the river corridor would remain within VRM class I objectives. Compared to the no-action alternative, the natural scenery at Glen Aulin would be enhanced by removing all permanent structures at the High Sierra Camp under this alternative.

Scenic segments would remain within VRM class II objectives under alternative 1. The NPS would improve the natural scenery and enhance views from key observation points at Tuolumne Meadows by removing the artificial wastewater treatment ponds and all commercial facilities, removing informal roadside parking, and implementing the ecological restoration program for the meadows. Overall, VRM class II objectives would be applied to the cultural landscape in the scenic segments of the river corridor, especially with potential contrast from new facilities (e.g., parking).

There would be local long-term minor adverse impacts on the natural scenery at Tuolumne Meadows associated with redevelopment of housing and the wastewater treatment plant. In addition, there would be a minor adverse impact on scenic resources and viewing opportunities along Tioga Road resulting from lack of scenic vista management.

Cumulative Impacts

The past, present, and reasonably foreseeable projects, plans, and actions that could have a cumulative impact on scenic resources in combination with alternative 1 would be the same as described for the no-action alternative. Overall, alternative 1 would protect or enhance localized scenic resources by removing some facilities in the river corridor. However, given the lack of iconic scenic vista management in scenic segments (along roadsides), there would be long term moderate adverse impacts on iconic views and visitor viewing opportunities

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on scenic resources are described below.

Wild Segments

With alternative 2, the Glen Aulin High Sierra Camp would be converted to a seasonal outfitter camp, and all permanent infrastructure associated with the camp except for a new composting toilet would be removed.

Temporary structures erected during the short summer season would be visible from the Glen Aulin trail, but the presence of the seasonal camp would be less noticeable than under existing conditions. Short-term activities to remove the permanent facilities and construct the composting toilet would result in temporary intrusions into views. Infrastructure associated with the High Sierra Camp, including a utility shed with a small solar panel and water pipes, would remain visible from some locations in the river corridor.

Scenic Segments

Several visitor and administrative facilities would be redesigned in place or relocated, and there would be an overall expansion in the development footprint to accommodate additional designated parking at Tuolumne Meadows. Some of the proposed new or redesigned facilities, including a new designated parking area south of Tioga Road and hard-sided cabins for employee housing, would have a less temporary and more permanent character than existing infrastructure. New development for designated parking would be in a highly visible location and visible from at least some key observation points. However, this new parking area would be less intrusive than the existing informal roadside parking that it is intended to replace.

The wastewater treatment ponds, the Tuolumne Meadows campground, and the Road Camp housing and maintenance area would remain in high- or moderate-visibility zones. The new consolidated stables would be in a moderate-visibility zone; this impact would be offset by removing the existing stable facilities and providing a new picnic and day use area overlooking the meadow. Views from eight outstanding vista points would be maintained following individual work plans to protect ecological conditions at each particular location.

Conclusion

Overall, implementation of alternative 2 would have a local long-term minor to moderate beneficial impact on scenic resources in the Tuolumne River corridor.

Wild segments in the river corridor would remain within VRM class I objectives. Compared to the no-action alternative, the NPS would improve the natural scenery at Glen Aulin under alternative 2 by removing all permanent infrastructure at the High Sierra Camp (with the exception of a composting toilet).

Scenic segments would remain within VRM class II objectives under alternative 2. The NPS would improve the natural scenery and enhance views from key observation points at Tuolumne Meadows by implementing the ecological restoration program for the meadows and removing informal roadside parking. Scenic vistas along Tioga Road would be improved by the removal of vegetation encroaching into the views. Overall, VRM class II objectives would be applied to the cultural landscape in the scenic segments of the river corridor, especially with potential contrast from new facilities. Outstanding scenery and viewing opportunities would be retained throughout the scenic segments, particularly along road corridors, resulting from vista management described in appendix I.

There would be a local long-term minor adverse impact on the natural scenery at Tuolumne Meadows associated with redevelopment of housing, redevelopment of the wastewater treatment plant, and development of a new designated parking area south of Tioga Road in an area visible from some key observation points. However, the new designated parking area would be less visible than the existing roadside parking that it is intended to replace. There might be an additional local long-term minor adverse impact on scenic resources associated with lodgepole encroachment into Tuolumne Meadows, if encroachment continued to occur under the proposed ecological restoration program.

Cumulative Impacts

The past, present, and reasonably foreseeable projects, plans, and actions that could have a cumulative impact on scenic resources in combination with alternative 2 would be the same as described for the no-action alternative. In conjunction with these plans and actions, alternative 2 would protect most of the scenery in the

river corridor and reduce current adverse impacts associated with informal roadside parking and lodgepole encroachment into scenic vistas, thus cumulatively resulting in a local long-term minor to moderate beneficial impact on scenic resources.

Environmental Consequences of Alternatives 3 and 4 (Preferred)

The impacts on scenic resources under alternatives 3 and 4 would be essentially the same. Therefore, these alternatives are addressed collectively, below. In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 or 4 on scenic resources are described below.

Wild Segments

The Glen Aulin High Sierra Camp would remain with alternative 3 or 4. New canvas colors on tents at the High Sierra Camp would better blend into the landscape but would still be visible from the trails through this portion of the Grand Canyon wild segment. Construction to improve facilities at the Glen Aulin High Sierra Camp would result in temporary intrusions into views.

Scenic Segment

There would be relatively small changes in the overall development footprint at Tuolumne Meadows under alternative 3 or 4. Facilities would be removed, relocated, or redesigned in ways intended to retain the rustic, dispersed character of development. Removal of the public fuel station and mountaineering shop building would reduce the presence of commercial facilities in the corridor, thus enhancing the natural scenic setting. The area would generally retain the character of a rustic outpost at the edge of the High Sierra wilderness. However, some of the proposed new facilities, including small hard-sided cabins to replace substandard employee tent cabins, would have a less temporary and more permanent character. Designated parking areas, some of which are visible from key observation points, would also appear more permanent than informal roadside parking. In alternative 4, the new visitor contact station and designated parking area west of Unicorn Creek would be visible from some key observation points. However, in both alternatives 3 and 4, new designated parking would be less visible than the existing roadside parking that it is intended to replace.

Most existing facilities, particularly those at the east end of the Tuolumne Meadows area, would be in nonvisible or low-visibility zones. The wastewater treatment ponds, the wastewater treatment plant, the campground, and the Road Camp housing and maintenance area would remain in high- or moderate-visibility zones. The store and grill would remain in moderate- and low-visibility zones.

Views from eight outstanding vista points would be enhanced while protecting ecological conditions at each particular location. Scenic viewing opportunities would be improved following individual work plans to protect ecological conditions at each particular location.

Conclusion

Overall, alternative 3 or 4 would have a local long-term minor to moderate beneficial impact on scenic resources in the river corridor.

Wild segments of the Tuolumne River corridor would remain within VRM class I objectives. As with the no-action alternative, local long-term negligible adverse impacts on the natural scenery associated with the visibility of facilities at the Glen Aulin High Sierra Camp would remain.

Scenic segments of the river corridor would remain within VRM class II objectives. Compared to the no-action alternative, alternative 3 or 4 would improve the natural scenery and enhance views from key observation points at Tuolumne Meadows by implementing the ecological restoration program for the meadows and removing informal roadside parking. Outstanding scenery and viewing opportunities would be retained

throughout the scenic segments, particularly along road corridors, resulting from vista management described in appendix I.

There would be a local long-term minor adverse impact on the natural scenery at Tuolumne Meadows associated with redevelopment of housing, the wastewater treatment plant, and in alternative 4, the relocation of the visitor center. The new visitor contact station and new designated parking area south of Tioga Road under alternative 4 would be in an area visible from some key observation points. However, the new designated parking area would be less visible than the existing roadside parking that it is intended to replace. There might be an additional local long-term minor adverse impact on scenic resources associated with lodgepole encroachment into Tuolumne Meadows, if that continued to occur under the proposed ecological restoration program.

Cumulative Impacts

The past, present, and reasonably foreseeable projects, plans, and actions that could have a cumulative impact on scenic resources in combination with alternative 3 or 4 would be the same as described for the no-action alternative. In conjunction with these plans and actions, alternative 3 or 4 would protect most of the scenery in the river corridor and reduce current adverse impacts associated with informal roadside parking and lodgepole encroachment into scenic vistas, cumulatively resulting in a local long-term minor to moderate beneficial impact on scenic resources.

Visitor Experience

Affected Environment

Stewardship of a wild and scenic river in a national park requires the consideration of two integrated purposes: (1) to preserve the river's free-flowing condition, water quality, and outstandingly remarkable values, and (2) to make these free-flowing rivers and their immediate environments available for the benefit and enjoyment of present and future generations.

The Tuolumne River corridor is a special place for many visitors to Yosemite National Park, drawing multiple generations of visitors to the banks of the river year after year. Visiting the river corridor has become a tradition for many visitors, and that tradition is a key component of the visitor experience. One returning visitor recounts:

I have been visiting Tuolumne Meadows for the last twenty-seven years on almost a yearly basis and I agree with the quote from John Muir that includes, "Going to the mountains is going home." I consider Yosemite, Tuolumne Meadows especially, as home. There is a special unique culture that is palpable in Tuolumne Meadows. I believe it stems from the quiet glory of the landscape and the spiritual connection of her visitors. (NPS 2006m)

The experience of visitors to the Tuolumne River corridor is dependent on a number of factors, including not only scenic grandeur, the natural environment of the High Sierra, and iconic cultural resources, but also the availability and quality of recreational and interpretive opportunities and visitor services. The current condition of these opportunities and services is described in this section.

Overview of Visitation and Visitor Demographics

Based on entrance station counts, Yosemite received an average of approximately 3.5 million visitors per year between 1985 and 2012. The highest recorded annual visitation, about 4 million, occurred in 1996, with a steady decline following the 1997 Merced River flood. However, parkwide use is again on the rise, with sharp increases experienced in recent years. Parkwide visitation averaged 3.9 million between 2010-2012 (see table 9-11). Visitation varies by month, with the greatest use occurring in July and August. Approximately 15% of all visitors come to Yosemite between November 1 and March 31 (see table 9-12).

Table 9-12.
Monthly Visitation, Yosemite National Park, 2012

Month	Monthly Visitation
January	120,496
February	113,341
March	136,687
April	243,102
May	356,500
June	528,186
July	623,101
August	660,118
September	482,004
October	322,687
November	141,868
December	125,314
TOTAL	3,853,404

Table 9-11.
Annual Visitation, Yosemite National Park 1990–2012

Year	Annual Visitation
1990	3,124,939
1991	3,423,101
1992	3,819,518
1993	3,839,645
1994	3,962,117
1995	3,958,406
1996	4,046,207
1997	3,669,970
1998	3,657,132
1999	3,493,607
2000	3,400,903
2001	3,368,731
2002	3,361,867
2003	3,378,664
2004	3,280,911
2005	3,304,144
2006	3,242,644
2007	3,503,428
2008	3,431,514
2009	3,737,472
2010	3,901,408
2011	3,951,393
2012	3,853,404

In general, there are two sometimes overlapping groups of Yosemite visitors: those who visit the developed or “frontcountry” areas of the park and those who visit Yosemite’s wilderness. For many

visitors to Yosemite, driving through the park provides the primary means of experiencing its many sweeping landscapes. The ability to make informal stops along the roads to take advantage of the unique and varied scenery contributes to each visitor’s opportunity to experience the park on his or her own terms.

A parkwide comprehensive study of visitor use in Yosemite National Park was conducted in the summer of 2005 (Littlejohn et al. 2005). This study provided a variety of visitor-related information, including demographic and use characteristics. The data collected allowed the NPS to compare visitor characteristics in Tuolumne Meadows to those in the park as a whole. A summary of Tuolumne area visitor demographic and use characteristics is shown in table 9-13.

Table 9-13.
Tuolumne Visitor Demographic and Use Characteristics

Gender	51.5% Male, 48.4% Female
Average age	32.8 years
Average group size	3.4 (statistically significant from overall park users at 5.2)
First-time visitors	51.7%
Average length of stay for day visitors	7.2 hours
Average length of stay for overnight visitors	3.7 days

Source: Littlejohn et al. 2005

Recreational Opportunities at Tuolumne Meadows

A wide range of recreational opportunities attract people of all ages and abilities to Tuolumne Meadows. Many individuals, families, and groups establish and renew traditional ties with the area, as the setting and kinds of activities they enjoy has remained essentially unchanged over decades.

One visitor describes the range of experiences available at Tuolumne Meadows:

Tuolumne Meadows is a locale that brings people into contact with great natural beauty on the edge of wilderness without requiring expeditionary ambition on the part of those who want the experience. Under snow for eight months every year, yet sitting astride a major highway, Tuolumne is partly wild and partly a resort, an oasis of outdoor accessibility for many thousands of curious folks, many of whom use it as a staging area into genuine wilderness, and others who are content with brief forays into the meadows, not venturing very far from their automobiles.
 (NPS 2006m)

The above comment captures what many would consider to be the traditional Tuolumne experience. The experience encompasses a wide variety of activities ranging from scenic driving to overnight wilderness backpacking. The 2005 visitor use study asked visitors which activities they participated in while visiting the park and which of these was their primary activity. These data were split out for Tuolumne area visitors specifically, and results are shown in table 9-14. Sightseeing; visiting the visitor center; participating in leisure pursuits such as painting, drawing, and photography; and day hiking are the most common activities. Of these, sightseeing and day hiking were the most often reported primary activities participated in by Tuolumne area visitors.

Table 9-14.
Tuolumne Visitor Activities

Activity	% Participating in Activity	% Identifying Activity as Their Primary Activity
Sightsee/take a scenic drive	91.9	60.0
Visit visitor center	58.9	0
Paint/draw/take photographs	54.1	4.4
Day hike	51.6	18.7
View wildlife/birdwatching	44.7	1.8
View roadside/trailside exhibits	44.3	0.4
Shop in park (other than park bookstore)	44.3	0
Eat in park restaurant	43.5	0
Picnic	37.8	0.4
Shop in park bookstore	33.3	0
Visit museum	26.4	0
Camp in developed campground	16.3	4.0
Other	14.6	4.9
Stay in park lodging	12.6	0
Attend ranger-led programs	8.9	0.4
Climbing	7.3	1.2
Overnight backpack	4.5	3.6

Source: Littlejohn et al. 2005

Visitor activities specific to the Tuolumne Wild and Scenic River can be categorized as direct and indirect river recreation. The *Interagency Reference Guide* characterizes this distinction as primary and secondary contact recreation (IWSRCC 1999). Primary contact recreation includes those activities in which there is prolonged and intimate contact with the water (e.g., swimming or wading). Secondary contact recreation involves

activities in which contact with the water is either incidental or accidental (e.g., fishing and shoreline activities). Both primary and secondary contact recreational activities take place in the Tuolumne River corridor. Boating and tubing are not allowed on the river.

Sightseeing

According to the 2005 visitor use survey, 92% of park visitor groups report that they sightsee during their visit, and 60% identify sightseeing as the primary reason for their visit.

Iconic views easily accessible from Tioga Road include the expansive Tuolumne Meadows, with Lembert Dome, Mount Dana, and Mount Gibbs to the east and the Tuolumne River meandering in the foreground. Another popular view is from the eastern side of Tuolumne Meadows looking west at Pothole Dome, Fairview Dome, and Cathedral and Unicorn Peaks, with the Tuolumne River flowing through the meadow. Seasonal wildflowers, wildlife sightings, and weather patterns can enhance these spectacular views.

Nearly half of the visitors who say they participate in sightseeing also participate in artistic pursuits, such as photography and painting. Wildlife viewing is another popular activity (NPS 1980b; Littlejohn et al. 2005; NPS 2006h).

Day Hiking

During the 2005 visitor use survey, 52% of visitor groups reported that they participated in day hiking. The Tuolumne River corridor offers access to hundreds of miles of hiking trails. The Pacific Crest Trail and John Muir Trail trailheads are located in Tuolumne Meadows, which also offers the most access to day hiking in the river corridor. One hiker describes:

Is there anything better than hiking through the upper meadows toward Mt. Lyell in the spring with wildflowers blooming, some chill left in the air and the sound of the river as it meanders along? Only the fall, when the crowds thin and the nighttime temperatures signal the advance of winter can the spring be rivaled. (NPS 2006m)

Popular destinations for short hikes in the Tuolumne Meadows area include the tops of Lembert and Pothole Domes and along the Lyell and Dana Forks. Additionally, many visitors walk to Parsons Memorial Lodge and Soda Springs.

Picnicking

Thirty-eight percent of visitor groups reported in the 2005 visitor use survey that they picnic during their visit. Enjoying lunch along the river, on a boulder or dome, at a campsite, or under the shade of a tree is an important part of the visitor experience. Visitors may also enjoy the only designated picnic area in the Tuolumne River corridor at the base of Lembert Dome. The few picnic tables located outside the Tuolumne store also offer an opportunity to sit down outside and eat. Most picnicking in the Tuolumne River corridor does not take place in designated picnic areas.

Swimming and Other Water Recreation

Swimming and wading in the Tuolumne River are popular in the summer in Tuolumne Meadows. Colder water temperatures make swimming in the Tuolumne River less popular than swimming in the Merced River or lower elevation lakes. Nonetheless, visitors who do choose to swim are often drawn to the countless pools, currents, and sandy banks along the river. Use of any type of vessel designed to carry passengers on the water is a restricted activity along the entire stretch of the Tuolumne River within Yosemite National Park as outlined in the 2009 Superintendent's Compendium (NPS 2009d).

Fishing

Fishing is a popular activity for visitors, particularly in the Tuolumne Meadows area. Popular fishing spots include the location directly northwest of the Tioga Road bridge and the riverbank near the A loop of the Tuolumne Meadows campground. Many informal trails provide access to the river's best fishing holes.

Because park waters were traditionally stocked, the NPS views fishing as an appropriate activity and one that helps remove nonnative species from national park waters. Various species of trout were introduced to park waters in the past, and brown, rainbow, and brook trout are now the fish most commonly caught in the Tuolumne River.

The NPS enforces California state fishing regulations. Fishing permits may be purchased at locations within Yosemite National Park, including the Tuolumne Meadows store.

Climbing

Climbers travel from all over the world to climb in Yosemite National Park. Yosemite is considered the most popular national park for climbing, and many routes are world renowned. While many consider the big walls of Yosemite Valley to be the key attraction for climbers, climbing in the Tuolumne River corridor is also very popular. One climber recounts:

I consider climbing at Tuolumne Meadows to be a great privilege and a national treasure. It is a favorite travel destination of mine. I hope to bring my children there climbing someday. And their children. (NPS 2006m)

Tuolumne Meadows is the central destination for climbing in the river corridor. Climbs in the Tuolumne Meadows area are generally shorter (fewer pitches) and require a different technique than many of the routes in Yosemite Valley. Beginner and intermediate climbing routes in the Tuolumne Meadows area attract novice climbers. Climbers often stage their trips from their motor vehicles in formal and informal parking areas along the Tioga Road. The parking area in front of the Tuolumne Meadows store is also a popular gathering area for climbers.

Interpretation and Orientation Services

The NPS and other organizations focus on the Tuolumne River and adjacent meadows as a centerpiece of nature interpretation and education in the Sierra Nevada. Ranger naturalists offer many programs in the Tuolumne River corridor in the summer focused on the natural and cultural history of Yosemite National Park and the High Sierra. Programs include a variety of two-hour morning and afternoon walks, half-day and all-day hikes, sunset programs, campfire talks, and stargazing. In addition, NPS interpretive rangers lead five- to seven-day loop trips accompanying visitors to the High Sierra Camps.

The Parsons Memorial Lodge Summer Series, a forum for the arts and sciences, takes place in Tuolumne Meadows at the historic Parsons Memorial Lodge. Speakers and performers who are experts in their fields complement and enhance the park's interpretive programs. Park partners also maintain an interpretive presence in the Tuolumne River corridor. The Yosemite Conservancy regularly offers courses in Tuolumne Meadows and occasionally hosts campfires at Tuolumne Meadows Lodge and programs at Olmsted Point.

The NPS provides visitors with information regarding Yosemite National Park in many different formats, including the free Yosemite Guide newspaper, a free park brochure/map, wayside exhibits at roadside turnouts, and supplemental education materials. Many of these materials are available online to facilitate trip planning before visitors arrive at the park.

According to the 2005 visitor use survey (Littlejohn et al. 2005), 59% of park visitors go to the Tuolumne Meadows visitor center to obtain general information or to ask questions for trip planning. The visitor center,

which is located south of Tioga Road in Tuolumne Meadows, contains hands-on exhibits about the natural and cultural history of the area, including the flora, fauna, insects, geology, Miwok and Paiute ancestral trans-Sierra trails, mining, Tioga Road, and John Muir. The Yosemite Conservancy offers books, hiking guides, maps, and other informational merchandise for sale.

The wilderness center in Tuolumne Meadows provides wilderness trip planning assistance. The wilderness center staff issue bear canisters and wilderness permits and provide visitors with information on Leave-No-Trace ethics to be used in the Yosemite Wilderness.

Visitor Services

Commercial services at Tuolumne Meadows include a store, grill, post office, mountaineering shop, and public fuel station. Overnight accommodations in the corridor include a campground, the Tuolumne Meadows Lodge, and the Glen Aulin High Sierra Camp. Guided stock rides and a mountaineering school are also offered.

Commercial Services

The Tuolumne Meadows store is located south of Tioga Road, approximately one mile east of the visitor center. The store is open seasonally and located within a canvas-sided tent with a permanent wooden frame. The store carries items such as backpacking and camping supplies, groceries, souvenirs, and firewood. A grill that serves fast food shares the same canvas tent building as the store. A post office in this structure serves visitors and employees and supports through-hikers on the Pacific Crest Trail and John Muir Trail with self-mailed packages. The NPS estimates that the post office receives approximately 150 packages per week during the summer, half of which are hiker food/resupply caches. Two self-service fuel pumps west of the store and grill provide visitors with fuel; water and air are also available to motorists.

Camping

The Tuolumne Meadows campground is one of the larger campgrounds in the national park system and offers tent, recreational vehicle (RV) (no hookups), group, horse, and backpacking sites to visitors. Half the sites are available on a first-come, first-served basis, and half are available for advanced reservations by phone or email. The maximum length of stay permitted is 14 days for most sites. In backpacker sites, campers are allowed to stay only one night before a trip and one night when they return. The average length of stay in campground sites is approximately five nights during the peak season (usually six weeks in July and August) and two nights during the shoulder seasons. Occupancy rates are often 100% in the peak season. The A-loop borders the Tuolumne River and is particularly popular with campers because of its proximity to the river.

One park camper reflects:

Camping brings the visitor into a direct relationship with park resources and distances the visitor from the commercial values of comfort and convenience and the expression of social status. Thus, camping brings the visitor closer to the very natural attributes for which national parks were set aside and protected. (NPS 2006m)

Lodging (High Sierra Camps)

The Tuolumne River corridor contains two of the park's seven rustic high-country lodging camps, some of which are connected by a camp-to-camp loop trail system. One of the camps, the Tuolumne Meadows Lodge (Tuolumne Meadows High Sierra Camp), is accessible by vehicle from Tioga Road. The Glen Aulin High Sierra Camp is accessible by hiking or horseback riding (as are the other camps outside the river corridor). A visit to one or more of the camps is a popular activity for people of various ages and abilities. Both Tuolumne Meadows Lodge and the Glen Aulin High Sierra Camp have occupancy rates exceeding 90% (NPS 2008m).

The camps are operated by the park concessioner and are open seasonally. Typically, Tuolumne Meadows Lodge opens to the public the last week in June and closes the second week in September. The Glen Aulin High

Sierra Camp generally opens the first or second week of July and closes in the first week of September, although there have been occasions when a deep snowpack has prevented the High Sierra Camps from opening at all.

Tuolumne Meadows Lodge is located along the Dana Fork. The lodge includes a hard-sided kitchen and supply storage area with a loading dock, a canvas-sided dining hall and reception area, 69 canvas guest tents (which can accommodate four guests each), and one hard-sided shower house with flushing toilets. Guest tents lack electricity; however, the shower house and dining/reception tent do have electricity. The lodge area facilities include paved and dirt paths between the dining hall/reception area and the guest tents, trash and recycling receptacles, a parking area with food storage lockers, a campfire ring with benches, and informational and directional signs.

The Glen Aulin High Sierra Camp is located approximately 6 miles downstream from Tuolumne Meadows at the top of the Grand Canyon of the Tuolumne. The High Sierra Camp includes a stone kitchen, a stone restroom with flush toilets, a storage building, a canvas-sided dining tent, eight guest tents, three employee tents, a canvas employee shower house, a hitching post and corral, and three additional metal or wooden storage facilities for supplies, water treatment, and garbage disposal. The camp lacks electricity; its kitchen lights and stove are fueled by propane. The radio telephone at Glen Aulin operates on solar power and is used for operations and emergencies. Lodging and dining capacity is 32 people plus 10 additional meals for backpackers. Supplies are delivered to Glen Aulin and waste is packed out by stock. Occasional operational needs require the use of a helicopter.

Mountaineering Classes and Guided Tours

The Yosemite Mountaineering School is located in Tuolumne Meadows and offers courses in rock climbing, alpine climbing, mountain climbing, ski guiding, day hiking/tours, and overnight guided backpacking trips throughout Yosemite National Park. The majority of climbing students are beginners; there were approximately 350 students in 2008. The school led approximately 187 clients on guided climbs in 2008.

Tuolumne Meadows Shuttle Service

The Tuolumne Meadows shuttle transports visitors to various locations throughout the Tuolumne Meadows area. During the summer, the 24-passenger shuttle runs every 30 minutes from 7:00 a.m. to 7:00 p.m. Shuttle stops include the Tuolumne Meadows Lodge, Dog Lake trailhead parking area, wilderness center, Lembert Dome, campground store and grill, visitor center, Cathedral Lake trailhead, Pothole Dome, Tenaya Lake, May Lake trailhead, and Olmsted Point. In addition to the Tuolumne Meadows shuttle service, a daily backpacker shuttle transports backpackers between Yosemite Valley and Tuolumne Meadows.

Wilderness Experience and Recreation

The Tuolumne was designated a wild and scenic river in 1984, under the California Wilderness Act – the same act that designated the Yosemite Wilderness. More than 90% of the Tuolumne River corridor is designated Wilderness. To stay overnight in wilderness, hikers must obtain a wilderness permit, and they must backpack to reach more remote destinations. However, not all wilderness in the Tuolumne River corridor is remote. The Tioga Road corridor provides relatively easy access to wilderness, particularly near Tuolumne Meadows. The wilderness experience in these areas differs from a remote wilderness experience. Visitors to more accessible areas in wilderness may encounter more people and human-made noises; however, a distinct kind of experience is still provided in these areas.

One visitor notes:

To me, Tuolumne Meadows is a place where I can have access to wilderness. Tuolumne is a place where I can find quiet, solitude, peace, relaxation, adventure and challenge. (NPS 2006m)

A wide variety of recreational activities are available in wilderness, including backpacking, camping, day hiking, nature study, fishing, swimming and wading, climbing, horseback riding and pack stock use, winter skiing, and trans-Sierra treks.

Wilderness Access and Trailhead Quotas

Access to the Yosemite Wilderness is managed through a system of zone capacities and related overnight trailhead quotas.

Wilderness zone capacities are enforced by controlling overnight access to the wilderness through a trailhead permit system. Controlling overnight use at the trailhead allows for maximum visitor freedom—considered a cornerstone of the wilderness experience—while allowing the park to limit or disperse use as appropriate. In addition, requiring a wilderness permit allows the NPS to have a face-to-face educational contact with every party spending the night in the wilderness. Wilderness day use is not regulated by the quota system.

While overnight visitation to the Yosemite Wilderness has decreased substantially since the quota system was instituted, demand for wilderness permits in the Tuolumne River corridor remains well above the established quotas. The Yosemite Wilderness is one of the busiest in the NPS system, and it is somewhat hard to find solitude within day hiking distance of Tuolumne Meadows trailheads during the summer hiking season. However, beyond that distance (usually 3 to 5 miles) conditions for solitude are more abundant.

Backpacking

The Tuolumne River corridor has 10 major trailheads that provide access to almost 800 miles of marked trails within Yosemite National Park. These trails are maintained seasonally by NPS backcountry trail crews with the help of the California Conservation Corps and Youth Conservation Corps members. Most marked and maintained wilderness trails are open to private and commercial stock use. Hikers in groups of eight persons or less are allowed to use cross-country routes and are encouraged to practice minimum-impact techniques. The development of informal trails continues to be problematic because these trails lead to vegetation trampling and cause erosion.

Trailhead quotas and recent numbers of permits issued for Tuolumne River corridor trailheads and other popular trailheads in the Tuolumne Meadows area are presented in table 9-15. Backpackers may obtain wilderness permits from the wilderness center in Tuolumne Meadows and elsewhere in the park.

Table 9-15.
Tuolumne River Corridor Wilderness Trailhead Permits, 2008 and 2010

Trailhead	Daily Quota	Number of Permits (total for year)		Number of People (total for year)	
		2008	2010	2008	2010
Lyell Canyon	40	1,361	1,182	3,531	3,261
Budd Creek (cross-country only)	5	82	86	176	207
Cathedral Lakes	25	877	885	2,602	2,527
Rafferty Creek (Vogelsang)	20	746	747	1,965	1,949
Young Lakes via Dog Lake	20	376	447	1,005	1,181
Young Lakes via Glen Aulin	10	200	175	489	410
Mono/Parker Pass	15	203	229	484	576
Glen Aulin	35	813	804	2,501	2,510
Glen Aulin to Cold Canyon/Waterwheel Falls	15	452	440	1,160	1,091
Poopenaut Valley	25	26	37	76	109

Backpackers often begin their hikes into the wilderness at Tuolumne Meadows trailheads for either the Pacific Crest Trail or the John Muir Trail. From these trails, which lead both north and south of the Tuolumne River, countless other trails diverge, and backpackers have access to the entire Yosemite Wilderness. Many

backpackers loop through the High Sierra Camps. Other popular destinations are Lyell Canyon and the Grand Canyon of the Tuolumne.

Some backpackers are through-hikers along the Pacific Crest Trail or John Muir Trail and have started at locations outside the park and enjoy a stop at Tuolumne Meadows. The Tuolumne Meadows post office serves as a support service for through-hikers who pick up self-mailed food caches at this location. The Pacific Crest Trail, officially completed in 1993, extends 2,650 miles from Mexico to Canada through three western states. In Yosemite National Park, the Pacific Crest Trail follows the Lyell Fork and the Tuolumne River through Tuolumne Meadows and on to Glen Aulin before veering north through Cold Canyon and beyond. The John Muir Trail begins at Happy Isles in Yosemite Valley; it continues for a total of 215 miles through Yosemite National Park (including a segment through Tuolumne Meadows and Lyell Canyon), the Ansel Adams Wilderness, Sequoia National Park, and Kings Canyon National Park; and ends at Mount Whitney.

Wilderness Camping

In much of the Tuolumne River corridor within wilderness, backpackers choose their own campsites. Camping is generally allowed anywhere in the wilderness, provided it is at least 100 feet from any water. Camping is discouraged in sensitive areas (i.e., meadows and other areas with fragile vegetation). In some areas, there are no-camping or no-fire zones. No-camping zones include all areas within 1 mile of public access roads, the Mono Pass/Dana fork area, the Gaylor Lakes basin, and within 4 trail miles of Tuolumne Meadows and Hetch Hetchy. Campfires are generally allowed below 9,600 feet in elevation, although restrictions exist in certain areas (due to the availability of dead and downed wood and the level of wildland fire danger).

A designated backpacker campground at Glen Aulin contains 35 backpacker sites. Facilities to support this campground include food storage lockers, a composting toilet, and fire pits. Concessioner staff at Glen Aulin High Sierra Camp and NPS backcountry utilities staff maintain these facilities cooperatively.

Low-impact camping practices have evolved over the years to better protect wilderness values. When wilderness campers obtain their permit, they are instructed in how to minimize or avoid impacts by camping in existing sites, minimizing trips to water to avoid creating informal trails, properly disposing of human waste and dishwater, leaving cultural artifacts where they find them, and storing food properly to prevent feeding wildlife.

Campsite monitoring and restoration of wilderness campsites started in the 1960s. Campsites are restored both by wilderness rangers and a dedicated wilderness restoration crew. Campsites close to water and in other sensitive locations are restored, while those in more durable locations are maintained. Lyell Canyon, in particular, has seen extensive restoration of campsites since the 1980s.

Day Hiking

Popular day hiking destinations in wilderness include the many pools and rapids below Tuolumne Meadows. Waterwheel Falls, 9 miles downstream from Tuolumne Meadows, is considered a day hiking destination by some visitors and is popular when water is high in the early season. Dog Lake, Elizabeth Lake, and Cathedral Lakes are also very popular destinations from trailheads located in Tuolumne Meadows.

In addition to day hiking from Tuolumne Meadows, park visitors may hike below Hetch Hetchy Reservoir. The Poopenaut Valley trail begins at a signed trailhead 4 miles past the Hetch Hetchy entrance station. It is a steep 2.5-mile roundtrip trek with approximately 1,300 feet of elevation change. The area is used for both day hikes and backpacking. The number of overnight wilderness permits issued for the area is relatively low but has been increasing since the time of designation (NPS 2008a).

Stock Use

Horseback riding and animal boarding services are provided at the Tuolumne Meadows stables operated by the park concessioner. The Tuolumne Meadows campground has a horse camp for visitors who bring their own stock for riding or packing.

The Tuolumne River corridor is available to both commercial and private stock use. The majority of stock use is conducted by the park concessioner to pack supplies and provide saddle trip access to the High Sierra Camps and day rides from a stable in Tuolumne Meadows. In addition to concessioner pack stock use, commercial outfitters bring horseback riders from the eastern Sierra gateway communities into the park via Donohue Pass and Lyell Canyon. A few visitors bring their own stock.

In wilderness, overnight parties are limited to 25 head of stock and 15 people. These groups are required to stay in campsites that have been previously used by stock. Stock use numbers vary from year to year, largely due to environmental and trail conditions.

The primary park concessioner currently offers 3 two-hour rides, 2 four-hour rides, and 1 full-day ride daily from the Tuolumne Meadows concessioner stable. A maximum of 12 people per ride can take the two-hour rides, and all three daily rides are often booked during July and August, when most of this use occurs. The four-hour rides accommodate a maximum of 10 people per ride and are less popular, and the full-day rides, which can take up to 6 people, are rare. The maximum total capacity of all these rides is 62 people per day. Horseback riding is a relatively popular recreational activity and also allows individuals with disabilities or mobility impairments the opportunity to experience the Yosemite Wilderness.

Most concessioner day rides currently leave the Tuolumne Meadows concessioner stable and take visitors to destinations in the river corridor wilderness. In recent years, the two-hour rides go past Dog Lake and up to the pass on the way to Young Lakes, the four-hour rides go to Twin Bridges on the Glen Aulin trail, and the occasional all-day ride usually goes to Waterwheel Falls. For the 2001 season, the NPS documented 1,148 two-hour rides, 139 four-hour rides, and 17 all-day rides. In 2011 the two-hour rides accounted for 2,264 total stock passes in Tuolumne Meadows and on the Young Lakes trail.

The Glen Aulin and Lyell Canyon trails are particularly popular trails for both hikers and stock users due to their scenic value, relatively flat grades, easy access from Tuolumne facilities, and position in relationship to the High Sierra Camp loop and the Pacific Crest Trail. Serving as major gateways to both the north and south, these two trails each rank among the top five most heavily used trails in the park. Both trails have been widened by the combination of heavy use by both stock and hikers.

In 2011, the concessioner accounted for 77% of the stock use on the Glen Aulin trail. High Sierra Camp set-up, resupply, and take-down accounted for 88% of this use, with the remaining concessioner stock use being saddle trips, half-day rides, and full-day rides. Other stock users on the Glen Aulin trail included private stock users (11%), commercial outfitters (8%), and NPS administrative use (4%).

The concessioner accounted for approximately 35%, of the stock use on the Lyell Canyon trail (primarily on the section between the stables and Rafferty Creek, leading toward Vogelsang High Sierra Camp). Other stock users on the Lyell Canyon trail included commercial outfitters (36%), private stock users (19%), and NPS administrative users (10%). See table 8-1 in chapter 8 for a more complete breakdown of stock use by trail within the river corridor.

Lyell Canyon meadows receive consistently high amounts of stock use, primarily due to their location as the best stock camping areas between Donahue Pass and Tuolumne Meadows. These meadows are used primarily by commercial pack operators, and occasionally by NPS trail crews. The season of use depends largely on snow pack on Donahue Pass but has started as early as July 12 or as late as August 5 in the last 10 years. An average of

72% of commercial stock use occurs in August. Between 2003 and 2007, commercial use nights have ranged from 219 to 564 animals and 134 to 339 people per year, with a maximum of 60 animals present on one night in 2007. Stock were present an average of 21 nights per season in Lyell Canyon. Lyell Canyon use accounted for 24% of all outfitter nights and 19% of all stock nights for all park uses in 2008.

The trail between Glen Aulin and Pate Valley is extremely rough and dangerous for stock. It is, at best, not recommended for stock, and it is often closed to stock due to trail conditions. Although it has been ridden, it is rare to see any stock other than for administrative use. Pate Valley is occasionally used by private and administrative riders to cross from White Wolf trailheads to the northern wilderness trails, but this use has declined since the removal of stock support facilities at Harden Lake and White Wolf.

Research indicates that stock can affect a visitor's wilderness experience by noise, sight, sound, and smell, which may be in either conflict or accord with their wilderness values. Stock use may enhance the cultural or historic feeling of a wilderness experience for some, while others may find the presence of stock annoying. The impact of stock is greatest in camp areas and along trails, where visitors and stock are in proximity to each other, and where visitors cite crowding and congestion, manure, biting flies, trampling, grazed meadows, and impacts on water and vegetation from stock use as interfering with their visitor satisfaction. Studies suggest that negative experiences are greater in areas with less stock, which might imply that keeping stock concentrated in traditional areas may have less impact on visitor experience than if it were dispersed to nontraditional areas. In general, hiker satisfaction is reduced when they encounter stock during wilderness visits (McClaran and Cole 1993; Lucas 1980).

Commercial Use in Wilderness

Overnight commercial use in the wilderness portions of the Tuolumne River corridor averaged approximately 451 person-nights per year from 2005 to 2009. Of those nights, 263 (58%) visitors were on stock trips and 188 were on hiking trips. Commercial day use was negligible, averaging only 65 use days for the whole season, most of which occurred on the Mono/Parker Pass trail. For this analysis, the use patterns in 2009 have been selected to best represent existing conditions. Commercial use in 2009 (475 person-nights) was slightly higher than the 5-year average, while the percentage of stock use (240 person-nights or 51%) was slightly lower than the 5-year average (NPS, Fincher 2010m).

Boating

As outlined in the 2009 *Superintendent's Compendium* (NPS 2009d), whitewater boating is currently a restricted activity along the entire stretch of the Tuolumne River within Yosemite National Park:

All free flowing rivers, creeks, and streams within Yosemite National Park, except the Main Stem and South Fork of the Merced River as defined in this section, are closed to the use of any type of vessel designed to carry passengers upon the water and any other device, such as air mattresses or inner tubes that may be so used. (36 CFR 1.5(a) (1); 36 CFR 1.5(f))

Although some sections of the river are attractive to world-class boaters, those who fail to comply with this regulation face a fine and the possibility of arrest.

Winter Activities

In the winter, camping in the river corridor is permitted under wilderness regulations and is regulated through the wilderness permit system. Winter recreation in the Tuolumne River corridor is very remote. One winter recreation user notes:

There's nothing like Tuolumne in the winter. The remoteness of Tuolumne is an asset, especially in winter. (NPS 2006m)

In general, the corridor is experienced by overnight users in the winter; however, some day use exists below Hetch Hetchy, which can be more accessible due to its lower elevation. Snowmobiles and other mechanized vehicles are not permitted in the Tuolumne River corridor except for administrative use that has gone through a minimum-requirements analysis. Ski touring is the most popular winter activity in the Tuolumne River corridor. One skier recalls:

Skiing in Tuolumne Meadows, along the river, is a unique experience. (NPS 2006m)

Trans-Sierra ski trips are offered through the Yosemite Mountaineering School and are also popular for individuals. Most trans-Sierra ski trips in Yosemite National Park originate in Yosemite Valley or in an eastern Sierra location and travel across the Sierra Nevada via Tuolumne Meadows. Many trans-skiers leave a food cache in Tuolumne Meadows near the campground office the summer before.

Shoulder season recreational activities depend on seasonal weather but can offer visitors a variety of recreational options. Depending on road opening operations, park visitors are sometimes allowed to bicycle on the Tioga Road prior to it being open to motor vehicles. More accessible backcountry skiing is another recreational opportunity for day use visitors during shoulder seasons. If there is snow pack in the spring after the Tioga Road is open, there are many places along the Dana Fork to do some skiing.

Environmental Consequences Methodology

This analysis evaluates impacts on the visitor experience in terms of how it might be altered as a result of the various concepts for visitor use and the associated use levels described in the alternatives. The analysis considers changes in the kinds of recreational opportunities that would be available (including specific activities), the level of support services and facilities (including information, education, and commercial services), and how those changes would affect visitors' overall experiences in the river corridor. Because the visitor experiences under most alternatives would be different corridorwide, in wild segments and in scenic segments of the Tuolumne River corridor, the discussion of impacts is subdivided by those three topics.

Context: For the purposes of this analysis, only local impacts are considered. This includes impacts that would occur within the Tuolumne River corridor.

Intensity: The intensity of the impact considers whether the impact on visitor opportunities or availability to wilderness would be negligible, minor, moderate, or major. Negligible impacts would not be detectable and would be expected to have no discernible impact. Minor impacts would be slightly detectable, although they would not be expected to have an overall impact on the visitor experience. Moderate impacts would be clearly detectable to the visitor and could have an appreciable impact on the visitor experience. Major impacts would have a substantial, highly noticeable influence on the visitor's experience and could permanently alter access to and availability of various aspects the visitor experience.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration, such impacts associated with construction or restoration activities that might occur during a single visit to the park. A long-term impact would be a more permanent change in the environment or destination that the visitor experiences.

Type: Judging whether changes to people's experiences are positive or negative is subject to personal preferences; what may be viewed as desirable change by some people could be considered undesirable by others. Therefore this analysis considers multiple points of view when drawing conclusions about the type of impact.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current condition and management, as described under Chapter 8 and “Affected Environment” above.

Corridorwide

Day and overnight use would remain unchanged throughout the Tuolumne River corridor under the no-action alternative. Visitors would continue to enjoy a wide range of recreational activities, including sightseeing and scenic driving, nature study, hiking, camping, fishing, swimming, backpacking, stock use, rock climbing, and mountaineering. Use throughout the corridor would remain generally unconfined. In wild segments, management of visitor use would be as unobtrusive as possible, thus allowing maximum freedom of movement and opportunities to seek solitude. In the scenic segments at Tuolumne and Dana Meadows, access would also remain largely unrestricted. Individuals, families, and groups with traditional ties to the area would find it unchanged except for increasing numbers of visitors. According to an unpublished subset specific to Tuolumne Meadows, created by the author of the recent parkwide transportation experience survey (White 2011), visitors to Tuolumne Meadows agree that under current conditions they have easy access to important park sites and attractions, they connect with the natural environment, they experience a sense of freedom, it is easy to access scenic overlooks and vistas, and they can go “where they want, when they want.”

Day visitor levels, which are on an upward trend, are expected to continue increasing. Day use in the river corridor is currently estimated at a maximum of 1,774 people at one time, based on the most current parking occupancy data and traffic count data through 2011. Overnight visitor use totals a maximum of 2,892 people per night. Overnight use would continue to be managed by the capacities of the Tuolumne Meadows campground, the Tuolumne Meadows Lodge, and the Glen Aulin High Sierra Camp. The existing system of wilderness zone capacities and related overnight trailhead quotas would continue to manage overnight use in wilderness areas within the Tuolumne River corridor. For the purposes of this analysis, the total maximum use at one time for the no-action alternative, which is used as a baseline for comparison with the other alternatives, would be 4,666 visitors.

Wild Segments

Overnight use would remain as unconfined as possible under the no-action alternative, relying on the current wilderness zone capacity system, restrictions on camping in sensitive areas, and group size limitations to protect wilderness character. With the zone capacity system in place, visitors’ wilderness experience would be protected from crowding; however, this limitation on access would mean that some individuals would not have access to a particular location on a particular date if the trailhead quota was already filled.

Day use would also remain generally unconfined; visitors would experience no change in access to trailheads throughout the river corridor. Increasing visitor day use levels could contribute to increased perceptions of crowding on trails within a day hike of Tuolumne Meadows trailheads, particularly the trail to Glen Aulin and Waterwheel Falls. The encounter rate on the trail to Glen Aulin occasionally reached 9 or more encounters with other parties per hour in 2010 (Broom and Hall 2010). The standard of an average of 12 encounters with other parties per hour proposed in chapter 5 to protect the wilderness experience on this trail would be met under existing conditions. There is a potential to exceed the encounter rate standard if peak season visitor use levels on this popular trail increase over time.

Commercial use would remain unchanged, thus allowing people who rely on commercial outfitters to continue to enjoy this opportunity to visit the wilderness. This use currently amounts to about 475 person-nights on overnight trips per year (240 on stock trips and 235 on hiking trips) and 65 person-days on day trips per year. Concessioner stock day rides would also remain unchanged, allowing a maximum of 62 people per day the opportunity to take a day ride into the wilderness. The park concessioner would continue to account for the

majority of pack stock use on the Glen Aulin trail. Concessioner pack stock also use a very short stretch of the Lyell Canyon trail from Tuolumne Meadows to Rafferty Creek. Impacts from pack stock use, which visitors indicate includes crowding and congestion, manure on trails and in camping areas, offensive odors, dust, biting flies, and trampled vegetation, would continue to pose an adverse impact on some visitors' wilderness experience.

The Glen Aulin High Sierra Camp would be retained at its current character and capacity, accommodating a maximum of 32 people per night with no change in the level of service. The area would remain accessible via horseback or day hiking and retain distinctive opportunities for people of various ages and abilities to enjoy a remote high-country overnight experience without having to pack camping supplies. For other visitors passing through the area, the camp would continue to intrude on their wilderness experience of this highly scenic area.

Boating would continue to be prohibited along the entire stretch of the Tuolumne River within Yosemite National Park.

Scenic Segments

Visitors traveling the Tioga Road corridor would continue to enjoy an outstanding scenic driving experience along this designated scenic byway. Occasional turnouts would provide opportunities to stop and look around or take pictures of the river and its surroundings.

Visitors to Tuolumne Meadows would continue to find a great diversity of recreational and educational opportunities easily accessible to people of various ages and abilities.

Parking for day visitors would remain managed on a limited basis, if necessary, at site-specific locations, and visitors could park wherever they could find or make space. The fact that most visitors agree they have easy access to important park sites and attractions (White 2011) indicates that they are finding unsanctioned places to park. During 2011, up to 40% of parking occurred at undesignated locations during the peak hours when data were collected (DEA 2012). Some dissatisfaction with vehicle congestion and crowding at popular spots along the river and in the meadow was expressed during public scoping, and this dissatisfaction would be expected to continue and could increase over time. Shuttle bus service would continue to make it possible for visitors to circulate between major use areas without having to walk or move their private vehicles.

The Tuolumne Meadows campground would continue to provide 308 tent and RV campsites (including stock campsites), seven group sites with a capacity of 30 people each, and 21 backpacker campsites, together accommodating a maximum 2,184 people per night. The Tuolumne Meadows Lodge would continue to operate at the current capacity and level of service, accommodating a maximum of 276 people per night. The demand for these facilities would continue to be high, and some visitors would not be able to access these facilities during peak use periods.

Commercial services would be retained at current levels. This would continue the opportunity for travelers on Tioga Road to stop, rest, and refuel, and experience the meadows and river for a brief period. Visitors who have come to rely on commercial services, including food, fuel, and basic camping supplies, to support their day or overnight visit would continue to benefit from these services. Through-hikers on the Pacific Crest Trail or John Muir Trail would continue to have the opportunity to pick up supplies through the Tuolumne Meadows post office.

Conclusion

The no-action alternative would retain the current opportunities for a variety of day and overnight use throughout the Tuolumne River corridor. Most visitors currently express satisfaction with their experience. Based on the trend over the past 20 years, the level of use over the life of the *Tuolumne River Plan* (approximately the next 20 years) could fluctuate, with periods of increase or decrease. Visitors seeking

commercial food service, supplies, lodging, and fuel service at Tuolumne Meadows would continue to have access to those services. Due to the shortage of designated parking at Tuolumne Meadows, some visitors would be frustrated trying to locate parking during peak hours, although it is likely that some visitors would continue to opportunistically create parking spaces as needed.

A localized long-term minor adverse impact on some visitors in wild segments would continue to result from relatively high encounter rates on trails within a day hike of Tuolumne Meadows, some visitors' aversion to sharing trails and campsites with stock, and some visitors' perception of intrusion of the Glen Aulin High Sierra Camp facilities into a highly scenic area. A relatively smaller number of visitors would benefit moderately by being able to access the wilderness with support from a commercial outfitter or park concessioner, or by being able to spend the night in a remote High Sierra setting without having to carry camping equipment or food. Overall, the no-action alternative would be expected to maintain visitor satisfaction in the wild and scenic segments of the river corridor, resulting in a long-term moderate beneficial impact on visitor experience.

Cumulative Impacts

The surrounding Sierra, Stanislaus, Inyo, and Humboldt-Toiyabe National Forests are conducting recreational facility analyses that consider the need to update or change sites in order to meet the demand for recreational resources. The national forest travel management plans are expected to guide the forms of travel and use in the forests. These plans could change capacity levels and opportunities in the region.

Current planning in Yosemite that involves high-elevation recreation and capacity includes the upcoming *Wilderness Stewardship Plan* that would update the 1989 *Wilderness Management Plan* and provide guidance for the management and use of designated Wilderness; and the *Merced Wild and Scenic Comprehensive River Management Plan* that would guide management of visitor use and user capacity in the Merced River corridor. Actions proposed in the ongoing *Merced River Plan* could impact visitation levels in the Tuolumne River corridor. Depending on the user capacity and/or levels and types of visitor services prescribed for the Merced River corridor, some visitors might choose to disperse from Yosemite Valley to other areas of the park or, conversely, some visitors might opt to visit the Merced River corridor rather than Tuolumne. In addition, the *Half Dome Trail Stewardship Plan* established limits for the popular Half Dome trail in wilderness and could cause some visitors to shift their use to the Tuolumne area.

In addition to these plans, several projects would directly affect visitor use in the Tuolumne River corridor:

- The Tioga Road Rehabilitation project will rehabilitate and resurface 38 miles of the Tioga Road from Crane Flat to the Tuolumne Meadows campground to ensure continued visitor use.
- The Tioga Trailheads project will improve circulation, accessibility, parking, viewing, food storage, wayfinding, and interpretive opportunities along the Tioga Road corridor.
- The Tioga Road Corridor Campground Accessibility Improvements will correct accessibility deficiencies at 20 campsites in 5 campgrounds along the Tioga Road corridor.
- The *Tenaya Lake Area Plan* will improve the visitor experience with upgrades to the picnic area, circulation, and accessibility, and an increase visitor safety.
- The issuance of Commercial Use Authorizations would involve actions regulating the operation of guided day hiking, overnight backpacking, fishing, photography workshops, stock use (pack animal trips and pack support trips for hikers), and Nordic skiing activities.
- The Traffic Management and Information System would facilitate previsit planning and keep visitors informed about traffic and parking conditions in the Tuolumne Meadows area. This potentially could prevent parking overflow and traffic congestion if visitors change their travel behavior as a result of having

information about busy conditions and subsequently avoiding attempting to park in Tuolumne Meadows when parking is full.

In conjunction with past, present, and foreseeable cumulative projects throughout Yosemite National Park and surrounding recreational areas, the no-action alternative would be expected to maintain visitor satisfaction in the wild and scenic segments of the Tuolumne River corridor. This would result in a long-term moderate beneficial impact on overall visitor experience.

Environmental Consequences Common to Alternatives 1–4

Although the visitor experience would vary among the action alternatives, some impacts would be common to all of them, as described below.

All Segments

Winter activities would continue to include cross-country skiing, trans-Sierra ski trips, snowshoeing, winter camping, overnight accommodations at the Tuolumne Meadows hut, and some day use and overnight use below Hetch Hetchy Reservoir. Shoulder season activities, including bicycling and more accessible cross-country skiing, would continue along the Tioga Road, depending on seasonal weather.

Wild Segments

Wild segments would continue to offer a wide spectrum of opportunities for solitude and primitive, unconfined recreation. Most ongoing recreational activities would continue under any of the action alternatives, including backpacking, dispersed primitive camping, hiking, nature study, rock climbing and mountaineering, fishing, swimming, and private stock use.

Overnight use would remain as unconfined as possible, relying on the existing system of wilderness zone capacities and related overnight trailhead quotas, restrictions on camping in sensitive areas, and group size limitations to protect wilderness character. With the zone capacity system in place, people's wilderness experience would be protected from crowding; however, this limitation on access would mean that some individuals would not have access to a particular location on a particular date if the quota was already filled.

Under any of the action alternatives, the NPS has determined limits on commercial use in the wilderness sections of the Tuolumne River corridor in accordance with the requirements of the Wilderness Act, the Concessions Management Improvement Act of 1998, and NPS *Management Policies 2006*. This determination is attached as appendix C. The limits on commercial services would vary by action alternative.

Scenic Segments

Visitors traveling the Tioga Road corridor would continue to enjoy an outstanding scenic driving experience along this designated scenic byway under any of the action alternatives. Occasional turnouts would provide opportunities to stop and look around or take pictures of the Tuolumne River and its surroundings. Monitoring of parking would document any shortages during the busiest days of the year and guide management in determining the most appropriate traffic management actions for minimizing impacts on the experience of visitors accessing the river corridor via Tioga Road.

Visitors to Tuolumne Meadows would continue to find a great diversity of recreational and educational opportunities easily accessible from Tioga Road to people of various ages and abilities. Most ongoing day recreational activities would continue under any of the action alternatives, including fishing, swimming and wading, picnicking, sightseeing, hiking, rock climbing and bouldering, and private stock use. A full range of interpretive and educational programs would be operated out of a visitor center or visitor contact station, at Parsons Memorial Lodge, and in the field. Better orientation and education about ecological restoration at Tuolumne Meadows would help visitors enjoy the river in ways that makes them participants in its protection.

Many visitors' overall experience would be enhanced by an increased understanding of the dynamic and fragile ecosystem and the role they play in the long-term enhancement and protection of this remarkable place.

Management activities associated with ecological restoration could be intensive and occasionally highly visible in Tuolumne Meadows, and visitors might be temporarily excluded from restoration areas. The role that visitors play in the long-term protection and enhancement of this remarkable place would continue to be a major theme of the interpretive program.

Environmental Consequences of Alternative 1

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 1 on visitor experience are described below.

Corridorwide

Alternative 1 would greatly enhance opportunities for those visitors seeking primitive, unconfined recreation and solitude by reducing the overall level of visitor use in the corridor; managing day and overnight use in wilderness to enhance opportunities for solitude; and eliminating all commercial use from the Tuolumne River corridor.

Under alternative 1, the NPS would reduce visitor use in the corridor from a maximum of 4,666 visitors to a maximum of 3,215 visitors. Day use would be reduced from a maximum of 1,774 people at one time to a maximum of 1,033 people at one time, and overnight use would be reduced from a maximum of 2,892 people per night to a maximum of 2,182 people per night. The visitor use capacity with alternative 1 would be managed through implementing the existing system of wilderness zone capacities, reducing the number of campsites, eliminating lodging, and by monitoring and managing parking in designated parking lots, as outlined in chapter 5.

With visitor use restricted to levels much lower than existing conditions, those able to park at Tuolumne Meadows would continue to have relatively unrestricted access to the Tuolumne Meadows area and the surrounding wilderness. Although visitors would be required to park in designated parking areas, their use away from Tioga Road would be managed as unobtrusively as possible, similar to the management of wilderness, which would allow visitors maximum freedom of movement and opportunities to seek solitude.

Management actions proposed under alternative 1 would greatly enhance opportunities for those visitors seeking this kind of experience, so long as they could find a parking space or campsite, or obtain a wilderness permit (all permit holders and people with campground reservations would have guaranteed parking and access). Trip-planning information and education would be provided to visitors en route to Yosemite, both in gateway communities and within the park. Those visitors who did not plan ahead and had difficulty finding parking during peak periods (currently defined as July, August, and September) and times of the day (approximately 11 a.m. to 3 p.m.) would either have to drive through, return at a different time when parking might be more available, or disperse to other areas to find opportunities to park and get out of their cars for an onsite recreational experience. For those visitors displaced due to enforcement of a day parking capacity during peak visitation periods, alternative 1 would greatly reduce opportunities for visitors to spend some time in the area or at least to do so as frequently or spontaneously as they do currently.

Wild Segments

Several trails with trailheads in the Tuolumne Meadows area would be managed to achieve a standard of an average of two encounters with other parties per hour from Rogers Creek through the Grand Canyon of the Tuolumne, and an average of four encounters per hour on other trails in wilderness. In keeping with the greater emphasis on solitude and self-reliance under alternative 1, this encounter rate would be more protective of solitude than the standard adopted for this river value, as described in chapter 5. If a day trailhead quota system

is necessary to achieve this standard, this quota system would be similar to the current overnight wilderness quota system. Implementation of a day use quota system would reduce perceptions of crowding and enhance opportunities for solitude for those visitors who were able to obtain a permit. However, it would also reduce opportunities for most visitors to take a spontaneous day hike into the wilderness.

The elimination of all commercial use in wild segments of the Tuolumne River corridor inside Yosemite National Park would remove the opportunity for visitors to use commercial outfitters to visit the river's wild segments, including those visitors who rely on this type of access due to physical disabilities. This commercial use currently amounts to about 475 person-nights on overnight trips per year (240 on stock trips and 235 on hiking trips) and 65 person-days on day trips per year. Although some commercial groups could disperse to other areas of the park, this would be more difficult for stock groups than hiking groups because there are a limited number of trails in the park built to accommodate stock use. However, with elimination of commercial use in wild segments, there would be a corresponding increase in opportunities for more self-reliant activities in wilderness, such as backpacking.

The elimination of commercial use would also discontinue concessioner stock day rides based out of Tuolumne Meadows. Visitors would no longer have the opportunity to participate in this type of ride within the river corridor. This type of use currently amounts to a maximum of 62 people per day.

Along the heavily used Young Lake and Glen Aulin trails, the removal of commercial stock use would reduce conflicts between hikers and stock users. People could still bring private stock into the wilderness for day rides or extended trips, and NPS administrative use of pack stock would continue.

Removal of the Glen Aulin High Sierra Camp would eliminate the opportunity for visitors to stay at this traditional camp (up to 32 people per night). The camp is part of a camp-to-camp loop system that allows visitors an unusual opportunity for a remote high-country overnight experience without having to hike and pack camping supplies. In conjunction with the removal of the Tuolumne Meadows Lodge, alternative 1 would eliminate two of the seven camps from this system, which would adversely affect the camp-to-camp experience for those visitors. For other wilderness visitors passing through the area, the elimination of the camp would remove an intrusion upon their wilderness experience of this highly scenic area.

Scenic Segments

The visitor experience at Tuolumne Meadows under alternative 1 would be changed from the visitor experience under the no-action alternative by management to enhance opportunities for primitive, unconfined recreation and solitude. The day use capacity would be greatly reduced, compared with existing conditions, which would allow the continuation of unstructured recreational opportunities, such as traveling offtrail in the meadows. However, informal trails would be removed and some trail delineation would be necessary to accomplish the goals of the ecological restoration plan (appendix H). This would be seen as a beneficial impact by some visitors and an adverse impact by others.

Because the demand for day parking on peak days at peak times would exceed the supply, the potential for frustration would be high for those visitors arriving during busy hours who would not be able to find a parking space. Since the overall designated parking capacity would be reduced under alternative 1, this would cause frustration not only for those visitors who are displaced but also for all visitors involved in searching for parking when demand exceeds supply. If visitation continues to increase 3% annually as projected, this would further exacerbate this issue.

The prohibition on roadside parking to protect river values and visitor safety would cause many visitors to park farther away from where they might wish to be. However, visitor safety and the condition of river values would be improved with the elimination of roadside parking. The elimination of shuttle bus service would require

visitors to move from one location to another within the Tuolumne Meadows area by walking, bicycling, or moving their private vehicles. Additional pedestrian trails would be provided to connect attraction sites.

Converting the Soda Springs road to a trail would reduce the current level of interpretive programs available at Parson Memorial Lodge because the elimination of vehicle access would limit accessibility and the transport of heavy loads.

The reduction in campsites to 237 tent and RV sites (maintaining the existing four stock sites, seven group sites and 21 backpacker campsites) would result in adverse impacts for up to 402 people per night who would not be able to obtain a tent or RV campsite at Tuolumne Meadows. Conversely, visitors who did obtain a campsite would enjoy a less congested, better delineated campground and less congestion in the Tuolumne Meadows area overall.

The elimination of the Tuolumne Meadows Lodge would remove showers and food service at the lodge and remove an opportunity to spend the night in the corridor for visitors who were not equipped to camp or backpack into the wilderness. This would affect a maximum of 276 people per night.

Consolidating a small visitor contact station with the wilderness center would be beneficial for visitors as it would allow access to NPS services at a single location. The elimination of all commercial services in the corridor would require visitors to be more self-reliant and prepared in advance for a trip to Tuolumne Meadows than under the no-action alternative. During the period of the year when facilities are in operation (usually June–October), the Tuolumne Meadows area has traditionally served as a location for travelers to stop, rest, and refuel, experiencing the meadows and river for a brief period. Some visitors rely on the commercial services, including food, fuel, and basic camping supplies, to support their day or overnight visit. The elimination of all commercial services and facilities would make the Tuolumne Meadows area less attractive for those visitors seeking amenities. However, it could be beneficial to the experience for those visitors seeking a more self-reliant experience. Through-hikers on the Pacific Crest Trail and John Muir Trail would no longer have the opportunity to ship and pick up supplies at the Tuolumne Meadows post office.

Under alternative 1 the closest commercial facilities would be 20 miles to the east in Lee Vining or 40 miles to the west at Crane Flat, though vending machines for ice and firewood would be provided at the campground. The closing of these services would result in an adverse impact on visitors who would need to refuel or need to buy or replace groceries, supplies, or mountaineering equipment in Tuolumne Meadows.

Conclusion

Alternative 1 would have a local long-term moderate beneficial impact on those visitors seeking a wilderness experience. These visitors would experience less crowded conditions corridorwide and fewer amenities at Tuolumne Meadows and Glen Aulin, resulting in greater opportunities for self-reliance and solitude. Conversely, the many visitors who take advantage of amenities such as commercial lodging, food service, supplies, fuel service, or mountaineering supplies/guide service at Tuolumne Meadows would no longer have access to those services. Commercial use restrictions proposed under alternative 1 would also eliminate opportunities for visitors to obtain commercially guided or assisted expeditions in wild segments of the Tuolumne River corridor, including services provided by commercial outfitters and the concessioner. Together these actions would result in local long-term moderate adverse impacts on visitors who rely on commercial services in the river corridor.

Although the demand for parking at Tuolumne Meadows would be reduced by the elimination of commercial services and amenities, some day visitors would likely have difficulty finding parking during peak use periods. This would have a local long-term minor adverse impact on visitors who are searching for parking during times when demand exceeds supply. This worst-case scenario would not occur during nonpeak periods.

Cumulative Impacts

Actions, projects, and plans that could have a cumulative impact on local and regional visitor experience in combination with alternative 1 would be the same as described for the no-action alternative.

Implementation of alternative 1 in conjunction with past, present, and reasonably foreseeable projects throughout Yosemite National Park and surrounding recreational areas would be expected to have a local long-term moderate beneficial impact on visitors seeking solitude and primitive, unconfined recreation, and a local long-term moderate adverse impact on those visitors who are no longer able to access Tuolumne Meadows or take advantage of existing commercial services. Actions proposed in the ongoing *Merced River Plan* could impact visitors at Tuolumne Meadows, depending on the user capacity and/or levels and types of visitor services prescribed for the Merced River corridor. For instance, if concessioner stock day rides are discontinued at both locations, there would be a cumulative minor adverse impact on visitors who would need to travel from Tuolumne Meadows to Wawona for that traditional experience, rather than to Yosemite Valley (where concessioner stock day rides are also currently offered).

Due to the slight reduction in parking at Tenaya Lake resulting from the *Tenaya Lake Area Plan*, visitors displaced from Tuolumne Meadows at peak times may not be able to disperse to Tenaya Lake, resulting in a local long-term moderate adverse impact. However, the additional parking along Tioga Road provided under the Tioga Trailheads project could offset some of the displacement of visitors that would occur when Tuolumne Meadows day use parking was full during peak use periods. The parkwide traffic management and information system would make general information about traffic conditions available to visitors, thus helping them plan ahead and avoid disappointment during peak periods when day parking was already full at Tuolumne Meadows. In addition, closure of the public fuel station under alternative 1 might increase crowding at the Crane Flat fuel station, 40 miles to the west on Tioga Road (although it is likely that the many visitors would refuel at Lee Vining, 20 miles to the east of Tuolumne Meadows in Mono County). Overall this would result in a local long-term minor to moderate adverse cumulative impact on visitor experience.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on visitor experience are described below.

Corridorwide

Under alternative 2, the NPS would enhance opportunities for those members of the public who expressed a desire for more recreational opportunities. This alternative would accommodate as much recreational use as possible while protecting river values. Opportunities to experience the river corridor would range from primitive, unconfined recreation to more easily accessible activities supported by a modest amount of commercial services. Use levels would be managed to protect sensitive resources and to maintain settings conducive to the intended range of experiences.

Alternative 2 would allow for an increase in total visitor capacity in the Tuolumne River corridor from a maximum of 4,666 visitors to a maximum of 5,051 visitors at one time. Day use could be increased from a maximum of 1,774 people at one time to a maximum of 1,913 people at one time, while overnight use could be increased from a maximum of 2,892 people per night to a maximum of 3,138 people per night. The visitor use capacity for alternative 2 would be managed through the existing system of wilderness zone capacities and related overnight trailhead quotas by increasing the overnight capacity of the Tuolumne Meadows campground, and by enforcing a designated day parking capacity through implementation of traffic management, as outlined in chapter 5. Within the Tuolumne Meadows area, new parking areas, trails, and picnic sites would be provided to expand recreational and education opportunities while confining impacts to resilient locations. With these facilities, day visitors could more readily walk to attraction sites, enjoy a picnic

overlooking the river and meadows, and otherwise experience the area without adversely affecting sensitive meadow and riparian habitats.

Management actions proposed with alternative 2 would enhance opportunities for those visitors seeking to enjoy the Tuolumne Meadows area, as long as they could find a parking space or campsite or obtain a lodging or campsite reservation or wilderness permit (all permit holders and people with reservations would have guaranteed parking and access). The overall number of people currently visiting the Tuolumne River corridor would be accommodated under alternative 2, and some future growth in visitation could be accommodated.

Wild Segments

Wilderness trails in the river corridor with trailheads in the Tuolumne Meadows area would be managed for an encounter rate that would average no more than 12 other parties per hour on the Lyell Canyon trail downstream of the Ireland Lake trail junction, 8 parties per hour on the Lyell Canyon trail upstream of the Ireland Lake trail junction, 12 parties per hour on the Glen Aulin trail, and 2 parties per hour on the trail from the Rogers Creek crossing through the Grand Canyon of the Tuolumne (see chapter 5). Day use on these trails would remain higher than use on wilderness trails; however, adopting this standard would protect visitor experience along trails from impacts associated with increasing use over time. If necessary, a day trailhead quota system similar to the current overnight zone capacity system would be implemented to achieve these standards. A day use quota could reduce the opportunity to take a day hike into the wilderness on a particular trail on a particular day. As noted in chapter 8, additional environmental compliance, including public participation, would be needed prior to implementing a day use quota system.

Commercial use in wilderness would continue to be allowed but with restrictions on types and levels of use, based on the “determination of extent necessary” for wilderness segments of the Tuolumne Wild and Scenic River corridor (see appendix C). The determination of extent necessary restricts commercial use (with the exception of use associated with High Sierra Camps) in wilderness to no more than two overnight groups per zone per night and no more than two day groups per trail per day. During the peak use months of July and August, additional restrictions would apply within the Glen Aulin and Lyell Canyon zones. The restrictions would depend on if the commercial group had a recreational purpose or if the group had an educational and/or scenic plus a recreational purpose (see appendix C for the definitions of ‘recreational’, ‘educational’, and ‘scenic’ purposes). Groups with only a recreational and educational/recreational purpose, as defined in appendix C, would not be allowed overnight use in the Glen Aulin zone in July and August. Commercial groups with only a recreational purpose would further have no weekend overnight use in Lyell Canyon. However, commercial overnight groups would be allowed to travel through restricted or weekend restricted zones as long they spent the night outside of those zones. This would allow commercial outfitters and their clients to travel the Pacific Crest National Scenic Trail/John Muir Trail during peak season, although it would require additional trip planning to accommodate these restrictions.

In the Lyell Canyon zone, groups with only a recreational purpose would be restricted to weekdays only for overnight use. Commercial groups having an educational/recreational or scenic/recreational purpose would be allowed on weekend nights, but would be capped at no more than 15% or 10% (respectively) of total use on weekend nights. However, commercial groups would be allowed to travel through restricted or weekend restricted zones as long they spent the night outside of those zones.

The visitors who would potentially be affected by these restrictions currently account for 475 person-nights per year (240 on stock trips and 235 on hiking trips) and 65 person-days on day trips per year. Based on existing levels of commercial use in Lyell Canyon and Glen Aulin zones, these restrictions would result in negligible to minor impacts on commercial outfitters and their clients, because the existing level of commercial use in these zones generally falls within the levels prescribed by the determination of extent necessary. Commercial outfitters and their clients with only a recreational purpose might be required to plan some trips during

nonpeak periods or to disperse to other areas inside or outside of the park. Rescheduling to other time periods or dispersal to other areas would be more difficult for stock groups than for hiking groups, as there are fewer trails maintained to accommodate stock use.

The determination of extent necessary would have no impact on private stock users in the Tuolumne River corridor. However, all stock groups would need to wait until the designated opening date in Lyell Canyon (implemented to protect sensitive meadow habitats during wet periods).

Concessioner stock day rides would continue, but at a reduced level of service. This would reduce the number of visitors who could enjoy this traditional experience from a maximum of 62 to a maximum of 24 people per day. NPS administrative stock use would continue. The reduction of concessioner stock use on trails would decrease, but not eliminate, the conflicts between hikers and stock users on trails.

The Glen Aulin High Sierra Camp would be retained at its current capacity under alternative 2; however, it would be converted to a temporary outfitter camp accommodating a maximum of 32 people per night. All permanent structures and infrastructure would be removed, with all remaining structures being temporary in nature. Unheated guest tents would be provided. The area would retain distinctive beneficial opportunities for people of various ages and abilities to enjoy a remote, high-country overnight experience without having to pack camping supplies. Overnight saddle trips and concessioner day rides to the camp would be discontinued which would eliminate the opportunity for visitors to complete the park's High Sierra Camp loop with stock. In addition, because the area would be included in the Yosemite Wilderness, camp guests would be subject to the existing wilderness trailhead quota system, which could further reduce the ability of visitors to access the camp.

For wilderness visitors passing through the Grand Canyon segment, the removal of High Sierra Camp facilities would reduce the perception of intrusion into a highly scenic area. For other visitors, the temporary outfitter camp would continue to intrude upon their wilderness experience.

Limited portions of the river would be opened to recreational boating. This activity would be regulated by the existing wilderness overnight trailhead quota system. Because of the high level of skill and physical fitness required, the short boating season in the Grand Canyon segment (about 6-8 weeks), and the prohibition on commercial boating, boating would have a beneficial impact on a minimal number of visitors.

Scenic Segments

Visitors to Tuolumne Meadows would continue to find a great diversity of recreational and educational opportunities easily accessible to people of various ages and abilities. Additional opportunities would be available for day visitors to walk to attraction sites, enjoy a picnic overlooking the river and meadows, and experience the river without adversely affecting sensitive meadow and riparian habitats. Improved access and facilities would enhance the experience, particularly for people with only a short time to spend in the area. However, visitors would be directed at trailheads to stay on trails and would be encouraged to minimize their impacts on sensitive habitats. This, in addition to the removal of informal trails at the meadows, would restrict some of the freedom of movement some visitors have come to expect at Tuolumne Meadows. However, these measures would help protect the subalpine meadows and magnificent scenery, for which many visitors expressed their support for during the development of this plan.

Under alternative 2, the total amount of designated parking at Tuolumne Meadows would be increased by 449 spaces. There would be sufficient parking at Tuolumne Meadows to meet the current demand for parking. However, if park visitation continued to increase, and parking demand continued to increase at Tuolumne Meadows, in the future some visitors might be displaced on peak use days and at peak use times.

The prohibition on roadside parking to protect river values and visitor safety would cause many visitors to park farther away from where they might wish to be. However, visitor safety and the condition of river values would

be improved with the elimination of roadside parking. Shuttle bus service would continue to make it possible for visitors to circulate between major use areas without having to move their private vehicles.

The capacity of the Tuolumne Meadows campground would be increased by 41 walk-in sites, and maintain the existing 304 tent and RV sites, 4 stock sites, 7 group sites, and 21 backpacker campsites. The addition of 41 walk-in campsites to the Tuolumne Meadows campground would help to meet the existing demand for camping facilities by allowing up to an additional 246 people per night to camp in the Tuolumne Meadows area. The Tuolumne Meadows Lodge would continue to operate at its current capacity and level of service, accommodating a maximum of 276 people per night.

Commercial services would be retained at current levels under alternative 2. Travelers would therefore continue to have opportunities on Tioga Road to stop, rest, and refuel while experiencing the meadows and river for a brief period. Visitors who have come to rely on commercial services, including food, fuel, and basic camping supplies, to support their day or overnight visit would continue to benefit from these services. Through-hikers on the Pacific Crest Trail and John Muir Trail would continue to have the opportunity to pick up supplies shipped to the Tuolumne Meadows post office.

Conclusion

Alternative 2 would result in a local long-term moderate beneficial impact on visitors who expressed a desire for more recreational opportunities. It would accommodate as much recreational use as possible by expanding opportunities for camping, sightseeing, and picnicking, and providing a new opportunity for recreational boating. Increased designated parking and improved information, facilities, and traffic management would make it easier for most visitors to access and experience the Tuolumne River corridor from Tuolumne Meadows.

Based on existing levels of visitation, under alternative 2 visitors would have little trouble finding parking and accessing the corridor. If park visitation continues to increase, in the future day visitors might have difficulty finding parking during peak use periods, resulting in a local long-term negligible adverse impact for some visitors. This worst-case scenario would not occur during nonpeak periods and during nonpeak times of the day.

A local long-term minor beneficial impact on visitor experience in wild segments of the river corridor under alternative 2 would result from standards implemented to manage encounter rates on trails within a day hike of Tuolumne Meadows and a reduction in stock use compared to the no-action alternative. A relatively small number of visitors would benefit to a moderate degree by being able to access the wilderness with support from a commercial outfitter or park concessioner, although the number of concessioner stock day rides would be reduced and overnight saddle trips to Glen Aulin would be discontinued. The ability to access the wilderness by whitewater boat and the ability to spend the night in a remote High Sierra setting without having to pack a tent or food would benefit some visitors who desire multiple backcountry recreational opportunities for varying skill levels. Some visitors' perception of the Glen Aulin High Sierra Camp facilities as an intrusion into a highly scenic area would be improved by the removal of permanent infrastructure and conversion to a seasonal outfitter camp.

Visitors seeking commercial lodging, food service, fuel, and camp supplies at Tuolumne Meadows would continue to have access to those services; however, there would be a local long-term minor adverse impact on visitors seeking mountaineering equipment/guiding services.

Cumulative Impacts

Actions, projects, and plans that could have a cumulative impact on local and regional visitor experience in combination with alternative 2 would be the same as described with the no-action alternative.

Implementation of alternative 2 in conjunction with past, present, and reasonably foreseeable projects throughout Yosemite National Park and surrounding recreational areas would be expected to have a local long-term moderate beneficial impact on most visitors, with the following exception: the *Tenaya Lake Area Plan* resulted in a slight decrease in parking at Tenaya Lake, which is the closest major park attraction to Tuolumne Meadows. If visitation levels increase, the day visitors potentially displaced from Tuolumne Meadows during peak use periods would not be likely to find parking at Tenaya Lake because both areas would be experiencing peak demand. This could result in increased undesigned parking along Tioga Road outside of the river corridor. However, the parking along Tioga Road provided under the Tioga Trailheads project could offset some of the potential future displacement of visitors that could occur when Tuolumne Meadows day parking is full. In addition, the parkwide traffic management and information system would make general information about traffic conditions available to visitors, thereby helping them plan ahead and avoid disappointment during peak periods. Overall, this would result in a local long-term minor adverse impact on the visitor experience.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on visitor experience are described below.

Corridorwide

Under alternative 3, the NPS would maintain a traditional Tuolumne experience in a historic setting. Opportunities to experience the river corridor would continue to range from primitive, unconfined recreation to more easily accessible activities supported by a modest amount of commercial services. Use levels would be managed to protect sensitive resources while allowing for freedom of movement in a historic setting. There would be little impact on visitors with strong traditional ties to the Tuolumne River corridor, who expressed a desire to see the area remain unchanged.

Total visitor use in the Tuolumne River corridor under alternative 3 would be reduced from a current maximum of 4,666 visitors at one time to a maximum of 4,316 visitors at one time. Day use capacity would be reduced from a maximum of 1,774 people at one time to a maximum of 1,568 people at one time, and overnight capacity would be reduced from a maximum of 2,892 people per night to a maximum of 2,748 people per night from reductions in lodging units at Tuolumne Meadows Lodge and the Glen Aulin High Sierra Camp. The visitor use capacity for alternative 3 would be managed through the existing system of wilderness zone capacities and related overnight trailhead quotas and by enforcing a designated day parking capacity through implementation of traffic management, as outlined in chapter 5. With day use restricted, visitors would be required to park in designated parking areas with clearly defined trailheads; however, they would continue to have relatively unrestricted access to the Tuolumne Meadows area and the surrounding wilderness.

Alternative 3 would enhance opportunities for visitors seeking to enjoy the Tuolumne Meadows area as long as they could find a parking space or campsite or obtain a lodging or campsite reservation or wilderness permit (all permit holders and people with reservations would have guaranteed parking and access). Those visitors who arrive during busy hours and have difficulty finding parking during peak periods (currently defined as July, August, and weekends in September) and times of the day (approximately 11 a.m. to 3 p.m.) would either have to drive through, return at a different time when parking might be more available, or disperse to other areas to find opportunities to park and get out of their cars for an onsite recreational experience.

Wild Segments

Under alternative 3, wilderness trails in the river corridor with trailheads in the Tuolumne Meadows area would be managed for an encounter rate that would average no more than 12 other parties per hour on the Lyell Canyon trail downstream of the Ireland Lake trail junction, 8 parties per hour on the Lyell Canyon trail

upstream of the Ireland Lake trail junction, 12 parties per hour on the Glen Aulin trail, and 2 parties per hour on the trail from the Rogers Creek crossing through the Grand Canyon of the Tuolumne (see chapter 5). Day use on these trails would remain higher than use on backcountry wilderness trails. The overall reduction in use in the Tuolumne Meadows area would be expected to carry over into a reduction in day hiking on these trails, and the implementation of an encounter standard would protect trails from additional increases in use over time.

If necessary, a day trailhead quota system similar to the current overnight zone capacity system would be implemented to achieve this standard. A day use quota would reduce the opportunity to take a day hike into the wilderness on a particular trail on a particular day. As noted in chapter 8, additional environmental compliance, including public participation, would be needed prior to implementing a day use quota system. However, monitoring data indicate that this action would not be likely under alternative 3.

Commercial use in wilderness would continue to be allowed but with restrictions on types and levels of use, based on the “determination of extent necessary” for wilderness segments of the Tuolumne Wild and Scenic River corridor (see appendix C). The determination of extent necessary restricts commercial use (with the exception of use associated with High Sierra Camps) in wilderness to no more than one overnight groups per zone per night and no more than one day groups per trail per day. During the peak use months of July and August, additional restrictions would apply within the Glen Aulin and Lyell Canyon zones. The restrictions would depend on if the commercial group had a recreational purpose or if the group had an educational and/or scenic plus a recreational purpose (see appendix C for the definitions of ‘recreational’, ‘educational’, and ‘scenic’ purposes). Groups with only a recreational purpose, as defined in appendix C, would not be allowed overnight use in the Glen Aulin zone in July and August, and would have no weekend overnight use in Lyell Canyon. However, commercial groups would be allowed to travel through restricted or weekend restricted zones as long they spent the night outside of those zones. This would allow some commercial outfitters and their clients to travel the Pacific Crest National Scenic Trail/John Muir Trail during peak season, although the restriction of one group per zone per day could reduce the number of commercial outfitters who could access the corridor. In addition, additional trip planning would be needed to accommodate weekend restrictions in Lyell Canyon. The park concessioner High Sierra Camp loop trips to Glen Aulin are not impacted by the determination of extent necessary.

In the Lyell Canyon zone, groups with only a recreational purpose would be restricted to weekdays only, for overnight use. Commercial groups having an educational/recreational or scenic/recreational purpose would be allowed on weekend nights, but would be capped at no more than 15% or 10% (respectively) of total use on weekend nights. However, commercial groups would be allowed to travel through restricted or weekend restricted zones as long they spent the night outside of those zones.

The visitors who would potentially be affected by these restrictions account for 475 person-nights per year (240 on stock trips and 235 on hiking trips) and 65 person-days on day trips per year. Based on existing levels of commercial use in Lyell Canyon and Glen Aulin zones, these restrictions would likely result in adverse impacts on commercial outfitters and their clients, because the existing level of overnight commercial use in these zones generally falls below the levels prescribed by the determination of extent necessary. Commercial outfitters and their clients might be required to plan during nonpeak periods or to disperse to other areas inside or outside of the park. Rescheduling to other time periods or dispersal to other areas would be more difficult for stock groups than for hiking groups, as there are fewer trails maintained to accommodate stock use.

The determination of extent necessary would have no impact on private stock users in the Tuolumne River corridor. However, all stock groups would need to wait until the designated opening date in Lyell Canyon (implemented to protect sensitive meadow habitats during wet periods).

Concessioner stock day rides would continue but at a reduced level of service, thus reducing the number of visitors who could enjoy this experience from 62 to 24 people per day. The reduction of concessioner stock use on trails would reduce, but not eliminate, the conflicts between hikers and stock users on trails.

The Glen Aulin High Sierra Camp would be retained but at a reduced capacity of 28 people per night and a reduced level of service. The area would remain accessible via horseback or day hiking, and would retain opportunities for people of various ages and abilities to enjoy a remote high-country overnight experience without having to pack camping supplies. Reducing the capacity of the camp would make it harder for some visitors to get a reservation. The removal of wood stoves from visitor tent cabins and the elimination of flush toilets would be a disappointment to some visitors. For other visitors passing through the area, the camp would continue to intrude upon their wilderness experience of this highly scenic area.

Scenic Segments

Visitors to Tuolumne Meadows would continue to find a great diversity of recreational and educational opportunities easily accessible to people of various ages and abilities under alternative 3. The day use capacity would be reduced, compared with existing conditions, which, when compared with alternatives 2 and 4, would allow more unstructured recreational opportunities, such as traveling offtrail in the meadows. However, informal trails would be removed and some trail delineation would be necessary to accomplish the goals of the ecological restoration plan (appendix H).

The total amount of designated parking at Tuolumne Meadows would be increased by 280 spaces, which would alleviate some traffic congestion and existing frustration by some visitors who have trouble finding parking under current conditions. However, assuming current use levels continue, the demand for day parking would exceed the parking supply on peak days at peak times. Some visitors arriving during busy hours would continue to be frustrated by not being able to find a parking space during the periods of peak use. This would cause frustration not only for those visitors who are displaced, but also for all visitors involved in searching for parking when demand exceeds supply. If visitation continues to increase 3% annually as projected, this would further exacerbate the problem.

The prohibition on roadside parking to protect river values and visitor safety would cause many visitors to park farther away from where they might wish to be. However, visitor safety and the condition of river values would be improved with the elimination of roadside parking. The expansion of shuttle bus service would make more sites accessible to visitors.

The Tuolumne Meadows campground would be retained at its current capacity, with 304 tent and RV campsites, 4 stock sites, 7 group sites, plus the 126-person backpacker area, which together would accommodate a maximum 2,184 people per night. The Tuolumne Meadows Lodge would be retained but at half its current capacity and would accommodate a maximum of 136 people per night. The demand for these facilities would continue to be high, and some visitors would not be able to access these facilities during peak use periods.

Most commercial services would be retained; the public fuel station would be removed. The elimination of fuel service and the mountaineering shop would adversely affect visitors who have come to rely on refueling at Tuolumne Meadows or visitors who need to buy or replace mountaineering equipment in Tuolumne Meadows. The closest commercial facilities for fuel would be 20 miles to the east in Lee Vining or 40 miles to the west at Crane Flat. The nearest mountaineering stores are in Mammoth Lakes, approximately 50 miles from Tuolumne Meadows.

However, travelers on Tioga Road would continue to have the opportunity to stop, rest, and experience the meadows and river for a brief period. Visitors who have come to rely on commercial services, including food

and basic camping supplies, to support their day or overnight visit would continue to benefit from these services. Through-hikers on the Pacific Crest Trail or John Muir Trail would continue to have the opportunity to pick up supplies shipped to the Tuolumne Meadows post office.

Conclusion

Alternative 3 would result in a local long-term minor to moderate beneficial impact on those visitors with strong traditional ties to the Tuolumne River corridor who expressed a desire to see the area remain unchanged. Visitors seeking commercial food service, supplies, and lodging at Tuolumne Meadows would continue to have access to those services, although fuel service would be discontinued and the lodging capacity of Tuolumne Meadows Lodge would be reduced by about half. Visitors would continue to have relatively unrestricted access to the Tuolumne Meadows area and the surrounding wilderness, supported by traditional amenities.

Based on existing levels of visitation, some day visitors might have difficulty finding parking during peak use periods, resulting in a local long-term minor to moderate adverse impact for some visitors. This worst-case scenario would not occur during nonpeak periods and nonpeak times of the day.

A local long-term minor beneficial impact on recreation in wild segments would result from implementation of standards to manage encounter rates on trails within a day hike of Tuolumne Meadows and a reduction in stock use, compared to the no-action alternative. Similarly, a relatively small number of visitors would continue to benefit by being able to access the wilderness with support from a commercial outfitter or park concessioner, or by being able to spend the night in a remote High Sierra setting without having to pack a tent or food. Some visitors' perception of the Glen Aulin High Sierra Camp facilities as an intrusion into a highly scenic area would continue.

Visitors seeking commercial food service and camp supplies at Tuolumne Meadows would continue to have access to those services; however, there would be a local long-term, minor adverse impact on visitors seeking fuel service or mountaineering equipment/guiding services. The reduced capacity at Tuolumne Meadows Lodge would result in a local long-term minor to moderate adverse impact on visitors who rely on lodging to stay overnight at Tuolumne Meadows.

Cumulative Impacts

Actions, projects, and plans that could have a cumulative impact on local and regional visitor experience in combination with alternative 3 would be the same as described for the no-action alternative.

Implementation of alternative 3 in conjunction with past, present, and reasonably foreseeable projects throughout Yosemite National Park and surrounding recreational areas would be expected to have a local long-term moderate beneficial impact on most visitors, with the following exception: the *Tenaya Lake Area Plan* resulted in a slight decrease in parking at Tenaya Lake, which is the closest major park attraction to Tuolumne Meadows. Day visitors potentially displaced from Tuolumne Meadows during peak use periods would not be likely to find parking at Tenaya Lake because both areas would be experiencing peak demand. This could result in increased undesignated parking along Tioga Road outside of the river corridor. However, the additional parking along Tioga Road provided under the Tioga Trailheads project could offset some of the visitor displacement that would occur when Tuolumne Meadows day parking was full during peak use periods. The parkwide traffic management and information system would make general information about traffic conditions available to visitors and help them plan ahead and avoid disappointment during peak periods when day parking was already full at Tuolumne Meadows. In addition, closure of the public fuel station might increase crowding at the Crane Flat fuel station, 40 miles to the west on Tioga Road, although many visitors would likely choose to refuel at Lee Vining, which is 20 miles east in Mono County. Overall, this would result in a local long-term minor adverse cumulative impact on the visitor experience.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on visitor experience are described below.

Corridorwide

Implementation of alternative 4 would help preserve a traditional Tuolumne experience but in a manner that reduces some development as well as the potential for impacts associated with certain types of development and use. Under this alternative, the NPS would continue to provide opportunities for experiences ranging from primitive, unconfined recreation to more easily accessible activities supported by a minimal amount of commercial services. All overnight opportunities would be retained while directing use to more resilient areas.

Total visitor use in the corridor has the potential to increase slightly from the estimated existing capacity of 4,666 people at one time to a maximum capacity of 4,727 people at one time. Day use could be increased from a maximum of 1,774 to a maximum of 1,839 people at one time, and maximum potential overnight use would be reduced slightly from a maximum of 2,892 people per night to a maximum of 2,888 people per night. The visitor use capacity would be managed through enforcing the existing system of wilderness zone capacities and related overnight trailhead quotas, by reducing the capacity of the Glen Aulin High Sierra Camp, and by enforcing a designated day parking capacity through implementation of traffic management, as outlined in chapter 5. To additionally reduce the potential for impacts, visitor use in the Tuolumne Meadows area would be generally confined to trails and other facilities in resilient locations. Improved facilities would allow day visitors to more readily walk to attraction sites, enjoy a picnic overlooking the river and meadows, and otherwise experience the area without adversely affecting sensitive meadow and riparian habitats and cultural resources.

Alternative 4 would enhance opportunities for those visitors seeking to enjoy the Tuolumne Meadows area as long as they could find a parking space or campsite or obtain a lodging or campsite reservation or wilderness permit (all permit holders and people with reservations would have guaranteed parking and access). The overall number of people currently visiting the river corridor would be accommodated under alternative 4; however, future growth in visitation might displace some visitors during peak use periods.

Wild Segments

Under alternative 4, most wilderness trails with trailheads in the Tuolumne Meadows area would be managed for an encounter rate that would average no more than 12 other parties per hour on the Lyell Canyon trail downstream of the Ireland Lake trail junction, 8 parties per hour on the Lyell Canyon trail upstream of the Ireland Lake trail junction, 12 parties per hour on the Glen Aulin trail, and 2 parties per hour on the trail from the Rogers Creek crossing through the Grand Canyon of the Tuolumne (see chapter 5). Implementation of these standards would protect trails from additional increases in use over time. As long as the user capacity for Tuolumne Meadows remains close to existing use levels (as prescribed in alternative 4), there would be no adverse impact on day use recreation associated with these standards.

If necessary, a day trailhead quota system similar to the current overnight zone capacity system would be implemented to achieve these standards. A day use quota would reduce the opportunity to take a day hike into the wilderness on a particular trail on a particular day. As noted in chapter 8, additional environmental compliance, including public participation, would be needed prior to implementing a day use quota system. As noted above, monitoring data indicate that this action would not be likely under this alternative.

Commercial use in wilderness would continue to be allowed but with restrictions on types and levels of use, based on the “determination of extent necessary” for wilderness segments of the Tuolumne Wild and Scenic River corridor (see appendix C). The determination of extent necessary restricts commercial use (with the exception of use associated with High Sierra Camps) in wilderness to no more than two overnight groups per zone per night and no more than two day groups per trail per day. During the peak use months of July and

August, additional restrictions would apply within the Glen Aulin and Lyell Canyon zones. The restrictions would depend on if the commercial group had a recreational purpose or if the group had an educational and/or scenic plus a recreational purpose (see appendix C for the definitions of ‘recreational’, ‘educational’, and ‘scenic’ purposes). Groups with only a recreational and educational/recreational purpose, as defined in appendix C, would not be allowed overnight use in the Glen Aulin zone in July and August. Commercial groups with only a recreational purpose would further have no weekend overnight use in Lyell Canyon. However, commercial overnight groups would be allowed to travel through restricted or weekend restricted zones as long they spent the night outside of those zones. This would allow commercial outfitters and their clients to travel the Pacific Crest National Scenic Trail/John Muir Trail during peak season, although it would require additional trip planning to accommodate these restrictions.

In the Lyell Canyon zone, groups with only a recreational purpose would be restricted to weekdays only for overnight use. Commercial groups having an educational/recreational or scenic/recreational purpose would be allowed on weekend nights, but would be capped at no more than 15% or 10% (respectively) of total use on weekend nights. However, commercial groups would be allowed to travel through restricted or weekend restricted zones as long they spent the night outside of those zones.

The visitors who would potentially be affected by these restrictions currently account for 475 person-nights per year (240 on stock trips and 235 on hiking trips) and 65 person-days on day trips per year. Based on existing levels of commercial use in Lyell Canyon and Glen Aulin zones, these restrictions would result in negligible to minor impacts on commercial outfitters and their clients, because the existing level of commercial use in these zones generally falls within the levels prescribed by the determination of extent necessary in appendix C. Commercial outfitters and their clients with only a recreational purpose might be required to plan some trips during nonpeak periods or to disperse to other areas inside or outside of the park. Rescheduling to other time periods or dispersal to other areas would be more difficult for stock groups than for hiking groups, as there are fewer trails maintained to accommodate stock use.

The determination of extent necessary would have no impact on private stock users in the Tuolumne River corridor. However, all stock groups would need to wait until the designated opening date in Lyell Canyon (implemented to protect sensitive meadow habitats during wet periods).

The elimination of concessioner stock day rides would eliminate the opportunity for visitors to participate in this traditional activity in the Tuolumne River corridor. Concessioner stock day rides currently amount to a maximum of 62 people per day. Based on current service levels, the amount of stock use on trails would be reduced by 3 two-hour and 2 four-hour rides per day, which might otherwise involve up to 14 head of stock per ride on the trails. Full-day rides, which occur only occasionally, would also be eliminated. These actions would reduce the number of horses that pass a fixed point on the Young Lakes trail by about 2,000 passes per year. Day rides would remain at Wawona, which is a considerable distance from Tuolumne Meadows.

The Glen Aulin High Sierra Camp would be retained, but at a slightly reduced capacity of 28 people per night and a reduced level of service. The area would remain accessible via concessioner saddle trips, private stock use, or day hiking, and would retain opportunities for people of various ages and abilities to enjoy a remote high-country overnight experience without having to pack camping supplies. However, reducing the capacity of the camp by four beds would make it harder for a very small number of visitors to get a reservation. This impact would include visitors who participate in the High Sierra Camp loop trips. The removal of wood stoves from visitor tent cabins, the elimination of flush toilets, and the elimination of meals-only service for backpackers would be a disappointment to some visitors. For other visitors passing through Glen Aulin, the camp would continue to intrude upon their wilderness experience of this highly scenic area.

The overall reduction in stock use at Tuolumne Meadows, from elimination of concessioner stock day rides and fewer packstrings used to supply Glen Aulin High Sierra Camp (due to the elimination of wood stoves and meals-only services) would reduce stock use corridorwide by up to 60%, and on the Glen Aulin trail by up to 43%. This would substantially reduce the impacts of stock use on trails, including conflicts between hikers and stock users, particularly along the heavily used Young Lake and Glen Aulin trails.

Limited portions of the river (from Pothole Dome to Pate Valley) would be opened to whitewater boating, a new recreational opportunity in the river corridor. This activity would be regulated by the existing wilderness overnight trailhead quota system. Because of the high level of skill and physical fitness required, the short boating season in the Grand Canyon segment (about 6-8 weeks), and the prohibition on commercial boating, this new recreational opportunity would have a beneficial impact on a minimal number of visitors.

Scenic Segments

Under alternative 4, visitors to Tuolumne Meadows would continue to find a great diversity of recreational and educational opportunities easily accessible to people of various ages and abilities. The total amount of designated parking at Tuolumne Meadows would be increased by 381 spaces. Under existing conditions, there would be sufficient parking at Tuolumne Meadows to meet the current demand for parking. However, if park visitation and parking demand continued to increase at Tuolumne Meadows, in the future some visitors may be displaced during peak use periods.

Prohibiting roadside parking to protect river values and visitor safety would cause many visitors to park farther away from where they might wish to be. However, visitor safety and the condition of river values would be improved with the elimination of roadside parking and increased traffic management. There would be substantial improvements to the pedestrian circulation system at Tuolumne Meadows, where new trail corridors would connect the visitor services areas (store and grill, visitor contact station) with the campground and major trailheads. The new visitor contact station would improve visitor experience by allowing visitors to park, orient themselves to their surroundings, and access multiple day hikes from one location.

To accommodate the prescribed maximum levels of use, visitors would be directed at trailheads to stay on trails (through less intrusive means where possible, such as signs and better trail delineation) and would be encouraged to minimize their impacts on sensitive habitats. This, in addition to the removal of informal trails at the meadows, would restrict some of the freedom of movement some visitors have come to expect at Tuolumne Meadows. However, these measures would help protect the subalpine meadows and magnificent scenery, which many visitors expressed their support for during the development of this plan. The Tuolumne Meadows campground would remain at its existing capacity, with 304 tent and RV campsites, 4 stock sites, 7 group campsites, and the 126-person backpacker area, which together would accommodate a maximum 2,184 people per night. The Tuolumne Meadows Lodge would continue to operate at the current capacity and level of service and accommodate a maximum of 276 people per night. The demand for these facilities would continue to be high, and some visitors would not be able to access these facilities during peak use periods.

Commercial services in the Tuolumne Meadows area would continue to include lodging, a camp store and grill and the mountaineering school. Through-hikers on the Pacific Crest Trail or John Muir Trail would continue to have the opportunity to pick up supplies shipped to the Tuolumne Meadows post office. The picnic areas at the store and grill and at the Lembert Dome trailhead would be enlarged and improved. Upgrading the ventilation at the vault toilet at Lembert Dome would improve visitor experience, and the NPS would install flush toilets at Lembert Dome, if possible. Replacing the skier pit toilet with a vault toilet would have a beneficial impact on winter visitors.

The elimination of public fuel service and the mountaineering shop would adversely affect visitors who have come to rely on refueling at Tuolumne Meadows or visitors who need to buy or replace mountaineering

equipment in Tuolumne Meadows. Under alternative 4, the closest commercial facilities for fuel would be 20 miles to the east in Lee Vining or 40 miles to the west at Crane Flat. The nearest mountaineering stores would be in Mammoth Lakes, approximately 50 miles from Tuolumne Meadows.

The increased frequency of the Tuolumne Meadows shuttle, which travels between Olmstead Point, Tenaya Lake, and among several sites in Tuolumne Meadows, should facilitate better circulation and reduce the need to refuel for overnight visitors. Emergency fuel would be available to visitors at the proposed administrative fuel tanks near the wastewater treatment facility.

Conclusion

Alternative 4 would have a local long-term minor to moderate beneficial impact on both visitors with strong traditional ties to the Tuolumne and visitors who expressed a desire for less development and a more sustainable way of enjoying the Tuolumne River. Improved information, facilities, and an increase in designated parking would make it easier for most visitors to access and experience the area. At existing levels of park visitation, visitors would have little trouble finding parking and accessing the river corridor. If park visitation continues to increase, in the future visitors might have difficulty finding parking during peak use periods, resulting in a local long-term negligible to minor adverse impact for some visitors. This worst-case scenario would not occur during nonpeak periods and times of the day.

A local long-term minor to moderate beneficial impact on recreation in wild segments of the river corridor would result from implementation of standards to manage encounter rates on trails within a day hike of Tuolumne Meadows and a substantial reduction in stock use compared to the no-action alternative. Similarly, some visitors would continue to benefit by being able to access the wilderness with support from a commercial outfitter or by being able to spend the night in a remote High Sierra setting without having to pack a tent or food. A relatively small number of skilled whitewater boaters would be able to access the wilderness by whitewater boat. One traditional use, concessioner stock day rides, would be discontinued, resulting in a local long-term minor adverse impact on a relatively small number of visitors. Some visitors' perception of the Glen Aulin High Sierra Camp facilities as an intrusion into a highly scenic area would continue.

Visitors seeking lodging, commercial food service, mountaineering guide service, and camp supplies at Tuolumne Meadows would continue to have access to those services; however, there would be a local long-term minor adverse impact on visitors seeking fuel service or mountaineering equipment.

Cumulative Impacts

Actions, projects, and plans that could have a cumulative impact on local and regional visitor experience in combination with alternative 4 would be the same as described for the no-action alternative.

Implementation of alternative 4 in conjunction with past, present, and reasonably foreseeable projects throughout Yosemite National Park and surrounding recreational areas would be expected to have a local long-term minor to moderate beneficial impact on most visitors, with the following exceptions:

The *Tenaya Lake Area Plan* resulted in a slight decrease in parking at Tenaya Lake, which is the closest major park attraction to Tuolumne Meadows. If visitation levels increase, the day visitors potentially displaced from Tuolumne Meadows during peak use periods would not be likely to find parking at Tenaya Lake because both areas would be experiencing peak demand. This could result in increased undesignated parking along Tioga Road outside of the river corridor. However, the parking along Tioga Road provided under the Tioga Trailheads project could offset some of the potential displacement of visitors that could occur when Tuolumne Meadows day use parking is full. In addition, the parkwide traffic management and information system would make general information about traffic conditions available to visitors, thus helping them plan ahead and avoid disappointment during peak periods. In addition, closure of the public fuel station might increase crowding at

the Crane Flat fuel station, 40 miles to the west on Tioga Road. Overall, this would result in a local long-term minor adverse cumulative impact on the visitor experience.

Actions proposed in the ongoing *Merced River Plan* could impact visitors at Tuolumne Meadows, depending on the user capacity and/or levels and types of visitor services prescribed for the Merced River corridor. For instance, if concessioner stock day rides are discontinued at both locations, there would be a cumulative minor adverse impact on visitors who would need to travel from Tuolumne Meadows to Wawona for that traditional experience, rather than to Yosemite Valley (where concessioner stock day rides are also currently offered).

Wilderness

Affected Environment

The Wilderness Act of 1964 secures for the American people of present and future generations the benefits of an enduring resource of wilderness. The Yosemite Wilderness was established by the California Wilderness Act of 1984. Of Yosemite National Park's 747,970 acres, over 704,500 acres (more than 94%) have been designated Wilderness, and another 927 acres (0.1%) are potential wilderness additions. The Tuolumne River was designated wild and scenic under the same act that designated the Yosemite Wilderness.

A wide variety of recreational activities are available in wilderness, including backpacking, camping, day hiking, nature study, fishing, swimming and wading, climbing, horseback riding and stock packing, winter skiing, and trans-Sierra treks. Within the more than 90% of the river corridor that is designated Wilderness, overnight visitors must obtain a wilderness permit, and they must backpack or ride stock to reach more remote destinations. However, not all the designated Wilderness in the Tuolumne River corridor is remote. The Tioga Road corridor provides relatively easy access to some wilderness areas, particularly in the Tuolumne Meadows area. The wilderness experience in this area differs from a remote wilderness experience. Visitors to more accessible areas in wilderness may encounter more people and human-made noises; however, a wilderness experience is still possible in these areas.

Definitions of Wilderness and Wilderness Character

The Wilderness Act is well known for its succinct definition of wilderness:

A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and community of life are untrammeled by man, where man himself is a visitor who does not remain.

The act allows for the designation of wilderness areas and establishes management directives that specify the preservation of wilderness character, which it describes more poetically:

The character of wilderness is an unseen presence capable of refocusing our perception of nature and our relationship to it. It is that quality that lifts our connection to a landscape from the utilitarian, commodity orientation that dominates the major part of our relationship with nature to the symbolic realm serving other human needs. (Federal Register 66:10, 3729-3730)

Although intangible and difficult to measure, wilderness character is additionally described by the Wilderness Act in terms of multiple qualities, including a state of naturalness, a lack of human developments, an “untrammeled” state, and conditions conducive to solitude or to primitive and unconfined experiences. Wilderness management requires an intention and a commitment to preserve these qualities, which are described in greater detail below:

- **Untrammeled:** Wilderness is essentially unhindered and free from modern human control or manipulation. This quality is affected by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness.
- **Natural:** A wilderness area is to be “protected and managed so as to preserve its natural conditions.” Wilderness ecosystems are substantially free from the impacts of modern civilization. This quality is affected by intended or unintended impacts of modern people on the ecological systems inside the wilderness since the area was designated.
- **Undeveloped:** The Wilderness Act states that wilderness is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation. . . where man himself is a visitor who does not remain” and “with the imprint of man’s work substantially unnoticeable.” This quality is affected by the presence of structures, installations, or habitations or by the use of motor vehicles, motorized equipment, or mechanical transport that increase people’s ability to occupy or modify the environment.
- **Opportunities for Solitude or Primitive and Unconfined Recreation:** The Wilderness Act states that wilderness has “outstanding opportunities for solitude or a primitive and unconfined type of recreation.” This quality is about the opportunity for people to experience wilderness in a particular way, rather than being about any particular kind of recreational activity. It addresses the chance to participate in primitive recreation (recreation typified by simplicity, lack of technology, and self-reliance, such as hiking, crosscountry skiing, canoeing, climbing), to sense natural sights and sounds, to be alone, to feel free, to take risks, to face physical and mental challenges of self-discovery and self-reliance, and to use traditional skills free from the constraints of modern culture. Wilderness must provide opportunities either for people to be alone (experience solitude) or for them to participate in primitive and unconfined recreation, or both. This quality is affected by factors that reduce these opportunities, such as encounters with other visitors, signs of modern civilization, recreation facilities, or management restrictions on visitor behavior.

Minimum Requirement Concept

The concept of “minimum requirements” comes from section 4(c) of the Wilderness Act of 1964:

Except as specifically provided for in this Act, and subject to existing private rights, there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act (including measures required in emergencies involving the health and safety of persons within the area), there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area. (16 USC 1133 (c))

The concept is applied to all administrative activities that could potentially affect wilderness character, including activities that are not specifically prohibited by section 4(c) of the Wilderness Act.

The *NPS Management Policies 2006* requires that all management decisions affecting wilderness must be consistent with the minimum requirement concept and that the NPS will use the minimum tool necessary to successfully, safely, and economically accomplish its management objectives. The NPS director’s order titled *Wilderness Stewardship (DO 41)* further describes the process for determining whether a proposed project is necessary to meet the minimum requirements for the administration of an area for the purpose of Wilderness, as defined by the act. This process, called the *minimum requirements analysis*, requires parks to

determine if the action (project) is necessary for the administration of the wilderness area, to realize the purpose of wilderness. Once the action (project) is determined necessary, parks must

next determine the activity (method or tool) to accomplish the action (project) with the least negative impact to wilderness. (DO 41, section 6.4)

Wilderness Access and Quotas

Access to the Yosemite Wilderness is managed through a system of zone capacities and related overnight trailhead quotas. The capacity system has been the park staff's most important tool in preserving wilderness character since the 1970s. However, it was never meant to be static or unexamined and has been modified and updated as appropriate through the years to continue to protect wilderness character. Trailhead quotas have been adjusted for two reasons: changing travel patterns or unacceptable resource conditions. Monitoring of resource conditions in wilderness has led to adjustments in zone capacities and reductions or increases in individual trailhead quotas. The NPS monitors water quality, meadow health, some wildlife species, trail conditions, informal trails, day use levels, encounters, people at one time, and campsite numbers and condition. Monitoring and restoration of wilderness campsites is a key component of management to limit resource impacts.

Visitor use levels are kept within capacities by controlling overnight access to the wilderness through a trailhead permit system. Controlling overnight use through a trailhead quota system allows for maximum visitor freedom inside wilderness—considered a cornerstone of the wilderness experience—while allowing the NPS to limit or disperse use as appropriate. In addition, requiring a wilderness permit allows the NPS to have a face-to-face educational contact with every party spending the night in the wilderness. Wilderness day use is not regulated by the quota system.

While overnight visitation to the Yosemite Wilderness has decreased since the quota system was instituted, the demand for wilderness permits in the Tuolumne River corridor remains well above the established quotas. The Yosemite Wilderness is one of the busiest in the NPS system, making it somewhat hard to find solitude within a day's hiking distance of Tuolumne Meadows trailheads. However, beyond that distance (usually 3 to 5 miles) conditions for solitude are more abundant.

Wilderness zones and zone capacities in the Tuolumne River corridor above Hetch Hetchy Reservoir are shown in figure 9-9.

Recreational Use in Wilderness

Please see the "Visitor Experience" affected environment discussion earlier in this chapter for a detailed description of wilderness experience and recreational use in the Tuolumne River corridor (for example, backpacking, wilderness camping, stock use in wilderness, and commercial use in wilderness).

Glen Aulin High Sierra Camp

The Glen Aulin High Sierra Camp is a concessioner-operated camp providing rustic lodging and meal service for up to 32 overnight guests. The High Sierra Camp was designated a potential wilderness addition within the Yosemite Wilderness by the 1984 California Wilderness Act. Utilities provided at the camp include both water and wastewater systems powered by solar energy and gas-powered generators; propane is used for cooking. Guest tent cabins have wood stoves but no electric power. The following facilities are located at the camp:

- three permanent structures (cookhouse, toilet building with flush toilets, and storage shed)
- dining tent with concrete and stone foundation and footings
- storage tent with concrete and stone foundation and footings
- shower tent (for employees only) with concrete foundation
- guest tent cabins (eight units) with concrete foundations
- employee tent cabins (four units) with concrete foundations

- water and wastewater treatment facilities (including a water storage tank, a chlorinator located in a small permanent building, a filter tank, surge tanks, a belowground septic tank, a wastewater leach mound, and solar panels), many with concrete foundations

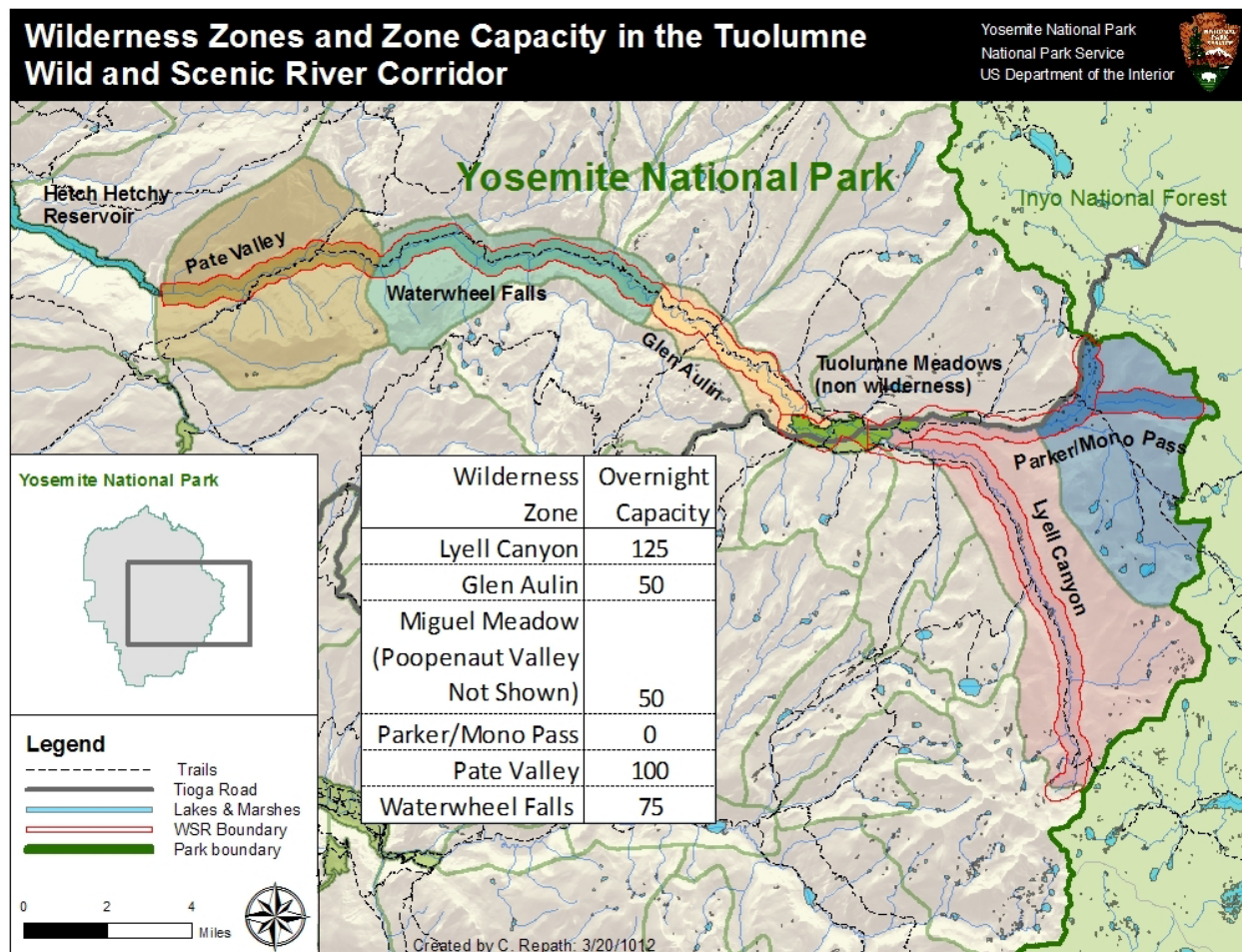


Figure 9-9. Wilderness Zone Capacity in the Tuolumne Wild and Scenic River Corridor, above Hetch Hetchy Reservoir. Each wilderness zone in the corridor is shown in a unique color. Note that zone capacities are greater than the corresponding trailhead quotas, to account for visitors spending multiple nights in the wilderness and for the fact that many zones have more than one trailhead providing access to them.

Environmental Consequences Methodology

The impact analysis considered impacts on wilderness character that would result from the proposed management under the *Tuolumne River Plan*, and whether those impacts would likely be beneficial or adverse to the wilderness character of the Tuolumne River corridor and the larger Yosemite Wilderness.

The conventional terms used by the NPS to measure the context, duration, intensity, and type of impact as part of NEPA analysis are not easily translated to impacts on wilderness character and its value to society because of the intangible and unquantifiable nature of this “unseen presence capable of refocusing our perception of nature and our relationship to it” (as it is described in the Wilderness Act). A NEPA analysis can more effectively be applied to the four more tangible qualities of wilderness character that are also identified by the Wilderness Act: untrammeled, natural, undeveloped, and providing opportunities for solitude or primitive and unconfined recreation. Therefore, in the analysis of impacts on wilderness character, professional judgment was applied to reach reasonable conclusions as to the effects on each of these qualities. Based on that analysis, a

conclusion was drawn about the overall context, intensity, duration, and type of impact on wilderness character under each alternative.

The definitions of context, intensity, duration, and type of impacts on wilderness presented in this section make reference to the kinds of actions that would have an impact on each of the four qualities associated with wilderness character. Certain kinds of actions could affect the various qualities differently, sometimes having a beneficial impact on one quality while also having an adverse effect on another quality. The kinds of actions that would affect each quality are summarized below:

- **Untrammeled.** This quality would be diminished by modern human activities or actions that intentionally control or manipulate the components or processes of ecological systems inside the wilderness. Any management activity, even an activity to restore an ecological feature or function, would create a negative change in the untrammeled quality of wilderness. Impacts on untrammeled quality are always cumulative and permanent.
- **Natural.** This quality would be diminished by intended or unintended impacts of modern civilization on ecological systems. Examples of actions that would diminish this quality include suppressing natural fire, allowing nonnative invasive species to become established or expand, or allowing native species to become endangered or extinct. Examples of actions that would preserve this quality include allowing natural fire, successful treatment of nonnative invasive species, and the restoration of native species. This quality would also be affected by intended or unintended impacts of modern civilization on historic or prehistoric cultural resources that do not “dominate the landscape.” Therefore, actions that would diminish this quality also include actions that would adversely affect archeological sites or other historic properties.
- **Undeveloped.** This quality would be diminished by the presence of structures or installations or by the use of motor vehicles, motorized equipment, or mechanical transport (including aircraft) that increased people’s ability to occupy or modify the environment. This quality would be preserved by eliminating or limiting development or use of equipment.
- **Opportunities for Solitude or Primitive and Unconfined Recreation.** Because this quality has three overlapping components (opportunities for solitude, opportunities for primitive recreation, and opportunities for unconfined recreation), predicting the impacts of proposed management actions is not always straightforward. For example, the designation of campsites could negatively affect unconfined recreation but positively affect solitude. Rebuilding a bridge that has washed out might preserve opportunities for primitive recreation for those who could not access an area without a bridge, but it could diminish opportunities for solitude, challenge, and self-reliance for those visitors who were able to cross the stream without a bridge. The way in which each component of this quality is analyzed, individually, is described below.
 - **Opportunities for Solitude.** This analysis is based on crowding. Actions that would increase crowding are considered adverse while those that would reduce crowding are considered beneficial. Crowding is often measured by the number of other groups encountered during a given time period, the people at one time at a popular destination, or the number of other groups camped within sight or sound of each other. Visitors’ perceptions of solitude are affected by their expectations, so a higher level of crowding may be considered acceptable closer to roads.
 - **Opportunities for Primitive Recreation.** The opportunity for primitive recreation and the quality of primitiveness are considered as having the dimensions of simplicity, lack of technology, and self-reliance (Johnson et al. 2005). Actions that would decrease these factors are considered adverse; those that would increase them are considered beneficial. The Wilderness Act does not endorse particular recreational activities in wilderness, nor are a diversity of types of activities considered to be part of wilderness

character. The Wilderness Act also does not require management that values a diversity of visitors. Therefore, such considerations are not included in the analysis of impacts on wilderness; rather, these considerations are factored into the analysis of impacts on the visitor experience (see the “Visitor Experience” impact topic, above).

- **Opportunities for Unconfined Recreation.** The analysis for this quality considers the relative ease with which visitors can travel freely in the wilderness and the amount of regulatory requirements placed on them once inside wilderness. It does not consider the regulations placed upon access to wilderness, such as restrictions upon the number of overnight trailhead permits. Access and user capacity are addressed under the “Visitor Experience” impact topic, above.

The impact analysis considered impacts on wilderness character that would result from the proposed management under the *Tuolumne River Plan*, and whether those impacts would likely be beneficial or adverse to the wilderness character of Tuolumne River corridor and the larger Yosemite Wilderness. The analysis of impacts is qualitative, and professional judgment was applied to reach reasonable conclusions as to the context, intensity, and duration of potential impacts on each of the qualities of wilderness character described above. For each of these qualities of wilderness character, potential impacts were analyzed using the following criteria:

Context: Context describes the area or location where the impact would occur. Local or localized impacts are those that would be limited to an area close to the activity. For example, campsite restoration would have a localized impact that does not extend beyond the immediate vicinity. Regional impacts would affect wilderness character within the entire project area or adjacent areas of Yosemite Wilderness. For instance, fire management activity could have a regional impact as it potentially affects large areas that are either allowed or not allowed to burn.

Intensity: Intensity describes the degree, level, or strength of an impact. For this analysis, intensity is classified as negligible, minor, moderate, and major. Negligible impacts would not be measurable. Minor impacts on wilderness character, which could include changes in encounter rates, agency-imposed restrictions, or natural character, would be detectable but would be localized to a specific area, although they might have the potential to become regional impacts. Moderate impacts on wilderness character would be readily apparent and would likely extend beyond the planning area. Mitigation would probably be necessary to offset adverse impacts. Major impacts would be readily apparent and would substantially change wilderness character locally, as well as beyond the planning area boundary. Extensive mitigation would likely be necessary to offset adverse impacts, and its success could not be guaranteed. Major impacts could include adding or removing large permanent installations.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration, such as short-term impacts on opportunities for solitude associated with administrative activities. A long-term impact would have a permanent impact on wilderness character, such as impacts on the unconfined characteristic that result from restrictions on freedom of movement. Some activities could have both short-term and long-term impacts on wilderness character; for instance, while an administrative activity (e.g. site restoration) would have a short-term impact on opportunities for solitude, the same activity could have a long-term impact on the untrammelled and undeveloped qualities of the restored area for visitors whose wilderness experience was permanently altered by human intrusion.

Type: Type describes impacts as beneficial or adverse. A beneficial impact is a positive change in one of the qualities of wilderness character listed above. An adverse impact is a change that diminishes a quality of wilderness character. Some activities could have both positive and negative impacts on different qualities, as described above.

Environmental Consequences of the No-Action Alternative

Under the no-action alternative, management of congressionally designated Wilderness would continue to reflect current practices based on the Wilderness Act, NPS policy, and Yosemite National Park wilderness policies and guidelines.

Wild Segments

Untrammelled

Wilderness would continue to be managed to respect the autonomy of nature. Low-intensity ecological restoration at wilderness campsites close to water and in other sensitive locations would continue, while those campsites in more resilient areas would be retained for use. Management and restoration activities would be conducted using the minimum requirement concept. However, all ecological restoration, even efforts to “undo” the impacts of past human activity, would diminish the untrammelled quality of wilderness.

Natural

Natural conditions would be sustained through natural ecological processes with minimal management. Water quality and clarity would remain exceptional. Ongoing management actions to protect natural processes from human impacts, including removal of invasive species, fire management, and low-intensity ecological restoration at sensitive campsites, would continue. Localized adverse impacts on soils, vegetation, wetlands, wildlife, soundscapes, and archeological resources would continue along some trail corridors, in the Glen Aulin area, and at camping and pack stock grazing areas in Lyell Canyon. In the Tuolumne Meadows area, subalpine meadow and riparian habitat, including some habitat in areas of designated Wilderness, would continue to decline in response to past disruptions to hydrologic and biological processes.

Undeveloped

Wilderness in the Tuolumne River corridor would continue to offer an escape from human-made structures, crowds, artificial light, and noise (with the exception of aircraft overhead) and allow visitors to experience natural quiet and spectacular scenery. The backcountry trail system, which includes signs, constructed trails, and bridges accessing the Tuolumne River corridor, would be retained; continued maintenance of this system would include the occasional use of motorized equipment like chainsaws, and occasional helicopter support. Restoration of campsites located in fragile areas would continue, and camping in existing sites would be encouraged. The Glen Aulin High Sierra Camp would be retained at its current character and capacity. The use of generators, pumps, kitchen tools and appliances, and helicopter support would continue to be required for seasonal maintenance of the permanent camp. The camp itself is not located in designated Wilderness; however, some structures related to the camp are (the water intake, water line, backcountry utility camp, and corral). Overall, some adverse impacts would continue under the no-action alternative; however, the undeveloped character of wilderness in the Tuolumne River corridor would remain protected through the minimum requirement concept.

Opportunities for Solitude or Primitive and Unconfined Recreation

The NPS would continue to manage overnight use in wilderness through the existing wilderness zone capacity system to ensure opportunities for solitude, particularly in remote areas in the Lyell Fork, upper Dana Fork, Grand Canyon of the Tuolumne, and Poopenaut Valley river segments. Increasing day visitor use levels could increase crowding within day hiking range of popular trailheads near Tioga Road and at Tuolumne Meadows, particularly on the trail to Glen Aulin and Waterwheel Falls, reducing opportunities for solitude in those areas.

Opportunities for primitive recreation (backpacking, dispersed camping, hiking, nature study, rock climbing and mountaineering, stock use, fishing, swimming, cross-country skiing, trans-Sierra ski trips, snowshoeing, and winter camping) would remain abundant.

Opportunities for unconfined forms of recreation would remain abundant corridorwide. For overnight visitors, camping restrictions in sensitive areas would continue, and overnight visitors would also be required to carry a permit and to present it to wilderness rangers, if requested. Restrictions, regulations, and the need to carry a permit would continue to have a minor impact on the unconfined quality of wilderness. Day use would remain generally unconfined, with no requirements or restrictions.

Scenic Segments

Under the no-action alternative, the portions of scenic segments located within designated Wilderness would be managed the same as the wild segments. Therefore, there is no separate impact analysis for scenic segments.

Conclusion

Compared to current conditions, the no-action alternative would have a regional long-term minor adverse impact on wilderness character. This conclusion is based on (1) an ongoing negligible diminishment of untrammeled quality caused by ongoing management to mitigate the potential for human-caused impacts to natural communities; (2) some ongoing localized adverse effects on natural and archeological resources, associated with stock use and foot traffic, primarily in Lyell Canyon; (3) an ongoing change in subalpine meadow and riparian habitat associated with historic disruptions to hydrologic and biological processes, primarily in Tuolumne Meadows and including some areas within and adjacent to designated Wilderness; (4) the retention of trails and of minor development associated with the Glen Aulin High Sierra Camp inside designated Wilderness; (5) the potential for increasing day use to diminish opportunities for solitude along wilderness trails near popular Tuolumne Meadows trailheads; and (6) no additional restrictions on primitive and unconfined recreation. In the context of the Tuolumne River corridor as a whole, these impacts would be detectable but quite localized; overall, the untrammeled, natural, and undeveloped qualities of wilderness would remain well protected; management would respect the autonomy of nature; and visitors would find excellent opportunities for primitive and unconfined recreation throughout the corridor, and for solitude in the more remote areas of the corridor.

Cumulative Impacts

Throughout the Yosemite Wilderness, site restoration, suppression of natural fires, and management of vegetation and wildlife would continue to result in local and regional adverse impacts on the untrammeled quality of wilderness. Adverse impacts from permanent structures and from mechanized and motorized support (including the use of helicopters) required for the High Sierra Camps and the backcountry trail system would continue. Overall, undeveloped qualities throughout the Yosemite Wilderness would remain protected. Ongoing programs for managing wildlife and vegetation in wilderness would allow natural ecosystems to recover from past actions and increase the likelihood of naturally functioning ecosystems throughout the park.

Outstanding opportunities for solitude or primitive recreation would remain abundant and be protected by the existing system of zone capacities and related overnight trailhead quotas. Permit requirements could increase if a day use reservation system in wilderness was implemented as a result of current planning for the *Merced Wild and Scenic River Comprehensive Management Plan*, this *Tuolumne River Plan*, or the *Wilderness Stewardship Plan*. Overall, past, present, and reasonably foreseeable plans and projects described in appendix L are expected to result in regional long-term minor adverse impacts on wilderness character in Yosemite in combination with the no-action alternative.

Environmental Consequences Common to Alternatives 1–4

Wild Segments

Untrammeled

Under any of the action alternatives, wilderness would continue to be managed to respect the autonomy of nature. Low-intensity ecological restoration at wilderness campsites close to water and in other sensitive

locations would continue, while campsites in more resilient areas would be retained. Additionally, portions of Tuolumne Meadows in and near designated Wilderness and sections of riverbank corridorwide would be restored as part of the ecological restoration program described in chapters 5 and 8 and appendix H. Management and restoration activities would be conducted using the minimum requirement concept. However, all ecological restoration, even efforts to “undo” the impacts of past human activity, would diminish the untrammeled quality of wilderness.

Natural

Natural conditions would be sustained through natural ecological processes, with increased management activity to restore previously disturbed ecological functions and to mitigate the potential for future disruptions. Fire management and removal of invasive species would continue, along with managing campsites and other activities near water sources. Additionally, the actions to protect water quality and free flow proposed in chapter 5 would be implemented under all of the action alternatives. Stock use in Lyell Canyon would be regulated to protect subalpine meadow and riparian communities and prehistoric archeological sites, and localized disturbed areas would be restored to more natural conditions. The implementation of the ecological restoration program, as described in chapters 5 and 8 and appendix H, would focus on restoring hydrologic processes and native plant communities in and near Tuolumne Meadows, including portions of the meadows in designated Wilderness, and sections of riverbank throughout the corridor. These actions would restore more natural conditions to previously disturbed areas. Informal trails would be removed from portions of the meadows in designated Wilderness (e.g., near Pothole Dome). Ecological restoration actions would be subject to a minimum requirement analysis.

Undeveloped

Wilderness in the Tuolumne River corridor would continue to offer an escape from human made structures, crowds, artificial light, and noise (with the exception of aircraft overhead) and allow visitors to experience natural quiet and spectacular scenery. Under any of the action alternatives, the backcountry trail system, which includes signs, constructed trails, and bridges accessing the Tuolumne River corridor, would be retained; maintenance of this system would continue to include occasional use of motorized equipment like chainsaws and occasional helicopter support. Restoration of campsites located in fragile areas would continue, and camping in existing sites would be encouraged. The backpacker campground at Glen Aulin would be retained under each of the action alternatives. The composting toilet at the campground would be replaced with a larger unit; this would involve helicopter support and the use of motorized equipment. Though some localized adverse impacts would continue, overall, the undeveloped character of wilderness in the Tuolumne River corridor would remain protected through use of the minimum requirement concept and monitoring and mitigation of impacts, including restoration of disturbed areas.

Opportunities for Solitude or Primitive and Unconfined Recreation

The existing system of wilderness zone capacities and related overnight trailhead quotas would continue to limit overnight use in wilderness areas within the Tuolumne River corridor. Remote areas in the Lyell Fork, upper Dana Fork, Grand Canyon of the Tuolumne, and Poopenaut Valley river segments would continue to provide opportunities for solitude. The overnight zone capacity system would remain an adaptive management tool to ensure a lack of crowding. Under any of the action alternatives, the wilderness zone capacities might be reduced in the future if the NPS determined that reductions were needed to protect opportunities for solitude; however, overnight use levels would not be increased under any alternative. For some overnight visitors, carrying the permit would present a hassle, restrict spontaneous use of the wilderness, and represent a lack of freedom and privacy. These impacts on overnight visitors would remain unchanged from the no-action alternative. If implementation of a day trailhead quota system with permits was necessary to achieve encounter rates in wilderness areas surrounding Tuolumne Meadows, there would be new adverse impacts on the unconfined recreational qualities of wilderness for day users, who would then also need to carry a permit.

However, the ability of wilderness travelers to go wherever they desired once they were in wilderness would remain unchanged. Opportunities for primitive recreation (backpacking, dispersed camping, hiking, nature study, rock climbing and mountaineering, fishing, swimming, stock use, cross-country skiing, trans-Sierra ski trips, snowshoeing, and winter camping) would remain abundant. Camping restrictions in sensitive areas would remain.

Scenic Segments

As with the no-action alternative, the portions of scenic segments within designated Wilderness would be managed the same as the wild segments of the river corridor. Therefore, there is no separate impact analysis for scenic segments.

Environmental Consequences of Alternative 1

Alternative 1 would have the following impacts on wilderness character in addition to the impacts already described under “Environmental Consequences Common to Alternatives 1–4” above.

Wild Segments

Untrammelled

Ecological restoration activity at the Glen Aulin High Sierra Camp would involve removal of permanent buildings and utility systems, soil decompaction, revegetation, and restoration of local streambanks and wetlands. Restoration activities would be conducted using the minimum requirement concept. However, all ecological restoration, even efforts to “undo” the impacts of past human activity would diminish the untrammelled quality of wilderness.

Natural

Removal of the Glen Aulin High Sierra Camp and meadow restoration activities would enhance the natural quality of wilderness by greatly reducing human noise, visual disturbance, and the availability of food and trash for wildlife in the area. Eliminating commercial pack stock use, with the exception of pack stock needed to supply the High Sierra Camps outside the river corridor, and elimination of concessioner stock day rides would reduce vegetation trampling and soil erosion along trails, and at camping and pack stock grazing areas throughout the river corridor.

Undeveloped

At the Glen Aulin High Sierra Camp, all permanent buildings (3), foundations (15), and infrastructure (water and wastewater treatment facilities, including a water storage tank, a small permanent building, a filter tank, surge tanks, a belowground septic tank, a wastewater leach mound, two generators, solar panels, and concrete foundations) would be removed. Restoration activities would be conducted using the minimum requirement concept; however, the use of motorized equipment and mechanical transport of equipment and demolition materials, including the use of helicopters, would be required. The undeveloped quality of wilderness would be adversely affected during these activities. However, after all the camp structures and infrastructure were removed, the site would be restored to more natural conditions and the area would be converted to designated Wilderness¹, improving the undeveloped quality of the Yosemite Wilderness.

Opportunities for Solitude or Primitive and Unconfined Recreation

Alternative 1 proposes a substantial reduction in encounter rates on several wilderness trails with trailheads in the Tuolumne Meadows area (trails along the Lyell Fork, and the Glen Aulin trail), setting the standard at an

¹ Once natural conditions were restored to this potential wilderness addition, the secretary of the interior could convert the area to designated Wilderness by publishing a notice in the *Federal Register*.

average of no more than four encounters with other parties per hour upstream of the Grand Canyon of the Tuolumne and two other parties per hour in the Grand Canyon. If monitoring determined that this level of use was being exceeded on some trails, day use wilderness trailhead quotas would be implemented. The encounter rate under alternative 1 would improve opportunities for solitude because it would result in fewer encounters than existing conditions, as well as fewer encounters than would be possible under the standard adopted for the outstandingly remarkable wilderness recreational value in chapter 5. For many visitors, the requirement of having to carry and produce a permit would represent a lack of freedom and privacy. However, the ability of wilderness travelers to go wherever they desired once they were in wilderness would remain unchanged.

Opportunities for solitude would be greatly improved at Glen Aulin, along the Glen Aulin trail, and along the Young Lakes trail by removing the High Sierra Camp (and its associated guests, stock packers, and employees). All commercial activities, including concessioner stock day rides into wilderness would also be discontinued under alternative 1. Abundant opportunities for primitive recreation, such as camping, hiking, backpacking, cross-country skiing, climbing, and private stock use would still be available, just not with the assistance of a commercial guide (which would make them even more consistent with the definition of primitive recreation). For visitors who do not rely on commercial outfitters, primitive recreation opportunities would be improved.

Conclusion

Overall, alternative 1 would have a local long-term moderate beneficial impact on wilderness character. This conclusion is based on the following assessment, in which the impacts common to all alternatives, including alternative 1, are summarized first, followed by the additional impacts specific to alternative 1: Under any of the action alternatives, management would respect the autonomy of nature, limiting operational activities to the minimum requirement. However, the untrammelled quality of wilderness would be adversely affected by management to restore ecological conditions to subalpine meadow and riparian habitat within and adjacent to designated Wilderness, primarily in the Tuolumne Meadows and Lyell Canyon segments; management to eliminate or mitigate localized impacts and the more extensive disruptions to hydrologic and biological processes caused by human activities in these areas would cause an adverse impact to the untrammelled quality of wilderness in order to achieve a beneficial impact to natural conditions. The natural and undeveloped qualities of wilderness would remain in or be restored to good condition. The existing backcountry trail system and associated maintenance requirements would remain under all alternatives. The undeveloped character of wilderness in the Tuolumne River corridor would remain protected through the use of the minimum requirement concept. Under all alternatives, visitors would continue to find excellent opportunities for solitude or primitive and unconfined recreation, or both. Overnight use in wilderness would continue to be managed through a trailhead quota system that would protect opportunities for solitude; no new impacts on overnight users would occur under the *Tuolumne River Plan*.

In addition to these common impacts, alternative 1 would enhance the natural and undeveloped qualities of wilderness and opportunities for solitude or primitive recreation by removing the Glen Aulin High Sierra Camp and adding the area to designated Wilderness. Activities during camp removal would adversely affect the untrammelled quality of the surrounding wilderness; however, overall the net effect would be an obvious improvement to wilderness character both locally and in the surrounding Yosemite Wilderness. Alternative 1 would also improve opportunities for solitude in wilderness throughout the wilderness corridor by substantially reducing encounter rates on trails. These use limits, combined with a significant reduction in commercial stock use on trails, would have a readily apparent beneficial impact on solitude or primitive recreation on and near trails throughout the river corridor.

Cumulative Impacts

As noted under the no-action alternative cumulative impacts, in the entire Yosemite Wilderness, site restoration, suppression of natural fires, and management of vegetation and wildlife would continue to result in

local and regional adverse impacts on the untrammeled quality of wilderness. Overall, undeveloped qualities throughout the Yosemite Wilderness would remain protected. Under alternative 1, permanent structures at Glen Aulin High Sierra Camp and the requirements for mechanized and motorized support of the camp (including the use of helicopters) would be removed. Other permanent structures in the Yosemite Wilderness would remain and mechanized and motorized support would still be required for the remaining High Sierra Camps and for backcountry trail system maintenance. In addition to the ecological restoration actions proposed under alternative 1, ongoing programs for managing wildlife and vegetation in wilderness would allow natural ecosystems to recover from past actions and increase the likelihood of naturally functioning ecosystems throughout the park.

Outstanding opportunities for solitude or primitive recreation would remain abundant and would be protected by the existing system of zone capacities and related overnight trailhead quotas. Permit requirements were recently implemented on the Half Dome trail, and such requirements could increase if a day use reservation system in wilderness was implemented as a result of current planning for the *Merced Wild and Scenic River Comprehensive Management Plan* or the *Wilderness Stewardship Plan*. Those plans could also have a beneficial impact the natural and undeveloped qualities of wilderness if they result in fewer permanent structures in the Yosemite Wilderness. In combination with alternative 1, the past and present projects and plans in Wilderness would result in a regional long-term moderate beneficial impact on wilderness character in Yosemite.

Environmental Consequences of Alternative 2

Alternative 2 would have the following impacts on wilderness character in addition to the impacts already described under “Environmental Consequences Common to Alternatives 1–4” above.

Wild Segments

Untrammeled

The Glen Aulin High Sierra Camp would be converted to a seasonal outfitter camp and all utility infrastructure, three permanent buildings, the backcountry utility camp, and both corrals would be removed. The infrastructure in designated Wilderness, including the existing water intake, storage tank, and water line, would be removed. Restoration actions proposed at Glen Aulin include soil decompaction, revegetation, and restoration of local streambanks and wetlands. Restoration activities would be conducted using the minimum requirement concept. However, all ecological restoration, even efforts to “undo” the impacts of past human activities, would diminish the untrammeled quality of wilderness.

Natural

Limited portions of the Tuolumne River would be opened to recreational boating. This action could increase the potential for adverse impacts on vegetation, soils, and archeological sites at put-in, portage, and take-out locations. Vegetation trampling and soil loss associated with concessioner stock day rides and commercial pack stock use would be reduced. Removal of the permanent infrastructure at the Glen Aulin High Sierra Camp would reduce the camp’s visual disturbance and would restore some portions of the camp to natural conditions.

Undeveloped

At Glen Aulin, motorized equipment and mechanical transport of equipment and materials, including helicopters, would be required to remove the majority of the camp infrastructure and install two composting toilets, one for the High Sierra Camp and one for the backpacker campground. In the short term, this would adversely affect the undeveloped quality of wilderness. When camp infrastructure removal activities were

completed, the area would be converted to designated Wilderness.² In the long term, converting the High Sierra Camp to a wilderness outfitters' camp would result in a beneficial impact on the undeveloped quality of the Yosemite Wilderness.

Opportunities for Solitude or Primitive and Unconfined Recreation

Opportunities for solitude on wilderness trails with trailheads in the Tuolumne Meadows area would be managed for an encounter rate that would average no more than 12 other parties per hour on the Lyell Canyon trail downstream of the Ireland Lake trail junction, 8 parties per hour on the Lyell Canyon trail upstream of the Ireland Lake trail junction, 12 parties per hour on the Glen Aulin trail, and 2 parties per hour on the trail from the Rogers Creek crossing through the Grand Canyon of the Tuolumne (see chapter 5). With the potential for day use levels to increase under alternative 2 (although they would be capped) trail use could slightly increase over existing conditions on trails within day hiking range of popular trailheads near Tioga Road and at Tuolumne Meadows. This would reduce opportunities for solitude in those areas compared to current conditions. Day use would remain generally unconfined under alternative 2. Setting the standard at a level of use that has not yet been reached on most trails would reduce the potential need for a day trailhead quota system for major trail segments. The ability of wilderness travelers to go wherever they desired once they were in wilderness would remain unchanged.

Abundant opportunities for self-led hiking, backpacking, cross-country skiing, climbing, stock use, and other primitive recreational activities would continue. The determination of extent necessary in appendix C would restrict the amount of commercial overnight and day use (e.g., recreation supported by commercial guide services, see appendix C for the definition of 'commercial use') in wild segments of the Tuolumne River corridor. Although not specifically protected under the Wilderness Act, all ongoing activities would continue, including all ongoing commercial activities. Concessioner stock day rides into wilderness and commercially guided trips would be reduced from existing levels under alternative 2. Additionally, limited portions of the river would be opened to recreational whitewater boating, thereby improving opportunities for self-reliant, primitive recreation. Boaters would be subject to the existing overnight wilderness capacities and camping restrictions.

Conclusion

Overall, alternative 2 would have a local long-term moderate beneficial impact on wilderness character. This conclusion is based on the following assessment, in which the impacts common to all alternatives, including alternative 2, are summarized first, followed by the additional impacts specific to alternative 2: Under any of the action alternatives, management would respect the autonomy of nature, limiting operational activities to the minimum requirement. However, the untrammelled quality of wilderness would be adversely affected by management to restore ecological conditions to subalpine meadow and riparian habitat within and adjacent to designated Wilderness, primarily in the Tuolumne Meadows and Lyell Canyon segments; management to eliminate or mitigate localized impacts and the more extensive disruptions to hydrologic and biological processes caused by human activities in these areas would cause an adverse impact to the untrammelled quality of wilderness in order to achieve a beneficial impact to natural conditions. The natural and undeveloped qualities of wilderness would remain in or be restored to good condition. The existing backcountry trail system and associated maintenance requirements would remain under all alternatives. The undeveloped character of wilderness in the Tuolumne River corridor would remain protected through the use of the minimum requirement concept. Under all alternatives, visitors would continue to find excellent opportunities for solitude

² Once natural conditions were restored to this potential wilderness addition, the secretary of the interior could convert the area to designated Wilderness by publishing a notice in the *Federal Register*.

or primitive and unconfined recreation, or both. Overnight use in wilderness would continue to be managed through a trailhead quota system that would protect opportunities for solitude; no new impacts on overnight users would occur under the *Tuolumne River Plan*.

In addition to these common impacts, alternative 2 would enhance the natural and undeveloped qualities of wilderness and opportunities for solitude or primitive recreation by converting the Glen Aulin High Sierra Camp to a seasonal outfitter camp with no permanent facilities except composting toilets, and adding the area to designated Wilderness, where it would be subject to wilderness management policies. Activities during camp removal would adversely affect the untrammeled quality of the surrounding wilderness; however, overall the net effect would be a noticeable improvement to the natural and undeveloped qualities of wilderness character in the corridor and an enhancement of the Yosemite Wilderness. Alternative 2 would also protect opportunities for solitude on all wilderness trails in the river corridor over the long term by establishing a standard for encounter rates on trails; because the standard would be higher than the number of encounters currently experienced on most trails, it could slightly reduce solitude from current conditions; however, the higher standard would also reduce the potential need for a day trailhead quota system. Finally, alternative 2 would improve opportunities for primitive recreation by restricting commercial use and allowing noncommercial whitewater boating.

Cumulative Impacts

As noted under the no-action alternative cumulative impacts, in the entire Yosemite Wilderness, site restoration, suppression of natural fires, and management of vegetation and wildlife would continue to result in local and regional adverse impacts on the untrammeled quality of wilderness. Overall, undeveloped qualities throughout the Yosemite Wilderness would remain protected. Under alternative 2, permanent structures at Glen Aulin High Sierra Camp and the requirements for mechanized and motorized support of the camp (including the use of helicopters) would be removed. Other permanent structures in the Yosemite Wilderness would remain and mechanized and motorized support would still be required for the remaining High Sierra Camps and for backcountry trail system maintenance. In addition to the ecological restoration actions proposed under alternative 2, ongoing programs for managing wildlife and vegetation in wilderness would allow natural ecosystems to recover from past actions and increase the likelihood of naturally functioning ecosystems throughout the park.

Outstanding opportunities for solitude or primitive recreation would remain abundant and would be protected by the existing system of zone capacities and related overnight trailhead quotas. Permit requirements were recently implemented on the Half Dome trail, and similar permit requirements could increase if a day use reservation system in wilderness was implemented as a result of current planning for the *Merced Wild and Scenic River Comprehensive Management Plan* or the *Wilderness Stewardship Plan*. Those plans could also have a beneficial impact on the natural and undeveloped qualities of wilderness if they result in fewer permanent structures in the Yosemite Wilderness. In combination with alternative 2, the past and present projects and plans in Wilderness would result in a regional long-term moderate beneficial impact on wilderness character in Yosemite.

Environmental Consequences of Alternative 3

Alternative 3 would have the following impacts on wilderness character in addition to the impacts already described under “Environmental Consequences Common to Alternatives 1–4” above.

Wild Segments

Untrammeled

Impacts on the untrammeled quality of wilderness under alternative 3 would be the same as described above under “Environmental Consequences Common to Alternatives 1–4.”

Natural

Vegetation trampling and soil loss would be reduced as a result of the decrease in concessioner stock day rides and restrictions on commercial pack stock use.

Undeveloped

At Glen Aulin, the backpacker camp and a slightly smaller High Sierra Camp would be retained outside of designated Wilderness. Utility upgrades at the two camps, including new composting toilets and two new water tanks (and removal of the existing tank), would require the short-term use of motorized equipment and mechanical transport of equipment and construction materials, including the use of helicopters, which would adversely affect the undeveloped quality of wilderness throughout plan implementation. Ongoing adverse impacts associated with the High Sierra Camp operations and seasonal maintenance of the camp would remain, including the use of generators, pumps, kitchen tools and appliances, and helicopter support. Some structures related to the camp would remain in designated Wilderness, including the backcountry utility camp and the corral.

Opportunities for Solitude or Primitive and Unconfined Recreation

Wilderness trails with trailheads in the Tuolumne Meadows area would be managed for an encounter rate that would average no more than 12 other parties per hour on the Lyell Canyon trail downstream of the Ireland Lake trail junction, 8 parties per hour on the Lyell Canyon trail upstream of the Ireland Lake trail junction, 12 parties per hour on the Glen Aulin trail, and 2 parties per hour on the trail from the Rogers Creek crossing through the Grand Canyon of the Tuolumne (see chapter 5). Even though the day use capacity of the Tuolumne Meadows area would be reduced under alternative 3, trail use could still increase over existing conditions and still remain within the standard, which would reduce opportunities for solitude compared to current conditions. Current monitoring data indicate that a day use reservation system would probably not be needed to stay within the proposed encounter rate standard. The ability of wilderness travelers to go wherever they desired once they were in wilderness would remain unchanged.

Opportunities for solitude would be slightly improved near Glen Aulin due to the reduction in overnight guest capacity at the camp. Abundant opportunities for self-led hiking, backpacking, cross-country skiing, climbing, stock use and other primitive recreational activities would continue. The determination of extent necessary in appendix C would restrict commercial overnight and day use (e.g., recreation supported by commercial guide services, see appendix C for the definition of ‘commercial use’) in wild segments of the Tuolumne River corridor. These restrictions on locations and timing of commercial use would not affect opportunities for primitive recreation as defined by the Wilderness Act, as opportunities for primitive recreation would still be available. Although not specifically protected under the Wilderness Act, all ongoing activities in wilderness would continue, including all ongoing commercial activities. Concessioner stock day rides and commercially guided trips would be reduced from existing levels under alternative 3.

Conclusion

Overall, alternative 3 would have a local long-term minor beneficial impact on wilderness character. This conclusion is based on the following assessment, in which the impacts common to all alternatives, including alternative 3, are summarized first, followed by the additional impacts specific to alternative 3: Under any of the action alternatives, management would respect the autonomy of nature, limiting operational activities to the minimum requirement. However, the untrammelled quality of wilderness would be adversely affected by management to restore ecological conditions to subalpine meadow and riparian habitat within and adjacent to designated Wilderness, primarily in the Tuolumne Meadows and Lyell Canyon segments; management to eliminate or mitigate localized impacts and the more extensive disruptions to hydrologic and biological processes caused by human activities in these areas would cause an adverse impact to the untrammelled quality of wilderness in order to achieve a beneficial impact to natural conditions. The natural and undeveloped

qualities of wilderness would remain in or be restored to good condition. The existing backcountry trail system and associated maintenance requirements would remain under all alternatives. The undeveloped character of wilderness in the Tuolumne River corridor would remain protected through the use of the minimum requirement concept. Under all alternatives, visitors would continue to find excellent opportunities for solitude or primitive and unconfined recreation. Overnight use in wilderness would continue to be managed through a trailhead quota system that would protect opportunities for solitude; no new impacts on overnight users would occur under the *Tuolumne River Plan*.

In addition to these common impacts, alternative 3 would protect opportunities for solitude on all wilderness trails in the river corridor over the long term by establishing a standard for encounter rates on trails; because the standard would be higher than the number of encounters currently experienced on most trails, it could slightly reduce solitude from current conditions; however, the higher standard would also reduce the potential need for a day trailhead quota system. Opportunities for primitive and unconfined recreation would be protected by restricting commercial use in wilderness. Utility upgrades in the Glen Aulin area would cause short-term localized adverse impacts on the undeveloped quality of wilderness; however, once these upgrades were completed, the long-term impact of the camp on undeveloped and natural qualities of wilderness would remain generally unchanged from current conditions.

Cumulative Impacts

Throughout the Yosemite Wilderness, site restoration, suppression of natural fires, and management of vegetation and wildlife would continue to result in local and regional adverse impacts on the untrammeled quality of wilderness. Adverse impacts from permanent structures and from mechanized and motorized support (including the use of helicopters) required for the High Sierra Camps and the backcountry trail system would continue. Overall, undeveloped qualities throughout the Yosemite Wilderness would remain protected. Ongoing programs for managing wildlife and vegetation in wilderness would allow natural ecosystems to recover from past actions and increase the likelihood of naturally functioning ecosystems throughout the park.

Outstanding opportunities for solitude or primitive recreation would remain abundant and be protected by the existing system of zone capacities and related overnight trailhead quotas. Permit requirements were recently implemented on the Half Dome trail, and similar permit requirements could increase if a day use reservation system in wilderness was implemented as a result of current planning for the *Merced Wild and Scenic River Comprehensive Management Plan*, this *Tuolumne River Plan*, or the *Wilderness Stewardship Plan*. Overall, past, present, and reasonably foreseeable plans and projects described in appendix L are expected to result in regional long-term minor beneficial impacts on wilderness character in Yosemite in combination with alternative 3.

Environmental Consequences of Alternative 4 (Preferred)

Alternative 4 would have the following impacts on wilderness character in addition to the impacts already described under “Environmental Consequences Common to Alternatives 1–4” above.

Wild Segments

Untrammeled

Impacts on the untrammeled quality of wilderness under alternative 4 would be the same as described above under “Environmental Consequences Common to Alternatives 1–4.”

Natural

Under alternative 4, limited portions of the Tuolumne River would be opened to recreational boating. This action could increase the potential for adverse impacts on vegetation, soils, and archeological sites at put-in, portage, and take-out locations. Vegetation trampling and soil loss associated with commercial stock use would

be greatly reduced by the elimination of concessioner stock day rides (although the concessioner saddle trips would remain) and reductions in the number of packstrings used to resupply the Glen Aulin High Sierra Camp. These actions would have beneficial impacts on the natural character of wilderness.

Undeveloped

The Glen Aulin High Sierra Camp would be retained at a reduced guest capacity under alternative 4. The camp itself would remain outside of designated Wilderness, and some of the related facilities that are currently within designated Wilderness would be relocated back inside the potential wilderness addition. The following modifications to camp infrastructure and operations would improve the undeveloped quality of wilderness:

- removing infrastructure from designated Wilderness, including the water intake for the High Sierra Camp and the water lines servicing the corral and backcountry utilities camp (leaving the backcountry utility camp and a small corral within wilderness)
- replacing all existing flush toilets with composting toilets and converting the leach mound to gray water only, which would eliminate the need for helicopters to haul wastewater sludge at the end of the season (composted waste would be removed by packstock)
- reducing the number of packstrings on the Glen Aulin trail used to support the camp
- replacing the tent cabin canvas with colors (e.g., gray or green) that blend in more naturally, although this impact would be slight

Proposed utility improvements might be flown in by helicopter or packed in with stock, pending the outcome of a minimum requirements analysis. Ongoing adverse impacts associated with operations and seasonal maintenance of the High Sierra Camp would continue, including the use of generators, pumps, kitchen tools, and appliances. Helicopters would no longer be needed seasonally to haul the sludge from the wastewater treatment facilities. New canvas colors on guest tent cabins at the Glen Aulin High Sierra Camp would be slightly less visible from trails.

Opportunities for Solitude or Primitive and Unconfined Recreation

Most wilderness trails with trailheads in the Tuolumne Meadows area would be managed for an encounter rate that would average no more than 12 other parties per hour on the Lyell Canyon trail downstream of the Ireland Lake trail junction, 8 parties per hour on the Lyell Canyon trail upstream of the Ireland Lake trail junction, 12 parties per hour on the Glen Aulin trail, and 2 parties per hour on the trail from the Rogers Creek crossing through the Grand Canyon of the Tuolumne (see chapter 5). Use could increase over existing conditions and still remain within the standard, which would reduce opportunities for solitude compared to current conditions. Excellent opportunities for solitude would remain in the more remote portion of the river corridor, downstream of Rogers Creek.

Day use would remain generally unconfined under alternative 4. The ability of wilderness travelers to go wherever they desired once they were in wilderness would remain unchanged. Opportunities for solitude would be improved near Glen Aulin due to the reduction in overnight guest capacity at the camp and the reduction in stock packstrings used to resupply the camp. Reducing packstrings would also have a beneficial impact on the primitive quality of wilderness character.

Opportunities for self-led hiking, backpacking, cross-country skiing, climbing, stock use, and other primitive recreational activities would remain abundant. The determination of extent necessary in appendix C would restrict commercial overnight and day use (e.g., recreation supported by commercial guide services, see appendix C for the definition of ‘commercial use’) in wild segments of the Tuolumne River corridor. Concessioner stock day rides into wilderness would be discontinued. However, the opportunity for stock day use would continue for private stock users and commercial outfitters. Additionally, limited portions

of the river would be opened to recreational whitewater boating, thereby improving opportunities for self-reliant, primitive recreation. Boaters would be subject to the existing overnight wilderness capacities and camping restrictions.

Conclusion

Overall, alternative 4 would have a local long-term minor to moderate beneficial impact on wilderness character. This conclusion is based on the following assessment, in which the impacts common to all alternatives, including alternative 4, are summarized first, followed by the additional impacts specific to alternative 4: Under any of the action alternatives, management would respect the autonomy of nature, limiting operational activities to the minimum requirement. However, the untrammelled quality of wilderness would be adversely affected by management to restore ecological conditions to subalpine meadow and riparian habitat within and adjacent to designated Wilderness, primarily in the Tuolumne Meadows and Lyell Canyon segments; management to eliminate or mitigate localized impacts and the more extensive disruptions to hydrologic and biological processes caused by human activities in these areas would cause an adverse impact to the untrammelled quality of wilderness in order to achieve a beneficial impact to natural conditions. The natural and undeveloped qualities of wilderness would remain in or be restored to good condition. The existing backcountry trail system and associated maintenance requirements would remain under all alternatives. The undeveloped character of wilderness in the Tuolumne River corridor would remain protected through the use of the minimum requirement concept. Under all alternatives, visitors would continue to find excellent opportunities for solitude or primitive and unconfined recreation, or both. Overnight use in wilderness would continue to be managed through a trailhead quota system that would protect opportunities for solitude; no new impacts on overnight users would occur under the *Tuolumne River Plan*.

In addition to these common impacts, alternative 4 would improve the natural and undeveloped qualities of wilderness by removing some of the facilities associated with the Glen Aulin High Sierra Camp from designated Wilderness and reducing the need for packstock resupply and helicopter trips. Utility upgrades in the Glen Aulin area would cause short-term localized adverse impacts on the undeveloped quality of wilderness; however, once these upgrades were completed, the long-term adverse impact of the camp on undeveloped and natural qualities of wilderness would be reduced. Alternative 4 would additionally protect opportunities for solitude on all wilderness trails in the river corridor over the long term by establishing standards for encounter rates; because the standard for most trails would be higher than the number of encounters currently experienced, it could slightly reduce solitude from current conditions. The lower standard established for the trail from Rogers Creek to Pate Valley would ensure that current opportunities for solitude on that more remote trail would be protected. Opportunities for primitive and unconfined recreation would be enhanced by restricting commercial use in wilderness, eliminating concessioner stock day rides, and allowing noncommercial whitewater boating.

Cumulative Impacts

Throughout the Yosemite Wilderness, site restoration, suppression of natural fires, and management of vegetation and wildlife would continue to result in local and regional adverse impacts on the untrammelled quality of wilderness. Adverse impacts from permanent structures and from mechanized and motorized support (including the use of helicopters) required for the High Sierra Camps and the backcountry trail system would continue. Overall, undeveloped qualities throughout the Yosemite Wilderness would remain protected. Ongoing programs for managing wildlife and vegetation in wilderness would allow natural ecosystems to recover from past actions and increase the likelihood of naturally functioning ecosystems throughout the park.

Outstanding opportunities for solitude or primitive recreation would remain abundant and be protected by the existing system of zone capacities and related overnight trailhead quotas. Permit requirements were recently implemented on the Half Dome trail, and similar permit requirements could increase if a day use reservation

system in wilderness was implemented as a result of current planning for the *Merced Wild and Scenic River Comprehensive Management Plan*, this *Tuolumne River Plan*, or the *Wilderness Stewardship Plan*. Overall, past, present, and reasonably foreseeable plans and projects described in appendix L are expected to result in regional long-term minor to moderate beneficial impacts on wilderness character in Yosemite in combination with alternative 4.

Park Operations and Facilities

Affected Environment

The NPS operates many programs and facilities within the Tuolumne River corridor. Trails are located corridorwide in designated Wilderness and nonwilderness, and facilities such as temporary and permanent residences, administrative and visitor service buildings (such as the visitor center), roads, and utility infrastructure are located in Tuolumne Meadows and below O'Shaughnessy Dam. Park operations and facilities along the Tuolumne River corridor are largely seasonal. Typically, operations in the river corridor are at full capacity from mid to late June through September. During the winter (generally October through May), most park operations and facilities are closed, except for some operations near Hetch Hetchy Reservoir and in Tuolumne Meadows.

National Park Service Operations

NPS operations fall into eight divisions: Resources Management and Science, Facilities Management, Visitor Protection, Interpretation and Education, Business and Revenue Management, Administrative Management, Project Management, and Planning. While the Administrative Management, Project Management, and Planning Divisions' activities influence activities in the Tuolumne River corridor, these divisions do not maintain a physical or on-site operational presence in the river corridor and are not included in the discussion below.

Staffing levels in the Tuolumne River corridor fluctuate annually and during the summer season, depending on operational needs. Housing is currently provided for 104 NPS employees at Tuolumne Meadows, and another six volunteer campground hosts reside in the Tuolumne Meadows campground. However, up to 150 NPS employees currently work out of Tuolumne Meadows in the summer, including NPS research and restoration crews, trail crews, and volunteers who work on an intermittent basis. While the actual number of employees at Tuolumne Meadows at any one time fluctuates due to the different nature and duration of employee assignments, the existing amount of housing is not sufficient to accommodate all of the NPS employees who are working in the area.

Resources Management and Science

The Resources Management and Science Division is responsible for resource data collection and monitoring, prescribing natural and cultural resource impact mitigation for construction projects, ecological restoration of sensitive areas, and vegetation and wildlife management. Facilities to support Resources Management and Science activities and programs include employee housing and vehicle parking.

Facilities Management

The Facilities Management Division is responsible for maintaining infrastructure. This division includes three branches (Utilities, Roads and Trails, and Buildings and Grounds), which maintain a seasonal presence in the river segments above Hetch Hetchy Reservoir during the summer season and a year-round presence in the nonwilderness administrative area below O'Shaughnessy Dam.

Facilities Management operations within the river corridor are based in Tuolumne Meadows. The Utilities Branch operates and maintains the Tuolumne Meadows water and wastewater treatment systems and the high-voltage electrical system. The backcountry utilities staff maintains the water and wastewater treatment facilities

at the Glen Aulin High Sierra Camp and the composting toilet at the adjacent backpacker campground. The Roads and Trails Branch is responsible for the seasonal opening of Tioga Road, maintaining parking infrastructure, maintaining frontcountry and backcountry trails, performing hazard tree removal, operating the NPS stable in Tuolumne Meadows, and removing trash in the Tuolumne Meadows area. The Buildings and Grounds Branch maintains administrative facilities, employee housing, and the campground. This branch also provides custodial services, trash and recycling removal, and historic structure preservation.

Facilities necessary to support Facilities Management activities include storage and staging areas, employee housing, vehicle parking, stables, and potable water and wastewater facilities.

Visitor Protection

The Visitor Protection Division performs various visitor management and resource protection duties, including frontcountry and backcountry wilderness law enforcement operations, provision of emergency medical services, search and rescue, structural and wildland fire protection, and transportation and circulation management. Protection rangers assist with monitoring natural and cultural resources, perform restoration activities, and provide assistance to visitors. Wilderness rangers maintain a winter presence in Tuolumne Meadows. Visitor Protection staff members are also located within the corridor below Hetch Hetchy Reservoir to help ensure security of the O'Shaughnessy Dam.

Facilities to support Visitor Protection activities at Tuolumne Meadows include a wilderness center, ranger station, parking for emergency vehicles and fire engines, search-and-rescue facilities, office and storage space, and employee housing.

Interpretation and Education

The Interpretation and Education Division is responsible for providing natural, cultural, and physical resource information, developing interpretive exhibits, and providing interpretive programs during the summer season, which consist of evening programs, ranger-led talks and walks, and ranger-led High Sierra Loop backpacking trips. In addition, interpretive staff members are responsible for managing the Tuolumne Meadows visitor center and Parsons Memorial Lodge. Interpretation and Education staff members also serve as the public information officer and family liaison officer during emergency operations, such as search-and-rescue and wildland fire events.

Facilities to support the Interpretation and Education Division in the Tuolumne River corridor include a visitor center, Parsons Memorial Lodge, campfire rings, office and storage space, vehicle parking, and employee housing.

Business and Revenue Management

The Business and Revenue Management Division is responsible for the operation and staffing of the Tuolumne Meadows campground and for managing concessioner operations, such as lodging, retail and eating establishments, and equestrian operations. The division manages the incidental business permit program, which regulates tour buses, commercial stock use, and commercial tour and recreational guiding services.

Facilities to support Business and Revenue Management operations include campground office and storage space, vehicle parking, and employee housing.

Concessioner Operations

The NPS concessioner is responsible for commercial operations in the Tuolumne River corridor, including the store, grill, public fuel station, mountaineering shop/school, Tuolumne Meadows Lodge, concessioner stable, and Glen Aulin High Sierra Camp. The concessioner is responsible for the seasonal set-up and tear-down of all concessioner-operated visitor services and concessioner employee housing in Tuolumne Meadows and at the Glen Aulin High Sierra Camp.

Approximately 103 concessioner support staff members work and live in the Tuolumne Meadows area during the summer, and 9 employees are required for the operation of the Glen Aulin High Sierra Camp.

Tuolumne Meadows Public Fuel Station

The Tuolumne Meadows public fuel station services visitors and employees on a seasonal basis. The station is one of four public fuel stations in the park, and is typically open from June-September. The Tuolumne public fuel station dispensed approximately 45,162 gallons of fuel in July /August 2011 and 61,901 gallons of fuel in July/August 2012. The Tuolumne Meadows station is approximately 20 miles from the nearest fuel station outside the park, at Lee Vining. The closest service station within the park is 40 miles east at Crane Flat. In comparison, the park's Crane Flat public fuel station dispensed 242,691 gallons in July/August 2011 and 265,070 gallons in July/August 2012.

National Park Service and Concessioner Stock Operations

While some stock use in Yosemite is private or commercial, a large portion of stock use is administrative and/or operational. Both the NPS and the concessioner use stock to support their operations in the Tuolumne River corridor.

The NPS uses stock to support backcountry utilities operations and trail crew camps, to assist with search-and-rescue operations, and for backcountry patrols. NPS stock use to support backcountry utilities operations is concentrated on the High Sierra Camp loop trail. Other use is spread throughout the area and changes as trail crew locations and other logistics change. The NPS maintains a stable at Ranger Camp in Tuolumne Meadows to support operational and administrative stock use. Up to 25 head of stock are boarded at the NPS stable, although the number varies widely, depending on seasonal operational needs.

The concessioner uses stock to support the operation of the High Sierra Camps. Four High Sierra Camps are supplied from Tuolumne Meadows. One or two strings of mules (five mules, one horse and rider) supply the Glen Aulin High Sierra Camp twice a week. May Lake, Vogelsang, and Sunrise High Sierra Camps are each supplied by two or three strings of mules two to three times per week during the summer season. All waste from the High Sierra Camps is packed out each week and trucked from Tuolumne Meadows to the proper facilities. The concessioner-operated Tuolumne Meadows stable serves as the primary staging area for High Sierra Camp operations. The concessioner stable has the capacity to board 100 head of stock (including up to 25 head to support High Sierra Camps) in the summer season and includes a barn, office, loading dock, and storage building with a walk-in refrigerator.

Park Infrastructure and Facilities

Trails and Trailheads

Trail construction within the Tuolumne River corridor varies from dirt footpaths to trails with elaborate stone construction suitable for both foot and stock use. Both the Pacific Crest Trail and the John Muir Trail pass through Tuolumne Meadows. The river corridor includes four major trailheads into wilderness (not including trailheads that provide access to primarily day use destinations, such as Parsons Memorial Lodge):

- The Lember Dome trailhead provides access to Lember Dome, Dog Lake, the Glen Aulin High Sierra Camp, the Grand Canyon of the Tuolumne, and areas north of Tioga Road. Support facilities at this trailhead include vehicle parking, vault toilets, several food storage lockers, and a picnic area.
- The trailhead for the Pacific Crest /John Muir Trails and the Dog Lake trail is located near the Bug Camp employee housing area. Visitors may park at this trailhead to access the Pacific Crest/John Muir Trails, the Lyell and Dana Forks of the Tuolumne River, Lyell Canyon, Vogelsang High Sierra Camp, and areas south of Tioga Road. Facilities associated with this trailhead include vehicle parking and food storage lockers.

- The Cathedral Lakes trailhead provides access to the Cathedral Range, Cathedral Lakes, Bud Lake, and Sunrise High Sierra Camp. Facilities associated with this trailhead include port-a-potties, food storage lockers, and limited roadside parking.
- The Poopenaut Valley trailhead is located off the road to Hetch Hetchy. There are no services at this trailhead.

All trailheads and trail junctions have directional signs, and some have interpretive signs.

Data collected in 2006 in the Tuolumne Meadows area suggest that there are significant impacts associated with formal and informal trails. For example, the highly used Dog Lake, Glen Aulin, Lyell Canyon, and Cathedral Lakes trails show significant signs of deterioration, which is most likely attributable to the high level and diversity of use these trails receive. These trails are popular access routes to the high country for day hikers, backpackers, rock climbers, and stock users (NPS 2006f).

Roads

The NPS maintains approximately 15 miles of roads within the Tuolumne River corridor. Tioga Road is the major park road within the corridor. Minor roads include the paved driveway to the wilderness center, ranger station, and Tuolumne Meadows Lodge; the partially paved road through the Tuolumne Meadows campground; the Soda Springs Road, which is the gravel road leading to the concessioner stable and continuing to Parsons Memorial Lodge and the wastewater treatment ponds (for administrative use only); and portions of the paved road that leads to Hetch Hetchy Reservoir and the O'Shaughnessy Dam.

The NPS is responsible for the seasonal opening and repair of Tioga Road. This road is closed by snow and fallen trees for most of the winter. Opening the road requires a considerable amount of time and resources, and for safety reasons, road and forestry staff are trained in avalanche safety prior to road opening activities, because the road goes through multiple avalanche zones. Plowing and tree removal generally begin in mid-April and take several weeks to complete. Opening dates vary due to weather and avalanche conditions, but the road generally opens in late May.

Bridges

At least nine bridges cross the Tuolumne River within Yosemite National Park, eight of which are in the wild and scenic river corridor. These include the Tioga Road bridge at Tuolumne Meadows, a single-vehicle bridge below O'Shaughnessy Dam (outside the corridor), and seven footbridges: one crossing the upper Lyell Fork near the middle base camp, Twin Bridges near Tuolumne Meadows, a Dana Fork bridge, a footbridge just south of Parsons Memorial Lodge, another "twin bridges" above Glen Aulin, a footbridge at Glen Aulin, and a bridge in Pate Valley. Three footbridges span tributaries very close to the river corridor: on Rafferty Creek just outside of Tuolumne Meadows and along Conness and Return Creeks in the Grand Canyon reach. There are low-water crossings throughout the Tuolumne River corridor.

Employee Housing

NPS employee housing is in three distinct camps within the river corridor. Concessioner employee housing is also in many locations within the corridor. While some employees are housed in hard-sided cabins, most are housed in canvas tents (canvas generally supported by wood frames). Both types of employee housing are equipped with electricity. All NPS and concessioner employee housing is occupied in the summer season only, except for housing for the two Tuolumne winter rangers. The NPS housing available at Tuolumne Meadows is not adequate to house the number of employees required on site to support current park operations. In addition, the existing tent housing does not meet Occupational Safety and Health Administration (OSHA) requirements or current NPS standards for seasonal employees, and some housing is located within 500 feet of livestock corrals, which is in violation of the OSHA code.

Road Camp, which is behind the visitor center along Tioga Road, has 17 beds for NPS employees. The area also includes a mess hall, restrooms, a shower house, and common areas.

Ranger Camp is between Tioga Road and the road leading to the Tuolumne Meadows Lodge. NPS employee housing at Ranger Camp consists of both cabins and canvas tents with a total capacity of 54 beds, and is occupied by staff from Interpretation and Education, Visitor Protection, Business and Revenue Management, and Facilities Management divisions. Additional facilities in Ranger Camp include the Tuolumne Meadows ranger station, search- and-rescue buildings with an ambulance bay, restrooms, a shower house, and a barn and corral. The larger cabin at Ranger Camp is used year-round as a residence. Bug Camp is directly east of Ranger Camp and has NPS employee housing that is temporary in construction. The canvas tents at Bug Camp are seasonally occupied by Resources Management and Science and Youth Conservation Corps staff. Additional facilities at Bug Camp include restrooms and several cabins designated for research staff. There are 33 beds available for NPS staff.

The concessioner maintains and occupies employee housing units during the summer season in the Tuolumne River corridor. Concessioner employee housing is largely double occupancy. Of these housing units, 24 are at the Tuolumne Meadows Lodge along the Dana Fork, 16 are behind the Tuolumne Meadows store and grill, five are behind the gas station, nine are at the concessioner stable, and four are at the Glen Aulin High Sierra Camp. Concessioner employee housing is constructed entirely of canvas tents with metal or wooden frames. Employee tent cabins are without electricity at Tuolumne Meadows Lodge and at the Glen Aulin High Sierra Camp. Currently, there are 103 concessioner beds at Tuolumne Meadows and 9 concessioner beds at the Glen Aulin High Sierra Camp.

Office and Storage Space

The NPS maintains office space at the ranger station, Tuolumne Meadows campground office, the wilderness center and the visitor center. The amount and size of office space at Tuolumne Meadows is not adequate to accommodate the number of employees required on site to support current park operations. In particular, there is insufficient space for NPS employees who are required for basic operations at the ranger station and at Road Camp.

The concessioner maintains office space at Tuolumne Meadows Lodge, the concessioner stable, and the public fuel station/mountaineering shop. Concessioner office space is adequate for the number of employees assigned to Tuolumne Meadows.

Utilities

Utility infrastructure is required year-round in the Tuolumne River corridor, although winter operations are reduced considerably. Separate domestic water and wastewater treatment facilities are located at Tuolumne Meadows; utilities staff are responsible for the operation and maintenance of these facilities. The spring opening of visitor service and administrative facilities is solely dependent on the ability of the utilities staff to operate these systems. Components of the water collection and treatment system, wastewater treatment and disposal system, and winter operations are discussed below.

Domestic Water Collection and Treatment System

The domestic water supply for the Tuolumne Meadows area comes from surface water drawn from the Dana Fork, also referred to as the Dana Fork diversion. This intake structure, located upstream from Tuolumne Meadows Lodge, consists of three individual concrete retaining walls partitioned by two openings that have the capability of being closed with what are known as “log gates” when the river level drops in late summer. The intake structure stretches approximately halfway across the river where the Dana Fork is split into two main channels; this structure affects only one channel. The height of the concrete walls is below typical spring runoff conditions (approximately 2 to 3 feet); these walls were designed to slow flow in a pool but allow surface water

to travel swiftly through the intake structure and not impede the free-flowing condition of the river. During the late summer when water levels drop, the log gates are placed in the partitions between the concrete walls to help keep the pool at a depth that allows surface water to be drawn.

Surface water enters the intake system through a coarse screen. When collected, surface water travels by gravity through a 10-inch-diameter pipe to a sedimentation tank located nearby. A series of valves along this pipe are used to turn the system off during the winter.

The domestic water treatment process begins when surface water enters the sedimentation tank. Baffles, or screens, are designed to slow the water flow, prevent short-circuiting, and capture the larger pieces of organic material, such as branches. The sedimentation tank is cleaned out annually (by hand with shovels) to clear out sediment buildup and large organics.

The final stage of the water treatment process takes place at a treatment facility and uses filters and chlorine injection. The water is tested, both prior to treatment and after chlorination, for numerous different parameters. The treatment facility building, which was built in 1951 and is north of Tuolumne Meadows Lodge, has two filtration tanks. At maximum production, the water system can treat and store 158,000 gallons per day. With only one filter operating, the system capacity is reduced to 79,000 gallons per day. The system's capacity is determined by its filtration capacity (efficiency) and its storage capacity. Chlorine is added to the filtered water and pumped to the storage tank, which can hold 100,000 gallons of domestic water prior to distribution. This means that the system can only store what it is capable of treating during a 15-hour period and has no excess storage capacity. Treated water is distributed to provide cold water to NPS tent cabins and the Tuolumne Meadows campground and to provide hot and cold water to hard-sided cabins, all restrooms and shower houses associated with employee housing, and the Tuolumne Meadows Lodge.

There is no water storage for the sole purpose of fire protection in Tuolumne Meadows. If a structural or wildland fire in a fire suppression zone developed within the Tuolumne Meadows area, water from the domestic water supply could be used or the park helicopter would collect water from the Tuolumne River.

In 2006 California decreased the direct filtration turbidity standard from 0.5 to 0.1 nephelometric turbidity units, assuming that all particulate matter in the water is a pathogen or an organic that could be harmful to human health. The NPS is operating the Tuolumne Meadows treatment system within the permitted regulations for this system; however, the system does not meet the new state regulations, and the current facility does not consistently meet the new turbidity standard. The current system will be upgraded outside of the *Tuolumne River Plan* process; the upgrades are currently scheduled to begin in 2014.

Wastewater Collection and Treatment System

The wastewater collection and treatment infrastructure in Tuolumne Meadows is a secondary treatment facility. The existing system includes a primary treatment plant, which separates out the solids. The secondary treatment process is composed of activated sludge, two settling ponds, and a sprayfield. Water quality is currently monitored monthly during the summer upstream and downstream of the settling ponds and sprayfield, west of the concessioner stables. Individual components of the wastewater collection and treatment facility are discussed below.

Three lift stations in Tuolumne Meadows (one along the Soda Springs Road, one along Tioga Road near the campground office, and one along Tioga Road between the store and visitor center) move wastewater to the treatment plant through areas where the gradient is flat/level and requires more than a gravity system.

The treatment plant in Tuolumne Meadows is located south of Tioga Road and east of the visitor center. All wastewater enters the wastewater treatment plant premises through a grate designed to catch large debris.

Wastewater is then pumped into a large, baffled open-aeration tank, where blowers inject it with air. Lab work (e.g., water quality testing) at the plant is minimal.

In the 1970s two settling ponds (approximately 4.5 acres in total) were constructed on the northern border of Tuolumne Meadows above the Soda Springs road. The liner for one pond was replaced in 1991 and the other was replaced in 2005. Large underdrains beneath the settling ponds capture snowmelt and route water around the ponds. After the wastewater has been aerated at the treatment plant, it is pumped beneath the meadow and river to these two settling ponds. When settled, water is then chlorinated and pumped through sprinklers at the sprayfield.

Helipad

A helipad is maintained at Gaylor Pit (a decommissioned borrow pit that has recently been restored to more natural conditions) to support visitor protection and other operations.

Winter Operations

Water and wastewater collection and treatment operations used during the summer season at Tuolumne Meadows are shut down around October 15 each year. Both systems are drained until they are empty, then the valves are closed and any needed repair or maintenance is attempted prior to the first major snow.

Winter operations in Tuolumne Meadows require water, wastewater collection, and electricity. Two rangers are stationed in Tuolumne Meadows at a winter cabin; however, at times up to 10 people, including park visitors or employees, temporarily stay in two additional cabins or a ski hut. The two additional cabins have electricity and heat, but no water; the ski hut has no utilities. There is a pit toilet nearby for skiers. The domestic water supply comes from a 250-foot-deep well that produces adequate water for six people. Wastewater is collected in a septic tank and dispersed into a leachfield. The capacity of the leachfield is adequate for existing use. Winter operations are powered by commercial electricity, and emergency backup generators are maintained to cover outages.

Glen Aulin Area Utilities

Water is collected from the Tuolumne River upstream from the High Sierra Camp and treated through a filtration and chemical process. Wastewater is collected in a septic tank and disposed through a leach mound north of the High Sierra Camp. The existing leach mound failed four times between 1996 and 2004. Since that time, various actions have been taken to prevent wastewater from surfacing in the leach mound. For example, the NPS implemented a water use limit of 600 gallons per day for the camp operation, which requires closure of the guest shower facilities and the use of paper cups and plates for dinner. These actions have helped prevent wastewater surfacing. The High Sierra Camp bathrooms contain old low-flow toilets and waterless urinals, which are only available to camp guests. In wet years, the leach mound is more saturated and the risk of failure is greater. In dry years, the High Sierra Camp may stay open longer, so the leach mound might get closer to failure by the end of the season. Sludge from the existing wastewater treatment system is removed at the end of each season by helicopter.

The Glen Aulin backpacker campground has an aging composting toilet. The facility is undersized for current use levels, but it can accommodate current use levels with incomplete composting. This toilet has high levels of use and is in need of repair.

Environmental Consequences Methodology

Proposed management actions in this *Final Tuolumne River Plan/EIS* are evaluated in terms of the context, intensity, and duration of impacts on concessioner or NPS operations and facilities, and whether the impacts would be considered beneficial or adverse.

Context: For the purposes of this analysis, only local impacts are considered. This includes impacts specific to operations and facilities within the Tuolumne River corridor.

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts are considered not detectable and would have no discernible effect on operations and facilities. Minor impacts would be slightly detectable but not expected to have an overall effect on the ability of the park to provide services and facilities. Moderate impacts would be clearly detectable and could have an appreciable effect on operations and facilities. Major impacts would have a substantial, highly noticeable influence on park operations and facilities and include impacts that would reduce the ability to provide adequate services and facilities to visitors and staff.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration and associated with maintenance-, restoration-, or construction-related activities. A long-term impact would have a permanent effect on operations and facilities.

Type: Impacts are evaluated in terms of whether they would be beneficial or adverse to park operations or facilities. Beneficial impacts would improve operations and/or facilities with the proposed level of employees. Adverse impacts would negatively affect operations and/or facilities or could impede the ability to provide adequate services and facilities to visitors and staff.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current conditions and management, as described under “Affected Environment,” above, and under “No-Action Alternative,” in chapter 8.

Staffing and Housing Needs

Current housing is summarized and compared to the current staffing level in table 9-16. As stated above under “Affected Environment,” there is not enough housing available at Tuolumne Meadows during the summer season to support the level of staffing needed to provide adequate visitor services, protection, and facility maintenance. As a result, NPS employees must crowd into the available housing, camp, or commute.

Visitor Service, Administrative, and Maintenance Facilities and Infrastructure

All existing visitor service, administrative, and maintenance facilities would be retained under the no-action alternative. Office and storage space would remain overcrowded. The proximity of the maintenance yard to the visitor center at Tuolumne Meadows would continue to cause some traffic issues for maintenance vehicles. Existing roads, parking areas, trails, trailheads, and bridges would be retained. The existing, aging utilities would be retained and continue to require intensive maintenance to keep them operational. Wastewater treatment would remain at the secondary level, with the treated wastewater continuing to be disposed of in the wastewater treatment ponds and sprayfields.

Conclusion

Continuation of conditions under the no-action alternative would have a local long-term minor adverse impact on operations. This impact would result from inadequate NPS housing, inadequate office and storage space, an

Table 9-16.
Employees Assignments and Available Housing at Tuolumne Meadows, No-Action Alternative

Location	Housing Available	Employees Assigned
NPS Employees		
Road Camp	17	varies
Ranger Camp	54	varies
Bug Camp	33	varies
Total NPS Employees	104	~150
Concessioner Employees		
Tuolumne Meadows Lodge	48	48
Behind the store and grill	42	42
Concessioner stable	13	13
Total Concessioner Employees	103	103
Total All Employees	207	

aging and high-maintenance wastewater treatment facility, and conflicts between administrative and visitor circulation patterns in the vicinity of the maintenance yard and visitor center. Although these impacts would not be new, they could be expected to worsen as facilities continued to age and visitor use increased.

Cumulative Impacts

Approved plans guide NPS managers in making long-term, annual, and day-to-day decisions regarding the management of programs, projects, and facilities in the Tuolumne River corridor. The programs, projects, and facilities directed by these plans have implications for funding and staffing needs. These needs are met on a priority basis consistent with the park budget and other management considerations. Approved plans that call for programs, projects, and facilities that could affect current operating and staffing levels in the Tuolumne River corridor include the following:

- *Yosemite General Management Plan*
- *Yosemite Wilderness Management Plan*
- *Yosemite Resources Management Plan*
- *Yosemite Fire Management Plan*
- *Parkwide Invasive Plant Management Plan Update*
- *Scenic Vista Management Plan*

Future plans with the potential to affect operations and staffing in the Tuolumne River corridor include the *Merced Wild and Scenic River Comprehensive Management Plan*, which is underway, and the upcoming *Wilderness Stewardship Management Plan*.

A project to improve the parkwide communication data network is currently underway to enhance operations in the Tuolumne River corridor. A Tioga trailheads project and a Tioga Road rehabilitation project are also underway.

To the extent that ongoing or future plans and projects result in improved utilities and facilities, the no-action alternative, together with the cumulative projects, would result in a local long-term minor beneficial impact on park operations. Many of the current and foreseeable projects would have short-term adverse impacts on park operations and facilities during construction activities related to the implementation of improvements.

Environmental Consequences of Alternative 1

Staffing and Housing Needs

Table 9- 17 presents the number of NPS and concessioner employees that would be assigned to and housed in the Tuolumne Meadows area under alternative 1.

Compared to the no-action alternative, NPS workload, and, possibly NPS staffing and housing needs, would be decreased by the following major actions:

- elimination of commercial stock use, which would reduce the need for trail-maintenance
- reductions in day and overnight user capacities, which would reduce the need for visitor protection and other visitor services
- elimination of roadside parking, which would reduce the need for road repairs and maintenance
- reduction in overall facilities and development, which would reduce the need for maintenance
- upgrading of utilities, which would reduce the need for maintenance

Table 9-17.
Employees Housed at Tuolumne Meadows, Alternative 1

Employee Classification	Number and Location
NPS employees	100 at Road Camp and Ranger Camp
Concessioner employees	2 at the concessioner stable

The NPS workload, and possibly NPS staffing and housing needs, would be increased by the following actions:

- expansion of the monitoring program associated with the management of user capacity
- enforcement of limitations on day parking
- implementation of the ecological restoration program
- restoration of natural conditions to areas where facilities would be removed at both Tuolumne Meadows and Glen Aulin (short-term staffing need)
- elimination of the public fuel station, which would increase the need for emergency roadside assistance

The net effect would be an overall decrease in NPS staffing and housing needs and elimination of the housing shortfall in the Tuolumne River corridor.

Concessioner staffing and employee housing needs would be mostly eliminated under alternative 1 by the following actions:

- elimination of commercial services (Tuolumne Meadows Lodge, store and grill, mountaineering shop/school, public fuel station, shuttle bus service, and concessioner stock day rides) at Tuolumne Meadows
- closure of the Glen Aulin High Sierra Camp

Two concessioner employees would be required at the stables to support High Sierra Camps outside the Tuolumne River corridor.

Visitor Service, Administrative, and Maintenance Facilities

Adapting the Civilian Conservation Corps (CCC) mess hall building (current site of the visitor center) for park operations would provide needed office space. Consolidating a visitor contact station with the wilderness center would eliminate conflicts between maintenance and visitor vehicle traffic and would improve the operational efficiency of visitor services (although there would no longer be a visitor contact function at the west end of Tuolumne Meadows). Retaining a diesel administrative fuel pump near the ranger station would provide a source of fuel for some administrative use in the area. Employees and visitors would need to travel to Lee Vining (20 miles east) or Crane Flat (40 miles west) for gasoline. The helipad at Gaylor Pit would continue to support visitor protection and other needs.

Stable Operations

Co-locating the NPS and concessioner stables would result in operational issues for both the NPS and the concessioner, including the need for adequate separation of herds, supplies, and equipment, since the two operations are managed and funded differently.

Utilities

The existing, aging utilities would be replaced with new facilities that would be more efficient and require less maintenance. However, the upgraded facilities would require a higher level of operator certification than the existing facilities. Utilities at the Glen Aulin High Sierra Camp would be removed, which would eliminate the maintenance requirements at the camp. The backpacker camp operation would continue at the existing level, with a composting toilet still requiring maintenance.

Short-Term Interruptions to Operations

Demolition, construction, and restoration activities under alternative 1 would temporarily disrupt some park operations, thus inconveniencing employees and making it difficult for them to operate efficiently during the construction period. Removal of infrastructure from the Glen Aulin High Sierra Camp would comply with a

minimum requirement analysis in accordance with the Wilderness Act and NPS policy and guidelines. The equipment needed and materials removed from the camp would either be flown by helicopter or packed with stock, pending the finding of the minimum requirement analysis. This could increase the timeframe needed to remove the camp.

Conclusion

Alternative 1 would result in a local long-term moderate beneficial impact on park operations associated largely with the reduction in required levels of service and staffing, which would eliminate the housing shortfall and overcrowding of administrative office and storage space. Additional benefits would result from reduced maintenance requirements at the wastewater treatment facilities and elimination of traffic conflicts between visitors accessing the visitor center and maintenance operations.

The operational issues associated with co-locating the stables would be addressed during facility redesign. Demolition, construction, and restoration activities would result in short-term minor to moderate adverse impacts on park operations.

Cumulative Impacts

Past, present, and reasonably foreseeable plans and projects that would affect operations in the river corridor in combination with alternative 1 are noted in the no-action alternative, above.

Many of the current and foreseeable projects would have short-term adverse impacts on park operations and facilities during construction activities related to the implementation of improvements. To the extent that ongoing or future projects resulted in improved utilities and facilities, alternative 1, together with the cumulative projects, would result in a local long-term moderate beneficial impact on park operations.

However, the reductions in visitor services at Tuolumne Meadows would potentially cause minor to moderate adverse impacts on operations at other visitor services areas in the park that are affected by other planning efforts, including the *Merced Wild and Scenic River Comprehensive Management Plan*. For instance, a reduction in day use parking in alternative 1 could increase traffic management requirements at other locations, as visitors dispersed elsewhere on Tioga Road, to Yosemite Valley, or to Wawona. Similarly, eliminating the Tuolumne Meadows public fuel station might increase demand at the closest in-park fuel station 40 miles to the west, at Crane Flat (although it is likely that many visitors would refuel at Lee Vining, 20 miles to the east, outside of the park).

Environmental Consequences of Alternative 2

Staffing and Housing Needs

Table 9-18 presents the number of NPS and concessioner employees assigned to and housed at Tuolumne Meadows under alternative 2.

Compared to the no-action alternative, under alternative 2 the NPS workload, and possibly NPS staffing and housing needs, would be decreased by the following major actions:

- upgrading of utilities, which would reduce the need for maintenance
- reduction in commercial stock use, which would reduce the need for trail maintenance
- elimination of roadside parking, which would reduce the need for road repairs and maintenance

The NPS workload, and possibly NPS staffing and housing needs, would be increased by the following actions:

Table 9-18.
Employees Housed at Tuolumne Meadows, Alternative 2

Employee Classification	Number and Location
NPS employees	100 at Road Camp or Ranger Camp 74 at Gaylor Pit
Concessioner employees	101 at Tuolumne Meadows Lodge 2 at the concessioner stable

- expansion of the monitoring program associated with the management of user capacity
- enforcement of limitations on day parking
- implementation of the ecological restoration program
- restoration of natural conditions to areas where facilities would be removed at both Tuolumne Meadows and Glen Aulin (short-term staffing need)
- the need to maintain fencing along trails (particularly in heavy snow years)
- allowing kayaking or similar recreational boating and the need for whitewater-certified personnel on the search-and-rescue staff

The expected net effect these actions under alternative 2 would be an overall increase in NPS staffing and housing needs to a maximum of 174 employees. Additional NPS employee housing would be provided at Gaylor Pit, thus eliminating the existing housing shortfall in the river corridor. Development of the currently undeveloped Gaylor Pit area would require a substantial planning, funding, and implementation effort.

Concessioner staffing needs would remain the same as the no-action alternative.

Visitor Service, Administrative, and Maintenance Facilities

NPS visitor service facilities (the visitor center and the wilderness center) would remain dispersed under alternative 2, with no gains in operational efficiency. Adapting the CCC mess hall building (current site of the visitor center) for park operations would provide needed office space and eliminate conflicts between maintenance and visitor vehicle traffic. Visitor protection functions would be relocated from the ranger station to the wilderness center, which would be expanded to adequately support both functions. The helipad at Gaylor Pit would continue to support visitor protection and other needs. In the long term, upgraded and expanded housing and improved utility systems would change maintenance needs, but the level of maintenance required to maintain all facilities would be expected to remain approximately the same as with the no-action alternative.

Stable Operations

Co-location of the NPS and concessioner stables at a currently undeveloped location east of Budd Creek would result in operational issues for both the NPS and the concessioner. Issues would include the need for adequate separation of staging areas for packers and the public; adequate separation of storage and use of vehicles, trailers, equipment, and feed; adequate separation of NPS and concessioner stock and of horses and mules; and health concerns regarding communicable diseases within the increased herd density and numbers.

Utilities

The aging utilities at Tuolumne Meadows would be replaced with new, more efficient facilities that would require less maintenance. However, the upgraded facilities would require a higher level of operator certification than the existing facilities. Utilities at Glen Aulin High Sierra Camp would be removed, which would remove most of the maintenance requirements at the camp. Composting toilets at the High Sierra Camp and the backpacker campground would still require maintenance.

Short-Term Interruptions to Operations

Demolition, construction, and restoration activities would temporarily disrupt some park operations under alternative 2, which would inconvenience employees and make it difficult for them to operate efficiently during the construction period. Work to convert the Glen Aulin High Sierra Camp to a temporary outfitter's camp would need to comply with a minimum requirement analysis in accordance with the Wilderness Act and NPS policy and guidelines. The equipment and materials needed to upgrade utilities and the demolition materials

removed would either be flown by helicopter or packed out by stock, pending the finding of the minimum requirement analysis. This could increase the timeframe needed to complete improvements at the camp.

Conclusion

Alternative 2 would result in a local long-term moderate beneficial impact on park operations. This would be associated primarily with the upgrading and expansion of housing to adequately accommodate the needed staff and the provision of adequate office and storage space. Upgraded wastewater treatment facilities and better separation between administrative and visitor use areas would also benefit park operations. The management issues raised by co-location of the NPS and concessioner stables could be largely resolved through sensitive facility design, although health and safety concerns would increase with an increased amount of stock in one location. Demolition, construction, and restoration activities would have short-term minor adverse impacts on park operations.

Cumulative Impacts

Past, present, and reasonably foreseeable projects that would affect operations in the river corridor in combination with alternative 2 are noted in the no-action alternative, above. To the extent that ongoing or future projects resulted in improved utilities and facilities, alternative 2, together with the cumulative projects, would result in a local long-term moderate beneficial impact on park operations.

Many of the current and foreseeable projects would have short-term adverse impacts on park operations and facilities during construction activities related to the implementation of improvements.

Environmental Consequences of Alternative 3

Staffing and Housing Needs

Table 9-19 presents the number of NPS and concessioner employees that would be assigned to and housed in the Tuolumne Meadows area under alternative 3.

Compared to the no-action alternative, under alternative 3 the NPS workload, and, possibly NPS staffing and housing needs, would be decreased by the following major actions:

- upgrading of utilities, which reduce the need for maintenance
- reduction in concessioner day rides, which would reduce the need for trail maintenance
- elimination of roadside parking, which would reduce the need for road repairs and maintenance

The NPS workload, and possibly NPS staffing and housing needs, would be increased by the following actions:

- expansion of the monitoring program associated with the management of user capacity
- enforcement of limitations on day parking
- implementation of the ecological restoration program
- restoration of natural conditions to areas where facilities would be removed at both Tuolumne Meadows and Glen Aulin (short-term staffing need)
- elimination of the public fuel station, which would increase the need for emergency roadside assistance

Table 9-19.
Employees Housed at Tuolumne Meadows, Alternative 3

Employee Classification	Number and Location
NPS employees	124 at Road Camp, Ranger Camp, Bug Camp and campsites behind Tuolumne Meadow Lodge
Concessioner employees	101 north of the parking area at Tuolumne Meadows Lodge 2 at the concessioner stable

The net effect would be an overall decrease in NPS staffing and housing needs to a maximum of 124 employees. The existing housing shortfall would be eliminated by developing 20 new campsites for NPS employees behind Tuolumne Meadows Lodge.

Concessioner staffing needs would remain the same as the no-action alternative.

Visitor Service, Administrative, and Maintenance Facilities

NPS visitor service facilities (the visitor center and the wilderness center) would remain dispersed, with no gains in operational efficiency. Consolidating operational facilities related to roads, trails, buildings, and grounds at the wastewater treatment site would provide needed office and storage space and eliminate conflicts between maintenance and visitor vehicle traffic. Consolidating the administrative fuel pumps, both gasoline and diesel, at that location would provide a source of fuel for emergency and administrative use in the area, thus reducing travel distance for NPS and concessioner vehicles and improving efficiency of operations. The administrative fuel pumps would also be available for emergency use by visitors. Visitor protection functions, including search and rescue, would continue to operate out of the ranger station and the nearby search-and-rescue cache. The helipad at Gaylor Pit would continue to support visitor protection and other needs. The level of maintenance required to maintain all facilities would be expected to remain approximately the same as with the no-action alternative.

Stable Operations

Stable operations would remain generally unchanged.

Utilities

The aging wastewater treatment facilities at Tuolumne Meadows would be replaced with new, more efficient facilities that would require less maintenance. However, the upgraded facilities would require a higher level of operator certification than the existing facilities. At the Glen Aulin High Sierra Camp most flush toilets would be replaced with composting toilets, with little change in maintenance requirements. Upgrades to the water treatment facilities would include installation of a small microhydro unit at the camp for temporary use to maintain water pressure during dry periods; this action would increase maintenance requirements for both the NPS and the concessioner.

Short-Term Interruptions to Operations

Demolition, construction, and restoration activities would temporarily disrupt some park operations under alternative 3, which would inconvenience employees and make it difficult for them to operate efficiently during the construction period. Because most existing facilities would be retained, the construction phase would be relatively short. Utility upgrades at the Glen Aulin High Sierra Camp would comply with a minimum requirement analysis in accordance with the Wilderness Act and NPS policy and guidelines. The equipment and materials needed to upgrade utilities at the camp would either be flown by helicopter or packed with stock, pending the finding of the minimum requirement analysis. This could increase the timeframe needed to complete improvements at the camp.

Conclusion

Alternative 3 would result in a local long-term moderate beneficial impact on park operations. Reducing the workload and providing employee campsites behind the Tuolumne Meadows Lodge would eliminate the housing shortfall at Tuolumne Meadows. The consolidation of adequate maintenance and operations facilities, with better separation between administrative and visitor use areas, and upgraded wastewater treatment facilities would also benefit park operations. Demolition, construction, and restoration activities would result in a short-term minor adverse impact on park operations.

Cumulative Impacts

Past, present, and reasonably foreseeable projects that would affect transportation in the river corridor in combination with alternative 3 are noted in the no-action alternative, above. To the extent that ongoing or future projects resulted in improved utilities and facilities, alternative 3, together with the cumulative projects, would result in a local long-term moderate beneficial impact on park operations.

However, the reductions in visitor services at Tuolumne Meadows would potentially cause local, long-term, minor adverse impacts on operations at other visitor services areas in the park that would also be impacted by other planning efforts, including the *Merced River Plan*. For instance, a reduction in day use parking in alternative 3 could increase traffic management requirements at other locations, as visitors disperse elsewhere on Tioga Road, to Yosemite Valley, or to Wawona (although this impact would be less than under alternative 1). Similarly, eliminating the Tuolumne Meadows public fuel station might increase demand at the closest in-park fuel station 40 miles to the west, at Crane Flat (although it is likely that the many visitors would refuel at the Lee Vining, 20 miles to the east of Tuolumne Meadows in Mono County).

Many of the current and foreseeable projects would have short-term adverse impacts on park operations and facilities during construction activities related to the implementation of improvements.

Environmental Consequences of Alternative 4 (Preferred)

Staffing and Housing Needs

Table 9-20 presents the number of NPS and concessioner employees that would be assigned to and housed at the Tuolumne Meadows area under alternative 4.

Compared to the no-action alternative, under alternative 4 the NPS workload, and possibly NPS staffing and housing needs, would be decreased by the following major actions:

- upgrading of utilities, which would reduce the need for maintenance
- reduction in commercial stock use, which would reduce the need for trail maintenance
- elimination of roadside parking, which would reduce the need for road repairs and maintenance

The NPS workload, and possibly NPS staffing and housing needs, would be increased by the following actions:

- expansion of the monitoring program associated with the management of user capacity
- enforcement of limitations on day use parking
- implementation of the ecological restoration program
- restoration of natural conditions to areas where facilities would be removed at both Tuolumne Meadows and Glen Aulin (short-term staffing need)
- the need to maintain fencing along trails (particularly in years of heavy snow)
- allowing kayaking or similar recreational boating and the need for whitewater-certified personnel on the search-and-rescue staff
- elimination of the public fuel station, which would increase the need for emergency roadside assistance

Table 9-20.
Employees Housed at Tuolumne Meadows, Alternative 4

Employee Classification	Number and Location
NPS employees	133 at Road Camp and Ranger Camp 30 at Gaylor Pit (up to 60 employees housed temporarily while permanent housing was under construction)
Concessioner employees	88 north of the parking area at Tuolumne Meadows Lodge 2 at the concessioner stable

The level of NPS facilities and NPS visitor services would remain comparable to the no-action alternative; however, additional NPS staff would be required, primarily to conduct activities needed to protect and enhance river values. Concessioner facilities, visitor services, and related staffing requirements would decrease compared with the no-action alternative. NPS housing at Tuolumne Meadows would be increased to accommodate 133 employees, and campsites would be provided for 30 more employees at Gaylor Pit.

This would provide sufficient on-site housing to meet staffing needs for 163 NPS employees and eliminate the housing shortage. Concessioner housing needs would be met with 88 beds in new housing north of the parking area at Tuolumne Meadows Lodge and 2 beds at the combined NPS/concessioner stable.

The consolidation of two stables operations could result in operational issues for both the NPS and the concessioner, as noted under “Stable Operations,” below.

Visitor Service, Administrative, and Maintenance Facilities

NPS visitor service facilities (the visitor contact station and the wilderness center) would remain separate, with no gains in operational efficiency under alternative 4. Adapting the CCC-era mess hall building (current site of the visitor center) for NPS operations would provide needed office space and eliminate conflicts between maintenance and visitor vehicle traffic. A rehabilitation of the existing historic ranger station to increase NPS office space would reduce crowding at that facility. Visitor protection functions, including search and rescue, would continue to operate out of the ranger station and the nearby search-and-rescue cache. The helipad at Gaylor Pit would continue to support visitor protection and other needs.

Consolidating the administrative fuel pumps, both gasoline and diesel, near the wastewater treatment facility would provide a source of fuel for emergency and administrative use in the area, resulting in no changes in travel distance or efficiency for park operations. The level of maintenance required to maintain all facilities would be expected to remain approximately the same as with the no-action alternative. The administrative fuel pumps would be available for emergency use by visitors.

Removing two concessioner-operated visitor services, the public fuel station and the mountaineering shop, would consolidate concessioner operations at the store/grill area, the stable, and at the lodge.

Stable Operations

The NPS and concessioner stables would be co-located at the site of the current concessioner stable. Under alternative 4, the concessioner stock operations would be reduced from 100 to 25 head of stock to support High Sierra Camps and saddle rides, while the NPS would maintain a maximum of 25 head to support trail maintenance and ranger patrols. The co-location of these two operations would result in operational issues for both the NPS and the concessioner. Issues would include the need for adequate separation of staging areas for packers and the public; adequate separation of storage and use of vehicles, trailers, equipment, and feed; adequate separation of NPS and concessioner stock and of horses and mules; and health concerns regarding communicable diseases with the increased herd density and numbers.

Utilities

The aging wastewater treatment facilities at Tuolumne Meadows would be replaced with new, more efficient facilities that would require less maintenance. However, the upgraded facilities would require a higher level of operator certification than the existing facilities. Replacing flush toilets with composting toilets would not change the level of required maintenance; however, the compost could be packed out at the end of each season, eliminating the existing need for helicopters to remove sludge resulting from the flush toilet/leach mound system. Installation of a small microhydro unit at the camp for temporary use to maintain water pressure during dry periods and removal of the water lines and water tanks serving the corrals would increase maintenance requirements for both the NPS and the concessioner.

Short-Term Interruptions to Operations

Demolition, construction, and restoration activities at Tuolumne Meadows would temporarily disrupt some park operations, which would inconvenience employees and make it difficult for them to operate efficiently during the construction period. Utility work at the Glen Aulin High Sierra Camp would comply with a minimum requirement analysis in accordance with the Wilderness Act and NPS policy and guidelines. The equipment and materials needed to upgrade utilities and demolition materials at the camp would either be flown by helicopter or packed with stock, pending on the finding of the minimum requirement analysis. This could increase the timeframe needed to complete improvements at the camp.

Conclusion

Alternative 4 would result in a local long-term moderate beneficial impact on park operations. Additional housing and campsites would eliminate the housing shortfall at Tuolumne Meadows. The consolidation of adequate administrative facilities, better separation between administrative and visitor use areas, and upgraded wastewater treatment facilities would also benefit park operations. The operational issues associated with co-locating the stables would be addressed during facility redesign. Demolition, construction, and restoration activities would result in a short-term minor adverse impact on park operations.

Cumulative Impacts

Past, present, and reasonably foreseeable plans and projects that would affect operations in the river corridor in combination with alternative 4 are noted in the no-action alternative, above. To the extent that ongoing or future projects resulted in improved utilities and facilities, alternative 4, together with the cumulative projects, would result in a local long-term moderate beneficial impact on park operations.

Many of the current and foreseeable projects would have short-term adverse impacts on park operations and facilities during construction activities related to the implementation of improvements.

However, the reductions in visitor services at Tuolumne Meadows would potentially cause local long-term minor adverse impacts on park operations at other visitor services areas in the park. For instance, eliminating the Tuolumne Meadows public fuel station might increase demand at the closest in-park fuel station 40 miles to the west, at Crane Flat (although it is likely that much of this demand would be met at the closest fuel station, which is outside the park is at Lee Vining, 20 miles to the east of Tuolumne).

Transportation

Affected Environment

Three California state highways lead to Yosemite National Park (California Highways 41, 120, and 140). These roads transition into the parkwide road system at the park's entrance stations. Yosemite has roughly 200 miles of roads, of which approximately 15 miles traverse the Tuolumne Wild and Scenic River corridor, primarily along Tioga Road (Highway 120). The State of California has no rights-of-way within the park; however, state highway numbers are used on park signs to help orient visitors. Additional transportation infrastructure within the park includes spur roads, access drives, pedestrian trails, bicycle paths, parking areas, and pull-outs.

Most visitors access the Tuolumne River corridor by private vehicle on Tioga Road; access is also available from Hetch Hetchy Road. At the western park entrance, California Highway 120 transitions to Big Oak Flat Road, which intersects Tioga Road at Crane Flat; at the eastern park entrance Highway 120 transitions directly to Tioga Road. The drive to Hetch Hetchy from Highway 120 begins outside the park boundary on the western side of the park. Hetch Hetchy Road, which is open all year, ends at O'Shaughnessy Dam, just outside the Below O'Shaughnessy Dam segment of the wild and scenic river corridor. Tioga Road, which traverses the Tuolumne Meadows and Lower Dana Fork scenic segments, is one of only a few trans-Sierra highways. It is closed between Crane Flat and Tioga Pass each year due to snowfall, usually from October or November to

May or June, depending on conditions. For this reason, traffic conditions and transportation facilities within the river corridor vary greatly by season.

The Lyell Fork, Upper Dana Fork, Grand Canyon, and Poopenaut Valley segments of the Tuolumne Wild and Scenic River corridor lie wholly in wilderness. There are no roads or other transportation facilities in these segments, other than hiking and stock trails, which are described above in the “Visitor Experience” and the “Park Operations and Facilities” sections. The closest vehicular access to the Lyell Fork and Upper Dana Fork segments is via trailheads along Tioga Road, which are in the Tuolumne Meadows and Lower Dana Fork segments. The Grand Canyon segment and lower portions of the Poopenaut Valley segments are extremely remote; the closest vehicular access to the Grand Canyon segment is via trailheads in Tuolumne Meadows or from White Wolf, and the closest vehicular access to the Poopenaut Valley segment is from Hetch Hetchy Road.

River Segments Upstream of O’Shaughnessy Dam (Lyell Fork, Upper and Lower Dana Fork, Tuolumne Meadows, and Grand Canyon Segments)

The Tioga Road parallels the Tuolumne River through the Tuolumne Meadows and Lower Dana Fork segments. The road then continues to parallel the branch of an unnamed tributary leading to Tioga Pass. Along with several secondary access roads (campground roads, administrative roads, etc.), Tioga Road provides the primary access to the Tuolumne River corridor. Because Tioga Road is closed in the winter, the descriptions in this section apply only to summer conditions. During winter, no vehicular traffic is allowed on Tioga Road, so transportation services and parking facilities are closed. Except for a very small portion of the corridor that can be accessed from Hetch Hetchy Road, the entire river corridor is essentially managed as wilderness during the winter, and access is possible only through wilderness-appropriate means, such as hiking or skiing.

Roadway System and Traffic Volumes

Tioga Road within the Tuolumne River corridor is a rural two-lane highway. There are currently no formal pedestrian or bicycle facilities along the road, so pedestrians and bicyclists either share the traffic lanes with vehicles or use the informal trails along both the north and south sides of the road. Formal and informal parking along the road offers opportunities for scenic viewing and access to attraction areas and facilities.

Traffic on Tioga Road consists of people visiting the park for sightseeing and recreation as well as people traversing the Sierra Nevada on California Highway 120. Between 2006 and 2010, the Tioga Pass entrance station received an average of 402,512 recreational visits for the peak season from July to September. Visitors arriving via automobile account for approximately 96% of Tuolumne visitation (NPS 2009I).

Traffic volumes on Tioga Road vary by hour, day of the week, and season. Generally, the busiest days are on weekends in the summer, with the highest traffic volumes on holiday weekends. The average daily two-way traffic volume reported just east of the Tioga Pass entrance station in 2009, 2010, and 2011 from July to September was 2,738; 2,982; and 3,096 vehicles per day, respectively. The maximum daily traffic volume for each year was 3,976 on August 2, 2009; 4,303 on August 8, 2010; and 4,277 on August 7, 2011. The average daily two-way traffic volume for all three years for July through September was 2,939, and the average maximum was 4,038. Traffic volumes on Tioga Road in 2010 and 2011 were very similar.

During July 2010, a license plate survey was conducted throughout Yosemite National Park. The results of this study reveal that approximately 16% of park visitors both enter and exit the Tioga Pass entrance station on the same day (DEA 2010).

Traffic Conditions

Although the average daily two-way traffic volumes on Tioga Road are well within the capacity of a two-lane highway, traffic congestion occurs during peak visitor use periods due to high traffic volumes combined with

full roadside parking, inadequate signage and visitor confusion about wayfinding, pedestrian and bicycle traffic, and vehicles recirculating between facilities and attraction areas. A visitor survey in 2007, however, found that most visitors to Yosemite did not feel that traffic congestion was a major problem in the park (White and Aquino 2008). Preliminary data from a 2010 visitor transportation study show the same results as the 2007 survey. According to an unpublished subset of data specific to Tuolumne Meadows that was created by the author of the recent parkwide Transportation Experience Survey (unpublished author communication related to White 2011), visitors to Tuolumne Meadows agree that (1) they have easy access to important park sites and attractions, (2) they connect with the natural environment, (3) they experience a sense of freedom, (4) it is easy to access scenic overlooks and vistas, and (5) they can go “where they want, when they want.” This is probably because visitor parking throughout Tuolumne Meadows is not limited or controlled. Roadside parking is widespread along the Tioga Road corridor, and visitors generally are able to find or create their own parking along roadsides.

Unlike Yosemite Valley, where a traffic management system is in place during peak season with managed intersections, some attended parking, and access limitations during gridlock conditions, Tuolumne Meadows has no such system. During peak periods, unmanaged congestion occurs in the areas from Lembert Dome to the Cathedral Lakes trailhead. Visitors currently have a great deal of freedom in Tuolumne Meadows and are able to park where they want, even in areas that may be damaging to natural or cultural resources. Sometimes visitors in search of parking move barriers such as boulders or signs so they are able to pull off the road to park. Parking areas that fill to capacity are often ringed by additional vehicles, with parking sometimes spilling onto adjacent roadsides. Congestion caused by unmanaged roadside parking also poses safety concerns. Lines of cars parked along Tioga Road through Tuolumne Meadows not only contribute to traffic congestion but also detract from the scenery that visitors enjoy while driving through the area.

Vehicle queuing was measured at the Tioga Pass entrance station on a Saturday in August 2006. The maximum queue length throughout the day was approximately 16 or 17 vehicles and occurred three times between 11:55 a.m. and 3:05 p.m. (DEA 2007). Although traffic volumes at the Tioga Pass entrance station have generally increased, especially during 2010 and 2011, park staff has been able to reduce queue lengths by prechecking visitors while they are waiting, and then delaying outbound traffic and allowing prechecked visitors to enter via the outbound lane. Preliminary data from the 2010 Tuolumne Meadow surveys show almost all visitors consider congestion at the Tioga Pass entrance as not a problem or just a small problem (unpublished author communication related to White 2011).

Vehicle Occupancy

The average vehicle occupancy for vehicles traveling along Tioga Road during the three-day collection period in August 2006 was 2.1 (DEA 2007). The actual average vehicle occupancy is likely somewhat larger than this value because it is assumed that some occupants of vehicles were not visible from the video used to collect the data and were not included. Other visitor studies conducted over the past 20 years have found the average vehicle occupancy to range from 2.6 to 3.4 (Van Wagendonk and Coho 1980; FHWA 1982; ORCA 1999; Littlejohn et al. 2005; Le et al. 2008). Based on this range, an average of 2.9 persons per vehicle is used for estimating visitor numbers for planning purposes in this document.

Vehicle Composition

The overwhelming majority of vehicles traveling along Tioga Road are private passenger vehicles (93%). Motorcycles comprise 3 % of the vehicles, and oversized vehicles (including buses, RVs, and commercial trucks) make up the remaining 4% (DEA 2007).

Transit and Tour Bus Services

Bus transportation in Yosemite National Park includes regional public transportation, charter and tour bus operators, concessioner-operated tours, and shuttle bus services provided by the park concessioner. The

existing transit services in the Tuolumne River corridor are concentrated along Tioga Road in the Tuolumne Meadows area, and consist of free local shuttles, tour bus service from Yosemite Valley, and regional bus service from outside of the park. While transit services elsewhere in the park operate year-round, the transit services in Tuolumne Meadows and in the Tuolumne River corridor operate only during the summer, generally from May through October, conditions permitting. The total number of buses entering through the Tioga Pass entrance station decreased from 1,509 in 2000 to 607 in 2009 (NPS 2009o).

Regional Bus Service: A regional bus service is provided along Highway 120 (Tioga Road within the park) by the Yosemite Area Regional Transportation System (YARTS). The YARTS Highway 120 route provides seasonal service between the Mammoth Lakes area on the east side of the Sierra and Tuolumne Meadows, with continuing service on to Yosemite Valley. In 2011, YARTS provided daily service in July and August but weekend service only in June and September.

The distance between Mammoth Lakes and Tuolumne Meadows is approximately 50 miles, and the one-way travel time is approximately 2 hours by bus. Major stops, from south to north, include Mammoth Lakes, June Lake, Lee Vining, and Tuolumne Meadows. Travel between Tuolumne Meadows and Yosemite Valley, including stops at White Wolf and Crane Flat, takes approximately 1 hour and 45 minutes.

Ridership on the YARTS regional bus service increased at an annual average of almost 9% from 2003 through 2009 (YARTS 2009b). The seasonal average ridership over this period was 2,450. The YARTS route along Highway 120 has few commuters, as opposed to the Highway 140 route, which has a high level of park and concessioner employee commuters. Over 86% of the total 3,301 ridership between June and September 2009 occurred in July and August.

Charter and Tour Buses: Although park entrance station statistics do not break out transit buses from charter and tour buses, the limited transit service provided by YARTS to the Tioga Pass entrance station means that most buses counted in this area are charter or tour buses. The NPS estimate for visitors arriving via bus has typically been in the range of 14,000 to 19,000 per season (NPS 2009o). Over the last decade, less than 4% of total visitors entering through the Tioga Pass entrance station have arrived by bus. Seasonal bus numbers peaked at 1,509 in 2000, decreased through 2005, and reached 607 in 2009 (NPS 2009o). As with other traffic volumes, bus numbers peak in the three-month period from July through August. Bus numbers fall off drastically before and after this period.

Tuolumne Meadows Shuttle Bus System: Two free seasonal shuttle bus routes serve the Tuolumne Meadows area: the Tuolumne Meadows shuttle route and the Tioga Pass shuttle route. These shuttles operate only during the summer, from June through mid-September, conditions permitting.

The Tuolumne Meadows shuttle route runs along Tioga Road from Tuolumne Meadows Lodge west to Olmsted Point. The shuttle makes 12 stops along a distance of about 11 miles. The one-way transit travel time is approximately 30 minutes, with departures every 30 minutes between 7:00 a.m. and 6:30 p.m. From 2001 to 2006, total annual riders on the Tuolumne Meadows shuttle averaged 16,590, with highest usage at 20,146 annual riders in 2004 and lowest usage at 13,710 riders in 2005 (DNC 2006a, 2006b). From 2001 to 2004, the Tuolumne Meadows shuttle operated from June to September, but in 2005 the shuttle operated only from July to September. The park concessioner provided data indicating there were 18,325 riders during the 2007 season. Peak usage occurs during July and August (DNC 2006a, 2006b).

The Tioga Pass shuttle route runs along Tioga Road from Tuolumne Meadows Lodge east to the Tioga Pass entrance station, with one intermediate stop at the Mono Pass trailhead. The distance is about 7 miles, and the transit travel time is approximately 15 minutes. Four eastbound and four westbound departures occur daily between 9 a.m. and 5:15 p.m. (DEA 2007).

Public comments suggest that while the shuttle bus system along Tioga Road is a valuable service to visitors, increased level of service and reliability is needed to encourage people to make greater use of the system and decrease congestion on roadways.

Park Tour Bus Service from Yosemite Valley: A seasonal daily tour bus operated by the park concessioner provides service between Yosemite Valley and Tuolumne Meadows Lodge. The distance is about 55 miles, and the one-way transit travel time is approximately 2 hours 30 minutes. Beginning at 8 a.m., the bus picks up passengers at Curry Village, Yosemite Village, and Yosemite Lodge; stops at White Wolf Lodge; and arrives at Tuolumne Meadows Lodge at approximately 10:30 a.m. The return departure leaves Tuolumne Meadows at 2 p.m. The bus will also stop at a variety of trailheads along the way whenever a stop is requested or the driver is flagged down (DEA 2007). Ridership on this tour bus service totaled 27 passengers on Saturday, August 12, 2006 (DEA 2007).

Parking Facilities

Numerous types of parking facilities exist along Tioga Road and within the Tuolumne Meadows area. *Formal parking areas* consist of clearly delineated parking spaces, which can be enumerated and managed. Generally, these are paved and striped parking areas. *Informal parking areas* are those that are either created by visitors who pull off and park along roadsides or are unpaved parking areas. Informal parking areas are not well delineated and can change in their size and form based on visitor parking behavior. Due to their informal nature, these areas are difficult to quantify for parking supply. *Roadside turnouts* are areas along Tioga Road (paved or unpaved) or other vehicle roadways that are used for emergency purposes, for short-term stops by visitors, or to accommodate overnight backpackers or climbers. Currently, most roadside parking areas and temporary turn-outs along the Tioga Road and within the Tuolumne Meadows area of the river corridor are not specifically designated or restricted by how they are used. *Designated parking* may be formal or informal and includes areas that the park service allows to be used for parking purposes. *Nondesignated parking* includes areas where visitors park but are not necessarily where the NPS prefers to have parking located.

There are 533 designated parking spaces in the river corridor at Tuolumne Meadows (not including the Tuolumne Meadows campground): 340 for day use and 193 for overnight. When visitors cannot find a spot to park in designated parking areas, they park in other informal, nondesignated areas along the side of the road or adjacent to existing parking areas (estimated at 337 additional vehicles parked during peak use periods), or they create new places to park altogether.

Visitor Parking Lots: There are 16 parking lots in the Tuolumne Meadows area, with a total designated parking supply (capacity) of 470 parking spaces (NPS 2009e). The lots range in capacity from 7 spaces to 102 spaces. Most lots provide only day parking; these lots provide 277 spaces. The other 193 parking spaces are located in lots that allow overnight parking, including the lot at the Tuolumne Meadows Lodge. These totals do not include the parking within the Tuolumne Meadows campground. The campground provides two parking spaces per campsite, including stock campsites, and five parking spaces for group campsites, for a maximum of 651 vehicles.

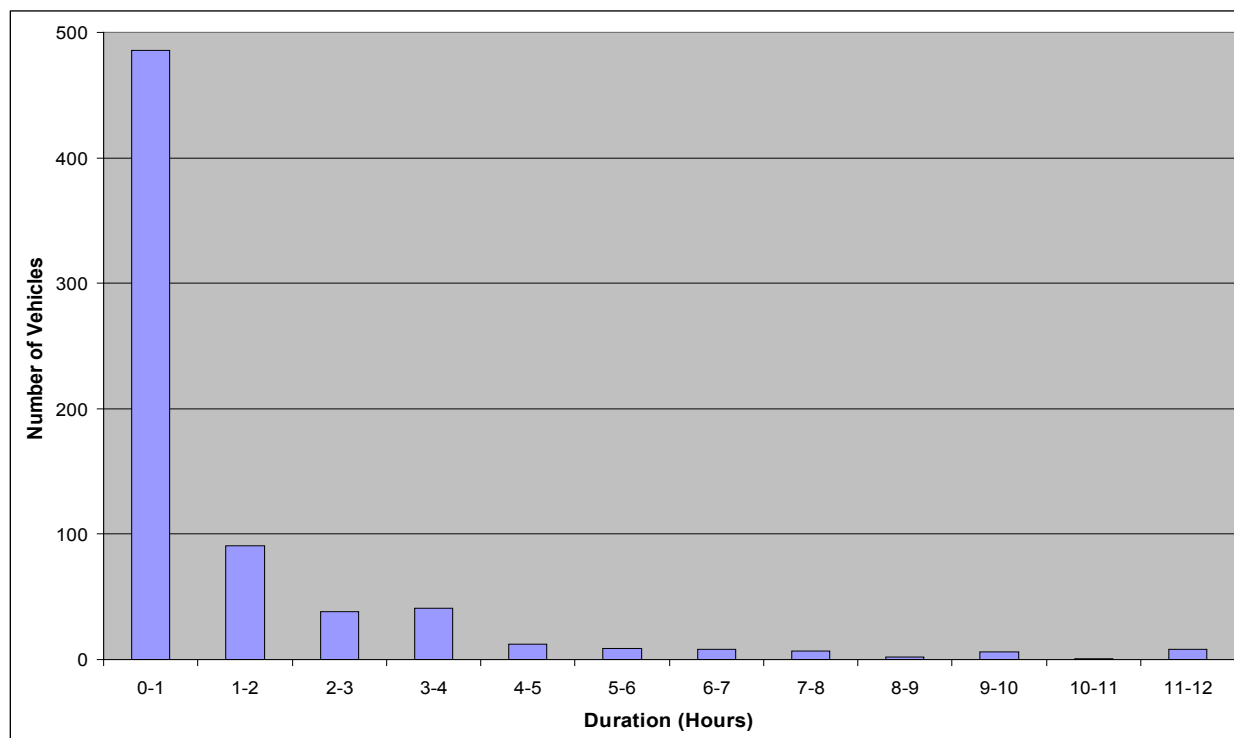
Roadside Parking: There are another 14 areas with formal or informal roadside parking between the Tioga Pass entrance station and Pothole Dome. Formal areas are designed for parking (approximately 63 spaces), while informal areas are where people pull off the road into unpaved areas. Of the informal roadside parking areas, the Cathedral Lakes trailhead and the parking on the road to the concessioner stable accommodate most of the overnight users (NPS 2009e). Parking along roadsides continues to increase when traffic volumes increase and visitors create new parking areas.

A parking study conducted August 11–13, 2006, found parking use was highest from mid-morning through late afternoon except for at the Tuolumne Meadows Lodge parking lots, which had their peak occupancy of 115

vehicles at 8 a.m. Peak use occurred at most areas from noon to 2 p.m. During the day, parking occupancy was greatest from the visitor center to the Tuolumne Meadows Lodge. The parking use in this area peaked at 687 vehicles at 1 p.m. (DEA 2007). The most recent parking study conducted from July 24 to August 20, 2011, also found parking use the highest from mid-morning through late afternoon. Again, most areas had peak use from noon to 2 p.m. During the 2011 study, the highest number of parked vehicles, excluding at the campgrounds, was 870 at noon on August 13. The two-way daily traffic volume on August 13 was 4,161 vehicles. There were only two days in 2011 with two-way traffic volumes higher than 4,161: 4,202 on August 5 and 4,277 on August 7. Parking counts were not conducted on those days, but it is likely that more than 870 vehicles were parked during the peak hours on these two days.

Length of stay data from the 2010 visitor surveys in Tuolumne Meadows indicate that approximately 60% of visitors stay more than 24 hours and 40% of visitors stay less than 24 hours. For visitors who stayed more than 24 hours, the average length of stay was 3.9 days, with a median of 3 days. For visitors who stayed less than 24 hours, the average length of stay was 7.4 hours, with a median of 8 hours. Parking availability data from the same surveys indicate that approximately 25% of visitors agreed that they had trouble finding a parking space, whereas approximately 64% of visitors disagreed (did not have trouble). The remaining 11% responded neutrally (unpublished author communication related to White 2011).

Parking duration was calculated for a representative sample of parking areas during the August 2006 study (see data collection methods in DEA 2007). The overall average parking duration for locations along Tioga Road from the entrance station to the Tenaya Lake area was 1.3 hours, with the majority (69%) of vehicles parking for less than one hour (see figure 9-10). Another 13% of vehicles parked between one and two hours, so in total, 82% of vehicles parked less than two hours between 8:00 a.m. and 7:00 p.m.



Source: DEA 2007

Figure 9-10. Overall Parking Duration in the Tuolumne Meadows Area.

The average parking duration was greatest at the Dog Lake trailhead parking area, with an average of 4.7 hours. The Tuolumne Meadows Lodge parking area and the roadside parking near Pothole Dome had the next highest average vehicle parking durations of 3.8 and 3.3 hours, respectively. Average parking duration was

lowest at the roadside parking areas near the Tioga Pass entrance station (30–35 minutes), at the Tuolumne Meadows Visitor Center (30 minutes), and at the roadside parking near the Cathedral Lakes trailhead (30 minutes) (DEA 2007).

Winter Conditions

Tioga Road closes due to snow each year, usually from sometime in November through late May or early June. The road closure extends from the Tuolumne Grove, just east of Crane Flat, to the Tioga Pass entrance station. (Highway 120, the continuation of Tioga Road outside the park, is also often closed in winter from Tioga Pass to 5 miles east of Lee Vining.) When Tioga Road is closed, it is not possible to drive to Tuolumne Meadows or enter Yosemite National Park from the east by vehicle.

Clearing of Tioga Road begins on or about April 15 each year and usually takes between one and two months. Predicting when the road will open is not possible, even in late spring, because weather in April and May can affect plowing progress significantly. Other factors affecting plowing operations include avalanche zones (26 potential areas), fallen trees, rockslides, road repairs, ditching, and brushing. When the plowing of Tioga Road is completed, additional utility work must be completed before facilities can be opened. Table 9-21 shows road opening and closing dates from 2006 to 2013.

Table 9-21.
Tioga Road Opening and Closing Dates

Year	Opened	Closed
2013	May 11	Dec 12
2012	May 7	Nov 8
2011	May 27	Nov 19 ^a
2010	June 5	Nov 19
2009	May 19	Nov 12
2008	May 21	Oct 30
2007	May 11	Dec 6
2006	Jun 17	Nov 27

^a Re-opened December 16, 2011– January 17, 2012.

River Segments below O'Shaughnessy Dam

The Hetch Hetchy Road barely overlaps with the Tuolumne River corridor boundary in the short segment below O'Shaughnessy Dam and the Poopenaut Valley. The portion of the river corridor from the dam to where the river exits the boundary of Yosemite National Park is largely without trails, except for a steep trail down to the river at Poopenaut Valley. The reservoir and trails emanating from it are a major park destination; however, they are not part of the designated Tuolumne Wild and Scenic River corridor.

Roadway System and Traffic Volumes

Hetch Hetchy Road is a narrow road beginning at the park boundary near the Hetch Hetchy entrance station and terminating at O'Shaughnessy Dam. Traffic on Hetch Hetchy Road consists primarily of people with the Hetch Hetchy area as their destination. A total of 44,017 visitors (including both recreational and non-recreational use) were reported at the Hetch Hetchy entrance station from January through October 2009 (NPS 2009o). This is in keeping with the long-term annual average of 44,181 visitors. Visitor use at Hetch Hetchy picks up in March and continues through November. Visitor numbers drop into the hundreds in December through February and typically peak in May and early June, based on weather conditions.

Traffic Restrictions

Buses and other vehicles over 25 feet in length are prohibited on Hetch Hetchy Road without a pilot vehicle and proper authorization (NPS 2009d). Accordingly, all visitor traffic is in passenger vehicles.

The 2009 *Superintendent's Compendium* for the Yosemite National Park states that Hetch Hetchy Road is only open to vehicle traffic during the day (7 a.m. to 9 p.m. May through Labor Day; 8 a.m. to 7 p.m. Labor Day through October; 8 a.m. to 5 p.m. November through March; and 7 a.m. to 8 p.m. in April). These operating hours may be restricted further based on any security threats to the water supply (NPS 2009d). Additionally, prior to authorizing entry into the park, park staff record the make, model, color, vehicle license, and party size of each vehicle.

Traffic Conditions

Only a short segment of the Hetch Hetchy Road is within the wild and scenic river corridor. The average daily traffic volumes on Hetch Hetchy Road are light and well within the capacity of the roadway. Although the road itself does not experience traffic congestion, backups do occur at the entrance station during May when Tioga Pass is closed, and during Memorial Day Weekend. The backups occur when the day visitor parking lot near O'Shaughnessy Dam is full. When this lot is full, day visitors must wait at the entrance station and can drive in only after another vehicle drives out. Overnight visitors with wilderness permits are allowed in because they park in a separate area. According to park staff, vehicle queues can get as long as 10 vehicles.

Transit and Tour Bus Services

There is no regional bus service to the Hetch Hetchy area. The closest point accessible by YARTS is Crane Flat on Big Oak Flat Road (Highway 120). There are no shuttle buses to the area from other parts of the park, and buses are not allowed on Hetch Hetchy Road.

Parking Facilities

Day parking for approximately four vehicles is available off Hetch Hetchy Road in the wild and scenic river corridor. Additional parking is available for people with overnight permits for Poopenaut Valley.

Environmental Consequences Methodology

The focus of this impact assessment is the effect of potential management actions on how well the transportation system would accommodate traffic flow and parking, as well as the overall transportation experience. Since overall traffic volumes through the Tuolumne River corridor would not be affected by the plan alternatives, conditions were assessed based on potential changes to the transportation system, parking facilities, and management of parking, as well as the implementation of management actions that would affect the overall transportation experience under each alternative. Changes in the transportation system and related parking were evaluated as to (1) how they address the maximum demand for parking; (2) how they address the average demand for parking; and (3) the associated effect of proposed management actions on the transportation experience. This analysis focuses on the Tioga Road corridor, including Tuolumne Meadows because there are no actions proposed for the small section of the Hetch Hetchy Road that is included in the Tuolumne River corridor. In addition, the analysis is only relevant to the time period when the Tioga Road is open, generally June through November.

The kinds and amounts of visitor use accounted for in the *Tuolumne River Plan* user capacity program include day and overnight users (see chapter 6, chapter 8, or appendix G). Day use capacity has been defined as the maximum amount of people who would be allowed to be in the river corridor at one time, with the exception of through-travelers on Tioga Road (note that throughout the day when some visitors left, others could arrive as long as the day use capacity was not exceeded). Overnight capacity has been defined as the number of total visitors allowed to stay overnight in either lodging facilities, the Tuolumne Meadows campground, or in wilderness according to the wilderness permit system. Because the *Tuolumne River Plan* prescribes these day and overnight visitor capacities along with associated parking spaces, this analysis assumes that a supply of designated parking would be provided that would support the day and overnight capacity prescribed for each alternative, and that no more parking would occur beyond that which is prescribed for each alternative.

Due to the dispersed nature of parking at Tuolumne Meadows and along Tioga Road, and to ensure that parking supply (and corresponding day use capacity) is not exceeded, for this analysis parking spaces are considered full when they are 90% occupied. This 90% occupancy assumption factors the amount of parking needed to accommodate visitors finding a space without recirculating and contributing to traffic congestion while searching for an appropriate parking space.

Three of the four action alternatives would provide a substantial increase in designated parking. In all alternatives, the amount of parking provided is tied to the user capacity for each alternative and the site constraints that limit the amount and location of development to protect and enhance river values. The user capacity program manages day visitors by establishing a corresponding number of day parking spaces at levels and in locations that are protective of river values. While the maximum demand is noted in the affected environment above, it is presented here to provide comparison between that supply (capacity) and maximum and average demand for parking during the peak summer season.

Informal roadside parking would be eliminated under all action alternatives to protect river values and ensure visitor safety. Physical barriers to roadside parking would be a component of each of the action alternatives (see appendix K for examples and guidelines). In addition, as a result of public comment and site analysis, the undesignated roadside parking that is removed would be relocated to upland areas that are protective of river values.

As part of the monitoring program outlined in chapter 5, this analysis assumes that NPS management would adjust actions to meet changing conditions, particularly when standards are not being met. This analysis also assumes that a parking management system would be institutionalized, including enhanced real-time communication regarding parking and traffic conditions, both within the park and in gateway communities. Several additional mechanisms for enforcing parking restrictions, including parking management staffing and a parking permit system, are being considered under the various alternatives. Additionally, it is assumed that day and overnight parking areas would be designated and well delineated, signed accordingly and for its use, and that the parking management system would ensure that day visitors did not park in overnight spaces and vice versa. This would ensure that neither day nor overnight visitors would be displaced by one another and that capacity is not exceeded. Finally, this analysis assumes that the vast majority of visitors would continue to access the Tuolumne River corridor via private automobile.

Impact Assessment

Each alternative was evaluated in terms of the context, intensity, and duration of the transportation impacts, and whether the impacts were considered to be beneficial or adverse to the overall transportation system, parking, traffic flow, and transportation experience. The assessment of impacts was based on the best professional judgment of NPS staff and management.

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts would be those that occur within Yosemite National Park or those that are specific to the Tuolumne River corridor. Regional impacts would be impacts on regional highways that provide access to the park.

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts would not be detectable and would have no discernible effect on visitors or would affect only a few visitors. Minor effects would be slight but detectable and could affect a minority of visitors. Moderate effects would be noticeable and could impact an appreciable amount of visitors. Major impacts would have a substantial, highly noticeable influence on the transportation system, parking, traffic flow, and the transportation experience and would affect the majority of visitors.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration, generally during plan implementation, and would be associated with transitional types of activities. A long-term impact would have a continual effect on the performance of the transportation system and related visitor experience after plan implementation.

Type: Impacts were evaluated in terms of whether they would be beneficial or adverse to the overall transportation system, parking, traffic flow, and transportation experience. Beneficial impacts would improve the transportation system, access to parking, traffic flow, and the overall transportation experience. Adverse impacts would occur when actions would negatively affect access to parking, traffic flow, the transportation system, and/or the related transportation experience.

Except under alternative 1, there are no transportation facilities in wild segments of the river corridor and no changes in road access or parking capacity are being considered for the segments below O'Shaughnessy Dam and Poopenaut Valley. Under alternative 1, there would be a minor decrease in the number of parking spaces available below the O'Shaughnessy Dam for Poopenaut Valley. Since the changes under alternative 1 are relatively minor, the transportation analysis focuses on the scenic segments of the Tuolumne River at Tuolumne Meadows and eastward along the Tioga Road to the Tioga Pass entrance station.

Environmental Consequences of the No-Action Alternative

The no-action alternative would retain the existing conditions within the Tuolumne River corridor, including existing kinds and amounts of visitor use along with the existing transportation system and parking availability. The NPS would continue to undertake transportation-related maintenance improvements and resource protection measures such as repaving; installing and maintaining signage; and trail, parking, and roadway delineation. Designated parking spaces would remain at their current levels, a portion of the parking would remain informal, and visitors could continue to create additional informal parking in nondesignated locations during peak use periods, including in areas of sensitive natural and cultural resources.

Currently, there is a total parking supply of 533 designated parking spaces, not including the Tuolumne Meadows campground. During the 2011 parking survey, the highest number of vehicles parked was 870 (DEA 2012). This means beyond the 533 designated parking spaces, there were an additional 337 vehicles parking in other informal or nondesignated parking areas. Based on these numbers, in Tuolumne Meadows during peak visitation hours, currently about 39% of the vehicles parked are not in designated parking locations. Thus, the maximum parking demand exceeds the available supply of designated parking spaces. The no-action alternative, however, would continue to accommodate parking demand because demand in excess of designated parking supply would continue to be met by visitors parking their vehicles in areas not designated for parking, such as roadsides and areas adjacent to existing parking lots.

Makeshift parking in undesignated locations would continue to be managed on a limited basis if necessary at site-specific locations, and visitors could park wherever they can find or make space. Under the no-action alternative, visitors would likely continue to create additional parking (roadside or adjacent to existing parking areas) spaces as needed, including potentially expanding parking into sensitive resource areas.

As noted in the "Affected Environment" section above, 2010 visitor surveys indicated that under current conditions, visitors have easy access to important park sites and attractions, they connect with the natural environment, they experience a sense of freedom, it is easy to access scenic overlooks/vistas, and they can go "where they want, when they want." Data from the 2010 visitor surveys specifically for Tuolumne Meadows indicate approximately 64% of visitors did not have trouble finding a parking spot compared to 25% of visitors who did (11% responded neutrally) (unpublished author communication related to White 2011).

Conclusion

Under the no-action alternative, the amount of designated parking at Tuolumne Meadows would remain inadequate to meet peak season demand. Parking would remain managed on a limited basis if necessary at site-specific locations, and visitors would likely continue to create parking in nondesignated locations that affect sensitive natural and cultural resources. The potential for vehicle and pedestrian conflicts along the side of Tioga Road would continue. Overall, this would result in a local long-term moderate adverse impact.

Cumulative Impacts

Past, present, and reasonably foreseeable projects that would affect transportation in the river corridor in combination with the no-action alternative include the traffic management and information system and the installation of the Communication Data Network, which would provide enroute communication of traffic and parking conditions within the park and in gateway communities when implemented. These improvements would facilitate previsit planning and keep visitors informed about traffic and parking conditions in the Tuolumne Meadows area, potentially resulting in reduced traffic congestion and a local long-term moderate beneficial impact on the transportation experience. The potential beneficial impact would be realized as long as visitors change their travel behavior as a result of having information about busy conditions and subsequently avoid attempting to park in Tuolumne Meadows when no parking is available.

Other projects that might affect transportation in the Tuolumne River corridor include the Tioga Road Rehabilitation project, the Tioga Trailheads project, the *Tenaya Lake Area Plan*, and the *Merced Wild and Scenic River Comprehensive Management Plan*. The Tioga Road Rehabilitation and the Tioga Trailheads projects would result in long-term moderate beneficial impacts from road and trailhead improvements and short-term moderate adverse impacts on the transportation experience associated with traffic disruption during construction periods. The Tioga Road Rehabilitation project is scheduled to span several years, pending funding. The *Tenaya Lake Area Plan* would result in a slight reduction in parking near Tenaya Lake. Because Tuolumne Meadows is the closest major park attraction area to Tenaya Lake, this could result in a minor to moderate adverse impact if visitors who are unable to park at Tenaya Lake attempt to park in Tuolumne Meadows when there is no parking is available. A similar adverse impact could occur at Tenaya Lake if parking at Tuolumne Meadows is full and visitors alternately attempt to park at Tenaya Lake when no parking is available there either. The *Merced Wild and Scenic River Comprehensive Management Plan* may also have an adverse impact if parking is reduced in Yosemite Valley, but that plan could have a beneficial impact if parking is increased and visitors are able to alternatively find parking in Yosemite Valley when Tuolumne is full.

Environmental Consequences of Alternative 1

As part of the management to restore opportunities for a self-reliant experience under alternative 1, and as a result of the elimination of visitor amenities, the total supply of formal designated parking spaces for both day and overnight visitors would be reduced from the current 533 to 481 spaces. Day parking would be decreased from 340 to 305 spaces. Due to the dispersed nature of this parking and to ensure that parking supply (and corresponding user capacity) is not exceeded, these spaces would be considered full when they are 90% occupied (at 275 spaces). This would ensure that visitors could find a space without recirculating and contributing to traffic congestion. The amount of overnight parking provided is projected to be sufficient to accommodate overnight visitors (176 spaces). These 451 spaces (275 + 176) would accommodate 52% of the existing peak season parking demand.

The reduction in day parking is tied to the significant reduction in visitor services and amenities at Tuolumne Meadows proposed with alternative 1. The lack of amenities in particular, such as eliminating the store, grill, commercial trail rides, and fuel station, would result in fewer people stopping for those services and theoretically would reduce the demand for day parking. Based on current demand, however, up to 45% of vehicles that currently park at Tuolumne Meadows would no longer be able to park. If visitation were to increase 3% annually as projected, the percentage of vehicles that would be unable to park would continue to increase. To secure day parking during the peak use season, visitors to Tuolumne Meadows would need to obtain information on parking conditions in advance to make informed choices and plan accordingly.

A key component of alternative 1 is the expectation that a trip to Tuolumne Meadows would require advance planning and preparation. Visitors who planned their trips in advance using available trip planning information

would have a positive experience. For those who choose a spontaneous visit or who do not obtain advance trip planning information, it would be difficult to find parking most of the time during the peak summer season.

As under all action alternatives, parking capacities would be monitored; these data would inform transportation strategy in the area and allow for additional management actions (see chapter 5) to be implemented. Roadside parking within Tuolumne Meadows would be prohibited, but a few pullouts signed for emergency use or short-term scenic viewing would be provided. (Other existing roadside parking along Tioga Road east and west of Tuolumne Meadows would remain.) The NPS would continue to undertake transportation-related maintenance improvements and resource protection measures, such as repaving; installing and maintaining signage; and trail, parking, and roadway delineation.

Visitors traveling the Tioga Road corridor would enjoy an enhanced scenic driving experience along this designated scenic byway with the removal of roadside parking and reductions in traffic congestion associated with the reduction of visitor services and amenities. The elimination of shuttle bus service would require visitors to either walk, bicycle, or drive their private vehicles to circulate within the Tuolumne Meadows area.

Construction activities would result in moderate adverse impacts on transportation, such as traffic delays, because construction is expected to span several years.

Conclusion

Under alternative 1, the NPS would reduce the total designated parking supply in the Tuolumne Meadows area by 52 spaces, from 533 to 481 spaces. Parking in nondesignated areas would no longer be allowed. Ongoing monitoring of parking capacities would result in targeted management actions to address traffic and parking management as needed.

Based on current conditions, up to 45% of the vehicles currently parking at Tuolumne Meadows on peak days could no longer be accommodated, resulting in a local long-term major adverse impact on parking and the transportation experience for many visitors due to the projected shortage of parking. This impact would be moderated somewhat because elimination of commercial services and amenities is expected to reduce the demand for parking at Tuolumne Meadows. However, based on the average traffic volume over the past three years and projected increases in park visitation, a 45% decrease in visitation at Tuolumne Meadows is unlikely. If visitation continues to grow 3% annually (as projected), alternative 1 could further result in local major adverse impacts on parking and the transportation experience. For overnight visitors, parking would remain adequate during both peak and nonpeak periods.

Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. For visitors able to park at Tuolumne Meadows during peak use periods, this would result in local long-term moderate beneficial impacts on parking and the transportation experience. The elimination of shuttle bus service would require visitors to either walk or move their private vehicles to circulate within the Tuolumne Meadows area, resulting in a local long-term minor adverse impact on traffic conditions and the transportation experience.

Cumulative Impacts

Past, present, and reasonably foreseeable projects that would affect transportation in the river corridor in combination with alternative 1 include the Traffic Management and Information System and the installation of the Communication Data Network, which when implemented would provide enroute communication of traffic and parking conditions within the park and in gateway communities. These improvements would facilitate previsit planning and keep visitors informed about traffic and parking conditions in the Tuolumne Meadows area, potentially resulting in reduced traffic congestion and a local long-term moderate beneficial impact on the transportation experience. The potential beneficial impact would be realized as long as visitors change their

travel behavior as a result of having information about busy conditions and subsequently avoid attempting to park in Tuolumne Meadows during times when there is no parking available.

As noted under the no-action alternative, other projects that may affect transportation in the river corridor in combination with alternative 1 include the Tioga Road Rehabilitation project, the Tioga Trailheads project, the *Tenaya Lake Area Plan*, and the *Merced River Wild and Scenic Comprehensive Management Plan*. The cumulative impacts of these plans and projects with alternative 1 would be the same as under the no-action alternative, with the following exception: Since Tuolumne Meadows is the closest major park attraction area to Tenaya Lake, the reduction in designated parking at Tenaya Lake could result in a moderate to major adverse impact if visitors who are unable to park at Tenaya Lake attempt to park at Tuolumne Meadows when parking is not available. A similar adverse impact could occur at Tenaya Lake if Tuolumne Meadows parking is full and visitors alternately attempt to park at Tenaya Lake when there is no available parking there either. Alternative 1 in combination with these cumulative plans and projects would result in a local short-term moderate adverse impact on transportation during construction periods. The improvements realized through these projects would not offset the long-term major adverse impacts on transportation that would result from the implementation of alternative 1.

Environmental Consequences of Alternative 2

As part of the management objective to expand recreational opportunities in the Tuolumne River corridor, alternative 2 would provide a total supply of 982 formal designated parking spaces for day and overnight use, an increase of 449 over existing designated parking. Increasing the supply of formal designated parking spaces for day visitors from 340 to 642 would be 302 spaces more than the existing designated day parking supply. Due to the dispersed nature of this parking and to ensure that parking supply (and corresponding day user capacity) is not exceeded, these spaces are considered full when they are 90% occupied (578 spaces). This would ensure that visitors could find a space without recirculating and contributing to traffic congestion. The amount of overnight parking provided is projected to be sufficient to accommodate overnight visitors (340 spaces). These 918 spaces (578 + 340) would accommodate 100% of existing peak season parking demand and accommodate some annual visitation growth (approximately 3% per year for two to three years in a row). However, if visitation does grow 3% annually (as projected), some day visitors may not find parking during peak use periods. Parking should remain adequate during nonpeak periods.

The increased supply of designated parking would help ensure that visitors could continue to have easy access to important sites and attractions in the river corridor. The majority of visitors would likely have little trouble finding a parking spot, thus enabling them to get out of their vehicles and enjoy wilderness-oriented experiences in Tuolumne Meadows and the river corridor.

As under all action alternatives, parking capacities would be monitored; these data would inform transportation strategy in the area and allow for implementation of additional management actions (see chapter 5). Roadside parking within Tuolumne Meadows would be prohibited, but a few pullouts would be provided for visitors to spend a short time looking at particularly scenic views. (Other roadside parking along Tioga Road east and west of Tuolumne Meadows would remain.) The NPS would continue to undertake transportation-related maintenance improvements and resource protection measures such as repaving; installing and maintaining signage; and trail, parking, and roadway delineation.

Visitors traveling the Tioga Road corridor would enjoy an enhanced scenic driving experience along this designated scenic byway with the removal of informal roadside parking and associated congestion. The current shuttle bus system would be improved to run more efficiently, more effectively accommodate visitor travel needs within the Tuolumne Meadows area, and reduce the number of private vehicles recirculating the roadway system.

Consolidating visitor services and providing a roadside trail along the south side of Tioga Road would support better pedestrian access between facilities and reduce vehicle pedestrian conflicts caused by people walking along the side of the road.

Construction activities would result in moderate adverse impacts on transportation, such as traffic delays, because construction is expected to span several years.

Conclusion

Under alternative 2, the NPS would increase the total designated parking supply by 449 spaces, from 533 to 982 spaces. Designated day parking would be increased by 302 spaces. Parking in nondesignated areas would no longer be allowed. The designated parking supply with alternative 2 would be more than sufficient to accommodate current peak season demand. The amount of designated parking would also be sufficient to accommodate overnight visitors. Ongoing monitoring of parking capacities would result in targeted management actions to further address traffic and parking management as needed during peak use times. Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. Overall, these actions would result in local long-term moderate beneficial impacts on traffic conditions, parking, and the transportation experience.

However, if visitation continues to grow 3% annually, within two to three years alternative 2 could result in a local minor adverse impact on parking and the transportation experience for some visitors during peak use periods, although parking should remain adequate during nonpeak periods. For overnight visitors, parking would remain adequate during both peak and nonpeak periods.

Consolidating visitor services and providing a roadside trail along the south side of Tioga Road would support better pedestrian access between facilities and reduce vehicle pedestrian conflicts caused by people walking along the side of the road. These actions under alternative 2 would result in local long-term moderate beneficial impacts on the transportation system and related experience.

Cumulative Impacts

The past, present, and reasonably foreseeable projects that would affect transportation in the Tuolumne River corridor in combination with alternative 2 would be the same as under alternative 1, with the following exception: Since Tuolumne Meadows is the closest major park attraction area to Tenaya Lake, the slight reduction in parking at Tenaya Lake could result in a minor to moderate adverse impact in the future if visitors who are unable to park at Tenaya Lake attempt to park at Tuolumne Meadows when parking is full. A similar adverse impact could occur at Tenaya Lake if Tuolumne Meadows is full and visitors alternately attempt to park at Tenaya Lake when it is full. Alternative 2, in combination with these cumulative plans and projects, would result in a local short-term moderate adverse impact on transportation during construction periods. However, the improvements realized through these projects would further enhance the long-term moderate beneficial impacts on transportation that would result from implementation of alternative 2.

Environmental Consequences of Alternative 3

As part of the management objective to maintain a traditional Tuolumne experience, alternative 3 would provide a total supply of 813 formal designated parking spaces for day and overnight use, an increase of 280 over the existing designated parking supply. The supply of formal designated parking spaces for day visitors would be increased from 340 to 510, an increase of 170 spaces over the existing designated day use parking supply. Due to the dispersed nature of this parking and to ensure that parking supply (and corresponding user capacity) is not exceeded, these spaces would be considered full when they are 90% occupied (at 459 spaces). This would ensure that visitors could find a space without recirculating and contributing to traffic congestion. The amount of overnight parking provided under alternative 3 is projected to be sufficient to accommodate

overnight visitors (303 spaces). These 762 spaces (459 plus 303) would accommodate 88% of existing peak season parking demand but would not accommodate the projected 3% annual visitation growth.

Based on existing conditions, the designated parking supply under alternative 3 would be sufficient to meet current average parking demand but not sufficient to meet parking demand during peak hours on peak days in July, August, and September. The amount of overnight parking would be sufficient to accommodate overnight visitors. To secure day parking during the peak season, visitors to Tuolumne Meadows would need to obtain information on parking conditions in advance to make informed choices and plan accordingly.

The increased supply of designated parking would help ensure that visitors could continue to have easy access to important sites and attractions in the Tuolumne River corridor most of the time. Except for peak hours on peak days, the majority of visitors would likely have little trouble finding a parking spot, thus enabling them to get out of their vehicles and enjoy wilderness-oriented experiences in Tuolumne Meadows and elsewhere in the river corridor.

As under all action alternatives, parking capacities would be monitored; these data would inform transportation strategy in the area and allow for additional management actions (see chapter 5) to be implemented. Roadside parking within Tuolumne Meadows would be prohibited, but a few pullouts would be provided for visitors to spend a short time looking at particularly scenic views. (Other roadside parking along Tioga Road east and west of Tuolumne Meadows would remain.) The NPS would continue to undertake transportation-related maintenance improvements and resource protection measures such as repaving; installing and maintaining signage; and trail, parking, and roadway delineation.

Visitors traveling the Tioga Road corridor would enjoy an enhanced scenic driving experience along this designated scenic byway with the removal of informal roadside parking and associated congestion. The current shuttle bus system would be improved to more effectively accommodate visitor travel needs within the Tuolumne Meadows area and reduce the number of private vehicles recirculating the roadway system.

Construction activities would result in moderate adverse impacts on transportation, such as traffic delays, because construction is expected to span several years.

Conclusion

Under alternative 3, the NPS would increase the total designated parking supply by 280 spaces, from 533 to 813 spaces. Designated day parking supply would be increased by 170 spaces. Parking in nondesignated areas would no longer be allowed. Ongoing monitoring of parking capacities would result in targeted management actions to further address traffic and parking management as needed during peak use times. Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. These actions would result in local long-term moderate beneficial impacts on parking for those who were able to park during peak use periods.

At nonpeak times and on nonpeak days, visitors would be expected to have little trouble parking. Based on current conditions, up to 12% of the vehicles currently parking at Tuolumne Meadows would not be accommodated during peak hours on peak days in July, August, and September, when the parking supply would not be sufficient to meet current maximum demand. This would result in a local long-term minor adverse impact on traffic conditions, parking, and the transportation experience for some visitors. If visitation continues to grow 3% annually (as projected), alternative 3 would result in long-term moderate adverse impacts on parking and the transportation experience for an increasing amount of visitors because projected difficulties finding day use parking during peak use periods. For overnight visitors, parking would remain adequate during both peak and nonpeak use periods.

Visitor services would remain dispersed, but the expansion of shuttle service along with improved trails would improve visitor access to and circulation among sites in the Tuolumne Meadows area, resulting in local long-term minor beneficial impacts on the transportation system and related experience.

Cumulative Impacts

The past, present, and foreseeable projects that would affect transportation in the Tuolumne River corridor in combination with alternative 3 would be the same as under alternative 1, with the following exception: Since Tuolumne Meadows is the closest major park attraction area to Tenaya Lake, the slight reduction in parking at Tenaya Lake could result in a minor to moderate adverse impact if visitors who are unable to park at Tenaya Lake attempt to park at Tuolumne Meadows when parking is full. A similar adverse impact could occur at Tenaya Lake if Tuolumne Meadows is full and visitors alternately attempt to park at Tenaya Lake when it is full. Alternative 3, in combination with these cumulative plans and projects, would also result in a local short-term moderate adverse impact on transportation during construction periods. However, the improvements realized through these projects would provide long-term moderate beneficial impacts on the transportation system and related experience when considered along with the implementation of alternative 3.

Environmental Consequences of Alternative 4 (Preferred)

As part of the management objective to preserve the Tuolumne experience and its resources, alternative 4 would provide a total supply of 914 formal designated parking spaces for day and overnight use, an increase of 381 over the existing designated parking supply. The supply of formal, designated parking spaces for day visitors would be increased from 340 to 562, an increase of 222 spaces over the existing day parking supply. Due to the dispersed nature of this parking and to ensure that parking supply (and corresponding user capacity) would not be exceeded, these spaces are considered full when they are 90% occupied (at 506). This would ensure that visitors could find a space without recirculating and contributing to traffic congestion. The amount of overnight parking provided with alternative 4 is projected to be sufficient to accommodate overnight visitors (352 spaces). These 858 spaces (352 + 506) would accommodate 99% of existing peak season parking demand and accommodate the projected 3% annual visitation growth for one to two years. Additionally, regional transit capacity would be increased by 135 people, the equivalent of three 45-passenger shuttle buses.

Based on existing conditions, designated parking under alternative 4 would be sufficient to meet current peak season parking demand. The amount of designated parking would also be sufficient to accommodate overnight visitors. The increased supply of designated parking would help ensure that visitors could continue to have easy access to important sites and attractions in the river corridor. Under current conditions, visitors would be expected to have little trouble finding a parking spot, thus enabling them to get out of their vehicles and enjoy wilderness-oriented experiences in Tuolumne Meadows and elsewhere in the river corridor.

If parking demand increased beyond existing levels, however, there may be parking shortfalls for day users on peak days at peak times. To secure day parking during the peak season, visitors to Tuolumne Meadows would need to obtain information on parking conditions in advance to make informed choices and plan accordingly. However, when parking is full, regional transit capacity would be increased under alternative, thus providing an additional means to access the Tuolumne River corridor.

Relocating the visitor center closer to the other major visitor facilities, improving shuttle service, and providing a roadside trail along the south side of Tioga Road would support better pedestrian access between facilities and reduce vehicle-pedestrian conflicts caused by people walking along the side of the road.

As under all action alternatives, parking capacities would be monitored; these data would inform the transportation strategy in the Tuolumne Meadows area and allow for implementation of additional management actions (see chapter 5). Roadside parking within Tuolumne Meadows would be prohibited, but a few pullouts would be provided for visitors to stop and take in the scenic views. (Other roadside parking along

Tioga Road east and west of Tuolumne Meadows would remain.) The NPS would continue to undertake transportation-related maintenance improvements and resource protection measures such as repaving; installing and maintaining signage; and trail, parking, and roadway delineation.

Visitors traveling the Tioga Road corridor would enjoy an enhanced scenic driving experience along this designated scenic byway with the reduced congestion associated with removing informal roadside parking. The current shuttle bus system would be improved to more effectively accommodate visitor travel needs within the Tuolumne Meadows area and reduce the number of private vehicles recirculating the roadway system.

Construction activities would result in moderate adverse impacts on transportation, such as traffic delays, because construction is expected to span several years.

Conclusion

Under alternative 4, the NPS would increase the total designated parking supply by 381 spaces, from 533 to 914 spaces. The designated day parking supply would be increased by 222 spaces. Parking in nondesignated areas would no longer be allowed. The designated parking supply would be sufficient to accommodate current peak season demand. The amount of designated parking would also be sufficient to accommodate overnight visitors. Additionally, regional transit capacity would be increased by 135 people, the equivalent of three 45-passenger shuttle buses. Ongoing monitoring of parking capacities would result in targeted management actions to further address traffic and parking management as needed during peak use times. Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. Overall, these actions would result in local long-term moderate beneficial impacts on traffic conditions, parking, regional transit, and the transportation experience.

However, if visitation continues to grow 3% annually (as projected), within one to two years alternative 4 could result in a local long-term minor adverse impact on parking and the transportation experience for some visitors on peak days at peak times, although day parking should remain adequate during nonpeak periods. For overnight visitors, parking would remain adequate during both peak and nonpeak periods.

Relocating the visitor center closer to the other major visitor facilities, improving shuttle service, and providing a roadside trail along the south side of Tioga Road would support better pedestrian access between facilities and reduce vehicle-pedestrian conflicts caused by people walking along the side of the road. These actions under alternative would result in local long-term moderate beneficial impacts on the transportation system and related experience.

Cumulative Impacts

The past, present, and foreseeable projects that would affect transportation in the Tuolumne River corridor under alternative 4 would be the same as those under alternative 1, with the following exception: Because Tuolumne Meadows is the closest major park attraction area to Tenaya Lake, the slight reduction in parking at Tenaya Lake could result in a minor to moderate adverse impact if visitors who are unable to park at Tenaya Lake attempt to park at Tuolumne Meadows when parking is full. A similar adverse impact could occur at Tenaya Lake if Tuolumne Meadows is full and visitors alternately attempt to park at Tenaya Lake when it is full. Alternative 4, in combination with these cumulative plans and projects, would also result in a local short-term moderate adverse impact on transportation during construction periods. However, the improvements realized through cumulative plans and projects would further enhance the long-term moderate beneficial impacts on transportation that would result from the implementation of alternative 4.

Energy Consumption and Climate Change

Affected Environment

Regulations, Policies, and Planning Objectives

There are a number of federal, park, and state policies that address the need to design and operate facilities in a manner that minimizes energy consumption and carbon emissions and maximizes the use of renewable energy sources. In particular, Executive Order 13123 calls on federal agencies to take the lead in implementing energy conservation, maximizing the use of renewable resources, and reducing greenhouse gas emissions. The order sets goals for reduced energy consumption by federal agencies. The NPS has incorporated requirements for energy efficiency into its management policies for design, construction, and operation of park facilities.

Energy Consumption

Energy consumption in the Tuolumne River corridor includes use of electricity, propane, firewood, and automotive fuels by the NPS and concessioner to provide visitor services and resource protection. In addition, park visitors use firewood and automotive fuels on an individual as-needed basis. The majority of energy consumption occurs at Tuolumne Meadows and is associated with the seasonal operation of the store, grill, post office, public fuel station, mountaineering shop/school, Tuolumne Meadows campground, NPS and concessioner stables, the visitor center, employee housing, and other NPS operations including water and wastewater treatment. In addition to these facilities, energy is also consumed at the Tuolumne Meadows Lodge and at Glen Aulin High Sierra Camp. Backpackers use firewood at locations below 9,600 feet throughout the river corridor. NPS, concessioner, and visitor vehicles use gasoline and diesel fuel in Tuolumne Meadows and along the Tioga Road. Energy consumption by concessioner services and NPS operations will vary on a year-over-year basis in these areas due to the length of time these facilities are operational (which vary based on seasonal constraints) and the amount of visitor use.

Climate Change

Gases that trap heat in the atmosphere are often called greenhouse gases. Emissions of greenhouse gases into the earth's atmosphere contribute to global climate change. The principal greenhouse gases that enter the atmosphere because of human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases. Global increases in carbon dioxide concentration are due primarily to fossil fuel uses and land use change, and global increases in methane and nitrous oxide are due primarily to agriculture. For the purposes of this assessment, only carbon dioxide and nitrous oxide are examined because they are the only pollutant emissions in the inventory that would likely change as a result of proposed actions.

- Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and as a result of other chemical reactions (e.g., the manufacturing of cement). Carbon dioxide is also removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle.
- Nitrous oxide is emitted during agricultural and industrial activities, as well as during the combustion of fossil fuels and solid waste.

Increasing emissions of greenhouse gases, such as carbon dioxide, are anticipated to result in an increase in the planet's average surface temperature. This increased temperature has the potential to have wide-reaching impacts on natural and human environments, including changes in weather patterns, precipitation, sea levels, vegetation, and many other conditions. The intergovernmental Panel on Climate Change estimates that average global temperature may rise from 0.6 to 4.0 degrees Celsius between 2000 and 2100 (Held et al. 2007).

In California, where the population has tripled since 1950, the surge in population growth has increased greenhouse gas emissions from industrial, commercial, and vehicular sources. Since the 1970s, emissions

sources operating within California have been subject to local stationary source controls and state and federal mobile-source controls.

Climate change has been identified as one of the highest priorities for the NPS, and the agency has already undertaken a number of actions at various parks, including Yosemite. Yosemite National Park participates in the Climate Friendly Parks Program implemented by the USEPA and the NPS, and the park has been designated a “Climate Friendly Partner.” To obtain this designation, Yosemite has conducted a baseline greenhouse gas emissions inventory; developed a Climate Action Plan; and committed to educating park staff, visitors, and community members about climate change.

The objective of Yosemite’s Climate Action Plan is to identify actions that Yosemite can undertake to reduce greenhouse gas emissions and thus address climate change. The plan recommends three strategies: reduce fuel use and greenhouse gas emissions from park facilities and operations, increase climate change outreach and education efforts, and perform subsequent emission inventories to evaluate progress and develop future emission mitigation actions.

In 2005, Yosemite’s greenhouse gas emissions from activities other than fire management totaled approximately 16,000 metric ton carbon equivalents. Of this total, 64% was caused by mobile combustion, 21% by stationary combustion, and 10% by purchased electricity, with the remainder caused by other sources.

Yosemite National Park has been incorporating energy efficiency and alternative fuel use into its facilities and operations, including the use of alternative fuels for park shuttle buses, upgrading lighting to more energy-efficient options, and upgrading facilities to be more energy efficient or to use renewable fuels. The park installed a 20-panel solar energy system and more energy-efficient motors and air handling systems at the El Portal wastewater treatment plant, as well as a 374-panel solar energy system for the El Portal maintenance complex and administrative facility. By implementing these and other energy conservation measures, the park estimates its emissions were reduced by over 180 metric tons carbon equivalent in 2008 (NPS 2008k).

Environmental Consequences Methodology

Changes to energy consumption in the Tuolumne River corridor were qualitatively evaluated by assessing changes in housing, NPS and concessioner facilities, camping, and vehicle fuel used. The climate change analysis evaluates both whether and how each alternative might contribute to climate change. Although there is a broad consensus in the scientific community that human activities are contributing to global climate change, there is limited guidance available on how to properly analyze the impact of local development projects on it. This is particularly true where the project is unlikely to result in large changes in local or regional emissions. Although the potential for impacts on global climate change may be hard to quantify for the level of changes being proposed, overall changes in energy consumption and related emissions and other factors can be qualitatively evaluated. This evaluation includes changes in the amount of energy consumed and related levels of direct and indirect greenhouse gas emissions.

Context: Any change in greenhouse gas emissions in the Tuolumne River corridor would be negligible at a regional scale. For the purposes of this analysis, only local impacts are considered. This includes impacts specific to energy consumption within the Tuolumne River corridor and Yosemite National Park.

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts would not be detectable and would have no discernible effect on the amount of energy consumed or the amount of emissions. Minor impacts would be slightly detectable but would not be expected to have an overall effect on those conditions. Moderate impacts would be clearly detectable and could have an appreciable effect on energy use or emissions. Major impacts would have a substantial, highly noticeable influence on and could permanently alter those conditions.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration and associated with transitional types of activities. A long-term impact would have a long-term or permanent effect on energy use or emissions.

Type: Impacts were evaluated in terms of whether they would be beneficial or adverse in terms of energy consumption and climate change. Beneficial impacts would reduce energy consumption or emissions. Adverse impacts would increase energy consumption or emissions.

Environmental Consequences Common to All Alternatives, Including No Action

Wild Segments

Under all alternatives, negligible energy consumption and related emissions by backcountry users throughout the corridor would have no effect on overall energy use.

Scenic Segments

Based on recent traffic count data, traffic volumes on Tioga Road are increasing. The composition of vehicle emissions would remain subject to state and federal emissions control standards and programs. For the foreseeable future, motor vehicle fleet turnover, cleaner-burning fuels, improved technologies, and stricter state and federal standards would likely decrease emissions. Under the no-action alternative, the overall impact of mobile sources of emissions would remain approximately the same as existing conditions. The *Tuolumne River Plan* would not affect the amount of through-traffic on Tioga Road; therefore, the impacts of through-traffic under any of the action alternatives would be the same as under the no-action alternative.

Energy use and emissions associated with administrative facilities below the O'Shaughnessy Dam would remain at or near their current levels.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of the current condition and management, as described under chapter 8 and "Affected Environment," above. In addition to "Environmental Consequences Common to All Alternatives, Including No Action," the no-action alternative would result in the following environmental consequences related to energy consumption and climate change:

Wild Segments

Under the no-action alternative, the Glen Aulin High Sierra Camp would remain in operation its current capacity. Energy use and emissions, including from wood-burning stoves used to heat employee and guest cabins, generator use, and propane to cook meals, would remain at current levels.

Scenic Segments

Under the no-action alternative, the existing NPS and concessioner facilities located in the Tuolumne River corridor would remain in operation at their current levels. Many of the facilities are older and less efficient than modern facilities constructed using current energy efficiency technology and standards. Energy use and emissions, including from wood-burning stoves, would remain at or near their current levels.

The existing amount and location of designated and undesignated parking would remain. Visitors would continue to find additional parking informally and to use private vehicles for circulation within the Tuolumne Meadows area, resulting in the continuing use of fuel and emissions at current levels.

Conclusion

Under the no-action alternative, there would be little or no change to energy use and related greenhouse gas emissions.

Cumulative Impacts

Through its participation in the Climate Friendly Parks Program, Yosemite National Park is committed to decreasing its greenhouse gas emissions from activities other than fire management. The NPS has been incorporating energy efficiency and alternative fuel use into its facilities and operations. By implementing the use of alternative fuels for park shuttle buses, upgrading facilities to be more energy efficient or to use renewable fuels, and installing solar energy systems in El Portal, the NPS estimates emissions were reduced by over 180 metric tons carbon equivalent in 2008 (NPS 2008k). Prescribed burning under the *Fire Management Plan* would continue to contribute to park greenhouse gas emissions, resulting in short-term negligible adverse impacts. Other current actions that could have short-term adverse impacts on greenhouse gas emissions include construction projects in the Tuolumne Meadows area and along the Tioga Road. In the long term, these actions in combination with the no-action alternative would result in negligible beneficial impacts on energy consumption and greenhouse gas emissions.

Environmental Consequences of Alternative 1

In addition to “Environmental Consequences Common to All Alternatives, Including No Action,” the environmental consequences of alternative 1 related to energy consumption and climate change are described below.

Wild Segments

The Glen Aulin High Sierra Camp would be removed under alternative 1. A short-term increase in energy consumption during deconstruction of the camp would be likely from the use of helicopters and mechanized equipment to remove infrastructure. In the long-term, wood burning at the backpacker’s campground would continue; however, the emissions sources at the High Sierra Camp (wood-burning stoves, generators, and propane for cooking) would be removed.

Scenic Segments

Replacement of the existing visitor center and wastewater treatment plant with newer, more efficient, and smaller facilities would reduce energy use and emissions. Elimination of commercial visitor services, including the grill, lodge, and concessioner stock day rides, would result in a reduction in use of electricity, propane, and firewood. The decrease in campground capacity would reduce the burning of firewood. Removal of the public fuel station would require visitors and employees stationed in Tuolumne Meadows to obtain fuel in Lee Vining or at Crane Flat. This could lead to additional emissions if people were not prepared upon arrival in Tuolumne Meadows and needed to make an additional trip to refuel. Short-term fuel and emissions increases would occur during demolition and restoration. Overall, the actions proposed under alternative 1 would result in a decrease in long-term greenhouse emissions.

Conclusion

Under alternative 1, the substantial reduction in visitor services and administrative facilities throughout the Tuolumne River corridor would result in a short-term expenditure of energy and emissions during implementation and a minor beneficial impact on energy consumption and greenhouse gas emissions in the long term.

Cumulative Impacts

Cumulative impacts under alternative 1 would be the same as described for the no-action alternative. Current and reasonably foreseeable projects in combination with alternative 1 would result in a long-term minor beneficial impact on energy consumption and greenhouse gas emissions.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to All Alternatives, including No Action,” the environmental consequences of alternative 2 related to energy consumption and climate change are described below.

Wild Segments

The permanent buildings at the Glen Aulin High Sierra Camp would be removed, and the camp would be replaced by a seasonal commercial outfitter camp. Wood burning at the backpacker campground would continue. Short-term increases in energy consumption during removal and reconstruction of the High Sierra Camp would be expected from the use of helicopters and mechanized equipment. In the long term, energy consumption would decrease under alternative 2; however, some of this decrease would be offset by the extra effort to set up and break down the outfitter camp annually.

Scenic Segments

Implementation of alternative 2 would increase visitor and administrative facilities, including campsites and employee housing, compared to the no-action alternative. This would increase the use of electricity and propane and the burning of firewood at the campground. New facilities, including employee housing, would be rebuilt or relocated, thus providing opportunities for energy efficiency improvements and upgrades. In the long term, implementation of alternative 2 would not likely result in any appreciable change in energy consumption or greenhouse gas emissions over existing levels. Short-term fuel and emissions increases would occur during demolition, construction, and restoration activities.

Conclusion

Under alternative 2, the increase in visitor and administrative facilities would be offset by energy efficiency improvements incorporated into new or renovated facilities. Short-term expenditures of energy and emissions would be expected during alternative implementation. Overall, alternative 2 would result in long-term negligible adverse impacts on energy consumption and greenhouse gas emissions in the Tuolumne River corridor.

Cumulative Impacts

Cumulative impacts under alternative 2 would be the same as described for the no-action alternative. In the long-term, current and reasonably foreseeable projects in combination with alternative 2 would result in a negligible beneficial impact on energy consumption and greenhouse gas emissions.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to All Alternatives, Including No Action,” the environmental consequences of alternative 3 related to energy consumption and climate change are described below.

Wild Segments

Under alternative 3, the Glen Aulin High Sierra Camp would remain in operation at a slightly reduced capacity. Energy use and emissions from wood-burning stoves at guest cabins would be eliminated; reducing the overnight guest capacity and eliminating meals-only service would reduce propane use from current levels. Wood burning at the backpacker campground would continue.

Scenic Segments

With the exception of the public fuel station and the guest capacity at Tuolumne Meadows Lodge, visitor services would remain essentially unchanged under alternative 3. Removal of the public fuel station would require visitors and employees stationed in Tuolumne Meadows to obtain fuel in Lee Vining or at Crane Flat. This could lead to additional emissions if people were not prepared when they arrived at Tuolumne Meadows

and needed to make an additional trip to refuel. Replacing the existing wastewater treatment plant, some administrative facilities, and employee housing would provide opportunities to improve energy efficiency. Increased shuttle service would be provided to reduce traffic circulation in private vehicles. These actions would slightly decrease overall energy consumption in the Tuolumne River corridor and greenhouse gas emissions. Short-term fuel use and emissions increases would occur during demolition, construction, and restoration activities.

Conclusion

Under alternative 3, short-term expenditures of energy and emissions would be expected during implementation. The elimination of some visitor amenities at Glen Aulin High Sierra Camp would decrease energy use and emissions in wild segments. In scenic segments, elimination of the public fuel station could increase or decrease energy use and emissions, depending on how many refueling trips would be needed for overnight visitors versus decreasing fuel truck deliveries to Tuolumne Meadows. In addition, there would be improvements in facility energy efficiency and expansion of the shuttle bus service at Tuolumne Meadows to reduce private vehicle circulation. Overall, this would result in a long-term negligible beneficial impact on energy consumption and greenhouse gas emissions.

Cumulative Impacts

Cumulative impacts under alternative 3 would be the same as described for the no-action alternative. In the long term, current and reasonably foreseeable projects in combination with alternative 3 would result in a negligible beneficial impact on energy consumption and greenhouse gas emissions.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to All Alternatives, Including No Action,” the environmental consequences of alternative 4 related to energy consumption and climate change are described below.

Wild Segments

Glen Aulin High Sierra Camp would remain in operation at a reduced capacity. Energy use and emissions from wood-burning stoves at guest cabins would be eliminated; reducing the overnight guest capacity and eliminating meals-only service would reduce propane use from current levels. Wood burning at the backpacker campground would continue. Replacing flush toilets with composting toilets would also reduce energy use by eliminating the need for helicopters to transport sludge from the wastewater treatment system at the end of each summer season.

Scenic Segments

The replacement of the existing wastewater treatment plant and other administrative and visitor facilities, including some employee housing and the visitor center at Tuolumne Meadows, would provide an opportunity for energy efficiency improvements. Removal of the public fuel station would reduce energy consumption and emissions by reducing truck trips to supply the station, however it would require some visitors to obtain fuel in Lee Vining or at Crane Flat (employees would have two small above-ground tanks to refuel). The additional trips could lead to additional emissions if some day visitors were not prepared when they arrived at Tuolumne Meadows and or if overnight visitors needed to make an additional trip to refuel. Similarly, the increase in regional public transit would increase emissions on Tioga Road; however compared with existing conditions, the impact of 3 additional buses per day would be negligible. The frequency of shuttle bus service within the Tuolumne Meadows area would be increased and pedestrian connectivity between trailheads, visitor services, lodging, and the campground would be improved, both of which would reduce visitors’ reliance on private vehicles to drive to destinations on Tioga Road. Overall, these actions would reduce the long-term use of

energy under alternative 4 compared to the no-action alternative. Short-term fuel and emissions increases would occur during demolition, construction, and restoration activities.

Conclusion

Under alternative 4, the slight increase in visitor and administrative facilities would be offset by energy efficiency improvements incorporated into new or renovated facilities. Short-term expenditures of energy and emissions would be expected during implementation. The elimination of some visitor amenities at Glen Aulin High Sierra Camp and associated reductions in helicopter use to support the camp would decrease energy use and emissions in wild segments. In scenic segments, elimination of the public fuel station could increase or decrease energy use and emissions, depending on how many refueling trips would be needed for overnight visitors versus decreasing fuel truck deliveries to Tuolumne Meadows. Overall, this would result in a long-term negligible beneficial impact on energy consumption and greenhouse gas emissions.

Cumulative Impacts

Cumulative impacts under alternative 4 would be the same as described for the no-action alternative. In the long term, current and reasonably foreseeable projects in combination with alternative 4 would result in a negligible beneficial impact on energy consumption and greenhouse gas emissions.

Socioeconomics

Affected Environment

This section presents information on the social and economic environments in the region that are anticipated to be most affected by management changes and development decisions in the Tuolumne River corridor. The following discussion of the economic environment describes county populations, economies, and fiscal situations. The discussion of the social environment addresses community characteristics, including housing and community infrastructure.

Data for the socioeconomic baseline were gathered from a number of sources, including the U.S. Bureau of the Census, the California Employment Development Division's Labor Market Information (based on Bureau of Labor Statistics data), the California Department of Finance, the California Board of Equalization, and various reports from the counties and communities themselves. Additionally, socioeconomic profiles for the counties in the region were developed based on the Economic Profile System and profiles for sub-county areas were developed based on the Economic Profile System Community. Both of these systems were developed by the Sonoran Institute and the BLM to provide information on socioeconomic characteristics of western communities. Information on visitor spending was gathered from visitor spending studies conducted between 2005 and 2011 (Littlejohn et al. 2005; Stynes 2007; Dean Runyan Associates 2011; NPS 2011b).

Regional Context

Yosemite National Park encompasses parts of three counties (Madera, Mariposa, and Tuolumne) and borders a fourth, Mono County. For the purposes of this analysis, the affected region is defined as the four-county area of these counties, all of which provide services to Yosemite National Park visitors and employees, and receive tax revenue or benefits from visitors and employees. Consequently, these counties would likely be most affected by changes in visitor levels in the park, park employment, and park spending on infrastructure. This is not meant to imply that changes in the number or type of visitors to the park, or other management changes in the park, would not affect other local economies throughout California or western Nevada. The impacts would be expected to be more direct and substantive in these four counties, as opposed to counties located farther from Yosemite. Changes to management within the Tuolumne River corridor in particular are likely to mostly impact gateway communities in Mono and Tuolumne County because these are the closest communities to the Tuolumne River corridor. Because some management measures might displace some users from the corridor to other portions of the park, however, there might also be impacts in the larger region.

The area around Yosemite National Park is rural in nature and contains a substantial amount of federally owned and managed lands, including the Stanislaus, Sierra, and Inyo National Forests. The 2009 population of the four-county region was 238,683, which accounts for less than 1% (0.6%) of the California population (see table 9-22). The population in the region has been growing rapidly over the last two decades, however, and has outpaced state population growth. For example, between 1990 and 2000, regional population growth was 29% versus less than 14% for the entire state. Of the four counties, only Tuolumne County's population increased by less than 14%. Growth slowed in the next decade (2000–2010), although the region still outpaced the state, growing 15% to the state's 10%. Mariposa County and Tuolumne County had much lower growth, at 6.5% and 1.6%, respectively. Mono County's growth was similar to the statewide average (10.5%) and Madera County's population increased 22.5% (although most of that growth occurred in the San Joaquin Valley to the west of the park). Population density in the four counties ranges from 71 people per square mile in Madera County to just under 5 people per square mile in Mono County, compared to a state average of 239 people per square mile.

Table 9-22.
Regional Population

Geographic Area	1990	2000	% Change	2010	% Change
Madera county	88,090	123,109	39.8	150,865	22.5
Mariposa county	14,302	17,130	19.8	18,251	6.5
Mono county	9,956	12,853	29.1	14,202	10.5
Tuolumne county	48,456	54,504	12.5	55,365	1.6
Region (all four counties listed above)	160,804	207,596	29.1	238,683	15.0
Entire state of California	29,758,213	33,871,648	13.8	37,253,956	10.0

Sources: U.S. Census Bureau 1990a, 2000a, 2010a

Regional employment in the early 1990s was close to 50,000, or less than 0.4% of total state wage and salary employment (see table 9-23). As with population growth, regional employment has outpaced the state. Between 2000 and 2010, regional employment increased 6.4%, whereas state employment decreased by 4.2%. Madera County had the greatest increase in employment (8.9%), but all four counties had greater increases (or smaller losses) in employment than the state overall. The region's total wage and salary employment in 2010 was estimated at 70,690 (see table 9-23). Government employment accounts for 28% of overall regional employment, as compared to 17% for the state (table 9-24). Leisure and hospitality services were more important in the region, and particularly in some of the counties, as discussed below.

Table 9-23.
Regional Wage and Salary Employment

Geographic Area	1990	2000	% Change	2010	% Change
Madera county	25,800	39,200	52.0	42,700	8.9
Mariposa county	4,780	4,890	2.3	5,310	8.6
Mono county	5,190a	6,400	23.3	6,870	7.3
Tuolumne county	14,190	15,950	12.4	15,810	(0.9)
Region (all four counties listed above)	49,960	66,440	33.0	70,690	6.4
Entire state of California	12,863,400	14,896,700	15.8	14,278,000	(4.2)

a 1990 data were not available for Mono County. 1992 data were used.

Source: CEDD 2012a

Table 9-24.
2010 California and Regional Employment by Industry

Industry	California	% Total	Regional	% Total	% of State
Total wage and salary ^a	14,278,000	100.0	70,690	100.0	0.5
Total farm	381,600	2.7	10,410	14.7	2.7
Mining, logging, and construction	586,600	4.1	1,890	2.7	0.3
Manufacturing	1,242,400	8.7	3,630	5.1	0.3
Trade, transportation, and utilities	2,616,900	18.3	8,370	11.8	0.3
Information	429,000	3.0	650	0.9	0.2
Financial activities	759,800	5.3	1,540	2.2	0.2
Professional and business services	2,069,400	14.5	4,160	5.9	0.2
Educational and health services	1,786,900	12.5	8,800	12.4	0.5
Leisure and hospitality	1,493,700	10.5	9,820	13.9	0.7
Other services	484,700	3.4	1,150	1.6	0.2
Government	2,427,100	17.0	19,690	27.9	0.8
Unaccounted ^a	-	-	-	0.9	

a CEDD data for industry sectors do not total to the total wage and salary level.

Source: CEDD 2012a

While regional population and employment growth have outpaced the state average, household and per capita incomes have remained below the state average (see table 9-25). Mariposa County's growth in income from 1999 to 2010 outpaced the state's income growth in the same period. The remainder of the counties in the region had lower growth in income than the state from 1999 to 2010.

Table 9-25.
Regional Household and Per Capita Income

Geographic Area	1989	1999	% Change	2010	% Change
Madera county					
Median household income	27,370	36,286	32.6	46,039	26.9
Per capita income	10,856	14,682	35.2	18,724	27.5
Mariposa county					
Median household income	25,272	34,626	37.0	49,098	41.8
Per capita income	13,074	18,190	39.1	27,064	48.8
Mono county					
Median household income	31,924	44,992	40.9	55,087	22.4
Per capita income	16,120	23,422	45.3	27,321	16.6
Tuolumne county					
Median household income	27,030	38,725	43.3	47,462	22.6
Per capita income	13,224	21,015	58.9	25,483	21.3
State of California					
Median household income	35,798	47,493	32.7	60,883	28.2
Per capita income	16,409	22,711	38.4	29,188	28.5

Sources: U.S. Census Bureau 1990b, 2000b, 2010.

Madera County

Population

Madera County is located south of Yosemite National Park and has the largest population of the four counties in the region (table 9-22). Madera County's 2010 population was estimated at 150,865, an increase of almost 23% over the 2000 census estimate. With a land area of 2,136 square miles, the county has a population density of approximately 71 persons per square mile. Madera County's population has been increasing at a faster rate than the state since the early 1970s (Sonoran Institute 2009a). The rate of population increase in Madera County from 2009 to 2010 was the fastest in this region (CDOF 2010). State Department of Finance population

projections for Madera County for 2020 are 212,874, an increase of 41% from the 2010 estimate (CDOF 2012). The county has only 2 incorporated cities, Madera and Chowchilla, and 11 unincorporated communities, including Oakhurst, which is considered one of the southern gateways to the park (see below). Approximately half of the county's population lives outside the incorporated areas, and much of the population is outside the mountainous areas closest to Yosemite National Park.

In 2010, the county's population was reported as 62.6% Caucasian, 3.7% Black, 2.7% Native American, and 1.9% Asian (U.S. Census Bureau 2010a). Approximately 54% of the population was of Hispanic or Latino descent.

Employment

Madera County's 2010 civilian labor force was estimated at 67,000, a 22% increase from 54,900 in 2000 (CEDD 2012b). Total 2010 wage and salary employment was 42,700 (CEDD 2012a). From 1990 through 2010, the county's employment was dominated by the agriculture and government sectors, which together made up approximately 46 to 49% of total employment (table 9-26). Farm employment and manufacturing have been decreasing over the last several years, while government and service employment has been increasing. Employment in the leisure and hospitality services has made up approximately 6 to 7% of employment in the county over the last two decades. In 2009, visitor spending was estimated to support 3,120 jobs. This is a decrease from the estimated 3,130 jobs in 2004 (Dean Runyan Associates 2011).

Table 9-26.
Madera County Employment by Industry

Industry	1990	% Total	2000	% Total	% Change	2010	% Total	% Change
Total wage and salary ^a	25,800	100.0	39,200	100.0	52.0	42,700	100.0	8.9
Total farm	7,100	27.3	11,900	30.3	68.0	10,300	24.1	-13.4
Natural resources, mining, and construction	1,500	5.8	1,500	3.8	0.0	1,100	2.6	-26.7
Manufacturing	3,200	12.3	2,900	7.4	-9.0	2,800	6.6	-3.4
Trade, transportation, and utilities	3,400	13.1	4,200	10.7	24.0	4,900	11.5	16.7
Information	600	2.3	600	1.5	0.0	400	0.9	-33.3
Financial activities	600	2.3	700	1.8	17.0	700	1.6	0.0
Professional and business services	700	2.7	2,200	5.6	214.0	2,700	6.3	22.7
Educational and health services	1,700	6.5	4,400	11.2	159.0	5,900	13.8	34.1
Leisure and hospitality	1,800	6.9	2,500	6.4	39.0	2,600	6.1	4.0
Other services	600	2.3	800	2.0	33.0	800	1.9	0.0
Government	4,800	18.5	7,600	19.3	58.0	10,600	24.8	39.5

a CEDD data for industry sectors does not total the total wage and salary level.

Source: CEDD 2012a

Income

Median household income in Madera County was estimated at \$46,039 in 2010, 24% lower than the statewide median household income (table 9-25). Per capita income increased by almost 28% between 1999 and 2010 to \$18,724, slightly lower than the statewide 29% increase. Median household incomes increased 27% over that period, again slightly less than the statewide increase (28%).

The 2010 census estimated that 14.6% of families in the county were below the poverty level, compared to 16% in 2000. This is slightly higher than the statewide rate of just over 10%. The U.S. Census Bureau (2010b) estimates that 19.3% of the Madera County population was below the poverty line in 2010 compared to 13.7% of the state.

Fiscal Status

Total county revenues in the fiscal year ending June 2010 were \$158 million (Madera County 2012). Taxes accounted for approximately 26% of total revenues. Property taxes accounted for 76% of total tax revenues.

Sales and use taxes and hotel/motel taxes made up another 20%. Total taxable sales for Madera County were \$1.2 billion in 2010, an increase of 36% from 2000 (CBOE 2000 and 2010). The county's property tax base increased 61% from 2000 to 2010 to \$10.3 billion (CBOE 2012).

A study by the California Travel and Tourism Commission and Division of Tourism evaluated the impact of visitors on county revenues for 2009 (Dean Runyan Associates 2011). Visitor-generated tax receipts were estimated at 26% of county receipts from local sales taxes and transient occupancy taxes in 2009. This indicates that visitor taxes are increasing in importance from 2004, when they accounted for 18%. Travel spending in Madera County increased annually from \$107.4 million in 1992 to \$213.9 million in 2008 but decreased slightly to \$208.3 in 2009. Travel spending in the county was mostly generated by visitors (99%), but also includes resident travel expenses. More than a quarter (27%) of visitor spending was spent on food and beverage services, 23% was spent on accommodations, 17% on retail sales, 13% on entertainment and recreation, and the remainder on transportation and food stores. Transient occupancy tax receipts for Madera County increased from \$1.5 million in 1999 to \$2.4 million in 2010, an increase of 62%.

Oakhurst Community

Oakhurst is located at the junction of Highway 41 and Highway 49, both major routes used by visitors to the park. Between 1990 and 2000, the population increased 10% to 2,868; since then, the population decreased to 2,829 in 2010 (U.S. Census Bureau 1990a, 2000a, 2012a). The 2010 population of Oakhurst was 90% Caucasian, 2% Native American, 2% Asian, and less than 1% Black. Almost 2% noted they were some other race, and 4% indicated they were of two or more races. Approximately 17% of residents indicated that they were of Hispanic or Latino heritage.

The labor force in Oakhurst increased 23% between 2000 and 2011 to 1,600 (CEDD 2012b). In 2010, there were an estimated 1,122 people employed (U.S. Census Bureau 2012b). Almost 29% were employed in arts, entertainment, recreation, accommodations and food service. Another 23% were employed in retail trade. Retail employment has consistently been one of the more important employment sectors for the Oakhurst area. Most Oakhurst residents (77%) worked within Madera County in 2000 and 56% worked within Oakhurst (Sonoran Institute 2007d).

The median household income in 2010 was estimated at \$35,155 and per capita income was estimated at \$21,693, both slightly lower than countywide income (U.S. Census Bureau 2012b). Poverty levels in Oakhurst were estimated at almost 10% of families and 12.7% of people, lower than the countywide averages.

Mariposa County

Population

Mariposa County is located in the western foothills of the Sierra Nevada. The eastern portion of Mariposa County contains a large part of Yosemite National Park, including Yosemite Valley and the administrative headquarters in El Portal. According to the census population estimates (U.S. Census Bureau 2010), Mariposa is one of the smallest counties in the state in terms of population (53rd out of 58). Population increased 6.5% from 2000 to 2010 to 18,251 (table 9-22). With a land area of 1,451 square miles, the population density is 12.6 persons per square mile. The population of Mariposa County increased at a faster rate than the state from 1990 to 1997, but has lagged behind the state since then (CDOF 2007, 2010). Mariposa County had one of the state's lowest population growth rates between 2009 and 2010 (CDOF 2010). While the county has no incorporated cities, there are three census-designated places, including Mariposa and Yosemite Valley, and 13 other small unincorporated communities, such as El Portal, which serves as a residential area for park employees and contains many park administrative offices. Mariposa serves as the county seat.

In 2010, the population of the county was over 88% Caucasian, almost 3% Native American, 1% Asian, and less than 1% Black (U.S. Census Bureau 2010). Another 7% indicated that they were “some other race.”

Approximately 9% of the population was of Hispanic or Latino descent.

Employment

Between 1999 and 2010, the labor force in Mariposa County increased 43%, from 6,650 to 9,520 (CEDD 2012b). Total wage and salary employment in the county was 5,310 in 2010 (CEDD 2012a). County employment is dominated by the leisure and hospitality sector and the government sector, which accounted for 39 to 40% and 35 to 41% of employment, respectively, between 2000 and 2010 (table 9-27). Employment in goods-producing industries (agriculture, mining, logging, construction, and manufacturing) has been decreasing. An estimated 4,250 jobs were supported by travel spending in 2009; this is a slight decrease from the estimated 4,300 jobs supported by visitors in 2004 (Dean Runyan Associates 2011).

Table 9-27.
Mariposa County Employment by Industry

Industry	1990	% Total	2000	% Total	% Change	2010	% Total	% Change
Total wage and salary ^a	4,780	100.0	4,890	100.0	2.3	5,310	100.0	9.6
Total farm	30	0.6	10	0.2	-66.7	20	0.4	100.0
Natural resources, mining, and construction	270	5.7	180	3.7	-33.3	120	2.3	-33.0
Manufacturing	160	3.4	120	2.5	-25.0	130	2.4	8.3
Trade, transportation, and utilities	370	7.8	340	7.0	-8.1	340	6.4	0.0
Professional and business services	100	2.1	250	5.1	150.0	170	3.2	-32.0
Educational and health services	220	4.6	150	3.1	-31.8	150	2.8	0.0
Leisure and hospitality	1,920	40.3	1,930	39.5	0.5	2,110	39.7	9.3
Other services	290	6.1	180	3.7	-37.9	0	0.0	-100.0
Government	1,430	30.0	1,730	35.4	21.0	2,160	40.7	24.9

a CEDD data for industry sectors does not total the total wage and salary level.

Source: CEDD 2012a

Income

Median household income in Mariposa County was estimated at \$49,098 in 2010, approximately 19% lower than the state median household income (table 9-25). Median household income increased 37% between 1989 and 1999 and 42% between 1999 and 2010. Per capita income increased 39% from 1989 to 1999 and 49% from 1999 to 2010. Incomes in the county have been rising less than incomes in the state overall. Nonlabor income, including dividends, interest, rent, and transfer payments (such as social security, retirement, and welfare) made up about 44% of total income in 2000 in the county (Sonoran Institute, 2009b).

The 2010 census estimated that 10% of families in the county and 12.5% of the people in the county were below the poverty level (U.S. Census Bureau 2012b). This compares to 10% of families and 13.7% of people in the state.

Fiscal Status

County revenues in 2010–2011 were \$70.3 million (Mariposa County 2012). Approximately 28% of the revenues were generated by taxes. Public assistance expenses accounted for 35% of expenditures and another 25% of expenditures were related to public protection services. Total taxable sales for Mariposa County were \$164 million in 2010, an increase of 29% since 2000 (CBOE 2000 and 2010). The total property tax base for the county in 2010 was \$2.0 billion dollars, up 74% from 2000 (CBOE 2012).

Visitor-generated tax receipts were estimated at over 92% of county receipts from local sales taxes and transient occupancy taxes in 2009 (Dean Runyan Associates 2011). Travel spending in Mariposa County has increased 14% from \$288.8 million in 2004 to \$328.9 million in 2009. Over 36% of visitor spending was related to accommodations and another 30% was related to food and beverage services. Another 16% was spent on

arts, entertainment, and recreation, and 13% was spent on retail sales. The remainder was spent on transportation and food stores. Transient occupancy tax receipts for Mariposa County increased from \$6.1 million in 2000 to \$11.4 million in 2010, an increase of 86%.

Mariposa Community

The community of Mariposa is located at the junction of Highway 49 and Highway 140, both major routes used by visitors to the park. The population of Mariposa increased 19% between 1990 and 2000 to 1,373 and 58% from 2000 to 2010 for a population of 2,173 (U.S. Census Bureau 1990a, 2000a, 2012a). The population of Mariposa was almost 87% Caucasian in 2010, just under 5% Native American, about 1% Asian, and less than 1% Black. Almost 6% indicated that they were “some other race.” Approximately 10% of residents indicated that they were of Hispanic or Latino heritage.

The labor force in Mariposa was 790 in 2010, an increase of 36% over 2000 (CEDD 2012b). A total of 754 people were employed, with 23% in public administration; 20% in finance, insurance and real estate; and another 16% in arts, entertainment, recreation, accommodations, and food service (U.S. Census Bureau 2012b). The high rate of government employment likely reflects Mariposa’s role as the county seat and residence for some Yosemite National Park employees. Almost 53% of Mariposa residents worked within the community of Mariposa in 2000, which could reflect the community’s role as county seat (Sonoran Institute, 2007c).

The median household income in 2010 was estimated at \$47,905 and per capita income was estimated at \$22,914, both slightly lower than countywide income (U.S. Census Bureau 2012b). Poverty levels in Mariposa were estimated at 7% of families and 13.5% of people, lower than the statewide averages.

Mono County

Population

Mono County is located on the eastern slope of the Sierra Nevada, east of Yosemite National Park. According to the 2010 Census population estimates, Mono County is one of the smallest counties in California in population (54th out of 58 counties) and has the lowest population in the study region, with a 2010 population estimate of 14,202 (table 9-22). This is an increase of 11% from the 2000 census population estimate of 12,853. With a land area of 3,044 square miles, the population density is about five persons per mile, the lowest in the region. The population of Mono County increased at a lower rate than Madera County but at a greater rate than Mariposa or Tuolumne Counties from 2009 to 2010 (CDOF 2010). The county has one incorporated city, Mammoth Lakes. There are 16 other small communities, including Lee Vining, which is the closest community to the park entrance near the intersection of US 395 and Highway 120.

In 2010, the population of the county was 82% Caucasian, 2% Native American, 1% Asian, and less than 1% Black (U.S. Census Bureau 2010). Almost 27% of the 2009 population was of Hispanic or Latino descent.

Employment

The labor force in Mono County in 2010 was estimated at 8,690, just less than 4% greater than in 2005 (CEDD 2012b). Total 2009 wage and salary employment in the county was estimated at 6,870 (CEDD 2012a). The county’s employment is dominated by the leisure and hospitality sector, which accounted for 45% of total county employment in 2010 (table 9-28). Government employment is the second most important employment sector, accounting for almost 24%. Employment in goods-producing industries has remained at 1 to 2% of total industry employment over the last few decades (CEDD 2012a). Employment in education and health services has decreased over the last several years. An estimated 4,740 jobs were supported by travel spending in 2009, a decrease from the 5,480 jobs estimated in 2004 (Dean Runyan Associates 2011). A separate study of visitor spending produced for the county estimates that visitor spending supported 4,478 jobs in 2008 (Lauren Schlau Consulting 2009).

Table 9-28.
Mono County Employment by Industry

Industry	1992	% Total	2000	% Total	% Change	2010	% Total	% Change
Total wage and salary ^a	5,190	100.0	6,400	100.0	23.3	6,870	100.0	7.3
Total farm	30	0.6	10	0.2	-66.7	30	0.4	200.0
Manufacturing	50	1.1	60	1.1	20.0	50	0.7	-16.7
Trade, transportation, and utilities	620	13.4	740	13.1	19.4	720	10.5	-2.7
Financial activities	310	6.7	380	6.7	22.6	320	4.7	-15.8
Professional and business services	220	4.8	340	6	54.5	380	5.5	11.8
Educational and health services	150	3.2	80	1.4	-46.7	50	0.7	-37.5
Leisure and hospitality	2,190	47.3	2,710	48.0	23.7	3,090	45.0	14.0
Other services	210	4.0	280	4.4	33.3	0	0	-100.0
Government	1,060	22.9	1,330	23.5	25.5	1,650	24.0	24.1

^a CEDD data for industry sectors does not total the total wage and salary level.

1990 data was not available for Mono County. 1992 data was used.

Source: CEDD 2012a

Income

Median household income in Mono County in 2010 was estimated at \$55,087, which is almost 10% lower than the state median (table 9-25) but higher than the rest of the region over the last few decades. Median household income increased by 22% from 1999 to 2010, as compared to 28% for the state. Per capita income (\$27,321) also increased less than for the state overall since 1999 (17% versus 29%). Non-labor income, including dividends, interest, rent, and transfer payments (such as social security, retirement, and welfare) made up about 26% of total income in the county in 2000 (Sonoran Institute 2009c).

The 2010 census estimated that 7% of families and 12% of people in the county were below the poverty level (U.S. Census Bureau, 2012b). This is slightly lower than the statewide rates of 10% and 13.7%, respectively.

Fiscal Status

Total revenues for Mono County in fiscal year 2010–2011 were almost \$53 million (Mono County 2011). Taxes made up the greatest portion of general fund revenues in 2008–2009, accounting for \$20.8 million (39%). Property taxes made up approximately 78% of total tax revenues. Public protection expenditures made up 40% of the county expenses, 20% was allocated to general government operations, and 20% was allocated to health and sanitation. Total taxable sales for Mono County were \$222 million in 2010, an increase of over 13% from 2000 (CBOE 2000 and 2010). The county's property tax base increased to \$5.5 billion in 2010, over double the value in 2000 (CBOE 2012).

Visitor-generated tax receipts were estimated at over 95% of county receipts from local sales taxes and transient occupancy taxes in 2009 (Dean Runyan Associates 2011). Travel spending in Mono County increased almost 7% from 2004 to 2009, from \$396.0 million to \$423.9 million. Approximately 36% of visitor spending was spent on accommodations, and another 20% was spent on food and beverage services. Arts, entertainment and recreation, and retail sales made up 16% and 14% of visitor spending, respectively. The remainder was spent on transportation and food stores. Transient occupancy tax receipts for Mono County more than doubled from 1999 to 2010, from \$6.1 million to \$12.8 million.

A separate study of visitor spending in Mono County came to similar conclusions (Lauren Schlau Consulting 2009). This study indicated that taxable visitor spending totaled \$267.8 million in 2008, of which 58% was spent on lodging. This study estimated that countywide (including Mammoth Lakes), visitor spending generated \$16.6 million in tax revenues, of which \$15 million were from lodging.

Town of Mammoth Lakes

Mammoth Lakes is located off of US 395 on the eastern side of the Sierra Nevada. Mammoth Lakes' economy is not as dependent on Yosemite National Park as some of the other gateway communities. In particular, the Tioga Road is closed in the winter and access to the park from the east is very limited. Mammoth's ski resorts provide an alternate economic base for winter tourism, and the many lakes in the area provide opportunities for summer recreation. Mammoth Lakes' population increased 16% between 2000 and 2010, from 7,093 to 8,234 (U.S. Census Bureau 2000a, 2012a). The Census reported that the population in Mammoth Lakes was 81% Caucasian, 1.6% Asian, less than 1% Native American, and over 14% some other race. Approximately 34% of the population reported Hispanic heritage.

The civilian labor force in Mammoth Lakes increased 14% between 2000 and 2011, to 5,080 (CEDD 2012b). As with the other gateway communities, employment in arts, entertainment, recreation, accommodations, and food services was a major percentage of employment at 34% (U.S. Census Bureau 2012b). Retail trade was the next largest industry sector at 11%. Mammoth residents are more likely to work in their own community, with only 17% of Mammoth's employed residents working outside the community in 2000 (Sonoran Institute 2007b). Only 8% worked outside of Mono County.

The median household income in 2010 was estimated at \$54,414 and per capita income was estimated at \$26,371, both lower than the county averages (U.S. Census Bureau 2012b). An estimated 10.3% of families and 15.2% of people in Mammoth Lakes were considered to be below the poverty level in 2010, which is slightly more than the county and state poverty rates.

Lee Vining

Lee Vining is located on US 395 just north of Highway 120. It is the closest community to the Tioga Pass entrance. Lee Vining is unincorporated and within the area designated by Mono County as the Mono Basin (which includes Mono City in addition to Lee Vining). Mono County estimates that the 1990 population of the Mono Basin was 398 and that the population increased to 496 by 2000, an increase of 25% over that period (Mono County 2007). The Mono Basin population made up about 8.5% of the total county population in 2003. The county estimates that just over 24% of the Mono Basin population was Hispanic in 2000.

The U.S. Census Bureau began reporting data for the Lee Vining area in 2010. The 2010 population was estimated at 222 (U.S. Census Bureau 2012a). The population is estimated to be 57% Caucasian, 11% Native American, and 22% some other race. An estimated 137 people were employed in the area, with 64% of the employment in the construction industry and another 35% in arts, entertainment, recreation, accommodations, and food services (U.S. Census Bureau 2012b). Median household income was estimated at \$68,167 and per capita income was estimated at \$17,037 in 2010. No data were available on poverty rates in this area.

Development in the Lee Vining area is constrained by the limited amount of private land in the area. In the unincorporated county as a whole, 94% of land is publicly owned, with 88% federally owned (Mono County 2000). Other major public entities with large land holdings in the area include the Los Angeles Department of Water and Power and the State of California. Residential and commercial development is located in small areas like Lee Vining that are constrained by public land on most sides. Future expansion for these small communities might rely on working with the USFS or BLM or Los Angeles Department of Water and Power for land acquisition (Mono County 2000).

Tuolumne County

Population

Tuolumne County is located in the central Sierra Nevada and contains part of the northern portion of Yosemite National Park. The county population increased 1.6% from 2000 to 2010 to 55,365 (table 9-22). With a land area of 2,236 square miles, the population density is almost 25 people per square mile. The annual population

growth rate in Tuolumne County was greater than the state's from 1990 to 1995, but the county's population growth has generally been lower than the state's since then (CDOF 2007, 2010). The population growth rate in Tuolumne County from 2009 to 2010 was estimated by the state as a slight decrease (CDOF 2010). The county has only one incorporated city, Sonora.

The population of the county in 2010 was 87% Caucasian, approximately 2% Black, and 2% Native American (U.S. Census Bureau 2012a). Almost 11% of the population was of Hispanic or Latino descent.

Employment

The labor force in Tuolumne County increased 13% from 2000 to 2010, to 25,890 (CEDD 2012b). Total 2010 wage and salary employment in the county was estimated at 15,810 (CEDD 2012a). Government employment accounts for over 33% of county employment (table 9-29). Education and health services employment accounts for another 17%, and the leisure and hospitality sector accounts for just under 13%. Goods-producing industries (e.g., farms, mining, manufacturing) accounted for just under 9% of 2010 employment, compared to 17% to 15% from 1990 to 2000. Education and health services employment has grown the most since 2000, increasing almost 59%. An estimated 2,250 jobs were supported by travel spending in 2009, down just slightly from 2,370 jobs in 2004 (Dean Runyan Associates 2011).

Table 9-29.
Tuolumne County Employment by Industry

Industry	1990	% Total	2000	% Total	% Change	2010	% Total	% Change
Total wage and salary ^a	14,190	100.0	15,950	100.0	12.4	15,810	100.0	-0.9
Total farm	90	0.6	180	1.1	100.0	60	0.4	-66.7
Natural resources, mining, and construction	1,480	10.4	1,120	7.0	-24.3	670	4.2	-40.2
Manufacturing	850	6.0	1,130	7.1	32.9	650	4.1	-42.5
Trade, transportation, and utilities	2,380	16.7	2,840	17.8	19.3	2,410	15.2	-15.1
Information	200	1.4	230	1.4	15.0	250	1.6	8.7
Financial activities	790	5.6	550	3.5	-30.4	520	3.3	-5.5
Professional and business services	880	6.2	890	5.6	1.1	910	5.8	2.2
Educational and health services	1,120	7.9	1,700	10.7	51.8	2,700	17.1	58.8
Leisure and hospitality	1,960	13.8	2,130	13.4	8.7	2,020	12.8	-5.2
Other services	550	3.9	630	4.0	14.5	350	2.2	-4.4
Government	3,910	27.5	4,540	28.5	16.1	5,280	33.4	16.3

a CEDD data for industry sectors does not total the total wage and salary level
Source: CEDD 2012a

Income

Median household income in Tuolumne County in 2010 was estimated at \$47,462, which is 22% lower than the state median (table 9-25). Median household income and per capita income increased by 40% to 60% between 1989 and 1999, significantly more than the state's rate of increase. The rate of increase slowed between 2000 and 2010 to a rate lower than the state's rate. Nonlabor income, including dividends, interest, rent, and transfer payments (such as social security, retirement, and welfare) made up about 44% of total income in the county in 2000 (Sonoran Institute 2009d).

The 2010 census estimated that 1,181 (8.3%) of the 14,229 families and 11.7% of people in the county were below the poverty level in 2010 (U.S. Census Bureau 2012b). This is lower than the state poverty rates.

Fiscal Status

Total Tuolumne County revenue for 2010–2011 was \$100.2 million, a decrease of almost 5% from the previous decade (Tuolumne County 2012a). Tax revenues made up over 29% of total revenues, totaling \$29.5 million. Public protection expenses accounted for 33% of total expenditures in 2010–2011, followed by public assistance at 21% (Tuolumne County 2012b). Health and sanitation accounted for 15% and general

government expenses accounted for 17.5% of total expenditures. Total taxable sales for Tuolumne County increased 6% between 2000 and 2010 to almost \$530 million (CBOE 2000 and 2010). While the total property tax base for the county increased 65% from 2000 to 2010, to \$6.3 billion dollars, the property tax base has decreased in recent years due to the overall decline in the state and local economy (CBOE 2012).

Visitor-generated tax receipts were estimated at almost 34% of county receipts from local sales taxes and transient occupancy taxes in 2009 (Dean Runyan Associates 2011). Travel spending in Tuolumne County increased 9.5% from 2004 to 2009, to \$162.0 million. Travel spending in the county was mostly generated by visitors (99.6%), although the total also includes resident travel expenses. About 29% of visitor spending was spent on food and beverage services, 24% on accommodations, 16% on entertainment and recreation, and 16% on retail sales. The remainder spent was on transportation and food stores. Transient occupancy tax receipts for Tuolumne County have increased 54% from 2000 to 2010, from \$1.1 million to \$1.7 million. Tuolumne County collects transient occupancy tax revenues generated at the Tuolumne Meadows Lodge and the Glen Aulin High Sierra Camp.

Sonora City

Sonora is located at the intersection of State Highways 49 and 108 in Tuolumne County. Sonora is one of the oldest incorporated cities in California. It is the only incorporated city in Tuolumne County and is the county seat. The city's population grew 11% between 2000 and 2010 from 4,423 to 4,903 (U.S. Census Bureau 2013). The population of Sonora is estimated to be 93% Caucasian, 1.4% Black, 1% Asian, and the remainder of other races (U.S. Census Bureau 2013). Approximately 5% of the community is reported to have Hispanic heritage.

The civilian labor force in Sonora increased 17% between 2000 and 2011 to 2,413 (U.S. Census Bureau, 2013). Educational and health care services made up 26% of industry employment with retail industry making up 18.5% and employment in arts, entertainment and recreation the third leading industry employer at 18% (U.S. Census Bureau 2013).

The median household income is estimated at \$31,424 and per capita income at \$28,425 compared to the county averages of \$47,462 for median household income and \$25,483 for per capita income. It is estimated that 10.3% of families and 17.5% of all people in Sonora are below the poverty level compared to 11.3% of families and 14.9% of people overall in the county.

Groveland/Big Oak Flat

Groveland is located on Highway 120, which is an important route for accessing the park, particularly for California residents headed for the Tuolumne Meadows area. The 2010 population of Groveland was estimated at 601 (U.S. Census Bureau 2010). The population was 90% Caucasian, 1.5% Native American, and 1.5% Asian. Just under 3% indicated that they were some other race. Of the total population, approximately 8% indicated that they were of Hispanic or Latino heritage.

The labor force in the Groveland area grew 16% between 2000 and 2010, to 1,560 (CEDD 2012b). Unlike the other gateway communities, the finance, insurance, and real estate sector accounted for the highest portion of employment (22%). Retail trade and arts, entertainment, and recreation made up strong sectors as well at 16% and 15%, respectively. Approximately 83% of the workers who lived in this area worked within Tuolumne County in 2000, but only 49% worked in the Groveland/Big Oak Flat area (Sonoran Institute 2007a).

The area's median household income in 2010 was estimated at \$45,221 and per capita income was estimated at \$27,331 (U.S. Census Bureau 2012b). The household income was lower than the county average, but the per capita income was higher. Labor earnings made up 54% of income in 2000, with interest and dividends making up 16% and retirement income making up another 16% (Sonoran Institute 2007a). The poverty rate was almost 16% of all people in the area in 2010, higher than the county or state rates (U.S. Census Bureau 2012b).

Visitor Population/Spending

A study of travel spending impacts was completed for California in 2011. The study evaluated travel expenditures at the point of sale, employment and earnings associated with travel expenditures, and local and state traveler-related tax receipts. The study documents \$95.1 billion of direct travel spending in California in 2010, up 7.5% from 2009 but still below its peak of \$97.5 billion in 2008 (Dean Runyan Associates 2011). Travel spending is estimated to have supported 873,000 jobs, with earnings of almost \$30 billion. As might be expected, 59% of those jobs were in accommodations and food service; another 24% were in arts, entertainment, and recreation. Travel spending generated \$11.1 billion in tax receipts in 2010, including \$2.1 billion of local tax revenues.

Total local sales tax receipts for the region were \$20.7 million in 2009, and transient occupancy tax receipts were \$29.3 million. Mariposa and Mono had the highest transient occupancy tax receipts, with over 86% of the region's transient occupancy tax receipts. Travel spending in the region was estimated at \$1,123.1 million, which supported 14,360 jobs in the region in 2009. This accounts for approximately 20% of total wage and salary employment in the region. The employment generated by travel spending accounts for 80% of total wage and salary employment in Mariposa County and 69% in Mono County, as opposed to 14% in Tuolumne County and only 7% in Madera County.

In 2011 the NPS issued a study on the impact of Yosemite National Park visitor spending on the economy within 60 miles of the park (NPS 2011b). The study found that park visitors spent a total of \$354.7 million in 2010. Almost 95% of this was spent by nonlocal visitors (visitors who live farther than 60 miles from the park). Nonlocal visitor spending is estimated to support over 4,602 jobs in the region and labor income of \$132.5 million.

A 2005 study estimated visitor spending in the region at \$255 million (Stynes 2007). Over 65% of this, or \$147 million, was spent outside the park but within a 50-mile radius of the park. Over 50% of visitor spending was on accommodations, and another 22% was spent in restaurants and bars. Although most park visitors indicated that visiting the park was their primary objective for visiting the area, some visitors indicated that they would have visited the area in any event. Thus, the study estimated that 90% of the impact from visitor spending should be considered to have been generated due to the park.

A visitor study conducted by the park in 2005 gathered information on where visitors stayed on the night prior to and after their visit to the park (Littlejohn et al. 2005). Seventy-five communities were mentioned for overnight stays on the night before a park visit; Oakhurst, Mariposa, and Groveland were in the top five communities mentioned. Mammoth was the 12th most frequently mentioned, Lee Vining was 26th, and Sonora with 28th on the list of communities mentioned. When asked about overnight stay locations on the night after a park visit, all of the communities discussed herein were in the top 15 locations mentioned, out of a total of over 200 places. Mammoth and Groveland were in the top five; Oakhurst and Lee Vining were in the top 10, Mariposa was the 15th mentioned, and Sonora was the 23rd mentioned.

Spending by visitor parties varies significantly between day visitors and overnight visitors, primarily because of the significance of lodging costs for overnight visitors. The average visitor spending by day in 2005 was \$71 compared to an average of \$394 for all overnight visitors (Stynes 2007). Day visitors spent 55% of this total within the park and 45% in the communities outside the park, but within 50 miles. Overnight visitors who stayed in the park spent 12% to 22% in the communities outside the park, while overnight visitors who stayed outside the park spent 68% to 89% in these communities (see table 9-30).

Table 9-30.
Spending by Day and Overnight Visitors

Type of Visitors	Total Spending per Party/per Trip	Proportion and Amount of Spending Outside the Park
Day visitors	\$71	46%, or \$32
Overnight visitors at in-park lodging	\$841	12%, or \$104
Overnight visitors at lodging outside the park	\$646	89%, or \$572
Overnight visitors camping in park campgrounds	\$240	22%, or \$54
Overnight visitors camping outside the park	\$337	68%, or \$228

a CEDD data for industry sectors does not total the total wage and salary level
 Source: Stynes 2007

Other NPS Spending

Yosemite National Park employed 892 people in 2010 and had a total payroll of \$39.3 million (NPS 2011b). The NPS employment and payroll supported an additional 1,005 jobs in the region and increased labor income by \$53.2 million. The NPS has approximately 150 employees assigned to the Tuolumne Meadows area during the summer season.

Concessioner and Other Organizations

The concessioner operates visitor services in the Tuolumne Meadows area, including a store, a small restaurant, a mountaineering shop/school, a gas station, a stable, and two High Sierra Camps (Tuolumne Meadows Lodge and Glen Aulin High Sierra Camp). Concessioner employees are stationed at Tuolumne Meadows seasonally, and many come from outside the region to work the summer season. Concessioner-operated facilities within the river corridor employ an estimated 112 people at Tuolumne Meadows and the Glen Aulin High Sierra Camp for the summer season.

At least nine commercial outfitters provide stock trips into the park, and use of Lyell and Virginia Canyons is very popular with outfitters (NPS 2010i). Other commercial and nonprofit organizations also provide recreational and educational tours within the Tuolumne River corridor during the summer season.

Environmental Consequences Methodology

The socioeconomics section evaluates potential impacts on the social environment, visitor populations, the regional economy, and Yosemite National Park and its primary concessioner. The social and economic environments of the surrounding communities are primarily affected by changes in visitor levels, visitor spending, park and concessioner employment, and park and concessioner spending in the regional economy. Each proposed measure within each alternative was reviewed to determine how they would affect these factors. Although none of the alternatives would implement a limit on the number of visitors entering the park, management of the area as proposed in some of the alternatives could reduce visitor use of the area within the Tuolumne River corridor and displace this use to other areas. Due to the uncertainties related to how visitors would react to proposed management measures, the analysis of impacts is qualitative, with professional judgment applied to reach reasonable conclusions as to the context, intensity, and duration of potential impacts.

Visitor Population and Spending

The visitor and population spending analysis identifies potential changes in park visitor levels and visitor spending that could result from implementation of each alternative. This section also describes possible changes in the composition of Yosemite visitors (e.g., park overnights, local overnights, and day visitors) and qualitatively addresses potential changes in visitor spending.

NPS and Concessioner Employment and Spending

The NPS and concessioner employment and spending analysis identifies potential changes in concessioner employment and spending for operations in the river corridor, as well as changes in park employment and spending for operations in the river corridor. Concessioner information on employment and spending is addressed qualitatively because of the confidentiality requirements related to the concession contract.

Social Environment

The social environment analysis identifies potential changes to the social environments of the surrounding counties and communities. Potential impacts could include changes in the demand for housing if park employment changed, changes in employee commutes if employees were reassigned, impacts on the capacity of community amenities if changes in employment changed populations, and changes in recreational opportunities associated with the potential management actions under each of the alternatives.

Local and Regional Economy

The local and regional economy analysis identifies how potential management actions under each alternative would affect facilities operated by the park or its primary concessioner, including the potential for increased or decreased employment and revenues or costs. This section also addresses potential changes in visitor spending and shifts in employment associated with implementation of each alternative. Again, because of the programmatic nature of the plan, impacts are discussed qualitatively. Those local economies most dependent on visitor spending are identified where relevant.

Impact Assessment

Proposed management actions under each alternative are evaluated in terms of the context, intensity, and duration of the socioeconomic impacts, and whether the impacts are considered to be beneficial or adverse to the socioeconomic environment.

Context: The context of the impact considers whether the impact would be local or regional. For the purposes of this analysis, local impacts would be those that occur within Yosemite National Park. Regional impacts would be impacts on the four-county area around the park (Madera, Mariposa, Mono, and Tuolumne).

Intensity: The intensity of the impact considers whether the impact would be negligible, minor, moderate, or major. Negligible impacts would not be detectable and would have no discernible effect on the socioeconomic environment. Minor impacts on the socioeconomic environment would be slightly detectable but would not be expected to have an overall effect. Moderate impacts would be clearly detectable and could have an appreciable effect. Major impacts would have a substantial, highly noticeable influence on the socioeconomic environment and could permanently alter the socioeconomic environment.

Duration: The duration of the impact considers whether the impact would occur in the short term or the long term. A short-term impact would be temporary in duration and would be associated with transitional types of activities. A long-term impact would have a permanent effect on the socioeconomic environment.

Type: Impacts are evaluated in terms of whether the impact would be beneficial or adverse to the socioeconomic environment. Beneficial socioeconomic impacts would improve the social or economic conditions in the park or in the affected region. Adverse socioeconomic impacts would negatively alter social or economic conditions in the park or in the affected region, or would affect low-income populations.

Environmental Consequences of the No-Action Alternative

There would be no changes to current use or management of the Tuolumne River corridor under the no-action alternative. The number of visitors in the river corridor could increase over time, but there would be no appreciable change in the amount and type of visitor facilities available in the Tuolumne Meadows area. Visitor

spending in the region and its impact on the regional economy would be anticipated to remain at current levels. NPS and concessioner staff levels would remain at their current levels, primarily limited by the availability of housing. Therefore, there would be no impact on the region's economy under this alternative.

Cumulative Impacts

Cumulative socioeconomic impacts discussed below are based on analysis of past, present, and reasonably foreseeable future actions in the region. The actions discussed below are those most likely to be relevant to the local and regional communities and economies.

Past projects likely resulted in minor short-term increases in economic activity in the local economies as construction works spent time and money in the area, including the projects listed below.

- Tuolumne Meadows Water Treatment Facility Regulatory Upgrade
- Gaylor Pit Lead Abatement
- Tuolumne Meadows Service Station Vapor Recovery Installation
- Tuolumne Meadows Water Line Replacement
- Tuolumne Winter Ranger Residence Install Alternative Power Sources

A number of current projects also have the potential to cause short-term increases in economic activity (related to employment, wages, and local sales) associated with construction activities, including communication system upgrades, road rehabilitation projects, and water treatment system improvements. The Commercial Use Authorization for Commercial Activities project supports visitor use of the park through commercial activities and has a positive impact on the local economies through local employment and wages as well as visitor spending. Other current projects, such as the *Merced Wild and Scenic River Comprehensive Management Plan*, the USFS Forest Plan revisions, and the Recreational Facility Analysis, could have beneficial or adverse impacts on the regional economy, depending on whether they recommend changes that could increase or decrease visitor numbers in the region.

The short-term impacts of most of the cumulative projects in combination with the no-action alternative would be minor and beneficial on the local and regional economy related to construction activities. Long-term impacts on visitor populations and spending could be positive or negative, depending on the outcome of planning projects such as the *Merced River Plan*, the *Wilderness Stewardship Plan*, and the Forest Plan revisions. Changes in visitor population and spending levels would affect the regional economy to some degree and could have substantial impacts on individual local economies.

In conjunction with the past, present, and reasonably foreseeable future projects, the no-action alternative would result in no changes in visitor spending in the long term, with an overall beneficial impact on the local and regional economies. If the planning projects result in implementation of policies that reduce visitor use of other public areas in the region, these impacts could be somewhat offset.

Environmental Consequences of Alternative 1

Impacts on Visitor Populations and Spending

Under alternative 1, the total user capacity in the river corridor would decrease by approximately 34%. Overnight capacity would be decreased 24% by eliminating lodging at Tuolumne Meadows Lodge and Glen Aulin High Sierra Camp, and by reducing the number of campsites at Tuolumne Meadows campground. Maximum day visitors in the corridor at one time would be decreased from an estimated 1,774 visitors (estimated on a peak day in August 2011) to 1,033 visitors, or an approximately 42% reduction in use. The elimination of commercial services at Tuolumne Meadows would likely decrease some of the demand for day use, resulting in a substantial number of visitors unable to or less likely to visit the Tuolumne River corridor in comparison with the no-action alternative.

The decrease in day use and the elimination of all commercial services in the corridor would result in a decrease in visitor spending within Yosemite National Park, particularly spending related to concessioner services.

Eliminating the Glen Aulin High Sierra Camp, eliminating the Tuolumne Meadows Lodge, eliminating concessioner stock day rides, and reducing access to the Tuolumne River corridor could result in some visitors not coming to the park and an overall reduction in day use spending in the region. Since commercial services would be reduced in the river corridor, there might be a shift of day visitor spending from the park to the gateway communities. Some visitors displaced from the river corridor might visit other areas of the region. Therefore, the regional impact might not be a full 42% decrease in day visitor spending corresponding to the estimated 42% reduction in river corridor use. However, the decrease in day visitor spending could be substantial, particularly in the gateway communities closer to Tuolumne Meadows, such as Groveland and Lee Vining.

It is assumed that the majority of the overnight visitors displaced from the scenic segments of the Tuolumne River corridor would be accommodated in other areas in the gateway communities. This would result in a substantial shift in spending from inside the park to areas outside the park. Visitors displaced from overnight accommodations may be more likely to visit another area altogether. Total overnight visitor spending in the region (both inside and outside the park) would likely decrease by less than the total decrease in overnight visitors (24%).

Overall, the impact on visitor populations and spending would be moderate and adverse in terms of number of visitors and overall visitor spending, but there would also be a shift of visitor spending from in the park to areas outside the park. This would mitigate some of the decrease in visitor spending in the gateway communities.

Impacts on NPS and Concessioner Employment and Spending

The elimination of commercial services under alternative 1 would result in a decrease in concessioner employment in the Tuolumne River corridor, thus eliminating approximately 110 seasonal jobs at Tuolumne Meadows and Glen Aulin High Sierra Camp. These seasonal jobs are held by a combination of residents from the surrounding communities and seasonal employees from outside the region. The reduction of employment would result in a loss of up to \$684,000 in concessioner employee wages if all 110 employees worked full time for four months at the prevailing local wage for retail workers. Based on conversations with current and former seasonal employees, a good portion of these wages is spent on groceries and other goods and services in the communities outside the park, particularly in Mono County. The decrease in concession employment would therefore have an adverse impact on the local economies from a decrease in concessioner employee wages being spent in the area.

As discussed above, the decrease in overnight lodging and services provided in Yosemite National Park would be expected to result in a substantial shift in visitor spending from inside the park to outside the park. This would result in a substantial decrease in revenues to the concessioner. Revenues to the park from concessioner operations would be reduced as well.

The number of NPS employees living in the river corridor would be expected to decrease under alternative 1 from approximately 150 to approximately 100, which would result in a decrease in employees and wages. Park expenditures on goods and supplies may decrease also because of the lower levels of visitor services and employment.

Impacts on the Social Environment

Since most concessioner and NPS employees are housed in the park, the decrease in concessioner and NPS employment would not be expected to result in any changes in overall population in the gateway communities or in the demand for housing or community facilities and/or services in these communities. The decrease in

parking and the number of day visitors allowed at any one time could result in a decrease in access to the Tuolumne River corridor for local residents, resulting in a minor adverse impact on the social environment.

Impacts on the Local and Regional Economy

The loss of an estimated 110 concessioner seasonal jobs and up to 50 NPS jobs in the river corridor would be a reduction of less than 1% of total regional employment and would likely have a minimal adverse impact on regional employment and wages. Since the demand for labor is higher during the summer season in the region, local displaced workers might be able to find alternate seasonal jobs. Concessioner and NPS employee spending in the communities outside the park would decrease and result in a minor adverse impact on most local economies outside the park. The impact on Lee Vining could be higher because of the small size of the community and the amount of concessioner and NPS wages spent in this area.

The reduction of lodging and commercial services in the Tuolumne River corridor would result in an overall decrease in spending in the park. If it is assumed that the majority of the visitor spending on lodging and commercial services would be displaced from the river corridor into surrounding areas, there could be a long-term minor beneficial impact on some of the local economies under alternative 1.

Tuolumne County currently receives transient occupancy taxes from visitor lodging at Tuolumne Meadows Lodge and Glen Aulin High Sierra Camp and sales tax revenues from retail purchases at the commercial service locations in Tuolumne Meadows. If visitors are relocated from within the river corridor to other lodging within the county, there would likely be a negligible impact on transient occupancy taxes. If visitors choose to stay outside the county, there would be a minor to moderate adverse impact on the local economy in Tuolumne County. Similarly, if retail purchases displaced from the river corridor still occur in Tuolumne County, there should be little decrease in sales tax. If these sales occur outside Tuolumne County, sales tax receipts for the county would be reduced, resulting in a minor to moderate adverse impact on the local economy.

Much of the decrease in revenues would affect the concessioner, although eliminating commercial use in the river corridor could affect local outfitters and other commercial permit holders in the gateway communities as well. If local outfitters and commercial permit holders reduced operations (as opposed to reallocating pack trips to other locations), there could be a minor adverse impact on the regional economy. If commercial outfitters in Mono County reduce operations and employment, rather than relocate stock trips to locations outside the river corridor, the effect on the local economy of Mono County would be minor to moderate.

If, however, the reduction of services and access to the Tuolumne River corridor reduces park visitation overall, rather than just redirecting some visitors out of the corridor, there could be a long-term minor to moderate adverse impact on the regional economy from a decrease in overall visitor spending.

Conclusion

Alternative 1 would result in a long-term minor to moderate adverse impact on visitor populations and spending because some visitors might decide not to visit the area if they could not access desired activities in the Tuolumne River corridor.

The impact on some local economies might be beneficial with some visitor spending shifting from inside the park to outside the park. The long-term impact on the region's economy might be adverse because overall visitor spending (inside and outside the park) would likely decrease somewhat. The type and intensity of these impacts would depend on whether overall visitor numbers to the region decreased because of the elimination of all commercial services in the corridor (including all lodging) or if some proportion of these visitors would shift use to communities outside of the park. Impacts on the local economy in Tuolumne County could be minor to moderate and adverse if the reduction in lodging and commercial services results in lower tax revenues to the county. In addition, the elimination of nearly all seasonal concessioner employees at Tuolumne

Meadows would decrease wages and spending on goods and services outside of the park during the summer season. This would result in a long-term minor adverse impact on the regional economy.

The elimination of commercial services in the river corridor could result in a small decrease in local employment if these commercial outfitters and other commercial permit operations reduced trips overall instead of redirecting them to areas outside the Tuolumne River corridor but within the park or region. Overall, the impact would likely be long term, minor, and adverse on the regional economy and a minor to moderate adverse impact on the local economy in Mono County.

The impact on the social environment would be long term, minor, and adverse as a result of the potential displacement of local recreation in the corridor. The impact on concessioner operations would be long term, moderate, and adverse due to the substantial decrease in revenues associated with eliminated lodging and other visitor services.

Cumulative Impacts

The list and analyses of past, present, or reasonably foreseeable projects that may have a cumulative impact on the planning area in combination with alternative 1 would be the same as provided under the no-action alternative and would result in an overall beneficial impact on the local and regional economies related to construction activities. In conjunction with these projects, the management actions proposed with alternative 1 would result in a decrease in visitor numbers and associated visitor spending in the long term. The adverse impact on the economy could be magnified by forest plan/recreation analysis policies that reduce visitor use elsewhere in the region. If the USFS Forest Plans increase visitor use of nearby areas, the cumulative projects could somewhat offset the adverse impact of alternative 1.

Environmental Consequences of Alternative 2

Impacts on Visitor Populations and Spending

Under Alternative 2, the total visitor capacity in the Tuolumne River corridor would increase by approximately 9%. These changes would occur in the scenic segments of the river corridor; the overall number of day and overnight visitors in the wilderness areas would not change from current levels. Overnight capacity would increase by 9% as a result of the added campsites at the Tuolumne Meadows campground. Maximum day use visitation in the corridor at any one time would be increased from an estimated 1,774 people (estimated on a peak day in August 2011) to 1,913 people, or an approximate increase of 8%. Visitor services in the Tuolumne Meadows area would continue at current levels, with some reduction in concessioner stock day rides. Commercial use in wilderness, such as pack stock trips, would be restricted on their timing, but use levels would be approximately the same as existing conditions. Recreational boating on portions of the river would be added, and boaters would be subject to the existing overnight wilderness quota system.

The increase in overnight use would result in an overall increase in visitor spending because overnight visitors spend more in the region than day visitors. Overnight visitors spend a smaller percentage of their total spending outside the park compared to day visitors, but spend a greater amount outside the park per trip overall.

Recreational boating on portions of the river would be added, and boaters would be subject to the existing wilderness quota system, including the fee associated with reserving a wilderness permit in advance. However, the overall socioeconomic effect would be slight, as the new use would be limited by the length of the boating season (about 6-8 weeks) and the level of skill and physical fitness required. In addition, 40% of wilderness permits are issued on a first-come, first-served basis at no charge. In 2013, the fee to reserve a wilderness permit was \$5 per reservation plus \$5 per person.

Impacts on NPS and Concessioner Employment and Spending

Concessioner employment would remain the same under alternative 2 as the no-action alternative.

Concessioner spending on goods and services associated with visitor services, such as supplies for the grill and store, would likely increase somewhat due to the higher level of spending by overnight visitors compared to day visitors. Supplies needed for the concessioner stable could decrease. The increase in overnight accommodations in the park would result in an increase in revenues to the concessioner, which would be offset to some degree by a decrease in revenues from concessioner stock day rides. The overall impact on the concessioner would be minor to moderate and beneficial in the long term.

NPS employees working in the river corridor would increase from approximately 150 to 174 under alternative 2. A substantial portion of spending by these employees for groceries and other goods and services occurs within the gateway communities outside the park. Park expenditures on goods and supplies would likely increase.

Impacts on the Social Environment

The increase in NPS employment in the river corridor would not likely result in any substantial changes in population in the gateway communities or in the demand for housing or other community services in these communities because these employees would be provided housing within the park. The increase in the number of day visitors allowed at any one time at Tuolumne Meadows would result in increased access to the corridor for local residents, resulting in a minor beneficial impact on the social environment.

Impacts on the Local and Regional Economy

The additional NPS jobs in the river corridor would likely have a minor beneficial impact on regional employment and wages. Reductions in concessioner stock day rides would be expected to have a minor adverse impact on concessioner employment and wages.

The effect of allowing limited whitewater boating through the Grand Canyon of the Tuolumne would be negligible on the local and regional economy, because the activity would be limited by the short boating season and level of skill and physical fitness required, and because boaters would be subject to the existing overnight wilderness trailhead quotas as other backcountry visitors.

The increase in campground capacity and NPS employees housed in the river corridor under alternative 2 would likely result in an overall increase in spending in the region. The restrictions on the timing of outfitter and other commercial permit operator trips in wilderness would result in a negligible decrease in regional employment, as the number of commercial trips allowed by the determination of extent necessary (appendix C) would be approximately the same as existing use levels. Overall, the impact on the regional economy would be minor and beneficial.

There would be a minor adverse impact on the local economy in Mono County if stock trips by outfitters were reduced instead of (1) either maintaining the same number of trips but directing them to areas outside the Tuolumne River corridor during restricted times, or (2) moving the trips to other days of the week.

Conclusion

Alternative 2 would result in a minor to moderate beneficial impact on visitor populations, visitor spending, and local and regional economies because of an overall potential increase in visitors (particularly overnight visitors, who tend to spend more outside of the park than day visitors). A substantial increase in NPS employees would increase wages and spending on goods and services outside of the park during the summer season, resulting in a long-term minor beneficial impact on local and regional economies.

Restrictions on outfitter and other commercial permit operators in wilderness are not likely to decrease local or regional employment, as the number of commercial trips allotted in alternative 2 is similar to existing conditions. There could be a minor adverse impact on the local economy of Mono County if commercial outfitters reduced trips overall instead of either maintaining the same number of trips but directing them to areas outside the Tuolumne River corridor at restricted times or moving the trips to other days of the week. The impact on the social environment would be minor and beneficial because there would be additional opportunities for local visitors to access the river corridor. The impact on concessioner revenue would be long term, negligible, and adverse because of the decrease in concessioner stock day rides and the removal of the mountaineering shop.

Cumulative Impacts

The list and analyses of past, present, and reasonably foreseeable projects that may have a cumulative impact on the planning area in combination with alternative 2 would be the same as provided under the no-action alternative, with an overall beneficial impact on the local and regional economies related to construction activities. In conjunction with these projects, implementation of alternative 2 would result in increased visitor spending in the long term and a beneficial impact on the local and regional economies. The long-term impacts on visitor populations and spending are uncertain because some planning projects could call for policies that increase or decrease visitor use levels in the park and surrounding national forests. If planning projects result in implementation of policies that reduce visitor use of other public areas in the region, it could somewhat offset the beneficial impacts of alternative 2.

Environmental Consequences of Alternative 3

Impacts on Visitor Populations and Spending

Under alternative 3, total visitor capacity in the Tuolumne River corridor would decrease by approximately 8%. Overnight capacity would be decreased by 5% by reducing lodging at the Tuolumne Meadows Lodge and the Glen Aulin High Sierra Camp. Maximum day visitors in the river corridor at one time would be reduced from an estimated 1,774 people (estimated on a peak day in August 2011) to 1,568 people, or by 12%. Day visitors would likely be displaced from the river corridor only on peak days or at peak times, and these visitors would still be able to visit the park but in areas outside of the river corridor. Therefore, overall day visitor numbers and spending for the park would likely remain much the same as under the no-action alternative. It is possible that some day visitors would not travel to the area if they were not able to access the Tuolumne River corridor, but this number is expected to be fairly low.

Impacts on NPS and Concessioner Employment and Spending

NPS employees working in the Tuolumne River corridor would be decreased from 150 to 124 under alternative 3. Concessioner employment would remain the same as with the no-action alternative. These seasonal jobs are held by a combination of residents from the surrounding communities and seasonal employees from outside the region. A substantial portion of spending by these employees for groceries and other goods and services occurs within the gateway communities outside the park. Park expenditures on goods and supplies would likely remain the same or decrease slightly.

Concessioner spending on goods and services associated with visitor services, such as supplies for the grill and store, would remain approximately the same under alternative 3 as the no-action alternative. Supplies needed for the concessioner stable could decrease.

Concessioner spending on supplies for the gas station and mountaineering shop/school would be eliminated. The decrease in lodging capacity, concessioner stock day rides, and retail sales would reduce revenues to the NPS and concessioner. NPS expenditures on goods and supplies would decrease minimally.

Impacts on the Social Environment

The decrease in NPS employment in the corridor under alternative 3 would not likely result in any substantial changes in population in the gateway communities or in the demand for housing or other community services in these communities because these employees would be provided park housing. The maximum number of day visitors allowed at any one time at Tuolumne Meadows would be reduced from existing conditions. There would be no discernible change in access to the Tuolumne River corridor for local residents, and a negligible beneficial impact on the social environment.

Impacts on the Local and Regional Economy

The decrease in lodging capacity in the Tuolumne River corridor could result in an overall decrease in spending in the region under alternative 3 if some visitors could not or chose not to stay elsewhere in the park or in the local community. However, much of the decreased revenue associated with the decrease in lodging availability in the river corridor would be experienced by the concessioner. If the decreased lodging availability resulted in reduced numbers of visitors to Yosemite, this would decrease revenue in the local communities. If the park visitor population remained the same but more visitors stayed overnight outside of the park, the impact on local economies could be beneficial.

Tuolumne County currently receives transient occupancy taxes from visitor lodging at Tuolumne Meadows Lodge and Glen Aulin High Sierra Camp and sales tax revenues from retail purchases at the commercial service locations in Tuolumne Meadows. If visitors who would have stayed at Tuolumne Meadows Lodge (where overnight occupancy would be reduced by 50% in alternative 3) or Glen Aulin High Sierra Camp chose to stay at other lodging within the county, there would likely be a negligible impact on transient occupancy taxes. If visitors chose to stay outside the county, there would be a minor to moderate adverse impact on the local economy in Tuolumne County. Similarly, if retail purchases displaced from the river corridor still occur in Tuolumne County, there should be little decrease in sales tax. If these sales occur outside Tuolumne County, sales tax receipts for the county would be reduced, resulting in a minor to moderate adverse impact on the local economy.

The decrease in NPS jobs in the Tuolumne River corridor would be expected to have an adverse impact on regional employment and wages. In addition, reductions in concessioner stock day rides would be expected to have an adverse impact on concessioner employment and wages.

The reduction in outfitter and other commercial trip opportunities under alternative 3 could result in a small decrease in local employment in Mono County if commercial operations decreased trips overall instead of either maintaining the same number of trips but directing them to areas outside the Tuolumne River corridor or moving the trips to other days of the week. Much of the reduction in revenues in alternative 3 would affect the concessioner, although eliminating commercial use in the corridor could affect local outfitters and other commercial permit holders in the gateway communities. If local outfitters and commercial permit holders reduced operations (as opposed to reallocating pack trips to other locations), there could be a minor adverse impact on the regional economy.

Conclusion

Alternative 3 would result in a long-term minor adverse impact on visitor populations and spending. The long-term impact on the local and regional economies would depend on whether overall visitor numbers to the region decreased because of the reductions in lodging, lowered visitor capacity, and reduced services, or visitor numbers remained constant, with use shifting to communities outside of the park when the corridor is at capacity. Impacts on the local economy in Tuolumne County could be minor and adverse if the reduction in lodging and commercial services results in lower tax revenues to the county. A decrease in NPS employees

would decrease wages and spending on goods and services outside of the park during the summer season, resulting in a long-term minor adverse impact on local and regional economies.

The reduction in outfitter and other commercial permitted trips could result in a small decrease in local employment if these commercial operations decreased trips overall instead of either redirecting them to areas outside the Tuolumne River corridor or moving the trips to other days of the week. Overall, this impact would likely be long term, minor, and adverse on the regional economy and on the local economy in Mono County.

The impact on the social environment under alternative 3 would be long term, minor, and adverse because there might be fewer opportunities for local recreation access in the corridor.

The impact on concessioner operations would be long term, minor to moderate, and adverse as a result of reduced lodging at the Glen Aulin High Sierra Camp, reduced lodging at the Tuolumne Meadows Lodge, reduced concessioner stock day rides, and removal of the gas station and mountaineering shop/school.

Cumulative Impacts

The list and analyses of past, present, or reasonably foreseeable projects that may have a cumulative impact on the planning area in combination with alternative 3 would be the same as provided under the no-action alternative, with an overall beneficial impact on the local and regional economies related to construction activities. In conjunction with these projects, the management actions proposed with alternative 3 would result in a long-term negligible to minor adverse impact on the local and regional economies. The results of the planning projects could be an increase or decrease of visitor populations and spending, depending on the decisions made in these plans. If the cumulative planning projects result in implementation of policies that reduce visitor use of other areas in the region, it could somewhat magnify the adverse impact of alternative 3. If the planning efforts implement policies that allow for higher levels of visitor use, the adverse impact of alternative 3 could be somewhat offset.

Environmental Consequences of Alternative 4 (Preferred)

Impacts on Visitor Populations and Spending

Alternative 4 would result in a very slight increase in total visitor capacity in the Tuolumne River corridor (by approximately 1%). Overnight capacity would be decreased by less than 1% due to reductions in capacity at Glen Aulin High Sierra Camp. Maximum day visitors in the river corridor at one time would be slightly increased from an estimated 1,774 people (estimated on a peak day in August 2011) to 1,839 people, or an increase of approximately 4%. Most visitor services in the Tuolumne Meadows area would continue at current levels, however the public fuel station and mountaineering shop would be removed and concessioner stock day rides would be discontinued. Commercial use in wilderness, such as pack stock trips, would be restricted on their timing and location, but allowable use levels would be approximately the same as existing conditions. With a relatively slight increase in maximum visitor capacity in the river corridor, overall visitor numbers and spending in the park would likely remain much the same as under the no-action alternative.

Recreational boating on portions of the river would be added, and boaters would be subject to the existing wilderness quota system, including the fee associated with reserving a wilderness permit in advance. However, the overall socioeconomic effect would be slight, as the new use would be limited by the length of the boating season (about 6-8 weeks) and the level of skill and physical fitness required. In addition, 40% of wilderness permits are issued on a first-come, first-served basis at no charge. In 2013, the fee to reserve a wilderness permit was \$5 per reservation plus \$5 per person.

Impacts on NPS and Concessioner Employment and Spending

The elimination of concessioner stock day rides in alternative 4 would eliminate approximately 13 seasonal jobs. These seasonal jobs are held by a combination of residents from the surrounding communities and

seasonal employees from outside the region. The reduction of employment would result in a loss of up to \$80,850 in concessioner employee wages if all 13 employees worked full time for four months at the prevailing local wage for retail workers. Based on conversations with current and former seasonal employees, a good portion of these wages is spent on groceries and other goods and services in the communities outside the park, particularly in Mono County. The decrease in concession employment would therefore have an adverse impact on the local economies from a decrease in concessioner employee wages being spent in the area.

The elimination of concessioner stock day rides, the mountaineering shop, and the gas station would result in a decrease of concessioner spending on supplies. The slight decrease in lodging at Glen Aulin High Sierra Camp, the elimination in concessioner stock day rides, and reductions in retail sales would reduce revenues to the concessioner and the NPS. The long-term impact on concessioner revenues would be minor and adverse.

NPS employees working in the corridor would increase from approximately 150 to 163, resulting in increased wages and an increase in potential NPS employee spending in local economies. NPS expenditures on goods and supplies for Tuolumne area operations would likely increase to support additional employees.

Impacts on the Social Environment

The increase in NPS employment in the Tuolumne River corridor would not be expected to result in any substantial changes in population in the gateway communities or in the demand for housing or other community services in these communities because these employees would be provided park housing. The maximum number of day visitors allowed at any one time at Tuolumne Meadows would be similar to existing conditions, resulting in no change in access to the corridor for local residents, and a negligible beneficial impact on the social environment.

Impacts on the Local and Regional Economy

The effect of allowing limited whitewater boating through the Grand Canyon of the Tuolumne would be negligible on the local and regional economy because the activity would be limited by the short boating season and level of skill and physical fitness required, and because boaters would be subject to the existing overnight wilderness trailhead quotas as other backcountry visitors.

The slight decrease in lodging capacity at the Glen Aulin High Sierra Camp under alternative 4 (a maximum of 4 visitors per night) would not be likely to affect overall visitor spending in the region. The implementation of a user capacity management program that caps visitor and administrative use levels at slightly higher than existing conditions would have a negligible impact on local or regional economy compared with existing conditions. The restrictions on the timing of outfitter and other commercial permit operator trips in wilderness would result in a negligible impact on regional employment, as the number of commercial trips allowed by the determination of extent necessary (appendix C) would be approximately the same as existing use levels.

The slight decrease in lodging at Glen Aulin High Sierra Camp would result in a very small decrease in transient occupancy taxes to Tuolumne County unless visitors displaced from the camp stayed in other lodging within the county. The effects on the local Tuolumne County economy would likely be adverse but negligible. Similarly, if retail purchases displaced from the river corridor still occur in Tuolumne County, there should be no decrease in sales tax. If these sales occur outside Tuolumne County, sales tax receipts for the county would be reduced, resulting in a minor adverse impact on the local economy. However, visitor spending on amenities no longer available at Tuolumne Meadows (fuel and mountaineering supplies) would likely increase in the local communities of Mono County and Tuolumne County.

There would be a minor impact on the local economy in Mono County if stock trips by outfitters were reduced instead of either maintaining the same number of trips but directing them to areas outside the Tuolumne River corridor during restricted times, or moving the trips to other days of the week.

Regional transportation providers would potentially benefit from this alternative, which allows up to three additional 45-passenger buses to service Tuolumne Meadows from outside the park (there is currently one regional transit bus run per day on a 45-passenger bus). The economic benefit of this option depends on visitor demand for regional public transit.

NPS expenditures on goods and supplies for Tuolumne Meadows operations would likely increase with alternative 4, as would NPS employee spending in local communities. There would be a decrease in concessioner spending in local communities resulting from the decreased concessioner services and employment in the river corridor.

Conclusion

Alternative 4 would result in a long-term negligible to minor beneficial impact on visitor populations and spending in the region. There would be a long-term negligible beneficial impact on the regional economy due to a slight increase in visitor capacity, the potential increase in regional public transit, and NPS employment in the river corridor. There would be a long-term negligible adverse impact on the regional economy from reductions in concessioner spending and concessioner employment in the river corridor.

Restrictions on outfitter and other commercial permit operators in wilderness are not likely to decrease local or regional employment, as the number of commercial trips allotted in alternative 4 is similar to existing conditions. There could be negligible adverse impacts on the local economy in Tuolumne County if the reduction in lodging at Glen Aulin and reduced commercial services results in lower tax revenues to the county. There could be a minor adverse impact on the local economy of Mono County if commercial outfitters reduced trips overall instead of either maintaining the same number of trips but directing them to areas outside the Tuolumne River corridor at restricted times or moving the trips to other days of the week.

The impact on the social environment would be negligible and beneficial under alternative 4 because use levels would be similar to existing conditions, resulting in no change in access to the corridor for local residents.

The impact on concessioner revenue would be long term, minor, and adverse due to the decrease in lodging capacity at Glen Aulin High Sierra Camp, elimination of concessioner stock day rides, and removal of the gas station and the mountaineering shop.

Cumulative Impacts

The list and analyses of past, present, and reasonably foreseeable projects that may have a cumulative impact on the planning area in combination with alternative 4 would be the same as provided under the no-action alternative, with an overall beneficial impact on the local and regional economies related to construction activities. In conjunction with these projects, alternative 4 would result in a short-term and long-term negligible to minor beneficial impact on the local and regional economies. If the planning projects result in implementation of policies that reduce visitor use of other public lands in the region, it could result in a cumulative adverse impact because the Tuolumne River corridor would not be able to accommodate displaced visitors from other locations on peak use days. If the upcoming planning efforts implement policies that allow for higher levels of visitor use outside the park, the overall cumulative impact would remain beneficial.

Analysis Topics: Historic Properties

Historic Buildings, Structures, and Cultural Landscapes

Scope of the Analysis

The following analysis includes historic properties and their contributing resources that meet the NHPA criteria for listing or eligibility for listing in the National Register of Historic Places (NRHP). Analysis of archeological resources and cultural resources of significance to American Indians are located later in this chapter, under “Archeological Resources” and “American Indian Traditional Cultural Resources.”

The wild and scenic river corridor includes the NRHP-eligible Tuolumne Meadows Historic District, NRHP-eligible Soda Springs Historic District (encompassed within the larger Tuolumne Meadows Historic District), the NRHP-eligible Tioga Road Historic District, and the NRHP-eligible Glen Aulin High Sierra Camp Historic District. A small portion of an area that the NPS considers potentially eligible for the NRHP near Hetch Hetchy Reservoir is also within the corridor. The corridor also includes buildings and structures that are listed on the NRHP, including Parsons Memorial Lodge, a National Historic Landmark, two buildings at Tioga Pass, and several buildings in the Tuolumne Meadows Historic District (table 9-31). While most historic development in the Tuolumne River corridor is located in nonwilderness segments of the river, individual historic buildings, structures, and features that are potentially eligible for the NRHP have been recorded in wilderness segments. For these wilderness areas, information is taken from overview documents (e.g., *Historic Resources Study, Yosemite: The Park and its Resources* [NPS, Greene 1987a]) and specific inventories (e.g., Wilderness Historic Resources Survey: 1988 Season Report and 1989 Season Report [NPS, Snyder et al. 1989a, 1990]).

Historic sites, buildings, structures, and objects are considered eligible for inclusion in the NRHP when they are associated with events that have made a significant contribution to the broad patterns of our history (criterion *a*); when they are associated with the lives of persons significant in our past (criterion *b*); when they embody the distinctive characteristics of a type, period, or method of construction (criterion *c*), or when they have contributed or have the potential to contribute information about the past (criterion *d*). Resources that have been determined eligible, or are already listed, on the NRHP under these criteria are listed in table 9-31 and are described in detail under the “Affected Environment” section, below.

Area of Potential Effect for this Plan

As defined under the ACHP regulations at 36 CFR 800.16(d), the area of potential effect means the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties. For the *Tuolumne River Plan*, the proposed planning area consists of the Tuolumne Wild and Scenic River corridor in Yosemite National Park (see figure 1-1 in chapter 1), and also includes the full extent of the Tuolumne Meadows Historic District, which lies partially outside the corridor (see figure 9-11).

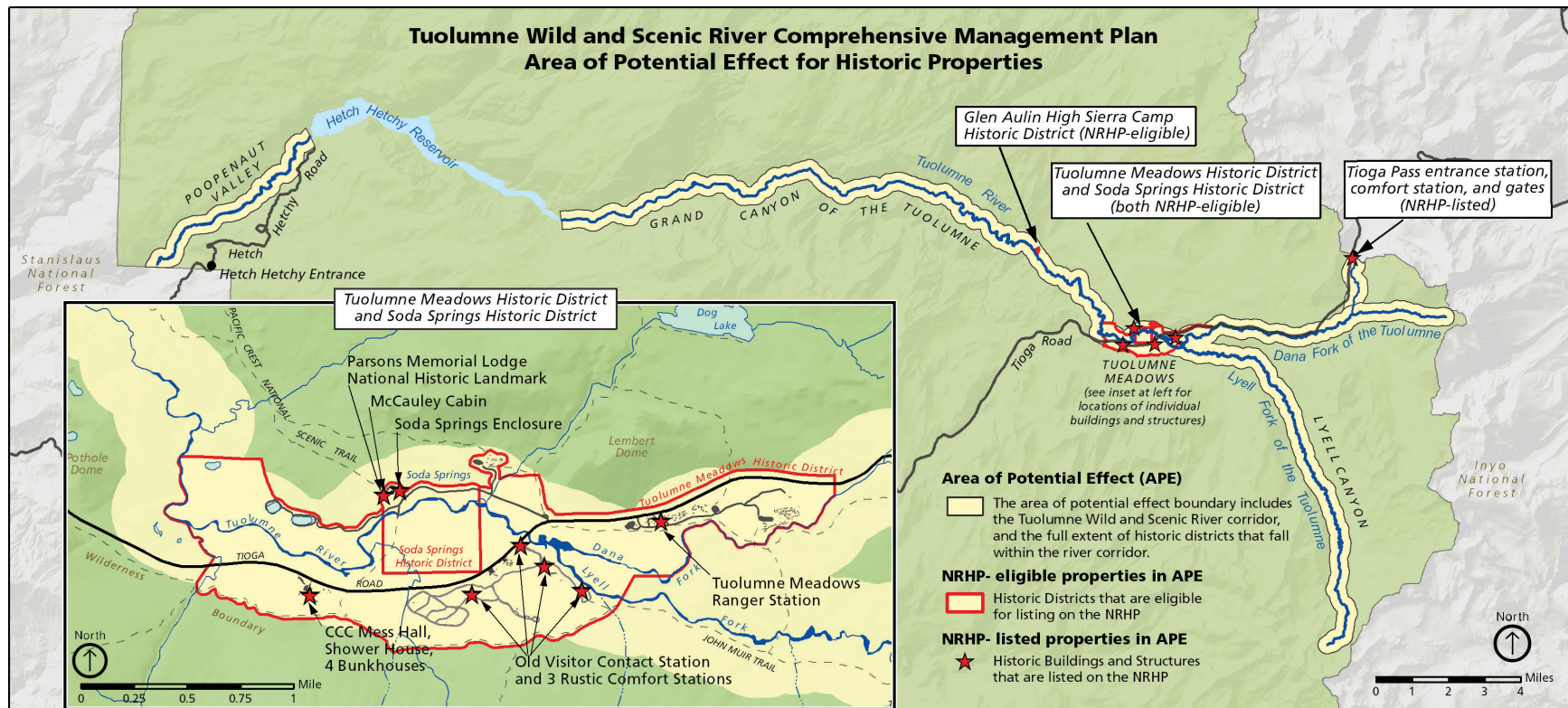


Figure 9-11. Area of Potential Effect for Historic Properties.

Affected Environment

Historical Context

The discovery of gold in 1852 brought prospectors through the Tuolumne Meadows area, and mining activity increased with the 1860 discovery of silver at Tioga Hill. In the latter 1860s, sheepherders brought their flocks to the high pastureland. Among the herders was renowned naturalist John Muir, who spent his first summer in the Sierra tending sheep and pondering the mountains' natural processes. Built along the alignments of prehistoric and historic trails on both sides of the Sierra Nevada, construction on the Great Sierra Wagon Road to provide access from the western side of the mountains began in 1882 and was completed in 1883. John Baptiste Lambert established a homestead in 1885 near Soda Springs, which he surrounded with a log enclosure to keep out grazing animals. The McCauley family, who operated the Glacier Point Hotel, acquired the property in 1898 to graze their livestock and built a cabin near Soda Springs that still stands. After the creation of Yosemite National Park in 1890, the U. S. Army maintained a patrol post at the same location until 1913.

The Sierra Club acquired the McCauley property in 1912 and built Parsons Memorial Lodge next to the cabin as the organization's mountain headquarters, reading room, and gathering place. The Sierra Club contributed to the purchase of the old Great Sierra Wagon Road for the NPS and, in 1915, the road was opened to motorists as the Tioga Road.

The Tioga Road influenced further development in the Tuolumne Meadows area by providing access to a new class of visitors, in ever-increasing numbers. To accommodate these visitors, the precursor of the present Tuolumne Meadows High Sierra Camp opened in 1916. By 1923, it also served as the base for Yosemite's new High Sierra Camp loop. The area's popularity prompted the NPS to begin construction of a rustic style administrative center (Ranger Camp) in 1924. A parkwide master plan, adopted in 1929, guided successive development in the area. Central to this plan was the creation of a public campground, with treated running water and a sewer system, to help minimize the damage unregulated camping was causing to natural resources. Additional facilities included the 1934 Road Camp and the postwar Insect Research Station (Bug Camp).

Historic Properties Listed on the National Register of Historic Places within the River Corridor

The following is a comprehensive list of historic districts and individual buildings and structures that are either listed or eligible for listing on the NRHP within the area of potential effect, listed in geographic order (table 9-31).

Historic Properties along the Lyell and Dana Fork River Segments

There are two NRHP-listed structures in the current Dana Fork segment: the Tioga Pass entrance station and the comfort station and entrance gates. These are further described below. These structures are currently within the wild and scenic river corridor boundary; however, if the proposed technical correction to the corridor boundary (see chapter 3) is approved, they would be outside of the revised river corridor boundary.

Known historical resources that are either eligible or potentially eligible for listing on the NRHP include the Tioga Road Historic District (discussed in greater detail below under Tioga Road Historic District); camps and other material remains indicative of early sheepherding, mining, U.S. Cavalry patrol activities; and structures related to the conducting of early scientific studies.

Table 9-31.
Summary of Historic Properties in the Tuolumne Wild and Scenic River Corridor that are Eligible for Listing or are Listed on the National Register of Historic Places

Historic Property	WSR Segment	NRHP Listing Status	NRIS number	Building number	Period of Significance
HISTORIC DISTRICTS					
Tuolumne Meadows Historic District	Tuolumne Meadows	eligible (2007)	--	--	1885-1961
Soda Springs Historic District	Tuolumne Meadows	eligible (2007)	--	--	1885-1937
Tioga Road Historic District	Tuolumne Meadows	eligible (2011)	--	--	1932-1961
Glen Aulin High Sierra Camp Historic District	Grand Canyon	eligible (2004)	--	--	1927-present
NRHP-LISTED BUILDINGS OR STRUCTURES					
Tioga Pass entrance station, Tioga Pass comfort station and entrance gates	Dana Fork (1979) ^a	listed (1978)	78000372	3200	1925-1949
Parsons Memorial Lodge (National Historic Landmark)	Tuolumne Meadows	listed (1979) NHL status 1987	79000283	3081	1900-1924
McCauley Cabin	Tuolumne Meadows	listed (1977)	77000359	3082	1900-1924
Soda Springs enclosure	Tuolumne Meadows	listed (1979)	79000282	HS-07	1850-1874
Tuolumne Meadows ranger station; old visitor contact station (not current contact station) and three rustic comfort stations at Tuolumne Meadows campground	Tuolumne Meadows	listed (1978)	78000370	3005, 30021, 3022 and 3023	1925-1949
CCC mess hall, shower house, and four bunkhouses at Road Crew Camp	Tuolumne Meadows	listed (1978)	78000371	3010, 3011, 3012, 3013, 3014, and 3015	1925-1949

a As noted in chapter 3, this segment was incorrectly included in the 1979 wild and scenic river eligibility study and will be removed from the wild and scenic river corridor upon implementation of the *Tuolumne River Plan*.

WSR = Wild and Scenic River; NRHP = National Register of Historic Places; NRIS = National Register Information System; NHL = National Historic Landmark

Tioga Pass

Two buildings at Tioga Pass, the entrance and comfort stations, are listed in the NRHP under criterion *c* for contributions to local architecture, with a period of significance from 1925 to 1949.

The Tioga Pass entrance station (also known as the Tioga Pass ranger station, NPS building 3200) was listed in the NRHP in 1978. Built in 1931 in conjunction with the realignment of Tioga Road, it was the first rustic stone building the NPS built in the Tuolumne Meadows/Tioga Pass area, and it set a precedent for use of that style. It is locally significant for 20th century architecture and social and humanitarian historic themes. The second building, the Tioga Pass comfort station (NPS building 3203), and entrance gates at Tioga Pass were added in 1934 and built in the same rustic stone style using Civilian Conservation Corps (CCC) labor. The Tioga Pass comfort station and the stone piers of the entrance gates were also listed in the NRHP in 1978 (NPS, Greene 1987a).

Historic Resources in the Dana Meadows Area

Several pioneer cabins or cabin ruins have been documented along the lower Dana Fork within the river corridor. The *Historic Resource Study, Yosemite: The Park and its Resources* (NPS, Greene 1987a) describes one of these, called the Dana Fork cabin, as an old sheep camp cabin on the Dana Fork. It is a one-room log structure with deteriorated walls and a collapsed roof, which was standing prior to 1925, and probably housed a shepherd or miner. Another building (Wilderness Historic Resources Survey [WHRS] building 32) is near a sheep corral (WHRS structure 89) on Parker Pass Creek (NPS, Snyder 1995b). The 1988 Wilderness Historic Resources Survey report (NPS, Snyder et al. 1989a) describes another structure (WHRS building 2), north of the old Mono Trail. This rectangular log structure has no doors, windows, or roof. It appears to be unfinished and might have been intended for use as a cache. Several tree blazes (a mark, usually carved, to indicate boundaries or trails) are also located within and near the lower Dana Fork (NPS, Snyder et al. 1989a).

Other historic structures and features along the upper Dana Fork, which will be outside the river corridor boundary if the proposed technical correction to the corridor boundary is approved, are an unfinished, collapsed wooden building (WHRS building 16), a sheep fence or counting gate (WHRS structure 39), and multiple tree blazes (NPS, Snyder et al. 1990; NPS, Snyder 1995b).

By the mid-1980s, historic-era resources in wilderness were rapidly deteriorating and in danger of being permanently lost (NPS, Snyder et al. 1989a; NPS, Snyder 1995b). Wooden structures were typically collapsed or deteriorated. Tree blazes were partially obscured by bark overgrowth, and some trees had fallen. Trail tread of historic but abandoned trail segments was no longer evident in some places, and trail corridors were detectable only by blazes or cairns (NPS, Snyder 1995b).

A number of additional historical resources were documented during the late 1980s and 1990s (NPS, Snyder et al. 1989a, 1990; NPS, Snyder 1995b). Current conditions for these resources are not known, but they are assumed to be somewhat more deteriorated from natural processes than they were when first documented. Some of these historical resources have already disappeared (NPS, Snyder 1995b). The subsurface archeological integrity at most historic sites is unknown.

Historic Properties in the Tuolumne Meadows Area (Tuolumne Meadows and Lower Dana Fork Segments)

Tuolumne Meadows Historic District

The Tuolumne Meadows Historic District was determined eligible for listing in the NRHP in 2007. The district is approximately 3.2 miles long by 1.0 mile wide and includes all of the historic development dating from 1885 to 1961 within Tuolumne Meadows and its immediate environs (figure 9-12). The historic district overlies (and in some areas extends beyond) portions of both the Tuolumne Meadows segment and the Lower Dana Fork segment of the wild and scenic river corridor. The historic district is delineated by the official wilderness boundary established in 1984, and consists of all the area within the wild and scenic river corridor that is not included in wilderness (NPS, 2007t).

The Tuolumne Meadows Historic District is locally significant under NRHP criteria *a* and *c*. Under criterion *a* (association with historic events or broad patterns of history), the historic district reflects the emergence of recreational tourism in California's high mountains and the development of a physical infrastructure to support this use. The historic district is also significant under criterion *a* for its association with early NPS master planning, and for its association with the CCC and other Depression-era relief programs. Under criterion *c* (embodying distinctive characteristics of a type, period, method of construction or the work of a master), the Tuolumne Meadows Historic District is significant because it includes outstanding examples of park rustic style architecture and naturalistic landscape architecture, styles that the NPS used extensively during the 1920s and 1930s and which have come to be recognized as the hallmark style for development in natural areas where the preservation of scenic beauty was desired (NPS 2007t).

The Tuolumne Meadows Historic District period of significance extends from 1885 to 1961. Although development has been ongoing since the period of significance ended, subsequent changes are compatible with the historic character and uses within Tuolumne Meadows and do not significantly affect the overall integrity of the historic district (NPS 2007t).

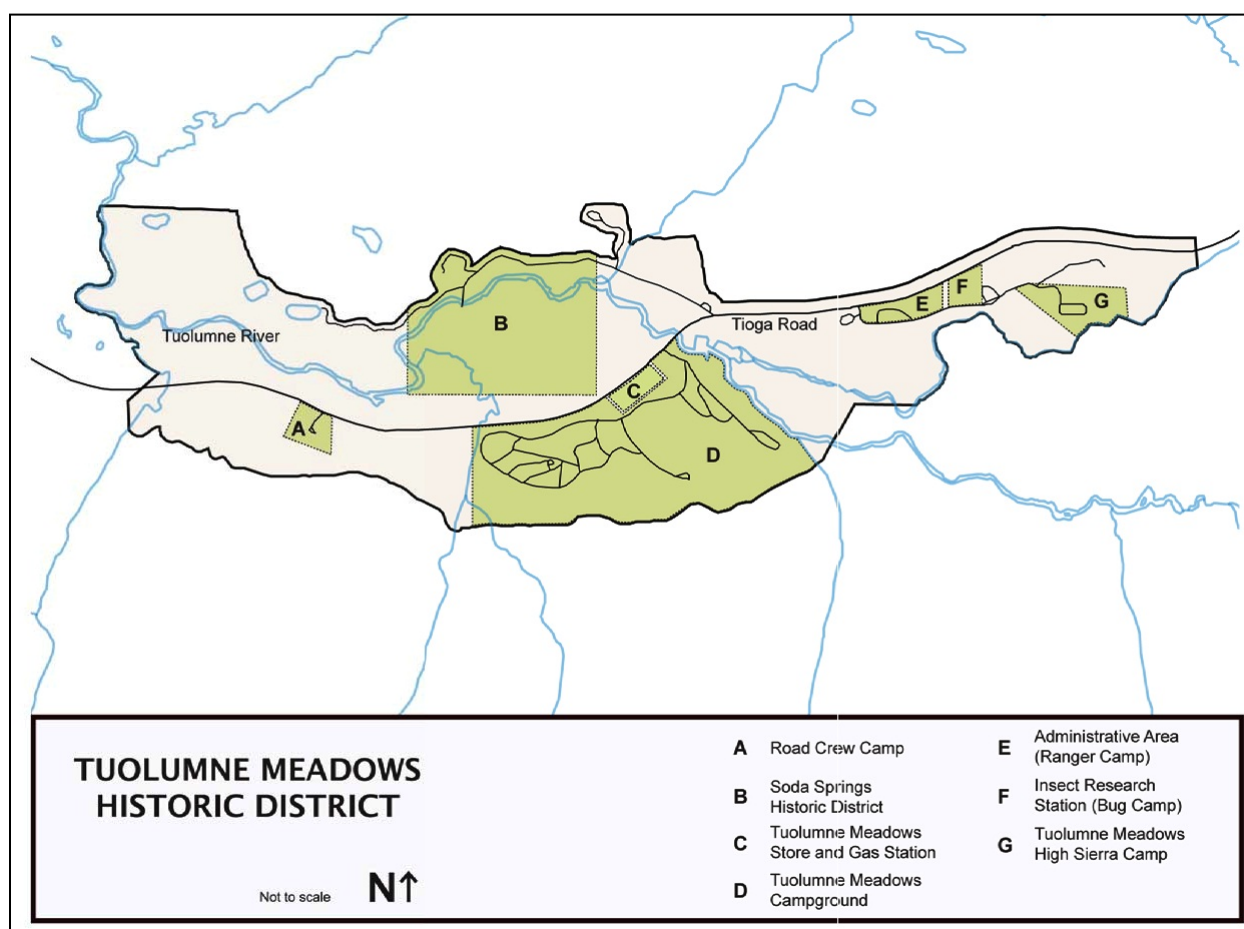


Figure 9-12. Tuolumne Meadows Historic District (NPS 2007t). Developed areas are shown in green.

Contributing Resources to the Tuolumne Meadows Historic District

Only the contributing resources to the Tuolumne Meadows Historic District (including individually NRHP-listed historic properties) that would be impacted by the proposed actions are described below.

Natural Systems and Features

Natural systems and features are defined as the natural conditions that have influenced or defined the development and resulting form of the cultural landscape. As one of the largest subalpine meadow complexes in the Sierra Nevada, the natural systems and features associated with the Tuolumne Meadows Historic District have contributed significantly to the cultural development of the landscape. The meandering streams, wildflower-studded meadows, subalpine forests, glacially polished domes, and expansive vistas have all influenced the processes and patterns of settlement and landscape interaction. The main natural features are essentially the same as those first encountered by Euro-American settlers during the 19th century and described in 1890 by John Muir, who noted the relationship between the distant backdrop of sublime mountains and the gentle, picturesque foreground of meadow, with a middleground of shadowy and nondescript forest separating the two.

Land Use

Many of the recreational facilities that the NPS introduced or expanded during the period of significance were concentrated within clusters on the periphery of the meadow to minimize harm to fragile ecosystems and to conserve both its natural and scenic values. The result of this clustering is a village-like aggregation of tent cabins and similarly ephemeral structures. Despite being temporary in nature architecturally, these structures have inspired cultural traditions that contribute as much or more to their significance as their architectural or

landscape design. The unique physical characteristics of these structures, including their cluster arrangement, spatial organization, and even their sparse simplicity and ephemeral nature, all contribute to their significance. While many of the cabins have repeatedly been altered, the land use associated with these structures and their landscapes remains compatible with historic patterns and is, therefore, an important character-defining feature of the overall historic district.

Circulation

Circulation is defined as the system of roads, trails, and associated physical structures that conduct movement through a landscape. The Tuolumne Meadows Historic District developed along one of the major circulation corridors traversing the Sierra Nevada. It also represents a historic nexus within an extensive system of trails that radiate in every direction through these mountains. Many of these trails represent routes used in precontact times by native peoples (see the “American Indian Traditional Cultural Resources” section later in this chapter for a further discussion of the trail system). The current Tioga Road follows the most important of these routes for much, though not all, of its present alignment. Nearly all of the trails now extant in the historic district were present during the period of significance, and most were used, if not actually constructed, by the U.S. Cavalry sometime between 1891 and 1913, and probably during the years of its most intensive patrol activity in and around Tuolumne Meadows between 1903 and 1906.

Circulation features that contribute to the Tuolumne Meadows Historic District include the Old Tioga Road (1915), the Great Sierra Wagon Road (1883–1915, see below), the campground loop road (1934), the John Muir Trail (1938), the Glen Aulin/Pacific Crest Trail (pre-1906), Dog Lake trail (pre-1906), Elizabeth Lake trail (1934), and Tenaya Lake trail (1957–1959).

Tioga Road is the most visible and significant circulation corridor within the historic district. It is currently a highway that connects Highway 395 at Lee Vining on the east side of the Sierra Nevada to the Big Oak Flat Road (Highway 120) on the west side. Most development that has occurred in the historic district since the 1930s has been consciously oriented in reference to this highway.

The entire Tioga Road, including the portion through Tuolumne Meadows, was determined eligible for listing in the NRHP in February 2012. The portion of the Tioga Road Historic District included in the area of potential effect is described below.

Views and Vistas

Views and vistas are defined as an expansive prospect or a broad range of vision, which may be naturally occurring or deliberately created or enhanced. Attention to views and vistas has been an important guiding principle for much development in the Tuolumne Meadows Historic District, with vantage points carefully selected to maximize the aesthetically varied effect of broad open meadows, dark forests, and a distant background of sublime mountain crags. The natural vegetation patterns of Tuolumne Meadows provide the opportunity for expansive views. Views into the meadow have been maintained for over 70 years by mechanical removal of encroaching lodgepole pines. Additionally, the siting of all post-1920s development was guided by the principle of not obstructing or competing with naturally occurring views and vistas. Reducing human visual impacts on the environment was a key reason for realigning the Tioga Road and eliminating all camping inside the meadow. Building locations and circulation patterns have been designed subsequently to take advantage of the scenic opportunities of this landscape while remaining as unobtrusive as possible.

Contributing views include high panoramic views of Tuolumne Meadows, views into and from within Tuolumne Meadows, and views from Tioga Road. The important visual relationships between natural features of Tuolumne Meadows and its adjacent developed areas remain largely intact. Although lodgepole pine encroachment has negatively affected the open character of some of the views into the meadows, most of the original scenic opportunities remain unobstructed due to efforts to remove encroaching conifers. Volunteers

under the direction of the NPS removed over 70,000 sapling conifers from 2006 to 2007 alone. The views and vistas landscape characteristic contributes significantly to the setting and feel of the Tuolumne Meadows Historic District.

Historic Buildings and Structures

Building character in the Tuolumne Meadows Historic District ranges from large, boulder-faced, historic park rustic architecture to seasonal, light, canvas-roofed structures. Relatively simple but otherwise permanent wood-framed structures are also common throughout the historic district. Most of these buildings are rustic and meant to blend unobtrusively into their natural settings, but they lack the careful craftsmanship and architectural detailing of the typical park rustic style.

However, a number of buildings in the Tuolumne Meadows Historic District are significant examples of the historic park rustic style and were designed to minimize the visual impact of constructed development. The CCC built some of the more distinctive and architecturally significant buildings in Tuolumne Meadows, often using site-sourced materials. The rustic style was perfectly suited for the patient handiwork of the CCC and benefited from such labor being readily available during the Great Depression. These buildings include the old visitor contact station, the three original campground comfort stations, and the original Road Crew Camp (Road Camp) complex. All of these buildings have been listed in the NRHP (NPS, Montague 2007s).

NRHP-listed buildings and structures within the Tuolumne Meadows Historic District include the CCC-era mess hall, showerhouse, and four bunkhouses at Road Crew Camp; the old visitor contact station and three rustic comfort stations at Tuolumne Meadows campground; and the Tuolumne Meadows Ranger Station at the administrative area (Ranger Camp). The Soda Springs Historic District, which is a component landscape within the Tuolumne Meadows Historic District, includes one National Historic Landmark property (Parsons Memorial Lodge) and two NRHP-listed properties: McCauley Cabin and the Soda Springs enclosure. A full list of buildings and structures that contribute to the Tuolumne Meadows Historic District, as well as individually NRHP-listed buildings in the district, is provided in table 9-32.

Tuolumne Meadows Historic District is a parent landscape that contains the following eight areas:

- one component landscape, the Soda Springs Historic District (described later in this section)
- six developed areas that contain both contributing and noncontributing features to the historic district, including fifty contributing buildings and structures and thirteen contributing circulation features (described below)
- one developed area, the Tuolumne Meadows stables and pack station, that contains no contributing buildings or structures

The six developed areas with contributing buildings and structures are described below.

Historic Buildings and Structures at Road Crew Camp (Road Camp)

The CCC built the Road Crew Camp (commonly known as Road Camp) in 1934 to provide maintenance and administrative facilities for the higher elevations of the Sierra Nevada. The development cluster retains its original six structures: the original mess hall building (now the Tuolumne Meadows visitor center), the shower house, and four bunkhouses. The mess hall, shower house, and four bunkhouses (buildings 3010, 3011, 3012, 3013, 3014, and 3015) were listed on the NRHP in 1978 (number 78000371) for their contributions to social history (criterion *a*) and architecture (criterion *c*), with a period of significance from 1925 to 1949. Four tent cabins are also contributing resources.

The mess hall structure is an excellent example of 1930s park rustic architecture, with its rubble-stone masonry foundation, main fireplace chimney, front porch floor and steps, and redwood board-and-batten siding. The

four identical bunkhouses and a shower house are clustered in the trees east of the mess hall structure. These were the first structures to be built in the Road Crew Camp area and are fine examples of park rustic style architecture. Built during the CCC era, all are wood-framed structures with rubble-masonry foundations and redwood board-and-batten siding. A large rubble-masonry chimney distinguishes the shower house. The bunkhouses still provide housing for seasonal NPS employees and retain most of their original materials and details of workmanship.

Table 9-32.
Summary of Contributing Buildings and Structures within Tuolumne Meadows Historic District, including Soda Springs Historic District

Tuolumne Meadows Historic District	Contributing Building or Structure (and NPS Building/Structure Number)
Road Crew Camp (Road Camp)	<ul style="list-style-type: none"> ▪ Mess hall (current visitor center/3010)^a ▪ 4 bunkhouses (3011, 3012, 3013, 3014)^a ▪ Shower house (3015)^a ▪ 4 tent cabins (3071, 3072, 3073, 3074) ▪ Explosives cache (RC1) ▪ Water fountain (RC6) ▪ Tioga Road culvert and stone headwall
Tuolumne Meadows campground	<ul style="list-style-type: none"> ▪ Contact station (3005)^a ▪ 3 CCC rustic comfort stations (3021, 3022, 3023)^a ▪ Rustic comfort station (3024) ▪ 4 Mission 66 comfort stations (3076, 3077, 3078, 3079) ▪ Dana campfire circle ▪ Tuolumne River bridge (Tioga Road bridge) (TC3) ▪ Original Meinecke campground circulation
Tuolumne Meadows store and gas station	<ul style="list-style-type: none"> ▪ Store, post office, and restaurant (SG-5) ▪ Gas station (SG2)
Tuolumne Meadows Lodge and High Sierra Camp	<ul style="list-style-type: none"> ▪ Bath house (TMV002) ▪ Kitchen/dining Hall (TMS003) ▪ 66 guest tent cabins (4-12 and 14-70)^b ▪ Storage shed (TME030) ▪ Campfire circle (HSC-6)
Administrative area (Ranger Camp)	<ul style="list-style-type: none"> ▪ Barn (3003) and tack shed (3004) ▪ Storage shed (3018) ▪ Naturalist cabin (3001) ▪ Ranger station (3000)^a ▪ Patrol cabin (3002) ▪ Shower house (3020) ▪ 7 tent cabins (3030, 3032, 3037, 3038, 3039, 3040, 3041) ▪ Weather station (AA7)
Insect research station (Bug Camp)	<ul style="list-style-type: none"> ▪ Kitchen/mess hall (3083) ▪ Comfort station (3049) ▪ 2 office/shed structures (3085 and 3086)
Soda Springs Historic District	Contributing Building or Structure (and NPS Building/Structure Number)
Soda Springs Historic District	<ul style="list-style-type: none"> ▪ Parsons Memorial Lodge National Historic Landmark (3081)^a ▪ Soda Springs enclosure (HS-07)^a ▪ McCauley Cabin (3082)^a ▪ Bruin Baffle (HS-7C) ▪ Soda Springs bridge pier and abutments (SS-05)

a Contributing building or structure in **bold type** if NRHP-listed.

b There are 69 guest tent cabins at Tuolumne Meadows Lodge. Of these, 66 contribute to the historic district.

Abbreviations: CCC = Civilian Conservation Corps; NPS = National Park Service; NRHP = National Register of Historic Places

Historic Buildings and Structures at Tuolumne Meadows Campground

The Tuolumne Meadows campground covers approximately 140 acres and is located just south of Tioga Road and west of the confluence of the Lyell and Dana Forks of the Tuolumne River. Developed between 1931 and 1934 in response to increasing recreational needs in the Tuolumne Meadows area, the design incorporated E. P. Meinecke's principles of campground planning and landscape protection. A series of one-way roads and individual spurs define vehicular and camping use. Contributing features include the original Meinecke campground circulation, the Tioga River bridge (also known as the Tuolumne Meadows bridge in historic

records, or Tioga Road bridge elsewhere in this document), the four original comfort stations built in the rustic architectural style, the four Mission 66 comfort stations, the Dana Campfire Circle, and the Tuolumne Meadows campground contact station. Four of these buildings: the contact station and three rustic comfort stations (buildings 3005, 30021, 3022 and 3023) were listed on the NRHP in 1978 (79000370) for their contributions to social history (criterion *a*) and architecture (criterion *c*), with a period of significance from 1925 to 1949.

Since the end of the period of significance for the historic district, alterations to the campground have included periodic maintenance and minor improvements that are compatible with its historic design and use. All buildings listed as contributing have been assessed and found to retain the majority of their original materials and character-defining features (NPS 2007t).

Historic Buildings and Structures at Tuolumne Meadows Store and Gas Station

Located in the forested buffer between the Tioga Road and the campground, the Tuolumne Meadows store and gas station (referred to as the “public fuel station” elsewhere in this document) provide food, supplies, outdoor equipment, and services to visitors. Although other structures have been added behind the two contributing buildings, the store, the gas station, and the associated parking areas have changed little since the date of their construction and contribute to the Tuolumne Meadows Historic District. Both the store and the gas station are contributing and have been found to retain the majority of their original materials and character-defining features. Noncontributing resources associated with the store and gas station include the store comfort station, the store laundry, the shower house and comfort station, the store tent cabins, the gas station utility and telephone shed, the soil and groundwater remediation shed, and the gas station cabins.

The current Tuolumne Meadows store was constructed in 1940 shortly after the realignment of the Tioga Road. The original store had been located on the old Great Sierra Wagon Road near the government administrative area (Ranger Camp). A simple canvas-roofed porch protects the doors to the general store, post office, and the grill. The translucent canvas roof is removed during the winter, thus allowing the entire structure to fill up with snow.

The gas station, which was built in 1959, is a compact structure located at the rear of its site west of the store and facing the Tioga Road. In addition to the attendant’s office, it contains a small repair shop, restrooms, and a sales area used for the mountaineering shop/school. The fuel pumps are arranged in front of the station on the Tioga Road side. Originally, this building was a full-service gas station with a garage occupying what is now the mountaineering shop/school. Inside the building, vestiges of the original garage can still be seen, including a below-grade car jack and the original merchandise display shelves.

Historic Buildings and Structures at Tuolumne Meadows Lodge and High Sierra Camp

Tuolumne Meadows Lodge and High Sierra Camp were recommended eligible for listing in the NRHP as a historic district in 1989 and 2004, respectively (Kirk and Palmer 2004). The SHPO concurred with the determination of eligibility in 2004. This recommendation was subsumed into the determination for eligibility for the Tuolumne Meadows Historic District in 2007 (NPS 2007t), where it is included as a developed area within the parent Tuolumne Meadows Historic District.

Buildings and structures at the camp are simple, in the tradition of the High Sierra Camps. Except for the kitchen, storage building, and bathhouse, most of the structures are roofed with canvas stretched over permanent metal frames. The dining and reception hall structure has a timber frame with canvas walls and roof, set on a slightly elevated concrete slab. The permanent kitchen and storage structures are built of conventional wood frame construction.

There are currently 69 guest tent cabins at the Tuolumne Meadows Lodge and High Sierra Camp. Of these, 66 are contributing structures and 3 are recent additions located in an area not historically used for this purpose. The employee tent cabins do not contribute to the historic district.

In 1983, the entire complex underwent maintenance after a major flood. At that time, all the wood platforms and framing for the tent cabins were replaced with concrete slabs and steel poles, and many cabins were reoriented or moved slightly to break up the spatial arrangement. Despite the modifications, the cabins still conveyed the historic significance of the camp because they retained the character-defining material (canvas), feeling, association, setting, and design (NPS 2007t). The kitchen/dining hall and bathhouse have had only modest alterations since the period of significance. The Tuolumne Meadows Lodge and High Sierra Camp is in good condition overall (NPS 2007t).

Historic Buildings and Structures at the Administrative Area (Ranger Camp)

The administrative area, which was developed along the Great Sierra Wagon Road toward the eastern end of Tuolumne Meadows, was constructed to provide maintenance and administrative services for the general area. Historically known as the government administrative area, or simply the administrative area, it has since become known more commonly as Ranger Camp. Contributing features include the original five buildings built in 1924: the ranger station, naturalist cabin, patrol cabin, barn, and shower house. The ranger station (building 3000) was individually listed on the NRHP (78000370) in 1978, in the same listing as the buildings and structures at Tuolumne Meadows campground (see above).

In addition to the five original buildings, seven tent cabins, a weather station, a tack shed, and a storage shed contribute to the eligibility of the historic district. The historic buildings are at the western end of the cluster of buildings. The NPS stable is also located in this area. Over the years, other buildings and structures have been added to the administrative area (Ranger Camp) and include tent cabins used for park housing. Although these structures are noncontributing because they were built after the period of significance, most are compatible with the historic character of the landscape cluster and do not detract from its significance. All structures listed as contributing have been assessed and found to retain the majority of their original materials and character-defining features.

Historic Buildings and Structures at the Insect Research Station (Bug Camp)

The Insect Research Station, more commonly known as Bug Camp, was constructed in response to a lodgepole needle miner (*Coleotechnites milleri*) infestation that occurred during the 1950s. The research station is located to the east of the administrative area. Aside from a slightly steeper south-facing slope, the terrain and subalpine forest of the Insect Research Station is similar to that of the administrative area. Tent cabins and other 1950s buildings are clustered among pines and boulders and are accessed through a paved parking lot off the former Great Sierra Wagon Road. Of the original camp, the mess hall, comfort station, and two office/shed structures date to the period of significance (NPS, 2007t).

Great Sierra Wagon Road (including portions of the Old Tioga Road)

The Great Sierra Wagon Road, portions of which are also known as Old Tioga Road, passes through both the Tuolumne Meadows Historic District and the Soda Springs Historic District and is considered a contributing element to both districts. Consistent with the determination of eligibility for the Tuolumne Meadows Historic District (NPS 2007t), the segments of the historic road within the APE for this project are referred to simply as the Great Sierra Wagon Road for clarity.

Constructed to supply active mines near the Sierra Nevada crest, the road was completed in 1883 and was used less than a year before the Great Sierra Consolidated Silver Mining Company folded in 1884. However, the road was frequently used by herders, scientific parties, and tourists, largely but not entirely without wheeled vehicles. The road deteriorated until Stephen Mather, the first NPS director, bought it and deeded it to the NPS

in 1915; the road was subsequently renamed Tioga Road (NPS 2007t). It became a trans-Sierran route in 1911, when the state completed a road down Lee Vining Canyon. In the 1930s, two major sections of the road were realigned, but a 21-mile section of the old wagon road was still in use until 1961, when the present-day Tioga Road was dedicated (NPS, Greene 1987a; NPS, Hart 1976a).

Soda Springs Historic District

Soda Springs Historic District is a component landscape within the parent Tuolumne Meadows Historic District, and was determined eligible for listing in the NRHP in 2007 (NPS 2007u). Soda Springs Historic District is significant at a local level under NRHP criterion *a* for its association with the contextual theme of outdoor recreation and environmental preservation, and under criterion *c* for its association with the firm of Maybeck and White, whose architecture, landscape design, and construction became an early model for park rustic architecture and naturalistic landscape architecture. The period of significance for this historic district is 1885 to 1937, beginning with the year John Baptiste Lambert homesteaded the land and ending with the construction of Bruin Baffle (a two-story standalone structure), the last substantial addition made by the Sierra Club (NPS, Montague 2007s).

Soda Springs Historic District derives its name from several mineral springs that lie on the edge of a granite bench just north of the Tuolumne River. The district, which comprises about 140 acres on the northern edge of Tuolumne Meadows, was the only portion of Tuolumne Meadows to be homesteaded. John Baptiste Lambert established a homestead claim in 1885, and the district boundary follows the original boundaries of Lambert's quarter-section homestead, adjusted for the wilderness boundary, which excludes several acres on the north and northwest sides of the original tract (NPS 2007u). A succession of three private owners—Jacob Lambert (John's brother), the McCauley family, and the Sierra Club—followed Lambert's occupancy before the property finally became part of Yosemite National Park in 1973, when the NPS bought the land from the Sierra Club.

The Soda Springs Historic District includes one National Historic Landmark property (Parsons Memorial Lodge) and two individually-listed NRHP properties: McCauley Cabin and the Soda Springs enclosure.

Soda Springs Historic District is in good condition, with a low level of impacts overall. Disturbances include changes in historic vegetation patterns, informal trails, and deferred maintenance of stone bridge piers and abutments (NPS 2007u). Preservation work was carried out at Parsons Memorial Lodge in 1993 and at Bruin Baffle in 2003. McCauley Cabin, which had been altered for adaptive use, was rehabilitated in 1996, and the Soda Springs enclosure, which had deteriorated, was restored in 2002 (NPS 2007u).

Contributing Resources to the Soda Springs Historic District

Some historically significant landscape characteristics, including natural systems and features (geomorphology, ecology, hydrology, and native vegetation) and spatial organization are not described because they would not be affected by the proposed actions. For instance, the determination of eligibility for the Soda Springs Historic District (NPS 2007u) notes that the natural systems and features of the district area intact; the *Tuolumne River Plan* alternatives would not impact this. Similarly, general spatial organization of the district would not be affected by this planning effort because contributing features at Soda Springs would remain at their historic locations and would retain their historic uses. Contributing features that might be impacted by *Tuolumne River Plan* alternatives are described below.

Circulation

A portion of the historic Great Sierra Wagon Road and the Pacific Crest Trail/Glen Aulin trail contribute to the Soda Springs Historic District. The Great Sierra Wagon Road is discussed in more detail under Tuolumne Meadows Historic District, above, and both features are described in the determination of eligibility for the Tuolumne Meadows Historic District (NPS 2007t).

There are two additional circulation features that contribute to the Soda Springs Historic District: the Soda Springs trail and the road to Parsons Memorial Lodge. The Soda Springs trail leads from the area just south of Parsons Memorial Lodge to the Soda Springs enclosure, and then on to the Pacific Crest Trail/Glen Aulin trail. The road to Parsons Memorial Lodge leads to an area that the Sierra Club used as a small parking lot southeast of the Soda Springs site. When the NPS purchased the property in 1973, the road was gated and its use was restricted to administrative functions.

Historic Buildings and Structures

Parsons Memorial Lodge National Historic Landmark. The Soda Springs Historic District includes Parsons Memorial Lodge, which was listed in the NRHP (number 79000283) in 1979 and was designated a National Historic Landmark in 1987 for its national significance in architecture.

Built in 1915, Parsons Memorial Lodge is one of the earliest rustic stone buildings in a national park. Situated at an elevation of 8,640 feet at the northern edge of Tuolumne Meadows and designed in the office of internationally renowned Berkeley architect Bernard Maybeck, Parsons Memorial Lodge was built to withstand the harsh environmental conditions encountered at this altitude “with the highly expressive use of simple natural materials indicative of the Bay Area architectural tradition” (NPS, Harrison, 1985g).

Parsons Memorial Lodge has been determined to be an outstandingly remarkable cultural value of the Tuolumne Wild and Scenic River corridor because it relates to the commemoration of the significance of this area as a place inspiring conservation activism on a national scale.

McCauley Cabin and Soda Springs Enclosure. The springs were enclosed in a log structure by John Baptiste Lumbert in the late 19th century. This log structure, known as the Soda Springs enclosure, is listed in the NRHP (number 79000282) for its association with Lumbert (criterion *b*) and the themes of science, exploration, and settlement. Other contributing historic features stand nearby, including McCauley Cabin and Parsons Memorial Lodge National Historic Landmark (see below). McCauley Cabin, also known as the Caretaker’s Cabin, was listed in the NRHP (number 77000359) in 1977 for its contributions to architecture, with a period of significance from 1900 to 1924.

Other Historic Buildings and Structures

See table 9-32, above, for a list of contributing and NRHP-listed structures within the Soda Springs Historic District. In addition to the individually NRHP-listed structures noted above, the district includes several additional structures and small-scale features introduced by the Sierra Club, including Bruin Baffle, a two-story standalone structure designed to prevent bears from accessing stored food, and a footbridge that crosses the Tuolumne River on the flat meadow floor directly south of Parsons Memorial Lodge. The footbridge, which was built in the summer of 1915, originally had a simple triangular truss structure with a center pier and masonry abutments of recessed mortar joints, similar to the masonry of the lodge. Log girders have been replaced with steel and thick wood plank decking, but the abutments and piers of this footbridge are historic. The center pier of the footbridge continues to rest on a large boulder midstream (NPS, Montague 2007s).

Tioga Road Historic District

The Tioga Road Historic District was determined eligible for listing in the NRHP in February 2012. The district encompasses 47 miles of road entirely within Yosemite National Park, beginning where Tioga Road intersects Big Oak Flat Road at Crane Flat and ending at the gate posts of the Tioga Pass entrance station. The period of significance for the Tioga Road is 1932–1961, from when construction started to when construction on the entire road was completed.

Tioga Road is significant on a state level under NRHP criterion *a* in the area of transportation for its associations with the development of automobile tourism and scenic preservation. Tioga Road is a historic

designed park landscape consisting of a linear system of features (horizontal and vertical alignments, cut and fill) and structures (bridges, culverts, retaining walls, and curbs) unified by design and function. It is a major park road that was designed and improved through the collaboration of the NPS and the Bureau of Public Roads to accommodate greater visitor access while still preserving Yosemite's natural scenery.

Tioga Road is also significant on a national level under NRHP criterion *a* in the area of conservation for its important role in galvanizing the conservation movement in the wake of Mission 66 park development. The Tioga Road project was the center of a major public controversy over appropriate road development in national parks during the 1950s, with prominent conservationists and conservation groups questioning the impacts of design standards and route of Tioga Road on scenic and natural resources. From a broader perspective, the controversy also questioned the appropriateness of road access to visit and experience wilderness.

The present alignment of the road within the area of potential effect was introduced between 1932 and 1934, when Tioga Road was reconstructed to mitigate its impact on Tuolumne Meadows and to take greater advantage of the panoramic views available to motorists traveling along the meadow's edge. Subsequent construction has modified the road in incidental ways (e.g., resurfacing, shoulder widening, and turnout insertion) but has never substantially altered the actual alignment in the Tuolumne Meadows area.

Contributing Resources to the Tioga Road Historic District (within the River Corridor)

Tioga Road was developed as a modern, high-quality road that was neither rough nor winding and blended built features with the existing natural surroundings. Contributing resources to the Tioga Road Historic District include the road itself and all associated landscape characteristics and structural elements built during the period of significance. Landscape characteristics include circulation patterns and features, topography and grading, vegetation, spatial organization, land use, natural features, and views and vistas. Contributing structural elements include features such as bridges, culverts, retaining walls, and curbs. The landscape characteristics and engineering structures that may potentially be affected by this planning effort are as detailed below.

Some historically significant landscape characteristics, such as land use, setting, natural features, spatial organization, and vegetation, are not described because they would not be affected by the proposed actions. For instance, land use would not be affected because the historical use of Tioga Road for transportation and recreation would remain. Similarly, general vegetation characteristics and natural features would not be affected by this planning effort because much of the development in Tuolumne Meadows was already in place during the period of significance. Proposed relocation and construction of facilities would not have an appreciable impact on natural features viewed from the road.

Circulation

Circulation patterns and features of the road have overall changed very little since the period of significance. Contributing circulation features that contribute to the significance of the road include historic intersections, parking areas, and turnouts. Noncontributing features include intersections, parking areas, and turnouts that post-date the period of significance or in which later alterations have negatively affected their integrity. Parking areas and turnouts are important circulation features of Tioga Road from Tuolumne Meadows to Tioga Pass (NPS 2011d).

Parking. There are 15 formal and informal parking areas documented between Cathedral Creek and Tioga Pass. All but two are paved. Nine of these provide trailhead access or access to services at Tuolumne Meadows. Based on their location and design, 10 of the 15 parking areas likely date to the period of significance for Tioga Road. There are five contributing parking areas within the area of potential effect: one each at Lembert Dome, the Tuolumne Meadows campground entrance, the current visitor center (the CCC mess hall at Road Crew

Camp), the Tuolumne Meadows store/grill, and two near at Pothole Dome. The other parking areas at Tuolumne Meadows, including the wilderness center parking area, the gas station area, and parking at the administrative area at Road Crew Camp are non-contributing because they were likely developed after the period of significance (NPS 2011d).

Turnouts. A survey conducted in support of the Tioga Road Determination of Eligibility (NPS 2011d) documented 129 turnouts from Cathedral Lakes trailhead to Tioga Pass. These turnouts are situated to take advantage of scenic vistas or provide trailhead access. All but two turnouts are either dirt or gravel. Based on design characteristics and location, 55 of the 129 turnouts are probably from the historic period. Some of these 55 are probably not original to the 1930s Tioga Road construction but were created later in the historic period. The remaining 74 turnouts were likely created after the period of significance as a result of visitor use, where visitors have informally created parking along the road shoulders.

Topography

The straight and level course of the road through Tuolumne Meadows and Dana Meadows, with moderate grades in between, is a defining characteristic of the road. The alignment and the grading of the road reflect the natural topography; however, its construction required considerable human manipulation to limit steep grades for a consistent and safe travel speed. Through Tuolumne Meadows, the road is a causeway constructed on fill with nearly flat profiles, areas of which were extended to become turnouts.

Views and Vistas

Tioga Road, which was designed for leisure travel, is considered one of the most scenic routes in California. It is a designated national and state scenic byway. The road provides close up views of spectacular scenic vistas and natural features, including expansive meadows, wide views of the Sierra Nevada crest and granite domes, and views of the Dana Fork and main stem of the Tuolumne River. The turnouts in the planning area were designed for viewing as well as trailhead access.

Historic Buildings and Structures

Bridges. The Tuolumne Meadows bridge (which is known as the Tuolumne River bridge in the Tuolumne Meadows Historic District documentation and which is referred to the Tioga Road bridge elsewhere in this document) was completed in 1934 and is listed on the Historic American Engineering Record (No. CA-109). The 87-foot-long and 34-foot-wide bridge is supported by rubble granite masonry abutments and two rubble granite masonry piers, which divide the structure into three spans (DOE 3-38). Although modern metal guardrails have been installed on the bridge, it retains its historic integrity and is a contributing resource of the historic district.

Retaining Walls. There are 10 retaining walls between Pothole Dome and Tioga Pass; three of these contribute to the historic district. Two of the walls are located on Tioga Road at the Tuolumne Meadows Campground and at the entrance to Tuolumne Meadows Lodge and High Sierra Camp. These probably date to the original 1930s road construction and were used to retain steep sections of fill. The third contributing retaining wall is a cut stone wall with stone stairs located at the parking lot of the Tuolumne Meadows store. This feature was probably built in 1953 when the parking lot at the store was enlarged to accommodate more vehicles (NPS 2011d).

Culverts. A survey conducted in support of the Tioga Road Historic District determination of eligibility for the NRHP (NPS 2011d) documented 59 culverts within the area of potential effect between Pothole Dome and the “little blue slide” area. Forty-eight of these culverts are considered contributing resources to the Tioga Road Historic District. There are four types of historic culverts in this road segment: corrugated metal pipes with (1) no end treatments, (2) with a stone headwall, (3) with a stone headwall and wingwall(s), and (4) a concrete box with stone headwall and wingwalls. The use of stone masonry for culverts was intended to blend with the

natural setting. The detailed masonry work on culvert headwalls, sluiceways, and retaining walls exhibit a high quality of construction.

The contributing culverts include a box culvert with stone lintel and stepped wingwalls at Budd Creek, which is typical of a culvert type found in the 1930s eastern and western segments of the Tioga Road. At Unicorn Creek, there are two reinforced concrete box culverts with stone lintels and stepped wingwalls.

Historic Properties in the Grand Canyon Segment

Glen Aulin High Sierra Camp Historic District

Glen Aulin High Sierra Camp was determined eligible for listing in the NRHP as a historic district in 2004. The district is eligible under NRHP criterion *a*, thematically associated with tourism, recreation, and the preservation ethic in Yosemite, with a period of significance from 1927 to present. The Glen Aulin High Sierra Camp is considered significant in recreation and education as one of three remaining high-country camps whose establishment dates back to the earliest days of the NPS.

The High Sierra Camps began operation in 1916, when NPS Director Stephen Mather asked park concessioner Desmond Park Service Company (Desmond Company) to build mountain chalets at Tenaya Lake, Tuolumne Meadows, and Merced Lake. Mather believed this would attract people into the park's high country, thus supporting NPS management objectives to facilitate visitor travel through backcountry areas, provide an environment in which visitors could be instructed in the tenets of conservation, and clarify NPS conservation objectives to the public. The Desmond Company went bankrupt in 1917, and as a result, the camps closed the following year. In 1920, the Desmond Company reorganized as the Yosemite National Park Company, and the NPS requested that the High Sierra Camps be reopened. Park Superintendent Washington B. Lewis advocated their reestablishment to fill a need he saw for simple, inexpensive accommodations for park visitors that could be provided at minimum expense to the operator. As a result, the camps at Tenaya Lake and Tuolumne Meadows, both accessible by Tioga Road, were reopened as "hikers' camps."

The success of these camps prompted Superintendent Lewis to request that the Yosemite National Park Company expand the system to include sites not accessible by roads. He sent park naturalist Carl P. Russell on a pack trip into the Sierra to choose sites for five additional camps. In 1923, Russell chose five additional campsites at Little Yosemite Valley, Merced Lake, Tenaya Lake, Boothe Lake, and Glen Aulin. The camps were constructed in the mid-1920s; of these five High Sierra Camps, only two (Merced Lake and Glen Aulin) remain.

Contributing Resources to the Glen Aulin High Sierra Camp Historic District

The Glen Aulin Historic District is made up of 18 contributing and 3 noncontributing buildings. The contributing buildings include 15 canvas-and-frame seasonal buildings (tent cabins) and 3 permanent buildings (cookhouse, toilet, and storage shed) (Kirk and Palmer 2004, Attached Form 3). The tent platforms for the guest cabins and dining room are neatly aligned in an arc facing southwest, focused on the confluence of Alkali Creek with the Tuolumne River. A corral is sited on a gentle slope a short distance from Conness Creek (see figure 8-1). Additional landscape elements that may contribute to the district's historic significance have not yet been evaluated.

Other Historic Resources in the Grand Canyon Segment

The Grand Canyon of the Tuolumne is in remote wilderness and contains relatively few historic structures or buildings, although the majority of the trails in the canyon are both former American Indian trails as well as historic-era trails (Davis-King and Snyder 2010). Other resources include historic trail stonework, a log sheep bridge, tree blazes, and a rock cairn in Pate Valley (NPS, Snyder et al. 1989a, 1990).

Below O'Shaughnessy Dam Segments

Hetch Hetchy Area

Historic resources in the Hetch Hetchy area, which the NPS considers potentially eligible for the NRHP, are found in five discontinuous units clustered around Hetch Hetchy Reservoir in an area spanning roughly 6 miles by 6 miles. The largest unit is the O'Shaughnessy Dam area, which includes the dam, a tunnel on the north side of the reservoir that accesses the north-shore recreational trails, nearby City of San Francisco staff housing, and a campground. The other four units consist of the following component landscapes: the Miguel Meadow area (Miguel Meadow and associated buildings and structures), the Lake Eleanor Dam area (Lake Eleanor Dam and associated buildings and structures), Hetch Hetchy Road (including the park entrance station area), and the Lake Eleanor to Hetch Hetchy road and trail. Most of these areas fall outside of *Tuolumne River Plan* boundary, with the exception of parts of the O'Shaughnessy Dam landscape, the Lake Eleanor to Hetch Hetchy road and trail, and Hetch Hetchy Road.

Within the river corridor boundary, a residential area near O'Shaughnessy Dam houses a caretaker and maintenance staff in historic buildings. One-way road systems provide circulation in the housing and parking areas. The historic two-lane Hetch Hetchy Road provides public access to the dam from the west; a portion of this road is within the wild and scenic river corridor. The roadbed was initially built as the right-of-way for a railroad that was used to haul materials to construct the dam. The railroad was converted to a roadway for automobile use after the dam was completed, and the area was reopened for public enjoyment (NPS 2007h).

Environmental Consequences Methodology

As noted in the introduction to this analysis topic, any prehistoric or historic building, structure, object, site, or district that is included in, or is eligible for inclusion in the NHRP is termed a historic property and is managed for protection under the NHPA. The ACHP has issued regulations for the implementation of NHPA section 106, entitled *Protection of Historic Properties* (36 CFR 800). These ACHP regulations discuss the following types of effect under NHPA section 106 (see the introduction to this chapter for more detail): no historic properties affected, no adverse effect, and adverse effect.

Adverse impacts on historic properties occur when irreparable alterations of features or patterns, including demolition, diminish the overall integrity of the resource so that it no longer qualifies for the NRHP. Adverse effects under NHPA section 106 can be addressed with a good-faith effort to consider whether and how to avoid, minimize, or mitigate the effect. This may involve modifying the undertaking, imposing certain mitigation conditions, or other measures negotiated in consultation with the California state historic preservation officer (SHPO), traditionally associated American Indian tribes and groups, and the public. The park-specific programmatic agreement (included in appendix D) stipulates standard mitigation measures that can be used to address adverse effects, including recordation, salvage, interpretation, and reevaluation of the NRHP status of the various historic properties and historic districts within Yosemite National Park.

All proposed actions in the *Tuolumne River Plan* would be performed in accordance with NPS cultural resource management guidelines, and consultation with interested parties would occur in accordance with the park-specific programmatic agreement or as otherwise agreed to in consultation with SHPO. Measures to mitigate any adverse effects of proposed actions would be implemented in consultation with the SHPO and would be documented in a memorandum of agreement or the NEPA decision document for this plan. If the NPS, SHPO, affected American Indian tribes and groups (if appropriate), and the ACHP could not agree on measures to avoid or minimize adverse effects and were unable to negotiate and execute an alternate memorandum of agreement in accordance with 36 CFR 800.6(b), the effect would remain adverse.

In accordance with 36 CFR 800 criteria of effect, historic properties in the Tuolumne River corridor are analyzed qualitatively, based on existing knowledge about values and significant elements and modifications

that could be identified to alter character-defining features (features that qualify properties for inclusion in the NRHP). The proposed actions are assessed for the potential effect they might have on historic resources in designated Wilderness; the NRHP-eligible Tioga Road Historic District, NRHP-eligible Tuolumne Meadows Historic District, NRHP-eligible Soda Springs Historic District, NRHP-eligible Glen Aulin Historic District; NRHP-listed buildings and structures, including the Parsons Memorial Lodge National Historic Landmark (see table 9-31); and potentially NRHP-eligible resources in the Hetch Hetchy area. Actions specific to individual alternatives that would affect these historic properties are described under each alternative, below.

Environmental Consequences of the No-Action Alternative

The no-action alternative would be a continuation of current conditions and management, as described under chapter 8 and “Affected Environment,” above.

Various park projects and maintenance activities that take place in the Tuolumne River corridor that might affect historic-era resources would be subject to compliance with the NHPA section 106 review process, which is augmented by national and park-specific programmatic agreements among the NPS, the ACHP, and the National Council of Historic Preservation Officers or the California SHPO (NPS, ACHP, and NCSHPO 2008; NPS, SHPO, and ACHP 1999). Both agreements are included in appendix D.

Wild Segments

Historic-era resources in wilderness would continue to be managed and protected under current cultural resource management policies. Current policies allow some historic-era resources to deteriorate via natural processes (e.g., tree blazes); these resources would be documented and recorded according to the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), and NPS *Management Policies 2006* (NPS 2006g). Other historic resources would be stabilized, rehabilitated, or otherwise protected in accordance with NPS *Management Policies 2006* and wilderness management policies, and would be consistent with guidance in the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Glen Aulin High Sierra Camp Historic District

The design and spatial organization of the historic Glen Aulin High Sierra Camp would remain as it is today. Historic buildings and structures that contribute to the historic district would be retained and would continue to be managed and protected under current resource management policies.

Scenic Segments

Tioga Road Historic District

Historic resources along Tioga Road would be managed and protected under current cultural resource management policies. There has been little change in the road corridor since the period of significance. The road was designed to access outstanding views and scenery, and it would continue to function in this manner under current management. The intended relationship of the road to the natural topography and vegetation would remain essentially unaffected.

Visitor use of Tuolumne Meadows would be expected to intensify without additional management controls. It is possible that more noncontributing turnouts, created opportunistically by visitors looking for parking, could alter the design of the road. This would diminish the aspect of design integrity at specific locations but would not alter the integrity of the road as a whole. The NPS would continue to avoid adverse effects or would otherwise carry out appropriate mitigation to minimize potential impacts, in accordance with NHPA section 106 compliance processes, NPS *Management Policies 2006* (NPS 2006g), national and park-specific programmatic agreements (see appendix D), and other park policies.

Tuolumne Meadows Historic District and Soda Springs Historic District

Historic properties and contributing cultural landscape features would be managed and protected under current cultural resource management policies. The park would continue to avoid adverse effects or would otherwise carry out appropriate mitigation to minimize potential impacts, in accordance with NHPA section 106 compliance processes, NPS *Management Policies 2006* (NPS 2006g), national and park-specific programmatic agreements (see appendix D), and other park policies.

Natural Systems and Features: Under the no-action alternative, the general pattern of development throughout Tuolumne Meadows and the historic relationship between the natural and built environment would not change. All existing contributing structures or features would remain. The meadows, riparian areas, and lodgepole upland areas would continue to be managed under current resource management policy.

Visitor use of Tuolumne Meadows would be expected to intensify without additional management controls. Increasing use levels since designation have been accompanied by increases in roadside shoulder parking, informal trail use, and intensive use at popular destinations, such as Soda Springs. These activities affect natural features that contribute to the Soda Springs and Tuolumne Meadows Historic Districts. Additional threats identified by the NPS include changes to historic vegetation patterns from conifer encroachment into the meadows (NPS, Montague 2007s; NPS 2007u).

Land Use: Land-use patterns in the Tuolumne Meadows Historic District would not change. The historic developed areas would remain and would continue to function as they do today.

Circulation: Circulation features in the Tuolumne Meadows Historic District would not change. Contributing and noncontributing roads and trails would remain in their current location and condition, and would continue to function as they do today.

Views and Vistas: The visual relationships between natural features at Tuolumne Meadows and its adjacent developed areas would remain largely intact under the no-action alternative. Conifer encroachment has affected the open character of views into the meadows; however, most of the historic scenic opportunities that contribute to the setting and feel of the Tuolumne Meadows Historic District would remain unobstructed (NPS, Montague 2007s).

Cars parked along Tioga Road would continue to encroach into historic views from the road and from the domes looking down on Tuolumne Meadows.

Historic Buildings and Structures: The historic design and spatial organization of the Tuolumne Meadows and Soda Springs Historic Districts would remain as they are today. Historic buildings and structures that contribute to the historic districts would be preserved in their currently good condition and would continue to be managed and protected under current treatment policies. Parsons Memorial Lodge would likewise be preserved in its currently good condition. Existing management practices would preserve and protect to the greatest extent possible the integrity and character of the historic districts, while minimizing deterioration caused by normal use and natural processes.

Table 9-32, above, provides an overview of contributing buildings and structures in the Tuolumne Meadows Historic District.

Hetch Hetchy Area

Historic resources within the river corridor under the no-action alternative would continue to be managed and protected under current cultural resource management policies.

Conclusion

There would be no adverse effect on potentially eligible historic resources in wilderness segments of the Tuolumne River corridor under the no-action alternative. Historic resources in wilderness would be managed and protected under current cultural resource management policies. Park projects and maintenance in wilderness areas would continue to be subject to the NHPA section 106 process, which is augmented by national and park-specific programmatic agreements (appendix D). Standard mitigation measures, as defined in the park-specific programmatic agreement, include photo documentation, salvage, and reevaluation of NRHP status.

There would be no adverse effect on the NRHP-eligible Tuolumne Meadows Historic District, NRHP-eligible Tioga Road Historic District, NRHP-eligible Glen Aulin Historic District, or NRHP-listed buildings and structures under the no-action alternative. Historic features that contribute to the districts would remain in good condition and would continue to be managed and protected under existing cultural resource management policies. However, existing threats to the natural systems within the Tuolumne Meadows and Soda Springs Historic Districts from increasing visitor use and changes to historic vegetation patterns would continue.

Cumulative Effects

In general, past development, operation, and maintenance of facilities throughout Yosemite National Park has protected and preserved the integrity of historic properties. Past actions that have had a cumulative effect on historic properties in the Tuolumne River corridor include routine maintenance activities prior to the institution of preservation maintenance guidelines and ongoing alteration of trails from livestock. Other impacts from recent actions include the Restoration of Disturbed Areas at Tuolumne Meadows Lodge project, and implementation of plans that addressed cultural resources in the Tuolumne River corridor, including the 1989 *Wilderness Management Plan*, the *Vegetation Management Plan*, and the *Fire Management Plan*. The past cumulative plans and projects have resulted in no adverse effect on historic properties within the *Tuolumne River Plan* project boundary (area of potential effect).

Implementation of current and/or reasonably foreseeable future actions is likely to affect individual historic properties. Specific impacts would depend upon the nature, location, and design of the facility to be developed or removed as well as the quantity of the historic properties affected. Site-specific avoidance, minimization, and mitigation measures would reduce the potential for adverse effects to historic properties.

Current and/or reasonably foreseeable future actions, projects, and plans that would have a cumulative effect on historic properties include:

- Implementation of management actions included within the upcoming *Wilderness Stewardship Plan*, which would update the 1989 *Wilderness Management Plan* to provide guidance to park operations for the management of Yosemite's designated Wilderness (over 95% of the park) and address land management issues within the wilderness, including cultural landscapes and other cultural and social resource variables. The plan update will also address the use of the High Sierra Camps.
- Current planning with the potential to affect historic properties includes the Merced Wild and Scenic River Comprehensive Management Plan, which will address historic resources in the Merced River corridor.
- Site-specific current planning in the park includes the Improve Parkwide Communications Data Network project, the *Tenaya Lake Area Plan*, the *Scenic Vista Management Plan*, and the Tioga Road Rehabilitation project, which would potentially affect historic properties through alterations and/or removal of contributing resources within the historic Tioga Road corridor. While the proposed roadside restoration, formalized turnouts, and hydrologic improvements along Tioga Road resulting from the Tioga Road Rehabilitation project would not affect the alignment of the road corridor through the historic district or the

status of the road as a contributing feature to the cultural landscape, contributing features of the historic property may be altered and/or removed. There would be an adverse effect from impacts on individual features within the Tioga Road Historic District; however, the effect on the integrity of the historic district would not be significant. Standard mitigating measures in the park's programmatic agreement will be applied.

The no-action alternative of the *Tuolumne River Plan* would not result in any additional adverse effects on historic properties. While existing threats to the natural systems within the Tuolumne Meadows and Soda Springs Historic Districts from increasing visitor use and changes to historic vegetation patterns would continue, historic properties would be retained and preserved.

Environmental Consequences Common to Alternatives 1–4

Wild Segments

As under the no-action alternative, historic-era resources in wilderness would be managed and protected under current cultural resource management policies under any of the action alternatives. Current policies allow some historic-era resources to deteriorate via natural processes (e.g., tree blazes); these resources would be documented and recorded according to the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), and *NPS Management Policies 2006* (NPS 2006g). Other historic resources would be stabilized, rehabilitated, or otherwise protected in accordance with *NPS Management Policies 2006* and wilderness management policies, and would be consistent with guidance in the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

At Glen Aulin High Sierra Camp, the proposed rerouting of a trail away from a wetlands area near Conness Creek under alternative 1, 2, 3, or 4 would have no adverse effect on the Glen Aulin High Sierra Camp Historic District.

Scenic Segments

Tioga Pass

The Tioga Pass area would be removed from the Tuolumne Wild and Scenic River corridor as part of a technical correction to the river corridor boundaries under the *Tuolumne River Plan* (see chapter 3). There would be no adverse effect on historic properties at Tioga Pass as a result of the technical correction; historic properties would continue to be managed under current cultural resource management policies.

Tioga Road Historic District

See table 9-33, below for a summary of contributing features and structures that are potentially affected by alternatives 1-4.

Removing undesignated roadside parking by installing new curbing (consistent with the historic resource) and restoring undesignated parking areas to natural conditions would affect both contributing and noncontributing turnouts along Tioga Road and along access roads in Tuolumne Meadows. Approximately 17 historic turnouts would be removed on Tioga Road between Pothole Dome and Tuolumne Meadows campground to help restore the ecological integrity of the meadows and reduce informal trailing. Approximately 4 historic turnouts through the meadows would be rehabilitated (paved, curbed, and potentially enlarged) to retain some of the historic characteristics of the road at Tuolumne Meadows. This action would also preserve the views and vistas intended by the road's original design.

Parking areas that contribute to the historic district, including the parking area at Lembert Dome, the entrance to the Tuolumne Meadows campground, the Tuolumne Meadows store, the current visitor center (the CCC mess hall), and at Pothole Dome would be retained. Alternative 2 would expand the parking area at Lembert Dome to accommodate picnicking.

If current visitor use trends continued, some visitors might be unable to find parking at Tuolumne Meadows during peak use periods, such as weekends, under alternatives 1, 2, 3, or 4. Although parking in undesignated locations would be discouraged, some displaced visitors might attempt to park along Tioga Road outside of the plan boundary, in particular west of Tuolumne Meadows. This could increase the potential for new noncontributing turnouts within the historic district. As noted above, creation of noncontributing turnouts would diminish the aspect of design integrity at specific locations but would not alter the integrity of the road as a whole.

Resource management actions would include modifying historic culverts or adding new culverts in the planning area to improve hydrologic conditions for restoration of the subalpine meadow. Sustaining the health of the meadows is essential to the integrity of the historic district. There are 35 contributing culverts on Tioga Road between Pothole Dome and the Tuolumne Meadows campground that would be affected. The adverse effect on Tioga Road Historic District resulting from culvert work would be minimized by salvaging and reusing stone masonry components from the headwalls of original historic culverts where feasible, and ensuring the new or modified structures (e.g., headwalls) are compatible with the materials, size, and scale of the historic features. Please see appendix H, chapter 2 for mitigation measures specific to historic culverts for this planning effort.

An additional resource management action under alternative 1, 2, 3, or 4 would be modification of the elevated road (causeway) leading to the Tuolumne Meadows bridge, also known as the Tuolumne River bridge in the Tuolumne Meadows Historic District (and referred to as the Tioga Road bridge elsewhere in this document) to improve the surface hydrology of the meadows. This action has the potential to affect the road appearance, design and materials in the vicinity of the bridge, which (as noted under "Affected Environment" above) includes the contributing causeway constructed through Tuolumne Meadows. In addition, modifications to the historic bridge may be required. These actions might affect the historic bridge design, however the NPS would seek to avoid and minimize any adverse effects in consultation with the SHPO.

As noted in chapter 8, because it is not yet known how the bridge and causeway would be modified to better accommodate surface hydrology, these actions would require additional evaluation in a separate compliance effort. Therefore, actions to modify the causeway and historic bridge along Tioga Road are not further evaluated in terms of effect in this analysis.

Table 9-33.
Summary of Contributing Structures within the Tioga Road Historic District – Common to Alternatives 1-4

Tioga Road Historic District	Action	Contributing Feature or Structure
Tioga Road Historic District	Rehabilitate or replace 35 culverts	48 culverts on Tioga Road between Pothole Dome and Tioga Pass
	Retain	3 retaining walls near Tuolumne Meadows campground and Tuolumne Meadows Lodge High Sierra Camp
	Retain (modify Lember Dome area in alternative 2)	5 parking areas: Lember Dome (1), Tuolumne Meadows store (1), Tuolumne Meadows campground entrance (1), existing visitor center (1), and Pothole Dome (2).
	Remove approximately 17 turnouts between Pothole Dome and Tuolumne Meadows campground; retain and rehabilitate 4 turnouts in this area.	55 turnouts between Pothole Dome and Tioga Pass
	Retain and potentially modify	Tuolumne Meadows bridge (also known as Tuolumne River bridge)

Tuolumne Meadows Historic District and Soda Springs Historic District

Natural Systems and Features: Ecological restoration of meadow and riparian areas, coupled with the removal of undesignated roadside parking, informal trails, and all facilities except roads and trails from these sensitive habitats, would reduce impacts on natural systems associated with development and use. In the long-

term, these actions would likely help restore and sustain the natural systems that historically defined the Tuolumne Meadows area and the Tuolumne River corridor.

Circulation: The proposed roadside natural resource restoration and installation of formalized turnouts would have no impact on the alignment of the road corridor through the historic district or the status of the road as a contributing feature to the historic district. Trails that contribute to the historic district would be unaffected with any of the action alternatives, except for the Great Sierra Wagon Road (see below).

Great Sierra Wagon Road. Under alternative 1, 2, 3, or 4, the NPS would take actions to improve hydrologic processes in Tuolumne Meadows along the historic Great Sierra Wagon Road, segments of which are contributing circulation features to both the Tuolumne Meadows Historic District and the Soda Springs Historic District. These actions include culvert improvements and narrowing of the roadbed (see chapters 5 and 8, as well as appendix H). NPS cultural resource specialists developed measures (NPS, Buhler et al. 2010e, see appendix H and appendix O) to minimize adverse effects. Mitigating measures developed specifically for the Great Sierra Wagon Road include maintaining the current alignment of historic segments and, when narrowing the roadbed, maintaining a minimum width of 10 feet to convey the corridor's historic use as a wagon road. In addition, modifications to historic culverts or additional new culverts along the Great Sierra Wagon Road would be designed for compatibility with the historic character of the road.

Although major reroutes or other significant alterations to the Great Sierra Wagon Road are not called for in this plan, if these actions were to occur, this work would be subject to additional review and compliance with the NHPA section 106 review process.

Several natural resource restoration actions deemed appropriate for the Great Sierra Wagon Road would not adversely affect the character of the historic road. These include removing roadside woody vegetation, which was not present in the historic period; repairing drainage swales along the roads; and filling/revegetating non-historic ditches associated with the kettle ponds, which were not an original feature of the Tuolumne Meadows Historic District.

Views and Vistas: The important visual relationships between the natural features of Tuolumne Meadows and its adjacent developed areas would remain largely intact under alternative 1, 2, 3, or 4. As with the no-action alternative, conifers would not be manually removed from the meadows to protect the historic landscape (but some of the action alternatives would allow for vegetation removal at specific scenic vista points, see appendix I). However, the restoration of a more naturally functioning meadow and riparian ecosystem, including the removal of structures and informal trails, would be expected to enhance the views and vistas that contribute to the setting and character of the Tuolumne Meadows Historic District. Ecological restoration, particularly restoration of hydrological processes, may limit conifer encroachment into meadow scenery. The NPS would continue to research the causes of conifer encroachment; for this analysis, it is assumed that conifer removal would only occur if research indicates an ecological benefit.

In addition, the removal of undesignated roadside parking along Tioga Road would improve historic views from the road and from the domes looking down on Tuolumne Meadows.

Historic Buildings and Structures: Actions related to site planning under any of the action alternatives, including maintenance of historic properties or addition of new elements to historic districts, would comply with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, NPS cultural resource management guidelines, or as otherwise agreed to in consultation with the SHPO and other interested parties. Any new design would utilize the *Yosemite Design Guidelines* (NPS 2011a) to ensure compatibility with the distinctive rustic character of the Tuolumne Meadow landscape. New construction that follows these

guidelines would avoid an adverse effect on the Tuolumne Meadows Historic District. There is no new construction proposed for the Soda Springs Historic District under any of the action alternatives.

The campground redesign would affect the three NRHP-listed CCC rustic comfort stations and the five additional historic comfort stations (one additional rustic comfort station and four Mission 66 comfort stations) that contribute to the Tuolumne Meadows Historic District. Actions would include updating plumbing to low-flow fixtures and could potentially include interior reconfiguration to address visitor experience issues. Any work on the campground comfort stations would be completed in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. This action might require a subsequent NHPA section 106 compliance process or further consultation with the SHPO to avoid an adverse effect.

Below O'Shaughnessy Dam Segments

There would be no change from existing management in this portion of the river corridor under any of the action alternatives. Historic resources that the NPS considers potentially eligible for listing on the NRHP would be managed and protected under current cultural resource management policies.

Environmental Consequences of Alternative 1

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 1 on historic properties are described below.

Wild Segments

Glen Aulin High Sierra Camp Historic District

The Glen Aulin High Sierra Camp would be removed under alternative 1, along with all buildings, structures, and features that contribute to the Glen Aulin High Sierra Camp Historic District. As the entire historic property would be removed (see table 9-34), the district would lose all of its integrity and would no longer be eligible for listing in the NRHP. Additional consultation with the SHPO would be required.

Table 9-34.
Summary of Contributing Buildings and Structures within the Glen Aulin High Sierra Camp Historic District – Alternative 1

Glen Aulin High Sierra Camp Historic District	Action	Contributing Building/Structure
Glen Aulin High Sierra Camp	Remove	15 canvas-and-frame seasonal buildings (tent cabins)
	Remove	3 permanent buildings (cookhouse, toilet, and storage shed)

Scenic Segments

Tuolumne Meadows Historic District and Soda Springs Historic District

Natural Systems and Features: Entire developed areas or large portions of developed areas would be restored to natural conditions under alternative 1. The general pattern of development throughout Tuolumne Meadows and the historic relationship between the natural and built environment would be affected by

- removal of the entire Tuolumne Meadows Lodge and High Sierra Camp, wastewater treatment ponds and sprayfield, gas station, the store and grill, the campground A loop, and part of the NPS housing at the Insect Research Station (Bug Camp)
- expansion of NPS employee housing at the administrative area (Ranger Camp)

Land Use: In the Tuolumne Meadows Historic District, historic land-use patterns related to the clustering of visitor service and administration areas in upland areas south of the meadows would be altered by reducing or eliminating the extent of commercial and visitor service areas. Administrative areas would also be substantially reduced due to the removal of associated infrastructure noted above under “Natural Systems and Features.”

The types of land use historically associated with Tuolumne Meadows, such as overnight lodging and camping and employee housing, would be permanently altered by the removal of all lodging and other visitor services, reductions in camping, and reductions in employee housing.

The Soda Springs Historic District would remain and continue to function as it does today.

Circulation: The road to Tuolumne Meadows Lodge and High Sierra Camp would be removed. This road is largely the original Great Sierra Wagon Road, which is a contributing resource within the Tuolumne Meadows Historic District. The original Meinecke circulation feature at Tuolumne Meadows campground would be altered by the removal of the campground A-loop road.

In addition to the impacts of actions on the Great Sierra Wagon Road detailed in the “Environmental Consequences Common to Alternatives 1–4” section, above, removing vehicle traffic from a section of the Great Sierra Wagon Road from the concessioner stable to Soda Springs would impact a contributing circulation feature to the Tuolumne Meadows Historic District and Soda Springs Historic District. Efforts to avoid an adverse effect include maintaining the historic roadbed as a trail, and treatment in accordance with mitigation measures developed by NPS cultural resource staff in *Ecological Restoration Planning for the Tuolumne Wild and Scenic River Comprehensive Management Plan* (NPS, Buhler et al. 2010e, see appendix H).

Historic Buildings and Structures: Alternative 1 actions proposed for contributing buildings and structures in developed areas of the Tuolumne Meadows Historic District (including the Soda Springs Historic District) are summarized in table 9-35.

As under all the action alternatives, maintenance of historic buildings and structures that are retained would comply with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties*, NPS cultural resource management guidelines, and stipulations in the park-specific programmatic agreement (see appendix D), or as otherwise agreed to in consultation with the SHPO and other interested parties.

Reconfiguration of interior space in the NRHP-listed CCC mess hall at Road Crew Camp to accommodate NPS housing would be completed in accordance with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties*. This action might require a subsequent NHPA section 106 compliance process or further consultation with the SHPO to avoid an adverse effect on this property.

Historic structures that would be removed under alternative 1 (which removes all commercial services from the meadows area) include the Tuolumne Meadows store and grill area, the gas station, all of the structures related to Tuolumne Meadows Lodge and High Sierra Camp, and contributing structures at the Insect Research Station (Bug Camp). Due to the number of historic features affected with this alternative, project implementation would be preceded by additional consultation with the SHPO.

Table 9-35.
Summary of Contributing Buildings and Structures within the Tuolumne Meadows Historic District, including the Soda Springs Historic District – Alternative 1

Tuolumne Meadows Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Road Crew Camp (Road Camp)	Retain, rehabilitate for housing-related use	Mess hall (current visitor center/3010)^a
	Retain	4 bunkhouses (3011, 3012, 3013, 3014)^a
	Retain	Shower house (3015)^a
	Retain	4 tent cabins (3071, 3072, 3073, 3074)
	Retain	Explosives cache (RC1) Water fountain (RC6)
	Modify	Tioga Road culvert and stone headwall
	Construct	New housing
Tuolumne Meadows campground	Retain	Contact station (3005)^a
	Retain and rehabilitate	3 CCC rustic comfort stations (3021, 3022, 3023)^a Rustic comfort station (3024) 4 Mission 66 comfort stations (3076, 3077, 3078, 3079)
	Retain	Dana campfire circle
	Retain and potentially modify	Tuolumne River bridge (Tioga Road bridge)(TC3)
	Remove A loop	Original Meinecke campground circulation
Tuolumne Meadows store and gas station	Remove	Store, post office, and restaurant (SG-5)
	Remove	Gas station (SG2)
Tuolumne Meadows Lodge and High Sierra Camp	Remove	Bath house (TMV002)
	Remove	Kitchen/dining Hall (TMS003)
	Remove	66 guest tent cabins (4-12 and 14-70) ^b
	Remove	Storage shed (TME030)
	Remove	Campfire circle (HSC-6)
Administrative area (Ranger Camp)	Retain	Barn (3003) and tack shed (3004)
	Retain	Storage shed (3018)
	Retain	Naturalist cabin (3001)
	Retain	Ranger station (3000)^a
	Retain	Patrol cabin (3002)
	Retain	Shower house (3020)
	Retain	7 tent cabins (3030, 3032, 3037, 3038, 3039, 3040, 3041)
	Retain	Weather station (AA7)
	Construct	New housing
Insect Research Station (Bug Camp)	Remove	Kitchen/mess hall (3083)
	Remove	Comfort station (3049)
	Remove	2 office/shed structures (3085 and 3086)
Soda Springs Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Soda Springs Historic District	Retain	Parsons Memorial Lodge (3081)^a
	Retain	Soda Springs enclosure (HS-07)^a
	Retain	McCauley Cabin (3082)^a
	Retain	Bruin Baffle (HS-7C)
	Retain	Soda Springs bridge pier and abutments (SS-05)

a Contributing building or structure in bold type if NRHP-listed.

b There are 69 guest tent cabins at Tuolumne Meadows Lodge. Of these, 66 contribute to the historic district.

Abbreviation: CCC = Civilian Conservation Corps; NPS = National Park Service; NRHP = National Register of Historic Places

Conclusion

There would be no adverse effect on historic resources in wilderness under any action alternative. Historic resources in wilderness segments of the Tuolumne River corridor would be managed and protected under current cultural resource management policies.

NRHP-eligible Glen Aulin High Sierra Camp Historic District: There would be an adverse effect resulting from the removal of all historic structures at the High Sierra Camp. The historic district would lose its integrity and would no longer be eligible for listing in the NRHP. Further consultation with the SHPO would be required.

NRHP-eligible Tioga Road Historic District: There would be an adverse effect from the removal of historic turnouts and potentially by modification of historic culverts. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically compatible materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

NRHP-eligible Tuolumne Meadows Historic District: There would be an adverse effect resulting from impacts on the following contributing features:

- removal of the campground A-loop road;
- actions along the Great Sierra Wagon Road to improve hydrologic processes. Mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would be used to minimize the adverse effect.
- removal of all contributing features from three of the seven developed areas in the Tuolumne Meadows Historic District: the entire Tuolumne Meadows Lodge and High Sierra Camp, the Tuolumne Meadows store/gas station area, and the Insect Research Station (Bug Camp). The historic design and spatial organization of the Tuolumne Meadows Historic District would likewise be altered by the removal of historic features. Due to the removal of a substantial number of contributing historic features and the alterations to the historic design of the Tuolumne Meadows Historic District, additional consultation with the SHPO would be required.
- As part of the campground redesign, there would be some interior work at contributing comfort stations, such as installation of new plumbing fixtures. The NPS would avoid an adverse effect through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and through consultation with the SHPO, if necessary.

Any modification of the Tuolumne River bridge, which also contributes to the Tioga Road Historic District, would require a subsequent NHPA section 106 compliance process.

NRHP-eligible Soda Springs Historic District: There would be an adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).

The natural systems and the views and vistas that historically defined the Tuolumne Meadows and Soda Springs Historic Districts would benefit from natural resource restoration activities proposed with alternative 1, including the removal of undesignated parking from roadside areas. New construction would occur within existing developed areas; potential adverse effects on the Tuolumne Meadows Historic District resulting from new construction would be avoided by requiring that new facilities be consistent to the maximum extent possible with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines).

NRHP-listed Parsons Memorial Lodge National Historic Landmark, McCauley Cabin, and Soda Springs Enclosure: no adverse effect.

NRHP-listed Ranger Station: no adverse effect.

NRHP-listed CCC rustic campground comfort stations and campground contact station: no adverse effect. All alternatives would rehabilitate the comfort stations as part of a campground redesign, which includes installation of new plumbing fixtures. The NPS would avoid an adverse effect on this property through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

NRHP-listed CCC mess hall, bunkhouse, and showerhouse at Road Crew Camp: no adverse effect. Alternative 1 would rehabilitate the NRHP-listed CCC mess hall to accommodate NPS housing. The NPS would avoid an adverse effect on this property through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

NRHP-listed buildings at Tioga Pass: no adverse effect.

Cumulative Effects

The past, present, and reasonably foreseeable future plans and projects that could have a cumulative effect on historic properties in combination with alternative 1 would be the same as described for the no-action alternative.

These plans and projects are not expected to have additional adverse effects on historic properties in the Tuolumne River corridor and would not alter the determination of adverse effect resulting from implementation of alternative 1. However, cumulative projects along Tioga Road would affect historic features (primarily culverts) within the Tioga Road Historic District outside of the *Tuolumne River Plan* planning area. The adverse effect of the roadside restoration and culvert work proposed for the *Tuolumne River Plan* under alternative 1, in combination with additional culvert work elsewhere on the road under other projects, would only affect a small proportion of the 772 individually contributing features to the Tioga Road Historic District and would not have a significant effect on the integrity of the historic district.

For the *Tuolumne River Plan*, the NPS would continue to avoid adverse effects or would otherwise carry out appropriate mitigation to minimize potential impacts, in accordance with the existing park-specific programmatic agreement (see appendix D) and other park policies. Standard mitigating measures would be applied in accordance with the park-specific programmatic agreement (appendix D), which stipulates recordation and salvage of historic materials, or as otherwise agreed to in consultation with SHPO and other interested parties.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on historic properties are described below.

Wild Segments

Glen Aulin High Sierra Camp Historic District

All of the permanent structures at Glen Aulin High Sierra Camp would be removed (except for a composting toilet), including all buildings and structures that contribute to the Glen Aulin High Sierra Camp Historic District, to convert the area to a seasonal outfitter camp that is consistent with a Wilderness designation (see table 9-36). Because all contributing buildings and structures would be removed, the historic district would lose integrity and no longer be eligible for listing on the NRHP. Additional consultation with the SHPO would be required.

Table 9-36.
Summary of Contributing Buildings and Structures within the Glen Aulin High Sierra Camp Historic District – Alternative 2

Glen Aulin High Sierra Camp Historic District	Action	Contributing Building/ Structure
Glen Aulin High Sierra Camp	Remove	15 canvas-and-frame seasonal buildings (tent cabins)
	Remove	3 permanent buildings (cookhouse, toilet, and storage shed)

Scenic Segments

Tuolumne Meadows Historic District and Soda Springs Historic District

Natural Systems and Features: The general pattern of development throughout Tuolumne Meadows and the historic relationship between the natural and built environment would be largely retained with alternative 2. Changes in the current pattern (in addition to changes that would be common to alternatives 1–4, described above) would include the following

- more structured delineation along formal trails in the meadows
- expansion of formal parking at Road Crew Camp, the store and grill, the Lemberg Dome parking area, and the Dog Lake/John Muir Trail trailhead near the Insect Research Station (Bug Camp)
- new formal parking near Pothole Dome and in an area between Unicorn Creek and the existing wastewater treatment facility (site of the proposed new day use area)
- a new consolidated NPS and concessioner stable in an upland area east of Budd Creek and west of the existing visitor center

Siting new construction in upland areas and the use of existing developed areas as much as possible would help avoid impacts on the natural setting of the cultural landscape.

Land Use: Under alternative 2, some existing land uses would change in the Tuolumne Meadows Historic District (e.g., consolidating NPS and concessioner stable operations), but the types of land use historically associated with Tuolumne Meadows, such as visitor services, administrative areas, and employee housing, would remain. Historic land-use patterns concentrating visitor service and administration areas in upland areas would continue, although the historic character of dispersed clusters of development would be affected by the addition of two new developed areas south of Tioga Road between Budd Creek and Road Crew Camp (consolidated NPS/concessioner stable) and between Unicorn Creek and the wastewater treatment facility (new day use area).

The Soda Springs Historic District would continue to function as it does now.

Views and Vistas: Historic views from outstanding vista points, including the Parsons Memorial Lodge doorway, would be maintained by controlling the encroachment of vegetation in a manner that was protective of ecological conditions and cultural values at each vista point (see appendix I).

Circulation: The original Meinecke circulation feature at Tuolumne Meadows Campground, a contributing feature to the Tuolumne Meadows Historic District, would be altered by the addition of a new walk-in camping area and general reconfiguration of the campground.

Historic Buildings and Structures: Actions proposed under alternative 2 for buildings and structures in developed areas of the Tuolumne Meadows Historic District (including the Soda Springs Historic District) are summarized in table 9-37.

Table 9-37.
Summary of Contributing Buildings and Structures within the Tuolumne Meadows Historic District, including the Soda Springs Historic District – Alternative 2

Tuolumne Meadows Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Road Crew Camp (Road Camp)	Retain, rehabilitate for park operations	Mess hall (current visitor center/3010)^a
	Retain	4 bunkhouses (3011, 3012, 3013, 3014)^a
	Retain	Shower house (3015)^a
	Retain	4 tent cabins (3071, 3072, 3073, 3074)
	Retain	Explosives cache (RC1) Water fountain (RC6)
	Modify	Tioga Road culvert and stone headwall
Tuolumne Meadows campground	Retain	Contact station (3005)^a
	Retain and rehabilitate	3 CCC comfort stations (3021, 3022, 3023)^a Rustic comfort station (3024) 4 Mission 66 comfort stations (3076, 3077, 3078, 3079)
	Retain	Dana campfire circle
	Retain and potentially modify	Tuolumne River bridge (Tioga Road bridge)(TC3)
	Modify	Original Meinecke campground circulation
Tuolumne Meadows store and gas station	Retain	Store, post office, and restaurant (SG-5)
	Retain	Gas station (SG2)
Tuolumne Meadows Lodge and High Sierra Camp	Retain	Bath house (TMV002)
	Retain	Kitchen/Dining Hall (TMS003)
	Retain	66 guest tent cabins (4-12 and 14-70) ^b
	Retain	Storage shed (TME030)
	Retain	Campfire circle (HSC-6)
Administrative area (Ranger Camp)	Retain	Barn (3003) and tack shed (3004)
	Retain	Storage shed (3018)
	Retain	Naturalist cabin (3001)
	Retain	Ranger station (3000)^a
	Retain	Patrol cabin (3002)
	Retain	Shower house (3020)
	Retain	7 tent cabins (3030, 3032, 3037, 3038, 3039, 3040, 3041)
	Retain	Weather station (AA7)
	Construct	New housing
Insect Research Station (Bug Camp)	Remove	Kitchen/mess hall (3083)
	Remove	Comfort station (3049)
	Remove	2 office/shed structures (3085 and 3086)
Soda Springs Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Soda Springs Historic District	Retain	Parsons Memorial Lodge (3081)^a
	Retain	Soda Springs enclosure (HS-07)^a
	Retain	McCauley Cabin (3082)^a
	Retain	Bruin Baffle (HS-7C)
	Retain	Soda Springs bridge pier and abutments (SS-05)

a NRHP-listed building or structure in bold type.

b There are 69 guest tent cabins at Tuolumne Meadows Lodge. Of these, 66 contribute to the historic district.

Abbreviation: CCC = Civilian Conservation Corps; NPS = National Park Service; NRHP = National Register of Historic Places

Under alternative 2, maintenance of historic buildings and structures that are retained would comply with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, NPS cultural resource management guidelines, and stipulations in the park-specific programmatic agreement (see appendix D), or as otherwise agreed to in consultation with the SHPO and other interested parties.

All contributing buildings and structures at the Insect Research Station (Bug Camp), would be removed. Removal of historic structures and features would be addressed through the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), NPS *Management Policies 2006* (NPS 2006g), or as otherwise agreed to with the SHPO.

Conclusion

There would be no adverse effect on historic resources in wilderness under any action alternative. Historic resources in wilderness segments of the Tuolumne River corridor would be managed and protected under current cultural resource management policies.

NRHP-eligible Glen Aulin High Sierra Camp Historic District: There would be an adverse effect resulting from the removal of all historic structures. The historic district would lose its integrity and no longer be eligible for listing in the NRHP. Further consultation with the SHPO would be required.

NRHP-eligible Tioga Road Historic District: There would be an adverse effect from removal of historic turnouts and potentially by modifying historic culverts. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically consistent materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

NRHP-eligible Tuolumne Meadows Historic District: There would be an adverse effect resulting from impacts on the following contributing features:

- (1) reconfiguration of campground roads to accommodate walk-in campsites, and
- (2) actions along the Great Sierra Wagon Road to improve hydrologic processes in Tuolumne Meadows. For the Great Sierra Wagon Road, mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would minimize adverse effects.
- (3) removal of contributing buildings and structures at the Insect Research Station (Bug Camp). The adverse effect would be addressed through the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), NPS *Management Policies 2006* (NPS 2006g), or as otherwise agreed to with the SHPO.

As part of the campground redesign, there would be some interior work at contributing comfort stations, such as installation of new plumbing fixtures. The NPS would avoid an adverse effect through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and through consultation with the SHPO, if necessary.

Any modification of the Tuolumne River bridge, which also contributes to the Tioga Road Historic District, would require a subsequent NHPA section 106 compliance process.

NRHP-eligible Soda Springs Historic District: There would be an adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).

The majority of historic features that contribute to the Tuolumne Meadows and Soda Springs Historic Districts would be unaffected by actions under this alternative. The historic design and spatial organization of the Tuolumne Meadows Historic District would be altered by the addition of two new developed areas south of Tioga Road between Unicorn and Budd Creeks. However, potential adverse effects of this and other new construction (within existing developed areas) under alternative 2 would be avoided by requiring that new facilities be consistent to the maximum extent possible with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines).

The natural systems and the views and vistas that historically defined the Tuolumne Meadows and Soda Springs Historic Districts would benefit from proposed natural resource restoration activities, including the removal of undesignated parking from the roadside, and proposed day visitor management. In addition, scenic vista management at select locations (see appendix I) would enhance historic vistas and views in the Tuolumne Meadows and Soda Springs Historic Districts.

NRHP-listed Ranger Station: no adverse effect.

NRHP-listed Parsons Memorial Lodge National Historic Landmark, Soda Springs Enclosure, and McCauley Cabin: no adverse effect.

NRHP-listed CCC rustic campground comfort stations and campground contact station: no adverse effect. All alternatives would rehabilitate the comfort stations as part of a campground redesign, which includes installation of new plumbing fixtures. The NPS would avoid an adverse effect on this property through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

NRHP-listed CCC mess hall, bunkhouses, and showerhouse at Road Crew Camp: no adverse effect. Alternative 2 would rehabilitate the NRHP-listed CCC mess hall to accommodate increased NPS administrative requirements. The NPS would avoid an adverse effect on this property through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

NRHP-listed buildings at Tioga Pass: no adverse effect.

Cumulative Effects

The past, present, and reasonably foreseeable future plans and projects that could have a cumulative effect on historic properties in combination with alternative 2 would be the same as described for the no-action alternative.

These plans and projects are not expected to have additional adverse effects on historic properties in the Tuolumne River corridor and would not alter the determination of adverse effect resulting from implementation of alternative 2. However, cumulative projects along Tioga Road would affect historic features (primarily culverts) within the Tioga Road Historic District outside of the *Tuolumne River Plan* planning area. The adverse effect of the roadside restoration and culvert work proposed for the *Tuolumne River Plan* under alternative 2, in combination with additional culvert work elsewhere on the road under other projects, would only affect a small proportion of the 772 individually contributing features to the Tioga Road Historic District and would not have a significant effect on the integrity of the historic district.

For the *Tuolumne River Plan*, the NPS would continue to avoid adverse effects or would otherwise carry out appropriate mitigation to minimize potential impacts, in accordance with the existing park-specific programmatic agreement (see appendix D) and other park policies. Standard mitigating measures would be applied in accordance with the park-specific programmatic agreement (appendix D), which stipulates recordation and salvage of historic materials, or as otherwise agreed to in consultation with SHPO and other interested parties.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on historic properties are described below.

Wild Segments

Glen Aulin High Sierra Camp Historic District

One historic guest cabin in the Glen Aulin High Sierra Camp would be removed under alternative 3 (see table 9-38). This resource would be documented and recorded according to the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), and NPS *Management Policies 2006* (NPS 2006g), or as otherwise agreed to with the SHPO and other interested parties. The remaining historic buildings and structures would be retained and maintained for their traditional uses. Maintenance and upgrading of utilities would be consistent with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties* and NHPA section 106 compliance processes.

Table 9-38.
Summary of Contributing Buildings and Structures within the Glen Aulin High Sierra Camp Historic District – Alternative 3

Glen Aulin High Sierra Camp Historic District	Action	Contributing Building/ Structure
Glen Aulin High Sierra Camp	Retain 14, remove 1	15 canvas-and-frame seasonal buildings (tent cabins)
	Retain	3 permanent buildings (cookhouse, toilet, and storage shed)

Scenic Segments

Tuolumne Meadows Historic District and Soda Springs Historic District

Natural Systems and Features: The general pattern of development throughout Tuolumne Meadows and the historic relationship between the natural and built environment would be largely retained with alternative 3. Changes in the current pattern (in addition to changes that would be common to any of the action alternatives, described above) would include the following:

- removal of one-half of the contributing guest cabins (33 cabins) and all the non-contributing employee housing at Tuolumne Meadows Lodge and High Sierra Camp
- expansion of formal parking at Road Crew Camp, the Lumbert Dome parking area, and the Dog Lake/John Muir Trail trailhead near the Insect Research Station (Bug Camp)
- new formal parking near Pothole Dome
- new concessioner housing north of the existing Tuolumne Meadows Lodge road and west of the water treatment facility

Siting new construction in upland areas and using existing developed areas as much as possible would help avoid potential impacts of new construction on the natural setting of the cultural landscape.

Land Use: Historic land-use patterns that concentrate visitor service and administration areas in upland areas would continue with alternative 3, although the extent of commercial and visitor service and administrative areas would be reduced by the removal of approximately one-half of the contributing guest tent cabins (35 cabins in total) and all of the non-contributing employee cabins at the Tuolumne Meadows Lodge and High Sierra Camp.

The types of land use historically associated with Tuolumne Meadows, such as visitor services, administrative areas, and employee housing, would remain. The Soda Springs Historic District would remain intact and would continue to function as it does today.

Views and Vistas: Historic views from outstanding vista points, including the Parsons Memorial Lodge doorway, would be maintained by controlling the encroachment of vegetation in a manner that was protective of ecological conditions and cultural values at each vista point (see appendix I).

Circulation: There would be no impacts on circulation features under alternative 3 beyond what is discussed in “Environmental Consequences Common to Alternatives 1–4,” above.

Historic Buildings and Structures: Alternative 3 actions proposed for buildings and structures in developed areas of the Tuolumne Meadows Historic District (including the Soda Springs Historic District) are summarized in table 9-39.

As under any of the action alternatives, maintenance of historic buildings and structures that are retained would comply with the *Secretary of the Interior’s Standards for the Treatment of Historic Properties*, NPS cultural resource management guidelines, and stipulations in the park-specific programmatic agreement (see appendix D), or as otherwise agreed to in consultation with the SHPO and other interested parties.

Historic buildings to be removed include the structure at the Tuolumne Meadows gas station and mountaineering shop, and 35 historic guest tent cabins at the Tuolumne Meadows Lodge and High Sierra Camp. The guest tent cabins at the lodge constitute the majority of contributing structures in Tuolumne Meadows Lodge and High Sierra Camp developed area; their removal would disrupt the distinctive historic character of the developed area, including the traditional clustering of structures. Employee tent cabins would also be removed at the lodge, but the employee cabins (circa 1980s) are not contributing features of the Tuolumne Meadows Historic District and are in an area not historically associated with tent cabin use.

Table 9-39.
Summary of Contributing Buildings and Structures within the Tuolumne Meadows Historic District, including the Soda Springs Historic District – Alternative 3

Tuolumne Meadows Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Road Crew Camp (Road Camp)	Retain	Mess hall (current visitor center/3010)^a
	Retain	4 bunkhouses (3011, 3012, 3013, 3014)^a
	Retain	Shower house (3015)^a
	Retain	4 tent cabins (3071, 3072, 3073, 3074)
	Retain	Explosives cache (RC1) Water fountain (RC6)
	Modify	Tioga Road culvert and stone headwall
Tuolumne Meadows campground	Retain	Contact station (3005)^a
	Retain and rehabilitate	3 CCC comfort stations (3021, 3022, 3023)^a Rustic comfort station (3024) 4 Mission 66 comfort stations (3076, 3077, 3078, 3079)
	Retain	Dana campfire circle
	Retain and potentially modify	Tuolumne River bridge (Tioga Road bridge) (TC3)
	Retain	Original Meinecke campground circulation
Tuolumne Meadows store and gas station	Retain	Store, post office, and restaurant (SG-5)
	Remove	Gas station (SG2)
Tuolumne Meadows Lodge and High Sierra Camp	Retain	Bath house (TMV002)
	Retain	Kitchen/dining Hall (TMS003)
	Remove 35	66 guest tent cabins (4-12 and 14-70) ^b
	Retain	Storage shed (TME030)
	Retain	Campfire circle (HSC-6)
Administrative area (Ranger Camp)	Retain	Barn (3003) and tack shed (3004)
	Retain	Storage shed (3018)
	Retain	Naturalist cabin (3001)
	Retain	Ranger station (3000)^a
	Retain	Patrol cabin (3002)
	Retain	Shower house (3020)
	Retain	7 tent cabins (3030, 3032, 3037, 3038, 3039, 3040, 3041)
	Retain	Weather station (AA7)
Insect Research Station (Bug Camp)	Retain	Kitchen/mess hall (3083)
	Retain	Comfort station (3049)
	Retain	2 office/shed structures (3085 and 3086)
Soda Springs Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Soda Springs Historic District	Retain	Parsons Memorial Lodge (3081)^a
	Retain	Soda Springs enclosure (HS-07)^a
	Retain	McCauley Cabin (3082)^a
	Retain	Bruin Baffle (HS-7C)
	Retain	Soda Springs bridge pier and abutments (SS-05)

a NRHP-listed building or structure in bold type.

b There are 69 guest tent cabins at Tuolumne Meadows Lodge. Of these, 66 contribute to the historic district.

Abbreviation: CCC = Civilian Conservation Corps; NPS = National Park Service; NRHP = National Register of Historic Places

Conclusion

There would be no adverse effect on historic resources in wilderness under any action alternative. Historic resources in wilderness segments of the Tuolumne River corridor would be managed and protected under current cultural resource management policies.

NRHP-eligible Glen Aulin High Sierra Camp Historic District: There would be an adverse effect from removing one historic guest cabin at the camp. This resource would be documented and recorded according to the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), and NPS *Management Policies 2006* (NPS 2006g), or as otherwise agreed to with the SHPO and other interested parties.

NRHP-eligible Tioga Road Historic District: There would be an adverse effect from removal of historic turnouts and, potentially, by modifying historic culverts. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically consistent materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

NRHP-eligible Tuolumne Meadows Historic District: There would be an adverse effect resulting from impacts on the following contributing features:

- (1) the reconfiguration of campground roads for a campground redesign, and
- (2) actions along the Great Sierra Wagon Road to improve hydrologic processes in Tuolumne Meadows. For the Great Sierra Wagon Road, mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would minimize the adverse effect.
- (3) removal of one contributing building at the gas station and the removal of 35 contributing guest tent cabins at Tuolumne Meadows Lodge High Sierra Camp. The adverse effect would be addressed through the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), NPS *Management Policies 2006* (NPS 2006g), or as otherwise agreed to with the SHPO.

As part of the campground redesign, there would be some interior work at contributing comfort stations, such as installation of new plumbing fixtures. The NPS would avoid an adverse effect through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and through consultation with the SHPO, if necessary.

Any modification of the Tuolumne River bridge, which also contributes to the Tioga Road Historic District, would require a subsequent NHPA section 106 compliance process.

NRHP-eligible Soda Springs Historic District: There would be an adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).

The majority of historic features that contribute to the Tuolumne Meadows and Soda Springs Historic Districts would be unaffected by actions under this alternative. The historic design and spatial organization of the Tuolumne Meadows Historic District would remain as they are today. The NPS would avoid potential adverse effects of new construction (within existing developed areas) by requiring that new facilities be consistent to the maximum extent possible with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines).

The natural systems and the views and vistas that historically defined the Tuolumne Meadows and Soda Springs Historic Districts would benefit from proposed natural resource restoration activities under alternative 3, including the removal of undesignated parking from roadside areas, and proposed day visitor management. In addition, scenic vista management at select locations (see appendix I) would enhance historic vistas and views in both the Tuolumne Meadows and Soda Springs Historic Districts.

NRHP-listed Parsons Memorial Lodge National Historic Landmark, Soda Springs Enclosure, and McCauley Cabin: no adverse effect.

NRHP-listed Ranger Station: no adverse effect.

NRHP-listed CCC mess hall, bunkhouses, and showerhouse at Road Crew Camp: no adverse effect.

NRHP-listed CCC rustic campground comfort stations and campground contact station: no adverse effect. All alternatives would rehabilitate the comfort stations as part of a campground redesign, which includes installation of new plumbing fixtures. The NPS would avoid an adverse effect on this property through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

NRHP-listed buildings at Tioga Pass: no adverse effect.

Cumulative Effects

The past, present, and reasonably foreseeable future plans and projects that could have a cumulative effect on historic properties in combination with alternative 3 would be the same as described for the no-action alternative.

These plans and projects are not expected to have additional adverse effects on historic properties in the Tuolumne River corridor and would not alter the determination of adverse effect resulting from implementation of alternative 3. However, cumulative projects along Tioga Road would affect historic features (primarily culverts) within the Tioga Road Historic District outside of the *Tuolumne River Plan* planning area. The adverse effect of the roadside restoration and culvert work proposed for the *Tuolumne River Plan* under alternative 3, in combination with additional culvert work elsewhere on the road under other projects, would only affect a small proportion of the 772 individually contributing features to the Tioga Road Historic District and would not have a significant effect on the integrity of the historic district.

For the *Tuolumne River Plan*, the NPS would continue to avoid adverse effects or would otherwise carry out appropriate mitigation to minimize potential impacts, in accordance with the existing park-specific programmatic agreement (see appendix D) and other park policies. Standard mitigating measures would be applied in accordance with the park-specific programmatic agreement (appendix D), which stipulates recordation and salvage of historic materials, or as otherwise agreed to in consultation with SHPO and other interested parties.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on historic properties are described below.

Wild Segments

Glen Aulin High Sierra Camp Historic District

All historic buildings and structures would be retained and maintained for their traditional uses (table 9-40). Maintenance and upgrading of utilities would continue to be consistent with national and park-specific programmatic agreements (see appendix D), *NPS Management Policies 2006* (NPS 2006g), and guidance in the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

Table 9-40.
Summary of Contributing Buildings and Structures within the Glen Aulin High Sierra Camp Historic District – Alternative 4

Glen Aulin High Sierra Camp Historic District	Action	Contributing Building/ Structure
Glen Aulin High Sierra Camp	Retain	15 canvas-and-frame seasonal buildings (tent cabins)
	Retain	3 permanent buildings (cookhouse, toilet, and storage shed)

Scenic Segments

Tuolumne Meadows Historic District and Soda Springs Historic District

Natural Systems and Features: The general pattern of development throughout Tuolumne Meadows and the historic relationship between the natural and built environment would be largely retained with alternative 4. Changes in the current pattern (in addition to changes that would be common to any of the action alternatives, described above) would include the following:

- more structured delineation along formal trails in the meadows and a new trail paralleling Tioga Road to connect visitor services on the south side of the road
- expansion of formal parking at Road Crew Camp, the Lember Dome parking area, and the Dog Lake/John Muir Trail trailhead near the Insect Research Station (Bug Camp) to replace undesignated parking removed from roadside areas
- new formal parking near Pothole Dome and at the gas station site
- new visitor contact station and new trailhead to Parsons Memorial Lodge in an undeveloped area between Unicorn Creek and the wastewater treatment facility
- new concessioner housing between the existing Tuolumne Meadows Lodge and High Sierra Camp road and the existing water treatment facility to replace housing removed from more ecologically sensitive locations

Siting new construction in upland areas and using existing developed areas would help minimize potential impacts of new construction on the natural setting of the area.

Land Use: Historic land-use patterns that concentrate visitor service and administration areas in upland areas would continue with alternative 4. The features contributing to the Soda Springs Historic District would remain and continue to function as they do today. In the Tuolumne Meadows Historic District, the types of land use historically associated with Tuolumne Meadows, such as visitor services, administrative areas, and employee housing, would remain.

Views and Vistas: Historic views from outstanding vista points, including the Parsons Memorial Lodge doorway, would be maintained by controlling the encroachment of vegetation in a manner that was protective of ecological conditions and cultural values at each vista point (see appendix I).

Circulation: Realigning a portion of the campground entrance road out of the floodplain would affect the overall location and configuration of historic campground roads.

Historic Buildings and Structures: Alternative 4 actions proposed for buildings and structures in developed areas of the Tuolumne Meadows Historic District (including the Soda Springs Historic District) are summarized in table 9-41.

As under all the action alternatives, maintenance of historic buildings and structures that are retained would comply with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, NPS cultural resource management guidelines, and stipulations in the nationwide and park-specific programmatic

agreements (see appendix D), or as otherwise agreed to per consultation with the SHPO and other interested parties.

Rehabilitation of the NRHP-listed Ranger Station at the administrative area (Ranger Camp) to accommodate increased NPS administrative requirements would likely require an addition to the building. The park would avoid an adverse effect on this property through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

Reconfiguration of interior space in the NRHP-listed CCC mess hall would be completed in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. This action might require a subsequent NHPA section 106 compliance process or further consultation with the SHPO to avoid an adverse effect.

Alternative 4 would remove one contributing historic building at the Tuolumne Meadows gas station in order to provide parking for vehicles relocated from the sides of Tioga Road, where undesignated roadside parking is impacting meadow/riparian areas and archeological resources. The gas station function would be removed in this alternative because the underground fuel tanks pose a risk to water quality and a public gas station is not considered necessary or feasible in the wild and scenic river corridor for the prescribed types and levels of use in this alternative (see chapter 7). Above-ground gas and diesel tanks would be provided for administrative and emergency use at Road Crew Camp.

The NPS considered repurposing the historic gas station structure as a visitor contact station, but this option was removed from consideration as the existing structure would be too small to accommodate the prescribed level of use under this alternative.

The historic Tuolumne Meadows Lodge and High Sierra Camp kitchen/dining hall would be relocated away from the river elsewhere in the lodge complex, at least 150 feet upslope from the Dana Fork, as part of a broader action to remove structures and use from riparian areas in Tuolumne Meadows. This action has the potential to adversely affect the historic property. However, the NPS would consult with the SHPO to avoid or minimize adverse effects to the property. The NPS would not move forward with the proposed relocation if the consequence of the action resulted in an assessment of non-eligibility of the property for listing on the NRHP.

The 66 contributing guest tent cabins at the lodge would remain. Three non-contributing guest tent cabins and all non-contributing employee tent cabins would be removed at the lodge. These cabins (circa 1980s) are in an area not historically associated with tent cabin use.

Interior work at the contributing bath house structure at Tuolumne Meadows Lodge High Sierra Camp to address plumbing and visitor experience issues would be completed in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. This action might require a subsequent NHPA section 106 compliance process or further consultation with the SHPO to avoid an adverse effect.

Table 9-41.
Summary of Contributing Buildings and Structures within the Tuolumne Meadows Historic District, including the Soda Springs Historic District – Alternative 4 (preferred)

Tuolumne Meadows Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Road Crew Camp (Road Camp)	Retain, rehabilitate interior for park operations	Mess hall (current visitor center/3010)^a
	Retain	4 bunkhouses (3011, 3012, 3013, 3014)^a
	Retain and rehabilitate	Shower house (3015)^a
	Rehabilitate to meet OSHA and NPS housing standards	4 tent cabins (3071, 3072, 3073, 3074)
	Retain	Explosives cache (RC1) Water fountain (RC6)
	Modify	Tioga Road culvert and stone headwall
Tuolumne Meadows campground	Retain	Contact station (3005)^a
	Retain and rehabilitate	3 CCC comfort stations (3021, 3022, 3023)^a Rustic comfort station (3024) 4 Mission 66 comfort stations (3076, 3077, 3078, 3079)
	Retain	Dana campfire circle
	Retain and potentially modify	Tuolumne River bridge (Tioga Road bridge)(TC3)
	Realign entrance road and A-loop	Original Meinecke campground circulation
Tuolumne Meadows store and gas station	Retain	Store, post office, and restaurant (SG-5)
	Remove	Gas station (SG2)
Tuolumne Meadows Lodge and High Sierra Camp	Retain, rehabilitate interior	Bath house (TMV002)
	Relocate	Kitchen/Dining Hall (TMS003)
	Retain	66 guest tent cabins (4-12 and 14-70) ^b
	Retain	Storage shed (TME030)
	Retain	Campfire circle (HSC-6)
Administrative Area (Ranger Camp)	Retain	Barn (3003) and tack shed (3004)
	Retain	Storage shed (3018)
	Retain	Naturalist cabin (3001)
	Rehabilitate to increase administrative space	Ranger station (3000)^a
	Retain	Patrol cabin (3002)
	Retain	Shower house (3020)
	Rehabilitate to meet OSHA and NPS housing standards	7 tent cabins (3030, 3032, 3037, 3038, 3039, 3040, 3041)
	Retain	Weather station (AA7)
Insect Research Station (Bug Camp)	Retain	Kitchen/mess hall (3083)
	Retain	Comfort station (3049)
	Retain	2 office/shed structures (3085 and 3086)
Soda Springs Historic District	Action	Contributing Building/ Structure (and NPS building/structure number)
Soda Springs Historic District	Retain	Parsons Memorial Lodge (3081)^a
	Retain	Soda Springs enclosure (HS-07)^a
	Retain	McCauley Cabin (3082)^a
	Retain	Bruin Baffle (HS-7C)
	Retain	Soda Springs bridge pier and abutments (SS-05)

a NRHP-listed building or structure in bold type.

b There are 69 guest tent cabins at Tuolumne Meadows Lodge. Of these, 66 contribute to the historic district.

Abbreviation: CCC = Civilian Conservation Corps; NPS = National Park Service; NRHP = National Register of Historic Places

Contributing structures at the NPS stable would be retained and would continue to be used for NPS operations.

Eleven contributing canvas tent cabins used for housing (four at Road Crew Camp and seven at the administrative area (Ranger Camp)) would be altered, renovated, or replaced in order to comply with OSHA standards and NPS housing codes. Because of the potential for an adverse effect on the Tuolumne Meadows Historic District, the NPS would consult with the SHPO to ensure that the proposed rehabilitation efforts meets the *Secretary of the Interiors Standards for the Treatment of Historic Properties* and avoids or minimizes any actions adversely affecting the historic property. The cabins would remain within their existing general locations and the NPS would reuse existing materials and foundations to the extent practicable.

Conclusion

There would be no adverse effect on historic resources in wilderness under any action alternative. Historic resources in wilderness segments of the Tuolumne River corridor would be managed and protected under current cultural resource management policies.

NRHP-eligible Glen Aulin High Sierra Camp Historic District: no adverse effect.

NRHP-eligible Tioga Road Historic District: There would be an adverse effect from removal of historic turnouts and, potentially, by modifying historic culverts. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically consistent materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

NRHP-eligible Tuolumne Meadows Historic District: There would be an adverse effect resulting from impacts on the following contributing features:

- (1) the reconfiguration of campground roads for a campground redesign, and
- (2) actions along the Great Sierra Wagon Road to improve hydrologic processes in Tuolumne Meadows. For the Great Sierra Wagon Road, mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would minimize the adverse effect.
- (3) removal of one contributing building at the gas station and the possible relocation of the contributing dining hall/kitchen building at Tuolumne Meadows Lodge and High Sierra Camp. The adverse effect would be minimized through standard mitigation measures, as defined in the national and park-specific programmatic agreements in appendix D, or as otherwise agreed to in consultation with the SHPO.

The rehabilitation of 11 contributing tent cabins at the administrative area (Ranger Camp) and Road Crew Camp could potentially result in an adverse effect; this action would require further design, compliance, and SHPO consultation.

As part of the campground redesign, there would be some interior work at contributing comfort stations, such as installation of new plumbing fixtures. In addition, the contributing bath house at Tuolumne Meadows Lodge and High Sierra Camp would be rehabilitated to address plumbing and visitor experience issues. The NPS would avoid an adverse effect through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and through consultation with the SHPO, if necessary.

Any modification of the Tuolumne River bridge, which also contributes to the Tioga Road Historic District, would require a subsequent NHPA section 106 compliance process.

NRHP-eligible Soda Springs Historic District: There would be an adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).

The majority of historic features that contribute to the Tuolumne Meadows and Soda Springs Historic Districts would be unaffected by actions under this alternative. The historic design and spatial organization of the Tuolumne Meadows Historic District would be altered by the addition of a new developed areas and new formal trail connections south of Tioga Road. The NPS would avoid potential adverse effects of this and other new construction (within existing developed areas) by requiring that new facilities be consistent to the maximum extent possible with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines).

The natural systems and the views and vistas that historically defined the Tuolumne Meadows and Soda Springs Historic Districts would benefit from proposed natural resource restoration activities under alternative 4, including the removal of undesignated parking from roadside areas, and proposed day visitor management. In addition, scenic vista management at select locations (see appendix I) would enhance historic vistas and views in both the Tuolumne Meadows and Soda Springs Historic Districts.

NRHP-listed Parsons Memorial Lodge National Historic Landmark, Soda Springs Enclosure, McCauley Cabin: no adverse effect.

NRHP-listed CCC rustic campground comfort stations and campground contact station: no adverse effect. All alternatives would rehabilitate the comfort stations as part of a campground redesign, which includes installation of new plumbing fixtures. The NPS would avoid an adverse effect on this property through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO if necessary.

NRHP-listed Ranger Station: Alternative 4 would rehabilitate the NRHP-listed Ranger Station to accommodate increased NPS administrative requirements. The NPS would avoid an adverse effect on these properties through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

NRHP-listed CCC mess hall, bunkhouses, and showerhouse at Road Crew Camp: no adverse effect. Alternative 4 would rehabilitate the NRHP-listed Ranger Station and NRHP-listed CCC mess hall to accommodate increased NPS administrative requirements. The NPS would avoid an adverse effect on these properties through application of the *Secretary of the Interior's Standards for the Treatment of Historic Properties* in conjunction with the *Yosemite Design Guidelines* (NPS 2011a), and through consultation with the SHPO.

NRHP-listed buildings at Tioga Pass: no adverse effect.

Cumulative Effects

The past, present, and reasonably foreseeable future plans and projects that could have a cumulative effect on historic properties in combination with alternative 4 would be the same as described for the no-action alternative.

These plans and projects are not expected to have additional adverse effects on historic properties in the Tuolumne River corridor and would not alter the determination of adverse effect resulting from implementation of alternative 4. However, cumulative projects along Tioga Road would affect historic features (primarily culverts) within the Tioga Road Historic District outside of the *Tuolumne River Plan* planning area. The adverse effect of the roadside restoration and culvert work proposed for the *Tuolumne River Plan* under

alternative 4, in combination with additional culvert work elsewhere on the road under other projects, would only affect a small proportion of the 772 individually contributing features to the Tioga Road Historic District and would not have a significant effect on the integrity of the historic district.

For the *Tuolumne River Plan*, the NPS would continue to avoid adverse effects or would otherwise carry out appropriate mitigation to minimize potential impacts, in accordance with the existing park-specific programmatic agreement (see appendix D) and other park policies. Standard mitigating measures would be applied in accordance with the park-specific programmatic agreement (appendix D), which stipulates recordation and salvage of historic materials, or as otherwise agreed to in consultation with SHPO and other interested parties.

Archeological Resources

Scope of the Analysis

The following analysis takes into account archeological resources in the Tuolumne Wild and Scenic River corridor, including those that have been or may be determined eligible for listing on the NRHP. An underlying assumption of this analysis is that the NPS would seek to conserve and protect all cultural resources in the planning and implementation of the alternatives addressed in chapter 8 because impacts on archeological resources are considered permanent.

Affected Environment

Overview

Settlement of the upper Sierra Nevada, including the Tuolumne River corridor area, began after the end of the Late Wisconsin glaciation, in an era now called the Holocene. Yosemite National Park archeological sites, which include camps, villages, trails, hunting areas, gathering locales, and more, are found from the crest of the Sierra Nevada down to the lower elevations of the park. Each archeological site is a unique resource that cannot be replaced or otherwise duplicated. The Tuolumne River corridor contains abundant archeological resources collectively representing several thousand years of human use of the area.

Identification of archeological sites in the corridor has resulted from several types of archeological activities, including surface pedestrian survey, subsurface investigations (excavation), site documentation, site evaluation, comparative research, data recovery, and monitoring of ground-disturbing activities. Approximately 30 percent of the river corridor has been surveyed for archeological resources, but many parts of the river corridor include large areas of steep terrain unlikely to contain most types of archeological sites, particularly those that contain data values. To obtain a more realistic perspective of how much of the river corridor has been archeologically surveyed, the Yosemite Predictive Model, weighted by factors of slope and distance to water, was employed to determine the probability of prehistoric site occurrence in unsurveyed areas (NPS, Shive 2007d). Results indicate that more than half (52%) of the areas with a high or medium probability for prehistoric sites have been surveyed in the river corridor (NPS, Shive 2007d).

Through archeological research up to and including 2010, archeological surveys and other activities have resulted in the documentation of 248 prehistoric, 18 combined prehistoric and historic, and 6 historic archeological sites in the corridor. Site densities (that is, concentrations of archeological sites) are high in several locations within the corridor, including Tuolumne Meadows, Dana Meadows, Lyell Canyon, Poopenaut Valley, and Pate Valley. One NRHP-eligible district, the Tuolumne Meadows Archeological District, overlaps with the river corridor. The Hetch Hetchy Archeological District is composed of two discontinuous units, one of which is within the river corridor. Archeological districts possess a significant concentration or continuity of sites united historically and by data values. They are composed of contributing and noncontributing elements (archeological sites) within their boundaries.

The most common prehistoric cultural constituents in the corridor include flaked lithic materials (mainly obsidian debitage [debris left over from the making of stone tools] and flaked stone tools, collectively called “lithic scatters”) and stationary milling features and their equipment. Less common are features that require subsurface or other archeological exploration for their identification, such as subsurface hearths, house pits, and other features. Caches of obsidian tools, house pit depressions, rock rings and enclosures, rock shelters, and pictographs are also found but are less common than lithic scatters.

As primary site constituents, obsidian tools and debitage have been a focus of park studies, especially during the last 25 years. Based on current obsidian hydration data (which uses the rate of water absorption of the obsidian piece to arrive at an approximate age when the piece was flaked from its parent material), initial use of the Tuolumne River corridor might have been as early as 6,000 years ago (Hull et al. 1995), but future investigations might reveal earlier occupations. Geochemical studies (generally related to the identification of obsidian quarry sources) indicate some distinction in obsidian acquisition patterns from eastern Sierra sources (NPS, Montague 2006o).

Due to the susceptibility of archeological resources to both purposeful and inadvertent vandalism, looting, and damage, the location and details of archeological sites are protected from public disclosure under federal regulations (16 *United States Code* [USC] 470w-3 and 16 USC 470hh). The location of specific archeological sites is not revealed in this document for their protection.

Sites along the Lyell and Dana Forks

Wild Segments: Lyell Fork and Upper Dana Fork

Scenic Segment: Lower Dana Fork

The NPS has identified 134 archeological sites along the two forks of the Tuolumne River. Lithic scatters account for most of the 73 sites along the Lyell Fork and the 61 sites along the Dana Fork, while several also include milling or other prehistoric features. Sixteen sites along the Dana Fork contain milling features, and ten sites contain other features, such as caches, rock rings, hearths, or house pits. One site along the Lyell Fork contains milling features, and seven sites contain features other than lithic scatters. Four sites contain historic materials.

The majority of the documented prehistoric sites along the Lyell and Dana Forks have not been formally evaluated for their eligibility to the NRHP. To date only nine sites along the Tioga Road corridor in the Lower Dana Fork segment have been subjected to test excavations to define their data potential and treatment needs or to evaluate their NRHP eligibility. Seven of these sites were found eligible and two were found ineligible. One of the eligible sites has undergone data recovery excavation, which was conducted to mitigate the impacts of utility installation. No archeological sites have been evaluated on the Lyell Fork.

Although few sites have been formally evaluated for their NRHP eligibility, many of the sites along both forks appear to have important research potentials that might make them significant (NPS, DePascale and Curtis 2006e). Pursuant to the *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines* (USDI 1995), the NPS considers unevaluated sites to be potentially eligible for the NRHP until determined otherwise through formal evaluation (NPS, Montague 2006o).

The most common causes of site disturbance in the Lyell Fork and the Lower Dana Fork segment are actions by hikers and/or pack stock, camping, and erosion. Less common sources of disturbance include trail construction, unauthorized collecting, and rodent activity. In the Lyell Fork, other less common sources of disturbance include grazing and trampling by pack stock, informal trails, and water control facilities. In the Lower Dana Fork, other less common sources of disturbance include roads, camping, structures, pipeline construction, motorized equipment, historic occupation, and transportation facilities.

Most sites that were evaluated for disturbance levels had low or moderate disturbance, but one site in the Lower Dana Fork segment was undergoing severe disturbance, primarily caused by visitor use. The site is bisected by a formal trail and exhibits evidence of trampling, campfire building, and possible unauthorized collection of artifacts. Most of the remaining unevaluated sites appear to be in fair to good condition, with five sites documented as being in poor condition, based on surface indicators. However, as archeological sites are largely subsurface, their data values and integrity cannot be fully evaluated without some form of excavation or scientific analysis; therefore, the condition of the majority of sites in these segments of the river corridor remains unknown (NPS, Montague 2006b). Since road corridors and some of the trail corridors have been surveyed, and unsurveyed areas tend to be more isolated, human-related disturbance in these areas may be somewhat less than the disturbance found in surveyed areas.

Tuolumne Meadows Archeological District

Scenic Segment: Tuolumne Meadows

A number of inventories have been conducted in the Tuolumne Meadows area over the past approximately six decades. By the 1970s, the NPS defined and nominated the Tuolumne Meadows Archeological District to the NRHP. The district was designated because of the significant concentration of sites, the diversity of materials contained in the sites, and their research potential to provide data on thousands of years of human prehistory.

The archeological district was determined eligible for listing in the NRHP in late 1978, based on surveys conducted in the 1950s and 1970s (Bennyhoff 1956; Napton 1978; Napton and Greathouse 1976b). The Tuolumne Meadows archeological district boundary generally follows the 8,800-foot elevation contour and the boundary defined for the 1970s archeological surveys, which encompasses 2,439 acres of land from Pothole Dome on the west to Rafferty Creek on the east (NPS, Anderson and Hammack 1977b). In addition to the Tuolumne Meadows sites, 9 unevaluated sites along the lower Dana Fork, 14 unevaluated sites along the Lyell Fork, and 8 sites at the head of the Grand Canyon segment are within the boundaries and management of the Tuolumne Meadows Archeological District. Archeological districts contain contributing and noncontributing elements. Until individual sites are evaluated as contributing or noncontributing to the eligibility of the archeological district, they are treated and managed as if they were contributing to the NRHP eligibility of the district.

The archeological resources in the district are significant at the local (Yosemite and Sierra regional) and state levels for their potential to provide information on human demographics, paleoenvironmental change, cultural chronology, prehistoric economic systems, settlement patterns, and sociocultural change, not to mention western hemisphere obsidian studies. They also have the potential to yield information about high-elevation resource procurement and past environmental conditions (NPS, Anderson and Hammack 1977b). Comparison of high-elevation materials with those from the lowlands is also considered important for understanding regional hunter-gatherer cultural patterns.

Most of the Tuolumne Meadows Archeological District has been resurveyed since the original district nomination. In the discipline of archeology in general, both survey and site documentation methods have become more rigorous and more comprehensive through time, which has required reconsideration of work conducted between 1950 and the 1970s (NPS, Montague 2006o). Seventy-five percent (1,580 acres) of the archeological district has been surveyed to current professional standards. The district is now known to contain 84 archeological sites, including 72 prehistoric archeological sites, 9 sites that contain both prehistoric and historic components, and 3 historic-era sites. Seventy-one isolates (isolated finds of cultural material not satisfying the criteria for site designation but still constituting evidence of past human activity) have been recorded within the Tuolumne Meadows Archeological District, including 42 historic isolates, 28 prehistoric isolates, and 1 of unknown origin. In addition, nine locations with blazed trees have been documented (NPS, Snyder 1995b). All but 3 of the 84 sites and their records have been updated or rerecorded to current Yosemite

archeological standards (NPS, Montague 2007s). The three sites not yet updated fall outside of the Tuolumne River corridor.

Some level of subsurface information is available for 22 of the sites within the Tuolumne Meadows Archeological District. Only six sites, all located in developed areas, have been subjected to test excavations, while data recovery excavations have occurred at three of these six sites (NPS, Montague 2007s).

As in the Dana and Lyell Fork areas, lithic scatters composed mainly of obsidian debitage are the primary site types and are present at all Tuolumne Meadows Archeological District sites with prehistoric components. Thirteen Tuolumne Meadows sites contain milling features, with a total of 15 stationary milling features, containing 68 mortars and 1 milling slick. Beyond stationary features and lithic scatters, some sites contain ground stone tools, flaked stone tools, cores, crystals, and used rocks (such as hammer stones and cooking stones). Other features documented at Tuolumne Meadows Archeological District sites include rock alignments, rock shelters, stone tool caches, and subsurface hearth features. Historical materials related to sheepherding, homesteading, early transportation, administration of the park, tourism, and, possibly, post-contact American Indian use, have been recorded at 12 sites within the Tuolumne Meadows Archeological District.

Sites are grouped into four classes, dependent in the NRHP status and whether or not the site retains further data potential (see table 9-42, below). Class 1 sites (45) were listed as contributing elements in the 1977 nomination form, but their specific data potentials have not been fully assessed because nomination of the district was based on surface information only. Class 2 sites (32) were recorded within the district boundaries after the nomination form was completed, and their eligibility remains to be determined under the NRHP criteria. Thus, most of the sites within the district boundaries, a total of 77, have yet to have their integrity and data potentials evaluated.

Table 9-42.
Tuolumne Meadows Archeological District Site Classes

Class	Number of Sites within Tuolumne Meadows Archeological District	Description (NRHP Status and/or Data Potentials)
Class I	45	Listed as contributing elements of the Tuolumne Meadows Archeological District in the 1977 NRHP nomination, but specific data potentials have not been fully assessed
Class II	32	Recorded within the archeological district after the determination of eligibility; eligibility for NRHP to be determined
Class III	4	Determined eligible for the NRHP and retain further data potential
Class IV	3	Determined ineligible for the NRHP; sites lack further data potential

Abbreviation: NRHP = National Register of Historic Places

Class 3 sites have been determined eligible for the NRHP (usually under criterion *d*), and they retain further data potentials. Four such sites are within the archeological district. As significant resources, the NPS recommends that this class of sites be avoided as part of planning. If the sites cannot be avoided, then appropriate treatment measures must be implemented to avoid adverse effects to the site. Class 4 sites, three of which are within the Tuolumne Meadows Archeological District, lack further data potential. Depending on any proposed actions, monitoring of ground-disturbing activities during construction might be recommended at this class of sites.

When nominated for inclusion on the NRHP in 1978, the Tuolumne Meadows Archeological District was considered to be in fair condition overall (NPS, Anderson and Hammack 1977b). Development and visitor use activity had exposed archeological sites to both direct impact from construction activities and indirect impact from casual collecting. Since the majority of the sites were assumed to be surface lithic scatters, the potential loss of information was judged to be severe. At least seven sites had been partially damaged by Tioga Road

construction work in the early 1930s. Extensive disturbance to another site resulted from the construction of the then-recent sewage-settling pond (NPS, Anderson and Hammack 1977b).

Currently, approximately three-quarters of the sites in the district are judged to be in good or fair condition. Four sites are in poor condition, and the condition of seven sites is not known (NPS, Montague 2006b). The most common causes of compromised site integrity and disturbances in Tuolumne Meadows are erosion, rodent activity, activities by hikers and/or livestock, informal trails, and roads. Less common sources of disturbance include construction of structures, trails, and utilities, and unauthorized collecting or looting (NPS, Shive 2007d). Most sites evaluated for disturbance levels had low or moderate disturbance, but 12 sites showed severe disturbance, primarily due to development and, to a lesser extent, visitor use (NPS, Montague 2007s; NPS, Shive 2007d). Most of the severely disturbed sites are in the developed areas, including the campground, wastewater treatment ponds, and along road or trail corridors. These sites, along with others in the developed zones, continue to be at high risk for ongoing visitor- and construction-related impacts. Almost all the sites in the meadows and along the river are affected by informal trails that bring visitors in closer proximity to the sites, and several sites have evidence of camping and campfires. Eleven sites were found to be missing previously documented lithic debitage or artifacts; presumably at least some of these were stolen (NPS, Shive 2007d).

Sites at Glen Aulin

Wild Segment: Grand Canyon of the Tuolumne

Ten archeological sites have been identified at and near Glen Aulin High Sierra Camp. Their condition is generally fair, with two sites in poor condition and two sites in unknown condition. The most common causes of site disturbance at these sites are trail construction and operation, activities by hikers and/or pack stock, and camping. Less common sources of disturbance include building campfires, theft or looting, erosion, structures, flooding and sheetwash (a thin film of water that contributes to erosion), rodent activity, and utilities. Of five sites evaluated for disturbance levels, two displayed moderate and two displayed severe levels of disturbance.

Sites in the Grand Canyon of the Tuolumne

Wild Segment: Grand Canyon of the Tuolumne

Within the Grand Canyon of the Tuolumne segment, 39 prehistoric sites have been identified, 8 of which also fall within the Tuolumne Meadows Archeological District (discussed above). Twenty-seven sites contain lithic material and thirteen include milling features. Other features, such as caches, rock rings, hearths, house pits, rock shelters, or pictographs occur at seven of the sites. Sites located in the Grand Canyon of the Tuolumne provide distinct evidence of trade and travel routes, tool caching, food and medicine procurement and processing, and related settlement. These sites might also be able to contribute to the understanding of human demography and cultural occupation in recent prehistory.

Three sites in the Grand Canyon and also within the Tuolumne Meadows Archeological District have been evaluated for their eligibility for the NRHP. Thirty-five prehistoric sites have not been formally evaluated (NPS, Montague 2006b), while one site has been recommended as eligible in 2005 (NPS, Gavette 2005d). This latter site was determined to be in fair condition after being affected by flooding, erosion, illegal collection of artifacts, and scientific study. Since designation, some of these impacts have continued, exacerbated by impacts of fire, hikers and/or stock, rodent activity, and trails (NPS, Gavette 2004b). The condition of other prehistoric sites in this river segment is, in general, fair to good, with approximately a third of all documented sites in good condition, and approximately half in fair condition. Three sites are documented as being in poor condition. The condition of several sites in this segment is not known (NPS, Montague 2006b).

The most common causes of site disturbance in the river corridor in the Grand Canyon segment are erosion and use by hikers and/or pack stock (between Tuolumne Meadows and Glen Aulin). Less common sources of

disturbance include camping, trail construction, unauthorized collecting or looting, rodent activity, fire, grazing, or trampling by pack stock. Below O'Shaughnessy Dam, causes of site disturbance also include roads, transportation facilities, and water control facilities. Just under half of the medium- and high-probability areas within the river corridor below Tuolumne Meadows have been surveyed. It is assumed similar types and levels of disturbance may be found at as-yet undocumented sites. However, since most road and trail corridors have been surveyed, and unsurveyed areas tend to be more isolated, human-related disturbance in unsurveyed areas may be somewhat less.

Although few sites in the Grand Canyon segment have been formally evaluated for their NRHP eligibility, many of the sites appear to have important research potential that might make them significant. Pursuant to the *Secretary of the Interior's Standards for the Treatment of Historic Properties*, the NPS considers unevaluated sites to be potentially eligible for the NRHP and contributing elements to the outstandingly remarkable archeological values of the Tuolumne River system until determined otherwise through formal NRHP evaluation (NPS, Montague 2006o).

Sites below O'Shaughnessy Dam

Scenic Segment: Below O'Shaughnessy Dam

Wild Segment: Poopenaut Valley

Low-elevation Sierra Nevada sites in Yosemite National Park are those that generally are in the 4,000-foot to about 2,000-foot elevation range. For purposes of the Tuolumne Wild and Scenic River corridor, this mainly encompasses sites in Poopenaut Valley and Below O'Shaughnessy Dam river segments.

The Hetch Hetchy Archeological District (NPS, Holland 1979), like the Tuolumne Meadows Archeological District, was determined eligible for the NRHP based on the surveys of the 1950s and 1970s (Bennyhoff 1956; Napton and Greathouse 1976b). Two sites comprised the Hetch Hetchy district at that time, one of which is located within the wild and scenic river corridor, in the nonwilderness segment below O'Shaughnessy Dam (NPS, Montague 2006o). This site was in fair condition, and assessed at 50% to 90% integrity in 1997, having been affected by road construction, fire, and flooding since its original documentation (NPS, Keefe et al. 1999). No new sites have been recorded in this archaeological district to date.

Outside of the Hetch Hetchy Archeological District, nine prehistoric sites, one multicomponent site, and one historic site have been recorded in the lower elevation portions of the river corridor. None of the sites have been formally evaluated for NRHP eligibility (NPS, Montague 2006b). In 2008, NPS assessed the impacts on archeological resources from the operation of O'Shaughnessy Dam. Fifty acres adjacent to the Tuolumne River, most of which had been examined before, were resurveyed. Seven previously documented sites were visited and four previously unrecorded sites were documented. Nine of the sites were found to be in good condition, while two sites were determined to be in fair condition. The sites in good condition showed signs of no disturbance or bioturbation (mixing of soil particles by organisms), while the two sites in fair condition had been disturbed by structural deterioration, tree falls and vegetation growth, flooding, and erosion (NPS, Gavette 2009b). However, flooding and erosion were considered natural and were not "...enhanced in anyway by the dam releases any more than they would be with an unimpeded flow regime" (NPS, Gavette 2009b).

Five of the same sites were revisited in 2010, and their condition was once again reviewed, this time during a high-water release from the dam. Using the same standards as the 2009 evaluation, three of the sites appeared to be in good condition, while one was considered to be in fair condition (NPS, Gavette 2010b). However, archeologists concluded that the causes of impact were natural and that it did not appear that the operation of the dam was adversely affecting the sites (NPS, Gavette 2010b).

Summary of Current Findings Regarding Condition

Several decades of site condition assessments conducted through 2007 found that archeological sites occurring in every river segment either have or appear to have important research potential. Almost all the archeological sites along the river and in meadows have been affected by informal trails and many of these sites are at risk of losing some of their integrity. The Archeological Sites Management Information System (ASMIS) is the NPS standardized database for the registration and management of archeological resources. ASMIS records contain data on resource conditions, threats and disturbances, proposed treatments, and management actions for known sites. Based on ASMIS evaluation criteria and standards, site monitoring was conducted from 2007 to 2011 of a sample set of 128 sites as of May 2011. Over that five-year interval (2007–2011), 98% of high data potential sites and 96% of low data potential sites in the sample were considered free of serious human impacts. Based on these recent site condition assessments, the archeological landscape is well within the management standard described in chapter 5. However, concerns about disturbances to sites caused by foot traffic and/or potential future facility development and maintenance remain.

Environmental Consequences Methodology

As noted on in the introduction to this chapter, any prehistoric or historic building, structure, object, site, or district that is included in, or is eligible for inclusion in the NHRP is termed a historic property and is managed for protection under the NHPA. The ACHP has issued regulations for the implementation of NHPA section 106, entitled “*Protection of Historic Properties*” (36 CFR 800). ACHP regulations discuss no historic properties affected, no adverse effect, and adverse effect types of effects under NHPA section 106 (see the introduction to this chapter for more detail).

Prehistoric and historic archeological sites and districts are considered eligible for inclusion in the NRHP when they are associated with events that have made a significant contribution to the broad patterns of our history (criterion *a*); when they are associated with the lives of persons significant in our past (criterion *b*); when they embody the distinctive characteristics of a type, period, or method of construction (criterion *c*), or when they have contributed or have the potential to contribute information about the past (criterion *d*). Prehistoric sites are usually evaluated for the NRHP under criterion *d* because it is the information value contained in the spatial and temporal relationships of the artifacts, soils, features, and other constituents that is unique. Prehistoric archeological sites are also valued by traditionally associated American Indian tribes and groups as well as individuals as tangible links to their unique cultural heritage. Given this, the views and values of traditionally associated peoples must be taken into account when evaluating prehistoric sites for eligibility to the NRHP. Some aspects of impact assessment methodology relate simply to whether an action affects the characteristics that might make a resource eligible for the NRHP, along with other laws and regulations. In general, adverse impacts on archeological resources occur when irreparable alteration of features or patterns, including destruction, diminishes the overall integrity of the data values or other resource values.

The focus of the methodology is on potential new impacts on archeological resources as a result of the *Final Tuolumne River Plan/EIS* alternatives, but also recognition of ongoing effects largely from visitor use and activities related to ongoing maintenance. If there would be no impacts, management objectives for these resources (that they retain their current levels of integrity) would be met. It is not possible to improve the condition of (have a beneficial impact on) an archeological resource. New impacts would include, but not be limited to (1) construction and maintenance of new facilities, (2) ground-disturbing natural resource restoration, or (3) human-caused factors, including visitor use activities. Ongoing impacts would include, but not be limited to (1) use of commercial, private and administrative pack stock, (2) visitor use (such as hiking, camping, or picking up artifacts), or (3) ongoing maintenance.

Human-related activities are within the NPS’s capacity to document, monitor, and mitigate as necessary. For instance, casual theft of artifacts is an unmitigated adverse effect. Although it is difficult to determine the extent

of the loss of artifacts and information due to this activity (as it has not been systematically monitored and documented in the past), casual theft is judged to occur more commonly in high visitor use areas. High visitor use areas are viewed as locations with increased potential for site damage in general.

Although natural forces can be quite destructive to the integrity of archeological sites, it would be extremely difficult and undesirable from the perspective of the NPS's overall mission, to attempt to halt or forestall these types of impacts in all but a few cases (NPS, Montague 2007s). The impact assessment is based on the assumptions listed below.

- The greater the archeological complexity, the greater potential value it has for contribution to scientific inquiries into the historic record. Development may affect the values that provide regional information.
- The more surficially visible an archeological site, the more potential there is for that site to be damaged by vandalism or looting. Increased visitor use and accessibility to site areas has the potential to affect archeological integrity adversely.
- The more developed areas become, the less protective buffer area there is surrounding an archeological site. Increased human presence brings an increased potential for compacted soil, altered surface features, and vegetation disturbance. Increased development has the potential to remove natural geographic features that serve to buffer and protect sites.
- Modifications of a river channel may cause channel instability and shifting, increased bank erosion, and might change flood flow elevations, thereby undercutting or otherwise removing archeological deposits nearby. Well-vegetated banks protect the integrity of the river channel and shore, thereby providing protection for the site deposits.

The types of actions that would affect archeological sites are ground-disturbing activities such as the development of campgrounds, roads, trails, parking lots, underground utilities, and structures. Ecological restoration might also affect archeological deposits, but in many cases restoration techniques could be modified to avoid effects to archeological sites while restoring natural conditions.

If such actions were proposed at class I or class II sites, as defined previously in table 9-42, then archeological investigations would be carried out to evaluate site significance. This type of work would generally entail the retrieval of a small sample of the deposit sufficient to characterize the site, assess its integrity, and identify specific values in relation to the Tuolumne Meadows Archeological District nomination form (NPS, Anderson and Hammack 1977b) or the NRHP criteria in general. A site-specific research design, tied to the parkwide archeological research design entitled *Archeological Synthesis and Research Design, Yosemite National Park, California (Archeological Synthesis and Research Design)* (Hull and Moratto 1999), would guide the archeological investigation. American Indian representatives would participate in archeological investigations as subject matter experts on American Indian values and traditional cultural knowledge, and might provide data about other site values. In addition, American Indian representatives would commonly monitor subsurface investigations.

If such actions were proposed at class III sites, which have already been determined eligible for the NRHP, then appropriate measures to mitigate impacts by project activities would be necessary prior to ground disturbance.

If such actions were proposed at class IV sites, which have already been determined ineligible for the NRHP and lack further data potential, similar mitigation as that proposed for other classes may be appropriate. While class IV sites are individually less important for their individual information potential, they are tangible elements that contribute to the understanding of prehistory, and they are also important in terms of their cultural value to contemporary traditionally associated peoples. In addition, the known presence of even a single site, though not eligible, may be an indicator that the area may contain other archeological resources.

Environmental Consequences of the No-Action Alternative

The no-action alternative is a baseline from which to compare other alternatives. It carries the underlying assumption that current trends in the conditions of and impacts to archeological sites would continue, consistent with ongoing management activities. The continuation of the current condition is described in chapter 8 and under “Affected Environment,” above.

Archeological sites would continue to be documented and monitored through the ASMIS system. Various park projects and maintenance activities that take place in the Tuolumne River corridor would continue to be confined to nonsensitive areas wherever feasible. Future actions that may affect archeological resources would be subject to compliance with the NHPA section 106 review process, which is augmented by national and park-specific programmatic agreements among the NPS, the ACHP, and the National Council of Historic Preservation Officers or the California SHPO. Both agreements are included in appendix D.

Wild Segments

Parkwide trends in visitor use levels would likely cause increased impacts on sites along the most easily accessible wilderness areas, such as those accessed along Tioga Road. Most sites in designated Wilderness upstream from Tuolumne Meadows would remain at risk of low to moderate impact. The potential for site damage would be greatest at several popular camping locations along the upper Lyell Fork and near turnouts along Tioga Road (NPS, Montague 2006b).

Current management of pack stock use in Lyell Canyon would continue to affect archeological sites. The effects, possibly adverse, include exposure of archeological deposits, soil compaction, modified or bare ground, confusion and displacement of archeological strata, and streambank erosion. These effects would continue to occur at pack stock camps and grazing areas as well as at formal and informal trails, where pack stock pass through or otherwise cross over archeological sites and their associated landscape.

Overall, in the wild segments of the river corridor below Tuolumne Meadows, archeological sites would remain relatively isolated and generally in fair to good condition under the no-action alternative. Human-caused impacts would continue at similar levels; however, these areas do not contain any of the highest visitor use zones that are viewed as locations with increased potential for site damage (NPS, Montague 2006b).

With visitation to Yosemite National Park generally increasing, trail use in the Grand Canyon segment, along the Pacific Crest Trail through Glen Aulin, and down to Waterwheel Falls would likely increase. Where archeological sites are close to the trail, visitors might easily discover and remove artifacts, and the potential risks associated with visitor use would increase.

Under the no-action alternative, sites in the Glen Aulin area would continue to sustain heavy visitor-related impacts associated with the current level of use. Routine maintenance activities and upkeep of existing facilities might affect one recorded archeological resource by disturbing intact deposits that possess unknown data potentials. Archeological testing to formally determine the eligibility of the site would need to be undertaken prior to ground disturbance. If found eligible, appropriate measures to mitigate impacts would be necessary. Mitigation measures may include avoidance, protective measures, archeological monitoring, and data recovery.

In the Poopenaut Valley segment, archeological sites would remain relatively isolated and generally in good to fair condition. The Ackerson Fire burned a portion of this area in 1996; some sites sustained minor-to-moderate damage from both fire effects and fire suppression activities (NPS, Keefe et al. 1999). Reassessment of these sites in 2008 and 2010 indicates that they are still in good to fair condition (NPS, Gavette 2009b; NPS, Gavette 2010b). Human-caused and natural impacts would continue at similar levels; however, these areas do not contain any of the highest visitor use zones that are viewed as locations with increased potential for site damage (NPS, Gavette 2009b; NPS, Gavette 2010b; NPS, Montague 2006b).

Scenic Segment

The highest visitor use areas in the Tuolumne River corridor, which have increased potential for site damage, include popular day hike destinations in the Tuolumne Meadows area, from the lower Lyell Fork to below Pothole Dome (NPS, Montague 2006b). Parkwide trends in visitor use levels would likely cause increased impacts on sites in these easily accessible areas.

Pack stock use would continue to affect archeological sites along stock trails through Tuolumne Meadows. Impacts would include exposure of archeological deposits, soil compaction, modified or bared ground, mixing of artifacts, and displacement of archeological strata.

Routine maintenance, restoration activities, and upkeep of existing facilities could adversely affect identified archeological resources by disturbing intact deposits, many of which possess unknown data potential. To mitigate these impacts, the park would avoid known archeological resources or implement treatment measures, including data recovery to retrieve important information in accordance with the national and park-specific programmatic agreements included in appendix D.

The one site in the Hetch Hetchy Archeological District that is inside the river corridor was in fair condition in 1997, having been affected by road construction, fire, and flooding since its original documentation (NPS, Keefe et al. 1999).

Conclusion

Archeological sites would continue to be documented and monitored, but would not be managed to an established standard under the no-action alternative. It is likely that current site impacts would continue and overall site conditions would eventually worsen under this alternative. Because the data potential of most of these sites have not been evaluated and condition assessments are sporadic, it is difficult to predict the overall severity of effects on archeological resources. The potential for an adverse effect on some of the archeological resources in the river corridor would continue.

For the most part, archeological sites in wild segments would remain intact, with some exceptions in wilderness adjacent to Tioga Road, along major trails (e.g., the John Muir Trail/Pacific Crest Trail), the Glen Aulin area, and in pack stock use areas in Lyell Canyon.

Many sites throughout the corridor, particularly those in high-use areas, would continue to be disturbed under the no-action alternative, and some would continue to be threatened by visitor and administrative activities. Since impacts on archeological resources cannot be reversed but only stopped from doing further harm, continued actions would have the potential for an adverse effect on archeological resources. For administrative activity, consultation with the park's Resources Management Science Division, adherence to the national and park-specific programmatic agreements in appendix D, and application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999) prior to conducting administrative activities that cause ground disturbance would be applied to avoid or minimize the potential adverse effect.

Cumulative Impacts

In general, past visitor use and related development, operation, and maintenance of facilities throughout Yosemite National Park has disturbed, destroyed, or affected the integrity of numerous archeological sites. Under the no-action alternative, resources throughout developed areas in the park would continue to be subject to damage from ongoing maintenance, construction, demolition, rehabilitation of existing facilities and utility corridors, vandalism, visitor access, pack stock trails, and natural processes. Nearly half the sites in the Tuolumne Meadows Archeological District have already sustained development-related impacts (NPS, Montague 2007s).

Implementation of current and/or reasonably foreseeable future actions is likely to disturb individual archeological resources. Specific impacts would depend upon the nature, location, and design of the facility to be developed or removed as well as the quantity and data potentials of the archeological resources(s) affected. Site-specific avoidance and mitigation measures would reduce the potential for adverse effects on archeological resources.

Current and/or reasonably foreseeable future trends, actions, projects, and plans that could have a cumulative effect on archeological resources in combination with the no-action alternative are listed below:

- The upcoming *Wilderness Stewardship Plan* might limit visitor use in certain areas, which would help reduce impacts to archeological resources.
- Implementation of management actions throughout the park called for in the *Fire Management Plan*, the *Parkwide Invasive Plant Management Plan Update*, the *Vegetation Management Plan*, the upcoming *High-Elevation Aquatic Ecosystem Recovery and Stewardship Plan*, and the *Scenic Vista Management Plan* would involve ground-disturbing activities that may affect archeological sites within the planning area.
- Current planning includes commercial use authorizations for commercial activities, which regulate commercially guided trips, including those using pack animals, and comprehensive planning for the Merced Wild and Scenic River, which will address user capacity in the Merced River corridor. Both of these have the potential to increase or reduce the risk of impacts on archeological resources, depending on which activities are authorized, their frequency, and where they occur.
- Site-specific current planning in the park includes planning for the communication data network, which received a finding of no significant impact in April 2010. Other current projects for Tenaya Lake, the Tioga Trailheads project, Tioga Road Rehabilitation, Tuolumne Meadows water treatment system improvements, Tuolumne Meadows concessioner stables corral modification, Cathedral Peak route delineation, and the Hetch Hetchy communication systems upgrade. All of these projects would each entail extensive grading, excavation, trenching, drainage improvements, and other ground disturbance at specific locations.

Cumulatively these projects, when combined with the no-action alternative, would result in an adverse effect on archeological resources.

Environmental Consequences and Mitigation Measures Common to Alternatives 1-4

Corridorwide

As described in chapter 5, the NPS would conduct a program of site condition assessments and systematic analysis and reporting of site data collected under any of the action alternatives. Management action (examples of which are shown in chapter 5, table 5-8) would be triggered if the number of individual sites free from serious unmitigated human impacts reached 90% of low data potential sites and 95% of high data potential sites, well within the management standard (or desired condition) set in chapter 5. This “management trigger” would help the NPS identify and arrest human-caused impacts well before the management standard is reached.

In areas where sites might be affected by ground disturbance, archeological testing would be conducted to formally determine the individual eligibility of each site. Evaluation procedures would be carried out pursuant to the national and park-specific programmatic agreements included in appendix D, and with the application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999). If found eligible, appropriate measures to mitigate impacts by project activities would be necessary prior to ground disturbance. Mitigation measures might include avoidance, protective measures, archeological monitoring, and data recovery (see appendix O for mitigation measures).

Where ecological restoration actions would potentially affect archeological resources, the actions would be designed to avoid impacts wherever feasible. If avoidance was not possible, archeological site treatments such as controlled testing and data recovery excavations, where necessary, would be employed to reduce the level of impact and avoid an adverse effect.

All treatments for precontact archeological sites would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Wild Segments

No new disturbance to archeological resources in designated Wilderness downstream of O'Shaughnessy Dam would be anticipated. Therefore, impacts under any of the action alternatives would be consistent with the impacts described above for the no-action alternative.

Scenic Segment

No new actions would occur in the administrative area below O'Shaughnessy Dam. Therefore, impacts would be consistent with the impacts described above for the no-action alternative.

Environmental Consequences of Alternative 1

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 1 on archeological resources are described below.

Wild Segments

Use in wilderness would be substantially decreased with alternative 1 as a result of reductions in day use levels at Tuolumne Meadows, the implementation (if necessary) of a day use wilderness permit system, and the elimination of concessioner stock day rides. This would decrease the potential for impacts on archeological sites, such as visitors removing artifacts and randomly or inadvertently altering site constituents, particularly where archeological sites are close to trails and favorable camping locations.

Elimination of most pack stock use, including nearly all commercial stock use (the concessioner would still resupply High Sierra Camps outside the river corridor from a corral at Tuolumne Meadows) would greatly reduce the potential for impacts at archeological sites, including exposure of archeological deposits, soil compaction, modified or bare ground, confusion and displacement of archeological strata, and streambank erosion. Restoration of localized areas disturbed by human and pack stock use in upper Lyell Canyon would require manual ground disturbance, which might affect archeological resources. As noted under "Environmental Consequences and Mitigation Common to Alternatives 1–4" above, appropriate measures to mitigate impacts from ecological restoration activities would be necessary before ground disturbance to avoid an adverse effect.

At Glen Aulin, demolishing and restoring the High Sierra Camp and replacing the composting toilet at the backpacker campground would have the potential to disturb a recorded archeological resource that has already sustained heavy visitor-related impacts. If avoidance of this site was not possible, archeological site treatments, such as controlled testing and data recovery excavations, would be employed to reduce the level of impact and avoid an adverse effect.

Scenic Segments

The potential for impacts on some archeological sites within the Tuolumne Meadows Archeological District would be decreased under alternative 1 through the reduction in day and overnight use levels. In addition, alternative 1 would reduce the potential for disturbance by eliminating roadside parking and eliminating

informal trails. The elimination of concessioner stock day rides would result in a decrease in the risk of stock-related impacts on archeological sites along trails through Tuolumne Meadows.

Implementation of the Tuolumne Meadows site plan associated with alternative 1 would have the potential to disturb the sites listed below in the Tuolumne Meadows Archeological District through ground-disturbing activities, including removing buildings, roads, and wastewater facilities; converting existing facilities; redesigning the campground; removing roadside parking and providing roadside pullouts; expanding formal parking areas; constructing trails; and implementing ecological restoration:

- twelve class I sites, which have been recommended eligible as contributing elements of the archeological district based on surface evidence.
- thirteen class II sites, which have not been individually evaluated for NRHP eligibility or as contributors to the archeological district.
- one class III site, which has been determined eligible for listing on the NRHP as a contributor to the archeological district.
- three class IV sites, which have been determined not eligible for the NRHP, individually or as a contributor to the archeological district. (However, depending on the ground disturbance that would take place, monitoring during construction might be recommended.)

One site outside of the Tuolumne Meadows Archeological District boundaries would be affected by planning activities. It has not been evaluated for NRHP eligibility.

Conclusion

Under alternative 1, the implementation of site condition assessments, analysis, and reporting program with management triggers for protective actions would help lower the potential for disturbances associated with human use and would reduce the risk of an adverse effect on archeological sites, compared with the no-action alternative.

There would be no adverse effect on archeological resources in wilderness. Lower use levels, elimination of concessioner stock day rides, elimination of nearly all commercial use, and restrictions on the location of camping and grazing areas in Lyell Canyon would reduce the risk of disturbance to archeological sites, compared with existing conditions. Restoration of localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.

At Glen Aulin High Sierra Camp, ground disturbance from removing the entire camp and proposed work at the backpacker campground might disturb a recorded archeological resource. If avoidance was not possible, archeological site treatments, such as controlled testing and data recovery excavations, would be employed to reduce the level of impact and avoid an adverse effect.

At Tuolumne Meadows, the risk of disturbance at archeological sites with alternative 1 would be decreased by reducing day and overnight visitor use levels, eliminating road shoulder parking, and eliminating informal trails.

However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from alternative 1. Implementation of the site plan at Tuolumne Meadows would have the potential to disturb 12 class I sites, 13 class II sites, 1 class III site, and 3 class IV sites. One site outside the archeological district might also be affected. Some of these impacts would be caused by ecological restoration activities; in many cases, restoration techniques could be modified to avoid impacts on individual archeological sites.

There would be no effect on archeological resources in river segments below O'Shaughnessy Dam, including the Hetch Hetchy Archeological District.

Corridorwide, archeological testing would be conducted to formally determine the individual eligibility of each site (if not already determined) where potential disturbance was likely. If specific actions proposed might affect a given site's NRHP eligibility, especially under NRHP criterion *d*, the adverse effect would be addressed through adherence to the NPS cultural resource management guidelines and the national and park-specific programmatic agreements in appendix D, and through application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999). All treatments for precontact archeological sites would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Cumulative Impacts

Past and existing cumulative effects in combination with alternative 1 would be the same as with the no-action alternative, with the following exceptions:

Reducing visitor use levels and activities corridorwide and implementing standards with management triggers to help ensure sites remain free from serious unmitigated human impacts would result in a reduced risk of an adverse effect to archeological sites. As noted above, potential adverse effects would be addressed through adherence to the NPS cultural resource management guidelines, national and park-specific programmatic agreements (appendix D), and application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999).

Environmental Consequences of Alternative 2

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 2 on archeological resources are described below.

Wild Segments

Although visitor use levels could be higher than existing conditions, some trail use in wilderness would decrease as a result of reductions in concessioner stock day rides and reductions in the amount of pack stock needed to resupply the Glen Aulin High Sierra Camp (which would be converted to an outfitter camp). This would reduce the potential for impacts such as random or inadvertent alteration of site constituents, particularly where archeological sites are close to the trails.

Regulations on where overnight camping with pack stock and grazing would be allowed in Lyell Canyon would reduce the potential for impacts on archeological sites at those locations. Restoration of localized areas disturbed by human and pack stock use in upper Lyell Canyon would require manual ground disturbance, which might affect archeological resources. As noted under "Environmental Consequences and Mitigation Common to Alternatives 1–4" above, appropriate measures to mitigate impacts from ecological restoration activities would be necessary prior to ground disturbance to avoid an adverse effect.

Recreational boating in the Grand Canyon segment under alternative 2 would be limited to six trips a year (and a maximum of eight people/boats per trip). This limited use would have the potential to damage archeological resources if boaters were allowed to take out or put in boats where there were archeological sites, or if they were allowed to portage their boats on trails that cut through archeological resources. Impacts would be avoided through consultation with park archeologists prior to designation of put-in, take-out, and portage locations.

At the Glen Aulin High Sierra Camp, deconstructing permanent structures, converting and continuing to use the area as a temporary outfitter camp, retaining the backpacker campground, and installing a new composting

toilet would have the potential to affect a recorded archeological resource. If avoidance of the site was not possible, the NPS would employ archeological site treatments, such as controlled testing and data recovery excavations, to reduce the level of impact and avoid an adverse effect.

Scenic Segments

Although visitor use at Tuolumne Meadows would be similar to existing conditions, the risk of some disturbance to archeological resources at Tuolumne Meadows would decrease through eliminating shoulder parking, eliminating informal trails, consolidating visitor use at specific locations, and moving pathways away from sensitive locations. However, the potential for disturbance of archeological sites would be increased by increased picnicking, the location of a boating put-in, and campground expansion.

Implementation of the Tuolumne Meadows site plan associated with alternative 2 would have the potential to disturb the sites listed below in the Tuolumne Meadows Archeological District through removing existing facilities, converting or replacing existing facilities, constructing new facilities, removing roadside parking and providing roadside pullouts, expanding parking and picnicking areas, constructing trails, and implementing ecological restoration activities:

- eight class I sites, which have been recommended eligible as contributing elements of the district based on surface evidence
- four class II sites, which have not been evaluated for NRHP eligibility
- two class III archeological sites, which have been determined eligible for listing on the NRHP
- no class IV sites

Conclusion

Under alternative 2, implementing site condition assessments, analysis, and reporting program with management triggers for protective actions would help lower the potential for disturbances associated with human use and would reduce the risk of an adverse effect on archeological sites compared with the no-action alternative.

There would be no adverse effect on archeological resources in wilderness. The reduction in concessioner stock day rides, reductions in commercial use, and restrictions on the location of camping and grazing areas in Lyell Canyon would reduce the risk of disturbance to archeological sites, compared with existing conditions. Restoring localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.

At Glen Aulin High Sierra Camp, ground disturbance from removing the entire camp and proposed work at the backpacker campground might disturb a recorded archeological resource. If avoidance was not possible, the NPS would employ archeological site treatments, such as controlled testing and data recovery excavations, to reduce the level of impact and avoid an adverse effect. There would also be a potential for adverse effects on archeological resources from recreational boating use at put-in, portage, and take-out locations between Tuolumne Meadows and Pate Valley; consultation with the park archeologist could avoid an adverse effect.

Although visitor use levels at Tuolumne Meadows could be higher with alternative 2 than existing conditions, when compared to the no-action alternative, the risk of disturbance to archeological resources at Tuolumne Meadows would decrease through eliminating shoulder parking, eliminating informal trails, consolidating visitor use at specific locations, and relocating pathways away from sensitive locations.

However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from alternative 2. Implementation of the site plan at Tuolumne Meadows would have the

potential to disturb eight class I sites, four class II sites, and two class III sites. Some of these impacts would be due to ecological restoration activities; in many cases restoration techniques could be modified to avoid impacts on individual archeological sites.

There would be no effect on archeological resources in river segments below O'Shaughnessy Dam, including the Hetch Hetchy Archeological District.

Corridorwide, archeological testing would be conducted to formally determine the individual eligibility of each site (if not already determined) where potential disturbance was likely. If specific actions proposed might affect a given site's NRHP eligibility, especially under NRHP criterion *d*, the adverse effect would be addressed through adherence to the NPS cultural resource management guidelines and the national and park-specific programmatic agreements in appendix D, and through application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999). All treatments for precontact archeological sites would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Cumulative Impacts

The impact of past, present, and reasonably foreseeable plans and projects listed in appendix L, in combination with alternative 2, would be the same as the no-action alternative with the following exceptions:

Alternative 2 proposes visitor use levels that could be higher than existing conditions, but with consolidated and more directed use at Tuolumne Meadows. It also proposes allowing limited recreational boating in a portion of the Tuolumne River corridor. Although this alternative would reduce potential disturbance to sites corridorwide by relocating use away from sensitive sites in the high-use areas and implementing a monitoring program, there would be a potential for adverse effects. As above, potential adverse effects would be addressed through adherence to the NPS cultural resource management guidelines, national and park-specific programmatic agreements (appendix D), and application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999).

Environmental Consequences of Alternative 3

In addition to "Environmental Consequences Common to Alternatives 1–4," the environmental consequences of alternative 3 on archeological resources are described below.

Wild Segments

Trail use in wilderness would decrease as a result of reductions in concessioner stock day rides into the wilderness and reductions in commercial use with alternative 3. This would reduce the potential for impacts, such as visitors removing artifacts and randomly or inadvertently altering site constituents, particularly where archeological sites are close to the trails.

Regulating where overnight camping with pack stock and grazing would be allowed in Lyell Canyon would reduce the potential for impacts on archeological sites. Restoration of localized areas disturbed by human and pack stock use in upper Lyell Canyon would require manual ground disturbance, which could affect archeological resources. As noted above under "Environmental Consequences and Mitigation Common to Alternatives 1–4," appropriate measures to mitigate impacts from ecological restoration activities would be necessary prior to ground disturbance to avoid an adverse effect.

At Glen Aulin, alternative 3 proposes retaining the High Sierra Camp at a reduced capacity, retaining the backpacker camp, and upgrading or replacing utilities. Utility upgrades and continued use of the High Sierra and backpacker camps might affect a recorded archeological resource. Siting the proposed utility upgrades in nonsensitive locations would avoid an adverse effect.

Scenic Segments

Overall, the risk of disturbance to archeological resources at Tuolumne Meadows within the Tuolumne Meadows Archeological District would be decreased under alternative 3 through reducing day use levels, eliminating roadside parking, and eliminating informal trails.

Implementation of the Tuolumne Meadows site plan associated with alternative 3 would have the potential to disturb the following sites in the Tuolumne Meadows Archeological District through converting or redesigning existing facilities, removing employee housing, removing roadside parking and providing roadside pullouts, expanding parking areas, constructing trails, and implementing ecological restoration activities:

- seven class I sites, which have been recommended eligible as contributing elements of the district based on surface evidence.
- two class II sites, which have not been evaluated for the NRHP.
- two class III archeological sites, which have been determined eligible for listing on the NRHP.
- one class IV archeological site, which has been determined not eligible for the NRHP. (However, monitoring may be recommended due to the ground disturbance that would take place.)

Conclusion

Under alternative 3, the implementation of site condition assessments, analysis, and reporting program with management triggers for protective actions would help lower the potential for disturbances associated with human use and result in a reduced risk of an adverse effect to archeological sites, compared to the no-action alternative.

There would be no adverse effect on archeological resources in wilderness. The reduction in concessioner stock day rides, reductions in commercial use, and restrictions on the location of camping and grazing areas in Lyell Canyon would reduce the risk of disturbance to archeological sites, compared with existing conditions. Restoration of localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.

At Glen Aulin, ground disturbance from utility upgrades would potentially disturb a recorded archeological resource. Siting the proposed utility upgrades in nonsensitive locations would avoid an adverse effect.

At Tuolumne Meadows, the risk of disturbance to some archeological resources at Tuolumne Meadows would be decreased through reducing visitor use levels, eliminating road shoulder parking, and eliminating informal trails.

However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from alternative 3. Implementation of the site plan at Tuolumne Meadows would have the potential to disturb seven class I sites, two class II sites, three class III sites, and one class IV site. Some of these impacts would be due to ecological restoration activities; in many cases, restoration techniques could be modified to avoid impacts on individual archeological sites.

There would be no effect on archeological resources in river segments below O'Shaughnessy Dam, including the Hetch Hetchy Archeological District.

Corridorwide, archeological testing would be conducted under alternative 3 to formally determine the individual eligibility of each site (if not already determined) where potential disturbance was likely. If specific actions proposed might affect a given site's NRHP eligibility, especially under NRHP criterion *d*, the adverse effect would be addressed through adherence to the NPS cultural resource management guidelines and the

national and park-specific programmatic agreements in appendix D, and through application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999). All treatments for precontact archeological sites would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Cumulative Impacts

The impact of past, present, and reasonably foreseeable plans and projects listed in appendix L, in combination with alternative 3, would be the same as the no-action alternative with the following exceptions:

Alternative 3 proposes an overall reduction of use in most areas. Reducing visitor use levels and activities corridorwide and implementing a monitoring program would help reduce the risk of an adverse effect on archeological resources. However, the potential for an adverse effect would remain. As above, adverse effects would be addressed through adherence to the NPS cultural resource management guidelines, national and park-specific programmatic agreements (appendix D), and application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999).

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on archeological resources are described below.

Wild Segments

Under alternative 4, trail use in wilderness would be decreased through eliminating concessioner stock day rides and reducing the amount of concessioner pack stock needed to resupply Glen Aulin High Sierra Camp. Non-concessioner commercial use would be restricted to approximately existing levels of use. This would decrease the potential for impacts on archeological sites, such as visitor removing artifacts and randomly or inadvertently altering site constituents, particularly where archeological sites are close to trails.

Regulations on where overnight camping with pack stock and grazing would be allowed in Lyell Canyon would reduce the potential for impacts on archeological sites. Restoration of localized areas disturbed by human and pack stock use in upper Lyell Canyon would require manual ground disturbance, which may affect archeological resources. As noted under “Environmental Consequences and Mitigation Common to Alternatives 1–4” above, appropriate measures to mitigate impacts from ecological restoration activities would be necessary prior to ground disturbance to avoid an adverse effect.

Recreational boating in the Grand Canyon segment under alternative 4 would be limited to six trips a year (and a maximum of eight people/boats per trip). This limited use would have the potential to damage archeological resources if boaters were allowed to take out or put in boats where there were archeological sites, or if they were allowed to portage their boats on trails that cut through archeological resources. Impacts would be avoided through consultation with park archeologists prior to designation of put-in, take-out, and portage locations.

At Glen Aulin, alternative 4 proposes retaining the High Sierra Camp at a slightly reduced capacity, retaining the backpacker camp, and upgrading or replacing utilities. Utility upgrades and continued use of the High Sierra and backpacker camps might affect a recorded archeological resource. Siting the proposed utility upgrades in nonsensitive locations would avoid an adverse effect.

Scenic Segments

The potential for disturbance to archeological sites throughout Tuolumne Meadows, within the Tuolumne Meadows Archeological District, would be decreased from eliminating roadside parking, eliminating informal trails, and consolidating visitor use in designated locations and pathways away from sensitive locations.

Implementation of the Tuolumne Meadows site plan associated with alternative 4 would have the potential to disturb the following sites in the Tuolumne Meadows Archeological District through ecological restoration activities, removing roadside parking and providing roadside pullouts, expanding parking areas, constructing and formalizing trails, removing and replacing facilities, redesigning the Tuolumne Meadows campground, and constructing employee housing:

- seven class I sites, which have been recommended eligible as contributing elements of the archeological district based on surface evidence.
- six class II sites, which have not been evaluated for the NRHP.
- two class III sites, which have been determined eligible for listing on the NRHP.
- two class IV sites, which have been determined not eligible for the NRHP. (However, monitoring may be recommended due to the ground disturbance that would take place.)

Conclusion

Under alternative 4, implementation of site condition assessments, analysis, and a reporting program with management triggers for protective actions would help lower the potential for disturbances associated with visitor use and would result in a reduced risk of an adverse effect on archeological sites, compared with the no-action alternative.

There would be no adverse effect on archeological resources in wilderness. The elimination of concessioner stock day rides into the wilderness, reductions in commercial use, reductions in pack stock used to resupply Glen Aulin High Sierra Camp, and restrictions on the locations of pack stock camping and grazing areas in Lyell Canyon would reduce impacts on archeological sites, compared with existing conditions. Restoring localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.

At Glen Aulin High Sierra Camp, ground disturbance from utility upgrades would potentially disturb a recorded archeological resource. Siting the proposed utility upgrades in nonsensitive locations would avoid an adverse effect. There would also be a potential for adverse effects on archeological resources from recreational boating use at put-in, portage, and take-out locations between Tuolumne Meadows and Pate Valley; consultation with the park archeologist could avoid an adverse effect.

Although visitor use levels at Tuolumne Meadows under alternative 4 would remain approximately the same as under the no-action alternative, the potential for disturbance to some archeological sites throughout Tuolumne Meadows would be decreased with elimination of roadside parking, elimination of informal trails, and consolidation of visitor use in designated locations and pathways away from sensitive locations.

However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from the implementation of alternative 4. Implementation of the site plan at Tuolumne Meadows would have the potential to disturb seven class I sites, six class II sites, two class III sites, and two class IV sites. Some of these impacts would be due to ecological restoration activities; in many cases, restoration techniques could be modified to avoid impacts on individual archeological sites.

There would be no effect on archeological resources in river segments below O'Shaughnessy Dam, including the Hetch Hetchy Archeological District.

Corridorwide, archeological testing would be conducted to formally determine the individual eligibility of each site (if not already determined) where potential disturbance was likely. If specific actions proposed might affect a given site's NRHP eligibility, especially under NRHP criterion *d*, the adverse effect would be addressed

through adherence to the NPS cultural resource management guidelines and the national and park-specific programmatic agreements in appendix D, and through application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999). All treatments for precontact archeological sites would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Cumulative Impacts

Past and existing cumulative effects in combination with alternative 4 would be the same as with the no-action alternative, with the following exceptions:

Reducing visitor use levels and activities corridorwide and implementing a monitoring program would reduce the risk of an adverse effect on archeological resources. However, the potential for an adverse effect would remain. As above, potential adverse effects would be addressed through adherence to the NPS cultural resource management guidelines, national and park-specific programmatic agreements (appendix D), and application of the *Archeological Synthesis and Research Design* (Hull and Moratto 1999).

American Indian Traditional Cultural Resources

Contributing Resources

American Indians who participated in the *Tuolumne River Plan* planning process and/or who contributed information for the supporting technical study (Davis-King and Snyder 2010) supplied information about traditional use sites and features important for maintaining cultural and spiritual traditions that are known to exist along the Lyell and Dana Forks, in Tuolumne Meadows, and throughout the entire Tuolumne River corridor. American Indians communicated that the Tuolumne River is a silver thread that connects places of spiritual, historical, medicinal, and cultural importance, and for them, it is the river in its entirety that has so much value. While there are places specifically identified as currently or historically important, these places gain significance to the American Indians because they are connected by and to the river.

Within the corridor are specific resources of value to American Indian people:

- the Tuolumne River water and springs along the corridor, particularly Soda Springs, which are considered sacred and healing
- ceremonial, traditional, and medicinal plants and fungi that have traditional use and association with places
- unique geologic features with ancestral stories associated with spiritual ancestors
- an ancient American Indian trail system in use today, connecting places of cultural importance
- archeological sites important to American Indian cultural history and/or important people, many of which have been continuously used for thousands of years
- the setting and solitude for sacred and ceremonial activities
- visually intact landscapes that provide cultural continuity with the past

Scope of the Analysis

Throughout this analysis, reference to “American Indians” specifically refers to people interviewed or who communicated information in support this planning effort, and should not be confused to mean all or even other American Indians.

This section of the environmental analysis addresses American Indian traditional cultural resources and places for traditional practices and provides some background on ethnogeographic considerations. These resources include those that are part of the collective use or knowledge of a place. Some contemporary resources are used

either by a community or by an individual for traditional activities, including gathering, ceremony, and teaching; these may or may not have been used ancestrally. Some of the places considered are also archeological sites, discussed above in the “Archeological Resources” section, while others are places in stories and discussed in oral histories, and still others are places where material items were/are acquired, or where ceremonies are conducted. This section considers assessments of the existing condition and potential effects on American Indian traditional cultural resources.

Although many of the resources addressed in this section overlap prehistoric archeological or historic-era resources addressed elsewhere in this final environmental impact statement, the values associated with those sites are often different from the American Indian traditional cultural perspective. The scientific (or data) value of precontact archeological sites is addressed under NRHP criterion *d*. In the case of American Indian values at archeological sites, NRHP criteria *a*, *b*, and/or *c* may be more applicable. Criterion *a* places value on ongoing events and “broad patterns” that shape a group’s history. Where archeological and American Indian values coincide, these would be addressed comprehensively in management strategies to enrich overall significance and interpretation of the resource, and allow for a holistic protection and enhancement. Archeological sites within the park generally, and in the Tuolumne River corridor specifically, are important examples of ancestral use of the meadow and river environment. These places may also have data that might provide understanding about why the people settled at a particular place or why they used a place (plant, animal, or geological resources, or sun exposure or water, for example), and the sites are often intact chronological repositories. These places connect American Indians to their history and understanding about who they are as a people and assist in the passing on of their traditions and knowledge.

Criterion *b* places value on association with important people. Some of the sites in the Tuolumne River corridor are directly connected with people important to American Indian traditions and stories, although these have not yet been connected to specific archeological sites. Places associated with important personages in stories may also have criterion *b* values. Criterion *c* looks at the artistic, engineering, or design features distinctive to a period; significant resources under this criterion tend to be built environment resources. American Indians interviewed for this planning effort suggested that the biological landscapes and gardens often associated with, or perhaps the principal reason for, archeological sites were created by their ancestors (“designed”) and generally have not been recognized or recorded, and thus may be lost or damaged. Sites might have criterion *c* values. Data values (criterion *d*) framed by professional archeologists may also be different from those developed by the American Indian descendants.

Affected Environment

American Indian settlement of the upper Sierra Nevada, including the meadow and corridor area, began thousands of years ago and continued largely uninterrupted until the arrival of non-Indians in the area (Moratto 1999). Travel along ancient corridors, plant gathering, animal hunting, use of areas for spiritual or other ceremonial purposes, and other activities marked the American Indian use of the Tuolumne River corridor. It is often thought that the upper elevations of the river corridor would have been uninhabitable for much of the year due largely to snow, while the lower elevations (in the Grand Canyon of the Tuolumne and below) might have been habitable year-round. Such assumptions do not take into account the tremendous environmental changes over millennia that might have allowed year-round use of the area in times past. By the time lifeway information was gathered about the American Indian people who used the upper river corridor, they were no longer using the area on a seasonal basis, and it is the activities and places that continued into the (ethnographic) present that are largely considered here.

Identification of the ethnographically important places was derived from several sources. Of primary value were the interviews and discussions with members of American Indian communities who provided direction for the research and a sense of importance for this analysis. For the study, the following groups were contacted:

- Bishop Paiute Tribe (the Paiute-Shoshone Indians of the Bishop Community)
- Bridgeport Paiute Indian Colony
- Mono Lake Kutzadikaa Indian Community and the Cultural Preservation Association
- Northfork Rancheria of Mono Indians
- Picayune Rancheria of the Chukchansi Indians
- Southern Sierra Miwuk Nation (also known as the American Indian Council of Mariposa County)
- Tuolumne Band of Me-Wuk Indians
- Washoe Tribe of Nevada and California

Prior to designation of the Tuolumne Wild and Scenic River corridor, American Indian values of the corridor had not been investigated, and there is little measure of what the American Indians might have thought before designation. In comparison to archeological and historical non-Indian studies, relatively few investigations of ethnographic and contemporary period American Indian studies have been completed in Yosemite National Park. Three studies provide some American Indian information relevant to the study region: (1) a study of baskets and their makers by Bates and Lee (1990); (2) a summary of park high-country ethnographic data (Bates and Lee 1994); and (3) a study of parkwide ethnogeography (Bibby 2002). These studies and those of early anthropologists discuss cultural association of particular linguistic or ethnic groups with specific territories (an understanding of cultural association and heritage provides context and reference for contemporary American Indian values). Other important data sources are historic documents, journals, archives, diaries, and other sources used to compile background data and support. These contain especially important observations of 19th century American Indians in, and historic conditions of, the river corridor, summarized in Davis-King and Snyder (2010).

In *Tradition and Innovation: A Basket History of the Indians of the Yosemite-Mono Lake Area*, former park employees Craig Bates and Martha Lee (1990) provide a detailed look at basketry in the central Sierra Nevada and discuss historic and genealogical issues surrounding the baskets and their makers. Importantly, they describe cultural affiliation, genealogies, and heritage resource issues that emphasize multiple linguistic groups living in the park. Their discussion of the census of August 9, 1929, lists 10 Indian people born in Yosemite, and 57 Indians living and many working in the park at that time. About 30 percent of those people (17 of the 57) were born at Mono Lake, less than 10 miles from the park boundary and study location, with the remaining people being from the western Sierra Nevada.

Through the discussion of baskets, Bates and Lee provide a detailed look at historic American Indian life in the Yosemite region, with their maps indicating that early ethnographers considered the middle reaches of the Tuolumne River through Hetch Hetchy and Pate Valleys to be largely Central Sierra Miwuk territory. These considered Tuolumne Meadows, all of the Lyell Fork, and most of the Dana Fork, including Dana Meadows, to be Southern Sierra Miwuk territory, thus leaving the Northern Paiute holding only the high crest areas of Kuna Creek, upper Parker Pass, and Virginia Canyon. The Washoe were clearly shown in Thompson Canyon, Kerrick Meadow, and upper reaches of Rancheria Creek (all outside the Tuolumne River corridor), a point supported by the extensive ethnographic work of Warren d'Azevedo (e.g., 1966). Presumably the maps in Bates and Lee were meant to represent things the “way they were” prior to Euro-American intrusion into the region, since they comment that “by 1900, Paiute people, both residents and visitors, outnumbered Miwok residents of Yosemite Valley, and thereafter it was their baskets that were most commonly sold in Yosemite as ‘Yosemite baskets.’” Paiute baskets are shown in the earliest photographs of the park (Bates and Lee 1990).

Bates and Lee (1994) also compiled preparatory information about historic American Indian use of Yosemite's northern area (north of the Highway 120/Tioga Road corridor). From Bates' personal library and extensive interaction with American Indian people during his decades in the park, along with conversations with local residents and research into historic archives, Bates and Lee found little data about American Indian uses in the Tuolumne River corridor. They also noted a paucity of information in the oral tradition of Yosemite Indians "except for anecdotal information that there were trails for crossing the Sierra, and their awareness of many obsidian flakes that have been found." For the most part, the activities identified in the remainder of the archival record are those that were already known—summer hunting and gathering and use of trails for access and escape from enemies (both Indian and non-Indian) as well as from heat and drought.

Bates and Lee observed that it was not surprising that the Indian people they interviewed were unaware of places in the northern portion of the park. Many of the older people interviewed were not yet born or were small children when their families last visited the high country for traditional use. The authors also noted that native people had adopted a Western lifestyle and consequently gathered fewer plants for food and medicine and virtually no plants for tools. Hunting in the park stopped with federal ownership of the land. This summary of use was reiterated by several informants who spoke of going to the grocery or drugstore rather than going to the meadows and mountains as their ancestors had in the past (Davis-King and Snyder 2010).

Brian Bibby (2002) assessed American Indian ethnogeography of the park and wrote that seven different tribal communities indicated they have a traditional, historic relationship with the lands presently within park boundaries. The seven groups are the Central Sierra Miwok, Southern Sierra Miwok, Bridgeport Paiute, Mono Lake Paiute, Owens Valley Paiute, Chukchansi Yokuts, and Western Mono. Bibby recognized that attempts to identify ethnic or tribal identity are problematic, noting that territorial information supplied may be contradictory and that borders and territories were quite fluid and changed because of historical and environmental circumstances. He quoted Kroeber (1925) regarding boundaries between the Sierra Miwok and the Paiute: "The 'boundary' may therefore well have been shifting as amity or hostility prevailed." Bibby (2002) further acknowledged disruption and destabilization of native communities upon the arrival of non-Indians who appeared to have "created, and accelerated, further changes in the ethnogeography of the Yosemite region."

Much of the information that is currently available on territories, land use, and geography stems from two additional sources—the ethnographic interviews from the first half of the 20th century and the oral histories from the American Indians and pioneer families over the last 150 years (Davis-King and Snyder 2010). Determining "territories" based on early historic records is difficult: "The observations of a pioneer in 1860, and/or the testimony of a native person in 1925, may reflect a tribal geography quite different than what it might have been two-hundred or five-hundred years earlier, let alone two-thousand years ago" (Bibby 2002). Bibby summarized various archival resources that discussed ethnicity in the mid-19th century and concluded that after 1850, "no single group appears to have maintained exclusive tenure" to the park area and "there was fairly regular travel through the high country by both Miwok and Paiute" (Bibby 2002). He provided a map of ethnographic claims to park areas, including Central Sierra Miwok claims to Hetch Hetchy and the Hog Ranch (Camp Mather) less than a mile south from the corridor; Southern Sierra Miwok claims to Tenaya Lake, Soda Springs, Mount Lyell, and Mount Hoffmann; and Mono Lake/Bridgeport Paiute claims to Hetch Hetchy, Pate Valley, Mount Lyell, Tenaya Lake, Tioga Pass, Virginia Creek, Buckeye Creek, and Tuolumne Meadows. Bibby also addressed the issue of seasonal occupation of Yosemite Valley and other areas of similar elevation, concluding that it was possible that people may have overwintered in Pate and Hetch Hetchy valleys.

Specific resources of value identified by American Indian people are discussed below.

Ancient Trail Systems

In a study conducted for this environmental analysis, Davis-King and Snyder (2010) provide a comprehensive discussion of American Indian trails in the river corridor, listing some 44 that largely cross the river and forks, connecting ancestral places on either side. This detailed investigation of the system of trails provides the most in-depth look at American Indian trail history, origin, and networks yet identified in the Sierra Nevada and is entirely focused on the Tuolumne River. Some of the trails are entirely within the river corridor, some cross, but explicitly meet the river, some parallel the river, while others have the river and its resources as their destination. Many of the places figure in the stories and history conveyed by American Indians. Soda Springs, in Tuolumne Meadows, for example, was not only a destination or at least a way point on journeys, but figures in ancestral stories and in beliefs about healing of the waters. Some special plants no longer present were also mentioned as having been associated with such springs.

Some trails were identified through historic documents, for example, military records that stated “we followed an old Indian trail.” A sequence of maps created over many decades was also useful to understand and plot trail location and morphology over time because these maps represent trails that existed before the era of heavier tourist trail construction. More comprehensive mapping in the 1890s allowed many old routes to be plotted for the first time—the trail into Poopenaut Valley, for example. Because the U. S. Cavalry, who prepared many of these maps, was often pursuing cattle or sheep herders, some of whom were Indian people, the mapping of trails often represented general locations of older trails that had been Indian trails. Field inspection and observation of lithic scatters or other American Indian indicators along the trails are among other means of identifying American Indian trails noted in Davis-King and Snyder (2010). The trails were not documented on forms and have not been included in park mapping of cultural resources.

Today, some ancient trails are used by stock and/or humans, while others are rarely used or have abandoned segments, and still others have been rerouted. Some of the trails (e.g., the Mono Trail) have ongoing significance to American Indian groups. Knowledge about the trails has been passed down from generation to generation, with an understanding that they are connectors to places of cultural and/or spiritual significance.

Natural Resources (Traditional Plants, Views, and Ceremonial Settings)

American Indians have been, and to some extent remain, connected to the natural environment. Their understanding of their history and their place in the world is intimately tied to and cannot be separated from their relationship with nature. This is firmly expressed in their desire for a more holistic perspective in the analysis of impacts and treatments to the Tuolumne River corridor. As expressed by American Indians, the water is not separate from the sky, wind, plants, earth or animals. They all have interworking relationships with one another—from this perspective, the impacts on American Indian places important for maintaining spiritual and cultural practices need to be considered in this larger framework. As expressed in interviews conducted in support of this planning effort, protection and traditional maintenance have been handed down the generations for thousands of years.

American Indians have been gathering in the Sierra Nevada, and probably Tuolumne Meadows and the Tuolumne River corridor for thousands of years (e.g., Rosenthal 2008). In addition to gathering, their oral history and traditions suggest that they have managed parts of the Sierran vegetative environment to produce straighter shoots for basket materials, for example. Other examples include altering propagation of diverse bulb or seed plants to increase yield, and burning meadows and forested areas to improve wildlife movement and browse for deer, increase desirable plants, and decrease encroachment of nondesirable plants. Some of these activities occurred in the Tuolumne River region, and there is some American Indian oral history to suggest that burning even occurred in the higher elevations (e.g., Colby’s [1949] conversations with J. B. Lambert appear to be the only written historic reference to Indian fires for plant management in Tuolumne Meadows), although this has not been adequately studied.

Horticultural techniques are fully integrated in the economic and subsistence practices of the American Indians who have ties to the river corridor and meadows. In interviews for this planning effort, many of the American Indians said they remain connected to the plants of the river corridor; other informants nodded in agreement. Some suggested that the plants were no longer the same—non-native grasses had overtaken native bunchgrasses for example, and some of the plants whose seeds were annually gathered are no longer abundant. The American Indians interviewed generally agreed that plants are disappearing because no one is gathering or tending them the way they used to be gathered or tended. That is, seed dispersal as a result of seed beaters no longer occurs; trimming, picking, and cutting of herbaceous plants no longer occurs; and conifer seedlings are no longer plucked from the meadow edges. This is because the people no longer travel in these areas, nor do they have NPS authorization for many of the activities. It was also noted that the flora is being affected by the introduction of nonnative weeds and grasses.

A majority of the American Indian people interviewed about the *Tuolumne River Plan* discussed the importance of the setting (viewshed), especially in Pate Valley, Tuolumne Meadows, the Lyell and Dana Forks, and in the corridor paralleling the Tioga Road (Davis-King and Snyder 2010). Some recalled that their ancestors came to the meadows to trade, gather, hunt, and escape the heat, and how their current connection to the past is enhanced by their ability to see and visit these ancestral places. The prospect of growth in Tuolumne Meadows especially is suggested to affect the “sacred blood of Mother Earth,” by which is meant, the water of the Tuolumne. Others noted that the ability to have quiet and solitude, free from mechanized noise, as well as reduced infrastructure, is important to the sanctity and reverence for places. Some settings are ceremonial, while others contain geological or other topographic features of value to the lifeways of the people.

The geological, palustrine, biological, and other natural resources important to the Yosemite American Indian community have been variously altered over time by both human and natural action. At least one of the important spiritual and cultural places is currently threatened by ongoing visitor use and natural processes. Increasing visitor use in the corridor affects the serenity and communion often needed for sacred and ceremonial activities. Some American Indians have expressed displeasure with the continued infrastructure in Tuolumne Meadows specifically, with a concern that it is not appropriate to have human waste facilities near or at ancestral places. There was also some discussion by American Indians interviewed for this planning effort that discontinuation of American Indian vegetation management practices has greatly affected the viewshed in Tuolumne Meadows, particularly, but also in Pate Valley and Poopenaut Valley. Beyond viewsheds, most American Indians interviewed recognized that annual burning in the river corridor (some specifically mentioning Tuolumne Meadows) improved habitat for the plants important to them, at least in some locations. The American Indians interviewed said their relatives told them about the burning, and while the ecological and scientific merit of this has not been studied, it affects how some American Indians view meadow health generally. Numerous plants are no longer found in the same abundance as when the informants were young, and other plants are far less common.

In summary, some of the changes in the environment have modified American Indian connection to important resources, but overall, the traditional cultural resources in the Tuolumne River corridor are remarkable and assist in maintaining the cultural and spiritual traditions of American Indian people.

American Indian Values Associated with Archeological Sites

Impacts of construction and other projects on archeological site data values are described earlier in this chapter under “Archeological Resources.” Impacts on American Indian values at these same ancestral sites are not necessarily mitigated by scientific data recovery because data recovery often assumes that only scientific values (NRHP criterion *d*) are affected. American Indian values may also include criteria *a*, *b*, and/or *c*, or other research interests under criterion *d* (see “Scope of the Analysis,” above). Some values at archeological sites

continue to be affected by ongoing visitor use and natural processes. Most American Indian traditional places, including archeological sites, are currently in a fairly stable condition.

Environmental Consequences Methodology

Adverse effects to American Indian traditional cultural resources include damage, alteration, destruction, isolation, neglect, deterioration, and other factors that might diminish the characteristics. Traditional cultural resources might also be affected if the community's ability to access that place or their ability to use that place affects the way in which the community connects to the traditional property. This can include visual and aural intrusions as well as physical alterations. An additional consideration from an American Indian perspective is that the management of the river and meadow be more holistic and integrate various actions and treatments to create a more unified river system.

Traditional cultural resources in the Tuolumne River corridor were analyzed qualitatively, based on existing knowledge about values and significant elements and modifications that could be identified to alter character-defining features. Actions proposed were assessed for the potential effect they might have on traditional cultural resources, including the American Indian trail system and American Indian values at archeological sites. Actions specific to individual alternatives that would affect these historic properties are described under each alternative, below.

Some Tuolumne River corridor places important to American Indians who participated in the *Tuolumne River Plan* planning process, are also precontact archeological sites with criteria values other than NRHP criterion *d* (scientific data). Recovery of scientific data, as called for in *An Archeological Research Design for Yosemite National Park* (Moratto 1981) and *Archeological Synthesis and Research Design* (Hull and Moratto 1999), does not necessarily mitigate the loss of a unique place in the history of a people. As such, data recovery as a mitigation factor is considered insufficient in maintaining the value of these resources under NRHP criteria *a*, *b*, and/or *c*. NPS managers recognize that continued consultation with American Indian groups and management of American Indian traditional cultural uses with their guidance is a preferred management strategy. An underlying assumption of this analysis is that the NPS would continue to manage American Indian traditional cultural uses in consultation with the associated tribes and would refer to an existing programmatic agreements between Yosemite National Park and the California SHPO executed in 1999 and a 2008 nationwide programmatic agreement among the NPS, the ACHP, and the National Conference Of State Historic Preservation Officers, subsequently referred to as the 2008 and 1999 programmatic agreements (NPS, ACHP, and NCSHPO 2008; NPS, ACHP, and SHPO 1999; included in appendix D).

Environmental Consequences of the No-Action Alternative

The no-action alternative assumes that current trends in the conditions of and impacts on American Indian traditional cultural resources would continue, including precontact archeological sites and other places of significance to American Indians. Archeological sites that are places important to American Indians would continue to be documented and monitored but would not be managed to an established standard under the no-action alternative. Traditionally associated American Indian tribes and groups would have opportunities to continue traditional cultural practices. Ongoing consultation with traditionally associated American Indian tribes and groups would continue to provide opportunities to develop solutions that would protect important places. Proposed actions in the Tuolumne River corridor would continue to be subject to national and park-specific programmatic agreements included in appendix D.

According to Davis-King and Snyder (2010), the ancient trail system appears to retain a relatively high degree of integrity in terms of location, setting, and feeling. Changes to the ancient trail system are ongoing and would continue due to a variety of factors, including administrative use and maintenance work, visitor foot traffic and informal trails, and stock use. While it is acknowledged that trails are not a static resource (by their very nature

they change in location and structural characteristics over time), it is not known what impacts ongoing uses are having on the integrity of the ancient trail system as a whole.

Wild Segments

American Indian cultural resources in designated Wilderness areas and at Glen Aulin would be managed and protected under current cultural resource management policies. Some archeological sites would continue to be affected by visitor use, management activities, and/or natural processes. Trail corridors that parallel or overlay portions of the ancient trail system would include soil churning and compaction from foot traffic, stock use, creation of informal trails, and trail maintenance.

American Indian plant management activities such as the removal of unwanted plants; the selective coppicing, pruning, and harvesting of plants; and annual burning of flats and meadows (e.g., Poopenaut Valley, Pate Valley, and possibly Glen Aulin) would continue to be prohibited in designated Wilderness.

One ceremonial and sacred place currently used by American Indians has been and would continue to be affected by visitor activities with the no-action alternative. The park currently assists the tribes in using this area, but visitor actions would not be curtailed or altered. Visitor intrusion affects the serenity and reverence necessary for ceremonial activities at this place.

Scenic Segments

American Indian cultural resources at Tuolumne Meadows and along the Tioga Road corridor east of Tuolumne Meadows would be managed and protected under current cultural resource management policies.

American Indians interviewed for this planning effort noted that the changes to the Tuolumne Meadows area in particular were cumulative, and that they could see changes in plant regimes over their lifetimes. Visual impacts on the Tuolumne Meadows traditional cultural viewshed associated particularly with conifer encroachment and modern construction would continue. Increasing levels of visitor use in Tuolumne Meadows and along the Tioga Road would intrude on the traditional cultural landscape, serenity, and feeling in these areas. Continued, unmodified, and increasing use of these areas might affect the setting and solitude for sacred and ceremonial activities. Risks to water quality (see the “Hydrology, Water Quality, and Floodplains” section earlier in this chapter) would be considered an adverse impact on American Indian values because the water is seen as a spiritual connector of important places.

Conclusion

Under the no-action alternative, American Indian cultural resources would be managed and protected at their current level of integrity under existing cultural resource management policies. Archeological sites that are places important to American Indians would continue to be documented and monitored but would not be managed to an established standard with the no-action alternative. Ongoing consultations with traditionally associated American Indian tribes and groups regarding traditional cultural practices and places would continue.

American Indian plant management activities, such as removing unwanted plants, would continue to be prohibited in designated Wilderness. Visitor-related impacts would include ongoing visitor intrusion on specific ceremonial and spiritual activities and places, and ongoing random visitor alteration of archeological sites that have importance to traditionally associated American Indian tribes and groups. Ongoing, site-specific physical impacts on trail corridors that parallel or overlay on the ancient trail system, such as soil churning, would continue under the no-action alternative.

At Tuolumne Meadows, traditional views and ceremonial settings would continue to be affected by changes in meadow vegetation associated with historic and current visitor use and development. Ongoing visual impacts on the Tuolumne Meadows viewshed would continue.

Cumulative Impacts

Resources important to American Indian people have been affected by a number of actions over the years, including visitor and management activities that impact sites with value to American Indians, changes to historic trails and their locations, increased human intrusions into the landscape, discontinuation of American Indian botanical management activities, and construction of various infrastructure and visitor facilities. A specific statement by some American Indians in tribal consultation meetings for this planning effort suggested that the status quo (the no-action alternative) does not adequately address the addition of people to the land over the last 200 years, and that without an understanding of carrying capacity, the no-action alternative may perpetuate effects on the environment. The no-action alternative, in combination with cumulative plans and projects (appendix L) would be subject to current cultural resource management guidelines, which include consultation with American Indian tribes and discussion of activities as called for the 2008 national and 1999 park-specific programmatic agreements.

Environmental Consequences Common to Alternatives 1–4

Many actions that would affect American Indian traditional cultural resources and mitigation to avoid or minimize adverse effects would be common to any of the action alternatives, as described below.

Archeological sites that are places important to American Indians would benefit from the implementation of a program of monitoring and ongoing study (as described in chapter 5), would ensure that archeological site disturbance did not exceed the protective standard established for these sites. A key part of the program would be the implementation of “management triggers” intended to ensure that any downward trend in conditions can be identified and arrested well before an adverse effect occurs. This program would help ensure that sites important to traditionally associated American Indian tribes and groups were protected from disturbances associated with human use.

Random visitor alteration of archeological sites throughout the corridor that have importance to tribes may continue, although the risk of alteration would be reduced by actions to divert visitor use away from sensitive locations.

American Indian plant management activities, such as removing unwanted plants; selective coppicing, pruning, and harvesting of plants; and annual burning of flats and meadows (e.g., Poopenaut Valley, Pate Valley, and possibly Glen Aulin) would continue to be prohibited in designated Wilderness.

Mitigation and Consultation

Ground disturbance to archeological sites may result from relocation of facilities, new development, or ecological restoration activities during implementation of the *Tuolumne River Plan* under any of the action alternatives. All treatments for precontact archeological sites would be in accordance with stipulations in the national and park-specific programmatic agreements (appendix D) and would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

As under the no-action alternative, traditionally associated American Indian tribes and groups would have opportunities to continue traditional cultural practices. Ongoing consultation with traditionally associated American Indian tribes and groups would continue to provide opportunities to develop solutions that would protect important places. Proposed actions in the Tuolumne River corridor would continue to be subject to national and park-specific programmatic agreements included in appendix D.

Wild Segments

Visitor intrusions at a ceremonial and sacred place currently used by traditionally associated American Indians would continue to be affected under any of the action alternatives. Visitor intrusion affects the serenity and reverence necessary for ceremonial activities. The NPS would continue to assist the tribes in using this area.

Scenic Segments

Implementation of the ecological restoration program under any of the action alternatives would improve the feeling and setting of Tuolumne Meadows from an American Indian perspective by removing many sources of existing impacts, including roadside parking and informal trails, and ultimately restoring a more naturally functioning meadow system. The restoration of riparian areas would provide a condition more similar to the desired American Indian landscape, as communicated by American Indian participants in this planning process. Removal of roadside parking and large-scale restoration of natural processes to Tuolumne Meadows might also restore the scenic vistas honored and appreciated by American Indians.

Natural hydrologic processes at Soda Springs, an important place mentioned by several American Indian participants in this planning process, would be improved as a result of the proposed ecological restoration program. This may be beneficial because restoration could affect the return of spring-related plants of importance to American Indians.

Reduced risk to water quality from stabilization of the “little blue slide” roadcut on Tioga Road would have a beneficial effect on American Indian values because the water is seen as a spiritual connector of important places.

Some trails or trail segments of the ancient trail system in the Tuolumne Meadows area may be affected by ecological restoration activities under any of the action alternatives. The implementation of mitigation and consultation called for under all action alternatives would assist the NPS in mitigating potential adverse impacts during ecological restoration activities.

Environmental Consequences of Alternative 1

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 1 on American Indian traditional cultural resources are described below.

Wild Segments

The reduction in foot traffic and removal of most concessioner and all other commercial use on trails that parallel portions of the ancient trail system would remove the source of some ongoing impacts on the traditional trail system, such as soil churning and soil compaction.

Random visitor alteration of sites throughout the corridor that have importance to tribes might continue under alternative 1, although the potential for alteration would be lower with actions to divert use away from sensitive locations and reduced day and overnight use levels corridorwide.

Removal of the Glen Aulin High Sierra Camp and restoration of the camp to more natural conditions would reduce risks to water quality at that location. In addition, the removal of the camp may be beneficial in that the number of visitors to the area would decrease, thereby allowing more serene vistas and experiences.

Scenic Segments

Under alternative 1, the NPS would remove commercial and visitor services, some administrative uses, and associated infrastructure. Removed infrastructure would include roadside parking; the entire Tuolumne Meadows Lodge; the wastewater treatment ponds, sprayfield, and service road; the public fuel station; part of the store/grill site; and part of NPS housing at the Insect Research Station (Bug Camp). Visitor and administrative use levels would be substantially reduced from existing conditions. This would return much of

the meadows area to more natural conditions, which would be seen as beneficial by American Indians who desire fewer intrusions into this landscape. The elimination of vehicle access and utilities at Parsons Memorial Lodge, McCauley Cabin, and the Soda Springs enclosure would be beneficial to American Indian values, especially in the Soda Springs area, which is an ancient place of importance.

Removal of the wastewater treatment ponds and the fuel station would eliminate potential risks to water quality, which would have a beneficial effect on American Indian values because the water is seen as a spiritual connector of important places.

Although the number of available camping spaces at the Tuolumne Meadows campground would be reduced with alternative 1, natural resource restoration at the campground A loop was specifically mentioned by some American Indians as a more desirable condition. The restoration of riparian areas at Tuolumne Meadows Lodge and at the former campground A loop would provide a condition more similar to the desired American Indian landscape, as communicated by American Indian participants in this planning process.

Consolidating NPS and concessioner stables and reducing overall levels of stock use in the river corridor would help reduce the potential for impacts on portions of the ancient trail system that pass through the meadows. American Indians who have participated in this planning effort expressed a preference for consolidation of stables at one location.

Conclusion

In comparison with the no-action alternative, alternative 1 would overall result in no adverse effect on American Indian traditional cultural resources.

Under any of the action alternatives, there would potentially be adverse effects on places of importance to American Indians. This would result from ground disturbance to precontact archeological sites during project implementation. As with any of the action alternatives, continued consultation with American Indian tribes may further result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that might be affected by ground disturbance during plan implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Benefits to American Indian traditional cultural resources with alternative 1 would include implementation of management standards and actions that would protect archeological sites corridorwide (see chapter 5), actions to remove many existing visitor intrusions (informal trails and roadside parking) and large built intrusions (all commercial service facilities, portions of roads) at Tuolumne Meadows and the Glen Aulin High Sierra Camp, lowered levels of visitor and administrative use, reduced risks to water quality, and extensive ecological restoration (the most of any alternative).

Restoration of more natural conditions at Tuolumne Meadows would improve the feeling and setting of that area and protect places of importance to American Indians, such as Soda Springs. Removal of all commercial development would also help restore the scenic vistas honored and appreciated by American Indians.

Significantly reduced foot traffic and pack stock use would lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. Ongoing visitor intrusion on specific ceremonial and spiritual activities and places in the corridor would continue, although intrusions would potentially be less frequent due to lower visitor use levels.

Cumulative Impacts

Resources important to American Indian people have been affected by a number of actions over the years, including visitor and management activities that affect sites with value to American Indians, changes to historic

trails and their locations, increased human intrusions into the landscape, discontinuation of American Indian botanical management activities, and construction of various infrastructure and visitor facilities.

Implementation of alternative 1, in combination with past, present, and reasonably foreseeable plans and projects, would make reparations to some of the resource areas, including the viewsheds at Tuolumne Meadows that have value to American Indians.

Environmental Consequences of Alternative 2

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 2 on American Indian traditional cultural resources are described below.

Wild Segments

The reduction of concessioner stock day rides and commercial use on trails that parallel or overlay traditional American Indian travel corridors would reduce the potential for impacts such as soil churning and compaction, as well as impacts on trail integrity.

Boating on a portion of the Tuolumne River (from Tuolumne Meadows to Pate Valley) would be allowed with alternative 2 and regulated by a permit system. To American Indians, the greatest effect of boating on the river would be a potential intrusion of visitors into a sacred place, and visitors would potentially gain access to sites and places they might not have under current management. Impromptu camping might occur on archeological sites with American Indian significance, including at least one place where cultural and spiritual activities take place on an annual basis. This type of use could affect the feeling, setting, and sanctity of an important spiritual and ceremonial place through the introduction of people and their attendant visual and audible intrusions.

Removing permanent structures, including the wastewater treatment system; replacing the existing backpacker campground composting toilet; and constructing a new composting toilet for camp guests at Glen Aulin would have a beneficial effect on American Indian values by removing built intrusions from the natural environment and reducing localized risks to water quality.

Scenic Segments

In addition to the beneficial effect of the ecological restoration program discussed under ‘Environmental Consequences Common to Alternatives 1–4,’ above, alternative 2 would remove and restore lands affected by facilities at Cathedral Lakes trailhead, concessioner housing behind the store/grill, campsites near riparian areas along the Tuolumne Meadows campground A loop, and cabins near riparian areas at Tuolumne Meadows Lodge. This would improve the feeling and setting of Tuolumne Meadows from the perspective of American Indians who participated in this planning process because it would improve overall visual conditions and restore the area to more natural conditions.

Under alternative 2, an increase in the number of visitors and employees at Tuolumne Meadows would be allowed during the summer season. In addition, this alternative would add two new developed areas south of Tioga Road to accommodate increased formal parking (to replace the informal parking occurring along Tioga Road) and a new day use picnic area. Increasing levels of use and development would result in further intrusions upon the traditional cultural landscape, serenity, and feeling at the meadows. However, eliminating informal trails at the meadows and consolidating visitor use in designated locations (such as the proposed new day use area) and pathways away from sensitive locations would help offset these impacts.

In addition, Alternative 2 would consolidate administrative uses, including stable operations, south of Tioga Road. Employee housing would be removed from ecologically sensitive locations and consolidated at Gaylor Pit, east of Tuolumne Meadows. Consolidation of the NPS and concessioner stables and employee housing were actions specifically requested by some American Indians who participated in this planning effort to reduce overall impacts on resources.

Proposed scenic vista management at Tuolumne Meadows and along Tioga Road might also help restore the scenic vistas honored and appreciated by American Indians.

Vehicular access to the Soda Springs area would continue with alternative 2, which is less desirable than restoring the land modified by the road. Upgrading the wastewater treatment ponds would address some risks to water quality, which might have a beneficial effect on American Indian values because the water is seen as a spiritual connector of important places.

Conclusion

Under alternative 2, there would potentially be adverse effects on places of importance to American Indians resulting from ground disturbance to precontact archeological sites during project implementation. As with any of the action alternatives, continued consultation with American Indian tribes might further result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that may be affected by ground disturbance during project implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

The addition of two new developed areas south of Tioga Road could affect the landscape, serenity, and feeling at Tuolumne Meadows in particular. In addition, recreational boating would have a potential adverse effect on places of spiritual and cultural significance to American Indians. Benefits to American Indian traditional cultural resources that may offset these impacts would include implementing management standards and actions that would protect archeological sites corridorwide (see chapter 5), removing permanent infrastructure from Glen Aulin, removing many existing visitor intrusions at Tuolumne Meadows (informal trails and undesignated roadside parking), removing built intrusions nearest the river at Tuolumne Meadows (the campground A loop and employee housing and some guest tent cabins at the lodge), consolidating visitor and administrative uses (including the stables), reducing risks to water quality from wastewater treatment upgrades, managing scenic vistas, and implementing extensive ecological restoration.

As under all action alternatives, restoration of more natural conditions at Tuolumne Meadows under alternative 2 would improve the feeling and setting of that area, help restore the scenic vistas honored and appreciated by American Indians, and protect places of importance such as Soda Springs.

Reduced pack stock use in the corridor would also lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. The potential for visitors to randomly alter archeological sites in the corridor would decrease because visitors would be diverted away from sensitive locations and visitor use levels managed.

Although there may be impacts resulting from boating on the Tuolumne River, potentially higher visitor use levels, and additional development to consolidate visitor services, in comparison with the no-action alternative, alternative 2 would result in no adverse effect on American Indian traditional cultural resources.

Cumulative Impacts

The cumulative impact of alternative 2 would be the same as under alternative 1.

Environmental Consequences of Alternative 3

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 3 on American Indian traditional cultural resources are described below.

Wild Segments

The reduction of foot traffic (due to lower visitor use levels), concessioner stock day rides, and commercial use on trails that parallel or overlay traditional American Indian travel corridors would reduce the potential for

impacts such as soil churning and compaction. Lowered use levels in wilderness would also benefit archeological site protection by reducing the potential for visitors to randomly alter sites.

Replacing the existing backpacker campground composting toilet and increasing water use restrictions at Glen Aulin would have a beneficial effect on American Indian values by reducing localized risks to water quality.

Scenic Segments

In addition to the beneficial effect of the ecological restoration program discussed above under 'Environmental Consequences Common to Alternatives 1–4,' alternative 3 would result in lower visitor use levels and remove and restore lands affected by facilities at Cathedral Lakes trailhead, housing behind the store/grill, the public fuel station, campsites near riparian areas along the campground A loop, and approximately half of the guest tent cabins and all employee housing near riparian areas at Tuolumne Meadows Lodge. Proposed scenic vista management at Tuolumne Meadows might also help restore the scenic vistas honored and appreciated by American Indians. These actions would improve the feeling and setting of Tuolumne Meadows from the perspective of American Indians who participated in this planning process because it would overall improve visual conditions and restore the area to more natural conditions.

Vehicular access to the Soda Springs area would continue under alternative 3, which is less desirable than restoring land modified by the road. Upgrading the wastewater treatment ponds and removing the fuel station would address some risks to water quality and would benefit American Indian values because the water is seen as a spiritual connector of important places.

Conclusion

Under alternative 3, there would potentially be adverse effects on places of importance to American Indians resulting from ground disturbance to precontact archeological sites during plan implementation. As in all action alternatives, continued consultation with American Indian tribes may further result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that may be affected by ground disturbance during plan implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Benefits to American Indian traditional cultural resources would include implementation of management standards and actions that would protect archeological sites corridorwide (see chapter 5), actions to remove existing visitor intrusions (informal trails and roadside parking), removal of built intrusions nearest the river (some campsites in the Tuolumne Meadows campground A loop, half of the guest tent cabins, and all employee tent cabins at the Tuolumne Meadows Lodge) at Tuolumne Meadows, lowered levels of visitor use, scenic vista management, reduced risks to water quality from removal of the public fuel station and upgraded wastewater treatment facilities, and extensive ecological restoration.

Under alternative 3, restoration of more natural conditions at the Tuolumne Meadows would improve the feeling and setting of that area, help restore the scenic vistas honored and appreciated by American Indians, and protect places of importance such as Soda Springs.

Reduced foot traffic and pack stock use would lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. The potential for visitors to randomly alter archeological sites in the corridor would decrease from diverting visitor use away from sensitive locations and lowered visitor use levels.

In comparison with the no-action alternative, alternative 3 would result in no adverse effect on American Indian cultural resources.

Cumulative Impacts

The cumulative impact of alternative 3 would be the same as described above under alternative 1.

Environmental Consequences of Alternative 4 (Preferred)

In addition to “Environmental Consequences Common to Alternatives 1–4,” the environmental consequences of alternative 4 on American Indian traditional cultural resources are described below.

Wild Segments

The reduction of concessioner stock day rides, reductions in pack stock used to resupply Glen Aulin High Sierra Camp, and commercial use restrictions on trails that parallel or overlay traditional American Indian travel corridors would decrease the potential for impacts such as soil churning and compaction. These actions would also benefit archeological site protection by reducing the potential for visitors to randomly alter sites.

Boating on a portion of the Tuolumne River (from Tuolumne Meadows to Pate Valley) would be allowed with alternative 4 on a trial basis and regulated by a permit system. To American Indians, the greatest effect of boating on the river would be a potential intrusion of visitors into a sacred place, and visitors would potentially gain access to sites and places they might not have under current management. Impromptu camping might occur on archeological sites with American Indian significance, including at least one place where cultural and spiritual activities take place on an annual basis. This type of use could affect the feeling, setting, and sanctity of an important spiritual and ceremonial place through the introduction of people and their attendant visual and audible intrusions.

Replacing the existing High Sierra Camp flush toilets with composting toilets, converting the camp’s leach mound to gray water only (no human waste), replacing the backpacker campground composting toilet, and increasing water use restrictions at Glen Aulin (by reducing guest capacity) would have a beneficial effect on American Indian values by reducing localized risks to water quality.

Scenic Segments

In addition to the beneficial effect of the ecological restoration program discussed under ‘Environmental Consequences Common to Alternatives 1–4,’ above, under alternative 4 the NPS would remove and restore lands affected by facilities at Cathedral Lakes trailhead, housing behind the store/grill, campsites near riparian areas along the Tuolumne Meadows campground A loop, and three guest cabins and all employee tent cabins near riparian areas at Tuolumne Meadows Lodge. This would improve the feeling and setting of Tuolumne Meadows from the perspective of American Indians who participated in this planning process because it would overall improve visual conditions and restore the area to more natural conditions. The restoration of riparian areas would provide a condition more similar to the desired American Indian landscape, as communicated by American Indian participants in this planning process.

The addition of a camping area reserved for traditionally associated tribes and groups was an action specifically requested by some American Indians who participated in the *Tuolumne River Plan* planning effort to ensure access to traditional cultural resources.

Under alternative 4, a slight increase in the number of visitors and employees at Tuolumne Meadows would be allowed during the summer season. In addition, this alternative would add one new developed area south of Tioga Road to accommodate increased formal parking (to replace the roadside parking occurring along Tioga Road) and a new visitor contact station. Increasing levels of use and development would result in further intrusions on the traditional cultural landscape, serenity, and feeling at the meadows. However, eliminating informal trails at the meadows and consolidating visitor use in designated locations and pathways away from sensitive locations would help offset these impacts.

In addition, NPS and concessioner stables would be consolidated with alternative 4. This action was specifically requested by some American Indians who participated in the *Tuolumne River Plan* planning effort to reduce overall impacts on resources.

Reducing overall levels of stock use in the Tuolumne River corridor would help reduce the potential for impacts on portions of the ancient trail system that pass through the meadows and through the river corridor.

Proposed scenic vista management at Tuolumne Meadows and along Tioga Road might also help restore the scenic vistas honored and appreciated by American Indians.

Vehicular access to the Soda Springs area would continue, which is less desirable than restoration of the land modified by the road. Removal of the wastewater treatment ponds, if the technology is available, and removal of the public fuel station would address some risks to water quality and benefit American Indian values because the water is seen as a spiritual connector of important places.

Conclusion

Under alternative 4, there would potentially be adverse effects on places of importance to American Indians resulting from ground disturbance to precontact archeological sites during project implementation. As with any of the action alternatives, continued consultation with American Indian tribes could result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that might be affected by ground disturbance during plan implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.

Adding developed areas south of Tioga Road to accommodate a new formal parking area and a visitor contact station could affect the landscape, serenity, and feeling at Tuolumne Meadows. In addition, recreational boating would have a potential adverse effect on places of spiritual and cultural significance to American Indians. Benefits to American Indian traditional cultural resources that may offset this impact would include implementation of standards that would protect archeological sites (see chapter 5), actions to remove many existing visitor intrusions (informal trails and roadside parking), removal of built intrusions nearest the river (e.g., some campsites in the Tuolumne Meadows campground A loop and some guest tent cabins at the Tuolumne Meadows Lodge), management of scenic vistas, consolidation of stables operations at Tuolumne Meadows, consolidation of visitor use along designated paths, reduced risk to water quality at Tuolumne Meadows and Glen Aulin, and extensive ecological restoration.

Under alternative 4, restoration of more natural conditions at Tuolumne Meadows would improve the feeling and setting of that area, help restore the scenic vistas honored and appreciated by American Indians, and protect places of importance such as Soda Springs. The addition of campsites for tribal use at Gaylor Pit would help ensure access to traditional cultural resources.

Reduced pack stock use would lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. The potential for visitors to randomly alter archeological sites in the river corridor would decrease from the diversion of visitor use away from sensitive locations and managed visitor use levels.

In comparison with the no-action alternative, alternative 4 would result in no adverse effect on American Indian cultural resources.

Cumulative Impacts

The cumulative impact of alternative 4 would be the same as described under alternative 1.

Irreversible and Irretrievable Commitment of Resources

The NEPA (section 101 2(c) (v)) and NPS DO 12 require a detailed discussion on any irreversible and irretrievable commitments of resources that would be involved in the implementation of the *Tuolumne River Plan*. Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of those resources would have on future generations. Irreversible commitments of resources are those that cannot be reversed except over an extremely long period of time. These irreversible effects primarily result from destruction of a specific resource (such as energy, minerals, or cultural resources) that either cannot be replaced or that are renewable only over long time spans. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored (such as “take” of a threatened or endangered species; disturbance of a cultural site; or commitment of time, money, or energy to a particular project).

Irreversible and irretrievable commitments of resources would occur under any of the alternatives, including the no-action alternative. The preferred alternative (alternative 4) would result in an irretrievable commitment of materials, time, money, and energy expended during implementation activities. Particular irreversible and/or irretrievable impacts that would result are noted below.

No-Action Alternative

The no-action alternative would result in the following irreversible or irretrievable commitments of resources:

- Archeological resources might see increased impacts at easily accessible areas resulting from parkwide trends in visitor use levels. The potential for site damage would be greatest at popular camping locations along the upper Lyell Fork, near turnouts along Tioga Road, and at popular day use destinations at Tuolumne Meadows. Damage to archeological sites would result in an irreversible impact on these resources.
- Energy consumption associated with continued park operations and visitor services would continue to result in an irretrievable commitment of resources. Overall energy consumption is expected to decrease over time under existing management objectives for park operations to install facilities, utility systems, and transportation systems that conserve energy, as outlined in *NPS Management Policies 2006*, the Energy Policy Act of 2005 and EOs 13423, 13123, and 13514.

Alternatives 1-4

For any of the action alternatives, consumption of fossil fuels and energy would occur during construction and operation activities. Fossil fuels (gasoline and diesel oil) would be used to power construction equipment and vehicles. Electrical power would be used for lighting and operations. The energy consumed for project construction and operation represents a permanent and nonrenewable commitment of these resources. Materials for construction of new facilities and associated private-sector economic and population growth would be irretrievably committed for the life of the project. Use of these materials represents a further depletion of natural resources. Construction and maintenance activities are considered a long-term irretrievable investment of these resources. The capital, labor, and energy required for construction would be an irreversible commitment of these resources, including public funds.

The following impacts on natural and cultural resources would be irreversible:

- Land that would be physically altered by construction would be committed to the new use for the foreseeable future and would represent a permanent commitment of the land for the life of the project to a developed use. This includes upland areas where parking and other visitor and administrative facilities would be relocated at Tuolumne Meadows, proposed new trails, and land that might be used to redesign the Tuolumne Meadows campground.

- Soil would be displaced by construction in upland areas at Tuolumne Meadows. Standard mitigation measures during construction include salvage of native soils for backfill.
- Historic buildings and/or structures that contribute to the Tuolumne Meadows Historic District and the Glen Aulin Historic District would be removed under all action alternatives. The number of historic buildings and structures removed or retained would vary by alternative, with alternative 1 removing the most contributing structures, including all the contributing buildings and structures from the Glen Aulin Historic District.

As under the no-action alternative, energy consumption associated with continued park operations and visitor services would continue under any of the action alternatives. However, design techniques and application of new technology to reduce energy and water consumption would be incorporated in the design of new facilities. Overall consumption would be expected to decrease over time with these proposed improvements.

Relationship between Short-Term Use of the Environment and Long-Term Productivity

The NEPA (section 101 2(c)(iv)) and NPS DO 12 require environmental impact statements to provide a detailed discussion on the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. Special attention is given to impacts that narrow the range of beneficial uses of the environment or pose a long-term risk to human health or safety.

Short-term uses of the environment associated with the action alternatives include energy and utility use during the construction of facilities or restoration activities associated with all alternatives. Construction and restoration would involve short-term increases in fugitive emissions and noise and would increase the use of fossil fuels in power equipment.

Long-term changes would include the proposed restoration activities and changes to the developed landscape resulting from proposed site plans and visitor use management at Tuolumne Meadows. All proposed development with any of the alternatives would occur in a location and manner that protects or enhances outstandingly remarkable values of the river; however, the proposed relocation of visitor and administrative facilities would adversely affect some resources during construction.

No-Action Alternative

The existing relationship of short-term uses of the environment and the maintenance and enhancement of long-term productivity would continue. Human-caused impacts on natural and cultural resources would continue to occur throughout the Tuolumne River corridor at existing levels, although these impacts may become exacerbated in high-use areas if parkwide trends of increasing visitor use levels continue. Resources in wilderness would remain for the most part undisturbed. Facilities and their associated use would remain in their existing locations at Tuolumne Meadows and Glen Aulin.

Alternatives 1–4

In general, the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity would be similar under any of the action alternatives (alternatives 1–4) because they would primarily vary in how a desired visitor experience is achieved.

The *Tuolumne River Plan* would not narrow the range of uses in the wild and scenic river corridor. Rather, the range of uses is determined by federal legislation, such as the WSRA and NPS policy. There are alternatives that remove more infrastructure from the river corridor (e.g., alternative 1) than others, but on balance each alternative would achieve long-term beneficial impacts on the environment corridorwide. By placing capacities

on the uses of the environment, alternatives 1 and 3 would reduce visitor day and overnight use levels (alternative 2 would potentially increase day and overnight use levels, while alternative 4 would cap them at approximately existing levels), but any of the action alternatives would enhance the long-term productivity of the river corridor, as required by the WSRA. None of the alternatives would pose an additional risk to human health and safety.

Short-term minor adverse impacts would result from construction and restoration activities (e.g., fugitive dust emissions temporarily affecting air quality and construction noise affecting soundscapes). The long-term productivity of resources would generally see beneficial impacts, as detailed below:

- **Soils:** In general, soils would remain undisturbed in wilderness areas, with exceptions in higher-use areas near Tioga Road, Tuolumne Meadows, and in upper Lyell Canyon. In the short term, there would be minor adverse impacts from trenching, grading, and excavation associated with removal and construction of facilities, drainage improvements, and vegetation restoration at Tuolumne Meadows. In addition, there would be long-term adverse impacts on soils where new visitor and administrative facilities are constructed. However, the overall long-term effect on the productivity of soil resources would be beneficial as a result of extensive restoration of meadow soils at Tuolumne Meadows in particular, where actions included in the proposed ecological restoration program would include decompaction, removal of nonnative fill, and restoration of hydrologic processes.
- **Hydrology, Water Quality, and Floodplains:** Water quality would remain excellent corridorwide. In the short term, there would be a potential for minor adverse impacts on water quality from construction activities. In the long term, the relocating facilities away from riparian areas at Tuolumne Meadows, stabilizing a road cut near the Dana Fork, replacing aging wastewater treatment facilities, capping water withdrawals near or below existing levels, and implementing an ecological restoration program would have beneficial impacts on the long-term productivity of hydrologic resources, including water quality. No new development would occur in the 100-year floodplain of the Tuolumne River, and all of the action alternatives would remove some existing infrastructure from the 100-year floodplain.
- **Vegetation, Wildlife, and Special Status Species:** There would be short-term minor adverse impacts associated with construction and restoration activities, including habitat disturbance in meadow and upland areas (associated with removal of facilities and construction of relocated facilities, respectively), disturbance from noise and ground vibrations, and the potential introduction and spread of invasive nonnative species. However, in the long term, implementing a comprehensive ecological restoration program to restore natural processes to the subalpine meadow would result in moderate beneficial impacts on native meadow and riparian community structure, diversity, and productivity.
- **Scenic Resources:** In the short term, restoration activities, construction of new facilities, and restoration of ecological conditions would result in temporary intrusions into views. In the long term, natural scenery and views would be improved by removing roadside parking along Tioga Road and, with alternatives 2–4, through management of the eight scenic vistas along Tioga Road, outlined in appendix I.
- **Energy Consumption and Climate Change:** In the short term, fuel consumption would increase as a result of construction and restoration activities. In the long term, under alternatives 1 and 4 there would be reductions in consumption related to the removal of overnight lodging, and under all alternatives, overall consumption is expected to decrease with time under existing management objectives to conserve energy, as outlined in *NPS Management Policies 2006*, the Energy Policy Act of 2005 and EOs 13423, 13123, and 13514. Design techniques and application of new technology to reduce energy and water consumption would be incorporated in the design of new facilities, including new housing units at Tuolumne Meadows.

Unavoidable Adverse Impacts

The NEPA section 101 2(c)(ii) and NPS DO 12 require environmental impact statements to provide a detailed discussion on unavoidable adverse impacts, if a proposed action would result in impacts that cannot be fully mitigated or avoided. For the purposes of this environmental impact statement, unavoidable adverse impacts are defined as those that cannot be mitigated and are moderate or major in intensity.

No-Action Alternative

With the exception of impacts on soundscapes caused by high-altitude aircraft overflights, which are neither in the jurisdiction nor control of the NPS, it is presumed that impacts resulting from the no-action alternative would be avoidable because they are addressed by the proposed actions in each of the action alternatives.

Alternative 1

- **Visitor Experience:** In order to meet alternative 1 objectives for greater self-reliance as part of a wilderness experience, commercial services and lodging would be removed from the Tuolumne River corridor. The removal of the Glen Aulin and Tuolumne Meadows High Sierra Camps from the river corridor, which would remove two of the six High Sierra Camps in the park, would cause an unavoidable adverse impact on visitors who enjoy this historic, rustic lodging experience. The removal of other commercial services would cause an unavoidable adverse impact on many visitors who currently obtain food, fuel, basic supplies, and equipment at the existing camper store and mountaineering shop/school in the Tuolumne Meadows area as well as the relatively small number of visitors who enjoy and/or rely on using commercial outfitters or the concessioner to access designated Wilderness in the river corridor. The substantially lower day and overnight user capacities in the corridor would cause an unavoidable adverse impact on displaced visitors who would no longer be able to get out of their cars to experience the area.
- **Socioeconomics:** There would be an unavoidable adverse impact on concessioner revenues due to the elimination of lodging and commercial services at Tuolumne Meadows.
- **Transportation:** A reduction in formal day parking and enforcement of parking restrictions would result in an unavoidable adverse impact on traffic conditions associated with a shortage of day parking compared with demand during peak use periods.
- **Historic Buildings, Structures, and Cultural Landscapes:** In order to meet alternative 1 objectives for greater self-reliance as part of a wilderness experience, a number of historic buildings and structures associated with commercial use would be removed from the potential wilderness addition at Glen Aulin and from Tuolumne Meadows. There would be an adverse effect from removing all historic buildings and structures from the Glen Aulin Historic District, which would lose all its integrity and would no longer be eligible for listing on the NRHP. In addition, all contributing historic features would be removed from three of the eight developed areas in the Tuolumne Meadows Historic District. Additional consultation with the California SHPO would be needed prior to plan implementation.

There would be an adverse effect on the Soda Springs Historic District resulting from actions along the Great Sierra Wagon Road to improve hydrologic processes in the meadows. Mitigation measures in appendix H and appendix O would be applied to minimize the adverse effect.

There would be an adverse effect on the Tioga Road Historic District resulting from the removal of historic turnouts in order to protect the subalpine meadow and riparian system from the radiating impacts associated with undesignated roadside parking. In addition, historic culverts could be rehabilitated or replaced. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified

features use historically consistent materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

Overall, due to adverse effects (as defined by NHPA) on historic districts under alternative 1, an adverse impact on the Tuolumne Meadows Historic District, Soda Springs Historic District, Glen Aulin Historic District, and the Tioga Road Historic District would be considered unavoidable.

Alternative 2

- **Historic Buildings, Structures, and Cultural Landscapes:** In order to meet alternative 2 objectives to expand recreational opportunities, there would be an adverse effect from removing a number of historic buildings, structures, and other features that contribute to the Tuolumne Meadows Historic District. Standard mitigation measures, as defined in the nationwide and park-specific programmatic agreements, or other measures as agreed to with the California SHPO, would be applied to minimize the adverse effect. There would also be an adverse effect from the removal of all historic buildings and structures from the Glen Aulin Historic District to convert the area to a seasonal outfitter camp that is consistent with a Wilderness designation. The historic district would lose all its integrity and would no longer be eligible for listing on the NRHP. Additional consultation with the California SHPO would be needed prior to plan implementation.

There would be an adverse effect on the Soda Springs Historic District resulting from actions along the Great Sierra Wagon Road to improve hydrologic processes in the meadows. Mitigation measures in appendix H and appendix O would be applied to minimize the adverse effect.

There would be an adverse effect on the Tioga Road Historic District resulting from the removal of historic turnouts in order to protect the subalpine meadow and riparian system from the radiating impacts associated with undesignated roadside parking. In addition, historic culverts could be rehabilitated or replaced. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically consistent materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

Overall, due to adverse effects (as defined by NHPA) on historic districts under alternative 2, an adverse impact on the Tuolumne Meadows Historic District, Soda Springs Historic District, Glen Aulin Historic District, and the Tioga Road Historic District would be considered unavoidable.

Alternative 3

- **Visitor Experience:** Some commercial services and approximately half of existing lodging would be removed from the river corridor, thus causing an unavoidable adverse impact on visitors who would no longer be able to obtain a reservation for the remaining available lodging, purchase mountaineering equipment, or purchase fuel in the river corridor. The lower day and overnight use capacities in the river corridor would cause an unavoidable adverse impact on displaced visitors, who would no longer be able to get out of their cars to experience the area at peak times.
- **Transportation:** Although formal parking would be increased, the associated enforcement of parking restrictions and overall reduction of day parking availability (compared with existing condition, where visitors park in nondesignated areas) would result in an unavoidable adverse impact on traffic conditions associated with a shortage of day parking compared with demand during peak use periods.
- **Socioeconomics:** There would be an unavoidable adverse impact on concessioner revenues under alternative 3 due to reductions in lodging and commercial services at Tuolumne Meadows.
- **Historic Buildings, Structures, and Cultural Landscapes:** There would be an adverse effect from removing a number of historic buildings, structures, and features that contribute to the Tuolumne Meadows Historic District and the Glen Aulin Historic District. Standard mitigation measures, as defined in the nationwide and

park-specific programmatic agreements in appendix D, or other measures as agreed to with the California SHPO, would be applied to minimize the adverse effect.

There would be an adverse effect on the Soda Springs Historic District resulting from actions along the Great Sierra Wagon Road to improve hydrologic processes in the meadows. Mitigation measures in appendix H and appendix O would be applied to minimize the adverse effect.

There would be an adverse effect on the Tioga Road Historic District resulting from the removal of historic turnouts in order to protect the subalpine meadow and riparian system from the radiating impacts associated with undesignated roadside parking. In addition, historic culverts could be rehabilitated or replaced. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically consistent materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

Overall, due to adverse effects (as defined by NHPA) on historic districts under alternative 3, an adverse impact on the Tuolumne Meadows Historic District, Soda Springs Historic District, Glen Aulin Historic District, and the Tioga Road Historic District would be considered unavoidable.

Alternative 4 (Preferred)

- **Visitor Experience:** In order to meet alternative 4 objectives to balance ecological restoration with a traditional Tuolumne experience, some commercial services would be removed from the river corridor, thus causing an unavoidable adverse impact on visitors who would no longer be able to take a concessioner day ride into wilderness, purchase mountaineering equipment, or purchase fuel in the corridor.
- **Historic Buildings, Structures, and Cultural Landscapes:** There would be an adverse effect on the Tuolumne Meadows Historic District from: reconfiguration of the Tuolumne Meadows campground roads during a campground redesign, actions along the Great Sierra Wagon Road to improve hydrologic processes that support meadow health, removing the historic gas station structure, potentially relocating the dining hall/kitchen at Tuolumne Meadows Lodge, and potentially the rehabilitation of 11 historic tent cabins to meet OSHA and NPS housing standards. The adverse effect would be minimized through standard mitigation measures, as defined in the national and park-specific programmatic agreements in appendix D, mitigation measures identified in appendix H and appendix O, or as otherwise agreed to in consultation with the California SHPO.

There would be an adverse effect on the Soda Springs Historic District resulting from actions along the Great Sierra Wagon Road to improve hydrologic processes in the meadows. Mitigation measures in appendix H and appendix O would be applied to minimize the adverse effect.

There would be an adverse effect on the Tioga Road Historic District resulting from the removal of historic turnouts in order to protect the subalpine meadow and riparian system from the radiating impacts associated with undesignated roadside parking. In addition, historic culverts could be rehabilitated or replaced. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically consistent materials and design. The historic design, spatial organization, and natural setting of Tioga Road would remain unaffected.

Overall, due to adverse effects (as defined by NHPA) on historic districts under alternative 4, an adverse impact on the Tuolumne Meadows Historic District, Soda Springs Historic District, and the Tioga Road Historic District would be considered unavoidable.

Summary Comparison of the Environmental Consequences of the No-Action and Action Alternatives

The environmental consequences of the no-action and action alternatives are summarized and compared in table 9-43.

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
GEOLOGY, GEOHAZARDS, AND SOILS				
<p>Wild Segments: Soils in wild segments would generally remain undisturbed, with localized adverse impacts along trail corridors, particularly near high-use areas such as Tuolumne Meadows and Tioga Road and at camping and pack stock grazing areas in Lyell Canyon. Impacts on soils at Glen Aulin include denuded areas near the High Sierra Camp; these impacts would continue to be local, long term, minor, and adverse.</p> <p>Scenic Segments: At Tuolumne Meadows, impacts on meadow soils from historic development, disrupted hydrologic processes, and ongoing use would continue; these impacts would be local, long term, moderate, and adverse.</p> <p>Natural hydrologic and related geologic processes in the wild segment and the scenic segment below O’Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.</p>	<p>Wild Segments: Under alternative 1, soils in wild segments would generally remain undisturbed with localized exceptions. There would be a local long-term moderate beneficial impact on soils along trail corridors from lower use levels, elimination of concessioner stock day rides, and elimination of commercial and most administrative pack stock from Tuolumne Meadows. There would be a local long-term moderate beneficial impact in upper Lyell Canyon where commercial pack stock use would be discontinued. At Glen Aulin, removal of the High Sierra Camp and restoration activity would result in local long-term moderate beneficial impacts in areas currently affected by facilities and foot and pack stock traffic.</p> <p>Scenic Segments: In the Tuolumne Meadows area, there would be a local, long-term, moderate, beneficial impact on meadow soils from soil decompaction, removal of nonnative fill, restoration of hydrologic processes, and restoration of native vegetation associated with removal of facilities and from the implementation of a comprehensive ecological restoration program. There would be local short-term and long-term minor to moderate adverse impacts on soils from construction of facilities in more resilient locations to replace those removed from more sensitive meadow and riparian areas.</p> <p>Natural hydrologic and related geologic processes in river segments below O’Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.</p>	<p>Wild Segments: Under alternative 2, soils in wild segments would generally remain undisturbed with localized exceptions. There would be a local long-term minor beneficial impact on soils along trail corridors due to reduced concessioner and commercial stock use. There would be a local long-term moderate beneficial impact in upper Lyell Canyon where camping, grazing, and access routes would be designated in more resilient locations. At Glen Aulin, removal of the High Sierra Camp (replaced with a seasonal camp) and restoration activity would result in local, long-term, minor to moderate, beneficial impacts in areas currently affected by permanent facilities. There would be minimal impact from recreational boating in the Grand Canyon of the Tuolumne due to very limited use.</p> <p>Natural hydrologic and related geologic processes below O’Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.</p> <p>Scenic Segments: Same as alternative 1.</p>	<p>Wild Segments: Under alternative 3, soils in wild segments would generally remain undisturbed with localized exceptions. There would be a local long-term minor beneficial impact on soils along trail corridors from reduced foot traffic and reduced concessioner and commercial stock use. There would be a local long-term moderate beneficial impact on soils in upper Lyell Canyon where camping and pack stock grazing and access routes would be designated in more resilient locations. At Glen Aulin, natural resource restoration at wetlands and a denuded section of riverbank would result in a local long-term minor beneficial impact on soils.</p> <p>Natural hydrologic and related geologic processes below O’Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.</p> <p>Scenic Segments: Same as alternative 1, with the following exception: there would be local short-term and long-term minor adverse impact on soils from the construction of new facilities in more resilient soils to replace roadside parking and housing removed from more sensitive soils near meadow and riparian areas.</p>	<p>Wild Segments: There would be a local long-term minor to moderate beneficial impact on soils along trail corridors in wilderness as a result of reduced pack stock use. There would be a local, long-term, moderate, beneficial impact in upper Lyell Canyon where camping and pack stock grazing and access routes would be designated in more resilient soil locations. At Glen Aulin, natural resource restoration at wetlands and a denuded section of riverbank would result in a local long-term minor beneficial impact on soils. There would be minimal impact from recreational boating in the Grand Canyon of the Tuolumne due to very limited use.</p> <p>Natural hydrologic and related geologic processes below O’Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.</p> <p>Scenic Segments: Same as alternative 1.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
HYDROLOGY, WATER QUALITY, AND FLOODPLAINS				
<p>Water Quality: Water quality and clarity would remain exceptional throughout the river corridor with ongoing monitoring and management. At Tuolumne Meadows and Glen Aulin, ongoing uses and associated facilities, including aging wastewater treatment facilities, would have the potential to cause local short-term moderate adverse impacts on water quality; however, ongoing mitigation efforts would reduce the impact of this risk to minor and adverse. Existing pack stock use would have the potential to cause local short-term minor adverse impacts on water quality along trails and near campsites and grazing areas in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail to Glen Aulin. Ongoing mitigation efforts to reduce this risk at Tuolumne Meadows would continue.</p> <p>Hydrologic Processes: Natural hydrologic processes would remain unaffected in the majority of the river corridor. At Tuolumne Meadows, existing disruptions to hydrologic processes from past facility development and other historic modifications to the meadows, as well as intense visitor use in certain locations, would remain, resulting in a local long-term moderate adverse impact on the hydrology of the subalpine meadow system at that location.</p> <p>Water withdrawals to support domestic needs at Tuolumne Meadows and Glen Aulin would continue, with local long-term negligible adverse impacts on downstream ecological communities. Future water restrictions might be needed to protect downstream habitats if visitor use increased or if the duration or intensity of low-flow periods increased as a result of climate change</p> <p>Natural hydrologic processes below O’Shaughnessy Dam would remain altered by the dam, which is outside of the planning area. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.</p> <p>Floodplains: Development within the 100-year floodplain at Tuolumne Meadows and at Glen Aulin would have a local minor adverse impact on natural flows at those locations.</p>	<p>Water Quality: With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 1. The removal of the Glen Aulin High Sierra Camp, the relocation and replacement of wastewater treatment facilities in Tuolumne Meadows, upgraded water and wastewater systems at Tuolumne Meadows, the removal of the public fuel facility at Tuolumne Meadows, and the stabilization of the road cut near the Dana Fork would result in a local long-term moderate beneficial impact on water quality.</p> <p>Reductions in stock use along trail corridors due to the elimination of concessioner day rides and commercial use would result in a local long-term minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail from Tuolumne Meadows to Glen Aulin.</p> <p>Hydrologic Processes: A reduction in water withdrawals to an average of about 30,000 gallons per day, with maximum levels at approximately 41,000 gallons per day during peak season for domestic needs at Tuolumne Meadows would result in a local long-term minor beneficial impact on streamflow and associated downstream ecological communities, and would avoid the need to introduce additional water restrictions in the future.</p> <p>Natural hydrologic processes would remain unaffected in the vast majority of the river corridor. Implementation of the ecological restoration program at Tuolumne Meadows, in conjunction with removal of many facilities, would result in a local long-term moderate beneficial impact on hydrologic processes.</p> <p>Floodplains: There would be no new development in the 100-year floodplain of the river. The majority of facilities would be removed from the 100-year floodplain of the river at Tuolumne Meadows, and all facilities would be removed from the 100-year floodplain at Glen Aulin. This would result in a local long-term minor to moderate beneficial impact on natural flows at those locations.</p>	<p>Water Quality: With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 2. Upgraded water and wastewater treatment facilities at Tuolumne Meadows, and the stabilization of the road cut near the Dana Fork, would result in local long-term minor beneficial impacts on water quality. Retention of the public fuel station and stables facilities at a reduced capacity would require ongoing monitoring and mitigation to minimize risks to water quality. There would be a local long-term minor beneficial impact from discontinuing use of the leach mound and installing a new composting toilet at Glen Aulin.</p> <p>Reductions in stock use along trail corridors from the reductions in concessioner day rides and commercial stock use would result in a local long-term negligible to minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail from Tuolumne Meadows to Glen Aulin. There would be no impact on water quality resulting from the introduction of recreational boating.</p> <p>Hydrologic Processes: An increase in water withdrawals to an estimated average of about 50,000 gallons per day for domestic needs at Tuolumne Meadows would result in a local long-term negligible adverse impact on stream flow and associated downstream ecological communities. Because water withdrawals would be capped at a level that is approximately the same as current peak water use, water conservation measures would be needed immediately upon plan implementation, and additional water storage capacity may be needed to stay within the proposed management standard of withdrawing no more than 10% of low flow, or 65,000 gallons per day maximum (see chapter 5). Of all the action alternatives, alternative 2 would have the greatest potential for requiring reductions in service during periods of low flow to ensure that the level of water consumption remained protective of river flows.</p> <p>Natural hydrologic processes would remain unaffected in the majority of the river corridor. Implementation of the ecological restoration program at Tuolumne Meadows, in conjunction with removal of infrastructure from meadow and riparian areas, would result in a local long-term moderate beneficial impact on hydrologic processes. Installation of new or expanded facilities, including a new trail corridor at Tuolumne Meadows and facilities south of Tioga Road, would have a local long-term minor adverse impact on hydrologic processes.</p> <p>Floodplains: With the exception of a proposed trail corridor at Tuolumne Meadows, new development under alternative 2 would occur outside of the 100-year floodplain. Structures at Glen Aulin High Sierra Camp within the 100-year floodplain would remain. Some development closest to the river would be removed from the 100-year floodplain at Tuolumne Meadows and all permanent facilities would be removed from the 100-year floodplain at Glen Aulin, resulting in a local long-term minor beneficial impact on natural flows at those locations.</p>	<p>Water Quality: With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 3. Upgraded water and wastewater treatment facilities at Tuolumne Meadows, the removal of the public fuel facility at Tuolumne Meadows, and the stabilization of the road cut near the Dana Fork would result in local long-term minor beneficial impacts on water quality. Retention of the stables facilities (at a reduced capacity) would require ongoing monitoring and mitigation to minimize risks to water quality. There would be a local long-term negligible to minor beneficial impact from installing a new composting toilet at Glen Aulin.</p> <p>Reductions in stock use along trails with the decrease in concessioner day rides and commercial pack stock use would result in a local long-term negligible to minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stables operations, and along the trail from Tuolumne Meadows to Glen Aulin.</p> <p>Hydrologic Processes: A slight decrease in water withdrawals to an estimated average of about 42,000 gallons per day for domestic needs at Tuolumne Meadows would result in a local long-term negligible beneficial impact on stream flow and associated downstream ecological communities. This level of water withdrawal would be expected to remain within the standard of no more than 10% of low flow. Additional water storage capacity and additional water restrictions may be needed in very low flow years.</p> <p>Natural hydrologic processes would remain unaffected in the majority of the river corridor under alternative 3. Implementation of the ecological restoration program at Tuolumne Meadows, in conjunction with removal of infrastructure from meadow and riparian areas, would result in a local long-term moderate beneficial impact on hydrologic processes. Installation of new or expanded facilities south of Tioga Road would have a local long-term minor adverse impact on hydrologic processes.</p> <p>Floodplains: New development would occur outside of the 100-year floodplain. Most structures at Glen Aulin High Sierra Camp within the 100-year floodplain would remain. Some development closest to the river would be removed from the 100-year floodplain at Tuolumne Meadows, resulting in a local long-term negligible beneficial impact on natural flows.</p>	<p>Water Quality: With proposed monitoring and management, water quality and clarity would remain exceptional throughout the river corridor under alternative 4. Upgraded water and wastewater treatment facilities at Tuolumne Meadows, the removal of the public fuel facility at Tuolumne Meadows, the consolidation of stables operations, and the stabilization of the road cut near the Dana Fork would result in local long-term minor beneficial impact on water quality. There would be a local long-term minor beneficial impact on water quality from reducing water withdrawals and installing a new composting toilet at Glen Aulin.</p> <p>Reductions in stock use along trail corridors, the elimination of concessioner day rides, and additional regulations concerning the location and amount of commercial pack stock use would result in a local long-term minor beneficial impact on water quality along trails in Lyell Canyon, near Tuolumne Meadows stable operations, and along the trail from Tuolumne Meadows to Glen Aulin.</p> <p>Hydrologic Processes: An increase in water withdrawals to an estimated average of about 47,000 gallons per day for domestic needs at Tuolumne Meadows would result in a local long-term negligible adverse impact on stream flow and downstream ecological communities. Because water withdrawals would be capped at a level that is approximately the same as current peak water use, Water conservation measures, including reduced levels of service, and additional storage capacity might be needed during periods of low flow to stay within the standard of withdrawing no more than 10% of low flow, or 65,000 gallons per day maximum (see chapter 5). Reductions in service are not likely under current hydrologic conditions, but might be necessary in the future if low flows increase in duration or intensity.</p> <p>Natural hydrologic processes would remain unaffected in the majority of the river corridor under alternative 4. The proposed ecological restoration activities, in conjunction with removal of infrastructure from the floodplain and meadow and riparian areas, would result in a local long-term moderate beneficial impact on hydrologic processes at Tuolumne Meadows. Installation of new or expanded facilities south of Tioga Road would have a local long-term minor adverse impact on hydrologic processes.</p> <p>Floodplains: New development would occur outside of the 100-year floodplain. One employee cabin would be relocated out of the 100-year floodplain at Glen Aulin High Sierra Camp. Approximately one-half of the development currently within the 100-year floodplain at Tuolumne Meadows would be removed, resulting in a local minor to moderate beneficial impact on natural flows at those locations.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
WETLANDS				
<p>Under the no-action alternative, wetlands in wild segments would overall remain undisturbed, with site-specific adverse impacts associated with trail use above Tuolumne Meadows, along the lower Dana Fork, and in Lyell Canyon. Local long-term moderate adverse impacts on wetlands would continue to occur at pack stock camp and grazing areas in Lyell Canyon. At Glen Aulin, vegetation impacts associated with pack stock and foot traffic would result in local long-term minor to moderate adverse impacts on wetlands. Wetlands downstream of O’Shaughnessy Dam would remain undisturbed by visitor use; however, the effect of the dam on downstream ecosystems is not yet known and is being studied.</p> <p>At Tuolumne Meadows, the impacts of use along road and trail corridors as well as high-use locations would continue to result in local long-term moderate adverse impacts on wetlands.</p>	<p>Wild Segments: Under alternative 1, wetlands in wild segments would overall remain undisturbed with localized exceptions. The reductions in day use foot traffic, a substantial reduction in concessioner stock use, and the elimination of commercial use in the corridor would result in local long-term moderate beneficial impacts on wetlands along trails between Tuolumne Meadows and Glen Aulin, and between Tuolumne Meadows and Lyell Canyon. In addition, the elimination of commercial pack stock use would allow restoration of wetlands in pack stock grazing and camping areas in Lyell Canyon.</p> <p>The removal of Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact to a 0.5-acre palustrine forested wetland currently affected by foot and stock traffic at the camp, as well as eliminate risks to wetlands posed by the current wastewater treatment system. Wetlands below O’Shaughnessy Dam would remain undisturbed, with the exception of altered hydrologic processes caused by the dam.</p> <p>Scenic Segments: At Tuolumne Meadows, the implementation of a comprehensive ecological restoration program under alternative 1, in combination with extensive site-specific restoration where facilities are removed and informal trails are restored, would allow for restoration of natural hydrology regimes and revegetation of approximately 36.7 acres of wetlands. These restoration actions would result in a local, long-term, moderate, beneficial impact on wetlands.</p> <p>Construction of relocated parking and administrative facilities at Road Camp and at Lambert Dome, and new development to accommodate a campground redesign would have a potential local long-term minor adverse impact on 3.0 acres of palustrine forested wetlands. Adhering proposed mitigation measures in appendix O and avoidance of wetlands where possible would minimize short-term and long-term impacts at these locations to minor and adverse.</p>	<p>Wild Segments: Under alternative 2, wetlands in wild segments would remain undisturbed, with localized exceptions. Proposed regulation of the timing, location, and amount of pack stock use in Lyell Canyon would result in a local, long-term, minor to moderate, beneficial impact on wetlands in those areas. Restoration of a 0.5-acre palustrine reforested wetland at Glen Aulin High Sierra Camp and discontinuing use of the camp’s leach mound would result in a local long-term moderate beneficial impact on wetlands. Limited recreational boating would introduce the potential for a local long-term minor adverse impact on a 3.23-acre wetland in Pate Valley (located in the Grand Canyon wild segment) near a trail junction where boaters would be required to hike out. The NPS would avoid this wetland when siting the boating takeout. Wetlands below O’Shaughnessy Dam would remain undisturbed, with the exception of altered hydrologic processes caused by the dam.</p> <p>Scenic Segments: At Tuolumne Meadows, implementation of a comprehensive ecological restoration program, in combination with site-specific restoration where facilities are removed and informal trails are restored, would allow for restoration of natural hydrology regimes and revegetation of approximately 21.7 acres of wetlands. These restoration actions would result in a local long-term moderate beneficial impact on wetlands.</p> <p>Construction of relocated parking and facilities, and new development to accommodate a campground redesign, would have the potential to affect approximately 4.4 acres of adjacent palustrine forested wetlands. Adherence to proposed mitigation measures in appendix O and avoidance of wetlands where possible would reduce the potential short-term and long-term impacts on wetlands to minor and adverse. In addition, the proposed new trail between the store and grill and Parsons Memorial Lodge would likely pass through multiple wetlands. The alignment of this trail would be determined through future site design; an elevated path would help minimize the potential adverse impact.</p>	<p>Wild Segments: Under alternative 3, wetlands in wild segments would overall remain undisturbed, with localized exceptions. Proposed regulation of the timing, location, and amount of pack stock in Lyell Canyon would result in a local long-term minor to moderate beneficial impact on wetlands in these areas. Restoration of a 0.5-acre palustrine reforested wetland at Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact on wetlands. The leach mound at the High Sierra Camp would continue to operate at capacity, thus posing a risk to wetlands between the mound and Conness Creek. Wetlands below O’Shaughnessy Dam would remain undisturbed, with the exception of altered hydrologic processes caused by the dam.</p> <p>Scenic Segments: At Tuolumne Meadows, the implementation of a comprehensive ecological restoration program, in combination with extensive site-specific restoration where facilities are removed and informal trails are restored, would allow for restoration of natural hydrology regimes and revegetation of approximately 21.7 acres of wetlands. These restoration actions would result in a local long-term moderate beneficial impact on wetlands. There would be no new adverse impacts on wetlands from the relocation of parking, visitor, or administrative facilities at Tuolumne Meadows.</p> <p>New development to accommodate a campground redesign under alternative 3 would have the potential to affect approximately 5.3 acres of forested wetlands in an already disturbed area. Adherence to proposed mitigation measures described in appendix O and avoidance of wetlands where possible would reduce potential short-term and long-term impacts to minor and adverse.</p>	<p>Wild Segments: Under alternative 4, wetlands in wild segments would overall remain undisturbed, with localized exceptions. Proposed regulation of the timing, location, and amount of pack stock in Lyell Canyon would result in a local long-term minor to moderate beneficial impact on wetlands in these areas. Greatly reduced packstock use on the trails between Tuolumne Meadows and Glen Aulin and Tuolumne Meadows to Young Lakes would have a long term, minor beneficial impact on the few wetlands found along those trail corridors. Restoration of a 0.5-acre palustrine reforested wetland at Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact on wetlands. Reduced water use at the High Sierra camp and converting the wastewater treatment system to gray water only would result in a local long-term minor to moderate beneficial impact by reducing the risk of overflow at the camp’s leach mound.</p> <p>Limited recreational boating would introduce the potential for a local long-term minor adverse impact on a 3.23-acre wetland in Pate Valley (located in the Grand Canyon wild segment) near a trail junction where boaters would be required to hike out. The NPS would avoid this wetland when siting the boating takeout. Wetlands at Poopenaut Valley would remain undisturbed, with the exception of altered hydrologic processes caused by O’Shaughnessy Dam.</p> <p>Scenic Segments: At Tuolumne Meadows, the implementation of a comprehensive ecological restoration program, in combination with extensive site-specific restoration where facilities are removed and informal trails are restored, would allow for restoration of natural hydrology regimes and revegetation of approximately 21.9 acres of wetlands. These restoration actions would result in a local long-term moderate beneficial impact on wetlands.</p> <p>New development to accommodate a campground redesign would have the potential to affect approximately 5.3 acres of forested wetlands in an already disturbed location. Adherence to proposed mitigation measures in appendix O and avoidance of wetlands where possible would reduce potential short-term and long-term impacts to minor and adverse.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
VEGETATION				
<p>Wild Segments: Under the no-action alternative, native plant communities in wild segments would overall remain undisturbed, with very localized losses of natural community structure, diversity, and productivity associated with foot travel and stock use along trail corridors, particularly near high-use areas such as Tuolumne Meadows and Tioga Road. Local long-term moderate adverse impacts on native plant communities would continue to occur at pack stock camps and grazing areas in Lyell Canyon. At Glen Aulin, vegetation impacts associated with current use at the camp would result in local long-term minor to moderate adverse impacts on wetland and riparian communities.</p> <p>Scenic Segments: At Tuolumne Meadows, the cause of change to the ecological integrity of the subalpine meadow system would continue to be studied, but no comprehensive restoration program would be implemented under the no-action alternative. Ongoing impacts related to disrupted hydrologic processes, historic development, and ongoing use would continue to result in the localized loss of natural community structure, diversity, and productivity in meadow and riparian communities, resulting in a local long-term moderate adverse impact on these sensitive resources.</p> <p>Natural hydrologic processes that support vegetation in both wild and scenic segments below O’Shaughnessy Dam would remain altered by the dam, which is outside of the river corridor. The NPS would continue to work with a consortium of local and federal agencies to inform releases intended to more closely mimic natural flows.</p>	<p>Wild Segments: Native plant communities in wild segments would overall remain undisturbed. Site-specific impacts associated with foot traffic and stock use would be much fewer and less intense than the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term moderate beneficial impact on natural community structure, diversity, and productivity in the Tuolumne River corridor.</p> <p>Displacing commercial pack stock use to other areas of the park might cause new impacts on native vegetation communities in wilderness areas that are currently infrequently used.</p> <p>The removal of Glen Aulin High Sierra Camp would result in a local, long-term, moderate, beneficial impact on native wetland and riparian communities currently affected by foot and stock traffic at the camp.</p> <p>Scenic Segments: At Tuolumne Meadows, the implementation of a comprehensive ecological restoration program and extensive site-specific restoration of previously disturbed sites, in conjunction with a reduction in visitor use, would result in a local long-term major beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term minor to moderate adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 1 would result in approximately 207.9 acres of restored meadow and riparian communities, 24.9 acres of restored upland communities, and up to 38.4 acres of disturbance to native upland communities in scenic segments. In addition, with lowered use levels at Tuolumne Meadows, there is an increased potential for parking in undesignated locations outside the plan boundary that could cause new impacts on native vegetation communities along Tioga Road. Impacts below O’Shaughnessy Dam would be the same as under the no-action alternative.</p>	<p>Wild Segments: Native plant communities in wild segments of the Tuolumne River corridor would overall remain undisturbed with very localized exceptions. The introduction of recreational boating could result in very localized impacts on riparian vegetation at put-in, portage, an take-out locations; however very limited use and proposed mitigation measures (appendix O) would minimize this impact. Site-specific impacts associated with stock use would be less intense than the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term minor beneficial impact on natural community structure, diversity, and productivity in the river corridor.</p> <p>The potential for displacing some commercial pack stock use to other areas of the park might cause new impacts on native vegetation communities in wilderness areas that are currently infrequently used.</p> <p>At Glen Aulin, removal of permanent structures (with the exception of composting toilets), a reduction in risk to water quality, and site-specific restoration of wetlands at the High Sierra Camp would result in a local long-term moderate beneficial impact on native vegetation in the area.</p> <p>Scenic Segments: At Tuolumne Meadows, the implementation of a comprehensive ecological restoration program and site-specific restoration of previously disturbed sites, in conjunction with the consolidation of visitor use in more resilient locations, would result in a local long-term moderate beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term minor to moderate adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 2 would result in approximately 170.4 acres of restored meadow and riparian communities, 4.5 acres of restored upland communities, and up to 39.9 acres of disturbance to native upland communities in scenic segments.</p> <p>In addition, if visitor use continued to increase, there would be an increased potential for parking in undesignated locations outside the plan boundary, which could cause new impacts on native vegetation communities along Tioga Road. Impacts below O’Shaughnessy Dam would be the same as under the no-action alternative.</p>	<p>Wild Segments: Native plant communities in wild segments of the Tuolumne River corridor would overall remain undisturbed, with very localized exceptions. Site-specific impacts associated with foot traffic and stock use would be less intense than the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term minor beneficial impact on natural community structure, diversity, and productivity in the river corridor.</p> <p>Displacing commercial pack stock use to other areas of the park might cause new impacts on native vegetation communities in wilderness areas that are currently infrequently used.</p> <p>A reduction in risks to water quality and site-specific restoration of wetlands at the Glen Aulin High Sierra Camp would result in a local long-term minor to moderate beneficial impact on native wetland and riparian communities at the camp.</p> <p>Scenic Segments: At Tuolumne Meadows, the implementation of a comprehensive ecological restoration program and site-specific restoration of previously disturbed sites in conjunction with a reduction in visitor use would result in a local long-term moderate beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term minor adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 3 would result in approximately 170.8 acres of restored meadow and riparian communities, 4.85 acres of restored upland communities, and up to 11.2 acres of disturbance to native upland communities in scenic segments. In addition, although alternative 3 would increase designated parking at Tuolumne Meadows, there would be increased potential for parking in undesignated locations outside the plan boundary, which could result in new impacts on native vegetation communities along Tioga Road.</p> <p>Impacts below O’Shaughnessy Dam would be the same as under the no-action alternative.</p>	<p>Wild Segments: Native plant communities in wild segments of the Tuolumne River corridor would overall remain undisturbed, with localized exceptions. The introduction of recreational boating could result in very localized impacts on riparian vegetation at put-in, portage, and take-out locations; however very limited use and proposed mitigation measures (appendix O) would minimize this impact. Site-specific impacts associated with foot traffic and stock use along trail corridors would be considerably reduced compared to the impacts of no action, particularly in areas of higher use between Tuolumne Meadows, Dana Meadows, and Lyell Canyon and between Tuolumne Meadows and Glen Aulin. This would result in a local long-term minor to moderate beneficial impact on natural community structure, diversity, and productivity in the river corridor.</p> <p>The potential for displacing some commercial pack stock use to other areas of the park might cause new impacts on native vegetation communities in wilderness areas that are at present infrequently used.</p> <p>A significant reduction in risks to water quality and site-specific restoration of wetlands at the Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact on native wetland and riparian communities at the camp.</p> <p>Scenic Segments: At Tuolumne Meadows, the implementing a comprehensive ecological restoration program and site-specific restoration of previously disturbed sites, in conjunction with reducing and consolidating visitor use in more resilient locations, would result in a local long-term moderate beneficial impact on native meadow and riparian community structure, diversity, and productivity. There would be a local long-term minor to moderate adverse impact on upland communities associated with the relocation of some facilities out of sensitive meadow and riparian areas. In terms of acres restored or disturbed, alternative 4 would result in approximately 170.6 acres of restored meadow and riparian communities, 2.9 acres of restored upland communities, and up to 28.1 acres of disturbance to native upland communities in scenic segments.</p> <p>In addition, although alternative 4 would increase designated parking at Tuolumne Meadows, if visitor use continued to increase, there would be a greater potential for parking in undesignated locations outside the plan boundary, which would cause new impacts on native vegetation communities along Tioga Road.</p> <p>Impacts below O’Shaughnessy Dam would be the same as under the no-action alternative.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
WILDLIFE				
<p>Under the no-action alternative, the continuation of current wilderness policies in wild segments of the Tuolumne River corridor would protect intact natural habitats, including the distribution, numbers, population composition, and interaction of native species. Species and habitat in predominantly untrailed alpine areas would remain undisturbed. In subalpine areas, habitat would remain overall undisturbed, with site-specific exceptions associated with trail corridors used by hikers and pack stock. These impacts would be minor and most evident closer to high-use areas such as Tuolumne Meadows.</p> <p>At Glen Aulin High Sierra Camp, habitat fragmentation and human disturbance would have minor adverse impacts on wildlife species, particularly those who use this area as a migration corridor. Between Glen Aulin and Hetch Hetchy Reservoir, and below O’Shaughnessy Dam, there would be local short-term negligible to minor adverse impacts on species and habitats due to occasional foot traffic and camping in these relatively remote areas.</p> <p>At scenic segments near Tuolumne Meadows, human disturbance at developed areas, diminished habitat, and fragmented habitat would continue to cause local long-term minor to moderate adverse impacts on wildlife species. This impact may be regional because the subalpine meadow system in these segments is a critical foraging and breeding area.</p>	<p>Wild Segments: Wildlife species and habitat in predominantly untrailed alpine areas would remain undisturbed. Subalpine habitat in wilderness would remain overall undisturbed with site-specific exceptions, generally confined to trail corridors and where wilderness borders high-use areas, such as Tuolumne Meadows or Tioga Road. Reducing concessioner pack stock use, elimination of concessioner day rides, eliminating commercial pack stock use, and overall lower use levels would have a local and potentially regional long-term moderate beneficial impact on wildlife by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road. Eliminating pack stock use areas in Lyell Canyon and removing the Glen Aulin High Sierra Camp would result in a local long-term moderate beneficial impact on wildlife species and habitat. Canyon and lower-elevation habitat between Glen Aulin and Hetch Hetchy Reservoir and below O’Shaughnessy Dam would remain undisturbed, with the exception of local negligible adverse impacts from disturbances such as occasional noise, human presence, and very minor modification to habitat from vegetation loss and soil compaction along trail corridors.</p> <p>Scenic Segments: At Tuolumne Meadows, there would be local and regional long-term moderate beneficial impacts on wildlife resources from implementation of an ecological restoration program, lowered day and overnight use levels, and extensive site-specific restoration where facilities would be removed from high-value meadow and riparian areas. There would be local short-term minor adverse impacts associated with ecological restoration activities and local short-term and long-term adverse impacts resulting from facility construction.</p>	<p>Wild Segments: Wildlife species and habitat in predominantly untrailed alpine areas would remain undisturbed. Subalpine habitat in wilderness would remain overall undisturbed with site-specific exceptions, generally confined to trail corridors and where wilderness borders high-use areas, such as Tuolumne Meadows or Tioga Road. Reducing concessioner stock day rides and reducing commercial stock use would have a local and potentially regional long-term minor beneficial impact on wildlife habitat by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road. There would be a local long-term moderate beneficial impact on wildlife species and habitat resulting from increased regulation on the timing and location of pack stock use in upper Lyell Canyon. Restoration activities at Glen Aulin High Sierra Camp would have a local long-term minor beneficial impact from reduced risks to water quality and associated riparian habitat. Canyon habitat between Glen Aulin and Hetch Hetchy Reservoir and below O’Shaughnessy Dam would remain undisturbed with the exception of local negligible adverse impacts from disturbances such as occasional noise, human presence, and very minor modification to habitat from vegetation loss and soil compaction along trail corridors. Limited recreational boating in the Grand Canyon would have a local long-term negligible adverse impact on wildlife.</p> <p>Scenic Segments: At Tuolumne Meadows, there would be a local and regional long-term moderate beneficial impact on wildlife resources from the implementation of an ecological restoration program and site-specific restoration in high-value meadow and riparian areas. There would be local short-term minor adverse impacts associated with ecological restoration activities and local short-term and long-term adverse impacts resulting from facility construction, including the construction of a new trail across the meadows.</p>	<p>Wild Segments: Wildlife species and habitat in predominantly untrailed alpine areas would remain undisturbed. Subalpine habitat in wilderness would remain overall undisturbed with site-specific exceptions, generally confined to trail corridors and where wilderness borders high-use areas, such as Tuolumne Meadows or Tioga Road. Reducing concessioner pack stock use, including stock day rides, reducing commercial stock use, and overall lower visitor use levels would have a local and potentially regional long-term minor to moderate beneficial impact on wildlife habitat by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road. There would be a local long-term moderate beneficial impact on wildlife species and habitat resulting from increased regulation on the timing and location of pack stock use in upper Lyell Canyon. Restoration activities at Glen Aulin High Sierra Camp would have a local long-term minor beneficial impact from reduced risks to water quality and associated riparian habitat. Canyon and lower-elevation habitat between Glen Aulin and Hetch Hetchy Reservoir and below O’Shaughnessy Dam would remain undisturbed, with the exception of local negligible adverse impacts from disturbances such as occasional noise, human presence, and very minor modification to habitat from vegetation loss and soil compaction along trail corridors.</p> <p>Scenic Segments: At Tuolumne Meadows, there would be a local and regional long-term moderate beneficial impact on wildlife resources from implementing an ecological restoration program and site-specific restoration in high-value meadow and riparian areas. There would be local short-term minor adverse impacts associated with ecological restoration activities and local short-term and long-term adverse impacts resulting from facility construction.</p>	<p>Wild Segments: Same as alternative 3, with the following exception: Reducing concessioner pack stock use and eliminating concessioner stock day rides would have a local and potentially regional long-term minor to moderate beneficial impact on wildlife habitat by reducing human-caused disturbance along trail corridors accessed from Tuolumne Meadows and Tioga Road. Limited recreational boating in the Grand Canyon would have a local long-term negligible adverse impact on wildlife.</p> <p>Scenic Segments: Same as alternative 3.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
SPECIAL STATUS SPECIES				
<p>Under the no-action alternative, special status species and habitat, including federally designated critical habitat, would overall remain undisturbed. There would be local minor site-specific impacts on habitat for special status wildlife and plant species associated with trail corridors radiating outward from Tuolumne Meadows and Tioga Road and at pack stock use areas in Lyell Canyon.</p> <p>Wild Segments: Canyon, riparian, and aquatic species and habitat in between Tuolumne Meadows and Hetch Hetchy Reservoir would remain relatively undisturbed. Below O’Shaughnessy Dam, some special status species habitat would continue to be disturbed by the diversion of water and regulated flows. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.</p> <p>Scenic Segments: At Tuolumne Meadows, the no-action alternative would likely adversely affect special status species due to the ongoing changes in ecological integrity of the subalpine meadow system. The cause of this change would continue to be studied. The NPS would continue to protect special status species under existing resource management programs. However, under the no-action alternative there would be an ongoing local and regional long-term moderate adverse impact on special status species due to habitat alteration and the potential for increasing visitor use to further disturb plant and wildlife populations.</p>	<p>Wild Segments: Special status species and habitat in wild segments, including federally designated critical habitat, would overall remain undisturbed under alternative 1. Reductions in foot traffic and pack stock use would result in overall beneficial impacts on special status species habitat along trail corridors radiating out from Tuolumne Meadows and Tioga Road, and in particular upper Lyell Canyon. As with the no-action alternative, special status species habitat in wilderness between Tuolumne Meadows and Hetch Hetchy Reservoir and below O’Shaughnessy Dam would remain relatively undisturbed, with the exception of species that may be affected by altered hydrological processes downstream of the dam. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.</p> <p>Scenic Segments: At Tuolumne Meadows, implementation of a comprehensive ecological restoration program to restore natural processes to the subalpine meadow, in combination with much lower use levels and extensive site-specific restoration, would result in local long-term moderate beneficial impacts on special status species habitat, including proposed critical habitat for two amphibian species. There would be a local short-term and long-term minor adverse impact on upland communities where existing parking and facilities would be relocated from more sensitive areas. Special status plants would be avoided during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife. Therefore, alternative 1 may affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.</p>	<p>Wild Segments: Special status species and habitat in wild segments, including federally designated critical habitat, would overall remain undisturbed. Reductions in concessioner stock use and additional regulations concerning commercial stock use would result in overall beneficial impacts on special status species habitat along trail corridors radiating outward from Tuolumne Meadows and Tioga Road, and in upper Lyell Canyon. As with the no-action alternative, special status species habitat in wilderness between Tuolumne Meadows and Hetch Hetchy Reservoir and below O’Shaughnessy Dam would remain relatively undisturbed, with local, site-specific exceptions along trail corridors. The NPS would continue to work with a consortium of individuals and groups to inform releases from the dam to improve downstream habitat.</p> <p>Scenic Segments: At Tuolumne Meadows, implementation of a comprehensive ecological restoration program to restore natural processes to the subalpine meadow, in combination with consolidated visitor use and site-specific restoration, would result in a local long-term moderate beneficial impact on special status species habitat, including proposed critical habitat for two amphibian species. There would be a local short-term and long-term minor adverse impact on upland communities where existing parking and facilities would be relocated from more sensitive areas. Special status plants would be avoided during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife. Therefore, alternative 2 may affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.</p>	<p>Wild Segments: Same as alternative 2, with the exception that alternative 3 does not propose recreational boating.</p> <p>Scenic Segments: At Tuolumne Meadows, implementation of a comprehensive ecological restoration program to restore natural processes to the subalpine meadow, in combination with lower visitor use levels and site-specific restoration, would result in a local long-term moderate beneficial impact on special status species habitat, including proposed critical habitat for two amphibian species. There would be a local short-term and long-term minor adverse impact on upland communities where existing parking and facilities would be relocated from more sensitive areas. Special status plants would be avoided during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife and plants. Therefore, alternative 3 might affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.</p>	<p>Wild Segments: Same as alternative 2.</p> <p>Scenic Segments: At Tuolumne Meadows, implementing a comprehensive ecological restoration strategy to restore natural processes to the subalpine meadow, in combination with consolidated visitor use, managed visitor use levels, and site-specific restoration, would result in a local long-term moderate beneficial impact on special status species habitat, including proposed critical habitat for two amphibian species. There would be a local short-term and long-term minor adverse impact on upland habitat where existing parking and facilities would be relocated from more sensitive areas. Special status plants would be avoided during construction, and the implementation of mitigation measures, such as surveys prior to construction, would minimize the impacts of construction activity on special status wildlife and plants. Therefore, alternative 4 may affect, but would not be likely to adversely affect, special status species in the Tuolumne River corridor.</p>
LIGHTSCAPES				
<p>Under the no-action alternative, lightscapes in designated Wilderness areas would continue to be dominated by sources of natural light and dark night skies. In-park sources of light pollution, including occasional campfires, vehicle headlights, and artificial lighting in Tuolumne Meadows and Glen Aulin, would have long-term, negligible to minor, adverse impacts on lightscapes in wilderness, primarily in areas near roads and other facilities.</p> <p>In Tuolumne Meadows, Glen Aulin, and the administrative area below O’Shaughnessy Dam, lightscapes would continue to be shaped by a combination of limited lighting at administrative facilities and visitor service areas, vehicle headlights along the Tioga Road and administrative roads, and campfires in campgrounds. Overall, in-park sources of light would continue to have a local, long-term, minor, adverse impact on lightscapes.</p>	<p>Lightscapes in designated Wilderness areas would continue to be dominated by sources of natural light and dark night skies. Adverse impacts on lightscapes in the lower Dana Fork wilderness area would be reduced by the elimination of many sources of artificial light from Tuolumne Meadows, resulting in a local long-term moderate beneficial impact. In-park sources of light pollution, including occasional campfires and vehicle headlights, would continue to have adverse impacts on lightscapes in wilderness, primarily in areas near roads and other facilities.</p> <p>In Tuolumne Meadows and Glen Aulin, the elimination of the majority of artificial light sources would reduce the effect of in-park sources of artificial light. In the administrative area below O’Shaughnessy Dam, lightscapes would continue to be shaped by limited lighting at administrative facilities.</p>	<p>Lightscapes in designated Wilderness areas would continue to be dominated by sources of natural light and dark night skies. In-park sources of light pollution, including occasional campfires, vehicle headlights, and artificial lighting in Tuolumne Meadows and Glen Aulin, would have long-term negligible adverse impacts on lightscapes in wilderness, primarily in areas near roads and other facilities.</p> <p>In Tuolumne Meadows, Glen Aulin, and the administrative area below O’Shaughnessy Dam, lightscapes would continue to be shaped by a combination of limited lighting at administrative facilities and visitor service areas, vehicle headlights along the Tioga Road and administrative roads, and campfires in campgrounds. In-park sources of light would continue to have a local long-term minor adverse impact on lightscapes.</p>	<p>Same as alternative 2.</p>	<p>Same as alternative 2.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
SOUNDSCAPES				
<p>Under the no-action alternative, soundscapes in designated Wilderness would continue to be dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice or sound made by stock. High-altitude aircraft overflights would continue to be the primary source of adverse impacts on natural soundscapes in both wilderness and nonwilderness areas in the Tuolumne River corridor. In wilderness areas close to the Tioga Road and Tuolumne Meadows, human-caused sound could also include vehicle and equipment noise and more apparent sounds of visitor and administrative activity. Overall this results in a local short-term moderate adverse impact in wild segments of the corridor.</p> <p>In developed areas at Tuolumne Meadows, Glen Aulin, and the administrative area below O'Shaughnessy Dam, the effects of human-caused sounds adjacent to Tioga Road and Hetch Hetchy Road, along major trails, at popular destinations, and in visitor service and administrative areas would continue to have local short-term minor to moderate adverse impacts under the no-action alternative. Management actions would be passive, with little mitigation towards reducing human-caused sounds.</p>	<p>With implementation of alternative 1, soundscapes in wild segments would continue to be dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice. Effects of in-park sources of noise on soundscapes in designated Wilderness would be negligible except in wilderness areas near Tioga Road in the Tuolumne Meadows and Lower Dana Fork segments, or along Hetch Hetchy Road, where vehicle noise would continue. Effects of in-park sources of noise in the Tuolumne Meadows area would be reduced with the elimination of commercial services and associated administrative uses.</p> <p>Overall, alternative 1 would result in a local long-term minor to moderate beneficial impact on natural soundscapes, when compared with the no-action alternative. High-altitude aircraft overflights, which are out of the control and jurisdiction of the NPS, would continue to be the primary source of adverse impacts on natural soundscapes in both wilderness and nonwilderness areas in the Tuolumne River corridor.</p>	<p>Soundscapes in wild segments of the Tuolumne River corridor would continue to be dominated by natural sources of sound, punctuated by noises from aircraft and the occasional human voice or sound made by stock. Effects of in-park sources of noise on soundscapes in designated Wilderness would be negligible except in wilderness areas near Tioga Road in the Tuolumne Meadows and Lower Dana Fork segments, or along Hetch Hetchy Road, where vehicle noise would continue.</p> <p>In Tuolumne Meadows and the administrative area below O'Shaughnessy Dam, the effects of human-caused sounds adjacent to roads, along major trails, at popular destinations, and in visitor service and administrative areas would continue to affect natural soundscapes. However, some human-caused noise is considered entirely appropriate for realizing the purpose of frontcountry locations. Construction-related noise during project implementation would result in local short-term minor to moderate adverse impacts.</p> <p>Overall, alternative 2 would result in a local long-term minor beneficial impact compared with the no-action alternative. High-altitude aircraft overflights, which are out of the control and jurisdiction of the NPS, would continue to be the primary source of adverse impacts on natural soundscapes in both wilderness and nonwilderness areas in the river corridor.</p>	<p>Same as alternative 2.</p>	<p>Same as alternative 2.</p>
AIR QUALITY				
<p>Wild Segments: Under the no-action alternative, wild segments would continue to be largely free of effects from local emissions, with the exception of prescribed and wildland fires, but would be subject to regional emissions trends. The continuation of existing conditions would be expected to have local long-term negligible to minor adverse impacts on air quality in wilderness.</p> <p>Scenic Segments: Air quality would remain generally good but would continue to be adversely affected by a combination of regional sources and locally generated emissions. Local sources of emissions would contribute to air pollution; however, overall impacts on air quality would be local and minor, with the notable exception of fine particulates at the Tuolumne Meadows campground, which might affect local air quality at levels that are unhealthy for sensitive groups. Pollution from these local sources would be generated primarily during the summer when air quality in the area is also most affected by regional sources.</p>	<p>Wild Segments: Wild segments would continue to be largely free of effects from local emissions, with the exception of prescribed and wildland fires, but would be subject to regional emissions trends. This would result in a local long-term negligible to minor adverse impact on air quality in wilderness. The removal of the Glen Aulin High Sierra Camp would result in a local minor to moderate beneficial impact.</p> <p>Scenic Segments: Tuolumne Meadows would be subject to emissions from construction-related activities during the summer season, resulting in a local short-term minor to moderate adverse impact. Impacts on air quality at Tuolumne Meadows under alternative 1 would be similar to the no-action alternative with the following exceptions: (1) the elimination of shuttle bus service, the substantial reduction in vehicles parking at the meadows, the elimination of commercial services and overnight use, reductions in campsite numbers, and the removal of the public fuel station would result in a local long-term moderate beneficial impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would result in a local long-term minor beneficial impact on air quality.</p>	<p>Wild Segments: Wild segments would continue to be largely free of effects from local emissions except for prescribed and wildland fires, but would be subject to regional emissions trends. This would result in a local long-term negligible to minor adverse impact on air quality in wilderness. At Glen Aulin High Sierra Camp, the elimination of woodstoves would reduce area emissions sources, resulting in a local long-term minor beneficial impact.</p> <p>Scenic Segments: Tuolumne Meadows would be subject to emissions from construction-related activities during the summer season, resulting in a local short-term minor to moderate adverse impact. Impacts on air quality at Tuolumne Meadows under alternative 2 would be similar to the no-action alternative with the following exceptions: (1) the increased number of campsites might increase fine particulate emissions at the Tuolumne Meadows campground (where local emissions already reach levels that are unhealthy for sensitive groups), resulting in a local, long-term, minor, adverse impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would be expected to result in a local long-term minor beneficial impact on air quality.</p>	<p>Wild Segments: Same as alternative 2.</p> <p>Scenic Segments: Tuolumne Meadows would be subject to emissions from construction-related activities during the summer season, resulting in a local short-term minor to moderate adverse impact. Impacts on air quality at Tuolumne Meadows under alternative 3 would be similar to under the no-action alternative with the following exceptions: (1) the proposed changes to shuttle circulation and frequency, the overall reduction in vehicles parking at the meadows, the reduction in overnight use, and the removal of the public fuel station would result in a local long-term minor to moderate beneficial impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would result in a local long-term minor beneficial impact on air quality.</p>	<p>Wild Segments: Same as alternative 2.</p> <p>Scenic Segments: Tuolumne Meadows would be subject to emissions from construction-related activities during the summer season, resulting in a local, short-term, minor to moderate, adverse impact. Impacts on air quality at Tuolumne Meadows would be similar to the no-action alternative with the following exceptions: (1) the proposed changes to shuttle circulation and frequency, the reduction of commercial services, and the removal of the public fuel station would result in a local long-term minor beneficial impact; and (2) the replacement of dated equipment such as generators with newer, more energy-efficient models to meet NPS sustainability goals would result in a local long-term minor beneficial impact on air quality.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
SCENIC RESOURCES				
<p>Wild Segments: Under the no-action alternative, wild segments of the river corridor would meet VRM class I objectives. Local long-term negligible adverse impacts on the natural scenery associated with the visibility of facilities at the Glen Aulin High Sierra Camp would remain.</p> <p>Scenic Segments: Scenic resources in Tuolumne Meadows area would meet VRM class II objectives. Most development would remain south of Tioga Road, thus minimizing the impact on the scenic resources of Tuolumne Meadows. Localized adverse impacts along the Tioga Road view corridor associated with roadside parking would remain. Overall, outstanding scenery and viewing opportunities would be retained throughout the river corridor. However, given the lack of iconic scenic vista management in scenic segments (along roadsides), there would be long-term moderate adverse impacts on iconic views and visitor viewing opportunities.</p>	<p>Overall, alternative 1 would have a local long-term minor to moderate beneficial impact on scenic resources in the Tuolumne River corridor.</p> <p>Wild Segments: Wild segments of the river corridor would remain within VRM class I objectives. Compared to the no-action alternative, the natural scenery at Glen Aulin would be enhanced by removing all permanent structures at the High Sierra Camp under this alternative.</p> <p>Scenic Segments: Scenic segments would remain within VRM class II objectives under alternative 1. The NPS would improve the natural scenery and enhance views from key observation points at Tuolumne Meadows by removing the artificial wastewater treatment ponds and all commercial facilities, removing informal roadside parking, and implementing the ecological restoration program for the meadows. Overall, VRM class II objectives would be applied to the cultural landscape in the scenic segments of the river corridor, especially with potential contrast from new facilities (e.g., parking).</p> <p>There would be local long-term minor adverse impacts on the natural scenery at Tuolumne Meadows associated with redevelopment of housing and the wastewater treatment plant. In addition, there would be a minor adverse impact on scenic resources and viewing opportunities along Tioga Road resulting from lack of scenic vista management.</p>	<p>Overall, alternative 2 would have a local long-term minor to moderate beneficial impact on scenic resources in the Tuolumne River corridor.</p> <p>Wild Segments: Wild segments in the river corridor would remain within VRM class I objectives. Compared to the no-action alternative, the NPS would improve the natural scenery at Glen Aulin under alternative 2 by removing all permanent structures at the High Sierra Camp (with the exception of a composting toilet).</p> <p>Scenic Segments: Scenic segments would remain within VRM class II objectives under alternative 2. The NPS would improve the natural scenery and enhance views from key observation points at Tuolumne Meadows by implementing the ecological restoration program for the meadows and removing informal roadside parking. Scenic vistas long Tioga Road would be improved by the removal of vegetation encroaching into the views. Overall, VRM class II objectives would be applied to the cultural landscape in the scenic segments of the river corridor, especially with potential contrast from new facilities. Outstanding scenery and viewing opportunities would be retained throughout the scenic segments, particularly along road corridors, resulting from vista management described in Appendix I.</p> <p>There would be a local long-term minor adverse impact on the natural scenery at Tuolumne Meadows associated with redevelopment of housing, redevelopment of the wastewater treatment plant, and development of a new designated parking area south of Tioga Road in an area visible from some key observation points. However, the new designated parking area would be less visible than the existing roadside parking that it is intended to replace. There might be an additional local long-term minor adverse impact on scenic resources associated with lodgepole encroachment into Tuolumne Meadows, if encroachment continued to occur under the proposed ecological restoration program.</p>	<p>Overall, alternative 3 would have a local long-term minor to moderate beneficial impact on scenic resources in the river corridor.</p> <p>Wild Segments: Wild segments of the Tuolumne River corridor would remain within VRM class I objectives. As with the no-action alternative, local long-term negligible adverse impacts on the natural scenery associated with the visibility of facilities at the Glen Aulin High Sierra Camp would remain.</p> <p>Scenic Segments: Scenic segments of the river corridor would remain within VRM class II objectives. Compared to the no-action alternative, alternative 3 would improve the natural scenery and enhance views from key observation points at Tuolumne Meadows by implementing the ecological restoration program for the meadows and removing informal roadside parking. Outstanding scenery and viewing opportunities would be retained throughout the scenic segments, particularly along road corridors, resulting from vista management described in Appendix I.</p> <p>There would be a local long-term minor adverse impact on the natural scenery at Tuolumne Meadows associated with redevelopment of housing and the wastewater treatment plant. There might be an additional local long-term minor adverse impact on scenic resources associated with lodgepole encroachment into Tuolumne Meadows, if that continued to occur under the proposed ecological restoration program.</p>	<p>Same as alternative 3, with the following exception:</p> <p>In the scenic segments at Tuolumne Meadows, the new visitor contact station and new designated parking area south of Tioga Road under alternative 4 would be in an area visible from some key observation points. However, the new visitor contact station and designated parking area would be less visible than the existing roadside parking that it is intended to replace.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
VISITOR EXPERIENCE				
<p>The no-action alternative would retain the current opportunities for a variety of day and overnight use throughout the Tuolumne River corridor. Most visitors currently express satisfaction with their experience. Based on the trend over the past 20 years, the level of use over the life of the <i>Tuolumne River Plan</i> (approximately the next 20 years) could fluctuate, with periods of increase or decrease. Visitors seeking commercial food service, supplies, lodging, and fuel service at Tuolumne Meadows would continue to have access to those services. Due to the shortage of designated parking at Tuolumne Meadows, some visitors would be frustrated trying to locate parking during peak hours, although it is likely that some visitors would continue to opportunistically create parking spaces as needed.</p> <p>A localized long-term minor adverse impact on some visitors in wild segments would continue to result from relatively high encounter rates on trails within a day hike of Tuolumne Meadows, some visitors’ aversion to sharing trails and campsites with stock, and some visitors’ perception of intrusion of the Glen Aulin High Sierra Camp facilities into a highly scenic area. A relatively smaller number of visitors would benefit moderately by being able to access the wilderness with support from a commercial outfitter or park concessioner, or by being able to spend the night in a remote High Sierra setting without having to carry camping equipment or food. Overall, the no-action alternative would be expected to maintain visitor satisfaction in the wild and scenic segments of the river corridor, resulting in a long-term moderate beneficial impact on visitor experience.</p>	<p>Alternative 1 would have a local long-term moderate beneficial impact on those visitors seeking a wilderness experience. These visitors would experience less crowded conditions corridorwide and fewer amenities at Tuolumne Meadows and Glen Aulin, resulting in greater opportunities for self-reliance and solitude. However, the many visitors who take advantage of amenities such as commercial lodging, food service, supplies, fuel service, or mountaineering supplies/guide service at Tuolumne Meadows would no longer have access to those services. Commercial use restrictions proposed under alternative 1 would also eliminate opportunities for visitors to obtain guided or assisted expeditions in wild segments of the Tuolumne River corridor, including services provided by commercial outfitters and the concessioner. Together these actions would result in local long-term moderate adverse impacts on visitors who rely on commercial services in the river corridor.</p> <p>Although the demand for parking at Tuolumne Meadows would be reduced by the elimination of commercial services and amenities, some day visitors would likely have difficulty finding parking during peak use periods. This would have a local long-term minor adverse impact on visitors who are searching for parking during times when demand exceeds supply. This worst-case scenario would not occur during nonpeak periods.</p>	<p>Alternative 2 would result in a local long-term moderate beneficial impact on visitors who expressed a desire for more recreational opportunities. It would accommodate as much recreational use as possible by expanding opportunities for camping, sightseeing, and picnicking, and providing a new opportunity for recreational boating. Increased designated parking and improved information, facilities, and traffic management would make it easier for most visitors to access and experience the Tuolumne River corridor.</p> <p>Based on existing levels of visitation, under alternative 2 visitors would have little trouble finding parking and accessing the corridor. If park visitation continues to increase, in the future day visitors might have difficulty finding parking during peak use periods (currently defined as July, August, and weekends in September) and times of the day (approximately 11 a.m. to 3 p.m.), thus resulting in a local long-term negligible adverse impact for some visitors. This worst-case scenario would not occur during nonpeak periods and during nonpeak times of the day.</p> <p>A local long-term minor beneficial impact on visitor experience in wild segments of the river corridor under alternative 2 would result from standards implemented to manage encounter rates on trails within a day hike of Tuolumne Meadows and a reduction in stock use compared to the no-action alternative. A relatively small number of visitors would benefit to a moderate degree by being able to access the wilderness with support from a commercial outfitter or park concessioner, although the number of concessioner stock day rides would be reduced and overnight saddle trips to Glen Aulin would be discontinued. The ability to access the wilderness by boat and the ability to spend the night in a remote High Sierra setting without having to pack a tent or food would benefit some visitors who desire multiple backcountry recreational opportunities for varying skill levels. Some visitors’ perception of the Glen Aulin High Sierra Camp facilities as an intrusion into a highly scenic area would be improved by the removal of permanent infrastructure and conversion to a seasonal outfitter camp.</p> <p>Visitors seeking commercial lodging, food service, fuel, and camp supplies at Tuolumne Meadows would continue to have access to those services; however, there would be a local long-term minor adverse impact on visitors seeking mountaineering equipment/guiding services.</p>	<p>Alternative 3 would result in a local long-term minor to moderate beneficial impact on those visitors with strong traditional ties to the Tuolumne River corridor who expressed a desire to see the area remain unchanged. Visitors seeking commercial food service, supplies, and lodging at Tuolumne Meadows would continue to have access to those services, although fuel service would be discontinued and the lodging capacity of Tuolumne Meadows Lodge would be reduced by about half. Visitors would continue to have relatively unrestricted access to the Tuolumne Meadows area and the surrounding wilderness, supported by traditional amenities.</p> <p>Based on existing levels of visitation, some day visitors might have difficulty finding parking during peak use periods, resulting in a local long-term minor to moderate adverse impact for some visitors. This worst-case scenario would not occur during nonpeak periods.</p> <p>A local long-term minor beneficial impact on recreation in wild segments would result from implementation of standards to manage encounter rates on trails within a day hike of Tuolumne Meadows and a reduction in stock use, compared to the no-action alternative. A relatively small number of visitors would continue to benefit by being able to access the wilderness with support from a commercial outfitter or park concessioner, or by being able to spend the night in a remote High Sierra setting without having to pack a tent or food. Some visitors’ perception of the Glen Aulin High Sierra Camp facilities as an intrusion into a highly scenic area would continue.</p> <p>Visitors seeking commercial food service and camp supplies at Tuolumne Meadows would continue to have access to those services; however, there would be a local long-term, minor adverse impact on visitors seeking fuel service or mountaineering equipment/guiding services. The reduced capacity at Tuolumne Meadows Lodge would result in a local long-term minor to moderate adverse impact on visitors who rely on lodging to stay overnight at Tuolumne Meadows.</p>	<p>Alternative 4 would have a local long-term minor to moderate beneficial impact on both visitors with strong traditional ties to the Tuolumne and visitors who expressed a desire for less development and a more sustainable way of enjoying the Tuolumne River. Improved information, facilities, and an increase in designated parking at Tuolumne Meadows would make it easier for most visitors to access and experience the area. At existing levels of park visitation, visitors would have little trouble finding parking and accessing the river corridor. If park visitation continues to increase, in the future visitors might have difficulty finding parking during peak use periods, resulting in a local long-term negligible to minor adverse impact for some visitors. This worst-case scenario would not occur during nonpeak periods and times of the day.</p> <p>A local long-term minor to moderate beneficial impact on recreation in wild segments of the river corridor would result from implementation of standards to manage encounter rates on trails within a day hike of Tuolumne Meadows and a substantial reduction in stock use compared to the no-action alternative. Similarly, some visitors would continue to benefit by being able to access the wilderness with support from a commercial outfitter or by being able to spend the night in a remote High Sierra setting without having to pack a tent or food. A relatively small number of skilled whitewater boaters would be to access the wilderness by whitewater boat. One traditional use, concessioner stock day rides, would be discontinued, resulting in a local long-term minor adverse impact on a relatively small number of visitors. Some visitors’ perception of the Glen Aulin High Sierra Camp facilities as an intrusion into a highly scenic area would continue.</p> <p>Visitors seeking lodging, commercial food service, mountaineering guide service, and camp supplies at Tuolumne Meadows would continue to have access to those services; however, there would be a local long-term minor adverse impact on visitors seeking fuel service or mountaineering equipment.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
WILDERNESS				
Compared to current conditions, the no-action alternative would have a regional long-term minor adverse impact on wilderness character. This conclusion is based on (1) an ongoing negligible diminishment of untrammeled quality caused by ongoing management to mitigate the potential for human-caused impacts to natural communities; (2) some ongoing localized adverse effects on natural and archeological resources, associated with stock use and foot traffic, primarily in Lyell Canyon; (3) an ongoing change in subalpine meadow and riparian habitat associated with historic disruptions to hydrologic and biological processes, primarily in Tuolumne Meadows and including some areas within and adjacent to designated Wilderness; (4) the retention of trails and of minor development associated with the Glen Aulin High Sierra Camp inside designated Wilderness; (5) the potential for increasing day use to diminish opportunities for solitude along wilderness trails near popular Tuolumne Meadows trailheads; and (6) no additional restrictions on primitive and unconfined recreation. In the context of the Tuolumne River corridor as a whole, these impacts would be detectable but quite localized; overall, the untrammeled, natural, and undeveloped qualities of wilderness would remain well protected; management would respect the autonomy of nature; and visitors would find excellent opportunities for primitive and unconfined recreation throughout the corridor, and for solitude in the more remote areas of the corridor.	Overall, alternative 1 would have a local long-term moderate beneficial impact on wilderness character. This conclusion is based on the following assessment: Actions common to alternatives 1-4: Under any of the action alternatives, management would respect the autonomy of nature, limiting operational activities to the minimum requirement. However, the untrammeled quality of wilderness would be adversely affected by management to restore ecological conditions to subalpine meadow and riparian habitat within and adjacent to designated Wilderness, primarily in the Tuolumne Meadows and Lyell Canyon segments; management to eliminate or mitigate localized impacts and the more extensive disruptions to hydrologic and biological processes caused by human activities in these areas would cause an adverse impact to the untrammeled quality of wilderness in order to achieve a beneficial impact to natural conditions. The natural and undeveloped qualities of wilderness would remain in or be restored to good condition. The existing backcountry trail system and associated maintenance requirements would remain under all alternatives. The undeveloped character of wilderness in the Tuolumne River corridor would remain protected through the use of the minimum requirement concept. Under all alternatives, visitors would continue to find excellent opportunities for solitude or primitive and unconfined recreation, or both. Overnight use in wilderness would continue to be managed through a trailhead quota system that would protect opportunities for solitude; no new impacts on overnight users would occur under the <i>Tuolumne River Plan</i> . Impacts specific to alternative 1: In addition to the above, alternative 1 would enhance the natural and undeveloped qualities of wilderness and opportunities for solitude and primitive recreation by removing the Glen Aulin High Sierra Camp and adding the area to designated Wilderness. Activities during camp removal would adversely affect the untrammeled quality of the surrounding wilderness; however, overall the net effect would be an obvious improvement to wilderness character both locally and in the surrounding Yosemite Wilderness. Alternative 1 would also improve opportunities for solitude in wilderness throughout the wilderness corridor by substantially reducing encounter rates on trails. These use limits, combined with a significant reduction in commercial stock use on trails, would have a readily apparent beneficial impact on solitude and primitive recreation on and near trails throughout the river corridor.	Overall, alternative 2 would have a local long-term moderate beneficial impact on wilderness character. This conclusion is based on the following assessment: Actions common to alternatives 1-4: see alternative 1 Impacts specific to alternative 2: In addition to the impacts common to alternatives 1-4, alternative 2 would enhance the natural and undeveloped qualities of wilderness and opportunities for solitude and primitive recreation by converting the Glen Aulin High Sierra Camp to a seasonal outfitter camp with no permanent facilities except composting toilets, and adding the area to designated Wilderness, where it would be subject to wilderness management policies. Activities during camp removal would adversely affect the untrammeled quality of the surrounding wilderness; however, overall the net effect would be a noticeable improvement to the natural and undeveloped qualities of wilderness character in the corridor and an enhancement of the Yosemite Wilderness. Alternative 2 would also protect opportunities for solitude on all wilderness trails in the river corridor over the long term by establishing a standard for encounter rates on trails; because the standard would be higher than the number of encounters currently experienced on most trails, it could slightly reduce solitude from current conditions; however, the higher standard would also reduce the potential need for a day trailhead quota system. Finally, alternative 2 would improve opportunities for primitive recreation by restricting commercial use and allowing noncommercial whitewater boating.	Overall, alternative 3 would have a local long-term minor beneficial impact on wilderness character. This conclusion is based on the following assessment: Actions common to alternatives 1-4: see alternative 1 Impacts specific to alternative 3: In addition to the impacts common to alternatives 1-4, alternative 3 would protect opportunities for solitude on all wilderness trails in the river corridor over the long term by establishing a standard for encounter rates on trails; because the standard would be higher than the number of encounters currently experienced on most trails, it could slightly reduce solitude from current conditions; however, the higher standard would also reduce the potential need for a day trailhead quota system. Opportunities for primitive and unconfined recreation would be protected by restricting commercial use in wilderness. Utility upgrades in the Glen Aulin area would cause short-term localized adverse impacts on the undeveloped quality of wilderness; however, once these upgrades were completed, the long-term impact of the camp on undeveloped and natural qualities of wilderness would remain generally unchanged from current conditions.	Overall, alternative 4 would have a local long-term minor to moderate beneficial impact on wilderness character. This conclusion is based on the following assessment: Actions common to alternatives 1-4: see alternative 1 Impacts specific to alternative 4: In addition to the impacts common to alternatives 1-4, alternative 4 would improve the natural and undeveloped qualities of wilderness by removing some of the facilities associated with the Glen Aulin High Sierra Camp from designated Wilderness and reducing the need for packstock resupply and helicopter trips. Utility upgrades in the Glen Aulin area would cause short-term localized adverse impacts on the undeveloped quality of wilderness; however, once these upgrades were completed, the long-term adverse impact of the camp on undeveloped and natural qualities of wilderness would be reduced. Alternative 4 would additionally protect opportunities for solitude on all wilderness trails in the river corridor over the long term by establishing standards for encounter rates; because the standard for most trails would be higher than the number of encounters currently experienced, it could slightly reduce solitude from current conditions. The lower standard established for the trail from Rogers Creek to Pate Valley would ensure that current opportunities for solitude on that more remote trail would be protected. Opportunities for primitive and unconfined recreation would be enhanced by restricting commercial use in wilderness, eliminating concessioner stock day rides, and allowing noncommercial whitewater boating.

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
PARK OPERATIONS AND FACILITIES				
Continuation of conditions under the no-action alternative would have a local long-term minor adverse impact on operations. This impact would result from inadequate NPS housing, inadequate office and storage space, an aging and high-maintenance wastewater treatment facility, and conflicts between administrative and visitor circulation patterns in the vicinity of the maintenance yard and visitor center. Although these impacts would not be new, they could be expected to worsen as facilities continued to age and visitor use increased.	Alternative 1 would result in a local long-term moderate beneficial impact on park operations associated largely with the reduction in required levels of service and staffing, which would eliminate the housing shortfall and overcrowding of administrative office and storage space. Additional benefits would result from reduced maintenance requirements at the wastewater treatment facilities and elimination of traffic conflicts between visitors accessing the visitor center and maintenance operations. The operational issues associated with co-locating the stables would be addressed during facility redesign. Demolition, construction, and restoration activities would result in short-term minor to moderate adverse impacts on park operations.	Alternative 2 would result in a local long-term moderate beneficial impact on park operations. This would be associated primarily with the upgrading and expansion of housing to adequately accommodate the needed staff and the provision of adequate office and storage space. Upgraded wastewater treatment facilities and better separation between administrative and visitor use areas would also benefit park operations. The management issues raised by co-location of the NPS and concessioner stables could be largely resolved through sensitive facility design, although health and safety concerns would increase with an increased amount of stock in one location. Demolition, construction, and restoration activities would have short-term minor adverse impacts on park operations.	Alternative 3 would result in a local long-term moderate beneficial impact on park operations. Reducing the workload and providing employee campsites behind the Tuolumne Meadows Lodge would eliminate the housing shortfall at Tuolumne Meadows. The consolidation of adequate maintenance and operations facilities, with better separation between administrative and visitor use areas, and upgraded wastewater treatment facilities would also benefit park operations. Demolition, construction, and restoration activities would result in a short-term minor adverse impact on park operations.	Alternative 4 would result in a local long-term moderate beneficial impact on park operations. Additional housing and campsites would eliminate the housing shortfall at Tuolumne Meadows. The consolidation of adequate administrative facilities, better separation between administrative and visitor use areas, and upgraded wastewater treatment facilities would also benefit park operations. The operational issues associated with co-locating the stables would be addressed during facility redesign. Demolition, construction, and restoration activities would result in a short-term minor adverse impact on park operations.
TRANSPORTATION				
Under the no-action alternative, the amount of designated parking at Tuolumne Meadows would remain inadequate to meet peak season demand. Parking would remain managed on a limited basis if necessary at site-specific locations, and visitors would likely continue to create parking in nondesignated locations that affect sensitive natural and cultural resources. The potential for vehicle and pedestrian conflicts along the side of Tioga Road would continue. Overall, this would result in a local long-term moderate adverse impact.	Under alternative 1, the NPS would reduce the total designated parking supply in the Tuolumne Meadows area by 52 spaces, from 533 to 481 spaces. Parking in nondesignated areas would no longer be allowed. Ongoing monitoring of parking capacities would result in targeted management actions to address traffic and parking management as needed. Based on current conditions, up to 45% of the vehicles currently parking at Tuolumne Meadows on peak days could no longer be accommodated, resulting in a local long-term major adverse impact on parking and the transportation experience for many visitors due to the projected shortage of parking. This impact would be moderated somewhat because elimination of commercial services and amenities is expected to reduce the demand for parking at Tuolumne Meadows. However, based on the average traffic volume over the past three years and projected increases in park visitation, a 45% decrease in visitation at Tuolumne Meadows is unlikely. If visitation continues to grow 3% annually (as projected), alternative 1 could further result in local major adverse impacts on parking and the transportation experience. For overnight visitors, parking would remain adequate during both peak and nonpeak periods. Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. For visitors able to park at Tuolumne Meadows during peak use periods, this would result in local long-term moderate beneficial impacts on parking and the transportation experience. The elimination of shuttle bus service would require visitors to either walk or move their private vehicles to circulate within the Tuolumne Meadows area, resulting in a local long-term minor adverse impact on traffic conditions and the transportation experience.	Under alternative 2, the NPS would increase the total designated parking supply by 449 spaces, from 533 to 982 spaces. Designated day parking would be increased by 302 spaces. Parking in nondesignated areas would no longer be allowed. The designated parking supply with alternative 2 would be more than sufficient to accommodate current peak season demand. The amount of designated parking would also be sufficient to accommodate overnight visitors. Ongoing monitoring of parking capacities would result in targeted management actions to further address traffic and parking management as needed during peak use times. Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. Overall, these actions would result in local long-term moderate beneficial impacts on traffic conditions, parking, and the transportation experience. However, if visitation continues to grow 3% annually (as projected), within two to three years alternative 2 could result in a local minor adverse impact on parking and the transportation experience for some visitors during peak use periods, although parking should remain adequate during nonpeak periods. For overnight visitors, parking would remain adequate during both peak and nonpeak periods. Consolidating visitor services and providing a roadside trail along the south side of Tioga Road would support better pedestrian access between facilities and reduce vehicle pedestrian conflicts caused by people walking along the side of the road. These actions under alternative 2 would result in local long-term moderate beneficial impacts on the transportation system and related experience.	Under alternative 3, the NPS would increase the total designated parking supply by 280 spaces, from 533 to 813 spaces. The designated day parking supply would be increased by 170 spaces. Parking in nondesignated areas would no longer be allowed. Ongoing monitoring of parking capacities would result in targeted management actions to further address traffic and parking management as needed during peak use times. Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. These actions would result in local long-term moderate beneficial impacts on parking for those who were able to park during peak use periods. At nonpeak times and on nonpeak days, visitors would be expected to have little trouble parking. Based on current conditions, up to 12% of the vehicles currently parking at Tuolumne Meadows would not be accommodated during peak hours on peak days in July, August, and September, when the parking supply would not be sufficient to meet current maximum demand. This would result in a local long-term minor adverse impact on traffic conditions, parking, and the transportation experience for some visitors. If visitation continues to grow 3% annually (as projected), alternative 3 would result in long-term moderate adverse impacts on parking and the transportation experience for an increasing amount of visitors because projected difficulties finding day use parking during peak use periods. For overnight visitors, parking would remain adequate during both peak and nonpeak use periods. Visitor services would remain dispersed, but the expansion of shuttle service along with improved trails would improve visitor access to and circulation among sites in the Tuolumne Meadows area, resulting in local long-term minor beneficial impacts on the transportation system and related experience.	Under alternative 4, the NPS would increase the total designated parking supply by 381 spaces, from 533 to 914 spaces. The designated day parking supply would be increased by 222 spaces. Parking in nondesignated areas would no longer be allowed. The designated parking supply would be sufficient to accommodate current peak season demand. The amount of designated parking would also be sufficient to accommodate overnight visitors. Additionally, regional transit capacity would be increased by 135 people, the equivalent of three 45-passenger shuttle buses. Ongoing monitoring of parking capacities would result in targeted management actions to further address traffic and parking management as needed during peak use times. Scenic viewing along the Tioga Road corridor would be improved by removing informal roadside parking and providing designated pullouts for short-term viewing. Overall, these actions would result in local long-term moderate beneficial impacts on traffic conditions, parking, regional transit, and the transportation experience. However, if visitation continues to grow 3% annually (as projected), within one to two years alternative 4 could result in a local long-term minor adverse impact on parking and the transportation experience for some visitors on peak days at peak times, although day parking should remain adequate during nonpeak periods. For overnight visitors, parking would remain adequate during both peak and nonpeak periods. Relocating the visitor center closer to the other major visitor facilities, improving shuttle service, and providing a roadside trail along the south side of Tioga Road would support better pedestrian access between facilities and reduce vehicle-pedestrian conflicts caused by people walking along the side of the road. These actions under alternative would result in local long-term moderate beneficial impacts on the transportation system and related experience.

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
ENERGY CONSUMPTION AND CLIMATE CHANGE				
Under the no-action alternative, there would be little or no change to existing energy use and related greenhouse gas emissions.	Under alternative 1, the substantial reduction in visitor services and administrative facilities throughout the Tuolumne River corridor would result in a short-term expenditure of energy and emissions during implementation and a minor beneficial impact on energy consumption and greenhouse gas emissions in the long term.	Under alternative 2, the increase in visitor and administrative facilities would be offset by energy efficiency improvements incorporated into new or renovated facilities. Short-term expenditures of energy and emissions would be expected during alternative implementation. The elimination of some visitor amenities at Glen Aulin High Sierra Camp would decrease energy use and emissions in wild segments. Overall, alternative 2 would result in long-term negligible adverse impacts on energy consumption and greenhouse gas emissions in the Tuolumne River corridor.	Under alternative 3, short-term expenditures of energy and emissions would be expected during implementation. The elimination of some visitor amenities at Glen Aulin High Sierra Camp would decrease energy use and emissions in wild segments. In scenic segments, elimination of the public fuel station could increase or decrease energy use and emissions, depending on how many refueling trips would be needed for overnight visitors versus decreasing fuel truck deliveries to Tuolumne Meadows. In addition, there would be improvements in facility energy efficiency and expansion of the shuttle bus service at Tuolumne Meadows to reduce private vehicle circulation. Overall, this would result in a long-term negligible beneficial impact on energy consumption and greenhouse gas emissions.	Under alternative 4, the slight increase in visitor and administrative facilities would be offset by energy efficiency improvements incorporated into new or renovated facilities. Short-term expenditures of energy and emissions would be expected during implementation. The elimination of some visitor amenities at Glen Aulin High Sierra Camp and associated reductions in helicopter use to support the camp would decrease energy use and emissions in wild segments. In scenic segments, elimination of the public fuel station could increase or decrease energy use and emissions, depending on how many refueling trips would be needed for overnight visitors versus decreasing fuel truck deliveries to Tuolumne Meadows. Overall, this would result in a long-term negligible beneficial impact on energy consumption and greenhouse gas emissions.
SOCIOECONOMICS				
There would be no changes to current use or management of the Tuolumne River corridor under the no-action alternative. The number of visitors in the river corridor could increase over time, but there would be no appreciable change in the amount and type of visitor facilities available in the Tuolumne Meadows area. Visitor spending in the region and its impact on the regional economy would be anticipated to remain at current levels. NPS and concessioner staff levels would remain at their current levels, primarily limited by the availability of housing. Therefore, there would be no impact on the region's economy under this alternative.	Alternative 1 would result in a long-term minor to moderate adverse impact on visitor populations and spending because some visitors might decide not to visit the area if they could not access desired activities in the Tuolumne River corridor. The impact on some local economies might be beneficial with some visitor spending shifting from inside the park to outside the park. The long-term impact on the region's economy might be adverse because overall visitor spending (inside and outside the park) would likely decrease somewhat. The type and intensity of these impacts would depend on whether overall visitor numbers to the region decreased because of the elimination of all commercial services in the corridor (including all lodging) or if some proportion of these visitors would shift use to communities outside of the park. Impacts on the local economy in Tuolumne County could be minor to moderate and adverse if the reduction in lodging and commercial services results in lower tax revenues to the county. In addition, the elimination of nearly all seasonal concessioner employees at Tuolumne Meadows would decrease wages and spending on goods and services outside of the park during the summer season. This would result in a long-term minor adverse impact on the regional economy. The elimination of commercial services in the river corridor could result in a small decrease in local employment if these commercial outfitters and other commercial permit operations reduced trips overall instead of redirecting them to areas outside the Tuolumne River corridor but within the park or region. Overall, the impact would likely be long term, minor, and adverse on the regional economy and a minor to moderate adverse impact on the local economy in Mono County. The impact on the social environment would be long term, minor, and adverse as a result of the potential displacement of local recreation in the corridor. The impact on concessioner operations would be a long term, moderate, and adverse due to the substantial decrease in revenues associated with eliminated lodging and other visitor services.	Alternative 2 would result in a minor to moderate beneficial impact on visitor populations, visitor spending, and local and regional economies because of an overall potential increase in visitors (particularly overnight visitors, who tend to spend more outside of the park than day visitors). A substantial increase in NPS employees would increase wages and spending on goods and services outside of the park during the summer season, resulting in a long-term minor beneficial impact on local and regional economies. Restrictions on outfitter and other commercial permit operators in wilderness are not likely to decrease local or regional employment, as the number of commercial trips allotted in alternative 2 is similar to existing conditions. There could be a minor adverse impact on the local economy of Mono County if commercial outfitters reduced trips overall instead of either maintaining the same number of trips but directing them to areas outside the Tuolumne River corridor at restricted times or moving the trips to other days of the week. The impact on the social environment would be minor and beneficial because there would be additional opportunities for local visitors to access the river corridor. The impact on concessioner revenue would be long term, negligible, and adverse because of the decrease in concessioner stock day rides and the removal of the mountaineering shop/school.	Alternative 3 would result in a long-term minor adverse impact on visitor populations and spending. The long-term impact on the local and regional economies would depend on whether overall visitor numbers to the region decreased because of the reductions in lodging, lowered visitor capacity, and reduced services, or visitor numbers remained constant, with use shifting to communities outside of the park when the corridor is at capacity. Impacts on the local economy in Tuolumne County could be minor and adverse if the reduction in lodging and commercial services results in lower tax revenues to the county. A decrease in NPS employees would decrease wages and spending on goods and services outside of the park during the summer season, resulting in a long-term minor adverse impact on local and regional economies. The reduction in outfitter and other commercial permitted trips could result in a small decrease in local employment if these commercial operations decreased trips overall instead of either redirecting them to areas outside the Tuolumne River corridor or moving the trips to other days of the week. Overall, this impact would likely be long term, minor, and adverse on the regional economy and on the local economy in Mono County. The impact on the social environment under alternative 3 would be long term, minor, and adverse because there might be fewer opportunities for local recreation access in the corridor. The impact on concessioner operations would be long term, minor to moderate, and adverse as a result of reduced lodging at the Glen Aulin High Sierra Camp, reduced lodging at the Tuolumne Meadows Lodge, reduced concessioner stock day rides, and removal of the gas station and mountaineering shop/school.	Alternative 4 would result in a long-term negligible to minor beneficial impact on visitor populations and spending in the region. There would be a long-term negligible beneficial impact on the regional economy due to a slight increase in visitor capacity and NPS employment in the river corridor. There would be a long-term negligible adverse impact on the regional economy from reductions in concessioner spending and concessioner employment in the river corridor. Restrictions on outfitter and other commercial permit operators in wilderness are not likely to decrease local or regional employment, as the number of commercial trips allotted in alternative 4 is similar to existing conditions. There could be negligible adverse impacts on the local economy in Tuolumne County if the reduction in lodging at Glen Aulin and reduced commercial services results in lower tax revenues to the county. There could be a minor adverse impact on the local economy of Mono County if commercial outfitters reduced trips overall instead of either maintaining the same number of trips but directing them to areas outside the Tuolumne River corridor at restricted times or moving the trips to other days of the week. The impact on the social environment would be negligible and beneficial under alternative 4 because use levels would be similar to existing conditions, resulting in no change in access to the corridor for local residents. The impact on concessioner revenue would be a long term, minor, and adverse due to the decrease in lodging capacity at Glen Aulin High Sierra Camp, elimination of concessioner stock day rides, and removal of the gas station and the mountaineering shop.

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
HISTORIC BUILDINGS, STRUCTURES, AND CULTURAL LANDSCAPES				
<p>There would be no adverse effect on potentially eligible historic resources in wilderness segments of the Tuolumne River corridor under any alternative, including the no-action alternative. Historic resources in wilderness would be managed and protected under current cultural resource management policies. Park projects and maintenance in wilderness areas would continue to be subject to the NHPA section 106 process, which is augmented by national and park-specific programmatic agreements (appendix D). Standard mitigation measures, as defined in the park-specific programmatic agreement, include photo documentation, salvage, and reevaluation of NRHP status.</p> <p>There would be no adverse effect on the NRHP-eligible Tuolumne Meadows Historic District, NRHP-eligible Tioga Road Historic District, NRHP-eligible Glen Aulin Historic District, or NRHP-listed buildings and structures under the no-action alternative. Historic features that contribute to the districts would remain in good condition and would continue to be managed and protected under existing cultural resource management policies. However, existing threats to the natural systems within the Tuolumne Meadows and Soda Springs Historic Districts from increasing visitor use and changes to historic vegetation patterns would continue.</p>	<p>NRHP-eligible Glen Aulin High Sierra Camp Historic District: Adverse effect resulting from the removal of all historic structures. The historic district would lose its integrity and would no longer be eligible for listing in the NRHP. Further consultation with the SHPO would be required.</p> <p>NRHP-eligible Tioga Road Historic District: Adverse effect from removal of historic turnouts and potential modification of historic culverts. The adverse effect would be minimized by locating proposed new turnouts in the same locations as historic turnouts, salvaging and reusing materials of original historic culverts, and ensuring that new or modified features use historically compatible materials and design.</p> <p>NRHP-eligible Tuolumne Meadows Historic District:</p> <ul style="list-style-type: none">Adverse effect resulting from the following:<ul style="list-style-type: none">(1) removal of the campground A-loop road;(2) actions along the Great Sierra Wagon Road to improve hydrologic processes. Mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would be used to minimize the adverse effect.(3) removal of all contributing features from three of the seven developed areas in the Tuolumne Meadows Historic District: the entire Tuolumne Meadows Lodge and High Sierra Camp, the Tuolumne Meadows store/gas station area, and the Insect Research Station (Bug Camp). The historic design and spatial organization of the Tuolumne Meadows Historic District would likewise be altered by the removal of historic features. Due to the removal of a substantial number of contributing historic features and the alterations to the historic design of the Tuolumne Meadows Historic District, additional consultation with the SHPO would be required.The NPS would avoid an adverse effect from interior work at contributing comfort stations, such as installation of new plumbing fixtures, through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> and through consultation with the SHPO, if necessary.Any modification of the Tuolumne River bridge would require a subsequent NHPA section 106 compliance process.New construction would occur within existing developed areas; potential adverse effects on the Tuolumne Meadows Historic District resulting from new construction would be avoided by requiring that new facilities be consistent to the maximum extent possible with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines). <p>NRHP-eligible Soda Springs Historic District: There would be an adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).</p> <p>NRHP-listed CCC rustic campground comfort stations and NRHP-listed CCC mess hall: no adverse effect resulting from modifications. The NPS would avoid an adverse effect on these properties through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> in conjunction with the <i>Yosemite Design Guidelines</i> (NPS 2011a), and through consultation with the SHPO.</p> <p>NRHP-listed Parsons Memorial Lodge: no adverse effect.</p> <p>All other NRHP-listed buildings and structures: no adverse effect.</p>	<p>NRHP-eligible Glen Aulin High Sierra Camp Historic District: Adverse effect resulting from the removal of all historic structures. The historic district would lose its integrity and no longer be eligible for listing in the NRHP. Further consultation with the SHPO would be required.</p> <p>NRHP-eligible Tioga Road Historic District: same as alternative 1.</p> <p>NRHP-eligible Tuolumne Meadows Historic District:</p> <ul style="list-style-type: none">Adverse effect resulting from the following:<ul style="list-style-type: none">(1) reconfiguration of campground roads to accommodate walk-in campsites, and(2) actions along the Great Sierra Wagon Road to improve hydrologic processes. Mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would be used to minimize the adverse effect.(3) removal of contributing buildings and structures at the Insect Research Station (Bug Camp). The adverse effect would be addressed through the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), NPS Management Policies 2006 (NPS 2006g), or as otherwise agreed to with the SHPO.The NPS would avoid an adverse effect from interior work at contributing comfort stations, such as installation of new plumbing fixtures, through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> and through consultation with the SHPO, if necessary.Any modification of the Tuolumne River bridge would require a subsequent NHPA section 106 compliance process.New construction would occur within existing developed areas and undeveloped areas; potential adverse effects on the Tuolumne Meadows Historic District resulting from new construction would be avoided by requiring that new facilities be consistent with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines).Scenic vista management at select locations (see appendix I) would enhance historic vistas and views in both the Tuolumne Meadows and Soda Springs Historic Districts. <p>NRHP-eligible Soda Springs Historic District: Adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).</p> <p>NRHP-listed CCC rustic campground comfort stations and NRHP-listed CCC mess hall: no adverse effect resulting from modifications. The NPS would avoid an adverse effect on these properties through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> in conjunction with the <i>Yosemite Design Guidelines</i> (NPS 2011a), and through consultation with the SHPO.</p> <p>NRHP-listed Parsons Memorial Lodge: no adverse effect.</p> <p>All other NRHP-listed buildings and structures: no adverse effect.</p>	<p>NRHP-eligible Glen Aulin High Sierra Camp Historic District: Adverse effect resulting from the removal of one historic guest cabin at the camp. This resource would be documented and recorded according to the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), and NPS <i>Management Policies 2006</i> (NPS 2006g), or as otherwise agreed to with the SHPO and other interested parties.</p> <p>NRHP-eligible Tioga Road Historic District: same as alternative 1.</p> <p>NRHP-eligible Tuolumne Meadows Historic District:</p> <ul style="list-style-type: none">Adverse effect resulting from the following:<ul style="list-style-type: none">(1) the reconfiguration of campground roads for a campground redesign, and(2) actions along the Great Sierra Wagon Road to improve hydrologic processes in Tuolumne Meadows. For the Great Sierra Wagon Road, mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would minimize the adverse effect.(3) removal of one contributing building at the gas station and the removal of 35 contributing guest tent cabins at Tuolumne Meadows Lodge High Sierra Camp. The adverse effect would be addressed through the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), NPS <i>Management Policies 2006</i> (NPS 2006g), or as otherwise agreed to with the SHPO.The rehabilitation of 11 contributing tent cabins at the administrative area (Ranger Camp) and Road Crew Camp could potentially result in an adverse effect; this action would require further design, compliance, and SHPO consultation.The NPS would avoid an adverse effect from interior work at contributing comfort stations, such as installation of new plumbing fixtures, through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> and through consultation with the SHPO, if necessary.The NPS would avoid an adverse effect from rehabilitation of the contributing shower house at Tuolumne Meadows Lodge High Sierra Camp through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> and through consultation with SHPO, if necessary.Any modification of the Tuolumne River bridge would require a subsequent NHPA section 106 compliance process.New construction would occur within existing developed areas; potential adverse effects on the Tuolumne Meadows Historic District resulting from new construction would be avoided by requiring that new facilities be consistent to the maximum extent possible with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines).Scenic vista management at select locations (see appendix I) would enhance historic vistas and views in both the Tuolumne Meadows and Soda Springs Historic Districts. <p>NRHP-eligible Soda Springs Historic District: Adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).</p> <p>NRHP-listed CCC rustic campground comfort stations and NRHP-listed CCC mess hall: no adverse effect resulting from modifications. The NPS would avoid an adverse effect on these properties through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> in conjunction with the <i>Yosemite Design Guidelines</i> (NPS 2011a), and through consultation with SHPO.</p> <p>NRHP-listed Parsons Memorial Lodge: no adverse effect.</p> <p>All other NRHP-listed buildings and structures: no adverse effect.</p>	<p>NRHP-eligible Glen Aulin High Sierra Camp Historic District: No adverse effect.</p> <p>NRHP-eligible Tioga Road Historic District: same as alternative 1.</p> <p>NRHP-eligible Tuolumne Meadows Historic District:</p> <ul style="list-style-type: none">Adverse effect resulting from the following:<ul style="list-style-type: none">(1) the reconfiguration of campground roads for a campground redesign, and(2) actions along the Great Sierra Wagon Road to improve hydrologic processes in Tuolumne Meadows. For the Great Sierra Wagon Road, mitigation measures developed by NPS cultural resource specialists (see appendix H) and standard mitigation measures in the park-specific programmatic agreement (appendix D) would minimize the adverse effect.(3) removal of one contributing building at the gas station and the possible relocation of the contributing dining hall/kitchen building at Tuolumne Meadows Lodge High Sierra Camp. The adverse effect would be addressed through the standard four-step process outlined in 36 CFR part 800, national and park-specific programmatic agreements (see appendix D), NPS <i>Management Policies 2006</i> (NPS 2006g), or as otherwise agreed to with SHPO.The rehabilitation of 11 contributing tent cabins at the administrative area (Ranger Camp) and Road Crew Camp could potentially result in an adverse effect; this action would require further design, compliance, and SHPO consultation.The NPS would avoid an adverse effect from interior work at contributing comfort stations, such as installation of new plumbing fixtures, through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> and through consultation with the SHPO, if necessary.The NPS would avoid an adverse effect from rehabilitation of the contributing shower house at Tuolumne Meadows Lodge High Sierra Camp through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> and through consultation with SHPO, if necessary.Any modification of the Tuolumne River bridge would require a subsequent NHPA section 106 compliance process.New construction would occur within existing developed areas; potential adverse effects on the Tuolumne Meadows Historic District resulting from new construction would be avoided by requiring that new facilities be consistent to the maximum extent possible with the historic materials, features, size, scale, proportion, and massing of the existing historic properties and of the district as a whole (see appendix K for design guidelines).Scenic vista management at select locations (see appendix I) would enhance historic vistas and views in both the Tuolumne Meadows and Soda Springs Historic Districts. <p>NRHP-eligible Soda Springs Historic District: Adverse effect resulting from actions along segments of the Great Sierra Wagon Road within the district (see above).</p> <p>NRHP-listed CCC rustic campground comfort stations and NRHP-listed CCC mess hall: no adverse effect resulting from modifications. The NPS would avoid an adverse effect on these properties through application of the <i>Secretary of the Interior’s Standards for the Treatment of Historic Properties</i> in conjunction with the <i>Yosemite Design Guidelines</i> (NPS 2011a), and through consultation with SHPO.</p> <p>NRHP-listed Parsons Memorial Lodge: no adverse effect.</p> <p>All other NRHP-listed buildings and structures: no adverse effect.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
ARCHEOLOGICAL RESOURCES				
<p>Archeological sites would continue to be documented and monitored, but would not be managed to an established standard under the no-action alternative. It is likely that current site impacts would continue and overall site conditions would eventually worsen under this alternative. Because the data potential at most of these sites has not been evaluated and condition assessments are sporadic, it is difficult to predict the overall severity of effects on archeological resources. The potential for an adverse effect on some of the archeological resources in the river corridor would continue.</p> <p>For the most part, archeological sites in wild segments would remain intact, with some exceptions in wilderness adjacent to Tioga Road, along major trails (e.g., the John Muir Trail/Pacific Crest Trail), the Glen Aulin area, and in pack stock use areas in Lyell Canyon.</p> <p>Many sites throughout the corridor, particularly those in high-use areas, would continue to be disturbed under the no-action alternative, and some would continue to be threatened by visitor and administrative activities. Since impacts on archeological resources cannot be reversed but only stopped from doing further harm, continued actions would have the potential for an adverse effect on archeological resources. For administrative activity, consultation with the park’s Resources Management Science Division, adherence to the national and park-specific programmatic agreements in appendix D, and application of the <i>Archeological Synthesis and Research Design</i> (Hull and Moratto 1999) prior to conducting administrative activities that cause ground disturbance would be applied to avoid or minimize the potential adverse effect.</p>	<p>Corridorwide: The implementation of site condition assessments, analysis, and reporting program with management triggers for protective actions would help lower the potential for disturbances associated with human use and would reduce the risk of an adverse effect on archeological sites, compared with the no-action alternative. Archeological testing would be conducted to formally determine the individual eligibility of each site (if not already determined) where potential disturbance was likely. If specific actions proposed might affect a given site’s NRHP eligibility, especially under NRHP criterion d, the adverse effect would be addressed through adherence to the NPS cultural resource management guidelines and the national and park-specific programmatic agreements in appendix D, mitigation measures in appendix O, and through application of the <i>Archeological Synthesis and Research Design</i> (Hull and Moratto 1999). All treatments for precontact archeological sites would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives.</p> <p>Wild Segments: There would be no adverse effect on archeological resources in wilderness. Lower use levels, elimination of concessioner stock day rides, elimination of nearly all commercial use, and restrictions on the location of camping and grazing areas in Lyell Canyon would reduce the risk of disturbance to archeological sites, compared with existing conditions. Restoration of localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.</p> <p>At Glen Aulin High Sierra Camp, ground disturbance from removing the entire camp and proposed work at the backpacker campground might disturb a recorded archeological resource. If avoidance was not possible, archeological site treatments, such as controlled testing and data recovery excavations, would be employed to reduce the level of impact and avoid an adverse effect.</p> <p>Scenic Segments: At Tuolumne Meadows, the risk of disturbance at archeological sites with alternative 1 would be decreased by reducing day and overnight visitor use levels, eliminating road shoulder parking, and eliminating informal trails.</p> <p>However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from alternative 1. Implementation of the site plan at Tuolumne Meadows would have the potential to disturb 12 class I sites, 13 class II sites, 1 class III site, and 3 class IV sites. One site outside the archeological district might also be affected. Some of these impacts would be caused by ecological restoration activities; in many cases, restoration techniques could be modified to avoid impacts on individual archeological sites.</p> <p>There would be no effect on archeological resources in river segments below O’Shaughnessy Dam, including the Hetch Hetchy Archeological District.</p>	<p>Corridorwide: Same as alternative 1</p> <p>Wild Segments: There would be no adverse effect on archeological resources in wilderness. The reduction in concessioner stock day rides, reductions in pack stock needed to support Glen Aulin High Sierra Camp, and restrictions on the location of camping and grazing areas in Lyell Canyon would reduce the risk of disturbance to archeological sites, compared with existing conditions. Restoring localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.</p> <p>At Glen Aulin High Sierra Camp, ground disturbance from removing the entire camp and proposed work at the backpacker campground might disturb a recorded archeological resource. If avoidance was not possible, the NPS would employ archeological site treatments, such as controlled testing and data recovery excavations, to reduce the level of impact and avoid an adverse effect. There would also be a potential for adverse effects on archeological resources from recreational boating use at put-in, portage, and take-out locations between Tuolumne Meadows and Pate Valley; consultation with the park archeologist could avoid an adverse effect.</p> <p>Scenic Segments: Although visitor use levels at Tuolumne Meadows could be higher than existing conditions, when compared to the no-action alternative, the risk of disturbance to archeological resources at Tuolumne Meadows would decrease by eliminating shoulder parking, eliminating informal trails, consolidating visitor use at specific locations, and relocating pathways away from sensitive locations. However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from alternative 2. Implementation of the site plan at Tuolumne Meadows would have the potential to disturb eight class I sites, four class II sites, and two class III sites. Some of these impacts would be due to ecological restoration activities; in many cases restoration techniques could be modified to avoid impacts on individual archeological sites.</p> <p>There would be no effect on archeological resources in river segments below O’Shaughnessy Dam, including the Hetch Hetchy Archeological District.</p>	<p>Corridorwide: Same as alternative 1.</p> <p>Wild Segments: There would be no adverse effect on archeological resources in wilderness. The reduction in concessioner stock day rides, reductions in commercial use, and restrictions on the location of camping and grazing areas in Lyell Canyon would reduce the risk of disturbance to archeological sites, compared with existing conditions. Restoration of localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.</p> <p>At Glen Aulin High Sierra Camp, ground disturbance from utility upgrades would potentially disturb a recorded archeological resource. Siting the proposed utility upgrades in nonsensitive locations would avoid an adverse effect.</p> <p>Scenic Segments: At Tuolumne Meadows, the risk of disturbance to some archeological resources at Tuolumne Meadows would be decreased through reducing visitor use levels, eliminating road shoulder parking, and eliminating informal trails.</p> <p>However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from alternative 3. Implementation of the site plan at Tuolumne Meadows would have the potential to disturb seven class I sites, two class II sites, three class III sites, and one class IV site. Some of these impacts would be due to ecological restoration activities; in many cases, restoration techniques could be modified to avoid impacts on individual archeological sites.</p> <p>There would be no effect on archeological resources in river segments below O’Shaughnessy Dam, including the Hetch Hetchy Archeological District.</p>	<p>Corridorwide: Same as alternative 1.</p> <p>Wild Segments: There would be no adverse effect on archeological resources in wilderness. The elimination of concessioner stock day rides, reductions in pack stock used to resupply Glen Aulin High Sierra Camp, and restrictions on the locations of pack stock camping and grazing areas in Lyell Canyon would reduce impacts on archeological sites, compared with existing conditions. Restoring localized areas disturbed by human and pack stock use would require manual ground disturbance in areas with archeological resources; however, restoration techniques would be modified to avoid an adverse effect on archeological sites while restoring natural conditions.</p> <p>At Glen Aulin High Sierra Camp, ground disturbance from utility upgrades would potentially disturb a recorded archeological resource. Siting the proposed utility upgrades in nonsensitive locations would avoid an adverse effect. There would also be a potential for adverse effects on archeological resources from recreational boating use at put-in, portage, and take-out locations between Tuolumne Meadows and Pate Valley; consultation with the park archeologist could avoid an adverse effect.</p> <p>Scenic Segments: Although visitor use levels at Tuolumne Meadows under alternative 4 would remain approximately the same as under the no-action alternative, the potential for disturbance to some archeological sites throughout Tuolumne Meadows would be decreased with elimination of roadside parking, elimination of informal trails, and consolidation of visitor use in designated locations and pathways away from sensitive locations.</p> <p>However, there would be an adverse effect on individual sites within the Tuolumne Meadows Archeological District resulting from the implementation of alternative 4. Implementation of the site plan at Tuolumne Meadows would have the potential to disturb seven class I sites, six class II sites, two class III sites, and two class IV sites. Some of these impacts would be due to ecological restoration activities; in many cases, restoration techniques could be modified to avoid impacts on individual archeological sites.</p> <p>There would be no effect on archeological resources in river segments below O’Shaughnessy Dam, including the Hetch Hetchy Archeological District.</p>

Table 9-43.
Summary Comparison of Impacts for the No-Action and Action Alternatives (continued)

No-Action Alternative	Alternative 1: Emphasizing a Self-Reliant Experience	Alternative 2: Expanding Recreational Opportunities	Alternative 3: Celebrating the Tuolumne Cultural Heritage	Alternative 4 (Preferred): Improving the Traditional Tuolumne Experience
AMERICAN INDIAN TRADITIONAL CULTURAL RESOURCES				
Under the no-action alternative, American Indian traditional cultural resources would be managed and protected at their current level of integrity under existing cultural resource management policies. Archeological sites that are places important to American Indians would continue to be documented and monitored but would not be managed to an established standard with the no-action alternative. Ongoing consultations with traditionally associated American Indian tribes and groups regarding traditional cultural practices and places would continue. American Indian plant management activities, such as removing unwanted plants, would continue to be prohibited in designated Wilderness. Visitor-related impacts would include ongoing visitor intrusion on specific ceremonial and spiritual activities and places, and ongoing random visitor alteration of archeological sites that have importance to traditionally associated American Indian tribes and groups. Ongoing, site-specific physical impacts on trail corridors that parallel or overlay on the ancient trail system, such as soil churning, would continue under the no-action alternative. At Tuolumne Meadows, traditional views and ceremonial settings would continue to be affected by changes in meadow vegetation associated with historic and current visitor use and development. Ongoing visual impacts on the Tuolumne Meadows viewshed would continue.	In comparison with the no-action alternative, alternative 1 would result in no adverse effect on American Indian traditional cultural resources. Under any of the action alternatives, there would potentially be adverse effects on places of importance to American Indians resulting from ground disturbance to precontact archeological sites during project implementation. Continued consultation with American Indian tribes may result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that might be affected by ground disturbance during plan implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives. In addition, restoration of more natural conditions at Tuolumne Meadows would improve the feeling and setting of that area, help restore the scenic vistas honored and appreciated by American Indians, and protect places of importance such as Soda Springs. Benefits to American Indian traditional cultural resources with alternative 1 would include implementation of management standards and actions that would protect archeological sites corridorwide (see chapter 5), actions to remove many existing visitor intrusions (informal trails and roadside parking) and large built intrusions (all commercial service facilities, portions of roads) at Tuolumne Meadows and the Glen Aulin High Sierra Camp, lowered levels of visitor and administrative use, reduced risks to water quality, and extensive ecological restoration (the most of any alternative). Removal of all commercial development would also help restore the scenic vistas honored and appreciated by American Indians. Significantly reduced foot traffic and pack stock use would lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. Ongoing visitor intrusion on specific ceremonial and spiritual activities and places in the corridor would continue, although intrusions would potentially be less frequent due to lower visitor use levels.	Although there may be impacts resulting from boating on the Tuolumne River, potentially higher visitor use levels, and additional development to consolidate visitor services, in comparison with the no-action alternative, alternative 2 would result in no adverse effect on American Indian traditional cultural resources. Under any of the action alternatives, there would potentially be adverse effects on places of importance to American Indians resulting from ground disturbance to precontact archeological sites during project implementation. Continued consultation with American Indian tribes might result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that may be affected by ground disturbance during project implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives. In addition, restoration of more natural conditions at Tuolumne Meadows would improve the feeling and setting of that area, help restore the scenic vistas honored and appreciated by American Indians, and protect places of importance such as Soda Springs. The addition of two new developed areas south of Tioga Road in alternative 2 could affect the landscape, serenity, and feeling at Tuolumne Meadows in particular. In addition, recreational boating would have a potential adverse effect on places of spiritual and cultural significance to American Indians. Benefits to American Indian traditional cultural resources that may offset these impacts would include implementing management standards and actions that would protect archeological sites corridorwide (see chapter 5), removing permanent infrastructure from Glen Aulin, removing many existing visitor intrusions at Tuolumne Meadows (informal trails and undesignated roadside parking), removing built intrusions nearest the river at Tuolumne Meadows (campsites at the campground A loop and employee housing and some guest tent cabins at the lodge), consolidating visitor and administrative uses (including the stables), reducing risks to water quality from wastewater treatment upgrades, managing scenic vistas, and implementing extensive ecological restoration. Reduced pack stock use in the corridor would also lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. Ongoing visitor intrusion on specific ceremonial and spiritual activities and places in the corridor would continue. However, the potential for visitors to randomly alter archeological sites in the corridor would decrease because visitors would be diverted away from sensitive locations and visitor use levels would be managed.	In comparison with the no-action alternative, alternative 3 would result in no adverse effect on American Indian traditional cultural resources. Under any of the action alternatives, there would potentially be adverse effects on places of importance to American Indians resulting from ground disturbance to precontact archeological sites during project implementation. Continued consultation with American Indian tribes might result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that may be affected by ground disturbance during project implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives. In addition, restoration of more natural conditions at Tuolumne Meadows would improve the feeling and setting of that area, help restore the scenic vistas honored and appreciated by American Indians, and protect places of importance such as Soda Springs. Benefits to American Indian traditional cultural resources would include implementation of management standards and actions that would protect archeological sites corridorwide (see chapter 5), actions to remove existing visitor intrusions (informal trails and roadside parking), removal of built intrusions nearest the river (some campsites in the Tuolumne Meadows campground A loop, half of the guest tent cabins, and all employee tent cabins at the Tuolumne Meadows Lodge) at Tuolumne Meadows, lowered levels of visitor use, scenic vista management, reduced risks to water quality from removal of the public fuel station and upgraded wastewater treatment facilities, and extensive ecological restoration. Reduced foot traffic and pack stock use would lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. Ongoing visitor intrusion on specific ceremonial and spiritual activities and places in the corridor would continue, although intrusions would potentially be less frequent due to lower visitor use levels. The potential for visitors to randomly alter archeological sites in the corridor would decrease from diverting visitor use away from sensitive locations and lowered visitor use levels.	In comparison with the no-action alternative, alternative 4 would result in no adverse effect on American Indian traditional cultural resources. Under any of the action alternatives, there would potentially be adverse effects on places of importance to American Indians resulting from ground disturbance to precontact archeological sites during project implementation. Continued consultation with American Indian tribes might result in solutions to decrease impacts on important places. Proposed treatment for archeological sites that may be affected by ground disturbance during project implementation would involve close consultation with traditionally associated American Indian tribes and groups to ensure these treatments incorporated native concerns, issues, and perspectives. In addition, restoration of more natural conditions at Tuolumne Meadows would improve the feeling and setting of that area, help restore the scenic vistas honored and appreciated by American Indians, and protect places of importance such as Soda Springs. The addition of campsites for tribal use at Gaylor Pit would help ensure access to traditional cultural resources. Adding a new developed area south of Tioga Road to accommodate a new formal parking area and a visitor contact station under alternative 4 could affect the landscape, serenity, and feeling at Tuolumne Meadows. In addition, recreational boating would have a potential adverse effect on places of spiritual and cultural significance to American Indians. Benefits to American Indian traditional cultural resources that may offset this impact would include implementation of standards that would protect archeological sites (see chapter 5), actions to remove many existing visitor intrusions (informal trails and roadside parking), removal of built intrusions nearest the river (e.g., some campsites in the Tuolumne Meadows campground A loop and some guest tent cabins at the Tuolumne Meadows Lodge), management of scenic vistas, consolidation of stables operations at Tuolumne Meadows, consolidation of visitor use along designated paths, reduced risk to water quality at Tuolumne Meadows and Glen Aulin, and extensive ecological restoration. Reduced pack stock use would lower the potential for physical disturbance along trail corridors that parallel or overlay American Indian travel corridors. Ongoing visitor intrusion on specific ceremonial and spiritual activities and places in the corridor would continue. However, the potential for visitors to randomly alter archeological sites in the river corridor would decrease from the diversion of visitor use away from sensitive locations and managed visitor use levels.

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Chapter 10: Consultation and Coordination

This chapter summarizes the consultation and coordination efforts undertaken for the *Final Tuolumne River Plan/EIS*. The *Tuolumne River Plan* was developed in accordance with the National Environmental Policy Act of 1969 (NEPA) and the implementing regulations developed by the Council on Environmental Quality (CEQ) (40 CFR 1508.22), which require diligence in involving any interested or affected members of the public in the planning process. Compliance with the National Historic Preservation Act (NHPA) was coordinated with the steps taken to meet NEPA review and documentation requirements and the NHPA section 106 review process to evaluate effects on cultural resources.

Throughout the planning process an intensive effort was made to involve professionals from all aspects of river and park management in consultation with elected officials, traditionally associated American Indian tribes and groups, partners in other agencies, park visitors and neighbors, gateway communities, and private citizens, as summarized below.

Scoping History

Formal internal and public scoping for the *Tuolumne River Plan* was conducted in accordance with CEQ regulations. Scoping is an open process used to establish issues and to guide the formulation and analysis of plan alternatives. Internal scoping was conducted in consultation with National Park Service (NPS) managers and staff, traditionally associated American Indian tribes and groups, affected state and federal agencies, and local and state governments. Public scoping was conducted in consultation with interested organizations and individuals.

Between May and November 2005, the NPS planning team began internal scoping for the *Tuolumne River Plan*. The discussion involved each management division in Yosemite National Park and focused on identifying planning issues and refining the statements of the outstandingly remarkable values of the river. In December 2005, the NPS and other government agency and tribal experts representing a wide range of disciplines and familiarity with the river corridor participated in a workshop to discuss the results of internal scoping and Interagency Council guidance for wild and scenic river planning. Representatives of American Indian tribes and groups with cultural associations in the river corridor, the U.S. Forest Service, the U.S. Geological Survey, and the City and County of San Francisco Public Utilities Commission participated. Internal scoping continued

Table 10-1.
Public Scoping Meetings

Meetings	Dates and Locations
All Tribes Meeting	July 5, 2006, Yosemite Valley
Public Meetings	July 12, 2006, Modesto July 13, 2006, San Francisco July 18, 2006, Tuolumne Meadows July 19, 2006, Lee Vining August 7, 2006, Mariposa August 12, 2006, Tuolumne August 14, 2006, Oakhurst August 15, 2006, Sonora August 17, 2006, Groveland August 28, 2006, Tuolumne
Open Houses	June 28, 2006, Yosemite Valley July 26, 2006, Yosemite Valley August 30, 2006, Yosemite Valley
Public Site Visit	August 29, 2006, Tuolumne Meadows
Gateway Partners Meetings	June 27, 2006, Yosemite Valley July 27, 2006, Yosemite Valley

until the end of the formal scoping period and included an All Tribes meeting with the traditionally associated American Indian tribes and groups on July 5, 2006.

Public scoping was initiated for the *Tuolumne River Plan* on June 27, 2006, and the NPS accepted scoping comments through September 7, 2006. The meetings scheduled during the scoping period are shown in table 10-1.

In addition, representatives of the NPS Tuolumne River planning team were available in Tuolumne Meadows and in Yosemite Valley throughout the summer of 2006 to answer questions and accept comments.

Written responses were received at the public scoping meetings and on site during the summer, and by fax, email, U.S. mail, and online through the Planning, Environment, and Public Comment (PEPC) website: parkplanning.nps.gov/yose_trp. A total of 457 individuals or organizations responded. Each response was carefully reviewed, and individual ideas were identified and assigned a code according to the subject matter. A total of 4,023 discrete individual ideas were identified. The Public Scoping Report and all of the comments are available for viewing on the park's website: www.nps.gov/yose/parkmgmt/trpprocess.htm.

Based on internal and public scoping comments and applicable federal law, regulations, and executive orders, the NPS determined that an environmental impact statement would be the appropriate level of compliance for the *Tuolumne River Plan*. The NPS published a notice of intent to prepare an environmental impact statement in the *Federal Register* (71:131) on July 10, 2006. The publication summarized goals of the plan, background, and scoping process information.

Public Involvement History

Beyond conducting intensive NEPA scoping, park managers further committed to extensive public involvement in the planning for the Tuolumne River, calling for a diversity of opportunities for public participation at multiple points in the planning process. These included All Tribes meetings, public work sessions to parallel planning team work sessions, socioeconomic workshops, open houses and other public forums, and meetings with park staff.

Public Planning Work Sessions, February 2007 to August 2010

The public was invited to participate in a series of “Planner for a Day” work sessions in the period from 2007 to 2010. The work sessions provided an opportunity for the public to work with the same data being utilized by the planning team to move through incremental steps in the process of developing alternatives for the *Tuolumne River Plan*. The results of these sessions helped inform the agency’s decision making at critical times in the planning process, and created an iterative line of communication between the public and the planning team. Members of the public and representatives of organizations and gateway communities attended. The work sessions were announced on the public website, through newsletters, and via announcements in local papers. Agendas for each meeting were also posted on the park’s website in advance of workshops.

Table 10-2.
Planner-for-a-Day Work Sessions

Date and Location	Stage of Planning Process
February 10, 2007 Yosemite Valley	Identification of outstandingly remarkable values and discussion of the range of comments received during public scoping
February 24, 2007 Yosemite Valley	Identification of planning issues and reasonable range of conditions (management objectives) for each outstandingly remarkable value
April 21, 2007 Yosemite Valley	Identification of possible management zones (characterized at that time as "management prescriptions") for the river corridor, creation of zoning maps to explore alternative locations for the zones, and application of management objectives
August 11, 2007 Parsons Memorial Lodge (Tuolumne Meadows)	Discussion of early concept alternatives presented in the July 2007 Tuolumne Planning Workbook
February 9, 2008 Yosemite Valley	Identification of indicators to evaluate the achievement of management objectives for the outstandingly remarkable values
June 21, 2008 Parsons Memorial Lodge	Discussion of revised management alternative concepts, including a preferred alternative, and preview of Tuolumne Meadows preliminary site plan concepts; Continued discussion of river values and conditions
July 18, 2008 Parsons Memorial Lodge	Discussion of Tuolumne Meadows preliminary site plan concepts presented in the July 2008 Tuolumne Planning Workbook, and creation of a preferred site plan alternative
August 9, 2008 Parsons Memorial Lodge	Discussion of Tuolumne Meadows preliminary site plan concepts presented in the July 2008 Tuolumne Planning Workbook, and creation of a preferred site plan alternative
July 17, 2009 Parsons Memorial Lodge	Discussion of planning issues, including conditions of outstandingly remarkable values and actions needed to protect and enhance
August 21, 2009 Parsons Memorial Lodge	Discussion of alternatives, including the preferred alternative and how user capacity is addressed in the plan
August 20, 2010 Parsons Memorial Lodge	Presentation as part of the Parsons Memorial Lodge Summer Series on the Wild and Scenic Rivers Act and this history of this <i>Tuolumne River Plan</i> effort
September 10, 2010 Parsons Memorial Lodge	Discussion of how the plan has evolved since 2006, including planning issues, conditions of outstandingly remarkable values, actions needed to protect and enhance user capacity, the range of alternatives, and upcoming schedule for release of plan
September 11, 2010 Parsons Memorial Lodge	Discussion of how the plan has evolved since 2006, including planning issues, conditions of outstandingly remarkable values, actions needed to protect and enhance user capacity, the range of alternatives, and upcoming schedule for release of plan

Socioeconomic Workshops, October 2006-September 2010

Another series of workshops focused specifically on how the socioeconomic conditions in local communities are affected by park management and planning, and how they might be affected by the *Tuolumne River Plan*. Interested gateway partners, including representatives of local governments and organizations, were invited to examine these socioeconomic issues in six community-based workshops.

Table 10-3.
Socioeconomic Workshops

Date and Location	Topics Discussed
October 12, 2006 Ski Museum, Mammoth Lakes	Park impact on communities Sonoran Institute Economic Profile System data How the western US is changing What needs to be addressed in the socioeconomic analysis of the <i>Tuolumne River Plan</i> alternatives
January 24, 2007 Mariposa Masonic Lodge, Mariposa	Sonoran Institute Economic Profile System data Economic development, Issues of concern to particular communities
September 10, 2007 Groveland Hotel, Groveland	Status of the Tuolumne River Plan Level of detail in the socioeconomic analysis Effects of the <i>Tuolumne River Plan</i> on communities
June 23, 2008 Lee Vining Community Center, Lee Vining	Socioeconomic analysis Employee housing options Levels of visitor service in Tuolumne Meadows
September 22, 2009 Regional Forest Office, Groveland	Yosemite National Park planning update Draft affected environment sections Socioeconomic analysis methods/limitations Range of alternatives Potential impacts of the <i>Tuolumne River Plan</i>
September 23, 2009 Lee Vining Community Center, Lee Vining	Yosemite National Park planning update Draft affected environment sections Socioeconomic analysis methods/limitations Range of alternatives Potential impacts of the <i>Tuolumne River Plan</i>
October 26, 2010 Groveland Community Hall, Groveland	Status of the Tuolumne River Plan Draft affected environment sections Socioeconomic analysis methods/limitations Range of alternatives Potential impacts of the <i>Tuolumne River Plan</i>

Public Review of Draft Zoning and Site Planning Alternatives

July 2007 Workbook

As part of the early process of establishing management objectives for the plan, a set of four draft management zoning alternatives was published in a Tuolumne Planning Workbook in July 2007. Four thousand copies of the workbook were distributed throughout the park and gateway communities and to the more than 1,000 members of the mailing list. People were asked to comment on the four draft zoning alternatives and to create their own alternative zoning plans.

Public comments were collected from the beginning of July through mid-September 2007. More than 250 comments were received via mail-back forms and through letters, faxes, and emails. Public maps and comments were posted to the park planning website and reviewed by the planning team.

The vast majority of the comments addressed only the Tuolumne Meadows segment of the corridor, and considerable interest was expressed in the on-the-ground implications of each concept. Alternative concept 4 proved difficult for the public to understand. Following public suggestions, a new management zone was created, and the original alternative 4 was revised to incorporate the new zone.

The expressed level of interest in Glen Aulin prompted park managers to reverse an earlier decision to defer decisions about all the High Sierra camps to the upcoming Wilderness Stewardship Plan, and instead to analyze alternatives for Glen Aulin in the *Tuolumne River Plan*.

July 2008 Workbook

A set of five management alternatives, including a fifth, preferred alternative developed by the planning team during winter 2007, was published in a second Tuolumne Planning Workbook in July 2008. This workbook also included four draft site plans for Tuolumne Meadows (one for each of the first four alternative zoning plans); however, the workbook did not include a site plan for the fifth, preferred alternative. Rather, the public was requested to comment on the four site plans included in the workbook and to suggest their own site plan for the preferred alternative, using a blank map included in the workbook.

An estimated 4,000 copies of this second workbook were distributed, similarly to the first workbook. The NPS received and reviewed more than 300 responses, which were posted to the park planning website, and which were used to develop the final site planning alternatives.

Open Houses and Other Public Forums, 2007-2010

Open houses were held monthly during the entire life of the planning process in Yosemite Valley to inform the public and gather comments. Additional open houses were held at Tuolumne Meadows in July and August in 2007, 2008, 2009, and 2010.

Representatives of the *Tuolumne River Plan* planning team were available to the public in Tuolumne Meadows throughout the summers of 2007, 2008, 2009 and 2010, where they provided information and accepted oral and written comments both in public meetings scheduled to address current topics and in informal gatherings.

Planning team members and members of the Tuolumne interpretive staff made numerous presentations featuring the planning process and planning issues as part of NPS and other agency and organization programs inside and outside the park, including meetings of the Rotary Club, presentations to school groups, quarterly Tuolumne River Stakeholders meetings, National Association of Resource and Recreation Planners annual conference, River Management Society biennial symposium, Interagency River Management Workshops, and George Wright Society conferences, and an event honoring the 40th anniversary of the Wild and Scenic Rivers Act.

On February 6, 2007, researchers and representatives of the park's Resources Management and Science Division conducted a Yosemite Forum session about research and studies conducted in support of the *Tuolumne River Plan*. This event took place in Yosemite Valley and was widely attended by park staff and interested members of the public.

On February 7-8, 2008, Yosemite National Park conducted a two-day User Capacity Symposium where academics, researchers, agency staff, tribes, and members of the public were invited to discuss the issues of capacity and how various mandates are interpreted and applied.

Beginning in 2006, the *Tuolumne River Plan* project manager posted an informational blog on the park's website (www.nps.gov/yose/parkmgmt/trp.htm). Monthly postings provided a window into the workings of the planning process, including issues being discussed by the team, updates of the plan's progress, as well as announcements of upcoming events related to the plan.

Meetings with Park Staff, 2007-2009

During the summers of 2007, 2008, and 2009, Tuolumne planning team members were available one day per week in Tuolumne Meadows to meet informally with NPS and concessioner staff, at times that were compatible with a variety of work schedules, to answer questions and receive comments for consideration by the planning team. Several formal staff meetings also took place in 2007 and 2008 to discuss the current planning milestones presented in the 2007 and 2008 Tuolumne Planning Workbooks.

In 2007, key staff were invited to participate in an on-site tour of Tuolumne Meadows, during which the management team exchanged ideas with maintenance staff, interpreters, road and trail crews, stable employees, utility operators, and others. From 2007-2010, smaller, focused staff meetings were held to discuss specific operations and facilities.

The planning team logged over 150 miles of hiking in the Tuolumne River corridor during site visits to Lyell Canyon, Dana Meadows, Tuolumne Meadows, the Grand Canyon of the Tuolumne, Pate Valley, Hetch Hetchy reservoir, and Poopenaut Valley.

Public Review of the Draft Plan and Environmental Impact Statement

The *Draft Tuolumne River Plan/EIS* was available to the public, federal, state, and local agencies and organizations for a 70-day public review period from January 8 through March 18, 2013. The NPS distributed the draft plan and EIS beginning January 8, 2013 and a Notice of Availability was published in the *Federal Register* on January 18, 2013. The NPS posted electronic copies of the *Draft Tuolumne River Plan/EIS* to the park's website at www.nps.gov/yose/parkmgmt/trp.htm on January 8, 2013 and hard copies and/or CDs of the document were distributed to individuals that requested them, as well as to congressional delegations, state and local elected officials, federal agencies, traditionally associated American Indian tribes and groups, organizations and local businesses, public libraries, and the news media. The NPS provided notice of the plan's availability for public comment via a press release distributed to a wide variety of news media and announcements placed on the park's website, online newsletters, printed newsletters, and local public libraries.

Park staff presented essential elements of the *Draft Tuolumne River Plan/EIS* at two webinars. The January 24, 2013 webinar focused on the preferred alternative. The January 31, 2013 webinar focused on protecting and enhancing river values and user capacity. Recordings of these webinars are available at <http://yose.webex.com>.

In addition, park staff hosted six public meeting on the *Draft Tuolumne River Plan/EIS*. These meetings consisted of an open house, presentation, and an opportunity to discuss the plan with park staff members and to provide comment. The public meeting schedule was as follows:

- January 30, 2013: Yosemite Open House in the Visitor Center Auditorium, Yosemite Valley, CA
- February 19, 2013: Fort Mason Center, San Francisco, CA
- February 20, 2013: Groveland Community Center, Groveland, CA
- February 21, 2013: Yosemite Lodge Cliff Room, Yosemite Valley, CA
- February 23, 2013: Mammoth Lakes City Council Chambers, Mammoth Lakes, CA
- February 27, 2013: Yosemite Open House in the Visitor Center Auditorium, Yosemite Valley, CA

The NPS received public comment letters through the Planning, Environment, and Public Comment (PEPC) website at http://parkplanning.nps.gov/yose_trp, by email at yoseplanning@nps.gov, and by U.S. mail. The full text of public comment letters received can be viewed on the project website at <http://www.nps.gov/yose/parkmgmt/trp.htm>. Personal information included with the comments (e.g., names and contact information) is redacted in the correspondence posted online to protect authors' privacy.

During the 70-day public comment period, the park received 1,280 public comment letters: 410 letters from 373 individuals, 2 federal agencies, 1 state agency, 9 county agencies or commissions, 1 town or city government, 5 businesses, 10 conservation/preservation organizations, 8 recreational organizations, and 1 American Indian tribe and/or group. In addition, the NPS received 1 form letter from a conservation/preservation organization that was signed and forwarded by 870 individuals. The analysis of these letters identified 1632 discrete comments, from which 529 general concern statements were generated. The results of the public comment analysis process and NPS responses to substantive public comments are provided in Appendix A: Public

Comment and Response Report. The changes to the *Draft Tuolumne River Plan/EIS* resulting from public comment are summarized in chapter 2 of this final environmental impact statement.

Tribal/Federal/State/Local Agency Consultation

Traditionally Associated Tribes and Groups

The NPS consulted with American Indian tribes and groups having a cultural association with the Tuolumne River corridor throughout the development of the *Tuolumne River Plan*. Consultation included special meetings, conceptual workshops, and site visits. Yosemite National Park maintains consultation relationships with seven American Indian tribes and groups that claim traditional cultural association with park lands and resources. This includes five federally recognized American Indian tribes (Bridgeport Paiute Indian Colony of California, Bishop Paiute Tribe, North Fork Rancheria of Mono Indians of California, Picayune Rancheria of the Chukchansi Indians, and the Tuolumne Band of Me-Wuk Indians), and two American Indian groups (American Indian Council of Mariposa County, Inc. [also known as the Southern Sierra Miwuk Nation] and the Mono Lake Kutzadika'a). Consultation with federally recognized tribes is on a government-to-government basis, which means that Yosemite National Park officials work directly with appropriate tribal government officials whenever plans or activities might directly or indirectly affect tribal interests, practices, and/or traditional use areas such as sacred sites.

The Yosemite National Park American Indian Consultation Program facilitates regulatory compliance NHPA, NEPA, the Native American Graves Protection and Repatriation Act, and other statutes, policies, and guidance related to American Indian resources, issues, and concerns. The NPS will continue to conduct formal and informal consultations with traditionally associated American Indian tribes and groups about proposed NPS plans and actions that have the potential to affect the treatment, use, and access to, cultural and natural resources with documented or potential cultural meaning for those groups. The NPS will continue to consult with traditionally associated American Indian tribes and groups during implementation of the *Tuolumne River Plan*.

Consultation was initiated by the park's superintendent and American Indian liaison on July 6, 2005, at an annual All Tribes meeting. Representatives of the following six groups were present at the meeting: the Tuolumne Band of Me-Wuk, the Bishop Paiute Indian Council, the American Indian Council of Mariposa County, Inc., the Chukchansi Picayune Rancheria, the Bridgeport Paiute Indian Colony, and the Mono Lake Kutzadika'a Paiute Indian Council. The North Fork Rancheria, Western Mono Tribal Government, was not represented at the meeting. The agency formally requested information from the tribes for the protection of traditional cultural places. Comments from the tribes were received, accepted, and considered throughout the planning process.

The Chukchansi Picayune Rancheria and the North Fork Rancheria informed the NPS that their tribes did not consider themselves to have cultural affiliation with the Tuolumne River corridor. They received plan updates at annual All Tribes meetings annually from 2006-2010, and in 2012.

On September 28, 2005, the NPS consulted with representatives of the Eastern Sierra tribes: the Mono Lake Kutzadika'a Paiute Indian Community and the Bridgeport Paiute Indian Colony. Both tribes indicated that they have significant interests in the Tuolumne Wild and Scenic River corridor. The Bishop Paiute Indian Council representative did not attend, but communicated with the Park American Indian Liaison that their tribe has cultural association in the Tuolumne River corridor. Consultation continued in 2006, 2007, 2008, 2009, and 2010 at annual meetings with the Eastern Sierra tribes, with all three eastern tribes represented. In April and May 2007, a representative from the Bishop Paiute Indian Colony attended two interagency workshops for the

development of management objectives. The Bishop Piute tribe and the NPS discussed the interests and concerns of the tribe at a government-to-government consultation meeting on May 30, 2012, in Bishop.

A quarterly meeting between the NPS and the Tuolumne Band of Me-Wuk Cultural Resources Department on October 19, 2005, initiated discussion of the *Tuolumne River Plan*. The park superintendent sent formal letters to the tribes with cultural association in Yosemite National Park, inviting them to the interagency workshop held in December 2005 to discuss the outstandingly remarkable values of the river. The park American Indian liaison attended a consultation meeting with the Tuolumne Me-Wuk Tribal Council on February 21, 2006. Consultation continued with quarterly meetings through 2006, 2007, and 2008. Following the 2006 and 2007 All Tribes meetings, formal letters were sent to the chairs of the five tribes with cultural affiliation in the river corridor requesting representatives for the public working sessions, open houses, and meetings. The interests and concerns of the traditionally associated American Indian tribes and groups were discussed at All Tribes meetings held July 24, 2007, in Tuolumne Meadows; July 22, 2008, in Wawona; and on July 13, 2012, in Lee Vining.

The NPS mailed a copy of the *Draft Tuolumne River Plan/EIS* on January 15, 2013 to the seven American Indian tribes and groups that claim traditional cultural association with park lands and resources. In response, the NPS received one comment letter from the Tuolumne Me-Wuk Tribal Council.

Following the public comment period, proposed changes to the *Draft Tuolumne River Plan/EIS*, as well as updates on the project schedule, were presented and discussed at an All Tribes meeting held on July 13, 2013. This meeting also served as a forum for American Indian tribes and groups to provide comment and discuss concerns.

The seven American Indian tribes and groups who claim traditional cultural association with park lands and resources will be provided with copies of this final environmental impact statement. Tribal consultation will continue for the duration of the *Tuolumne River Plan* planning and implementation period.

Federal Advisory Council on Historic Preservation and California State Historic Preservation Officer

A programmatic agreement among the NPS at Yosemite, the California State Office of Historic Preservation (SHPO), and the federal Advisory Council on Historic Preservation (ACHP) regarding planning, design, construction, operation, and maintenance was developed in consultation with American Indian tribes and groups having cultural association with Yosemite National Park, and was executed in 1999 (NPS, SHPO, and ACHP 1999).

Early in the planning phases of this project, the park anticipated that a phased identification of historic properties would be needed due to the large size and remoteness of the project area, the limited, and often pedestrian or equestrian access, the short field season in the higher elevation areas, and the need for confidentiality, among other factors. Per the requirements in Stipulation VI of the 1999 programmatic agreement and 36 CFR 800.3 (b), the NPS initiated consultation with the SHPO in 2006 and the ACHP in 2008 regarding the development of the *Tuolumne River Plan*. The NPS introduced the *Tuolumne River Plan* undertaking through written correspondence, and indicated the review process for NHPA section 106, as amended, would be conducted in coordination with the NEPA review process. The NPS also notified the SHPO and the ACHP that consultation with American Indian tribes and groups associated with the Tuolumne Wild and Scenic River watershed commenced on July 6, 2005, and would continue for the duration of the planning process, in accordance with Stipulation V.C. of the 1999 programmatic agreement.

The need for a phased identification (especially the deferral of identification in the wilderness areas) prompted a letter from the park to the SHPO in August 2006, followed by a letter to the ACHP in April 2008.

These letters informed both parties that the NPS initiated the identification of historic properties by compiling and evaluating existing information, and indicated that scoping was underway for other appropriate identification efforts, in accordance with section 110 of NHPA.

The ACHP responded to the NPS in June 2008, acknowledging that the park wished to comply with NHPA section 106 by preparing an environmental impact statement and record of decision in lieu of using the regulation procedures in 36 CFR 800.3 through 800.6 (those sections include initiation of the section 106 process, identification of historic properties, assessment of adverse effects, and resolution of adverse effects). The letter further stipulates that certain standards must be met, principally those at 36 CFR 800.8(c)(1)(i) through (v). These are briefly discussed below.

Section 36 CFR 800.8 of the regulations implementing NHPA discusses treatment of historic properties using NEPA and requires that the following occur:

- Identify consulting parties (36 CFR 800.8(c)(1)(i)).
- Identify historic properties and assess the effects of the undertaking (with the scope and timing phased to reflect consideration of project alternatives in the NEPA process) (36 CFR 800.8(c)(1)(ii)).
- Consult regarding the effects of the undertaking on historic properties with the SHPO, Indian tribes, other consulting parties, and the advisory council during NEPA scoping, environmental analysis, and the preparation of NEPA documents (36 CFR 800.8(c)(1)(iii)).
- Involve the public (36 CFR § 800.8(c)(1)(iv))
- In consultation with identified consulting parties, develop alternatives and proposed measures that might avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties (36 CFR 800.8(c)(1)(v)).

The *Final Tuolumne River Plan/EIS*, in particular the sections that address development of alternatives, discussion and identification of historic properties to date, and an assessment of effects to those properties, is provided to satisfy some of these requirements.

The ACHP and the SHPO were provided with review copies of the *Draft Tuolumne River Plan/Draft EIS*. No response from the SHPO or ACHP was received during the Draft EIS public comment period, but the SHPO requested a summary of consultation and public outreach and a summary of public and tribal comments related to NHPA during a phone conversation on April 23, 2013. The NPS emailed the requested materials along with a summary of anticipated changes between the Draft and Final EIS that were a result of public, agency, and tribal comments. The SHPO emailed a list of specific questions on these materials, and both groups participated in a conference call on July 16, 2013. The NPS responded to the SHPO's written questions via email on September 18, 2013. Consultation with the SHPO will continue for the duration of the *Tuolumne River Plan* planning and implementation period.

The ACHP and the SHPO have been provided with review copies of this final environmental impact statement.

Federal Agencies

U.S. Army Corps of Engineers, Regulatory Board

The Clean Water Act (Public Law 92-500) requires that federal land agencies consult with the U.S. Army Corps of Engineers (Army Corps) regarding wetlands located in or near proposed projects. The NPS is consulting with the Army Corps regarding the *Tuolumne River Plan* in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

Under Section 404 of the Clean Water Act (33 U.S.C. 1344), permit approval is required for projects that may result in the discharge of dredged or fill material into waters of the United States. This includes all navigable

waters, their tributaries, impoundments of these waters, and adjacent wetlands. Examples of Section 404 activities include infrastructure development, road fills, and riprap. Some actions proposed in the *Tuolumne River Plan* may require permits for the discharge of fill material. The NPS will work with the Army Corps to obtain required Section 404 permits prior to implementing any such actions.

Under Section 10 of the Rivers and Harbors Act (33 U.S.C. 403), permit approval is required for the placement of structures in or over, or work in or over, navigable waters of the United States which affects their course, location, condition or capacity. The Army Corps administers Section 10 permits. The NPS will ensure that all Army Corps permit approvals associated with the *Tuolumne River Plan* are in place prior to implementation. The NPS will serve as the lead agency on behalf of the Army Corps in future consultation with the SHPO regarding permits related to the *Tuolumne River Plan*.

The NPS provided a copy of the *Draft Tuolumne River Plan/EIS* to the Army Corps as part of the consultation process, and received a comment letter on the plan in support of the alternative that restores and protects the most waters of the United States. The NPS is working with the Army Corps to ensure that wetland maps associated with the *Tuolumne River Plan* are verified per Army Corps standards, prior to submittal of permit applications.

U.S. Fish and Wildlife Service

The Endangered Species Act of 1973, as amended (16 USC 1531 et seq.), requires federal agencies to consult with the U.S. Fish and Wildlife Service to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitat. The NPS initiated consultation with the Fish and Wildlife Service on June 22, 2006, and a notification letter was sent to the agency on June 26, 2006. Updated species lists were obtained from the Fish and Wildlife Service on December 1, 2009, February 4, 2010, and April 22, 2013. On April 24, 2013 the Fish and Wildlife Service proposed two species for listing under the Endangered Species Act that potentially occur in the project area: the Sierra Nevada yellow-legged frog (*Rana sierrae*) and the Yosemite toad (*Anaxyrus canorus*). The agency also proposed critical habitat for these species within the Tuolumne River corridor. The NPS will conference and/or consult as appropriate with the U.S. Fish and Wildlife Service to ensure that NPS actions adhere to any special management requirements for these species. The NPS will obtain updated lists of federally endangered or threatened species prior to project implementation.

U.S. Forest Service

The U.S. Forest Service administers the area from the Yosemite National Park boundary at Tioga Pass to the east (Inyo National Forest) and the Tuolumne Wild and Scenic River corridor west (downstream) of the NPS administered segments (Stanislaus National Forest). The park initiated consultation with Inyo and Stanislaus National Forests regarding the *Tuolumne River Plan* on June 22, 2006, and letters of notification were sent to the Inyo and Stanislaus National Forests on June 26, 2006. U.S. Forest Service representatives from Stanislaus National Forest participated in a workshop to discuss river values on December 7, 2005, and an informational meeting on September 6, 2006.

State Agencies

State Water Resources Control Board and Central Valley Regional Water Quality Control Board

The NPS works with state and local government agencies to maintain the highest possible water quality standards and to take action to restore substandard waters, as directed by *NPS Management Policies 2006* and Directors Order 84, Public Health (2004).

The State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards (RWQCBs) are the regulatory boards within California's Environmental Protection Agency that derive their authority from section 401 of the Clean Water Act and Section 13020 of the California Water Code. The SWRCB allocates rights to the use of surface water and, along with the regional boards, is charged with protecting surface, ground, and coastal waters throughout the state. The RWQCB issues permits that govern and restrict the amount of pollutants discharged into the ground or surface water, which includes regulating storm water during construction activities.

Under the Clean Water Act's Section 401, every applicant for a federal permit or license for any activity that may result in a discharge to a water body must obtain State Water Quality Certification that the proposed activity will comply with state water quality standards, if an activity would result in a discharge to a water body.

Yosemite National Park is under the jurisdiction of Regional Board 5, Central Valley, and obtains any necessary permits and/or certifications for construction activities from that board. If required, the NPS would file a Notice of Intent to discharge storm water and prepare and implement provisions of a Storm Water Pollution Prevention Plan to control run-off from construction activities. A notification letter was sent to SWRCB on June 26, 2006. The NPS provided a copy of the *Draft Tuolumne River Plan/EIS* to the RWQCB, who in turn notified the NPS by phone that they will provide input as part of future permitting processes, as necessary.

Local Governments

Gateway Communities

Yosemite National Park is bordered by four primary gateway communities: Lee Vining, Groveland, Oakhurst, and Mariposa. While the park contributes to the cultural, environmental, and economic well-being of the region, the local communities play an important role in the preservation of the park and its resources. In recognition of this interdependent relationship, the NPS cofounded with gateway community members and organizations the Yosemite Gateway Partners in 2003. Through quarterly meetings, the Yosemite Gateway Partners facilitate dialogue between the gateway communities and the NPS. In addition to Yosemite Gateway Partners, NPS representatives regularly attend and participate in gateway community tourism boards, chambers of commerce, boards of supervisors, and other community agencies, councils, and organizations.

Gateway and neighboring communities have been extensively involved in the identification of the low-income and minority communities that could potentially be affected by the proposals and alternatives, and in the socioeconomic planning process for the *Tuolumne River Plan*. Notification letters were sent June 22, 2006, to county councils of governments, community development departments, planning departments, and boards of supervisors for Inyo, Madera, Mariposa, Mono, San Francisco, San Joaquin, Stanislaus, and Tuolumne Counties, as well as to the Association of Bay Area Governments, the Central Sierra Planning Council, and the Turlock and Modesto Irrigation Districts. Representatives attended socioeconomic workshops held in Lee Vining on July 8, 2008, and September 23, 2009, in Groveland on September 10, 2007, September 22, 2009, and October 26, 2010, and in Mariposa on January 24, 2007. Members from boards of supervisors of gateway communities attended the planner-for-a-day sessions and public open houses throughout the planning process. All interested stakeholders from gateway communities were invited to public planning and socioeconomic workshops, in addition to Gateway Partners meetings, held quarterly throughout the planning process. The Yosemite Planning Division chief and the project manager for the *Tuolumne River Plan* also presented updates on the plan at gateway planning commission meetings, boards of supervisors meetings, and meetings of various community organizations interested in the planning effort.

City of San Francisco and Tuolumne River Watershed Agreement

The relationship between Yosemite National Park and the City and County of San Francisco began with passage of the Raker Act on December 6, 1913. Over the years, the NPS and the city have worked together to

ensure that the provisions of the Raker Act are followed to preserve park resources in the Tuolumne River and Eleanor Creek watersheds.

The primary city agencies involved in the Hetch Hetchy partnership are the SFPUC and its subsidiary, Hetch Hetchy Water and Power. At present, six of Yosemite's nine administrative divisions contribute directly to watershed protection, under the guiding leadership of the Yosemite management team. The most current Memorandum of Agreement for the Comprehensive Management of Watersheds Supplying the San Francisco Regional Water System within Yosemite National Park was signed on November 2, 2010. The agreement formalizes the commitment from Yosemite and the SFPUC to work in concert to protect the watershed for a five-year planning horizon.

The agreement serves as the mechanism for the SFPUC to fund the following NPS activities:

- Provide watershed controls to preserve the watershed as a high-quality drinking water source, including source water protection and Raker Act water quality provisions.
- Improve environmental stewardship of the Tuolumne River ecosystem.
- Provide security for facilities that are essential to the SFPUC within Yosemite National Park.

City of San Francisco representatives participated in workshops with the Tuolumne River planning team to discuss river values on December 7, 2005, and to identify a preferred alternative on February 25-27, 2008. Staff members also participated in numerous public planning workshops and presentations in Tuolumne Meadows. One City of San Francisco representative participated in the January 2010 internal document review of the *Draft Tuolumne River Plan/EIS*. The SFPUC received a copy of the *Draft Tuolumne River Plan/EIS* and submitted a comment letter during the public comment period, which was analyzed with other public comment.

Other Partnerships

Yosemite Conservancy

Yosemite Conservancy is the nonprofit philanthropic partner formed by a merger of the Yosemite Association and The Yosemite Fund. Their mission is to inspire people to support projects and programs that preserve and protect Yosemite National Park's resources and enrich the visitor experience. The Yosemite Conservancy has funded more than 380 projects through \$71 million in grants to help preserve and protect the park. The Yosemite Conservancy restores trails, provides bear-proof lockers, issues wilderness permits, conducts wildlife preservation and outdoor education programs, and more. Annually the Yosemite Conservancy recruits over 400 volunteers to work in the park to repair trails, remove invasive species, and provide visitor information.

NatureBridge

Since 1971 thousands of school-aged children have benefited from learning in "nature's classroom" through the residential field science programs offered by NatureBridge. NatureBridge also offers professional development for teachers, summer youth programs, backpacking adventures, community outreach programs, and service learning projects.

Concessioners

Consistent with law (36 CFR 51.23) and agency policies (Directors Orders 48A and 48B), the NPS contracts with private businesses that offer a range of commercial services to park visitors. Currently, the primary hospitality contract is held by Delaware North Companies Parks and Resorts at Yosemite. Delaware North Companies operates lodging, restaurants, sightseeing tours, recreational activities, interpretive programs, stores, shuttles, and fuel stations in the park under a contract with the U.S. Department of the Interior. Under the terms of the concession contract, it also engages in an agreement with the U. S. Postal Service to provide

incoming/outgoing mail service at the Tuolumne Meadows store. Future concession contracts will be written to incorporate the terms and conditions of approved plans, including the *Tuolumne River Plan*.

Commercial Use Authorizations

As authorized by law (36 CFR 5.3) and NPS *Management Policies 2006* and Directors Order 53, the NPS issues commercial use authorizations to business entities that offer services to visitors that are not typically provided by the concessioner. Commercial bus operators, wilderness outfitters and guides, and other small businesses operate in the park under the terms of commercial use authorizations. Commercial use in designated Wilderness is limited in accordance with the requirements of the Wilderness Act, the Concessions Management Improvement Act of 1998, and NPS management policies (see the “Determination of Extent Necessary for Commercial Services in the Wilderness Segments of the Tuolumne Wild and Scenic River Corridor” in appendix C).

Yosemite Area Regional Transportation System

Under a formal agreement between the NPS and the Yosemite Area Regional Transportation System (YARTS) Joint Powers Authority, YARTS administers a contract for transportation services to and through Yosemite National Park, including along the Tioga Road in the Tuolumne River corridor.

List of Agencies and Organizations that Received a Copy of the Final Tuolumne River Plan/EIS

The following pages list the agencies and organizations who received a hard copy, CD, or email notification of the *Final Tuolumne River Plan/EIS*.

U.S. Government

Members of Congress

- Senator Barbara Boxer
- Senator Diane Feinstein
- Representative Tom McClintock
- Representative Howard McKeon
- Representative George Miller
- Representative Jeff Denham
- Dennis Cardoza

Federal Agencies

- Advisory Council on Historic Preservation
- Executive Office of the President, Council on Environmental Quality (CEQ)
- Federal Emergency Management Association
- U.S. Department of Agriculture, Forest Service
 - Humboldt-Toiyabe National Forest
 - Inyo National Forest
 - Pacific Southwest Forest and Range Experiment Station
 - Rocky Mountain Research Station
 - Sierra National Forest, Minarets Ranger District
 - Stanislaus National Forest. Groveland Ranger District
- U.S. Department of Agriculture, Natural Resource Conservation Service
- U.S. Department of Defense
 - Army Corps of Engineers, Regulatory Board
- U.S. Department of the Interior Library
- U.S. Geological Survey
 - Menlo Park, California, Office
 - USGS Publications Department
 - Water Resources Division, Western Region
- U.S. Attorney’s Office
- U.S. Department of Justice
- U.S. Department of Transportation, Federal Highway Administration, Sacramento
- U.S. Environmental Protection Agency, San Francisco Regional Office
- U.S. Postal Service, Yosemite National Park

- U. S. Department of the Interior
 - Bureau of Land Management, Folsom, California, Office
 - Bureau of Reclamation, Sacramento Office
 - Fish and Wildlife Service, Sacramento Regional Office
 - National Park Service
 - Air Resources Division
 - Alaska Regional Office
 - Columbia Cascades Seattle Office
 - Denver Service Center
 - Geologic Resources Division
 - Office of Legislative and Congressional Affairs
 - Pacific Great Basin Support Office
 - Pacific West Regional Office
 - National Park Service, continued
 - Rivers, Trails, and Conservation Assistance Program
 - Washington Office
 - Water Resources Division
- National Parks
 - Big Cypress National Park
 - Canyonlands National Park
 - Channel Islands National Park
 - Crater Lake National Park
 - Death Valley National Park
 - Everglades National Park
 - Flagstaff Area National Monuments
 - Grand Canyon National Park
 - Grand Teton National Park
 - Golden Gate National Recreation Area
 - Joshua Tree National Park
 - Lake Mead National Recreation Area
 - Lassen Volcanic National Park
 - Mount Rainier National Park
 - North Cascades National Park
 - Point Reyes National Seashore
 - Rocky Mountain National Park
 - Sequoia and Kings Canyon National Parks
 - Yellowstone National Park
 - Zion National Park

American Indian Tribes and Groups

- American Indian Council of Mariposa County, Inc.
- Bishop Paiute Tribe
- Bridgeport Indian Colony
- Picayune Rancheria of the Chukchansi Indians
- Mono Lake Kutzadika'a Tribe
- Sierra Mono Museum
- North Fork Rancheria of Mono Indians of California
- Tuolumne Band of Me-Wuk Indians
- Tuolumne Mewuk Rancheria
- Western Mono Tribal Government

California State Government

State Representatives

- Senator Tom Berryhill, California State Senate
- Representative Kristen Olsen, California State Assembly
- Representative (elected) Frank Bigelow, California State Assembly

State Agencies, Organizations, and Parks

- California Native American Heritage Commission
- California Office of Historic Preservation
- California State Clearinghouse, Governor's Office of Planning and Research
- California Regional Water Quality Control Board
- California State Library
- California State Mining and Mineral Museum
- California State Water Resources Control Board
- California Trade and Commerce Agency
- California Water Commission
- Indian Grinding Rock State Historic Park

County and Local Governments

- Alameda County
 - Hayward Area Recreation and Park District
- Fish Camp
 - Fish Camp Town Planning Advisory Council
- Fresno County
 - Council of Fresno County Governments
 - Fresno County Planning and Resource Management
- Groveland
 - Community Services District
 - Community Development Department
 - Air Pollution Control District
- Inyo County
 - Board of Supervisors
 - Planning Department
- Madera County
 - Board of Supervisors
 - Planning Division
- Mariposa County
 - Air Pollution Control District
 - Department of Public Works
 - El Portal Town Planning Advisory Committee
 - Board of Supervisors
 - Housing and Community Development
 - Planning Department
 - Sheriff
 - Unified School District
 - Yosemite West Community Planning Advisory Committee
- Merced County
 - Public Utilities District
 - Department of Environmental Health
 - Fire Department
- Merced County, continued
 - Merced Irrigation District
 - Association of Governments
 - Board of Supervisors
 - Planning Commission
 - Planning Department Office
- Mono County
 - Board of Supervisors
 - Community Development Department
 - Planning Commission
 - Eastern Sierra Council of Governments
- San Francisco City and County
 - Planning Department
 - Public Utilities Commission, Hetch Hetchy Water & Power
- San Joaquin County
 - San Joaquin County Council of Governments
 - Air Pollution Control District
- Stanislaus County
 - Environmental Review Committee
 - Modesto Irrigation District
 - Modesto Community and Economic Development Department
 - Planning and Community Government
 - Stanislaus Council of Government
 - Turlock Irrigation District (also Merced County)
- Tuolumne County
 - Board of Supervisors
 - Community Development
 - Air Pollution Control District
 - Department of Public Works
 - Planning Commission

Visitor Bureaus and Visitor Centers

- Eastern Madera County Chamber of Commerce
- Yosemite / Mariposa County Tourism Bureau, Mariposa
- Mariposa County Visitors Center (Chamber of Commerce), Mariposa
- Yosemite Sierra Visitors Bureau, Oakhurst
- Oakhurst Area Chamber of Commerce, Oakhurst
- Merced Visitor Services / California Welcome Center, Merced
- Tuolumne County Visitors Bureau, Sonora
- Yosemite Chamber of Commerce, Groveland
- Mono Lake Committee Information Center and Bookstore, Lee Vining
- Mono Basin National Forest Scenic Area Visitor Center, Lee Vining

Visitor Bureaus and Visitor Centers, continued

- Lee Vining Chamber of Commerce, Lee Vining
- Mono County Tourism and Film Commission, Mammoth Lakes
- Bridgeport Chamber of Commerce, Bridgeport
- Northern Mono Chamber of Commerce, Topaz

Organizations

- Access Fund
- ADA Compliance Service
- American Institute of Architects California Council
- American Alpine Club
- American Hiking Society
- American Whitewater
- Aspen Environmental Group
- Associated Press
- Association of Bay Area Governments
- Automobile Club of Southern California
- Backcountry Horsemen of California
- Biophilia Society
- Calabasas Historical Society
- California Bicycle Coalition
- California Native Plant Society, Sequoia Chapter
- California Preservation Foundation
- California State Horsemen's Association
- California Trout, Inc., Sierra Nevada Office
- California Wilderness Coalition
- Californians for Western Wilderness
- Central Sierra Environmental Resource Center
- Conservation Study Institute
- County Line Riders of Catalina
- Cycle California! Magazine
- Earth Island Institute
- Earth First! – Santa Cruz
- Earth Island Institute
- Earthjustice Legal Defense Fund
- East Bay Bicycle Coalition
- Eastern Sierra Transportation
- Economic Development Council
- El Portal Elementary School
- El Portal Town Planning Advisory Committee
- Environment & Natural Resources
- Environment Now
- Environmental Defense Fund
- Fish Camp Property Owners Association
- Foothill Resources
- Forest Preservation Association
- Fresno Flats Historical Library, SHSA
- Friends of the Forest
- Friends of the River
- Friends of Yosemite
- Groveland Rotary
- Heritage Trails
- High Sierra Hikers Association
- Mariposans for the Environment and Responsible Government
- National Audubon Society
- National Parks and Conservation Association
- Native Habitats
- Natural Resources Defense Council
- NatureBridge
- Northcoast Environmental Center
- National Tour Association
- National Trust for Historic Preservation, California Office
- Pacific Gas and Electric Public Affairs
- Pacific Legal Foundation
- Planning and Conservation League
- San Joaquin Raptor Wildlife Rescue Center
- Saving Yosemite
- Service Employees International Union Local 535
- Sequoia Alliance
- Sierra Club
 - Condor Group
 - Loma Prieta Chapter
 - Merced Group
 - National Office
 - Range of Light, Toiyabe Chapter
 - Tehipite Chapter
 - Tuolumne Group
 - Yosemite Task Force Committee
- Sierra Club Legal Defense Fund
- Sierra Foothill Conservancy
- Sierra Nevada Alliance
- Sierra Railroad Company
- Sierra Recreation Association
- Sierra Telephone
- Sonoma County Horseman's Council
- Soroptomist International of Groveland
- Southern Yosemite Visitor's Bureau
- Tall Timbers Research Station

Organizations, continued

- Teamsters 386
- The Nature Conservancy Weed Program
- The Trust for Public Land
- The Wilderness Society California/Nevada Region
- The Wilderness Society National Office
- Tilden Wildcat Horseman
- Tuolumne County Alliance for Restoration and Environment
- Tuolumne River Preservation Trust
- Upper Merced River Watershed Council
- Wawona Area Properties Owners Association
- Wawona Town Plan Advisory Committee
- Western Horseman's Association
- Wild Earth Advocates
- Wild Wilderness
- Wildlands Center for Preventing Roads
- Wilderness Watch
- Yosemite Area Audubon
- Yosemite Area Regional Transportation System
- Yosemite Campers Association
- Yosemite Valley Campers Coalition
- Yosemite Chamber of Commerce
- Yosemite Conservancy
- Yosemite Restoration Trust
- Yosemite Valley School
- Yosemite West Homeowners

Public Media

Newspapers and Digital Media

- Associated Press
- Bakersfield Californian
- Contra Costa Times
- EDN Magazine
- Fresno Bee
- Los Angeles Times
- Mariposa Gazette
- Merced Sun-Star
- Modesto Bee
- Mountain Democrat
- Oakland Tribune
- Sacramento Bee
- San Francisco Chronicle
- San Francisco Examiner
- San Jose Mercury News
- Sierra Star
- Stockton Record
- Sonoma Union Democrat

Radio Stations

- KCBS AM – San Francisco
- KCRA TV
- KFBK – Sacramento
- KFIV – Modesto
- KGO AM – San Francisco
- KMJ – Fresno
- KMPH – Fresno
- KQVR - TV
- KUHL/KZSQ Radio
- KVML, KZSQ, & KKBN

Television Stations

- KQED – San Francisco
- KRON – San Francisco
- KTVU – Oakland
- KXTV – Sacramento
- NBC Network News – Los Angeles

Libraries

- Alameda County, Main Branch
- Bridgeport
- Columbia College Library
- Contra Costa County, Concord Branch
- El Portal
- Groveland
- Indiana University Library
- Lee Vining
- Los Angeles City Public Library
- Mammoth Lakes
- Marin County, Main Branch
- Mariposa County
- Merced
- Modesto
- Oakhurst
- Robert Crown Law Library
- Sacramento County, Central Branch
- Salazar Library, Sonoma State University
- San Bernardino County, Main Branch
- Santa Cruz County Library
- San Diego City, Main Branch
- San Francisco City, Main Branch

Libraries, continued

- San Jose City, Main Branch
- San Mateo County, References Section
- Sonoma County Library
- Sonora
- Stanford University Green Library
- Stanislaus County Library
- University of California at Berkeley, Main Library
- University of California at Davis, Shields Library
- University of California at Los Angeles, University Research Library
- University of California at Los Angeles Maps/Government Information Library
- Wawona
- Yosemite National Park Research Library

Colleges and Universities

- California State University Fresno
- California State University Long Beach
- California State University Sacramento
- California State University Sonoma
- California State University Stanislaus
- Columbia College
- Cooperative Ecosystem Studies Units (CESU) Network
- Cornell College
- Merced College
- North Carolina State University
- Prescott College
- Stanford University
- University of California at Berkeley
- University of California at Davis
- University of California at Los Angeles
- University of California at Merced
- University of California Water Resources Center Archives
- University of California Library Tech Services

The names of individuals receiving the *Final Tuolumne River Plan/EIS*, or notification of online availability of the document, are available upon request.

Chapter 11: List of Preparers

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YOSEMITE NATIONAL PARK, EXECUTIVE LEADERSHIP TEAM			
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Name	Responsibility	Education	Years Experience
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Jeannette Simons	Former Park Historic Preservation Officer and American Indian Liaison	M.A. Anthropology B.A. Anthropology	14 Public 14 Private
Greg Stock	Park Geologist, Resources Management and Science Division	PhD Earth Science B.S. Geology	5 NPS 7 other
Steve Thompson	Branch Chief, Wildlife Management; Resources Management and Science Division	M.S. Ecology – Wildlife B.S. Biology	21 NPS 5 other
Judi Weaser	Branch Chief, Vegetation and Ecological Restoration; Resources Management and Science Division	M.S. Community Development B.S. Zoology	22 NPS

Name	Responsibility	Education	Years Experience
NATIONAL PARK SERVICE, DENVER SERVICE CENTER			
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Kate Randall	Landscape Architect, Graphics	MLA Landscape Architecture B.A. International Studies and Environmental Studies	5 Public 2 Private
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Andrea Schmid	NEPA Compliance Specialist	M.S. Natural Resource Ecology/Journalism and Communications B.S. Horticulture	8 Private
Gail Slemmer	Writer/editor	B.A. Modern Languages	26 Public 13 Private
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Lynn Compas	Associate Archeologist	M.A. Cultural Resource Management B.S. Anthropology Minor Geology	22 Public and Private
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Chapter 12: Glossary

Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
ADA	The Americans with Disabilities Act
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
CAAQS	California Ambient Air Quality Standards
CARB	California Environmental Protection Agency, Air Resources Board
CCC	Civilian Conservation Corps
CDFG	California Department of Fish and Game
CDN	Communications Data Network
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	Comprehensive Management Plan
dB	Decibel
dBA	Decibel (on the “A-weighted” scale)
DCS	Distributed control subsystem
DNC	Delaware North Companies Parks and Resorts at Yosemite, Inc.
DO	Director’s Order
EA	Environmental assessment
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
FEIS	Final environmental impact statement
FONSI	Finding of No Significant Impact
GIS	Geographic information system(s)
GMP	General Management Plan
gpd	Gallons per day
gpm	Gallons per minute
IWSRCC	Interagency Wild and Scenic Rivers Coordinating Council
kWh	Kilowatt hour
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NPS	National Park Service
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
ORV	Outstandingly Remarkable Value
PEPC	Planning, environment, and public comment data base
PG&E	Pacific Gas and Electric
PM	Particulate matter
RV	Recreational vehicle
RWQCB	Regional Water Quality Control Board
SHPO	State historic preservation officer
SNEP	Sierra Nevada Ecosystem Project
UFAS	Uniform Federal Accessibility Standards

USACE	U.S. Army Corps of Engineers
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile organic compound
WIMS	Wilderness Impact Monitoring System
YARTS	Yosemite Area Regional Transportation System
YCC	Youth Conservation Corps
YTS	Yosemite Transit System

Technical Terms

100-year floodplain: The area along the river corridor that would receive floodwaters during a 100-year flood event. A 100-year flood event has the probability of occurring 1% of the time during any given year. If a 100-year flood event occurs, the following year will still have the same probability for occurrence of a 100-year event. For the purposes of this plan, the 100-year floodplain also includes wetlands and meadows associated with the hydrologic and ecological processes of the river.

Adaptive management: A process that allows the development of a plan when some degree of biological and socioeconomic uncertainty exists. It requires a continual learning process, a reiterative evaluation of goals and approaches, and redirection based on an increased information base and changing public expectations.

Adverse effect: In the context of the National Historic Preservation Act, an adverse effect occurs when an action will alter, directly or indirectly, any of the characteristics of a historic property that qualify it for inclusion in the National Register of Historic Places, in a way that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative (36 CFR 800). Also see 'Effects,' below.

Adverse impact: In the context of the Wild and Scenic Rivers Act (WSRA) an adverse impact is a substantial reduction in the condition of a wild and scenic river value in relation to baseline conditions as a result of public use, development, and/or administrative use. Also see 'Effects,' below.

Affected environment: Existing biological, physical, social, and economic conditions of an area that are subject to change, both directly and indirectly, as a result of a proposed human action.

Alluvial: An adjective referring to alluvium, which are sediments deposited by erosional processes, usually by streams.

Alluvium: A general term for clay, silt, sand, gravel, or similar unconsolidated rock fragments or particles deposited during comparatively recent geologic time by a stream or other body of running water.

Alternatives: Sets of management elements that represent a range of options for how, or whether to proceed with a proposed project. An environmental impact statement analyzes the potential environmental and social impacts of the range of alternatives presented.

Archeological resources: Historic and prehistoric deposits, sites, features, structure ruins, and anything of a cultural nature found within, or removed from, an archeological site.

Area of potential effect: The geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if such properties exist. The area of potential effect is influenced by the scale and nature of the undertaking and may be different for different kinds of effects caused by the undertaking.

Bed: Refers to the relatively flat or level bottom (substrate) of a body of water, as in a lakebed or riverbed.

Best management practices: Effective, feasible (including technological, economic, and institutional considerations) conservation practices and land- and water-management measures that avoid or minimize adverse impacts to natural and cultural resources. Best management practices may include schedules for activities, prohibitions, maintenance guidelines, and other management practices.

Biodiversity: Biodiversity, or biological diversity, is generally accepted to include genetic diversity within species, species diversity, and a full range of biological community types. The concept is that a landscape is healthy when it includes stable populations of native species that are well distributed across the landscape.

Boundaries: The areas that receive protection under the Wild and Scenic Rivers Act. Boundaries include an average of not more than 320 acres of land per mile, measured from the ordinary high-water mark on both sides of the river.

CEQ regulations: The Council on Environmental Quality was established by the National Environmental Policy Act (see NEPA) and given the responsibility for developing federal environmental policy and overseeing the implementation of NEPA by federal agencies.

Classifications: The status of rivers or river segments under the Wild and Scenic Rivers Act ("wild," "scenic," or "recreational"). Classification is based on the existing level of access and human alteration of the site.

Commercial service: A commercial service is one in which any duties or work are provided by one person or entity for another person or entity in exchange for money. It includes, but is not limited to such things as: guiding, packing, cooking, carrying, instructing, demonstrating, providing gear and food, navigating, providing first aid and emergency services, and other services typically provided under the description of "guiding and outfitting." Please see the *Tuolumne River Plan/Final EIS* Appendix C, Part 5B for more information.

Comprehensive management plan (CMP): A plan to protect and enhance a Wild and Scenic River. The Tuolumne River Plan is the National Park Service's comprehensive management plan for segments of the Tuolumne River corridor under its jurisdiction.

Cultural landscape: "A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values." There are four general types of cultural landscapes, not mutually exclusive: *historic sites*, *historic designed landscapes*, *historic vernacular landscapes*, and *ethnographic landscapes*. (Preservation Brief 36)

Cultural Landscapes Inventory: The Cultural Landscapes Inventory (CLI) is a database containing information on the historically significant landscapes within the National Park System. This evaluated inventory identifies and documents each landscape's location, size, physical development, condition, landscape characteristics, and character-defining features, as well as other valuable information useful to park management.

Degradation: In the context of wild and scenic river comprehensive management planning, degradation is the state in which a wild and scenic river value (free flow, water quality, and/or outstandingly remarkable values) has been fundamentally altered by public use or development to the point that its value is lost for at least a decade.

Designated parking: Paved or unpaved areas that the NPS allows to be used for parking purposes.

Disturbance: A change in environmental conditions that causes a detectable change in an ecosystem. Relevant examples of ecological disturbances include fires, strong wind events, and floods. Human-caused disturbances include trampling, noise, and excavation/construction activities. Disturbance can be temporary in duration, but have long-term impacts on natural communities or cultural resources.

Ecological restoration: Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

Ecosystem: An ecosystem can be defined as a geographically identifiable area that encompasses unique physical and biological characteristics. It is the sum of the plant community, animal community, and environment in a particular region or habitat.

Effect: In the context of NEPA, the CEQ has defined an effect as a direct result of an action which occurs at the same time and place; or an indirect result of an action which occurs later in time or in distance, but are still reasonably foreseeable; or the cumulative results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR 1508.8).

Emergent wetland: A wetland characterized by frequent or continual inundation dominated by herbaceous species of plants typically rooted underwater and emerging into air (e.g., cattails, rushes). The emergent wetland class is characterized by erect, rooted, herbaceous hydrophytes (e.g., cattails, rushes), excluding mosses and lichens. This vegetation is present for most of the growing season in most years. Perennial plants usually dominate these wetlands. All water regimes are included, except sub-tidal and irregularly exposed.

Enhancement: Per guidance from the Interagency Wild and Scenic Rivers Coordinating Council, enhancement is defined as actions taken to improve the condition of wild and scenic river values (free flow, water quality, and outstandingly remarkable values).

Environmental consequences: This section of an environmental assessment describes the impacts a proposed action will have on resources. Direct, indirect, and cumulative impacts, both beneficial and adverse, are analyzed. The context, duration, and intensity of impacts are defined and quantified as much as possible.

Environmental impact statement (EIS): A public document required under NEPA that identifies and analyzes activities that might affect the human and natural environment.

Environmentally preferable alternative: The environmentally preferable alternative is the alternative within the range of alternatives presented in a draft environmental impact statement (DEIS) that best promotes the goals of NEPA. In general, this is the alternative that causes the least damage to the environment and best

protects natural and cultural resources. In practice, one alternative may be more preferable for some environmental resources, while another alternative may be preferable for other resources.

Erratic: A rock fragment of any size carried by glacial ice, or by floating ice, deposited at some distance from the outcrop of origin.

Facilities: Buildings and the associated supporting infrastructure such as roads, trails, and utilities.

Floodplain: A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial: Of or pertaining to a river. *Fluvial* is a technical term used to indicate the presence or interaction of a river or stream within the landform.

Formal parking area: Clearly delineated parking spaces which can be enumerated and managed. Generally, these are paved and striped parking areas.

Free-flowing river: Existing or flowing in natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway (as defined in the Wild and Scenic Rivers Act - 16 USC 1286 [b]).

Frontcountry: An area generally accessible by road, as opposed to more remote 'backcountry' areas where access requires trail or crosscountry travel. Frontcountry areas often have facilities to support visitor use, as opposed to backcountry areas, where visitors are expected to be more self-reliant.

Geomorphic: Of or pertaining to the form of the earth or of its surface features.

Glacial till: Glacially transported and unconsolidated mixtures of clay, silt, sand, and gravel deposited directly by and underneath a glacier without being reworked by meltwater.

Glaciation: Effects on landforms produced by the presence and movement of a glacier.

Governing mandates: The National Park Service is directed to address user capacity, resource protection, and public enjoyment of park resources through a number of pieces of legislation such as laws, regulations, policies, and programs referred to in the Tuolumne River Plan as *mandates*. These mandates establish the authority and responsibility for management in Yosemite National Park.

Grazing-night: One animal grazing for one night.

Groundwater recharge: The process involved in the absorption and addition of surface water to the zone of saturation or aquifer.

Groundwater: All subsurface water (below soil/ground surface), distinct from surface water.

Hazardous material: A substance or combination of substances, that, because of quantity, concentration, or physical, chemical, or infectious characteristics, may either: (1) cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating illness; or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Hazardous waste: Hazardous wastes are hazardous materials that no longer have practical use, such as substances that have been discarded, spilled, or contaminated, or that are being stored temporarily prior to proper disposal.

Headwaters: The point or area of origin for a river or stream.

High Sierra camps: Overnight lodging facilities operated by the concessioner in the backcountry that include tent cabins, food service, and other amenities. The Glen Aulin High Sierra Camp and Tuolumne Meadows Lodge are two of the High Sierra camps considered in this document.

Historic building: For the purposes of the National Register of Historic Places, a building can be a house, barn, church, hotel, or similar construction, created principally to shelter human activity. “Building” may also refer to a historically and functionally related unit, such as a courthouse and jail or a house and barn.

Historic district: A historic district is an area which possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development. To be eligible for the National Register of Historic Places, a district must be significant, as well as being an identifiable entity. It must be important for historical, architectural, archeological, engineering, or cultural values.

Historic property: A historic property is any prehistoric or historic building, site, district, structure, or object that is included in, or eligible for inclusion in, the National Register of Historic Places. Types of historic properties can include archeological sites, historic cultural landscapes, and traditional cultural properties (listed as sites, buildings, or districts).

Historic site: A historic site is the location of significant event which can be prehistoric or historic in nature. It can represent activities or buildings (standing, ruined, or vanished). It is the location itself which is of historical interest in a historic site, and it possesses cultural or archeological value regardless of the value of any structures that currently exist on the location. Examples of sites include shipwrecks, battlefields, campsites, natural features, and rock shelters.

Historic structure: For the purposes of the National Register of Historic Places, the term “structure” is used to distinguish from buildings those functional constructions made usually for purposes other than creating human shelter. Examples of structures include bridges, gazebos, and highways.

Hydrologic response: The response of a watershed due to precipitation. Usually refers to the resulting streamflow from a precipitation event.

Impact: See ‘Effect.’

Implementation plan: Implementation plans tier off programmatic plans (such as general management plans or comprehensive river management plans) and focus on how to implement an activity or project needed to achieve a long-term goal. Implementation plans may direct specific projects as well as ongoing management activities or programs. They provide a more extensive level of detail and analysis than do programmatic plans. Implementation plans are required to undergo NEPA review.

Implementation project: Implementation projects are specific actions identified in an implementation plan.

Impoundment: A dam or other structure that obstructs the flow of water in a river or stream.

Indicator: A quantifiable measure of resource conditions that is periodically measured and monitored as representative of the condition of wild and scenic river values (free flow, water quality, and outstandingly remarkable values).

Informal parking area: Parking areas that are either created by visitors who pull off and park along roadsides or are unpaved parking areas. Informal parking areas are not well delineated and can change in their size and form based on visitor parking behavior.

Informal trail: An informal trail is an unsanctioned, nondesignated trail between two locations. Informal trails often result in trampling stresses to sensitive vegetation types.

Lacustrine: Of or relating to lakes.

Management concern: In the context of comprehensive wild and scenic river management planning, a management concern is an impact identified in a baseline conditions assessment, or in future monitoring, that may bring the condition of a value below that described by the management standard, but that does not bring it down to the adverse impact state.

Management standard: In the context of comprehensive wild and scenic river management planning, the management standard is the desired condition of a wild and scenic river value (free flow, water quality, and outstandingly remarkable values).

Metamorphic rock: Metamorphic refers to rocks derived from pre-existing rocks by mineralogical, chemical, structural changes.

Mitigation: Activities that will avoid, reduce the severity of, or eliminate an adverse environmental impact.

Natural processes: All processes, such as geologic, hydrologic, biological, and ecological, that are not the result of human manipulation.

No-action alternative: The alternative in a plan that proposes to continue current management direction. "No action" means the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward.

Nonattainment area: A geographical area identified by the U.S. Environmental Protection Agency and/or the California Air Resources Board as not meeting national and/or California ambient air quality standards (NAAQS / CAAQS) for a given pollutant.

Nonnative species: Species of plants or wildlife that are not native to a particular area and often interfere with natural biological systems.

Nonwilderness: Areas that have not been designated for special protection under the Wilderness Act.

NPS management policies: A policy is a guiding principle or procedure that sets the framework and provides direction for management decisions. Current NPS servicewide management policies are contained in the NPS publication *Management Policies 2006*. Unwritten or informal "policy" and people's various understandings of NPS traditional practices are never relied on as official policy.

Ordinary High Water Mark/Line: The line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (U.S. Army Corps of Engineers).

Outstandingly remarkable values (ORVs): The scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values of a wild and scenic river that make it worthy of designation and that shall be protected for the benefit and enjoyment of present and future generations (16 USC 1272).

Overnight capacity: Refers to the actual number of visitors who can be accommodated each night in lodging, camping, and High Sierra camp facilities within Yosemite National Park. Capacity is determined by counting the maximum number of people permitted in each campsite, wilderness zone, and/or the room occupancy within lodging units.

Palustrine: The palustrine system was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie, which are found throughout the United States. It also includes the small, shallow, permanent, or intermittent waterbodies often called ponds. Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers. The Palustrine system includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5%. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 hectares (20 acres), (2) active wave-formed or bedrock shoreline features lacking, (3) water depth in the deepest part of basin less than 2 meters at low water, and (4) salinity due to ocean-derived salts less than 0.5%.

Particulate matter (PM-10 and PM-2.5): Fractions of particulate matter characterized by particles with diameters of 10 microns or less (PM-10) or 2.5 microns or less (PM-2.5). Such particles can be inhaled into the air passages and the lungs and can cause adverse health effects. High levels of PM-2.5 are also associated with regional haze and visibility impairment.

Planning: A dynamic, interdisciplinary, process for developing short- and long-term goals for visitor experience, resource conditions, and facility placement.

Pluton: A general term applied to any body of intrusive igneous rock that originates deep in the earth.

Potential wilderness additions: Areas in wilderness where an existing use precluded full designation under the California Wilderness Act.

Preferred alternative: The preferred alternative is the alternative within the range of alternatives presented in a draft environmental impact statement (DEIS) that the agency believes would best fulfill the purpose and need of the proposed action. While the preferred alternative is a different concept from the environmentally preferable alternative, they may be one and the same for a particular project.

Pristine: Unaltered, unpolluted by humans.

Programmatic plan: Programmatic plans establish broad management direction for Yosemite National Park. The 1980 Yosemite General Management Plan is a programmatic plan with a purpose to set a "clearly defined direction for resource preservation and visitor use" and provide general directions and policies to guide

planning and management in the park. The Tuolumne River Plan is also a programmatic plan that guides future activities in the Tuolumne River corridor. Programmatic plans are required to undergo NEPA review.

Protection: Per guidance from the Interagency Wild and Scenic Rivers Coordinating Council, protection is defined as actions taken to eliminate adverse impacts on a wild and scenic river value.

Public comment process: The public comment process is a formalized process required by the National Environmental Policy Act (NEPA) in which the National Park Service must publish a notice of availability in the *Federal Register*, providing public notice that a draft environmental impact statement (DEIS) and associated information, including scoping comments and supporting documentation, is available for public review and input pursuant to the Freedom Of Information Act.

Public scoping process: Scoping is a formalized process used by the National Park Service to gather public and agency ideas and concerns on a proposed action or project. A notice of intent (NOI) is published in the *Federal Register*, announcing the agency's intent to prepare an environmental impact statement and a request for written public/other agency scoping comments to further define the goals and data needs for the project. In addition, although not required by the National Environmental Policy Act (NEPA) or the Council on Environmental Quality (CEQ) NEPA regulations, public scoping meetings may be held and integrated with any other early planning meetings relating to the proposed project.

Record of decision: The documentation of the ultimate choice of an alternative that has been analyzed in a draft environmental impact statement, the mitigation measures that will be implemented, and the decision rationale.

Riffle (riffle/pool): A riffle is part of the natural sequence of a stream pattern as it alters between riffles and pools in a linear direction. Riffles are the steeper, shallower areas where turbulence is usually present due to shallow water flowing over the channel substrate. Pools are the calmer, less steep areas where deeper water is present, typically in a wider channel width. Additionally, there are glides that are linear stream areas where no turbulence is present due to sufficiently deep water but stream velocities are higher than typical of pool areas. Glides are usually not as wide across the stream channel as compared to pools.

Riparian areas: The land area and associated vegetation bordering a stream or river.

Riprap: A layer of large, durable fragments of broken rocks specially selected and graded, thrown together irregularly or fitted together to prevent erosion by waves or currents.

River corridor: The area within the boundaries of a wild and scenic river (e.g., the Tuolumne River corridor).

Riverine: Of or relating to a river. A riverine system includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens and (2) habitats with water containing ocean-derived salts in excess of 0.5%. A channel is an open conduit, either naturally or artificially created, which periodically or continuously contains moving water or which forms a connecting link between two bodies of standing water.

Roadside turnout: Areas along roads (paved or unpaved) or other vehicle roadways that are used for emergency purposes or for short-term stops by visitors.

Section 7 determination process: Section 7 of the Wild and Scenic Rivers Act specifies restrictions on hydro and water resources development projects. Water resources projects are subject to Section 7 of the Wild Scenic

Rivers Act (16 USC 1278). Section 7(a) states, "*no department or agency of the United States shall assist by loan, grant, license or otherwise in the construction of any water resources project that would have a direct and adverse effect on the values for which such river was established, as determined by the Secretary charged with its administration.*"

Sediment: A particle of soil or rock that was dislodged, entrained, and deposited by surface runoff or a stream. The particle can range in size from microscopic to cobble stones.

Segment: Section 2 of the Wild and Scenic Rivers Act requires that the Tuolumne River be classified and administered as 'wild,' 'scenic,' or 'recreational' river segments, based on the condition of the river corridor at the time of boundary designation. The classification of a river segment indicates the level of development on the shorelines, the level of development in the watershed, and the accessibility by road or trail. Wild segments are free of impoundments and generally inaccessible except by trail, with watersheds and/or shorelines essentially primitive and unpolluted; scenic segments are free of impoundments, with watersheds and shorelines largely undeveloped, but accessible in places by roads; and recreational segments are readily accessible by road or railroad, may have some development along the shorelines, and may have undergone impoundment or diversion in the past. There are no segments classified as recreational in the Tuolumne River corridor.

Site hardening: Any development that creates an impervious ground surface. Usually used as a way to direct visitor use and reduce impacts to resources.

Special status species: Species of plants and animals that receive special protection under state and/or federal laws. Also referred to as "listed species" or "endangered species."

Specific conductivity: A measure of how well water can conduct an electrical current. A failing sewage system would raise the conductivity because of the presence of chloride, phosphate, and nitrate; an oil spill would lower the conductivity.

Subalpine: Designating or growing in mountain regions just below the timberline.

Superintendent's Compendium: Each national park superintendent has discretionary authority to regulate or limit certain uses and/or to require permits for specific activities within the boundaries of a national park. Current regulations are published annually in the Superintendent's Compendium.

Traditional cultural property: Traditional cultural resource that is eligible for or listed on the National Register of Historic Places as a historic property

Traditional cultural resource: Any site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it.

Treatment: Work carried out to achieve a historic preservation goal. The four primary treatments are *preservation, rehabilitation, restoration, and reconstruction* (as stated in the Secretary of the Interior's *Standards for the Treatment of Historic Properties*).

Undesignated parking: Areas where visitors park, but not necessarily areas where the NPS prefers to have parking located.

User capacity: As it applies to wild and scenic rivers, the “Final Revised Guidelines for Eligibility, Classification and Management of River Areas” (USDA and USDA 1982) defines capacity as “the quantity of recreation use which an area can sustain without adverse impact on the outstandingly remarkable values and free-flowing character of the river area, the quality of recreation experience, and public health and safety.”

User: Visitors and employees in the Tuolumne River corridor.

Visitor experience: The perceptions, feelings, and reactions a park visitor has in relationship with the surrounding environment.

Visitor use levels: Refers to the quantity or amount of use an specific area receives, or the amount of parkwide visitation on a daily, monthly, or annual basis.

Visitor use: Refers to the types of recreation activities visitors participate in, numbers of people in an area, their behavior, the timing of use, and distribution of use within a given area.

Walk-in campground: A campground with consolidated parking areas separated from the individual campsites. Campers walk a short distance from the parking area to their campsites.

Watershed: The region drained by, or contributing water to, a stream, lake, or other body of water.

Wetland: Wetlands are defined by the U.S. Army Corps of Engineers (CFR, Section 328.3[b], 1986) as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wild and scenic river: A river receiving special protection under the Wild and Scenic Rivers Act.

Wilderness: Designated wilderness areas are protected by the provisions of the 1964 Wilderness Act; they are characterized by a lack of human interference in natural processes.

Wilderness impact monitoring system (WIMS): Wilderness monitoring is an integral part of Yosemite's wilderness management program. Visitor use patterns have been tracked since 1975 from wilderness permits and field reports by rangers. Monitoring of campsite and trail impacts began in the 1970s. A program now called the Wilderness Impact Monitoring System (WIMS) monitors and evaluates campsite conditions in the wilderness that ensure that the trailhead quotas and wilderness education about proper backcountry care are adequately protecting wilderness values. Using WIMS, visitor satisfaction information, patrol data, and a variety of other studies, the National Park Service conducts wilderness-wide inventory and monitoring. Data gathered from these studies are used to determine when, where, and why significant change occurs, to adjust management practices as appropriate, to eliminate unacceptable impacts, and to provide a system for tracking those changes.

Wilderness trailhead quota system: The Wilderness Trailhead Quota System was established in the 1970s to protect wilderness areas within Yosemite National Park. This system assigns a daily quota for each wilderness trailhead in the park, based on scientific studies that evaluated ecological condition and historic use patterns. Controlling use at the trailhead allows for maximum visitor freedom—considered a cornerstone in wilderness experience—while allowing the park to limit or disperse use as appropriate. The Wilderness Trailhead Quota System allows for a total of 1,280 overnight visitors to enter the Wilderness each day. Day use in Wilderness is not currently limited or controlled.

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Chapter 13: References

Advisory Council on Historic Preservation

- n.d. "Protection of Historic Properties." Code of Federal Regulations. Title 36, part 800. Accessed online at <<http://www.achp.gov/regs-rev04.pdf>>.

Albers, S., and D. Duriscoe

- 2001 "Modeling Light Pollution from Population Data and Implications for National Park Service Lands." *The George Wright Society Forum* 18:4.

Allen-Diaz, Barbara H.

- 1991 "Water Table and Plant Species Relationships in Sierra Nevada Meadows." *American Midland Naturalist* 126(1):30-43.

Allen-Diaz, B., R.B. Barrett, W. Frost, L. Huntsinger, and K.W. Tate

- 1999 *Sierra Nevada Ecosystems in the Presence of Livestock*. Report to the Pacific Southwest Research Station. Albany, CA: USDA Forest Service.

Anderson, Dorothy H., David W. Lime, and T.L. Wang

- 1998 *Maintaining the Quality of Park Resources and Visitor Experiences: A Handbook for Managers*. Saint Paul, MN: University of Minnesota, Department of Forest Resources, Cooperative Park Studies Unit.

Andrews, Edmund D.

- 2010 *Hydrology of the Sierra Nevada Network National Parks: Status and Trends*. Draft Report. Boulder: University of Colorado, Institute for Arctic and Alpine Research.

Archer, E.K., B.B. Roper, R.C. Henderson, N. Bouwes, S.C. Mellison, and J.L. Kershner

- 2004 Testing Common Stream Sampling Methods for Broad-Scale, Long-Term Monitoring. Rocky Mountain Research Station General Technical Report RMRS-GTR-122. Fort Collins, CO: USDA Forest Service.

Atwill, Edward R., Neil K. McDougald, Kenneth W. Tate, Jan W. van Wagtendonk, and Arthur Smith

- 2004 "Yosemite Packstock/Wildlife and Microbial Water Quality Project." National Park Service Research Permit and Reporting System, Investigator Annual Report 32705. Accessed online January 12, 2008 at <<https://science1.nature.nps.gov/research/ac/search/iars/Iar?reportId=32705>>.

- 2008 "Hetch Hetchy Watershed Packstock and Microbial Water Quality Study." Final Report, School of Veterinary Medicine, University of California at Davis, January 31, 2008.

Bane, B.

- 2012 "2011 Archeology Visitor Use and Impact Monitoring Program, Yosemite National Park, California." Unpublished report to the National Park Service, Yosemite Archeology Office, Yosemite National Park, CA.

Bates, Craig D., and Martha J. Lee

- 1990 *Tradition and Innovation: A Basket History of the Indians of the Yosemite-Mono Lake Area*. El Portal, CA: Yosemite Association.
- 1994 "Preliminary Findings, High Country Ethnohistory Study." On file, Yosemite Research Center, El Portal, CA.

Benkobi, L., M.J. Trlica and J.L. Smith

- 1993 "Soil Loss as Affected by Different Combinations of Surface Litter and Rock." *Journal of Environmental Quality* 22: 657-61.

Bennyhoff, James A.

- 1956 *An Appraisal of the Archaeological Resources of Yosemite National Park*. University of California Archaeological Survey Reports No. 34. Berkeley.

Benson, R., M. Baldrice, W. J. Mundy, R. Hayden, and J. Brady

- 1985 "Archaeological Site Record for CA-TUO-2834." Central California Information Center, Turlock, California.

Benya, James R.

- 2000 "When Less Light Is Better: A New Standard for Yosemite National Park." Accessed online October 27, 2007 at <<http://www.landscapeonline.com/research/article/326>>.

Bibby, Brian

- 2002 "Ethnography of Yosemite National Park and Cultural Traditions Associated with Death." Manuscript on file at Yosemite Archeology Office, Yosemite National Park, CA.

Blackburn, W.H., and F.B. Pierson

- 1994 "Sources of Variation in Interrill Erosion on Rangelands." In *Variability in Rangeland Water Erosion Processes*, ed. by W.H. Blackburn, F.B. Pierson, Jr., G.E. Schuman, and R. Zartman. Madison, WI: Soil Science Society of America.

Bohn, C.

- 1986 Biological Importance of Streambank Stability. *Rangelands* 8:55-56.

Botti, Stephen J.

- 2001 *An Illustrated Flora of Yosemite National Park*. El Portal, CA: Yosemite Association.

Boyers, Laurel

- 2012 *Stock Use in the Tuolumne River Corridor*. Prepared for Yosemite National Park, CA.

Bradford, David F., Farinaz Tabatabai, and David M. Graber

- 1993 "Isolation of Remaining Populations of the Native Frog, *Rana muscosa*, by Introduced Fishes in Sequoia and Kings Canyon National Parks, California." *Conservation Biology* 7(Dec. 1993): 882-88.

Bradford, David F., Scott D. Cooper, Thomas M. Jenkins, Jr., Kim Kratz, Orlando Sarnelle, and Aaron D. Brown

- 1998 "Influences of natural acidity and introduced fish on faunal assemblages in California alpine lakes." *Canadian Journal of Fisheries and Aquatic Sciences* 55(1998): 2478-91.

Broom, Theodore J., and Troy E. Hall

- 2009 *A Guide To Monitoring Encounters in Wilderness*. Moscow: University of Idaho, College of Natural Resources, Department of Conservation Social Sciences.
- 2010 *An Assessment of Indirect Measures for the Social Indicator of Encounters in the Tuolumne Meadows Area of Yosemite National Park*. Report for Yosemite National Park. Moscow: University of Idaho, College of Natural Resources, Department of Conservation Social Sciences.

Brumm, Henrik

- 2004 "The Impact of Environmental Noise on Song Amplitude in a Territorial Bird." *Journal of Animal Ecology* 73(3): 434-40.

Bureau of Land Management, U.S. Department of the Interior (BLM)

- 1984 *Manual 8400 - Visual Resource Management*. Washington, D.C.: Department of the Interior.
- 1986a *Manual 8410 - Visual Resource Inventory*. Washington, D.C.: Department of the Interior.
- 1986b *Manual 8410 - Visual Resource Inventory*. Washington, D.C.: Department of the Interior.
- 2007a *Manual 8400 - Visual Resource Management*. Washington, D.C.: U.S. Department of the Interior.
- 2007b *Manual 8410 - Visual Resource Inventory*. Washington, D.C.: U.S. Department of the Interior.
- 2007c *Manual 8431 - Visual Resource Contrast Rating*. Washington, D.C.: U.S. Department of the Interior.

Burley, Joel, and J. D. Ray

- 2007 "Surface Ozone in Yosemite National Park." *Elsevier Journal*. Available online at <<http://www.sciencedirect.com>>.

Burton, T.A., S.J. Smith, and E.R. Cowley

- 2011 *Riparian Area Management: Multiple Indicator Monitoring (MIM) of Stream Channels and Streamside Vegetation*. Technical Reference 1737-23. BLM/OC/ST-10/003+1737. Denver, CO: USDI, Bureau of Land Management, National Operations Center.

California Board of Equalization (CBOE)

- 2000 *Taxable Sales in California (Sales & Use Tax) During 2000*. Fortieth Annual Report. Accessed online March 2012 at <<http://www.boe.ca.gov/>>.
- 2010 *Taxable Sales in California (Sales & Use Tax) During 2010*. Fiftieth Annual Report. Accessed online March 2012 at <<http://www.boe.ca.gov/>>.

- 2012 “Table 7 – Assessed Value of County-Assessed Property Subject to General Property Taxes, Inclusive of the Homeowner’s Exemption, By Class of Property and by County.” State Board of Equalization Annual Report, Statistical Appendix Tables. Accessed online March 2012 at <http://www.boe.ca.gov/annual/table7.htm>.

California Central Valley Regional Water Quality Control Board

- 2011 *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region*. Fourth ed. Accessed online February 2012 at http://www.swrcb.ca.gov/rwqcb5/water_issues/basin_plans/sacsjr.pdf

California Department of Finance (CDOF)

- 2007 *Historical Population Estimates for City, County and the State, 1991-2000, with 1990 and 2000 Census Counts*. Accessed online December 2010 at http://www.dof.ca.gov/research/demographic/reports/estimates/e-4/1991-2000/documents/E-4_90-00_Rpt.XLS.
- 2010 *Tables of July 2010 County Estimates Ranked by Size, Numeric, and Percent Change*. Accessed online December 2010 at http://www.dof.ca.gov/research/demographic/reports/estimates/county_rankings/2009-10/documents/County_Estimates_Tables_7-2010.xls.
- 2012 *Population Projects by Race/Ethnicity for California and its Counties, 2000-2050*. Table 2: County by Race, 2020. Rev. Aug. 10, 2009. Accessed online March 2012 at <http://www.dof.ca.gov/research/demographic/reports/projections/p-1/>.

California Department of Fish and Game (CDFG)

- 1988 “Crosswalk Between WHR and California Vegetation Classifications,” by S. De Becker and A. Sweet. In *A Guide to Wildlife Habitats of California*, edited by Kenneth E. Mayer and William F. Laudenslayer, Jr. Sacramento, CA.
- 2000 *Wildlife Habitat Relationships Database*. Software application, version 7.0.
- 2001 “Historical and Present Distribution of Chinook Salmon in the Central Valley Drainage of California,” by Ronald M Yoshiyama, Eric R. Gerstung, Frank W. Fisher, and Peter B. Moyle. In *Contributions to the Biology of Central Valley Salmonids*, edited by Randall L. Brown. Fish Bulletin No. 179. Sacramento, CA.
- 2003 *Natural Diversity Database*. Software application, version 7.0, dated July 4, 2003. Wildlife and Habitat Data Analysis Branch.
- 2007a *California Natural Diversity Database (CNDDB)*. Software application.
- 2007b “Special Animals.” *California Natural Diversity Database*. Software application dated October 2007. Biogeographic Data Branch.

California Department of Public Health

- 2008 *California Regulations Related to Drinking Water, 2008*. Accessed online February 2012 at http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Lawbook/DWRegBook2008_03_09a.pdf.

California Department of Transportation (Caltrans)

- 2007 *Traffic Volumes on the California State Highway System*. Sacramento, CA: California Department of Transportation, Division of Traffic Operations.

California Division of Mines and Geology (CDMG)

- 1996 *Probabilistic Seismic Hazard Assessment for the State of California*. Draft. Open-file report 96-08.
- 1997 *Fault-Rupture Hazard Zones in California*, by Earl W. Hart. Special Publication No. 42.
- 1999 "Map Sheet 48." Seismic Shaking Hazard Maps of California, by M. Petersen, D. Beeby, W. Bryant, T. Cao, C. Cramer, J. Davis, M. Reichle, G. Saucedo, S. Tan, G. Taylor, T. Toppozada, J. Treiman, and C. Wills. Sacramento: California Division of Mines and Geology.

California Employment Development Department (CEDD)

- 2012a *Industry Employment and Labor Force – by Annual Average, March 2010 Benchmark*. Labor Market Information Division. Accessed March 2012 at <www.labormarketinfo.edd.ca.gov>.
- 2012b *Unemployment Rates (Labor Force)*. Labor Market Information Division. Accessed March 2012 at <www.labormarketinfo.edd.ca.gov>.

California Environmental Protection Agency, Air Resources Board (CARB)

- 2008 *California Regional Haze Plan*. Draft.
- 2009 *California Almanac of Emissions and Air Quality*, by P. Cox, A Delao, A Komorniczak, and R. Weller. Planning and Technical Support Division.
- 2013a *California Ambient Air Quality Standards*. Accessed online September 30, 2013 at <<http://www.arb.ca.gov/research/aaqs/caaqs/caaqs.htm>>.
- 2013b *California Area Designation Maps*. Accessed online September 30, 2013 at <<http://www.arb.ca.gov/desig/adm/adm.htm>>.

California Integrated Seismic Network (CISN)

- 2004 *Adobe Hills Swarm – Background Information*. Accessed online September 24, 2004 at <<http://www.cisn.org/special/evt.04.09.18/background.html>>.

California Native Plant Society (CNPS)

- 2001 *Inventory of Rare and Endangered Plants of California*. 6th ed. Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. Sacramento, CA: California Native Plant Society.

California Water Resources Control Board (CWRCB)

- 2004 *Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List*. Resolution no. 2004-0063. Accessed online February 2, 2012, at <http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/ffed_303d_listingpolicy093004.pdf>.

California Wetlands Monitoring Workgroup (CWMW)

- 2009 *Using CRAM (California Rapid Assessment Method) To Assess Wetland Projects as an Element of Regulatory and Management Programs*. Accessed online at http://www.waterboards.ca.gov/mywaterquality/monitoring_council/wetland_workgroup/docs/tech_bulletin_cram.pdf

Carpenter, S.

- 2004 "Archeological Predictive Model for Yosemite National Park." Draft report prepared by InteResources Planning for the National Park Service. Yosemite Archeology Office, Yosemite National Park, CA.

Carrico, C.M., S. M. Kreidenweis, J. L. Collett, Jr., G. R. McMeeking, P. Herckes, G. Engling, T. Lee, J. Carrillo, D. E. Day, W. C. Malm, J. L. Hand

- 2006 *Yosemite Aerosol Characterization Study of 2002*. Prepared in cooperation with the National Park Service. Fort Collins: Colorado State University, Department of Atmospheric Science, and the Cooperative Institute for Research in the Atmosphere.

Castelle, A.J., A.W. Johnson, and C. Conolly

- 1994 "Wetland and Stream Buffer Requirements: A Review." *Journal of Environmental Quality* 23, p. 878-882.

Cerda, A.

- 1999 "Parent Material and Vegetation Affect Soil Erosion in Eastern Spain." *Soil Science Society of America Journal* 63(2):362-368

Clow, D.W., R.S. Peavler, J. Roche, A.K. Panorska, J.M. Thomas, and S. Smith

- 2011 "Assessing Possible Visitor-Use Impacts on Water Quality in Yosemite National Park, California." *Environmental Monitoring and Assessment* 183(1-4):197-215.

Colby, William E.

- 1912 "Sierra Club Purchases the Soda Springs Property." *Sierra Club Bulletin* 8(4): 273.
- 1949 "Jean (John) Baptiste Lumbert-Personal Memories." *Yosemite Nature Notes* 28(9): 112-117.

Cole, David N.

- 1987 "Research on Soil and Vegetation in Wilderness: A State-of-Knowledge Review." *Proceedings – National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions*. General Technical Report INT-200, 135-77.
- 1990 *Ecological Impacts of Wilderness Recreation and Their Management*. Second ed. International Wilderness Leadership Foundation.
- 1993 *Trampling Effects on Mountain Vegetation in Washington, Colorado, New Hampshire, and North Carolina*. Intermountain Research Station Research Paper INT-464. Ogden, UT: USDA Forest Service.
- 1995 "Experimental Trampling of Vegetation I: Relationship between Trampling Intensity and Vegetation Response." *Journal of Applied Ecology* 32: 203-214

- 2003 “Carrying Capacity and Visitor Management: Facts, Values and the Role of Science.” Presentation at the George Wright Society Conference, Denver, Colorado.

Cole, David N., and Troy E. Hall

- 2005 “Wilderness Visitors and Experiences in Oregon and Washington: Trailhead Surveys in Thirteen Forest Service Wildernesses.” Unpublished report. Aldo Leopold Wilderness Research Institute & University of Idaho.
- 2008 *Wilderness Visitors, Experiences, and Management Preferences: How They Vary with Use Level and Length of Stay*. Research Paper RMRS-RP-71. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Cole, David N., and G. Stankey

- 1997 “Historical Development of Limits of Acceptable Change: Conceptual Clarifications and Possible Extensions.” In *Proceedings - Limits of Acceptable Change and Related Planning Processes: Progress and Future Directions*. General Technical Report INT-GTR-371. Ogden, UT: USDA Forest Service.

Cole, David N., and Others

- 1997 *High-use Destinations in Wilderness: Social and Biophysical Impacts, Visitor Responses, and Management Options*, by Cole, A. E. Watson, T.R. Hall, and D.R. Spildie. Missoula, MT: USDA, Forest Service, Rocky Mountain Research Station.
- 2004 “Response of Mountain Meadows to Grazing by Recreational Packstock,” by Cole, J.W. van Wagtendonk, M.P. McClaran, P.E. Moore, and N.K. McDougald. *Journal of Range Management* 57: 153-160.
- 2005 “Addressing Visitor Capacity of Parks and Rivers,” by Cole, Robert Manning, and David Lime. *Parks & Recreation* 2005 (March):8-10.

Cooper, David J., Jessica D. Lundquist, John King, Alan Flint, Lorraine Flint, Evan Wolf, Fred C. Lott, and James Roche

- 2006 *Effects of the Tioga Road on Hydrologic Processes and Lodgepole Pine Invasion into Tuolumne Meadows, Yosemite National Park*. Fort Collins: Colorado State University, Department of Forest, Rangeland and Watershed Stewardship.

Council on Environmental Quality

- 1997 *Considering Cumulative Effects Under the National Environmental Policy Act*.

Cushing, C.E., K. W. Cummins, and G. W. Minshall, eds.

- 2006 *River and Stream Ecosystems of the World*. Berkeley: University of California Press.

Dale, D., and T. Weaver

- 1974 “Trampling Effects on Vegetation of the Trail Corridors of North Rocky Mountain Forests.” *Journal of Applied Ecology* 11(2): 767-772.

Darveau, M., P. Beauchesne, L. Belanger, J. Huot, and P. LaRue

- 1995 "Riparian Forest Strips as Habitat for Breeding Birds in Boreal Forest." *Journal of Wildlife Management* 59, p. 67-78.

Darveau, M., P. Labbe, P. Beauchesne, L. Belanger, and J. Huot,

- 2001 "The Use of Riparian Forest Strips by Small Mammals in a Boreal Balsam Fir Forest." *Forest Ecology and Management* 143, p. 95-104.

David Evans and Associates, Inc. (DEA)

- 2007 *Tuolumne Meadows Visitor Transportation System: Summary of August 2006 Data Collection and Analysis*. Submitted to National Park Service, El Portal, CA: Yosemite National Park.
- 2010 "Yosemite National Park License Plate Survey: Data Collection and Preliminary Results." Presentation to the National Park Service. Denver Service Center, Denver, CO.
- 2012 *Parking Data Compilation and Protocol – Yosemite National Park: Available Parking Data Summary*. National Park Service, Yosemite CA.

Davidson, C.

- 2004 "Declining Downwind: Amphibian Population Declines in California and Historical Pesticide Use." *Ecological Applications* 14: 1892–1902.

Davidson, C., H.B. Shaffer, and M.R. Jennings

- 2002 "Spatial Tests of the Pesticide Drift, Habitat Destruction, UV-B, and Climate-Change Hypotheses for California Amphibian Declines." *Conservation Biology* 16: 1588–1601.

Davis, T., T. A. Croteau, and C. H. Marston, eds.

- 2004 "America's National Park Roads and Parkways: Drawings from the Historic American Engineering Record." In *The Road and American Culture*, edited by D. Hokanson. Baltimore, MD: The John Hopkins University Press.

Davis-King, Shelly, and James B. Snyder

- 2010 *The Silver Thread: Upper Tuolumne River American Indian Land Use in Yosemite National Park: Ethnographic Context for the Tuolumne Wild and Scenic River Comprehensive Management Plan and Environmental Impact Statement, Tuolumne County, California*. Submitted to National Park Service, El Portal, CA: Yosemite National Park.

Dawson, J. O., P. N. Hinz and J. C. Gordon

- 1974 "Hiking Trail Impact on Iowa Stream Valley Forest Preserves." *Iowa State Journal of Research* 48:329-337.

D'Azevedo, Wilbur A.

- 1966 "Comments on Tribal Distribution." In *The Current Status of Anthropological Research in the Great Basin: 1964*, edited by Warren D'Azevedo, Wilbur A. Davis, Don D. Fowler, and Wayne Suttles. Desert Research Institute, Technical Report Series, S-H. Social Sciences and Humanities Publications No. 1. Reno, NV.

Dean Runyan Associates

- 2011 *California Travel Impacts by County, 1992-2009: 2010 Preliminary State & Regional Estimates*. California Travel and Tourism Commission, Sacramento, California. April 2011.

DeBenedetti, S., and D. Parsons

- 1979 "Natural Fire in Subalpine Meadows: A Case Description from the Sierra Nevada." *Journal of Forestry* 77: 477-479.

Delaware North Corporation Parks & Resorts at Yosemite, Inc. (DNC)

- 2006a "Visitor Shuttle System, Passenger Statistics."
- 2006b "Yosemite Shuttle Passenger Statistics." Report run May 10.

DeSante, D.F., and George, T.L.

- 1994 "Population Trends in the Landbirds of Western North America." In *A Century of Avifaunal Change in Western North America*, edited by J.R. Jehl, Jr., and N.K. Johnson. Studies in Avian Biology No. 15.

Dierker, J.L., and L.M. Leap

- 2005 *Archaeological Site Monitoring and Management Activities along the Colorado River in Grand Canyon National Park, Fiscal Year 2004*. RCMP Report No. 90. Salt Lake City: UT: U.S. Bureau of Reclamation.
- 2006 *Archaeological Site Monitoring and Management Activities along the Colorado River in Grand Canyon National Park, Fiscal Year 2005*. RCMP Report No. 91. Salt Lake City: UT: U.S. Bureau of Reclamation.

Donnermeyer, C.

- 2005 "VERP Visitor Experience and Resource Protection: Summary of Efforts and Synthesis of Information for the FLAG Area Monuments." Unpublished draft report. National Park Service, Flagstaff Area National Monuments, Flagstaff, AZ.

Drost, Charles A., and Gary M. Fellers

- 1994 Drost, Charles A., and Gary M. Fellers. "Decline of Frog Species in the Yosemite Section of the Sierra Nevada." Technical Report NPS/WRUC/NRTR-94-02. United States Department of the Interior, National Park Service, Western Region Cooperative National Park Studies Unit, The University of California, Davis, CA.
- 1996 "Collapse of a Regional Frog Fauna in the Yosemite Area of the California Sierra Nevada, USA." *Conservation Biology* 10(2): 414-25.

DuBarton, A., and C. Sandy

- 2007 "Glacier Point Road, Yosemite National Park." In *Cultural Landscape Inventory*. Branch of Historical Architecture and Landscapes, Yosemite National Park, CA.

Dull, R. A.

- 1999 Palynological Evidence for 19th Century Grazing-Induced Vegetation Change in the Southern Sierra Nevada, California, USA. *Journal of Biogeography* 26: 899-912.

EA Engineering, Science, and Technology, Inc. (EA Engineering)

- 2003 *2000/2001 Air Emissions Inventories: Summary Report for Twenty-One National Park Service Units*. Prepared for National Park Service, Air Resources Division, Lakewood, CO.

Eagan, S., P. Newman, S. Fritzke, L. Johnson

- 2004 "Subalpine Meadow Restoration in Yosemite National Park." *Ecological Restoration* 22(1): 24-29.

Eagles, P.F., S.F. McCool, and C.D. Haynes

- 2002 *Sustainable Tourism in Protected Areas: Guidelines for Planning and Management*. World Commission on Protected Areas, Best Practice Protected Area Guidelines Series No.8. IUCN – World Conservation Union.

Environmental Laboratory

- 1987 *Corps of Engineers Wetland Delineation Manual*. Technical Report Y-87-1. Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station.

Epanchin, Peter Nicholas

- 2009 "Indirect Effects of Nonnative Trout on an Alpine-Nesting Passerine Bird via Depletion of an Aquatic Insect Subsidy." Ph.D. Dissertation, University of California, Davis.

Faber, P. M.

- 2005 *California's Wild Gardens - A Guide to Favorite Botanical Sites*. Berkeley and Los Angeles: University of California Press.

Fahnestock, J.T., and J.K. Detling.

- 2000 "Morphological and Physiological Responses of Perennial Grasses to Long Term Grazing in the Pryor Mountains, Montana." *American Midland Naturalist* 143: 312-320.

Fairley, Helen, and Christian Downum

- 2000 "Evaluating Elements of Archaeological Site Integrity to Determine Limits of Acceptable Change: A Case Study at Wupatki National Monument, Arizona." Unpublished report. National Park Service, Flagstaff Area National Monuments, Flagstaff, AZ.

Federal Highway Administration (FHWA)

- 1982 *Transportation Planning Study*. Prepared for National Park Service. El Portal, CA: Yosemite National Park.

Finlay, J.C., and V.T. Vredenburg

- 2007 "Introduced Trout Sever Trophic Connections in Watersheds: Consequences for a Declining Amphibian Population." *Ecology* 88(9): 2187-98.

Foin, T., E. Garon, C. Bowen, J. Everingham, and R. Schultz

- 1977 “Quantitative Studies of Visitor Impacts on Environments of Yosemite National Park, California, and Their Implications for Park Management Policy.” *Journal of Environmental Management* 5:1-22.

Forman R.T.T.

- 1995 *Land Mosaics*. New York, NY: Cambridge University Press.

France, R., H. Culbert, and R. Peters

- 1996 “Decreased Carbon and Nutrient Input to Boreal Lakes from Particulate Organic Matter following Riparian Clear-Cutting.” *Environmental Management* 20, p. 579-583.

Frazier J.W., K.B. Roby, J.A. Boberg, K. Kenfield, J.B. Reiner, D.L. Azuma, J.L. Furnish, B.P. Staab, and S.L. Grant

- 2005 *Stream Condition Inventory Technical Guide*. Vallejo, CA: USDA Forest Service, Pacific Southwest Region, Ecosystem Conservation Staff.

Fritzke, S., and P. Moore

- 1998 “Exotic Plant Management in National Parks of California.” *Fremontia* 26(4): 49-53.

Gaines W.L., P.H. Singleton, and R.C. Ross

- 2003 *Assessing the Cumulative Effects of Linear Recreation Routes on Wildlife Habitats on the Okanogan and Wenatchee National Forests*. Gen. Tech. Rep. PNW-GTR-586. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Galliano, Steven J., and Gary M. Loeffler

- 2000 *Scenery Assessment: Scenic Beauty at the Ecoregion Scale*. Portland, Oregon: Forest Service Pacific Northwest Research Station.

Gassaway, L.

- 2005 “Hujpu-St: Spatial and Temporal Patterns of Anthropogenic Fire in Yosemite Valley.” M.A. thesis, San Francisco State University, California.

Gee, Marion, Sara Stansfield, and Joan Clayburgh

- 1996 *Sierra Nevada Ecosystem Project Final Report to Congress*. Vol. I: *Assessment Summaries and Management Strategies*; Vol. II: *Assessments and Scientific Basis for Management Options*; Vol. III: *Assessments, Commissioned Reports, and Background Information; Addendum*. Davis: University of California.
- 2008 *State of Sierra Frogs: A Report on the Status of Frogs and Toads in the Sierra Nevada and California Cascade Mountains*. Sierra Nevada Alliance.

Gilman, E.F., I.E. Leone and F. B. Flower

- 1987 “Effect of Soil Compaction and Oxygen Content on Vertical and Horizontal Root Distribution.” *Journal of Environmental Horticulture* 5: 33-36.

Gleick, P. H.

- 2000 *Water: The Potential Consequences of Climate Variability and Change for the Water Resources of the United States*. Oakland, CA: Pacific Institute for Studies in Development, Economics, and Security.

Gossart, W.

- 2005 "2004 Priority 1 Archeological Site Condition Monitoring, Wupatki National Monument, AZ." Unpublished Report. National Park Service, Flagstaff Area Monuments, Flagstaff, AZ.

Graber, D.M.

- 1996 "Status of Terrestrial Vertebrates." In *Assessments and Scientific Basis for Management Options*. Vol. 2 of the Sierra Nevada Ecosystem Project. Davis: University of California.

Graefe, A.R., F.R. Kuss, and J.J. Vaske

- 1984 "Social Carrying Capacity: An Integration and Synthesis of Twenty Years of Research." *Leisure Sciences* 6(4), 395-431.
- 1990 *Visitor Impact Management: A Planning Framework*. Washington, DC: National Parks Conservation Association.

Gramann, J.

- 1992 *Visitors, Alternative Futures, and Recreational Displacement at Yosemite National Park*. Contract report to the National Park Service. San Francisco, CA: Western Regional Office, Division of Planning, Grants, and Environmental Quality.

Gregory, S.V., F.J. Swanson, W.A. McKee, and K.W. Cummings

- 1991 "An Ecosystem Perspective on Riparian Zones." *Bioscience* 41: 540-51.

Griffiths, R., M. Madritch, and A. Swanson

- 2005 "Conifer Invasion of Forest Meadows Transforms Soil Characteristics in the Pacific Northwest." *Forest Ecology and Management* 208:347-358. Accessed online through *Science Findings* 94 (June 2007) at <<http://www.fs.fed.us/pnw/science/scifi94.pdf>>.

Grinnell, J., and T.I. Storer

- 1924 *Animal Life in the Yosemite: An Account of the Mammals, Birds, Reptiles, and Amphibians in the Sierra Nevada*. Berkeley: University of California Press.

Grumet, Robert S.

- 1988 *Archeology in the National Historic Landmarks Program*. Archeological Assistance Program Technical Brief No. 3. Washington, DC: U.S. Department of the Interior, National Park Service.

Gutierrez, J., and I. I. Hernandez

- 1996 "Runoff and Interrill Erosion as Affected by Grass Cover in a Semi-Arid Rangeland of Northern Mexico." *Journal of Arid Environments* 34(3):287-295.

Haas, G.E.

- 2002 *Visitor Capacity on Public Lands and Waters: Making Better Decisions*. Ashburn, VA: National Parks and Recreation Association.

Hall, F.C., and L. Bryant

- 1995 Herbaceous Stubble Height as a Warning of Impending Cattle Grazing Damage to Riparian Areas. USDA Forest Service Gen Tech Rep PNW-362. 10 p.

Hammitt, W.E., and D.N. Cole

- 1998 *Wildland Recreation: Ecology and Management*. Second ed. New York, NY: John Wiley & Sons, Inc.

Hargis, C. D., and D. R. McCullough

- 1984 "Winter Diet and Habitat Selection of Marten in Yosemite National Park." *Journal of Wildlife Management* 48:140-46.

Haugo, R.D., and C.B. Halpern

- 2007 "Vegetation Responses to Conifer Encroachment in a Dry, Montane Meadow: A Chronosequence Approach." *Canadian Journal of Botany* 85:285-298.

Hawes, E., and M. Smith

- 2005 *Riparian Buffer Zones: Functions and Recommended Widths*. Report to the Eightmile River Wild and Scenic Study Committee.

Hayden, R., R. Benson, and B. Wickstrom

- 1985 "Archaeological Site Record for CA-TUO-2830." Central California Information Center, Turlock, California.

Hayden, R., J. Brady, B. Wickstrom, W. J. Mundy, M. Baldrice, and R. Benson

- 1985a "Archaeological Site Record for CA-TUO-2829." California Information Center, Turlock, California.

- 1985b "Archaeological Site Record for CA-TUO-2833." Central California Information Center, Turlock, California.

Heady, Harold F., and Paul J. Zinke

- 1979 *Vegetational Changes in Yosemite Valley*. Washington, D.C.: U.S. Government Printing Office.

Held, Tony, Terry Rivasplata, Ken Bogdan, Tim Rimp, and Rich Walter

- 2007 *Addressing Climate Change in NEPA and CEQA Documents*. Jones and Stokes Climate Change Focus Group. Available online at <<http://www.climatechangeocusgroup.com>>.

Herbst, David B., Erik L. Silldorff, and Scott D. Cooper

- 2009 "The influence of introduced trout on the benthic communities of paired headwater streams in the Sierra Nevada of California." *Freshwater Biology* (2009).

Hickman, J. C., ed.

- 1993 *The Jepson Manual: Higher Plants of California*. Berkeley: University of California Press.

Hoffmann, C.C., C. Kjaergaard, J. Uusi-Kamppa, H.C.B. Hansen, and B. Kronvang

- 2009 "Phosphorus Retention in Riparian Buffers: Review of Their Efficiency." *Journal of Environmental Quality* 38, p. 184201955.

Holmquist, Jeffrey G., and Jutta Schmidt-Gengenbach

- 2003 "Do Trails Fragment Meadows More than We Think? A Bug's View." *Sierra Nature Notes* 3 (Feb. 2003).
- 2004 "Trails and Meadow Fragmentation in Yosemite National Park: Effects on Invertebrate Fauna and Patterns of Abundance and Biodiversity." Prepared for National Park Service, Yosemite National Park, CA.
- 2008 "Effects of Experimental Trampling Addition and Reduction on Vegetation, Soils, and Invertebrates in Tuolumne Meadows." Report prepared for the National Park Service. Bishop: University of California, White Mountain Research Station.

Holmquist, Jeffrey G., Jutta Schmidt-Gengenbach, and Sylvia Al Haultrain

- 2010 "Does Long-term Grazing by Pack Stock in Subalpine Wet Meadows Result in Lasting Effects on Arthropod Assemblages?" *Wetlands* 30:252-62.

HRS Water Consultants, Inc.

- 1994 "Tests of Existing Wells and Test-Well Site Selection, Hodgdon Meadows and White Wolf Campground, and Test-Well Drilling and Completion, Tuolumne Meadows and White Wolf Campground, Yosemite National Park." Technical report prepared for the National Park Service. Yosemite National Park, CA.

Huber, N. King

- 1989 *The Geologic Story of Yosemite National Park*. Washington, DC: U.S. Government Printing Office.

Hull, K. L., R. W. Bevill, W. G. Spaulding, and M. R. Hale

- 1995 *Archeological Site Subsurface Survey, Test Excavations, and Data-Recovery Excavations for the Tuolumne Meadows Sewer Replacement Project in Tuolumne Meadows, Yosemite National Park, California*. Prepared by Dames & Moore for the National Park Service. Yosemite Research Center Publications in Anthropology No. 16. El Portal, CA: Yosemite National Park.
- 2001 "Reasserting the Utility of Obsidian Hydration Dating: A Temperature-Dependent Empirical Approach to Practical Temporal Resolution with Archaeological Obsidians." *Journal of Archaeological Science* 28: 1025-40.

Hull, K. L., and M. J. Moratto

- 1999 *Archaeological Synthesis and Research Design, Yosemite National Park, California*. Prepared by Dames & Moore and INFOTEC Research for the National Park Service. Yosemite Research Center Publications in Anthropology No. 21. El Portal, CA: Yosemite National Park.

Interagency Wild and Scenic Rivers Coordinating Council (IWSRCC)

- n.d. *Wild and Scenic Rivers Act Reference Guide*. Available online at <<http://www.nps.gov/rivers/>>.

- 1999 “The Wild and Scenic River Study Process.” Part of the *Wild and Scenic Rivers Act Reference Guide*. Available online at <<http://www.nps.gov/rivers/publications.html/study-process.pdf>>.
- 2002 *Wild and Scenic River Management Responsibilities*. Technical Report. Portland, OR: U.S. Forest Service.
- 2004 *Wild and Scenic Rivers Act: Section 7*. Technical Report. Portland, OR: U.S. Forest Service.
- 2010 “Newly Designated Wild and Scenic River: Interim Management and Steps to Develop a Comprehensive River Management Plan.” Part of the *Wild and Scenic Rivers Act Reference Guide*. Available online at <<http://www.nps.gov/rivers/publications.html/study-process.pdf>>.
- 2011a *A Compendium of Questions & Answers Relating to Wild & Scenic Rivers*. Technical Report. Available online at <<http://www.rivers.gov/documents/q-a.pdf>>.
- 2011b WSRA Section 7(a) Flowcharts. Available online at <<http://www.rivers.gov>>.

Jakubos, B., and W. H. Romme

- 1993 “Invasion of Subalpine Meadows by Lodgepole Pine in Yellowstone National Park, Wyoming, USA.” *Arctic and Alpine Research* 25: 382-90.

Jennings, M.R.

- 1994 “Status of Amphibians.” In *Assessments and Scientific Basis for Management Options*. Vol. 2 of the Sierra Nevada Ecosystem Project. Davis: University of California.

Johnson, B., T. Hall, and D. Cole

- 2005 *Naturalness, Primitiveness, Remoteness, and Wilderness Visitors' Understanding and Experience of Wilderness Qualities*. Moscow: University of Idaho.

Jones & Stokes

- 2002 *Revised Delineation of Wetlands and Deepwater Habitats in the Greater Tuolumne Meadows Area, Yosemite National Park, California*. Prepared for the National Park Service, Yosemite National Park.

Karlstrom, Ernest L.

- 1962 “The Toad Genus *Bufo* in the Sierra Nevada of California.” *University of California Publications in Zoology*, edited by W.B. Quay, S.B. Benson, P.R. Marler. 16(1): 1-104.

Karr, J.R., and I.J. Schlosser

- 1977 *Impact of Near-Stream Vegetation and Stream Morphology on Water Quality and Stream Biota*. EPA/600/3-77-097. Washington, DC, U.S. Environmental Protection Agency.

Kattelman, R., and M. Embury

- 1996 “Riparian Areas and Wetlands.” In *Status of the Sierra Nevada, Sierra Nevada ecosystem project: final report to Congress*. Vol. III: 201-267. Davis, CA: University of California at Davis, Center for Water and Wildland Resources.

Kauffman, J.B., and W. C. Krueger

- 1984 "Livestock Impacts on Riparian Ecosystems and Streamside Management Implications: A Review." *Journal of Range Management* 37:430–8.

Kauffman J.B., R.J. Beschta, N. Otting, D. Lytjen

- 1997 "An Ecological Perspective of Riparian and Stream Restoration in the Western United States." *Fisheries* 22: 12–24.

Keeler-Wolf, T.

- 2001 *Vegetation Classification for Yosemite National Park*. El Portal, CA: Archeology Office, Yosemite National Park.

Kershner, J.L., E.K. Archer, M. Coles-Ritchie, E.R. Cowley, R.C. Henderson, K. Kratz, C.M. Quimby, D.L. Turner, L.C. Ulmer, and M.R. Vinson

- 2004 *Guide to Effective Monitoring of Aquatic and Riparian Resources*. General Technical Report RMRS-GTR-121. Fort Collins, CO. USDA, Forest Service, Rocky Mountain Research Station.

Kim, M-K., and J. Daigle

- 2011 "Detecting Vegetation Cover Change on the Summit of Cadillac Mountain Using Multi-Temporal Remote Sensing Datasets: 1979, 2001, and 2007." *Environmental Monitoring and Assessment* 180(1-4):63-75.

Kintigh, K., J. Altschul, W. Lipe, and N.S. Urquhart

- 2007 "Legacy Monitoring Data Review Panel Report to the Grand Canyon Monitoring and Research Center." Unpublished report. Archeology Office, Grand Canyon National Park, AZ.

Kirk, Andrew, and Charles Palmer

- 2004 "Historic Resources of Yosemite National Park." Multiple Property Documentation Form. Prepared by University of Las Vegas, History Department. Prepared for National Park Service, Yosemite National Park, Branch of History, Architecture and Landscape, Yosemite National Park, CA.

Knapp, R. A.

- 2005 "Effects of Nonnative Fish and Habitat Characteristics on Lentic Herpetofauna in Yosemite National Park, USA." *Biological Conservation* 121: 265-79.

Knapp, Roland A., Daniel M. Boiano, and Vance T. Vredenburg

- 2007 "Removal of nonnative fish results in population expansion of a declining amphibian (mountain yellow-legged frog, *Rana muscosa*)." *Biological Conservation* 135(2007): 11-20.

Knapp, Roland.A., and K.R. Matthews

- 2000 "Non-native Fish Introductions and the Decline of the Mountain Yellow-legged Frog from within Protected Areas." *Conservation Biology* 14: 428–38.

Knapp, Ronald A., and Orlando Sarnelle

- 2008 "Recovery After Local Extinction: Factors Affecting Re-establishment of Alpine Lake Zooplankton." *Ecological Applications* 18(8): 1850-59.

Knight R.L.

- 2000 "Forest Fragmentation and Outdoor Recreation in the Southern Rocky Mountains." In *Forest Fragmentation in the Southern Rocky Mountains*. ed. by R.L. Knight., F.W. Smith, W.H. Romme, and S.W. Buskirk. Boulder, CO: University Press of Colorado.

Kondolf, G. M.

- 1993 "Lag in Stream Channel Adjustment to Livestock Exclosure, White Mountains, California." *Restoration Ecology* 1:226-230.

Kondolf, G. M., J. C. Vick, and T. M. Ramirez

- 1996 "Salmon Spawning Habitat Rehabilitation on the Merced River, California: An Evaluation of Project Planning and Performance." *Transactions of the American Fisheries Society* 125:899-912.

Krause, B.

- 2001 "Loss of Natural Soundscape." Paper presented to the World Affairs Council.

Kroeber, A

- 1925 *Handbook of the Indians of California*. Bureau of American Ethnology Bulletin No. 78.

Kutiel, P.

- 1999 "Tendencies in the Development of Tracks in Open Areas." *Journal of Environmental Management* 23, 401-408.

Lah, K. J.

- 2000 "Developing Social Standards for Wilderness Encounters in Mount Rainier National Park: Manager-Defined Versus Visitor-Defined Standards." In *Wilderness Visitors, Experiences, and Visitor Management*. Vol. 4 of Proceedings of Wilderness Science in a Time of Change Conference. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Lauren Schlau Consulting

- 2009 *Economic and Fiscal Impacts and Visitor Profile of Mono County Tourism for FY 2008*. Prepared for Mono County Economic Development Department, Mammoth Lakes, CA.

Lawson, S, and P. Newman.

- 2001 "A Spatial Analysis of Campsites in Lyell Canyon in Yosemite National Park." In *Proceedings of the 2000 Northeastern Recreation Research Symposium*, edited by Gerard Kyle. USDA Forest Service General Technical Report NE-276. Newtown Square, PA: U.S. Department of the Agriculture, Forest Service, Northeastern Research Station.

Laymon, S.A.

- 1987 "Brown-Headed Cowbirds in California: Historical Perspectives and Management Opportunities in Riparian Habitats." *Western Birds* 18(1): 63-70.

Le, Y.F., E. Papadogiannaki, N. Holmes, and S. Hollenhorst

- 2008 *Yosemite National Park Visitor Study: Winter 2008*. Prepared for the National Park Service, Yosemite National Park, CA.

Le Conte, J.

- 1875 *A Journal of Ramblings through the High Sierra of California by the University Excursion Party*. Reprinted 1971. New York: Sierra Club/Ballantine Books.

Lee, P., C. Smyth, and S. Boutin

- 2004 "Quantitative Review of Riparian Buffer Width Guidelines from Canada and the United States." *Journal of Environmental Management* 70, p. 165-180.

Lee, R. G.

- 1977 "Alone with Others: The Paradox of Privacy in Wilderness." *Leisure Sciences* 1(1), 3-19.

Leung, Y.F., and J. L. Marion

- 2000 "Recreation Impacts and Management in Wilderness: A State-of -Knowledge Review." *Wilderness Ecosystems, Threats, and Management*. Wilderness Science in a Time of Change Conference. USDA Forest Service Proc. RMRS-P-15-VOL-5. Ogden, UT.

Leung, Y.F. and Others

- 2002 "More than a Database: Integrating GIS Data with the Boston Harbor Islands Carrying Capacity Study," by Leung, N. Shaw, K. Johnson, and R. Duhaime. *The George Wright Forum* 19 (1), 69-78.
- 2011a *Developing Methods for Integrated Analysis of Meadow Condition and Informal Trail Data in Yosemite National Park*, by Leung, K. Bigsby, and C. Kollar. Technical report submitted to the National Park Service. Yosemite National Park, CA.
- 2011b "Developing a Monitoring Protocol for Visitor-Created Informal Trails in Yosemite National Park, USA," by Leung, T. Newburger, M. Jones, B. Kuhn, and B. Woiderski. *Journal of Environmental Management* 47:93-106.
- 2011c "Examining the Ecological Significance of Visitor-Created Informal Trails as an Indicator for Yosemite National Park," by Leung, T. Newburger, B. Woiderski, L. Ballenger, K. Bigsby, and C. Kollar. Manuscript in preparation. Yosemite National Park, CA.

Liddle, M.J.

- 1975 "A Theoretical Relationship between the Primary Productivity of Vegetation and Its Ability To Tolerate Trampling." *Biological Conservation* 8: 251-255.
- 1991 "Recreation Ecology: Effects of Trampling on Plants and Corals." *Trends in Ecology & Evolution* 6:13-17.

Lime, D. and G. Stankey

- 1971 *Carrying Capacity: Maintaining Outdoor Recreation Quality*. Recreation Symposium Proceedings. USDA Forest Service.

Lind, Amy J., Hartwell H. Welsh, Jr., and Randolph A. Wilson

- 1996 "The Effects of a Dam on Breeding Habitat and Egg Survival of the Foothill Yellow-legged Frog (*Rana Boylii*) in Northwestern California." *Herpetological Review* 27(2): 62-67.

Lindenmayer, D. B., and J. Fischer

- 2006 *Habitat Fragmentation and Landscape Change: An Ecological and Conservation Synthesis*. Washington, DC: Island Press.

Lindquist, S.S., and G.E. Haas

- 1999 *Congress on Recreation and Resource Capacity – Book of Abstracts*. Fort Collins: Colorado State University, College of Natural Resources.

Lipsett, Michael, Barbara Materna, Susan Lyon Stone, Shannon Therriault, Robert Blaisdell, and Jeff Cook

- 2008 *Wildfire Smoke: A Guide for Public Health Officials*. California Department of Public Health. Accessed online October 7, 2010 at <<http://www.arb.ca.gov/smp/progdev/pubeduc/wfgv8.pdf>>.

Little, B., E.M. Seibert, J. Townsend, J.H. Sprinkle, Jr., and J. Knoerl

- 2000 *Guidelines for Evaluating and Registering Archeological Properties*. National Register Bulletin 36. Washington, DC: National Park Service.

Littlejohn, Margaret A., Bret H. Meldrum, and Steven J. Hollenhorst

- 2005 *Yosemite National Park Visitor Study, Summer 2005*. Visitor Services Project Report 168. Prepared for the National Park Service, Social Science Program. Moscow: University of Idaho.
- 2010 *Yosemite National Park Visitor Study*. Moscow, ID: University of Idaho, Park Studies Unit.

Loheide, S.P., II, and E. G. Booth

- 2010 “Effects of Changing Channel Morphology on Vegetation, Groundwater, and Soil Moisture Regimes in Groundwater Dependent Ecosystems.” *Geomorphology*, doi:10.1016/j.geomorph.2010.04.016. In press.

Loheide, Steven P., Richard S. Deitchman, David J. Cooper, Evan C. Wolf, Christopher T. Hammersmark, and Jessica D. Lundquist

- 2009 “A Framework for Understanding the Hydroecology of Impacted Wet Meadows in the Sierra Nevada and Cascade Ranges, California, USA.” *Hydrogeology Journal* 17(1):229-46.

Loheide, Steven P., II, and Steven M. Gorelick

- 2007 “Riparian Hydroecology: A Coupled Model of the Observed Interactions between Groundwater Flow and Meadow Vegetation Patterning.” *Water Resources Research* 43, W07414.

Lowry, Christopher S., and Steven P. Loheide, II

- 2010 “Groundwater-Dependent Vegetation: Quantifying the Groundwater Subsidy.” *Water Resources Research* 46, W06202, doi:10.1029/2009WR008874.

Lucas, Robert C.

- 1964 *The Recreational Capacity of the Quetico-Superior Area*. Research Paper INT-277. USDA, Forest Service.
- 1980 *Use Patterns and Visitor Characteristics, Attitudes and Preferences in Nine Wilderness and Other Roadless Areas*. Res. Pap. INT-253. Ogden, Utah: USDA, Forest Service.

Lundquist, Jessica D., Michael D. Dettinger, Daniel R. Cayan, Brian Huggett, Heidi Roop, Jim Roche, Allen Glazner, David Peterson

- 2005 "Summary of Tuolumne River Hydrology." Prepared for the National Park Service, Yosemite National Park, CA.

Madej, M. A., W. E. Weaver, and D. K. Hagans

- 1994 "Analysis of Bank Erosion on the Merced River, Yosemite Valley, Yosemite National Park, California, USA." *In: Environmental Management* 18(2):235-50.

Madera County

- 2012 "Madera County 2011-2012 Budget". Madera County, California. Accessed March 2012 at <http://www.madera-county.com/administrativemanagement/budgets/11-12-budget.html>.

Manning, Robert E.

- 1999 *Studies in Outdoor Recreation: Search and Research for Satisfaction*. Second ed. Corvallis: Oregon State University Press.
- 2007 *Parks and Carrying Capacity: Commons Without Tragedy*. Washington: DC: Island Press.

Manning, R., W. Valliere, B. Minter, B. Wang, and C. Jacobi

- 2000 "Crowding in Parks and Outdoor Recreation: A Theoretical, Empirical, and Managerial Analysis." *Journal of Park and Recreation Administration* 18(4), 57-72.

Mariposa County

- 2012 County of Mariposa, Final Budget, Fiscal Year 2011-12. Mariposa County, Mariposa, CA.

Matthews, Kathleen R., Roland A. Knapp, and Karen L. Pope

- 2002 "Garter Snake Distributions in High-Elevation Aquatic Ecosystems: Is There a Link with Declining Amphibian Populations and Nonnative Trout Introductions?" *Journal of Herpetology* 36(1) 16-22.

Maurer, J. R.

- 1999 "Great Gray Owl Impact Assessment for the Tuolumne Grove Parking Lot Development Proposal." Unpublished Report to Office of Design and Engineering, Division of Maintenance, Yosemite National Park, CA.

Mayer, K.E., and W.F. Laudenslayer, Jr. (eds.)

- 1988 *A Guide to Wildlife Habitats of California*. Sacramento: California Department of Fish and Game, Resources Agency.
- 1998 *A Guide to Wildlife Habitats in California*. Sacramento: California Department of Forestry and Fire Protection.

Mayer, P.M., S.K. Reynolds, Jr., T.J. Canfield, and M.D. McCutchen

- 2006 *Riparian Buffer Width, Vegetative Cover, and Nitrogen Removal Effectiveness: Review of Current Science and Regulations*. EPA/600/R-05/118. Cincinnati, OH: U.S. Environmental Protection Agency.

McClaran, Mitchel P., and David N. Cole

- 1993 *Packstock in Wilderness: Use, Impacts, Monitoring, and Management*. General Technical Report INT-301. Ogden, UT: USDA Forest Service, Inermountain Research Station.

McClelland, L. F.

- 1998 *Building the National Parks: Landscape Design and Construction*. Baltimore, MD: The John Hopkins University Press.

McCool, S.F.

- 1989 "Limits of Acceptable Change: Some Principles Towards Serving Visitors and Managing Our Resources." In *Proceedings of a North American Workshop on Visitor Management in Parks and Protected Areas*, edited by R. Graham and R. Lawrence. Waterloo, ON: University of Waterloo.

McCool, S.F., R.N. Clark, and G.H. Stankey

- 2007 *An Assessment of Frameworks Useful for Public Land Recreation Planning*. General Technical Report PNW-GTR-705. Portland, OR: USDA Forest Service.

McGarigal K, and B.J. Marks

- 1995) *FRAGSTATS: Spatial Pattern Analysis Program for Quantifying Landscape Structure*. Gen. Tech. Rep. PNW-GTR-351. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

McGurk, Bruce, ed.

- 2008a "Compliance with Minimum Streamflow Releases." *Hetch Hetchy Water and Power Procedures*.
- 2008b *Proceedings of the Western Snow Conference*. Soda Springs, CA: Western Snow Conference: Omnipress.

McMeeking G.R., S.M. Kreidenweis, M. Lunden, J. Carrillo, C.M. Carrico, T. Lee, P. Herckes, G. Engling, D.E. Day, J. Hand, N. Brown, W.C. Malm, and J.L. Collett, Jr.

- 2006 "Smoke-Impacted Regional Haze in California during the Summer of 2002." *Agricultural and Forest Meteorology* 137 (1-2):25-42.

McNutt, S., W. Bryant, and R. Wilson

- 1991 "Mono Lake Earthquake of October 23, 1990." *California Geology* 44(2): 27-32.

Micheli, E.R. and J.W. Kirchner

2002. "Effects of Wet Meadow Riparian Vegetation on Streambank Erosion: 2. Measurements of Vegetated Bank Strength and Consequences for Failure Mechanics." *Earth Surface Processes and Landforms* 27:687-697.

Milestone, J. F.

- 1978 "The Influence of Modern Man on the Stream System of Yosemite Valley." M.S.thesis, San Francisco State University, CA.

Millar, Constance I., and Robert D. Westfall

- 2010 "Distribution and Climatic Relationships of the American Pika (*Ochotona princeps*) in the Sierra Nevada and Western Great Basin, U.S.A.: Periglacial Landforms as Refugia in Warming Climates." *Arctic, Antarctic, and Alpine Research* 42(1).

Millar, Constance I., Robert D. Westfall, Diane L. Delany, John C. King, and Lisa J. Graumlich

- 2004 "Response of Subalpine Conifers in the Sierra Nevada, California, USA, to 20th Century Warming and Decadal Climate Variability." *Arctic, Antarctic, and Alpine Research* 36(2): 181-200.

Miller, E. and C. B. Halpern

- 1998 "Effect of Environment and Grazing Disturbance on Tree Establishment in Meadows of the Central Cascade Range, Oregon, USA." *Journal of Vegetation Science* 9: 265-82.

Miller, R.F., and G.B. Donart

- 1981 "Response of *Muhlenbergia porteri* to Season of Defoliation." *Journal of Range Management* 34: 91-94.

Mitsch, W., and J.G. Gosselink

- 2007 *Wetlands*. Fourth ed. John Hoboken, NJ: Wiley & Sons.

Mono County

- 2000 *Land Use Element 2000*. Community Development Department.
- 2007 *Mono County Housing Element*. Amended 2004 report. Community Development Department.
- 2011 2011-12 Final Budget, Mono County, California.

Montgomery, D.R., B.D. Collins, J.M. Buffington, and T.B. Abbe

- 2003 "Geomorphic Effects of Wood in Rivers." *American Fisheries Society Symposium*, 37, p. 21-47.

Monz, C., and Leung, Y.F.

- 2006 "Meaningful Measures: Developing Indicators of Visitor Impacts in the National Park Service Inventory and Monitoring Program." *The George Wright Forum* 23:17-27.

Moore, P.E., A.E.L. Colwell, and C.L. Coulter

- 2005 "Special Status Vascular Plant Surveys and Habitat Modeling in Yosemite National Park." Unpublished report to the National Park Service, Inventory and Monitoring Program, Yosemite National Park, CA.

Moratto, Michael J.

- 1976 Tuolumne Wild and Scenic River Study: Archaeology. Submitted to the U. S. Forest Service, Stanislaus National Forest, Sonora, California.
- 1981 *An Archeological Research Design for Yosemite National Park. Publications in Anthropology* No. 19. Tucson, AZ: National Park Service, Western Archeological and Conservation Center.

- 1999 “Cultural Chronology 2: The Yosemite Data.” In *Archaeological Synthesis and Research Design, Yosemite National Park, California*, edited by Kathleen L. Hull and Michael J. Moratto. Yosemite Research Center Publications in Anthropology No. 21.
- Morgan, R.P.C.
- 1986 *Soil erosion and Conservation*, ed. by D.A. Davidson. Wiley, NY: Longman Scientific and Technical.
- Moritz, Craig
- 2007 *A Resurvey of the Historic Grinnell-Storer Vertebrate Transect in Yosemite National Park, California*. Final report prepared for the Sierra Nevada Network Inventory and Monitoring Program, Sequoia and Kings Canyon National Parks, CA.
- Moritz, Craig, James L. Patton, Chris J. Conroy, Juan L. Parra, Gary C. White, and Steven R. Beissinger
- 2008 “Impact of a Century of Climate Change on Small-Mammal Communities in Yosemite National Park, USA.” *Science* 322: 261.
- Moskal, M., and M. Halabisky
- 2010 *Analysis of Social Trails in Mt. Rainier National Park- Pilot Study*. Technical report submitted to the National Park Service. Ashford, WA: Mt. Rainier National Park.
- Muir, John
- 1911 *My First Summer in the Sierra*. Boston and New York: Houghton Mifflin Company.
- Mundy, W.J.
- 1992 *The 1985 and 1986 Eastern Tioga Road N, Yosemite National Park, California*. Vol. 1. Yosemite Research Center Publications in Anthropology No. 17. El Portal, CA: Yosemite National Park.
- Mundy, W. J., J. Brady, R. Hayden, R. Benson, M. Baldrice, and K. Phillips
- 1985a “Archaeological Site Record for CA-TUO-2825.” Central California Information Center, Turlock, CA.
- 1985b “Archaeological Site Record for CA-TUO-2829.” Central California Information Center, Turlock, CA.
- Mundy, W. J., B. Wickstrom, and M. Baldrice.
- 1985 “Archaeological Site Record for CA-TUO-754/H.” Central California Information Center, Turlock, CA.
- Mutch, L. S., M. Goldin Rose, A. M. Heard, R. R. Cook, and G. L. Entsminger
- 2008 *Sierra Nevada Network Vital Signs Monitoring Plan*. Natural Resource Report NPS/SIEN/NRR—2008/072. Fort Collins, CO: National Park Service.
- Napton, L. Kyle
- 1978 Archeological Overview of Yosemite National Park, California. Submitted to USDI National Park Service, Western Archeological and Conservation Center, Tucson.

Napton, L. Kyle, and Elizabeth Anne Greathouse

- 1976a *Archeological Investigations in Yosemite National Park, California: Part 1, Project Summary*. Submitted to National Park Service, Western Archeological and Conservation Center, Tucson, AZ.
- 1976b *Archeological Investigations in Yosemite National Park, California: Part 6, DCP Area B*. Prepared for the National Park Service, Yosemite National Park, CA. Turlock: California State College, Stanislaus, Institute for Archeological Research.

National Academy of Sciences

- 1897 *Report of the Committee Appointed by the National Academy of Sciences*. Washington, D.C.

National Park Service, U.S. Department of the Interior (NPS)

- 1959 *A Report on the Status, Changes and Ecology of Backcountry Meadows in Sequoia and Kings Canyon National Parks*, by C. W. Sharsmith. Technical report. Research Library, Sequoia National Park, CA.
- 1972 “Yosemite Backcountry Inventory, Summer 1972,” by Daniel O. Holmes. Yosemite National Park, CA.
- 1975a “Parsons Memorial Lodge,” by Leslie Starr Hart. National Register of Historic Places Inventory Nomination Form. Denver Service Center, Denver, CO.
- 1975b “Soda Springs Cabin,” by Leslie Starr Hart. National Register of Historic Places Inventory Nomination Form. Denver Service Center, Denver, CO.
- 1976a “Great Sierra Wagon Road,” by Leslie Starr Hart. National Register of Historic Places Inventory Nomination Form. Denver Service Center, Denver, CO.
- 1976b “McCauley Cabin,” by Leslie Starr Hart. National Register of Historic Places Inventory Nomination Form. Denver Service Center, Denver, CO. [Referenced previously as NPS, Hart 1977)
- 1977a *Natural Resources Management Plan for Yosemite National Park*. Yosemite National Park, CA.
- 1977b “Tuolumne Meadows Archeological District,” by Keith M. Anderson and Nancy S. Hammack. National Register of Historic Places Inventory Nomination Form. Western Archeological and Conservation Center, Tucson, AZ.
- 1978 *Draft Environmental Impact Statement, General Management Plan, Yosemite National Park*. Yosemite National Park, CA.
- 1979 “Hetch Hetchy Archeological District,” by F. Ross Holland. National Register of Historic Places Inventory Nomination Form. Western Archeological and Conservation Center, Tucson, AZ.
- 1980a “Yosemite Interim Land Acquisition Plan.” Yosemite National Park, CA.
- 1980b *Yosemite National Park General Management Plan*. Yosemite National Park, CA.

- 1985a Archeological Site Record for CA-TUO-754/H, prepared by W. J. Mundy, B. Wickstrom, and M. Baldrice. On file, Central California Information Center, Turlock, California.
- 1985b Archeological Site Record for CA-TUO-2825, prepared by W. J. Mundy, J. Brady, R. Hayden, R. Benson, M. Baldrice, and K. Phillips. On file, Central California Information Center, Turlock, California.
- 1985c Archeological Site Record for CA-TUO-2829, prepared by R. Hayden, J. Brady, B. Wickstrom, W. J. Mundy, M. Baldrice, and R. Benson. On file, Central California Information Center, Turlock, California.
- 1985d Archeological Site Record for CA-TUO-2830, prepared by R. Hayden, R. Benson, and B. Wickstrom. On file, Central California Information Center, Turlock, California.
- 1985e Archeological Site Record for CA-TUO-2833, prepared by R. Hayden, J. Brady, W. J. Mundy, M. Baldrice, B. Wickstrom, and R. Benson. On file, Central California Information Center, Turlock, California.
- 1985f Archeological Site Record for CA-TUO-2834, prepared by R. Benson, M. Baldrice, W. J. Mundy, R. Hayden, and J. Brady. On file, Central California Information Center, Turlock, California.
- 1985g "Parsons Memorial Lodge," by Laura Soulliere Harrison. National Historic Landmark Nomination Form. Western Regional Office, Santa Fe, NM.
- 1986a "Archaeological Site Record for CA-TUO-166," by B. Wickstrom, S. Psota, K. Hull, M. Hale, D. Bieling, and A. Brereton. Yosemite Archeology Office, Yosemite National Park, CA.
- 1986b "Yosemite Wilderness Trail and Campsite Impact Monitoring System," by C. A. Sydorik. Yosemite National Park, CA.
- 1987a *Historic Resources Study, Yosemite: The Park and its Resources*, by Linda W. Greene. Denver, CO: Denver Service Center.
- 1987b "Parsons Memorial Lodge." *National Historic Landmarks Program*. Accessed online July 7, 2009 at <<http://tps.cr.nps.gov/nhl/detail.cfm?ResourceId=1803&ResourceType=Building>>.
- 1989a "Wilderness Historic Resources Survey: 1988 Season Report," by James B. Snyder, J. B. Murphy, and R. W. Barrett. In *Studies in Yosemite History* No. 1. Yosemite Research Library, Yosemite National Park, CA.
- 1989b *Yosemite National Park Wilderness Management Plan*. Yosemite National Park, CA.
- 1990 "Wilderness Historic Resources Survey: 1989 Season Report," by James B. Snyder, R. W. Barrett, and J. B. Murphy. *Studies in Yosemite History* No. 2. Yosemite Research Library, Yosemite National Park, CA.
- 1991 *How to Apply the National Register Criteria for Evaluation*. National Register Bulletin 15, Washington, DC: National Park Service.

- 1992a “Archaeological Site Record for CA-TUO-500,” prepared by S. Jackson, D. Tatro, K. Morrell, and K. Hovey. Yosemite Archeology Office, Yosemite National Park, CA.
- 1992b *Yosemite National Park Concession Services Plan/Environmental Impact Statement*. Yosemite National Park, CA.
- 1993a “Did Salmon Reach Yosemite Valley or Hetch Hetchy?” by Jim Snyder. Memorandum to Superintendent Mike Finley dated May 9. Yosemite National Park, CA.
- 1993b *Yosemite National Park Resources Management Plan*. Yosemite National Park, CA.
- 1994a Baseline Water Quality Inventory and Analysis Yosemite National Park. NPS Technical Report NPS/NRWRD/NRTR-94/30, 595 pp.
- 1994b *Report on the Effects of Aircraft Overflights on the National Park System*. Washington, DC: National Park Service.
- 1995a *Environmental Assessment for the Tuolumne Meadows Design Concept Plan; Comprehensive Design Plan, NPS Employee Housing Element; and Management of the Tuolumne River Scenic Classified Segments*. Draft. Yosemite National Park, CA.
- 1995b “Wilderness Historic Resources Survey: Reports 1990-1995,” by James B. Snyder. Yosemite Archeology Office, Yosemite National Park, CA.
- 1996 *The Dana Meadows Archeological Testing Project, Yosemite National Park, Tuolumne County, California*, by Suzanna T. Montague. Yosemite Research Center Publications in Anthropology No. 19. El Portal, CA: Yosemite National Park.
- 1997a *How To Apply the National Register Criteria for Evaluation*. National Register of Historic Places Bulletin No. 16A. Washington, DC: National Park Service.
- 1997b *Vegetation Management Plan*, by J.E. Hall. El Portal, CA: Yosemite National Park.
- 1997c Visitor Experience and Resource Protection (VERP) Framework: A Handbook for Planners and Managers. Denver, CO: Denver Service Center.
- 1998a *Biological Assessment on the Valley Elderhorn Longhorn Beetle and the California Red-legged Frog for the Yosemite Valley Housing Plan: Draft Addendum/Supplement to the Final Environmental Impact Statement for the General Management Plan*. Yosemite National Park, CA.
- 1998b “Determination of Eligibility: Yosemite Valley Cultural Landscape Historic District,” by Cathy Gilbert and Ethan Carr. Yosemite Research Center, El Portal, CA.,
- 1998c *Director’s Order 28 (DO-28) Regarding Cultural Resources Management and the Accompanying Cultural Resource Management Guideline*. Washington, DC. Available online at http://www.nps.gov/history/history/online_books/nps28/28contents.htm.
- 1999a *Ackerson Post-Fire Archeological Project, Yosemite National Park, California*, by Timothy M. Keefe, Bruce M. Kahl, and Suzanna T. Montague. Yosemite Research Center Technical Report No. 5. El Portal, CA: Yosemite National Park.

- 2000a “Archaeological Site Record for CA-TUO-754/H,” by Sonny Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2000b “Archaeological Site Record for CA-TUO-2825,” by Sonny Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2000c “Archaeological Site Record for CA-TUO-2829,” by Sonny Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2000d “Archaeological Site Record for CA-TUO-2830,” by Sonny Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2000e “Archaeological Site Record for CA-TUO-2833,” by Sonny Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2000f “Archaeological Site Record for CA-TUO-2834,” by Sonny Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2000g *Director’s Order 47: Soundscape Preservation and Noise Management*. Accessed online November 1, 2007 at <http://www.nature.nps.gov/naturalsounds/laws_policies/do47.cfm>.
- 2000h *Merced Wild and Scenic River Comprehensive Management Plan and Environmental Impact Statement*. Yosemite National Park, CA.
- 2001 “Preserving Pristine Night Skies in National Parks and the Wilderness Ethic,” by D. Dursicoe. *The George Wright Society Forum* 18: 4.
- 2002a *Air Quality in the National Parks*. Second ed. Lakewood, CO: Air Resources Division.
- 2002b “Integrating Social, Ecological, and Managerial Indicator of Quality into Carrying Capacity Decision Making in Yosemite National Park Wilderness.” Yosemite National Park, CA.
- 2004a “Air Resources Management.” *Natural Resources Management Reference Manual* 77. Washington, DC. Available online at <<http://www.nature.nps.gov/rm77/air.cfm>>.
- 2004b “Archaeological Site Record for CA-TUO-22,” by Peter Gavette. Yosemite Archeology Office, Yosemite National Park, CA.
- 2004c “National Register Federal Program Regulations.” *Code of Federal Regulations*, title 36, part 60.1.
- 2004d *Park Planning Program Standards*. Washington, D.C: Division of Park Planning, Facilities, and Lands. Available online at <<http://www.planning.nps.gov/policy.cfm>>.
- 2004e *Yosemite National Park Fire Management Plan / Environmental Impact Statement*. Yosemite National Park, CA.
- 2005a *A Sense of Place: Design Guidelines for Yosemite Valley*. Yosemite National Park, CA.
- 2005b *Merced Wild and Scenic River Revised Comprehensive Management Plan and Supplemental Environmental Impact Statement*. Yosemite National Park, CA.

- 2005c “Preliminary Report of Night Sky Monitoring Visit to Yosemite National Park,” by Dan Duriscoe. NPS Night Sky Team. Yosemite National Park, CA
- 2005d “Summary of Archeological Investigations at CA-TUO-22, Pate Valley, Yosemite National Park,” by Peter Gavette. Yosemite National Park, CA.
- 2005e *Yosemite National Park Acoustic Monitoring Report*, by Kurt Fristrup. Fort Collins, CO: Natural Sounds Program Office.
- 2006a *100-Year Floodplain and Ordinary High Water Mark Determinations for the Tuolumne Meadows and Glen Aulin High Sierra Camp Areas, Yosemite National Park*, by James Roche, Jason Smith, and Joshua Baccei. El Portal, CA: Yosemite National Park, Division of Resources Management and Science.
- 2006b “Archeological Project List, TWSR Corridor,” by S. Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2006c “Archeology Site Table.” Yosemite Archeology Office, Yosemite National Park, CA.
- 2006d “Delineation of Waters of the United States, Including Wetlands: Glen Aulin High Sierra Camp and Backpacker’s Campground Area,” by Crystal Elliot. Branch of Vegetation and Restoration, Division of Resources Management and Science, Yosemite National Park, CA.
- 2006e “Fieldwork Summary of the 1994 Lower Lyell Canyon Archeological Survey,” by Paul DePascale and David L Curtis. Yosemite National Park, CA.
- 2006f “Formal and Social Trail Assessments for the Tuolumne Meadows Area.” Yosemite National Park, CA.
- 2006g *Management Policies 2006*. Washington, DC.
- 2006h *National Park Service Visitor Report, Yosemite National Park*. Report Dates June-October 2006. Accessed online on January 3, 2007 at <<http://www2.nature.nps.gov/mpur/Reports>>.
- 2006i *Sierra Nevada Network: Vital Signs Monitoring Plan, Phase III*. Draft Report.
- 2006j “Status of Water-Related Data Collection Efforts and Studies, Tuolumne River Plan,” by J. Meyer. Division of Resources Management and Science, Yosemite National Park, CA.
- 2006k “Tuolumne Meadows Historic District, Yosemite National Park,” by T. Babalis, G. Stromberg, D. Schaible, and S. Torgerson. In *National Park Service Cultural Landscape Inventory, 2006*. Branch of Historical Architecture and Landscapes, Yosemite National Park CA.
- 2006l *Tuolumne Wild and Scenic River Outstandingly Remarkable Values*. Draft. Yosemite National Park, CA. Available online at <www.nps.gov/yose/planning/trp>.
- 2006m *Tuolumne Wild and Scenic River Plan Public Scoping Report*. Yosemite National Park, CA.
- 2006n “Tuolumne Wild & Scenic River Planning: Archeological Summary, Assessment of Data Gaps, and Proposed Study Plan,” by Sonny Montague. Yosemite National Park, CA.

- 2006o “Tuolumne Wild and Scenic River Planning: Definition of Archeological Project Types and Terms,” by S. Montague. Yosemite Archeology Office, Yosemite National Park, CA.
- 2006p “Tuolumne Wild and Scenic River: Preliminary VERP Water Quality Monitoring.” Yosemite National Park, CA.
- 2006q “Upper Tuolumne Watershed Parking Survey of All Locations Used for Automobile Parking, Yosemite National Park,” by Bill Kuhn. National Planning and Compliance Office, Yosemite National Park, CA.
- 2006r *Yosemite National Park Acoustic Monitoring Report*, by Kurt Fristrup. Fort Collins, CO: Natural Sounds Program Office.
- 2006s “Yosemite National Park Collections Management Report,” by Cari Kreshak. In *United States Department of the Interior, National Park Service, Park Collections Management Reports (CMR) for FY 2006*. Database accessed online March 2012 at http://www.governmentattic.org/docs/NPS_CMReports_FY2006.pdf.
- 2007a *Air Resources Information System, Natural Lightscapes Monitoring and Data*. Accessed online October 29, 2007 at <http://www2.nature.nps.gov/air/lightscapes/monitorData/yose>.
- 2007b *Air Resources Information System: Natural Lightscapes Overview*. Accessed online October 19, 2007 at <http://www2.nature.nps.gov/air/lightscapes/overview.cfm>.
- 2007c *Air Resources Information System: Sierra Nevada Vital Signs Network*. Accessed online October 21, 2007 at <http://www2.nature.nps.gov/air/permits/aris/networks/sien.cfm>.
- 2007d “Archeology in Support of the Tuolumne Wild and Scenic River Comprehensive Management Plan,” by Kristen L. Shive. Yosemite National Park, CA.
- 2007e *ASMIS 3.01 Archeological Sites Management Information System Data Dictionary*. Washington, DC: National Park Service, National Center for Cultural Resources.
- 2007f *ASMIS 3.01 Archeological Sites Management Information System User Guide*. Washington, DC: National Park Service, National Center for Cultural Resources.
- 2007g *Compendium of Superintendent’s Orders for Yosemite National Park*. Yosemite National Park, CA.
- 2007h “Hetch Hetchy, Yosemite National Park.” Draft. In *Cultural Landscape Inventory*. Branch of Historical Architecture and Landscapes, Yosemite National Park, CA.
- 2007i “High Sierra Camp Utility System Workshop Summary Report.” Yosemite National Park, CA.
- 2007j *Interim Outdoor Lighting Guidelines*, by NPS Night Sky Team. Draft. Yosemite National Park, CA.
- 2007k *Looking Downstream: Ecological Responses to an Altered Hydrologic Regime Downstream of Hetch Hetchy Reservoir, Yosemite National Park*, by Greg Stock, Ph.D., James Roche, Monica Buhler, Sarah Stock, Jeff Holmquist, Ph.D., Jutta Schmidt-Gengenbach, Denise Della-Santina, and Laura Clor. Yosemite National Park, CA.

- 2007l *Natural Lightscapes: Dark Night Sky*. Yosemite National Park Fact Sheet. Yosemite National Park, CA.
- 2007m "Pack Stock Use Assessment in Mountain Meadows," by Joy Fischer and Crystal Elliot. Interim Status Report. Yosemite National Park, CA.
- 2007n *Poopenaut Valley Delineation of Waters of the United States, Including Wetlands*, by Monica Buhler and Denise Della Santina. El Portal, CA: Yosemite National Park.
- 2007o *Scenic Analysis of Tuolumne Meadows*, by Steven Torgerson and Daniel Schaible. Yosemite National Park, CA.
- 2007p *Soundscape Inventory and Monitoring*. Accessed online November 1, 2007 at [<http://www.nature.nps.gov/naturalsounds/impacts/>](http://www.nature.nps.gov/naturalsounds/impacts/).
- 2007q *Special Status Plants in the Tuolumne River Corridor*, by Lisa Acree, Dena Grossenbacher, and Alison E. Colwell. Yosemite National Park, CA.
- 2007r *Standard Operating Procedure for Coordinating the National Historic Preservation Act (NHPA) & National Environmental Policy Act (NEPA)*. Draft. Yosemite National Park, CA.
- 2007s "The Tuolumne Meadows Archeological District: Report of Archeological Investigations and Recommendations in Support of the Tuolumne Meadows Plan," by Sonny Montague. Yosemite National Park, CA.
- 2007t "Tuolumne Meadows Historic District, Yosemite National Park." In *National Park Service Cultural Landscapes Inventory, 2007*. Branch of History, Architecture, and Landscapes, Yosemite National Park, CA.
- 2007u "Tuolumne Meadows Soda Springs Historic District, Yosemite National Park." In *Cultural Landscapes Inventory, 2007*. Branch of Historical Architecture and Landscapes, Yosemite National Park, CA.
- 2007v *Tuolumne Planning Workbook: Report on Progress from 2005 to Present*. Yosemite National Park, CA.
- 2007w *Upper Lyell Canyon Meadow Health Assessment Data*. Vegetation Management & Restoration Ecology Branch, Resources Management and Science Division, Yosemite National Park, CA.
- 2008a "1998-2008 Overnight Statistics for Poopenaut Valley." Wilderness Branch, Yosemite National Park, CA.
- 2008b *Grand Canyon South Rim Visitor Transportation Plan Environmental Assessment*. Accessed online December 15, 2011, at [<http://www.nps.gov/grca/parkmgmt/trans.htm>](http://www.nps.gov/grca/parkmgmt/trans.htm).
- 2008c "Guidebook for the Blue Ridge Scenery Conservation System." Working draft. Asheville, NC: Blue Ridge Parkway.
- 2008d *Invasive Plant Management Plan for Yosemite National Park: Environmental Assessment*. Yosemite National Park, CA.

- 2008e “Monthly Wilderness Use Data for 2007.” Yosemite National Park, CA.
- 2008f “Report on Visitor Use of the Tioga Road Trailheads.” Visitor Use and Social Science Branch, Yosemite National Park, CA.
- 2008g *Special Status Plants Found at Dana Meadow, Tuolumne Campground, and Tenaya Lake*, by Lusetta Nelson and Alison E. Colwell. Yosemite National Park, CA.
- 2008h *Tuolumne Meadows Lodgepole Pine Removal Project, Completion Report*, by Lusetta Nelson. Division of Resources Management and Science, Yosemite National Park, CA.
- 2008i “User Capacity Management Monitoring Program, Annual Monitoring Report 2007.” Unpublished report. Visitor Use and Social Science Branch, Division of Resources Management and Science, Yosemite National Park, CA.
- 2008j “User Capacity Management Monitoring Program, Field Monitoring Guide 2008.” Unpublished report. Visitor Use and Social Science Branch, Division of Resources Management and Science, Yosemite National Park, CA.
- 2008k *Yosemite Emissions Reduction Efforts*. Draft Report. Resources Management Department, Yosemite National Park, CA.
- 2008l *Yosemite Exterior Lighting Guidelines*. Draft. Yosemite National Park, CA.
- 2008m “Yosemite High Sierra Camps Annual Use Data.” Yosemite National Park, CA.
- 2009a *Air Quality in National Parks: 2008 Annual Performance and Progress Report*. Natural Resource Report NPS/NRPC/ARD/NRR—2009/151. Denver, CO: Air Resources Division.
- 2009b “Archeological Fieldwork Summary for the 2008 Looking Downstream Project: Assessing Impacts Related to Operations of O’Shaughnessy Dam on Archeological Sites in the Tuolumne River Corridor,” by Peter Gavette. Yosemite Archeology Office, Branch of Anthropology and Archeology, Resources Management and Science Division, Yosemite National Park, CA.
- 2009c “Archeological Site Condition Assessments for the 2008 User Capacity Management Monitoring Program,” by J.M. Middleton. Unpublished final summary report. Archeology Office, Yosemite National Park, CA.
- 2009d *Compendium of Superintendent’s Orders for Yosemite National Park*. Yosemite National Park, CA. Available online at <<http://www.nps.gov/yose/parkmgmt/upload/compendium.pdf>>.
- 2009e *Estimating Visitor Use of the Tuolumne*, by James Bacon. Yosemite National Park, CA.
- 2009f “List of Categorical Exclusions.” Planning Division, Yosemite National Park, CA.
- 2009g *Monthly Traffic Data Reports*. May-September 2007 data. File M0507025.PRN.
- 2009h *Packstock Use Assessment in Subalpine Meadows of the Tuolumne River Watershed*, by Elizabeth Ballenger, Lisa Acree, and Joy Fischer. Yosemite National Park, CA.

- 2009i “Protective Actions Undertaken in the Tuolumne River Watershed 2000 to 2008.” Compiled from the San Francisco Public Utilities Commission’s Annual Reports and Updates on the Watershed Control Program and Sanitary Survey for the Hetch Hetchy Water Supply, 2000 to 2008. Planning Division, Yosemite National Park, CA.
- 2009j “Understanding Visual Resources Management: An Approach To Valuing Scenic Quality.” Training materials. Yosemite National Park, CA.
- 2009k “User Capacity Management Monitoring Program, Annual Monitoring Report 2008.” Unpublished report. Visitor Use and Social Science Branch, Division of Resources Management and Science, Yosemite National Park, CA.
- 2009l “User Capacity Management Monitoring Program, Field Monitoring Guide 2009.” Unpublished report. Visitor Use and Social Science Branch, Division of Resources Management and Science, Yosemite National Park, CA.
- 2009m “Vegetation Analysis for Tuolumne Meadows,” by Elizabeth Ballenger and Lisa Acree. Yosemite National Park, CA.
- 2009n “Wilderness Issues in the Tuolumne Wild and Scenic River,” by Mark Fincher. Wilderness Office, Division of Visitor and Resource Protection, Yosemite National Park, CA.
- 2009o “YOSE District YTD Report.” Reports dated January 2001 through October 2009. National Park Service, Public Use Statistics Office. Available online at <http://www.nature.nps.gov/stats/park.cfm>.
- 2010a *Addressing User Capacity for the Tuolumne Wild and Scenic River*. El Portal, CA: Yosemite National Park.
- 2010b “Archeological Fieldwork Summary for the 2010 Looking Downstream Project: Assessing Impacts Related to Operations of O’Shaughnessy Dam on Archeological Sites in the Tuolumne River Corridor, Poopenaut Valley, Yosemite National Park,” by Peter Gavette. Yosemite Archeology Office, Branch of Anthropology and Archeology, Resources Management and Science Division, Yosemite National Park.
- 2010c *Archeological Sites Management Information System, Version 3.1 User Guide*. Washington, DC: National Park Service, National Center for Cultural Resources, Archeology Program.
- 2010d “Assessment of Hydrologic Function and Wetland Habitat,” by K. Noon and M. Martin. Trip report. Water Resources Division, Denver, CO.
- 2010e *Ecological Restoration Planning for the Tuolumne Wild and Scenic River Comprehensive Management Plan*, by Monica Buhler, Sue Beatty, Liz Ballenger, and Daniel Schaible, with Introduction by Lisa Acree. El Portal, CA: Yosemite National Park, Division of Resources Management and Science.
- 2010f *LCS Summary Report: Management Category and Assessed Condition Report – List of Classified Structure Definitions*. El Portal, CA: Yosemite National Park.

- 2010g “Pacific Fishers.” Accessed online May 20, 2010 at <<http://www.nps.gov/yose/naturescience/fishers.htm>>.
- 2010h *Pack Stock Capacity Calculations for Pilot Management Study of Upper Lyell and Virginia Canyons, Yosemite National Park*, by L. Ballenger. Division of Resources Management and Science. El Portal, CA: Yosemite National Park.
- 2010i *Pack Stock Management in Yosemite National Park: A White Paper*, by Lisa Acree, Jim Roche, Liz Ballenger, and N.S. Nicholas. El Portal, CA: Yosemite National Park.
- 2010j *Pack Stock Use Assessment in Subalpine Meadows of the Tuolumne River Watershed*, by E. Ballenger, E.J. Baccei, and L. Acree. 2008 Yosemite National Park report submitted to the San Francisco Public Utilities Commission.
- 2010k *Scenic Vista Management Plan for Yosemite National Park: Environmental Assessment*. El Portal, CA: Yosemite National Park, CA.
- 2010l *Visitor Use and Impact Monitoring Field Guide*. El Portal, CA: Yosemite National Park.
- 2010m “Yosemite Scenic Rating Worksheet.” Yosemite National Park, CA.
- 2010n “Yosemite’s Wilderness Trailhead Quotas and Visitor Capacity,” by Mark Fincher. Wilderness Office, Division of Visitor and Resource Protection, Yosemite National Park, CA.
- 2011a *A Sense of Place: Design Guidelines for Yosemite National Park*. Washington, D.C.: U.S. Government Printing Office.
- 2011b *Economic Benefits to Local Communities from National Park Visitation and Payroll, 2010*, by Daniel J. Stynes. Natural Resource Report NPS/NRSS/EQD/NRR – 2011/481. Fort Collins, CO: National Park Service, Natural Resource and Stewardship and Science.
- 2011c “Summary Report: Archeology Visitor Use and Impact Monitoring Program 2007-2010, Yosemite National Park, California,” by B. Bane. Unpublished report. Archeology Office, Yosemite National Park, CA.
- 2011d *Tioga Road Rehabilitation: Historic Context and Determination of Eligibility*. El Portal, CA: Yosemite National Park.
- 2011e “Water Quality.” Yosemite National Park Visitor Use and Impacts Monitoring Program. Accessed online March 19, 2012 at <http://www.nps.gov/yose/naturescience/upload/02_Water_Quality.pdf>.
- 2011f *Yosemite Lighting Guidelines*. El Portal, CA: Yosemite National Park.
- 2012a “2011 Archeology Visitor Use and Impact Monitoring Program, Yosemite National Park, California,” by B. Bane. Yosemite Archeology Office, Yosemite National Park, CA.
- 2012b *Looking Downstream: Physical and Ecological Responses to River Flow Downstream of Hetch Hetchy Reservoir, Yosemite National Park.*, by Greg Stock, James Roche, Monica Buhler, and Sarah Stock. 2010 Update. El Portal, CA: Yosemite National Park, Resources Management and Science.

2012c “Park Operations: Managing Overnight Stock Use at Yosemite National Park: A Science-Based Approach,” by J.D. Abbe and L. Ballenger. *Park Science* 28(3):99–102. Accessed 16 April 2013 at <http://www.nature.nps.gov/ParkScience/index.cfm?ArticleID=552>.

2013a *Pacific Fisher Status and Recovery 2009 – 2011*, by Lindsay Cline. Final Report. El Portal, CA: Yosemite National Park, Resources Management and Science.

2013b *Tuolumne Wild and Scenic River Public Comment and Response Report*. El Portal, CA: Yosemite National Park.

National Park Service (U.S. Department of the Interior), California State Historic Preservation Officer, and Advisory Council on Historic Preservation (NPS, SHPO, and ACHP)

1999 “Programmatic Agreement Among the National Park Service at Yosemite, the California State Historic Preservation Officer and the Advisory Council on Historic Preservation regarding Planning, Design, Construction, Operations and Maintenance, Yosemite National Park, California.” Amended October 2003. Yosemite National Park, CA.

National Park Service (U.S. Department of the Interior), Advisory Council on Historic Preservation, and National Conference of State Historic Preservation Officers (NPS, ACHP, and NCSHPO)

2008 *Programmatic Agreement Among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference Of State Historic Preservation Officers For Compliance With Section 106 of the National Historic Preservation Act*. Washington, DC: National Park Service Washington Office. Available online at <http://www.nps.gov/history/howto/PAToolkit/overview.htm>.

National Park Service, National Register of Historic Places (NRHP)

1990 *How to Apply the National Register Criteria for Evaluation*, by Patrick W. Andrus, ed. by Rebecca H. Shrimpton. National Register Bulletin. Available online at <http://www.nps.gov/nr/publications/bulletins/nrb15/>.

National Park Service (U.S. Department of the Interior) and U.S. Air Force (U.S. Department of Defense) (NPS and USAF)

2002 *United States Air Force/National Park Service Western Pacific Regional Sourcebook*, by H. Thompson, S. Oppermann, S. Sample, M.R. Saraniero, P. Voorhees, and G.F. Pease.

National Research Council

1992 *Restoration of Aquatic Ecosystems: Science, Technology and Public Policy*. Washington, DC: National Academy Press.

Natural Resources Conservation Service, U.S. Department of Agriculture (NRCS)

2006 *Soil Survey Geographic (SSURGO) Database for Yosemite National Park, California*. Fort Worth, TX. Available online at <http://SoilDataMart.nrcs.usda.gov/>.

2007 *Soil survey of Yosemite National Park, California*. Accessed online at http://soils.usda.gov/surve/printed_survey/.

NatureServe

- 2005 *Classification of the Vegetation of Yosemite National Park and Surrounding Environs in Tuolumne, Mariposa, Madera and Mono Counties, California*. Prepared for the National Park Service, Yosemite National Park, CA.

Newman, Peter

- 2002 "Integrating Social, Ecological, and Managerial Indicators of Quality into Carrying Capacity Decision Making in Yosemite National Park Wilderness." Ph.D. Dissertation. Natural Resources, University of Vermont.

Newman, P., and R. Manning

- 2002 "Intergrating Social, Ecological and Managerial Indicators of Quality into Carrying Capacity Decision Making in Yosemite National Park Wilderness." Yosemite National Park, CA.

Newman, Peter, E. Pilcher, and D. Stack

- 2006 *Yosemite National Park Phase I Soundscape Report*. Fort Collins: Colorado State University, Department of Natural Resource Recreation and Tourism.

Nijhuis, Michelle

- 2005 "The Ghosts of Yosemite." *High Country News* (October 17, 2005).

Olson-Rutz, K.M., C.B. Marlow, K. Hansen, L.C. Gagnon, and R.J. Rossi

- 1996 "Recovery of High Elevation Plant Communities after Packhorse Grazing." *Journal of Range Management* 49: 541-545.

ORCA Consulting

- 1999 *Yosemite National Park Visitor Study*. Prepared for National Park Service, Yosemite National Park, CA.

Osbourne L.L., and D.A. Kovacic

- 1993 "Riparian Vegetated Buffer Strips in Water-Quality Restoration and Stream Management." *Freshwater Biology* 29, p. 243-258.

Pacific Crest Trail Association (PCTA)

- 2009 "Trail History." Accessed online July 13, 2009 at <http://www/pcta.org/about_trail/history.asp>.

Pacific Lightworks

- 2007 "Yosemite National Park Exterior Lighting Guidelines." Final Draft Report. Prepared for Yosemite National Park, CA.

Patterson, M., and W. E. Hammitt

- 1990 "Backcountry Encounter Norms, Actual Reported Encounters, and Their Relationship to Wilderness Solitude." *Journal of Leisure Research* 22(3), 259-275.

Pettebone, D., and Others

- 2008 *Estimating Visitor Use in Yosemite National Park*, by Pettebone, D., P. Newman, C. Beaton, D. Stack, and A. Gibson. Report for Yosemite National Park. Fort Collins: Colorado State University, Center for Protected Areas Management and Training.
- 2010 *Half Dome Trail Visitor Use Monitoring Report*, by Pettebone, B. Meldrum, C. Leslie, K. King, and J. Meath. El Portal, CA: Yosemite National Park.
- 2013 "A Visitor Use Monitoring Approach on the Half Dome Cables to Reduce Crowding and Inform Park Planning Decisions in Yosemite National Park." *Landscape and Urban Planning* 118: 1–9.

Pierson, E.D., and G.M. Fellers

- 1998 *Distribution and Ecology of the Big-Eared Bat (Corynorhinus townsendii) in California*. US Geological Survey, Biological Resources Division.

Pierson, E.D., and W.E. Rainey

- 1993 "Bat Surveys: Yosemite Valley and Hetch Hetchy Reservoir, July 1993." Prepared for Resources Management and Science Division, Yosemite National Park, CA.
- 1998 "Distribution of the Spotted Bat, *Eudermma maculatum*, in California." *Journal of Mammalogy* 79(4): 1296-1305.

Pietola, L., R. Horn, and M. Yli-Halla

- 2005 "Effects of Trampling by Cattle on the Hydraulic and Mechanical Properties of Soil." *Soil & Tillage Research* 82(1):99-108.

Poole, G.C.

- 2002 Fluvial Landscape Ecology: Addressing Uniqueness within River Discontinuum." *Freshwater Biology* 47:641-660.

Pope, Karen L., Justin M. Garwood, Hartwell H. Welsh, Jr., and Sharon P. Lawler

- 2008 "Evidence of indirect impacts of introduced trout on native amphibians via facilitation of a shared predator." *Biological Conservation* 141(2008):1321-31.

Pritchard, D., J. Anderson, C. Correll, J. Fogg, K. Gebhardt, R. Krapf, S. Leonard, B. Mitchell and J. Staats

- 1998 *Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas*. Technical Report 1737-15. USDI Bureau of Land Management and USDA Forest Service and Natural Resources Conservation Service.

Quin, Richard H.

- 1991 "Yosemite National Park Roads and Bridges." *Historic American Engineering Record*. Yosemite Research Library, Yosemite National Park, CA.

Rachowicz, L.J., R.A. Knapp, J.A.T. Morgan, M.J. Stice, V.T. Vredenburg, J.M. Parker, and C.J. Briggs

- 2006 "Emerging Infectious Disease as a Proximate Cause of Amphibian Mass Mortality in *Rana muscosa* Populations." *Ecology* 87: 1671–83.

Rachowitz, L.J., and V.T. Vredenburg

- 2004 "Transmission of *Batrachochytrium dendrobatidis* within and between Amphibian Lifestages." *Diseases of Aquatic Organisms* 61: 75-83.

Ratliff, R. D.

- 1985 *Meadows in the Sierra Nevada of California: State of Knowledge*. USDA Forest Service, General Technical Report PSW-84.

Radle, Lyn Autumn

- "The Effect of Noise on Wildlife: A Literature Review." *World Forum for Acoustic Ecology Online Reader*. Available online at <http://www.nature.nps.gov/naturalsounds/PDF_docs/wildlifebiblio_Aug08.pdf>.

Reese, Devin A., and Hartwell H. Welsh, Jr.

- 1998 "Comparative Demography of *Clemmys marmorata* Populations in the Trinity River of California in the Context of Dam-introduced Alterations." *Journal of Herpetology* 32(4): 505-15.

Repath, Charles

- 2011 *Delineation of Wetlands and other Waters of the United States in and Near the Mariposa Grove of Giant Sequoias*. Prepared for the National Park Service. El Portal, CA: Yosemite National Park.

Reynolds, R. D.

- 1959 "Effect of Natural Fires and Aboriginal Burning upon the Forests of the Central Sierra Nevada." M.A. Thesis. University of California, Berkeley.

Rocheft, R., and D.D. Swinney

- 2000 "Human Impact Surveys in Mount Rainier National Park: Past, Present, and Future." In *Wilderness Ecosystems, Threats, and Management*. Vol. 5 of Proceedings of the Wilderness Science in a Time of Change Conference, compiled by D.N. Cole, S.F. McCool, W.T. Borrie, and J. O'Loughlin. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Rogers, J., and J. Sovic

- 2001 "The Ultimate Cultural Resource?" *The George Wright Society Forum* 18 (4).

Rosenthal, Jeffrey S.

- 2008 Prehistory of the Sonora Region: Archaeological and Geoarchaeological Investigations for Stage 1 of the East Sonora Bypass Project, State Route 108, Tuolumne County, California. Volume I: Synthesis. Far Western Anthropological Research Group, Inc., Davis, California. Submitted to Central Sierra Environmental Services Branch, California Department of Transportation, District 10, Stockton, California.

Rosgen, D. L.

- 1996 *Applied River Morphology*. Second ed. Wildland Hydrology.
- 2001 "A Stream Channel Stability Methodology." Proceedings of the Seventh Federal Interagency Sedimentation Conference, Reno, NV. Accessed online at <http://www.wildlandhydrology.com/assets/CHANNEL_STABILITY_.pdf>

Rovito, Sean M.

- 2010 "Lineage divergence and speciation in the Web-toed Salamanders (Plethodontidae: *Hydromantes*) of the Sierra Nevada California." *Molecular Ecology* 19(2010): 4554-71.

Rundel, Philip W., and Shari B. Stuner

- 1998 "Native Plant Diversity in Riparian Communities of the Santa Monica Mountains, California." *Madrono* 45(2): 93-100.

San Francisco Public Utilities Commission (SFPUC)

- 2007 *Annual Report and Update on Watershed Control Program and Sanitary Survey for the Hetch Hetchy Water Supply*. Yosemite National Park, CA.
- 2008 *Water Quality Protection Plan*. San Francisco, CA.
- 2009 *Annual Report and Update on Watershed Control Program and Sanitary Survey for the Hetch Hetchy Water Supply*. Yosemite National Park, CA.
- 2010 *Annual Sanitary Survey Update Report for the Hetch Hetchy Water Supply*. Burlingame, CA: SFPUC Water Quality Division, Engineering Section.
- 2012 *Annual Sanitary Survey Update Report for the Hetch Hetchy Water Supply*. Burlingame, CA: SFPUC Water Quality Division, Engineering Section.

Shelby, B., and T.A. Heberlein

- 1986 *Carrying Capacity in Recreation Settings*. Corvallis, OR: Oregon State University Press.

Siegel, Rodney B., and David F. DeSante

- 2002 *Avian Inventory of Yosemite National Park (1998-2000)*. Final Report. Point Reyes, CA: Institute for Bird Populations.

Siegel, Rodney B., Robert L. Wilkerson, and David F. DeSante

- 2008 "Extirpation of the Willow Flycatcher from Yosemite National Park." *Western Birds* 39:8-21.

Sierra Nevada Ecosystem Project

- 1996 *Status of the Sierra Nevada: Assessment Summaries and Management Strategies*. Wildland Resources Center Rept. No. 36. Davis, CA: University of California at Davis.

Smaldone, D., Charles Harris, Nick Sanyal, and Doug Lind

- 2005 "Place Attachment and Management of Critical Park Issues in Grand Teton National Park." *Journal of Park and Recreation Administration* 23(1): 90-114.

Smith, David A.

- 2009 *The Military and Yosemite: The Cavalry Years*. Sacramento: The California State Military Museum. Available online at <<http://www.militarymuseum.org/YosemiteCavalry.html>>.

Smith, D. D., and W.H. Wischmeier

- 1962 "Rainfall Erosion." *Advances in Agronomy* 14: 109-148.

Snyder, James B.

- 2005 "Soda Springs and Marble Outcrops in Yosemite National Park." Document on File, Davis-King & Associates, Standard, California.

Sonoran Institute

- 2007a "A Socioeconomic Profile, Groveland – Big Oak Flat CDP, California." Produced by the Economic Profile System Community, November 7, 2007.
- 2007b "A Socioeconomic Profile, Mammoth Lakes Town, California." Produced by the Economic Profile System Community, November 7, 2007.
- 2007c "A Socioeconomic Profile, Mariposa CDP, California." Produced by the Economic Profile System Community, November 7, 2007.
- 2007d "A Socioeconomic Profile, Oakhurst CDP, California." Produced by the Economic Profile System Community, November 7, 2007.
- 2009a "A Socioeconomic Profile, Madera County, California." Produced by the Economic Profile System, 2009 Version, February 13, 2009.
- 2009b "A Socioeconomic Profile, Mariposa County, California." Produced by the Economic Profile System, 2009 Version, February 13, 2009.
- 2009c "A Socioeconomic Profile, Mono County, California." Produced by the Economic Profile System, 2009 Version, February 13, 2009.
- 2009d "A Socioeconomic Profile, Tuolumne County, California." Produced by the Economic Profile System, 2009 Version, February 13, 2009.

Stebbins, R.C., and N.W. Cohen

- 1995 *A Natural History of Amphibians*. Princeton, NJ: Princeton University Press.

Stein, E.D., A.E. Fetscher, R.P. Clark, A. Wiskind, J.L. Grenier, M. Sutula, J.N. Collins, and C. Grosso

- 2009 "Validation of a Wetland Rapid Assessment Method: Use of EPA's Level 1-2-3 Framework for Method Testing and Refinement." *Wetlands* 29(2):648-665.

Stewart, W. P., and D.N. Cole

- 2001 "Number of Encounters and Experience Quality in Grand Canyon Backcountry: Consistently Negative and Weak Relationships." *Journal of Leisure Research* 33(1), 106.

Stone, Eric

- 2000 "Separating the Noise from the Noise: A Finding in Support of the 'Niche Hypothesis,' that Birds Are Influenced by Human-Induced Noise in Natural Habitats." *Anthrozoos* 13(4): 225-31.

Storer, T.

- 1925 *A Synopsis of the Amphibia of California*. University of California Publications in Zoology No. 27.

Stuart, S., J.S. Chanson, N.A. Cox, B.E. Young, A.S.L. Rodrigues, D.L. Fishman, and R.W. Waller

- 2004 "Status and Trends of Amphibian Declines and Extinctions Worldwide." *Science* 306: 1783–86.

Stynes, Daniel J.

- 2007 *Impacts of Visitor Spending on the Local Economy: Yosemite National Park, 2005*. Prepared for the National Park Service, Social Science Program. Michigan State University, Department of Community, Agriculture, Recreation and Resource Studies.

Suding, K. N., K. L. Gross, and G. R. Houseman

- 2004 "Alternative States and Positive Feedbacks in Restoration Ecology." *Trends in Ecology & Evolution* 19:46-53.

Sumner, E.

- 1936 "Special Report on a Wildlife Study in the High Sierra in Sequoia and Yosemite National Parks and Adjacent Territory." National Archives, U.S. National Park Service Records, Washington, DC.

Swanson, A. E.

- 1983 *Denudation Rates in Small Disturbed and Undisturbed Subalpine Basins*. Santa Cruz: University of California.

Swanson, F.J., T. K. Kratz, N. Caine, and R.G. Woodmansee

- 1982 "Landform Effects on Ecosystem Patterns and Processes." *BioScience* 38: 2, 92-98.

Swanson, G.A.

- 1992 "Cycles of Cattails in Individual Wetlands: Environmental Influences." *Proceedings of Cattail Management Symposium*. U.S. Department of Agriculture.

Tate, K.W., E.R. Atwill, J.W. Bartolome, and G. Nader

- 2006 "Significant *Escherichia coli* Attenuation by Vegetative Buggers on Annual Grasslands." *Journal of Environmental Quality* 35, p. 795-805.

Taylor, D. W.

- 1997 "Flora of the Yosemite Sierra." Unpublished second draft. Jepson Herbarium, University of California, Berkeley.

Trimble, S.W., and A.C. Mendel

- 1995 "The cow as a Geomorphic Agent – A Critical Review." *Geomorphology* 13: 233-253

Tuolumne County

- 2012a "Summary of Additional Financing Sources by Source and Fund, Governmental Funds, Fiscal Year 2011-2012." State Controller Schedules, Schedule 5. Accessed online March 2012 at <http://portal.co.tuolumne.ca.us/>.
- 2012b "Summary of Financing Uses by Function and Fund, Governmental Funds, Fiscal Year 2011-2012." State Controller Schedules, Schedule 7. Accessed online March 2012 at <http://portal.co.tuolumne.ca.us/>.

Unger, P.W., and T.C. Kaspar

- 1994 "Soil Compaction and Root Growth – A Review." *Agronomy Journal* 86:759-766.

University of California, Davis (UC Davis)

- 1996 *Sierra Nevada Ecosystem Project, Final Report to Congress*. Vol. I: *Assessment Summaries and Management Strategies*; Vol. II: *Assessments and Scientific Basis for Management Options*; Vol. III: *Assessments, Commissioned Reports, and Background Information; Addendum*. Davis: University of California.

U.S. Census Bureau, U.S. Department of Commerce

- 1990a "Table DP-1. General Population and Housing Characteristics: 1990." *1990 Census of Population and Housing*. Summary Tape File 1. Accessed online between October 1 and November 10, 2007 at <<http://factfinder.census.gov>>.
- 1990b "Table DP-3. Labor Force Status and Employment Characteristics: 1990." *1990 Census of Population and Housing*. Summary Tape File 3. Accessed online between October 1 and November 10, 2007 at <<http://factfinder.census.gov>>.
- 1990c "Table DP-4. Income and Poverty Status in 1989: 1990." *1990 Census of Population and Housing*. Summary Tape File 3. Accessed online between October 1 and November 10, 2007 at <<http://factfinder.census.gov>>.
- 2000a "Table DP-1. Profile of General Demographic Characteristics: 2000." *Census 2000*. Summary File 1. Accessed between October 1 and November 10, 2007 at <<http://factfinder.census.gov>>.
- 2000b "Table DP-3. Profile of Selected Economic Characteristics: 2000." *Census 2000*. Summary File 3. Accessed online between October 1 and November 10, 2007 at <<http://factfinder.census.gov>>.
- 2000c "Table DP-4. Profile of Selected Housing Characteristics: 2000." *Census 2000*. Summary File 3. Accessed online between October 1 and November 10, 2007 at <<http://factfinder.census.gov>>.
- 2010 *People Quick Facts*. Accessed online at <quickfacts.census.gov>.
- 2012a *Profile of General Population and Housing Characteristics: 2010* 2010 Demographic Profile Data, American Fact Finder. Accessed online March 2012 at <factfinder2.census.gov>.
- 2012b *Selected Economic Characteristics, 2005-2009*. American Community Survey, 5-Year Estimates. American Fact Finder. Accessed online March 2012 at <factfinder2.census.gov>.

U.S. Department of the Interior (USDI)

- 1899 *Report of the Secretary of the Interior for the Fiscal Year Ended June 30, 1899*. Washington, D.C: Government Printing Office.
- 1995 *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings*, by Kay D. Weeks and Anne Grimmer. Washington, DC: National Park Service, Cultural Resource Stewardship & Partnerships, Heritage Preservation Services.

- 2007 *Adaptive Management: The U.S. Department of the Interior Technical Guide*, by B.K. Williams, R.C. Szaro, and C.D. Shapiro. Washington, DC: Adaptive Management Working Group.

U.S. Department of the Interior and U.S. Department of Agriculture (USDI and USDA)

- 1982 "Final Revised Guidelines for Eligibility, Classification and Management of River Areas." *Federal Register* 47:39453-61.

U.S. Environmental Protection Agency (USEPA)

- 1993 "Determining Conformity of General Federal Actions to State or Federal Implementation Plans." Final Rule. *Federal Register* 58: 63253.
- 2012 "Approval and Promulgation of Implementation Plans; California; Determinations of Attainment for the 1997 8-hour Ozone Standard." Final Rule. *Federal Register* 77: 71551.
- 2012 *Recreational Water Quality Criteria*. U.S. Environmental Protection Agency, publication # 820-F-12-058.
- 2013a *Green Book: Currently Designated Nonattainment Areas for All Criteria Pollutants, as of July 31, 2013*. Accessed online September 30, 2013 at <<http://www.epa.gov/air/oaqps/greenbk/>>.
- 2013b *National Ambient Air Quality Standards*. Accessed online September 30, 2013, at <<http://epa.gov/air/criteria.html>>.

U.S. Fish and Wildlife Service, U.S. Department of the Interior (USFWS)

- 1979 *Classification of Wetlands and Deepwater Habitats of the United States*, by L.M. Cowardin, V. Carter, F.R. Govet, and E.T. LaRoe. FWS/OBS-79/31. Washington, DC.
- 1996 *The National Wetlands Inventory*. Available online at <<http://www.wetlands.fws.gov/>>.
- 2001 "Endangered and Threatened Wildlife and Plants: Final Determination of Critical Habitat for the California Red-legged Frog in Alameda, Butte, Contra Costa, El Dorado, Fresno, Kern, Los Angeles, Marin, Mariposa, Merced, Monterey, Napa, Plumas, Riverside, San Benito, San Diego, San Joaquin, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Solano, Sonoma, Stanislaus, Tehama, Tuolumne, and Ventura Counties, California: Final Rule." *Federal Register* 66: 49.
- 2002 "Determination of Endangered Status for Southern California Distinct Vertebrate Population Segment of the Mountain Yellow-legged Frog (*Rana muscosa*).". *Federal Register* 67.
- 2004 "Endangered and Threatened Wildlife and Plants: Proposed Designation Determination of Critical Habitat for the California Red-legged Frog (*Rana aurora draytonii*): Proposed Rule." *Federal Register* 69: 71.
- 2006 "Endangered and Threatened Wildlife and Plants: Designation of Critical Habitat for the California Red-legged Frog, and Special Rule Exemption Associated with Final Listing for Existing Routine Ranching Activities: Final Rule." *Federal Register* 71: 71.
- 2007a "Endangered and Threatened Wildlife and Plants: Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife." *Federal Register* 72: 130.

- 2007b “Federal Endangered and Threatened Species that Occur in or May Be Affected by Projects in the Counties and/or USGS 7.5 Minute Quads You Requested. Accessed online August 2007 at <http://www.fws.gov/sacramento/es/spp_lists/auto_list.cfm>.
- U.S. Fish and Wildlife Service (U.S. Department of the Interior) and National Marine Fisheries Service (National Oceanic and Atmospheric Administration) (USFWS and NMFS)
- 1998 *Endangered Species Act Consultation Handbook: Procedures for Conducting Section 7 Consultations and Conference Activities*.
- U.S. Forest Service, U.S. Department of Agriculture (USFS)
- 1980 *California Wildlife and Their Habitats: Western Sierra Nevada*, by J. Verner and A. S. Boss. General Technical Report PSW-37. Berkeley, CA: Pacific Southwest Forest and Range Experimental Station.
- 1988 *Tuolumne Wild and Scenic River Management Plan Revisions*. Stanislaus National Forest, Pacific Southwest Region. Available on line at <http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5126197.pdf>.
- 1995 *Landscape Aesthetics: a Handbook for Scenery Management*. Agricultural Handbook Number 701. Washington, D.C.: U.S. Department of Agriculture, Forest Service.
- 1996 “Status of Riparian Habitat.” In *Assessments and Scientific Basis for Management Options*. Vol. 2 of the Sierra Nevada Ecosystem Project. Available online at <<http://www.ceres.ca.gov/snep/pubs/v2s3.html>>.
- U.S. Forest Service (U.S. Department of Agriculture) and National Park Service (U.S. Department of the Interior) (USFS and NPS)
- 1979a *Tuolumne Wild and Scenic River Study and Environmental Impact Statement*. Tuolumne County, CA.
- 1979b *Tuolumne Wild and Scenic River Study: Final Environmental Impact Statement and Study Report*. Tuolumne County, CA.
- U.S. Geological Survey, U.S. Department of the Interior (USGS)
- 1990 “Earthquake History, 1769-1989,” by William L. Ellsworth. In *The San Andreas Fault System, California*, edited by Robert E. Wallace. U.S. Geological Survey Professional Paper 1515. Washington, DC: U.S. Government Printing Office.
- 1998 *Rockfall Hazards in Yosemite Valley DOI*, by Gerald Wieczorek, Meghan M. Morrissey, Giulio Iouine, and Jonathan Goos. USGS Open File Report 98-467. Reston, VA: U.S. Geological Survey.
- 2005 *Special Status Vascular Plant Surveys and Habitat Modeling in Yosemite National Park*, by Peggy E. Moore, Alison E. L. Colwell, and Charlotte L. Coulter. Prepared for the National Park Service, Yosemite National Park, CA.
- Vale, T. R., and G. R. Vale
- 1994 *Time and the Tuolumne Landscape: Continuity and Change in the Yosemite High Country*. Salt Lake City: University of Utah Press.

Vande Kamp, M.E.

- 2009 *Visitor-Experience Indicators and Standards for the Wilderness Management Zones in Mount Rainier National Park: Recommendations for Final Selection*. Technical Report NPS/PWR/UW/NRTR-2009-03.

Van Haveren, B. P.

- 1983 "Soil Bulk Density as Influenced by Grazing Intensity and Soil Type on a Shortgrass Prairie Site." *Journal of Range Management* 586-588.

Vannote, R. L., G. W. Minshall, K. W. Cummins, J. R. Sedell, and C. E. C. Cushing

- 1980 "The River Continuum Concept." *Canadian Journal of Fisheries and Aquatic Sciences* 37:130-137.

Van Wagtendonk, J.W., and P.R. Coho

- 1980 "Visitor Use Patterns in Yosemite National Park." *Journal of Travel Research*:12-17.
- 1986 "Trailhead Quotas, Rationing Use to Keep Wilderness Wild." *Journal of Forestry* 84(11): 22-24.
- 1993 "Spatial Patterns of Lightning Strikes and Fires in Yosemite National Park." *Proceedings of the 12th Conference Fire and Forest Meteorology*. Bethesda, MD: Society of American Foresters.

Vaske, J. J., and M.P. Donnelly

- 2002 "Generalizing the Encounter-Norm-Crowding Relationship." *Leisure Sciences* 24:255-269.

Vaske, J. J., B. Shelby, A.R. Graefe, and T.A. Heberlein

- 1986 "Backcountry Encounter Norms: Theory, Method and Empirical Evidence." *Journal of Leisure Research* 18:137-187.

Voorhees, P., and K. Lindsay

- 1998 *Prevalence and Severity of Overflights on U.S. National Parks: Preliminary Results of the 1998 Survey of National Park Superintendents*. Washington, DC.: National Parks Conservation Association.

Vredenburg, V.T.

- 2004 "Reversing Introduced Species Effects: Experimental Removal of Introduced Fish Leads to Rapid Recovery of a Declining Frog." In *Proceedings of the National Academy of Sciences, USA* 101: 7646-50.

Vredenburg, V.T., R. Bingham, R. Knapp, J.A.T. Morgan, C. Moritz, and D. Wake

- 2007 "Concordant Molecular and Phenotypic Data Delineate New Taxonomy and Conservation Priorities for the Endangered Mountain Yellow-legged Frog." *Journal of Zoology*.

Vredenburg, V.T., G. Fellers, and C. Davidson

- 2005 "The Mountain Yellow-legged Frog *Rana muscosa* (Camp 1917)." In *Status and Conservation of US Amphibians*, edited by M. Lanoo. Berkeley: University of California Press.

Waddle, Terry, and Jeff Holmquist

- 2013 “Macroinvertebrate Response to Flow Changes in a Subalpine Stream: Predictions from Two-Dimensional Hydrodynamic Models.” *River Research and Applications* 29:366 – 379. Published online Nov. 21, 2011 in Wiley Online Library <wileyonlinelibrary.com>.

Wagar, J.A.

- 1964 *The Carrying Capacity of Wild Lands for Recreation*. Forest Science Monograph 7. Washington, DC: Society of American Foresters.

Walker, M.D., and Others

- 1994 “Effects of Interannual Climate Variation on Aboveground Phytomass in Alpine Vegetation,” by Walker, P.J. Webber, E.H. Arnold, and D. Ebert-May. *Ecology* 75: 393-408.
- 1995 “Effects of Interannual Climate Variation on Phenology and Growth of Two Alpine Forbs,” by Walker, R.C. Ingersoll, and P.J. Webber. *Ecology* 76: 1067-1083.

Watson, Alan, Jessica Blackwell, David Cole, Gregg Fauth, Erik Frenzel, Steven Martin, David J. Parsons, Alison Steiner, Dan Williams

- 2013 *Sequoia and Kings Canyon National Parks (SEKI) Wilderness: Taking Stock of Visitor Perceptions and Trends, Manger Recollections, Long-term Observations, and Resource Conditions*. Collaborative project of Sequoia and Kings Canyon National Parks, Humboldt State University, and the Aldo Leopold Wilderness Research Institute. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Watson, A. E., R. Cronn, and N.A. Christensen

- 1998 *Monitoring Inter-Group Encounters in Wilderness*. Gen. Tech. Rep. RMRS-RP-14. Fort Collins, CO: US Forest Service, Rocky Mountain Research Station.

Weixelman, D.A.

- 2009 “U.S. Forest Service Long Term Range Monitoring 2008 Report.” Unpublished report. Adaptive Management Services, USDA Forest Service, Nevada City, CA.

Weixelman, D.A., G. Bakker and J. Fites.

- 2003 “USFS Region 5 Range Monitoring Project 2003 Report.” Unpublished report. Adaptive Management Services, USDA Forest Service, Nevada City, CA.

Weixelman, D.A., and D.C. Zamudio.

- 2003 “Determining Ecological Status of Sierra Nevada Mountain Meadows Using Plant Frequency and Soil Characteristics.” In: *California Riparian Systems: Processes and Floodplain Management, Ecology, and Restoration*. ed. by P.M. Faber. Proceedings of the 2001 Riparian Habitat and Floodplains Conference. Sacramento, CA: Riparian Habitat Joint Venture.

Welch, D.J.

- 1991 *Riparian Forest Buffers – Functional and Design Protection and Enhancement of Water Resources*. USDA Forest Service Publication NA-PR-07-91. U.S. Department of Agriculture.

Wenger, S.

- 1999 *A Review of the Scientific Literature on Riparian Buffer Width, Extent, and Vegetation*. Athens, GA: University of Georgia, Institute of Ecology, Office of Public Service and Outreach.

Whiles, Matt R., Karen R. Lips, Cathy M. Pringle, Susan S. Kilham, Rebecca J. Bixby, Roberto Brenes, Scott Connelly, Jose Checo Colon-Gaud, Meshagae Hunte-Brown, Alexander D. Huryn, Chad Montgomery, and Scot Peterson

- 2006 "The Effects of Amphibian Population Declines on the Structure and Function of Neotropical Stream Ecosystems." *Frontiers in Ecology and the Environment* 4(1): 27-34.

Whitaker, D.M., and Montevecchi, W.A.,

- 1999 "Breeding Bird Assemblages Inhabiting Riparian Buffer Strips in Newfoundland, Canada." *Journal of Wildlife Management*. 63, p. 167-179.

White, Dave

- 2011 "Yosemite National Park Transportation Experience Survey: Summary of Data Collection and Preliminary Results." Presentation to the National Park Service. Denver Service Center, Denver, Colorado.

White, Dave D., and Jessica F. Aquino

- 2008 *Visitor Perspectives toward Transportation Issues in Yosemite National Park*. Draft Final Technical Report. Phoenix: Arizona State University, College of Public Programs, School of Community Resources and Development.

White, Dave D., Yolonda L. Youngs, Jill A. Wodrich, and Tiffani Borcharding

- 2006 *Visitor Experiences and Transportation Systems in Yosemite National Park*. Final Technical Report. Phoenix: Arizona State University, College of Public Programs, School of Community Resources and Development.

White, P. J. T., B.J. McGill, and M.J. Lechowicz

- 2012 "Human-Disturbance and Caterpillars in Managed Forest Fragments." *Biodiversity and Conservation* 20(8):1745-1762.

Wildman, A.

- 1992 "The Effect of Human Activity on Great Gray Owl Hunting Behavior in Yosemite National Park, California." Master's Thesis, University of California, Davis.

Williams, J.H.

- 1914 *Yosemite and its High Sierra*. San Francisco: Tacoma and San Francisco.

Wimpey, J., and J.L. Marion

- 2011 "A Spatial Exploration of Informal Trail Networks within Great Falls Park, VA." *Journal of Environmental Management* 92:1012-1022.

Yosemite Area Regional Transportation System (YARTS)

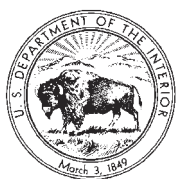
2009a YARTS Summer 2009 Highway 120 Schedule, June-September 2009. Accessed on line between October 1 and December 1, 2009 <<http://www.yarts.com/schedules.html>>.

2009b “YARTS Ridership Data for July 1999 through November 2009.” Provided by Dick Whittington, YARTS Transit Manager.

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