5. RIVER VALUES AND THEIR MANAGEMENT

This chapter begins with a brief orientation to the river values identified for the Merced River, designated as a Wild and Scenic River in 1987, and the concepts of management standards, adverse effect, and degradation integral to protection. The bulk of the chapter discusses each river value in detail, including a summary of its current condition, associated management concerns and considerations, specific actions to protect and enhance the river value, and the monitoring program the National Park Service (NPS) will use to protect river values from adverse effect in the future. The monitoring program described in this chapter and the associated actions to protect river values are common to all alternatives. Further actions designed to enhance river values vary by alternative (see "Alternatives" Chapter 8).

MANDATE TO PROTECT AND ENHANCE RIVER VALUES

The Merced River was added to the National Wild and Scenic Rivers System in acknowledgement of the river's (1) free-flowing condition, (2) water quality, and (3) outstandingly remarkable values (ORVs). Collectively, these qualities are referred to as river values. Section 10(a) of the Wild and Scenic Rivers Act (WSRA) provides the following broad direction related to river management:

> *Each component of the national wild and scenic rivers system shall be administered in such manner as to protect and enhance the values which caused it to be included in said system without, insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. In such administration primary emphasis shall be given to protecting its aesthetic, scenic, historic, archaeologic, and scientific features. Management plans for any such component may establish varying degrees of intensity for its protection and development, based on the special attributes of the area.*

Under the Merced River Plan, protection and enhancement of river values is accomplished by a series of initial actions to address immediate concerns and a commitment to a monitoring program to ensure that river values remain protected over time. In addition, all action alternatives in the plan include a number of site-specific actions directed toward the general improvement of conditions in the river corridor, thereby enhancing river values and fulfilling the goals of the WSRA.

THE RIVER VALUES OF THE MERCED WILD AND SCENIC RIVER

This section describes the river values of the Merced Wild and Scenic River. There are 20 outstandingly remarkable values (ORVs) in addition to the river's free-flowing condition and water quality, which the Wild and Scenic Rivers Act stipulates must be protected for all Wild and Scenic Rivers.

Free-Flowing Condition

A river must be in a free-flowing state to be eligible for inclusion in the National Wild and Scenic Rivers System. Once a river is designated, the managing agency is required to preserve it in its free-flowing condition for the benefit and enjoyment of present and future generations.

Water Quality

Another goal of the WSRA is to protect the water quality of designated rivers. Water quality in the Merced River is exceptionally high, and far superior to federal and state standards.

Outstandingly Remarkable Values (ORVs)

Section 1(b) of WSRA describes other values to be protected with wild and scenic river designation:

> *"It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be preserved for the benefit and enjoyment of present and future generations".*

The Interagency Wild and Scenic Rivers Coordinating Council (Interagency Council or IWSRCC) was formed in 1995 to assist those federal and state agencies charged with administering designated wild and scenic rivers.[1] The council's mission is to make recommendations that will foster consistency in the interpretation and implementation of WSRA. The council has issued specific guidance and criteria for identifying ORVs (IWSRCC 1999):

- To be considered an ORV, a value must be river-related or river-dependent. To be considered river-related or river-dependent, a value must be located in the river or on its immediate shorelands (generally within 0.25 mile on either side of the river); contribute substantially to the functioning of the river ecosystem; and/ or owe its location or existence to the presence of the river.
- To be considered an ORV, a value must be rare, unique, or exemplary in a regional or national context. To be considered rare, unique, or exemplary, a value should be a conspicuous example from among a number of similar values that are themselves uncommon or extraordinary.

The council described additional criteria for assessing each category of ORVs listed in the WSRA, noting that these criteria may be modified to make them more meaningful to a particular river. The council also notes that while no specific national evaluation guidelines have been developed for the "other similar values" mentioned in WSRA, agencies may assess additional river-related values, including but not limited to hydrology, paleontology, and botany resources, consistent with the guidance provided (IWSRCC 1999).

The NPS described and refined ORVs for the Merced River several times during the planning history for the river. As noted above, ORVs for the Merced were discussed in the river's eligibility study (1986), the *1996 Draft Yosemite Valley Housing Plan*, and previous river plans (2000 and 2005) that were ultimately invalidated by legal decisions. The major changes in the ORVs through time were:

- Air quality was listed as an ORV in the *1996 Draft Yosemite Valley Housing Plan*. Air quality was not listed as an ORV in the 2000 *Merced River Plan/EIS* and subsequent plans because it was inconsistent with IWSRCC criteria, and because it is not river-related or river-dependent.
- "Scientific resources" were removed as an ORV because the topic was considered vague, and the topic was inherent in all ORVs.
- Two ORVs, geology and hydrology, were merged in 2010. In the view of subject-matter experts, these interdependent ORVs are difficult to address separately in the context of the *Merced River Plan/DEIS*.

[1] See http://rivers.gov/council.html.

In 2010, the NPS conducted six workshops to consult with members of the public, academia, tribes, and other governmental agencies regarding ORVs for the *Merced River Plan/DEIS*. At the public workshops, the NPS described the ORVs to date and asked three questions:

1. Do you have any specific knowledge of locations with river-related or river-dependent features or resources not addressed by the NPS ORV report?
2. Do you have any knowledge or observations regarding the conditions of river features and values that should be addressed?
3. How should the NPS protect and enhance river resources and values?

The NPS also accepted written input on ORVs, and more than 30 people or organizations submitted letters. With input from other agencies, tribes, and members of the public, Yosemite park staff used the best available science and their professional judgment, to refine and finalize the list of river-related values for the *Merced River Plan/DEIS* (Table 5-1). The Sierra Nevada region was the primary region of comparison for determining rare, unique or exemplary status. More detail about each of the Merced River ORVs is provided in this chapter.

TABLE 5-1: OUTSTANDINGLY REMARKABLE VALUES (ORVS) OF THE MERCED WILD AND SCENIC RIVER IN YOSEMITE

Outstandingly Remarkable Values of the Merced Wild and Scenic River in Yosemite
Biological ORVs
Segments 1 and 5 – Merced River Above Nevada Fall and South Fork Merced River Above Wawona
1. The Merced River sustains numerous small meadows and riparian habitat with high biological integrity.
Segment 2 – Yosemite Valley
2. The meadows and riparian communities of Yosemite Valley comprise one of the largest mid-elevation meadow-riparian complexes in the Sierra Nevada.
Segments 7 and 8 – Wawona and South Fork Merced River below Wawona
3. Sierra sweet bay (*Myrica hartwegii*) is a rare plant found on river banks of the South Fork Merced River.
Geologic/Hydrologic ORVs
Segment 1 – Merced River Above Nevada Fall
4. The upper Merced River canyon is a textbook example of a glacially-carved canyon.
Segment 2 – Yosemite Valley
5. The "Giant Staircase," which includes Vernal and Nevada falls, is one of the finest examples in the western United States of stair-step river morphology.
6. The Merced River from Happy Isles to the west end of Yosemite Valley provides an outstanding example of a rare, mid-elevation alluvial river.
Segment 4 – El Portal
7. The boulder bar in El Portal was created by changing river gradients, glacial history, and powerful floods. These elements have resulted in accumulation of extraordinarily large boulders, which are rare in such deposits.
Cultural ORVs
Segment 2 – Yosemite Valley
8. Yosemite Valley American Indian ethnographic resources include a linked landscape of specifically mapped traditional-use plant populations and as well as the ongoing traditional cultural practices that reflect the intricate continuing relationship between indigenous peoples of the Yosemite region and the Merced River in Yosemite Valley.
9. The Yosemite Valley Archeological District is an unusually rich and linked landscape that contains dense concentrations of resources that represent thousands of years of human settlement.

TABLE 5-1: OUTSTANDINGLY REMARKABLE VALUES (ORVS) OF THE MERCED WILD AND SCENIC RIVER IN YOSEMITE

Outstandingly Remarkable Values of the Merced Wild and Scenic River in Yosemite
Cultural ORVs (continued)
Segment 2 – Yosemite Valley (continued)
10. The Yosemite Valley Historic Resources represent a linked landscape of river-related or river-dependent, rare, unique or exemplary buildings and structures that bear witness to the historical significance of the river system.
Segment 4 – El Portal
11. The El Portal Archeological District contains dense concentrations of resources that represent thousands of years of occupation and evidence of continuous, far-reaching traffic and trade. This segment includes some of the oldest deposits in the region and archeological remains of the Johnny Wilson Ranch, a regionally rare historic-era American Indian Homestead.
Segment 5 – South Fork Merced River Above Wawona
12. This segment includes regionally rare archeological features representing indigenous settlement and use along the South Fork Merced River at archeological sites with rock ring features.
Segments 5, 6, 7, and 8 – South Fork Merced River above Wawona, Wawona Impoundment, Wawona, South Fork Merced River below Wawona
13. The Wawona Archeological District encompasses numerous clusters of resources spanning thousands of years of occupation, including unusually rich evidence of continuous far-reaching traffic and trade. In Segment 7, remains of the U.S. Army Cavalry Camp A. E. Wood document the unique Yosemite legacy of the African-American Buffalo Soldiers and the strategic placement of their camp near the Merced River.
14. The Wawona Historic Resources ORV includes one of the few covered bridges in the region and the National Historic Landmark Wawona Hotel complex. The Wawona Hotel complex is the largest existing Victorian hotel complex within the boundaries of a national park, and one of the few remaining in the United States with this high level of integrity.
Scenic ORVs
Segment 1 – Merced River Above Nevada Fall
15. Visitors to this Wilderness segment experience exemplary views of serene montane lakes, pristine meadows, slickrock cascades, and High Sierra peaks.
Segment 2 – Yosemite Valley
16. Visitors to Yosemite Valley experience views of some of the world's most iconic scenery, with the river and meadows forming a placid foreground to towering cliffs and waterfalls.
Segment 3 – The Merced Gorge
17. The Merced River drops 2,000 feet over 14 miles, a continuous cascade under exemplary Sierra granite outcrops and domes.
Segments 5 and 8 – South Fork Merced River Above and Below Wawona
18. The South Fork Merced River passes through a vast area of exemplary and wild scenic beauty.
Recreational ORVs
Segment 1 – Merced River Above Nevada Fall
19. Visitors to federally designated Wilderness in the corridor engage in a variety of river-related activities in an iconic High Sierra landscape, where opportunities for primitive and unconfined recreation, self-reliance, and solitude shape the experience.
Segment 2 – Yosemite Valley
20. Visitors to Yosemite Valley enjoy a wide variety of river-related recreational activities in the Valley's extraordinary setting along the Merced River.

PROTECTING AND ENHANCING RIVER VALUES

At the direction of the U.S. President in 1982, the Secretaries of the Interior and of Agriculture jointly promulgated regulations (hereafter referred to as the guidelines[2]) implementing WSRA. The guidelines interpret the "protect and enhance" directive of WSRA as a "nondegradation and enhancement mandate for all designated river areas, regardless of classification." Under the guidelines, rivers must be "managed to protect and enhance the values for which the river was designated, while providing for public recreation and resources uses which do not adversely impact or degrade those values." To do so, agencies are instructed to address the kinds and amounts of public use that the river area can sustain without adverse effect to river values. Guidance is also provided on the location of major public-use facilities with regard to the river corridor and agencies are instructed to ensure that any such development does not adversely impact river values.[3]

The U.S. Court of Appeals for the Ninth Circuit (the Ninth Circuit) has interpreted WSRA and its implementing guidelines to mean that a comprehensive river management plan must contain provisions designed to prevent any adverse effects or degradation from occurring. Specific thresholds must be stated for mandatory management action that will occur ahead of any such impacts or degradation. In addition, a comprehensive river management must address "both past and ongoing degradation."[4]

In its technical report on managing wild and scenic rivers, the Interagency Council recommends that managers should document and eliminate adverse effects on ORVs, free flow, and water quality, "including activities that were occurring on the date of designation."[5] According to the council, any past degradation or adverse effects in existence as of the date of designation should be carefully assessed, and the managing agency should establish "a positive trajectory for any value that was in a degraded condition."[6]

In order to assess the health of river values at the date of designation and to ensure that no further degradation or adverse effect occurs, the Interagency Council recommends "the river administering agency should document baseline resource conditions and monitor changes to these conditions."[7] According to the council, this baseline:

> *"…serves as the basis from which the degree/intensity of existing and future impacts can be measured. All future activities are to be measured from this baseline to ensure continued high quality conditions and to eliminate adverse impacts (protect) or improve conditions (enhance) within the river corridor. If a thorough resource assessment that includes a baseline description of the outstandingly remarkable values is not completed at the time of designation, this assessment should be included in the river management plan. The river management plan then establishes the baseline conditions at the time of designation—including a description of any degradation—and proposes management actions that will be taken to improve conditions until they meet the requirement to protect and enhance the river's values."*

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2 National Wild and Scenic River System; Final Revised Guidelines for Eligibility, Classification and Management of River Areas, 47 FR 39454 (1982).

3 Id. at 39458-9. In order to be located within the river area, major public use facilities such as visitor centers, administrative facilities, and developed campgrounds, must be (1) necessary for public use or resource protection; and (2) infeasible to move outside the river area; and (3) have no adverse effects on River Values.

4 Friends of Yosemite v. Kempthorne, 520 F.3d 1024, 1035-36 (Ninth Circuit, 2008) [hereafter FYVIII].

5 IWSRCC, "Wild and Scenic River Management Responsibilities," page 26 (2002), available at http://www.rivers.gov/publications/management.pdf.

6 IWSRCC, "A Compendium of Questions and Answers Relating to Wild & Scenic Rivers," page 69 (2011), available at http://rivers.gov/publications/q-a.pdf.

7 IWSRCC, "Wild and Scenic River Management Responsibilities," page 22 (2002), available at http://rivers.gov/publications/management.pdf.

By assessing baseline conditions, past adverse effects or degradation can be identified and corrected.[8] In addition, any downward trends that could lead to adverse effects or degradation can be identified and addressed at an early stage. The river management plan then responds to the management situation described in the baseline condition report. The plan identifies management actions needed to correct situations where river values are threatened and proposes additional actions to enhance river values, where possible. In April 2011, the NPS produced a draft baseline conditions report of river values both at the time of the Merced River's 1987 designation and 2010. The July 2012 version of the *Merced Wild and Scenic River Values Baseline Conditions Report* incorporates the findings of scientific studies conducted specifically for the Merced River planning effort.

The WSRA program embodied in the river management plan includes the following steps, each of which is important in carrying out the act's mandate:

1. Identify and define river values
2. Define the terms "adverse effect," "degradation," "enhancement," "management standard," "management concern," and "management consideration" as they are used to describe the condition of river values
3. Assess the baseline condition of all river values, including both the current state and, to the extent possible, the condition at the time of designation (1987)
4. Select measurable indicators for each river value, and set metrics for the associated management standard and triggers for management concerns as well as thresholds for adverse effect and degradation
5. Assess each river value for the presence of adverse effects, degradation and/or management concerns, as defined in steps 2 and 4
6. Describe and commit to management actions needed to mitigate or eliminate adverse effects, degradation and management concerns
7. Implement a monitoring program for each indicator, with pre-determined conditions which will trigger specific management actions needed to ensure that river values remain protected and enhanced over time.

KEY CONCEPTS FOR RIVER MANAGEMENT UNDER WSRA

The following sections provide definitions of "adverse effect" and "degradation" in the context of WSRA requirements, which are not to be confused with similar terminology used for the National Environmental Policy Act (NEPA) analysis included in "Volume II" of this EIS or the analysis completed in accordance with the National Historic Preservation Act (NHPA). For purposes of WSRA, an *adverse effect* to a river value is not synonymous with an *adverse effect* to an impact under NEPA or an *adverse effect* to a historical property under NHPA. In this chapter, adverse effects under WSRA pertain specifically to ORVs and are defined according to measurable thresholds determined at a segmentwide scale. Adverse effects documented in NEPA for this plan are resource-specific and may be observed at a smaller scale. Thus, the adverse effects reported in Volume II do not necessarily equate to adverse effects/effects under WSRA/NHPA.

[8] According to the Interagency Council, adverse effects to river values "must be identified in development of the CRMP, with appropriate strategies detailed for their resolution." IWSRCC, "Wild and Scenic River Management Responsibilities," page 22 (2002), available at http://rivers.gov/publications/management.pdf.

Just as clarity is needed when defining the ORVs, it is necessary to define a number of terms in order to know how to translate the protection and enhancement mandate of WSRA into management activities. Recent guidance by the Interagency Council (IWSRCC 2011) equates protection under WSRA with the elimination of adverse effects. It is, therefore, important to define adverse effect in order to know what constitutes a "protected" state. The following sections define this term and others that are used in the management framework for protecting individual river values that has been developed for this plan and included in full detail later in the chapter.

Adverse Effect (WSRA)

Adverse effect is defined as a substantial reduction in the condition of a river value in relation to baseline conditions as a result of public use, development, and/or administrative use. An adverse effect is a segmentwide condition and requires immediate attention by the agency. It may be detected by periodic monitoring or by other means. When more than one indicator is monitored for any river value, an adverse effect associated with any one of the indicators constitutes an adverse effect on the value as a whole.

Under WSRA, the NPS must protect the river area against those impacts that "substantially interfere" with river values.[9] Degradation is not explicitly defined by WSRA or the Interagency Council guidelines. In cases of this nature, the Ninth Circuit has held that, absent further guidance, such terms should be given their ordinary meaning.[10] Therefore, the NPS has defined the term in accordance with its plain, ordinary meaning, and best professional judgment. The conclusion reached was that, for purposes of WSRA, an adverse effect would be defined as a substantial reduction in the condition of a river value throughout a given river segment. Such an impact could be sudden and unforeseeable, or it could develop over a specified period of time, as reflected through the findings of periodic assessments.[11]

As discussed in this chapter, the specific conditions that constitute an adverse effect have been defined for each river value. These metrics were established using the best available scientific information, including research conducted specifically for this planning effort, and reasoned professional judgment.

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9 Hell's Canyon Alliance v. U.S. Forest Service (USFS), 227 F.3d 1170, at 1177-78 (Ninth Circuit 2000). As one court has observed, the act requires managers to exercise discretion and judgment in order to strike a balance between use and preservation. Sierra Club v. Babbitt, 69 F. Supp. 2d 1202, 1254 (E.D. Cal. 1999). ("If anything, the WSRA seems deliberately ambiguous as to how an agency is supposed to balance the recognized tension between use and preservation.")

10 Friends of Yosemite Valley v. Norton, 348 F.3d 789, 796 (Ninth Circuit 2003) (citing Hell's Canyon Alliance v. USFS, 227 F.3d 1170, at 1177 (Ninth Circuit 2000). "Degradation" is not a term from the act, but from the Secretaries' Guidelines for River Areas. The Supreme Court has recently reaffirmed that where an agency's regulations construing a statute are ambiguous, the agency's own interpretation of those terms are entitled to substantial weight. Chase Bank USA, N.A. v. McCoy, 131 S. Ct. 871, 880 (2011). In this case NPS has determined that the ordinary meaning of the term "degradation" is the most reasoned reading of the text of the guidelines because it will enable the agency to use the best available science to establish clear and specific thresholds for degradation of each outstandingly remarkable value (ORV), as well as a monitoring program that triggers action intended to prevent degradation prior to its incidence. See FYVIII, 348 F.3d at 1034.

11 The requirement that in order to be an adverse effect, a decline must be substantial and sustained over time is intended to exclude limited, transitory, or natural fluctuations in condition from the definition. Many river values may experience temporary downward trends that are not indicative of any threat to the segment-wide condition of the river value as a whole. For example, an animal may drown while crossing the Merced River, thereby temporarily increasing nearby coliform bacteria counts. In another example, some downward trends may be the result of natural variations in function over time. Drought years, for example, may negatively influence the diversity and productivity of grasses in Yosemite Valley Meadows for several years in a row. For these reasons, the trends leading to adverse effects must be reflective of something more than inconsequential changes or short-term fluctuations. More rarely, sudden unforeseeable impacts may occur that require immediate action to mitigate. For example, a chemical or fuel spill that meadow would create such an adverse effect.

Degradation

Degradation is defined as the state in which a river value has been fundamentally altered by public use or development to the point that its value is lost for at least a decade. Degradation is a long-term condition that is segmentwide. A river value has been degraded when recovery would only be possible through a sustained change in park management and a significant investment of financial and natural capital. Degradation may be detected by the baseline condition assessment, by periodic monitoring, or by other means.

The Ninth Circuit has held under WSRA that a comprehensive management plan must "trigger management action before degradation occurs."[12] Like adverse effect, degradation is not defined in either the act or the guidelines. This plan therefore relies on the common, ordinary meaning of the term. Merriam Webster's *Collegiate Dictionary, Tenth Edition*, defines degradation as a "decline to a low, destitute, or demoralized state," while degrade is defined as "to lower or impair in respect to some physical property" or "to lower in grade, rank, or status." Similarly, Webster's *Third New International Dictionary Unabridged* uses both of the above definitions of degrade as well as "to lower from a superior to an inferior level." Thus, the common, ordinary meaning of degradation is consistent with that given above: a substantial reduction in the condition of a river value to a clearly defined, low state of functioning.

As presented in this chapter, each river value has a specific set of conditions that equate to degradation. The NPS relied on the best available science and reasoned professional judgment in determining conditions.

Enhancement

Enhancement **is defined as actions taken to improve the condition of a river value.** This definition is based upon guidance provided by the Interagency Council: "Enhance rivers by seeking opportunities to improve conditions."[13] Such actions would improve the conditions of a river value to the point where the river value's condition meets or exceeds the management standard (defined below).

Management Standard

A management standard **is defined as the desired condition of a river value.** Under this plan, all river values will be protected and enhanced in accordance with WSRA and the Secretaries' Guidelines for River Areas. The management standard is the desired condition of a river value attainable under current trends and influences beyond NPS control. As discussed in more detail below, most river values are currently in a condition that is better than the management standard and within desired conditions. Enhancement actions included in the plan will serve to increase this margin of quality.

Management Concern

The goal of this river plan is to maintain all river values in a condition that meets or exceeds the associated management standard. However, in a dynamic natural setting, fluctuations in resource conditions can be expected to occur over time. The key to successful management then is to provide a series of checkpoints in the monitoring framework that will be used to trigger actions to arrest downward trends before conditions

[12] FYVIII, 520 F.3d 1024, 1034-35 (Ninth Circuit 2008).

[13] IWSRCC, "Wild and Scenic River Management Responsibilities," page 26 (2002), available at http://rivers.gov/publications/management.pdf.

drop below the management standard. Therefore, for each river value, a series of "trigger points" have been established at incremental levels above the management standard. When monitoring indicates that the condition of the river value has dropped below a trigger point, the situation is described as a ***management concern***. Management concerns are to be immediately addressed and corrective measures have been pre-identified and included in the management framework described for each river value later in this chapter.

Management concerns are segmentwide conditions (such as informal trails fragmenting a meadow complex that dominates a river segment) but are correctable and do not bring the river value condition to the level of adverse effect or degradation. Another form of management concern is a downward trend in river condition that is occurring so slowly that the river condition has not yet been adversely affected but would if given adequate time and continued decline. In either case, the NPS will take the actions identified for each river value when a trigger point is reached. A river value that has documented management concerns is still considered to be protected but requires management action to remain so.

Management Consideration

Management considerations are localized areas of impact to components of a river value where management actions can be taken that will improve (enhance) conditions in the river corridor. Management considerations were developed from information in the *Merced Wild and Scenic River Values Draft Baseline Conditions Report*, the 2011 ORV workshops, public comment, and park staff input. Management considerations also include programs or specific actions to protect and enhance the long-term condition of river values, such water quality monitoring. Because of limited extent, management considerations can be corrected with relatively simple actions that help to ensure the associated river value remains at or above the management standard.

Baseline Conditions Assessment

To assess the health of river values and ensure that no degradation or adverse effect occurs, the Interagency Council recommends that managing agencies "document baseline resource conditions and monitor changes to these conditions."[14] According to the council, the baseline resource condition:

> *"… serves as the basis from which the degree/intensity of existing and future impacts can be measured. All future activities are to be measured from this baseline to ensure continued high quality conditions and to eliminate adverse effects (protect) or improve conditions (enhance) within the river corridor. If a thorough resource assessment that includes a baseline description of the ORVs is not completed at the time of designation, this assessment should be included in the river management plan [for the Merced River Plan/DEIS, that assessment is summarized in this chapter, and provided in its entirety in an attached DVD]. The river management plan then establishes the baseline conditions at the time of designation—including a description of any degradation—and proposes management actions that will be taken to improve conditions until they meet the requirement to protect and enhance the river's values …."*[15]

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14 Interagency Wild and Scenic Rivers Coordinating Council, "Wild and Scenic River Management Responsibilities," page 22 (2002), available at: http://rivers.gov/publications/management.pdf.

15 Interagency Wild and Scenic Rivers Coordinating Council, "A Compendium of Questions & Answers Relating to Wild & Scenic Rivers," page 70 (2011), available at www.rivers.gov/publications/q-a.pdf.

By assessing baseline conditions, managing agencies can identify and correct past degradation.[16] Downward trends that could lead to adverse effects and degradation can be identified and addressed at an early stage. In April 2011, the NPS produced a draft baseline conditions report of river values both at the time of the Merced River's 1987 designation and in 2010. The *Merced Wild and Scenic River Values Baseline Conditions Report* continued to be revised to reflect newly completed scientific studies that informed river values. An updated July 2012 baseline conditions report is available at http://www.nps.gov/yose/parkmgmt/mrp_documents.htm.

Monitoring Program

The monitoring program in the *Merced River Plan/DEIS* fulfills the Secretarial Guidelines to ensure "studies will be made during preparation of the management plan and periodically thereafter to determine the quantity and mixture of recreation and other public use which can be permitted without adverse effect on the resource values." This plan defines a set of measureable indicators to monitor the condition of each river value through time as described in this chapter. Yosemite National Park staff selected indicators for their ability to provide insight into the integrity of the river value and provide early warnings of change. Park staff also required indicators to support objective and easily obtained data collection that is repeatable across time and across observers. The monitoring program for an individual river value may be refined, if necessary, through time as more information becomes available.

HISTORICAL RESOURCE CONDITIONS ASSOCIATED WITH DEVELOPMENT

This section provides an overview of development patterns over time in Yosemite Valley, the extent of development that has occurred in the past, and how this development has been managed over the decades. The *Draft Baseline Conditions Report* (available online) provides more detailed information on changes in resource condition over time, and "Proposed Ecological Restoration Actions within the Merced River Wild and Scenic River Corridor" (Appendix E) provides a more detailed explanation on actions of this plan to improve conditions of the Biological ORVs.

Overview of Historic Development Patterns

Since the Yosemite Grant was established in 1864, Yosemite Valley has been the focus of constant, ongoing human attention and manipulation. The Valley's development footprint has constantly changed over time, growing, shrinking, and changing pursuant to the human needs and perceptions of the given era. Along with the development footprint, human activities have influenced the natural vegetation and condition of the Merced River over time. These changes have been the subject of numerous inquiries over time, including several books (Runte 1990, Demars 1991, Sanborn 1981, Carr 1998) and, more recently, a National Register nomination (NPS 2006) for the Yosemite Valley Historic District. The nomination, which succinctly describes the long evolution of Yosemite Valley development, indicates several changes in park philosophy since 1864:

[16] According to the Council, adverse effects to River Values "must be identified in development of the comprehensive management plan, with appropriate strategies detailed for their resolution." Interagency Wild and Scenic Rivers Coordinating Council, "Wild and Scenic River Management Responsibilities," page 22 (2002), available at http://rivers.gov/publications/management.pdf.

> *"The Yosemite Valley landscape is the result of a long and complex history of interactions between natural systems and human influences. For thousands of years, American Indians managed the landscape through burning and other practices. In the 1860s, Euro-Americans took over management of the valley floor landscape for the purpose of preserving it as a public park. This has resulted in a 150-year history of agricultural use, clearing, burning, and facility development. Yosemite Valley today is the landscape record of one of the most ambitious and historically significant experiments in the preservation of natural scenery ever attempted."*

Unlike much of the rest of Yosemite and most backcountry areas in the country's other large national parks, Yosemite Valley is a landscape as much influenced by people as it is by nature.

Historic manipulations of the Yosemite Valley landscape began almost immediately after Euro-American discovery. The first permanent hotel in Yosemite Valley was built in 1856. Called the Lower Hotel, it was the first of a string (Lower Hotel, Upper Hotel, Leidig Hotel) that were in place by 1869 (Greene 1987). Clusters of buildings also proliferated at the foot of the present Four Mile Trail (the "Lower Village"), and south of the river to opposite Yosemite Falls (Yosemite Village, now referred to as Old Yosemite Village). The first road reached the valley in 1874, with a carriage road circumnavigating the valley floor completed in 1882. During this era (1851-1889), homesteaders built farm buildings, corrals, fences, bridges, a ferry crossing, gardens, orchards, irrigation ditches, fenced grazing areas, sawmills, and plantings of hay and grain. Visitors also camped anywhere they desired throughout the valley in this era.

This summary of human structures only begins to provide one with an idea of the full extent of human activity and changes occurring in the valley at this time. Widespread human *activity* was also occurring that manipulated the landscape in both obvious and subtle ways. Additional vignettes taken from the Yosemite Valley Cultural Landscape Report (1994) demonstrate Yosemite Valley was no different from the rest of California, experiencing rapid and irreversible change at this time:

- *"The land between Hutchings' House (Sentinel Hotel) and the Merced River was a small lawn with scattered shade trees, hitching posts and rails. Across the river, meadowland was used to grow hay" (1868).*
- *"By 1870, Lamon's gardens and orchards were producing strawberries, raspberries, blackberries, apples, pears, peaches, nectarines, plums, and almonds. In additions, 20 acres of El Capitan Meadow were plowed in an unsuccessful attempt to grow hay."*
- *"In 1879, the portion of land between the later Sentinel Hotel and the Merced was in use as a barnyard."*
- *"To alleviate the problem of the winding Merced River's tendency to change its banks and threaten crops and buildings, and to drain some of the valley's swampy meadows for development, Galen Clark used dynamite to blast away much of the moraine at the foot of the El Capitan. With the natural dam removed, the water table dropped at least five feet" (Milestone 1978 and 1990).*
- *"After the moraine was blasted, the marshy Leidig Meadow became fit for cultivation. The meadow was sown with timothy for hay until 1888."*
- *"In 1881, fine forage grasses had been thinned out of the meadows by constant travel and grazing animals. Coarser, more robust grasses replaced them."*
- *"In 1884, to stop the Merced's erosion activities, a trench lined with willow trees planted at an angle of forty degrees was dug along the river's banks and filled with rocks."*
- *"One hundred and fifty acres of the Stoneman Meadow were cleared and plowed for hay in 1887."*
- *"J.M. Hutchings established an elm-lined boardwalk between his hotel (the Upper Hotel or Sentinel Hotel) and his home at the foot of Yosemite Falls around 1866."*

Rapid development in Yosemite Valley inspired John Muir to fight for national park designation, which occurred in 1890. While 1,400 square miles surrounding Yosemite Valley were designated as national park, the original Yosemite Grant lands (the Valley and Mariposa Grove) were not. Nonetheless, the change in land designation surrounding the valley inspired the first understanding that rampant development and manipulation of the valley itself should be limited, for the State of California Commissioners overseeing it wrote: "The policy of this Commission is to preserve the floor of the valley as nearly as possible in its natural state; to avoid the grouping of buildings so as to form a village … to restore as rapidly as consistent with well ascertained principles of forestry, the park-like condition of the valley" (State of California 1890). Implementing policy over the course of the next decade, the commissioners specified no more than 200 acres on the valley floor would be under cultivation at one time. The commissioners also began the first attempts to improve resource conditions in the Valley:

> *"The policy of the commissioners of 1890 was to restore the vegetation of the valley to its 1851 appearance by clearing underbrush, reducing human intrusions to a minimum, and encouraging the growth of flowering plants. They responded to criticism of their management by arguing that the shifting banks of the Merced were responsible for much of the destruction of timber and meadowland in the valley."*

While these ideas were notable in their novelty, actual reduction in impacts did not occur throughout Yosemite Valley. Indeed, 1890 was perhaps the beginning of over a century of debate about what the proper level of development and recreation in the valley should be, and about the tension between articulated policies and their implementation on the ground in Yosemite Valley. While the commissioners oversaw the demolition of numerous structures and the continued clearing of trees and brush from meadows, the park's concessioner was expanding facilities to accommodate growing tourist numbers during that same time period with Camp Curry opening in 1899. In another example of actions taken to both protect park resources while accommodating visitors, riprap to protect a sugar pine at the bridge of the same name was installed in 1899, while almost all of Lower Village was removed (with only three buildings remaining there by 1901) (NPS 1994).

The paired efforts to protect resources and accommodate visitation continued during the U.S. Army's oversight of Yosemite (1906 to 1916), as well as the beginning years of the NPS (that took over Yosemite's administration in 1916). The army oversaw the construction of roads for automobile use. Tourist establishments complemented the roads. By 1913, the Old Village contained a general store, studio, dance and lecture pavilion, offices, the Cosmopolitan Bathhouse, several cottages, the Yosemite Chapel, a butcher shop, bakery, Wells Fargo office, cottages, a Masonic Lodge, and miscellaneous residences and out buildings. Nearby, a paddock for Tule elk appeared, as did an ice rink, ski jump, and toboggan run. Entertaining events complemented the structures, with bear-feeding shows and the fire fall starting during this era; riprapping continued as well.

Conversely, between 1916 and 1931, the NPS replaced this same village with its contemporary Yosemite Village. Designed and planned to be more harmonious with the surroundings, the new village was farther away from the Merced River (NPS 1994). The NPS phased out grazing in valley meadows, created designated picnic areas, and experimented with burning in Ahwahnee, Cook's and Bridalveil meadows.

The pattern of development and protection continued into the modern era. Mission 66, a decade-long program to upgrade park facilities nationwide, resulted in more structures in Yosemite Valley, as well as the removal of development from valley meadows, and an increase in associated meadow restoration programs.

Today, this combination of protecting and restoring resources while managing for development away from the river continues. The comparison of past development to current development shows the struggle between accommodating visitors and the services they require while protecting the natural scenery that drew tourists to Yosemite Valley in the first place. Never an easy balance to strike, this cursory review indicates that, while the development footprint has not decreased substantially, it has shifted away from the Merced River corridor and its Biological ORVs. Additionally, while some perceived incongruent activities may still occur in the valley, many more have joined the history books as public thinking about natural resource management and national park service policy has evolved. Overall, the NPS has done much to protect and enhance the Merced River and its resources before ORVs were ever defined.

Further detail on the impacts from development and public use can be found under the Historic Resource Conditions section under each individual ORV explanation.

Historical Resource Conditions by ORV

The following sections examine the impacts to ORVs from this history of development and public use.

Biological and Geological/Hydrological ORVs

Yosemite Valley Meadows and Riparian Vegetation: It is widely acknowledged that there have been significant changes in the vegetation composition of Yosemite Valley since 1851, particularly with regard to increase in extent/density of conifers and reduction of meadow extent. It is also widely acknowledged that American Indians strongly influenced the vegetation of Yosemite Valley (Gibbens and Heady 1964, Heady and Zinke 1978, Anderson 2005). While some scientific studies have shown natural factors contributing to these changes, it is most likely a combination of human induced and natural changes, such as cessation of American Indian burning, altered hydrology, domestic livestock grazing, public use of the meadows, wildlife herbivory, natural succession, and climate change.

Gibbens and Heady (1964) found that Yosemite Valley was forested prior to the arrival of American Indians, noting that American Indians controlled brush and tree growth in the Valley, keeping vegetation at the stage best suited to their needs. Indians largely accomplished this goal through the use of fire (Ernst 1943; Reynolds 1959, Anderson and Carpenter 1991, Taylor 2006). The Euro-American arrivals essentially eliminated anthropogenic fire from the Valley in the 1850s—perhaps the first ecological change bearing upon a Merced River ORV. Elimination had immediate effects, with a widespread establishment of trees in and around the meadows taking place after 1860 (Gibbons and Heady 1964). Plowing, mowing, burning, and probably in some cases severe overgrazing, complicated the increase in tree cover to varying degrees, as did the clearing activities of the 1890s, 1930s and 1940s. Nonetheless, a substantial reduction in the size of the meadows was becoming evident by the time Gibbens and Heady did their work.

Several authors (Heady and Zinke 1978, Anderson and Carpenter 1991, Taylor 2006) since have refined these conclusions, but the fundamental conclusion—that Yosemite Valley meadows have shrunk in size in the historic era—remains. Alterations in meadow hydrology, almost always making meadows drier, have had an equally altering effect. The blasting of the recessional moraine, for example, likely dropped the water table in El Capitan Meadow by approximately 5 feet, making it more conducive for tree establishment. Ditching done to drain the meadows had that effect, with roads built across meadows exacerbating the hydrological alterations (Madej et al. 1994, Milestone 1978, Cooper et al. 2008).

Madej conducted the primary investigation into the historic manipulation of the Merced River itself (Madej et al., 1991, Madej et al. 1994). She and her co-authors summarize the impacts to the Merced River in East Yosemite Valley in four general categories (Madej et al., 1991), all of which alter river dynamics significantly:

1. Vegetation loss caused by visitor use and subsequent bank erosion
2. Systematic removal of large wood from the channel up until the 1980s
3. Gravel mining for park road construction
4. Several bridges with openings too small to accommodate even minor flood flows

These changes have been significant, and likely irreversible. In fact, two of the scientists to examine Yosemite Valley meadows concluded—"So much alteration of the meadows has occurred that they can no longer be restored to their primitive state" (Heady and Zinke 1978:20). The extent to which this change should be considered adverse is unclear: Both Gibbens and Heady (1964) and Heady and Zinke (1978) argue that meadows largely exist and persist because of human intervention. To perpetuate meadows, perpetual management intervention will be required.

High Elevation Meadows: The meadows in the Merced Lake vicinity (Merced Lake-Shore, Merced Lake-West and Merced Lake-East, for example) were grazed by NPS and concessioner stock in 1987 and showed typical grazing-related impacts such as trampling, erosion, and a decline in herbaceous production (Sharsmith 1961).

Cultural ORVs

Yosemite Valley, Wawona, and El Portal Archeological Districts: Many of the most-researched archeological sites have been impacted by park-related development, often by construction of facilities that are now important historic resources themselves. For example, one multi-component archeological site located immediately adjacent to the LeConte Memorial Lodge experienced impacts from construction of the lodge and an associated road in 1915. At other archeological sites, pre-contact American Indian villages and middens have been damaged. The impacts have been largely due to construction of administrative and visitor facilities, including buildings, roads, utilities, trails, etc. In some El Portal locations, impacts to archeological sites are from mining and logging during the early 1900s. Though these sites may have been damaged, they are nonetheless listed as contributing elements of their respective archeological districts. The majority of the impacts to these sites occurred well before their National Register listings, and the impacts were not significant enough to preclude listing. Despite the impacts, these sites have been documented to contain intact cultural deposits with information important to understanding regional pre-contact and historic-era American Indian lifeways.

Yosemite Valley Black Oaks: Similar to meadows in Yosemite Valley, American Indians actively managed black oak stands in Yosemite Valley. This management likely included burning or hand pulling to discourage conifer encroachment and undergrowth, deer control, and planting. The purpose of this active management was to ensure a good harvest of acorns, which was an important part of their diet, and the reason for the Ethnographic ORV. Since the active management of black oak stands by American Indians ceased in the mid-1800s, mature individuals are being encroached upon by conifers, and recruitment (number of saplings) is low.

Scenic ORVs

Visible Historic Developments: Historic developments may be visible from the river in segments 1, 2, 3, 6, and 7. These include the Merced Lake High Sierra Camp, roads and other transportation infrastructure, lodging such as Housekeeping Camp and Yosemite Lodge, and campgrounds in Yosemite Valley, for example. These historic-era developments may affect the scenic ORV.

Recreational ORVs

Parkwide annual visitation was first recorded in 1906, marked at 5,414 annual visitors. A decade later, annual visitation increased six-fold to 33,390. At that time, the U.S. Army established checkpoints in Yosemite Valley (by 1913) to regulate traffic and respond to accidents (NPS 1994). Another 10 years later in 1926, annual visitation jumped to 274,209. It almost doubled again in 1936 to 431,192. While visitation was drastically reduced with the advent of World War II, the end of the war led to visitation skyrocketing. Visitation grew from 116,682 in 1943 to 640,483 in 1946. It was at this point in time when managers first acknowledged that existing visitor facilities and circulation routes were inadequate to handle the dramatic influx (NPS 1994). By the Mission 66 era, when visitation exceeded 1,000,000 (first in 1954), the NPS decided:

> *"the limited area of the Valley, in relation to the physical facilities essential to operate the park and to serve the tremendous number of park visitors attracted to it, is the heart of the problem. We can no longer continue to build, construct and develop operating facilities on the Valley floor without seriously impairing and ultimately destroying those qualities and values which the National Park Service was created to preserve and protect for future generations".*

Since then, visitation has continued to grow, regularly exceeding 2 million by 1967, 3 million by 1994, and 4 million today. Crowding and traffic congestion has become increasingly common.

River Values Not Impacted By Development

Some ORVs have not been affected by past development: the boulder bar in El Portal, the Giant Staircase, the glacially carved canyon, scenery in the South Fork area, recreation above Nevada Fall, high elevation archeological sites and rare features along the South Fork of the Merced River, Sierra sweet bay, and water quality.

Conclusion for Historical Resource Conditions by ORV

The above descriptions are just a very brief window into the multitude of changes that have taken place in Yosemite Valley since the first Euro-Americans arrived. The examples given illustrate the extent of past development in Yosemite Valley prior to the Merced Wild and Scenic designation. They are not meant to justify the current level of development in the Valley, but to remind us of how far the NPS has come in improving resource conditions within the Merced River corridor. Yosemite Valley has gone from an area where construction was haphazardly and hastily placed to capitalize on the best scenic views and where visitor use extended across most available space, to a more thoughtfully planned spatial organization that has attempted to move increasing use to areas of less sensitivity. The planned actions proposed in this Merced River Plan (see this chapter's discussions of each ORV and in Chapter 8) are intended to ensure that ORVs are protected and to implement actions to enhance the river values.

RIVER VALUE CONDITION, PROTECTION, AND ENHANCEMENT

This section describes the program to protect and enhance each ORV as proposed in the *Merced River Plan/DEIS*. For each ORV, the following will be discussed:

- The current condition of each ORV and condition at the time of the river's 1987 designation
- A description of the management program and actions to ensure each ORV is protected before adverse effects or degradation could take place. The management program includes:
  - A description of the indicator(s) used to monitor the condition of each ORV
  - Definitions of the management standard, adverse effect, and degradation
  - A description of the set of measures that would trigger increasingly aggressive management actions to protect each ORV
- Management concerns and associated protective actions proposed in Alternatives 2-6
- Management considerations and actions to enhance river values proposed in Alternatives 2-6

River Value: Free-flowing Condition

River Value: Free-flowing Condition
Location: All Segments of the Merced River
Description: A free-flowing river, or section of a river, moves in a natural condition without impoundment, diversion, straightening, riprapping, or other modification of the waterway (WSRA 1968, Section 16). Management considerations concerning free-flowing conditions focus on human-constructed modifications within the bed and banks of the Merced River, such as riprap, bridges, and infrastructure.
Management Objective: Reduce the overall amount of human-constructed modifications within the bed and banks of the Merced River through restoration, redesign, and other appropriate methods.

Condition at Time of Designation (1987)

As the Merced River flows from its headwaters in the High Sierra at 13,000 feet through its descent to El Portal at 2,000 feet, various elements impeded its movement at the time of designation in 1987.

- In the highest reaches of the Merced River, a few small structures and scattered sections of riprap impeded river flows in Segments 1 and 5. A small diversion dam above Nevada Fall diverted some flows during spring high water. Four small, wooden footbridges crossed the river upstream of the Nevada Fall Bridge and created minor constrictions.
- Between Nevada Fall and the Happy Isles Bridge, bedrock and massive talus boulders line the river channel, making it more resistant to human impacts. The free-flowing condition of the river was largely intact in this section, with only minor constrictions at the Vernal Fall Bridge, the Happy Isles Bridge, the Happy Isles Gauging Station Footbridge, three footbridges near the Happy Isles Nature Center, and footings associated with the Happy Isles Diversion Dam (which were removed in 2004-2005). From Happy Isles Bridge to Clark's Bridge, the channel was confined on the right bank by moraines for much of its length. This reach was generally stable at the time of designation (Madej et al. 1991).
- Below Clark's Bridge, the river becomes a meandering alluvial system. Although the alluvial reach of the Merced River in Yosemite Valley has been relatively free-flowing compared with most rivers in California, this segment was the most impacted reach of the river within the park, especially in east Yosemite Valley floor between Clark's Bridge and Sentinel Bridge.

In 1879, large boulders were blasted to deepen and widen the river gap through the El Capitan moraine, which lowered the base level of the Merced River by four to five feet (Milestone 1978). As a result, the extent and frequency of flooding in the upstream meadows were reduced within approximately three to four miles of the moraine (approximately up to Superintendent's Bridge) leading to drier conditions and loss of wetlands.

Since the 1870s, large wood, such as downed trees and logjams, was removed from the river to reduce flood risk near bridges and to facilitate road construction and river recreation. Large organic matter contributes to channel *roughness*, which slows down flows and dissipates energy of the water. The practice has encouraged faster, more erosive flows and promoted vertical channel erosion, referred to as downcutting, rather than point bar creation, lateral migration, and avulsion. The removal of large wood also contributed to channel simplification, creating a more homogeneous river. An inventory of large wood was done around the time of the river's 1987 designation (Madej et al. 1994). This study found 12 pieces of wood per kilometer in the upper study reach (between Clark's Bridge and Sentinel Bridge) and 29 pieces per kilometer in the lower reach (comprising 1.6 miles upstream of El Capitan Bridge). Cardno ENTRIX repeated this survey in 2010 and found the level of wood loading in 1994 was 7%-17% of the levels found in natural systems within the Douglas-fir/ponderosa pine forest of the eastern Cascades (Fox and Bolton 2007).

Evidence, such as historical maps and floodplain topography, suggests the Merced River has always had a high rate of lateral erosion, which may have increased in response to human activities, such as trampling along the banks. Between 1879 and the early 1970s, the NPS performed extensive bank stabilization to prevent channel migration near campsites and infrastructure. Riprap—used successfully as a management tool to prevent channel erosion—inhibits the free-flowing condition of the river by preventing natural stream processes, such as lateral migration and point bar formation (Florshiem et al. 2008; Schmetterling et al. 2001). By 1987, 25% of the river's banks had undergone bank revetment, primarily lined with riprap, between Clark's Bridge and Sentinel Bridge (the area with the greatest infrastructure and human presence). In the less-visited West Valley downstream of Swinging Bridge, riprap lines only 2% of the channel.

Between 1919 and 1986, visitor trampling along the banks between Clark's Bridge and Sentinel Bridge damaged riparian vegetation to the point that the river channel widened by an average of 27% and by more than 100% in some locations. In 1987 at the time of designation, 39% of the Yosemite Valley segment was actively eroding. Downstream in the west Valley, 25% of the banks were actively eroding. A strong association was found between levels of human use around campsites and river access points and the loss of riparian vegetation cover and accelerated bank erosion (Madej et al. 1991).

At the time of the river's designation, 11 historic bridges spanned the Merced River between Happy Isles and the Pohono Bridge. Hydraulic constrictions were especially pronounced at three arch bridges built in the 1920s: Stoneman, Sugar Pine, and Sentinel bridges (Madej 1991). Restrictive bridges cause eddy currents upstream and downstream that lead to bank erosion. Additionally, accelerated flows through the narrow opening have scoured the channel bed near bridges and resulted in bar formation downstream and river migration. Bridges also created hard points that anchored channel migration, preventing channel evolution. Some bridges, such as Sugar Pine Bridge, created such strong confinement that they appear to have increased the potential for channel avulsion by substantially eroding and widening naturally-occurring cutoff channels. The impacts of some of these bridges were exacerbated by the elevated road causeways leading to them, which intercepted and concentrated floodplain flows at high water.

Two dams and numerous utility crossings at the time of designation affected the Merced River's free-flowing condition.

- The Happy Isles Dam footing, a three-foot-high structure spanning the river, created a barrier to flow though it was no longer used to produce electricity or divert water.
- The Cascades Diversion Dam, a 17-foot-high structure about one mile downstream of Pohono Bridge, impeded the free-flowing condition of the river though it was no longer used for hydroelectricity since the mid-1980s. This decaying structure was removed in 2004.
- Utility lines crossed the riverbed at 13 locations, acting as small dams. The North Pines Lift Station at the confluence of the Merced River and Tenaya Creek also exacerbated riverbank erosion.

In Segment 4 at the time of designation, the Merced River near El Portal was confined by Foresta Road and associated abutments and riprap, which encroached into the historical channel bed in places. In El Portal, a small levee was located on the left bank of the Merced River, just downstream from the El Portal Road Bridge. This approximately 300-foot deflection bar protects the Trailer Village area from flooding. There is also a levee near the gas station and store. Other modifications to the river in Segment 4 include remnant rock diversions and the use of the Greenemeyer sand pit in the floodplain for sand capture and storage.

Bridges on the Merced River near El Portal included the El Portal Road Bridge and the Foresta Road Bridge. Neither bridge created significant impoundments that affected the free-flowing condition of the river.

In Segment 6 at the time of designation in the Wawona area, a small impoundment at the intake of Wawona's surface water supply was located near the end of Forest Drive. By the time of designation, the pool had filled with small cobbles, sands, and other sediments; however, this impoundment was not a major source of sediment and did not act as a significant barrier to river flow and dynamics.

In Segment 7 at the time of designation, Wawona bridges on the South Fork Merced River include the Swinging Bridge upstream of Wawona; the historic Wawona Covered Bridge, a timber-framed covered bridge; and the South Fork Bridge (Wawona Road). At the time of designation, the South Fork Bridge was a narrow bridge that has since been replaced. The original South Fork Bridge had unreinforced masonry cobble abutments and piers within the channel that affected the free flow of the South Fork Merced River and created local scour holes.

Current Condition

In Segments 1 and 5, all structures that existed at the time of designation remain, including the diversion dam above Nevada Fall and several small footbridges. Water for domestic consumption at Merced Lake High Sierra Camp is taken directly from the Merced River. Such withdrawals constitute at most 0.5% of the river's flow, as determined from 2012 abstraction rates (one of the driest years in Yosemite history).

Segment 2 is the most complex stretch of the Merced River because it includes Yosemite Valley, which hosts the majority of Yosemite's current 4 million annual visitors. Segment 2, therefore, incorporates the most impacts and the greatest number of management actions taken since designation, as presented here:

- Localized riverbank restoration projects have been implemented since 1987 at Housekeeping Camp, North Pines Campground, Sentinel Bridge, former Lower River Campground, and the original El Capitan Picnic Area. In addition, the Happy Isles Dam was removed in 2004. Restoration techniques included soil decompaction, re-vegetation, bioengineering stabilization, riprap removal, and fencing installation. Through restoration, approximately 1,700 cubic yards of riprap have been removed from the Merced River's banks; 2,600 feet of biotechnical bank stabilization have been installed; and 15,000 feet of fencing have been installed (Cardno ENTRIX 2012). In addition, 13 utility lines have been removed from the riverbed, and the North Pines Lift Station has been removed from riverbanks at the confluence of the Merced River and Tenaya Creek. These actions

eliminated some impediments to the free-flowing condition of the river; however, the fundamental causes of channelization remains large wood removal from the channel, bank revetment (e.g. riprap), bridge confinement, and continued bank erosion.

- No hardened bank stabilization, such as riprap, has been installed since the 1987 designation. Although the installation of riprap in Yosemite Valley largely ceased in the early 1970s, more than 3,500 meters of riprap still line the edges of riverbanks and streambanks in Yosemite Valley. Since 1987, the river has undermined riprap in some locations, and bank erosion is occurring behind the lines of riprap in other locations.
- Under current conditions, large wood continues to be managed, although less aggressively than in 1987 conditions. Large wood is maneuvered to riverbanks in the designated rafting area from Stoneman Bridge to Sentinel Beach, a practice considered best management due to the presence of commercial rafting. In part due to this practice, Cardno ENTRIX found that in the upper reach wood loading had increased from 19 to 70 pieces per mile, while in the lower reach the load had increased from 47 to 97 pieces per mile. This increase was also attributed to bank erosion and wood recruitment resulting from the 1997 flood. Within Yosemite Valley, wood loading varies, with the highest levels found in the Happy Isles reach. In Yosemite Valley, large wood loading is likely still below levels found in comparable natural settings, with a level of approximately 26%-35% of that found in a similar study of unmanaged watersheds in the eastern Cascades (Cardno ENTRIX 2012).
- Yosemite Valley's historic bridges continue to constrict river flows, similar to constrictions at the time of designation. Following the 1997 flood, the Happy Isles Gauge Bridge was removed from the channel, and Sentinel Bridge was reconstructed upstream of its original location. Three historically significant arch bridges continue to produce major hydraulic constrictions during high water events: Sugar Pine, Ahwahnee, and Stoneman bridges. The elevated multi-use trail connecting Sugar Pine and Ahwahnee bridges exacerbates these effects. At Sugar Pine Bridge, the bridge's small opening diverts some river flow into a cutoff channel. Greater flow and a steeper slope in the cutoff channel has led to substantial widening since 1919, increasing the potential for avulsion of the main channel in this location. At other bridges—even some of the non-arch bridges like Housekeeping and Swinging bridges—large scour holes have developed. Constructed of multiple piers on top of fill in the river bottom, these bridges create a weir-like impact to free-flowing conditions. Superintendent's Bridge, similarly, disrupts flow and results in the formation of artificial rapids.
- The current condition of additional infrastructure, related to bridges, affects the free-flowing condition of the Merced River in Segment 2. This includes abutments still standing at the former Happy Isles footbridge and the Happy Isles Gauge Bridge. In addition, the Pohono Bridge gauging station, identified as critical infrastructure, could be relocated north outside the river's bed and banks.
- Riverbank erosion and widening in Segment 2 have continued to occur since the time of designation. Erosion has developed on the outside of meander bends, with the most significant location near Sentinel Beach Picnic Area. Channel widening also developed through erosion of both banks between Swinging Bridge and El Capitan Picnic Area and on the outer bends between El Capitan Picnic Area and El Capitan Meadow (Cardno ENTRIX 2012).
- Water for domestic consumption is pumped from three different wells in Yosemite Valley. Even though extraction rates approach 700,000 gallons daily in the summer (the period of greatest use), groundwater levels in Yosemite Valley show very little effect. This is most likely due to both to the aquifer's great depth (there is as much as 2,000 feet of sediment overlying bedrock in Yosemite Valley, so there is substantial water-holding capacity) and due to recharge from surrounding areas. Consequently, such water extraction has no impact on the river's free flow, on groundwater recharge in nearby meadow/riparian areas, or on downstream ecosystems (Newcomb and Fogg 2011).

In Segment 3, the Cascades Diversion Dam, a 17-foot-tall impoundment that backed up the river 200 feet, was removed in 2004, allowing the river channel to be restored to natural conditions. Also in Segment 3, the El Portal Road was partially rebuilt after it suffered significant damage during the 1997 flood (the Merced River eroded the road's embankments). About 7.5 miles of the roadway were rebuilt, with extensive riprap.

Segment 4 conditions in El Portal continue to be similar to those at the time of the river's designation. The river is confined by Highway 140 and revetment (riprap, for example), which in places encroach into the historical channel bed. The small deflection bar built to protect the Trailer Court still exists. Other free-flowing impediments include the El Portal Road berm, remnant rock diversions, and remnants of the Greenemeyer sand pit no longer used for sand capture. Water for domestic consumption is taken from three wells in the El Portal area. These wells do not appear to affect groundwater levels or those in the Merced River (which has substantially higher flows than it does in Yosemite Valley).

In Segments 6 and 7 in Wawona, the South Fork Bridge was damaged during the 1997 flood and replaced in 2006 with a new bridge without piers in the river channel. As established in the WSRA Section 7 determination process, an evaluation for direct and adverse effects by the new bridge found no significant impediment to the free-flowing condition of the river during most flow conditions. In addition, a water intake structure at Swinging Bridge, diverting water to the Wawona Water Treatment Plant, remains.

Water for domestic consumption in Wawona (Segment 7) is taken directly from the South Fork Merced River, in Segment 6. In most years, there is adequate flow for the withdrawals, but in dry years like 2012 river levels can reach critically low levels. In 1987, the NPS implemented the *Wawona Water Conservation Plan*, which set the rate of diversion from the Wawona water intake at 0.59 cubic feet per second (NPS 1987) (water is diverted for domestic and irrigation uses). To protect instream flows for aquatic habitat, the plan enacts mandatory water conservation whenever the river reaches flows of less than 6 cubic feet per second. At flows of less than 6 cubic feet per second, diversions were limited to 10% of the river flow. The plan adequately protects the river's aquatic invertebrates and other life forms during such drought years, but increases in such withdrawals could harm native fauna (Holmquist and Waddle 2012). All alternatives would continue the conservation plan.

In Segments 5 and 8, current free-flowing conditions remain the same as in 1987 at the time of river's designation. There are no human-caused impediments within the river channel.

Management Program for Free-flowing Condition of the Merced River

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. The program to manage this river value identifies actions to address specific management considerations and a set of trigger points associated with management actions to maintain desired conditions. To prevent future impacts, the NPS would require all projects involving construction within the bed or banks of the river to undergo a Section 7 analysis as described in "Section 7 of WSRA—Determination Process for Water Resources Projects" (Chapter 4). The analysis would take place in advance of project implementation to ensure no adverse effects or degradation impacts occur on the free-flowing condition of the river.

Indicator - Impediments to Free-flowing Condition

WSRA specifies guidelines for determining appropriate actions within the bed and banks of a Wild and Scenic River. Section 7 of the act restricts hydrologic and water resource development projects and directs managing agencies to specify a process to determine whether or not a proposed water resources project is appropriate. Chapter 4 articulates the Section 7 Determination Process for Water Resources Projects, as proposed in the *Merced River Plan/DEIS*. This process is used to ensure that the free-flowing condition of the Merced River is preserved, in lieu of a specific monitoring program.

Management Standard

The management standard for free-flowing condition shall be preservation of the river in its current state, with no additional structures or impediments to free-flow within the bed and banks of the river. The Wild and Scenic Rivers Act provides for existing structures, as of designation, to remain.

Adverse Effect

Adverse effects on the free-flowing condition of the Merced River are defined as an increase in the number of bridges or addition of riverbank riprap; an addition of water diversion structures, or otherwise modifying the waterway in such a manner that free-flowing condition is negatively affected.[17] The addition of any structure within the bed and banks of the river would trigger a Section 7 analysis under WSRA. This definition of adverse effect would allow the NPS to add or modify structures if absolutely necessary, but would trigger an analysis that assures these structures do not impact free-flowing condition. Consider a proposal, for example, to add riprap to support a washed-out section of trail through a narrow section of a canyon. If there is no alternate route for the trail that is feasible and the river is otherwise constrained by the topography, then addition of a short section of riprap may not be considered a substantial impact to free-flow. If, on the other hand, riprap is required to maintain the trail in a historic trail alignment, and the river has migrated into the trail corridor and further migration would be impeded by the addition of riprap, then this would be considered an adverse effect to free-flow or even degradation.

Degradation Standard

Degradation of the free-flowing condition of the Merced River is defined as the addition of any structure that constrains the movement of the river through avulsion or progressive migration. Additional structures exceed this minimum and would contribute to a degraded state of the river.

Monitoring Free-flowing Condition

Proposed park management actions (for example, projects involving construction, maintenance, and activities involving ground disturbance) are already regularly reviewed by subject-matter experts and park management at NPS's Monthly Planning Forum. At this forum, any project proposed within the bed and banks of the Merced River is mandated to complete a Section 7 determination process to ensure compliance with Section 7 of WSRA. Table 5-2 displays trigger points and Section 7 analysis response associated with free-flowing conditions.

TABLE 5-2: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR FREE-FLOWING CONDITION

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Proposed construction of a project within the bed or banks of the Merced River.	Section 7 analysis.	Such analysis is required by the Wild and Scenic River Act and would prevent adverse effects from occurring.

[17] Adverse effect and degradation are specifically defined for the Merced River (they are not for the Tuolumne River in the *Tuolumne River Plan/DEIS*) because the potential for new development in the Merced River corridor is substantially greater than it is the Tuolumne River corridor. Specifically, the Merced River has considerably more existing impediments to free flow in Yosemite Valley, there are substantially more management actions proposed in the *Merced River Plan/DEIS* than in the *Tuolumne River Plan/DEIS*, and Yosemite Valley is not designated wilderness (where such wilderness boundaries closely approach the Tuolumne River, precluding such kinds of development in that area).

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached the trigger point identified in Table 5-2 above. There are no management concerns associated with the free-flowing condition river value.

Management Considerations and Enhancement Actions

Management considerations associated with this river value include the riverbank riprap, infrastructure within the bed and banks of the river, and bridges. The following actions would take place under Alternatives 2-6 to address these management considerations:

- ***Riprap revetment.*** Remove riverbank riprap to restore natural river processes. Replace riprap with native riparian vegetation and re-vegetate with riparian species (3,400 linear feet). Use bioengineering techniques where riverbank stabilization is necessary for infrastructure protection (2,300 linear feet) under Alternatives 2-6.
- ***Footings at the former Happy Isles footbridges***. Remove former footings and river gauge base from the bed and banks of the Merced River. Re-vegetate denuded informal trails.
- ***Base of the former gauging station at Happy Isles.*** Remove the gauge base from the bed and banks of the Merced River. Re-vegetate denuded areas.
- ***Pohono Bridge Gauging Station.*** Move the gauging station north of the river outside of the bed and banks of the river. Re-vegetate denuded areas.

The *Merced River Plan/DEIS* considers a range of options to address bridge-related considerations. These options range from removal of three bridges under Alternatives 2 and 3 to retention of all historic bridges under Alternative 6:

- **Alternative 2:** Remove Stoneman Bridge and restore river banks to natural conditions. Redesign the intersection at Sentinel Bridge and convert Southside Drive to a two-way road. Remove the Sugar Pine and Ahwahnee bridges and the berm that connects them, and restore river banks to natural conditions. Re-route the multi-use trail north of the river.
- **Alternative 6:** Retain all historic bridges. Improve riverbank condition and increase channel complexity at Sugar Pine and Ahwahnee bridges through construction of engineered log jams, strategic placement of large wood, removal of rip rap, and use of riverbank bioengineering techniques. Reduce the width of the cut-off channel associated with Sugar Pine Bridge by importing fill material, constructing log jams, and use of bioengineered bank stabilization techniques. If subsequent monitoring of riparian conditions reveals insufficient improvement (i.e. CRAM rating remains below 0.71) within 10 years of the implementation of these actions, more aggressive management action would be initiated, and the NPS would consider the removal of Sugar Pine Bridge.[18]

The NPS would remove Sugar Pine and Ahwahnee bridges in Alternative 4, and Sugar Pine Bridge in Alternative 5.

[18] Strategically placed log jams diffuse and direct high velocity flows, a property that makes them a valuable tool to mitigate altered flow regimes around bridges. Log jams, unlike traditional rock revetment, reintroduce habitat complexity within the channel by creating additional bars and scour holes, and by providing cover for aquatic organisms (e.g. Abbe et al., 2003). When used in conjunction with the wood retention policy and other log jams designed to facilitate bar formation, riparian vegetation recruitment, and resultant channel narrowing, log jams used around bridges form part of a comprehensive restoration and mitigation strategy designed to improve the hydrologic function of the Merced River.

Conclusion: Protecting and Enhancing Free-flowing Condition

The free-flowing condition of the Merced River is determined to be absent of adverse effects, degradation, and management concerns, although management considerations are present. The *Merced River Plan/DEIS* proposes actions to address specific considerations including removing riprap and removing unnecessary infrastructure in the river channel under Alternatives 2-6. Alternatives 2-6 consider a range of options to address bridge-related impacts in Segment 2, Yosemite Valley. The actions range from complete removal of selected bridges, to retention of bridges and use of design and engineering techniques such as constructed log jams to improve riverbank conditions and increase channel complexity near bridges. To prevent future impacts, the NPS would require all projects involving construction within the bed or banks of the river to undergo a Section 7 analysis. The analysis would take place well in advance to ensure that no adverse effects or degradation impacts occur on the free-flowing condition of the river.

River Value: Water Quality

River Value: Water Quality
Location: All Segments of the Merced River
Management Objective: Maintain exceptional water quality on all segments of the Merced River within Yosemite National Park and the El Portal Administrative Area.

Condition at Time of Designation (1987)

The U.S. Geological Survey (USGS) began ongoing monitoring of Merced River water-quality constituents at the Happy Isles gauge in 1968. At the time of river's designation in 1987, the USGS continued to monitor the Happy Isles gauge. Then, in 1994, the NPS published a comprehensive water quality report, which established baseline water-quality data for the Merced River. The overall water quality of the river was exceptionally high, with relatively few impacts caused by development and visitor use. Water quality in the South Fork Merced River above Wawona was characterized as high, while generally low in nutrients, salts, and suspended sediment, and high in dissolved oxygen. Only minor impacts from human activities were indicated (NPS 1994). Although limited data has been collected for the Merced River above Nevada Fall, the available information documented high water quality (Clow et al. 1996).

Current Condition

Current water quality in all Merced River segments is high, with most water quality sampling results near natural background levels. Water samples collected near Sentinel Bridge and Pohono Bridge showed higher bacteria levels than elsewhere in the watershed, but even those levels were well below public health limits (Clow et al. 2011). Nutrient concentrations are very low and have been for similar undeveloped areas (Brown and Short 1999; Clow et al. 2011). Some Yosemite Valley samples (9%-14%) indicated trace amounts of petroleum hydrocarbons (Peavler et al. 2008), most likely a result of stormwater runoff from parking lots and roads. Petroleum hydrocarbon concentrations, when detected, were well below the State of California water-quality limits. Higher water temperatures may result from a wider channel with less shading vegetation on the banks. Higher temperatures can result in decreased dissolved oxygen concentration.

Management Program for Water Quality

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program.

Indicators of Water Quality

The following variables related to water quality can be tied to human contact with water:

- Nutrient levels (total dissolved nitrogen, total phosphorus, nitrate plus nitrite, and total dissolved phosphorous)
- Total petroleum hydrocarbons
- *E. coli* (The State of California has proposed replacing the general fecal coliform indicator with *E. coli* as a more direct indicator of human disease potential. Adoption is on hold until the U.S. Environmental Protection Agency finishes a court-mandated review of bacteriological criteria, due October 2012. Given the likelihood that state standards will change, the NPS is adopting *E. coli* rather than fecal coliform as an indicator of water quality.)

Management Standard

The management standard for water quality shall be anti-degradation of the indicator condition from a baseline established in 2004-2008. Site-specific management targets are exceeded when annual sampling (nutrients and *E. coli*, respectively) exceeds the 95% upper confidence limit of the baseline condition (75th or 50th percentile) in greater than one in five years. Similarly, the standard for petroleum hydrocarbons is exceeded when hydrocarbons are detected in greater than one in five years.

Water quality criteria for the upper Merced River are established by the California Water Control Board through the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins. The Water Quality Control Plan adheres to the federal Anti-degradation Policy (40 CFR 131.12) by stating: "Chief among the State water policies for water quality control is State Water Board Resolution No. 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California). It requires that wherever the existing quality of surface or ground waters is better than the objectives established for those waters in a basin plan, the existing quality would be maintained unless as otherwise provided by Resolution No. 68-16 or any revisions thereto."

Adverse Effect

An adverse effect would be either of the following:

- Exceedance of the draft EPA's bacteriological criteria for water contact recreation *E. coli* one-day standard of 235 MPN/100ml (Most Probable Number of bacterial colonies per 100 milliliters) *and* subsequent exceedance of the 90-day geometric mean standard of 126 MPN/100ml. Exceedance of the bacteriological standard indicates a persistent contamination problem beyond normal flushing rainstorms that would result likely in a violation of state water-quality standards (protecting the designated use of Merced River waters for recreation).
- Exceedance of EPA Maximum Contamination Level for nitrate+nitrite of 10 mg/l (milligrams of nitrate and nitrite expressed as the weight of elemental nitrogen). Exceedance of the Nitrate+Nitrite criteria would be a violation of state water-quality standards as applied to municipal water sources. Waters designated for municipal use must also adhere to California drinking water regulations (Title 22), which include the EPA's Maximum Contaminant Limit for Nitrate+Nitrite. Levels of Nitrate+Nitrite, currently within Yosemite, are 10-100 times lower than this Maximum Contaminant Limit.

Degradation Standard

Degradation is defined as the inclusion of any Merced River segment on the federal Section 303d (Clean Water Act) listing of waters not attaining minimum water quality objectives. For the Merced River and the chosen water quality indicators, this will occur when there are 10 or more exceedances of the EPA's water quality standards over the course of the 303d reporting period of three years.

States are mandated "to identify waters that do not meet applicable water quality standards with technology-based controls alone and prioritize such waters for the purposes of developing Total Maximum Daily Loads (TMDLs)," according to California State Water Resources Control Board.

Monitoring Water Quality

The Merced River's water quality, as measured by nutrient levels and *E. coli*, would be measured at six locations and petroleum hydrocarbons at three of those six locations (noted with asterisks):

- Merced River above Nevada Fall
- Merced River above Happy Isles Bridge
- Merced River above Pohono Bridge*
- Merced River below Foresta Bridge*
- South Fork Merced River above Swinging Bridge
- South Fork Merced River below Wawona Campground*.

The monitoring protocol is available as a part of the overall Visitor Use and Impacts Monitoring program field guide: http://www.nps.gov/yose/naturescience/upload/Visitor-Use-Monitoring-Guide-v1-0-2010.pdf. In addition, Table 5-3 displays trigger points related to water-quality conditions and management response.

TABLE 5-3: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR WATER QUALITY

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Statistically significant upward trend in concentration of any of the indicator analyses at any one monitoring site.	Initiate investigation of water quality conditions in the area of consideration to identify potential point source.	These standards indicate possible deterioration of water quality. Steps taken here are focused on determining the persistence and source of the problem and whether more serious investigation and action are required to resolve the issue.
Trigger Point 2: Exceedance of proposed USEPA bacteriological criteria for water contact recreation E. coli one-day standard of 235 MPN/100ml at any one monitoring site in 2 consecutive monthly samples.	Initiate weekly sampling of E. coli at sites exceeding the limit until sample concentration falls below single sample limit (235 MPN/100 ml). Assure at least 5 samples are taken over the course of the 90 days following the first exceedance in order to determine 90-day geometric mean to determine adherence to proposed E. coli standard. If the geometric mean is greater than the 90-day standard of 126 MPN/100ml, a subsequent investigation shall take place.	This trigger point indicates potential violation of a state (and EPA) water quality standard. Subsequent prescribed sampling would determine whether the event was one time only or more persistent (more serious) in nature.

TABLE 5-3: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR WATER QUALITY

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Points 1 or 2	These actions may be taken for either trigger point above, depending on the type of impact: • Increase educational messaging regarding water quality. • If impacts are related to human waste (and where allowed by management objectives), provide toilet facilities. • If impacts result from erosion, improve conditions through restoration, trail rerouting, etc. • If impacts result from stock use, redirect/ reduce/limit stock use in certain areas. • Increase enforcement of permit requirements. • Increase ranger patrols in river areas to protect water quality and educate users. • Close some areas temporarily or permanently.	Actions may be initiated during or after the investigations listed under either trigger point to protect water quality and human health.
Source: Environmental Protection Agency		

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-3. There are no management concerns associated with the water quality river value.

Management Considerations and Enhancement Actions

Management considerations pertaining to this river value include water quality related to the impacts of automotive fluids and surface water runoff; potential hazards related to dump stations, septic tanks, and leach fields; and accelerated erosion and potential sediment loading in the Merced River. While water quality in the Merced River meets standards, the Secretarial Guidelines (USDI and USDA 1982) direct managing agencies to maintain or, where necessary, improve water quality to levels that meet federal criteria or federally approved state standards in Wild and Scenic River areas. The following actions proposed in the *Merced River Plan/DEIS* would take place to address these issues:

- Wawona Impoundment: Alternatives 2-6 would retain the current water collection and distribution system, and continue to implement the Water Conservation Plan related to the minimum flow analysis for the South Fork. Abandoned infrastructure (not related to the water collection and distribution system) would be removed from a side channel of the South Fork Merced River.
- Pack Trail from Concessioner Stables in Yosemite Valley to Happy Isles: Alternatives 2 and 4 would remove the pack trail along the Merced River and restore the area to natural conditions, as the Concessioner Stables would be removed. Alternatives 3 and 6 would re-route the pack trail to the north along the road where the stock trails converge with the Valley Loop Trail.
- Odger's Fuel Storage Facility: Alternatives 2-6 would remove and relocate the facility out of the 500-year floodplain.
- Yosemite Village Day-use Parking Area: Alternatives 2 and 3 would move the parking area north of its current location and closer to the Village Center. Northside Drive would be rerouted south of the parking area, outside the 10-year floodplain. The NPS would restore meadow and floodplain communities. Under Alternatives 4, 5, and 6, parking would be moved north to about 150 feet away from the ordinary high-water mark. The NPS would riparian habitat adjacent to the river.

- Parking Areas: Move parking lots away from the river and/or construct stormwater run-off mitigation measures that incorporate best management practices.
- Upper Pines RV Dump Station: Alternatives 2-6 would relocate dump station away from the river to a site between Curry Village and the entrance to the Pines Campgrounds.
- Wawona RV Dump Site: Alternatives 2-6 would relocate the dump site to an appropriate location away from the river.
- Waste Water Collection System for the Wawona Campground: Alternatives 2-6 would remove the current septic system and develop a waste water collection system. The NPS would build a pump station above the Wawona Campground to connect the facility to the existing waste water treatment plant.

Actions to address accelerated riverbank erosion and potential sediment loading are described under Geological/Hydrological ORV 7— the Merced River in Yosemite Valley as an outstanding example of a rare, mid-elevation alluvial river.

Conclusion: Protecting and Enhancing Water Quality

The Merced River's water quality is determined to be absent of management concerns, adverse effects, or degradation, although management considerations are present. To remedy these considerations, the *Merced River Plan/DEIS* proposes to continue to implement a water conservation plan for Wawona, including minimum flow thresholds; re-route the stock trail between Happy Isles Bridge and Clark's Bridge for stock use; and move parking lots away from the river and/or construct stormwater run-off mitigation measures that incorporate best management practices.

The plan would consider options to relocate the Upper Pines and Wawona RV dump stations, develop a wastewater collection system for the Wawona Campground to minimize water use and discharge, To preserve water quality in the future, the NPS would monitor the condition of water quality, and take specific actions should specific trigger points be reached. These trigger points are selected to inform managers well in advance of adverse effects or degradation impacts on water quality.

BIOLOGICAL ORVs

This section describes the program to protect and enhance each Biological ORV as proposed in the *Merced River Plan/DEIS*. Three Biological ORVs exist in the Merced River corridor, each related to specific segment(s) of the river (Table 5-4).

TABLE 5-4: BIOLOGICAL ORVS AND ASSOCIATED INDICATORS

ORV Number and Key Resource	Segment(s)	Indicator to be Monitored through Time
1. High-elevation meadows and riparian habitat	1 and 5	1. Meadow bare soil 2. Meadow fragmentation resulting from proliferation of informal trails 3. Streambank stability
2. Mid-elevation meadows and riparian communities in Yosemite Valley	2	1. Meadow fragmentation resulting from proliferation of informal trails 2. Status of riparian habitat 3. Riparian bird abundance
3. Sierra sweet bay population in the Wawona area	7 and 8	1. Population decline

Biological ORV—High-elevation Meadows and Riparian Habitat

ORV 1—The Merced River sustains numerous small meadows and riparian habitat with high biological integrity.
Location: Segment 1 (Merced River above Nevada Fall) and Segment 5 (South Fork Merced River above Wawona)
Rationale: Numerous small meadows and adjacent riparian habitats in this high-elevation environment owe their existence to the river and its annual flooding. The meadows and riparian habitat are exemplary in their intact condition and the great diversity of plant and animal species they support.
Management Objective: Manage human use in meadows and riparian habitat within the Merced River corridor to maintain high ecological condition; minimize habitat fragmentation; and protect the integrity of streambanks to conserve ecosystem processes associated with meadow and riparian function.

ORV Condition at the Time of Designation (1987)

Meadow conditions in 1987 at the time of designation were likely similar to conditions of today, with some exceptions. At the time of designation, the NPS allowed the concessioner to graze its pack stock at Merced Lake-West Meadow and Merced Lake-Shore Meadow, and trampling and grazing impacts were reportedly widespread and severe in these areas (Sharsmith 1961). In the early 1990s, the NPS closed these meadows to grazing. In general, the drier, upland edges of subalpine meadows in the Sierra Nevada became more forested during the last century. A comprehensive study by Millar et al. (2004) determined that this occurred during a "single distinct climatic pulse" that occurred from 1946 to 1975, when the weather was warm and dry with little annual variability and conditions fostered pine seed germination. Historic sheep grazing (Sharsmith 1959; Dunwiddie 1977) and fire suppression (DeBenedetti and Parsons 1979) are also implicated in conifer invasion in meadows. Pack stock grazing and fire suppression that occurred between 1946 and 1975 may have contributed to the forest invasion by adding more stress to grazed meadow plants. It is difficult to ascertain the extent, timing, or causes of this historic forest spread in specific subalpine and alpine reaches of the Merced River corridor due to a lack of studies and lack of consistent documentation of conifer removal activities in the past 150 years (Ballenger et al. 2011).

Current ORV Condition

In 2010, park personnel evaluated the condition of high elevation and subalpine meadows of the Merced River corridor. Most meadows reflected high ecological integrity, with the exception of some site-specific impacts. Alpine meadows displayed little to no impacts from visitors or pack stock, with the exception of braided and rutted formal trails in several meadows along the Red Peak and Triple Peak Forks (Ballenger et al. 2011). No stock impacts or informal trails were observed in alpine meadows in the river corridor (Ballenger et al. 2011). Subalpine meadows displayed site-specific negative impacts. For example, Merced Lake - East Meadow exhibited very low vegetation cover and high bare-ground levels associated with several years of administrative pack stock grazing. Researchers documented extensive informal trails at two subalpine meadow sites—Merced Lake - Shore and Merced Lake - East Meadow (Ballenger et al. 2011).

Management Program for ORV 1

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. The NPS conducted a widespread condition assessment for meadows in Segment 1 in 2010 (Ballenger et al. 2011). This study evaluated every meadow in the corridor in its entirety, using assessment protocols tailored to different elevations. In subalpine meadows, the study evaluated over 30 different metrics associated with meadows. In alpine meadows, the study focused on coarse composition of vegetation and substrate, and plant communities. In subalpine sites, the study assessed streambank and channel condition using an interagency protocol (Burton et al. 2011), and in alpine sites, the study used a rapid assessment protocol.

This condition assessment provided a foundation to focus meadow monitoring in Segment 1 on areas of special concern. Three distinct indicators were selected to monitor meadow conditions through time. The indicators are: (1) bare soil cover in meadows, (2) fragmentation of meadow habitats as a result of proliferation of informal trails; and (3) physical streambank stability. The NPS is currently testing a pilot monitoring protocol to precisely monitor the bare ground indicator in Segments 1 and 5.

Indicator 1 – Meadow Bare Soil for ORV 1

The amount and distribution of bare soil is considered an important indicator of meadow integrity as it directly relates to site stability and susceptibility to wind and water erosion (Smith and Wischmeier 1962; Morgan 1986; Benkobi et al. 1993; Blackburn and Pierson 1994; Gutierrez and Hernandez 1996; Cerda 1999). Researchers have linked grazing activities to increases in bare soil as well as decreased plant cover, decreased primary productivity, and shifts in species composition (Miller and Donart 1981; Trimble and Mendel 1995; Olson-Rutz et al. 1996; Fahnestock and Detling 2000; Cole et al. 2004). Trampling, by either humans or stock, can produce similar results (Cole 1995; Liddle 1975, 1991) with the added impact of soil compaction that compromises root growth and water infiltration (Gilman et al. 1987; Unger and Kaspar 1994; Pietola et al. 2005).

Candidate metrics for monitoring ecological condition in meadows subject to grazing and/or trampling pressures include vegetative cover, bare soil, species composition, and meadow productivity. Bare soil and basal vegetative cover are more sensitive indicators of meadow condition than species composition (Cole et al. 2004). For instance, bare soil increases at lower levels of disturbance compared with shifts in species composition in a variety of montane vegetation types of North America (including alpine meadow) (Cole 1993). Plant productivity may be more sensitive to grazing pressure than bare soil (Cole et al. 2004), but this measure may be impractical to monitor in Wilderness meadow settings. Furthermore, plant productivity is subject to high interannual variability resulting from climatic factors, such as precipitation (Walker et al. 1994), snowpack, or snowmelt (Walker et al. 1995). In addition to its relevance for monitoring meadow condition, bare soil measured from point data is efficient, objective, easily obtained, and repeatable across time and observers. Therefore, bare soil may be one of the most robust indicators of changes in meadow ecological condition.

Weixelman and Zamudio (2001) generated low, moderate and high ecological condition classes for bare soil cover values based on monitoring data from a comprehensive multi-year study in U.S. Forest Service meadows in the Sierra Nevada range (Table 5-5). These values were used to inform condition class development in Yosemite; however, the park may further refine condition classes based on monitoring data collected in Yosemite (protocol in development). These data will be collected from meadows with visitor

and pack stock use as well as meadows with no to low use levels and provide reference sites to discern changes in condition unrelated to human use or management actions. The monitoring approach may also include collecting information on meadow characteristics and human use to have an empirical basis for assessing bare soil causal factors. A specific approach would be determined during monitoring design.

TABLE 5-5: BARE SOIL COVER VALUES FOR ECOLOGICAL CONDITION CLASSES AMONG SIERRA NEVADA MEADOW TYPES (FROM WEIXELMAN ET AL. 2003)

Meadow type	High Condition	Moderate Condition	Low Condition
Montane			
Hydric meadow	0-4%	5-9%	>9%
Mesic meadow	0-6%	7-13%	>13%
Xeric meadow	0-8%	9-13%	>13%
Temporarily flooded	TBD	TBD	TBD
Subalpine			
Hydric meadow	0-4%	5-8%	>8%
Mesic meadow	0-6%	7-13%	>13%
Xeric meadow	TBD	TBD	TBD
Temporarily flooded	TBD	TBD	TBD
NOTE: The montane zone is 4,000 to 8,000 feet in elevation and the subalpine zone is 8,000 to 9,500 feet in elevation			

Management Standard

To meet the management standard for meadow bare soil, at least 75% of sites monitored in the river segment would have bare soil cover values within the range of high ecological condition, and no more than 15% of sites in low ecological condition (Weixelman and Zamudio 2001).

The values for bare soil cover that define ecological condition classes would vary according to meadow type and elevation (Table 5-5). For example, to be in a high condition class, a moist meadow would not have bare soil exceeding 6%, and a wet montane meadow (5,000-8,000 feet [1,500-2,400 meters]) would not have bare soil exceeding 4%. One meadow may contain up to 3 meadow types (wet, moist and dry), each of which would be sampled as an independent unit (a "site") and its values for condition class applied respectively. In order to determine whether the standard would be met at the segment-wide level, a percentage of sites in each low, moderate and high condition classes would be calculated.

The NPS based these management standards on data and recommendations from the U.S. Forest Service Region 5 (California) Range Monitoring Project. This project has been monitoring bare soil in relation to livestock use in Sierra Nevada meadows for 12 years (Weixelman 2009).[19] Ecological condition classes for bare soil values are based on point-intercept data collected from 363 meadows across a broad disturbance gradient (Weixelman and Zamudio 2001).

[19] There are no known standards for bare soil in published academic literature.

Adverse Effect

Adverse effects would be indicated when bare soil cover values are twice the bare soil cover value for low ecological condition (regardless of meadow type) in at least 40% of the sites in a river segment. For example, a subalpine wet meadow with double the bare soil cover value (as measured by point-intercept data) would have >16% bare soil cover. If a river segment contained 50 monitored sites, an adverse effect would be present if there were more than 20 sites with such a doubling of their respective bare ground cover values.

The condition ratings in Weixelman and Zamudio (2001) provide ecologically meaningful ranges for bare ground values that were derived from analyzing meadow data from the Sierra Nevada. This condition class approach provides a way to distinguish adverse effect from minor fluctuations in the amount of bare soil. Increases in bare soil that result in a values at double the low condition rating for more than 40% of meadow sites in a river segment would signify a more significant decline than a minor, short-term fluctuation in one meadow.

Degradation Standard

Degradation would be indicated when bare soil cover values are twice the bare soil cover value for low ecological condition (regardless of meadow type) in at least 80% of the sites in a river segment. For example, a subalpine wet meadow with double the bare soil cover value (as measured by point-intercept data) would have >16% bare soil cover. If a river segment contained 50 monitored sites, an adverse effect would be present if there were more than 40 sites with such a doubling of their respective bare ground cover values.

The ecological processes that sustain meadows are integrally tied to plant composition, vegetative structure, and soil stability. A meadow in low ecological condition would have a predominance of shallow- and tap-rooted species, lower vegetative cover, and a greater extent of bare soil. High amounts of bare soil indicate low meadow productivity and greater susceptibility to erosion. Bare soil amounts of the magnitude described above, widespread across meadows in a river segment, would likely indicate that the processes sustaining meadow function are in jeopardy within that segment of the Merced River corridor.

Monitoring – Meadow Bare Soil

The NPS is collaborating with the University of California-Berkeley and the University of Arizona to develop a protocol to monitor meadow bare soil cover. Together they completed a draft monitoring protocol and collected pilot data from representative meadow types in summer 2012. They will further refine the protocol based on pilot data results and will implement the protocol in meadows of concern and reference meadows in summer 2013.

Monitoring would occur in Segment 1 above Nevada Falls (e.g., Merced Lake, Washburn Lake, Lyell Fork) and in Segment 5 on the South Fork Merced River above Wawona (Moraine Meadow and meadows upstream of Moraine Meadow, for example). The NPS would evaluate meadows of concern as well as reference meadows within the Segments 1 and 5. As the protocol develops, specific meadows of concern will be identified for monitoring. Reference sites (meadows with little to no visitor or stock use) will also be monitored as needed to provide a comparison with meadows of concern. Every five years, NPS staff will re-evaluate which meadows in the corridor are in need of monitoring. The NPS would evaluate the effectiveness of the indicators on a regular basis to assure that the combination of these metrics fully protect ORV 1.

Bare soil amounts vary among meadow vegetation types and elevation zones. This variability is addressed by different values to define ecological condition for dry, moist, and wet meadows (Weixelman and Zamudio

2001). Temporarily flooded meadow types may also contribute to greater variability in bare soil cover than other wet meadows (NPS unpublished data). This variability may necessitate the development of bare soil standards for temporarily flooded meadows during the early portion of the monitoring program.

The recommended monitoring interval for bare soil is three to five years unless the amount of bare soil exceeds a management trigger, prompting an increase in monitoring frequency. A subset of sites may receive annual monitoring to obtain estimates of inter-annual variation. Monitoring may occur any time between meadow flowering and first snowfall. Table 5-6 displays the trigger points at which actions would be taken to maintain meadow condition well above the management standard. These trigger points are focused on both site-level and segmentwide conditions. Responses are taken at the individual meadow level; this is necessary to avoid a downward trend segment-wide that may be difficult to mitigate at that scale.

TABLE 5-6: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR HIGH-ELEVATION MEADOWS (BARE SOIL)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Bare soil indicates low ecological condition at any monitored site. OR less than 90% of monitoring sites within a river segment are rated in high ecological condition for bare soil.	Apply a secondary assessment method (e.g., California Rapid Assessment Method [CRAM, CWMW 2009]) for a qualitative evaluation of meadow condition.	Rapid assessments are diagnostic tools that provide standardized, rapid, field-based assessments of the overall condition or functional capacity of meadows. Assessing meadow condition would aid in identifying key stressors that may be affecting meadow condition. Assessment results would assist with interpretation of monitoring results. CRAM, for example, has undergone extensive peer review, and it performs well when compared with fine-scale quantitative condition assessments (Stein et al. 2009). A version of CRAM tailored to wet meadows is in development; it is best used in combination with quantitative measures (M. Denn, NPS, pers. comm.)
	Increase education about BMPS in meadows for all who use them.	Education in maintaining meadow condition would help prevent further increases in bare soil associated with human use.
Trigger Point 2: Bare soil indicates low ecological condition at any monitored site for two monitoring periods AND secondary assessment method indicates use is a stressor. OR less than 90% of monitoring sites within a river segment are rated in high ecological condition for bare soil.	Increase education about Best Management Practices in meadows for Wilderness visitors, park staff, and park partners.	Education in maintaining meadow condition would help prevent further increases in bare soil associated with human use.
	Work with Stakeholders to develop strategies for timing of use, then reducing use if needed to minimize impacts. Work with stakeholders to adjust use levels annually.	Determining effective strategies with stakeholders for managing meadow use is a necessary step in the process to protect and enhance meadow condition.
	Increase monitoring frequency: Monitor annually for 5 years and adaptively manage use levels based on monitoring results.	Frequent monitoring would help facilitate more rapid detection of, and management response to, changes in ecological condition. Its utility would be to evaluate the effectiveness of changes in the intensity and/or timing of use on meadow condition.
	Rest the meadow if necessary: temporarily discontinue grazing until conditions improve based on secondary assessment results. Establish a preliminary grazing capacity or adjust grazing capacity.	Allowing a period of meadow "rest" (removing stresses from grazing and/or trampling) has been shown to facilitate meadow recovery. Effects of trampling and grazing that are expected to decline with reduced use or avoidance of early-season use include soil compaction, bare ground exposure, and plant disturbance. Grazing capacities are estimates of use levels that can be sustained in a meadow based on available forage cover, productivity and site condition which can guide in setting an appropriate level of use.

TABLE 5-6: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR HIGH-ELEVATION MEADOWS (BARE SOIL)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 3: Less than 80% of monitoring sites within a river segment are rated as high condition or greater than 15% of sites in low ecological condition OR Bare soil is double the value of low ecological condition class at a site OR Previous management actions (such as reduction in use) have been ineffective OR Assessments for 5 years have not shown improvement in ecological condition	Apply a secondary assessment method (e.g., California Rapid Assessment Method [CRAM, CWMW 2009]) for a qualitative evaluation of meadow condition.	Rapid assessments are diagnostic tools that provide standardized, rapid, field-based assessments of the overall condition or functional capacity of meadows. Assessing meadow condition would aid in identifying key stressors that may be affecting meadow condition. Assessment results would assist with interpretation of monitoring results. CRAM, for example, has undergone extensive peer review, and it performs well when compared with fine-scale quantitative condition assessments (Stein et al. 2009). A version of CRAM tailored to wet meadows is in development; it is best used in combination with quantitative measures (M. Denn, NPS, pers. comm.)
	Rest the meadow: temporarily discontinue grazing until conditions improve based on secondary assessment results. Establish a preliminary grazing capacity or adjust grazing capacity.	Allowing a period of meadow "rest" (removing stresses from grazing and/or trampling) has been shown to facilitate meadow recovery. Effects of trampling and grazing that are expected to decline with reduced use or avoidance of early-season use include soil compaction, bare ground exposure, and plant disturbance. Grazing capacities are estimates of use levels that can be sustained in a meadow based on available forage cover, productivity and site condition which can guide in setting an appropriate level of use.
	Increase monitoring frequency.	Frequent monitoring would help facilitate more rapid detection of, and management response to, changes in ecological condition. Its utility would be to evaluate the effectiveness of changes in the intensity and/or timing of use on meadow condition.

Indicator 2 – Meadow Fragmentation Due to Proliferation of Informal Trails for ORV 1

This indicator encompasses fragmentation of high elevation meadow habitat due to the proliferation of informal trails. (The NPS will also use this indicator to monitor meadow conditions in Yosemite Valley as described in the next section.) Informal trails or social trails are tracks created by visitors or administrative use that are noticeable to observers and generally not managed directly by park staff, as opposed to formal trails that are mapped, periodically assessed, and maintained (Leung et al. 2002, 2011b). Various informal trail metrics have been commonly used as indicators of visitor-caused impacts throughout federal land management agencies, including other parks like Mount Rainier and Acadia (Kim and Daigle 2011; Rochefort and Swinney 2000), due to representation of impacts to both social and ecological conditions (Leung et al. 2011b; Monz and Leung 2006). Informal trail management has been found to be more difficult in subalpine environments where recovery rates are slow (Eagan et al. 2004; Kim and Daigle 2011).

The NPS selected this fragmentation-related indicator for this ORV because of its sensitivity in detecting spatial changes and thus protecting the pristine quality of large areas of intact meadow. In studies of trail impacts outside of meadow environments, researchers identified disturbance to vegetation and soils within one to three meters of the trail's edge (Dawson et al. 1974; Dale and Weaver 1974; Leung et al. 2011c). Research within meadow environments has demonstrated that impacts from trails can extend beyond the direct impacts on trails and can have sizeable impacts radiating from the trail's edge into the meadow (Holmquist 2004). The degree of fragmentation reflects the potential for impacts to meadow hydrology, habitat quality, soil moisture, and the introduction of non-native species (Forman 1995, Leung et al. 2011c; Lindenmayer and Fischer 2006). Trail corridors have also been shown to pose barriers for small mammals and other wildlife (Knight 2000; Miller et al. 1998; Gaines et al. 2003).

Although fragmentation is commonly used to measure impacts on the landscape scale, park managers and scientists at Yosemite and other public lands have used these metrics to assess impacts from recreation in the form of tracks and informal trails (Kutiel 1999; Leung et al. 2011b; White et al. 2011; Wimpey and Marion 2011). Investigation of trampling impacts in Yosemite Valley meadows demonstrates that meadow condition is poorer in heavily used areas, smaller areas are more prone to difficulties with recovery than larger areas, and visitor-created trampling has a significantly negative impact on vegetation and macroinvertebrate structure and diversity (Holmquist 2004; Leung et al. 2011a; Holmquist and Schmidt-Gengenbach 2008; Foin et al. 1977).

As fragmentation exists as a proxy for the aforementioned impacts, a fragmentation measure known as the Largest Patches Index –5 (LPI_5) would be used to measure level of fragmentation. Adapted from the concept of Largest Patch Index (Table 5-7) (McGarigal and Marks 1995), this index derives from the sum of areas of the five largest patches without informal trails divided by total landscape (meadow) area and then multiplied by 100. The resulting percentage indicates the extent to which the meadow area is divided (fragmented) owing to the existence of visitor-created trails. If no trails are present, the total index value would be 100%. The main purpose of grouping the five largest patches, instead of evaluating the single largest patch, is to reduce the index's over-sensitivity to changes in one single patch. Just as parks such as Mount Rainier have found variations of this metric best suited to their meadow system (Moskal and Halabisky 2010), Yosemite park staff and collaborators also considered the three largest and 10 largest patches (LPI_3, LPI_{10}), ultimately determining that five best achieved a balance between simplicity and representativeness for Yosemite's meadows.

TABLE 5-7: LARGEST PATCHES INDEX (LPI_5) – YOSEMITE VALLEY MEADOWS

Meadow	2006	2007	2008	2009	2010	2011
Ahwahnee		96.97			98.37	
Bridalveil		96.59			99.25	
Cooks A	93.84		75.53	80.05	78.63	86.19
Cooks B	99.10		98.20			99.34
Cooks C			99.09			95.04
El Capitan	87.24		83.47	78.18	78.01	79.23
Leidig		63.06		95.89	82.37	86.95
Sentinel A		92.58			93.55	
Sentinel B		98.37				99.90
Slaughterhouse A	98.60		98.27			86.86
Slaughterhouse B	99.02		99.31			99.74
Stoneman A	99.62	99.30	99.37	99.29	98.99	98.92
Stoneman B	99.71	99.90	99.81	99.91	99.94	99.84
Weighted Mean LPI_5 (Using Most Recent Data)						90.98

Management Standard

The fragmentation standard (LPI_5) for the montane and subalpine meadow complexes within segments 1, 2, and 5 of the Merced River corridor is a weighted mean of 93% for each segment, with no individual meadow less than 90%. The sum of the five largest intact patches for each selected meadow within the segment should be greater than or equal to 93%, as represented as a weighted mean, with no individual meadow less than 90%. The weighted mean values are selected by determining each individual meadow size relative to the total meadow area within each segment. Because the overall size of the meadow complex is a key component of the meadow ORV, using a weighted mean ensures protection for the integrity and overall extent of individual meadows and the full complex within each segment.

A group of subject matter experts determined this standard based on data from meadows throughout Yosemite (not just those in the Merced River corridor) that experienced elevated visitation levels, reduced vegetation cover, and an increased occurrence of invasive species. As there are no specific standards established for this metric in the literature, subject matter experts turned to two information sources to determine the appropriate standard for meadow fragmentation in the Merced River Corridor. First, they considered the fragmentation values recorded for several years in meadows both in the Merced and in the Tuolumne Corridors (since 2008). Meadows found to exhibit LPI_5 values below 90% were meadows with restoration needs and potential threats to biodiversity, soil erosion, and increased fragmentation. Conversely, meadows that were fully protective of species biodiversity, overall ecological integrity, and meadow hydrology (the fundamental components of this ORV) had a higher fragmentation standard, 93%. Second, the subject matter experts also performed a GIS analysis to determine the range of LPI_5 values expected to be found after management actions outlined in this plan are implemented. Another part of this second analysis was to consider the potential *impacts* that could incur alongside all of the proposed *actions* in the plan, such as expanding a campground next to a meadow. This second, two-pronged analysis determined that the fragmentation level (the LPI_5) would be 93%. Through these two analyses, then, park managers determined that the meadow fragmentation management standard of 93% would both protect this ORV and be attainable for the Yosemite Valley meadows.[20]

Adverse Effect

An adverse effect would be indicated at the segment level, when the weighted mean for the total meadows within one segment has dropped below an LPI_5 threshold of 81% for three consecutive years of annual assessments despite management actions to improve the connectivity and overall health of the meadow. Owing to fluctuations that are possible from year to year, specific precipitation patterns would be evaluated to ensure that the sampling interval reflects impacts caused by visitors as opposed to other natural causes.

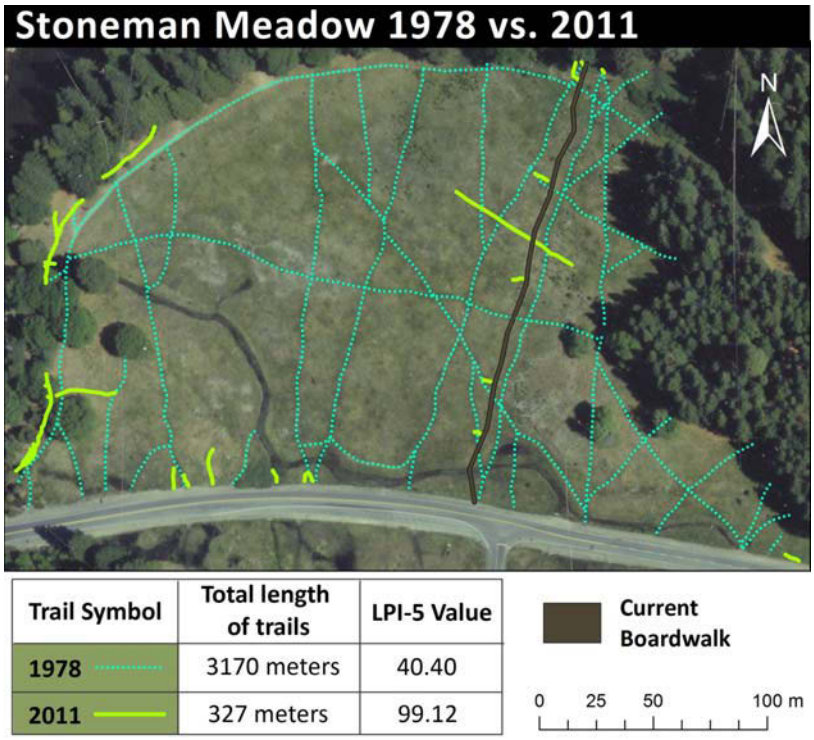
Patch size in some meadows has been shown to be associated with reduced total vegetation, increased bare ground cover and an increased presence of non-native plants (Leung et al. 2011b). The value chosen to represent adverse effects reflects conditions found in individual meadows identified by park staff, managers, and subject matter experts as needing significant restoration actions. This value relates to low values for meadows within Yosemite Valley as well as Tuolumne Meadows, both of which have been identified for comprehensive ecological restoration. Through several years of data collection in Yosemite meadows, the value of 81% has been selected to reflect the condition of meadows that had extensive trailing networks, significant trampling impacts from trailing and areas of bare ground, and identified as needing extensive ecological restoration. These meadows should demonstrate accelerated recovery rates and good response to restoration once actions are taken. A conservative number has been chosen from existing data for increased sensitivity to impacts (NPS 2009).

[20] As conditions are different across meadow types, which respond differently to varying levels of use, the management standard selected here for the Merced River corridor varies slightly from that selected to protect meadow values in the Tuolumne River Corridor, which is 90%.The fragmentation standards for the two plans demonstrate the range of acceptable values that are fully protective of the sensitive resources and that accommodate the inherent temporal variability in results from meadow fragmentation. In scaling this value up to the level of the segment, managers utilized best professional judgment in selecting a weighted mean that protects the river values at the segment level.

Degradation Standard

Degradation would occur when fragmentation resulting from informal trailing results in a LPI_5 of 40%, as reflected as a weighted mean of all meadows recorded within a segment. This applies to montane and sub-alpine meadow complexes in the Merced River corridor.

FIGURE 5-1: INFORMAL TRAILS IN STONEMAN MEADOW IN 1978 AND 2011



These 1978 informal trail values were determined based on the presence of trails in this aerial photograph from the Yosemite Archives. For LPI-5 values, all 1978 trails were given a default trail width of 12".

Using archival aerial photographs, NPS staff members were able to simulate meadow degradation in certain Yosemite Valley meadows. Specifically, spatial analysis utilizing a 1978 image of Stoneman Meadow (Figure 5-1) revealed that an LPI_5 of 40% existed prior to intensive restoration efforts. The figure represents an example of a meadow in a degraded state. Although this meadow has shown evidence of recovery in recent years, the recovery was a result of intensive restoration efforts, significant financial investment, and several years of planning. Past conditions in Stoneman Meadow represent meadow conditions that park managers and scientists feel best represent the level of degradation for meadows in Yosemite, including subalpine and alpine meadows. Current conditions in Stoneman meadow demonstrate the potential for recovery that is possible through intensive restoration efforts.

Monitoring Meadow Fragmentation due to the Proliferation of Informal Trails

All meadows selected for monitoring will be evaluated for a complete set of measures reflecting extent, proliferation, and condition of trails and disturbed areas (Leung et al. 2011b). Monitoring of informal trails in meadows within the Merced River corridor would take place during the middle of the growing season before plant senescence. All meadows with a high potential for visitor-created impacts would be monitored on a three-year basis or at a maximum of five years. Meadows with specific management considerations would be monitored annually. Increased monitoring frequency may be triggered by actions listed in Table 5-8. Meadows of consideration are identified for increased monitoring based on other trends found in metrics collected alongside fragmentation data. Table 5-8 depicts measures that would trigger management response.

TABLE 5-8: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR HIGH-ELEVATION MEADOWS (MEADOW FRAGMENTATION)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Decrease in LPI_5 threshold below 93% at the level of an individual meadow.	• Increase meadow monitoring assessments to one-year interval at each individual meadow that surpasses this value. Target the largest patches in meadow, and analyze trail condition and emergence of new trails. • Increase enforcement and education of best management practices in meadows. • Implement restoration practices, including visitor messaging, restoration signs after Wilderness Minimum Requirement Analysis, delineation of trails determined to be less disturbing to meadow ecology, and closure of informal trails.	This action allows increased sensitivity to changes in trails, and would allow managers better opportunities to identify meadows of consideration, and take actions well before adverse effects are incurred. With more frequent assessment, emerging trails and particularly problematic trails would be identified and restoration actions taken.
Trigger Point 2: Data analyses from annual monitoring of fragmentation yields results less than an LPI_5 value of 93% for three consecutive years in an individual meadow or, a decrease below 90% at the level of an individual meadow.	Further restoration of disturbed areas and informal trails in specific meadows that exceed trigger. Depending on the degree and extent of impacts, the NPS would enact some or all of the following actions: • Use boardwalks or hardened surfaces to allow access to sensitive areas. • Delineate trails through upland areas and along meadow perimeters to allow access while reducing fragmentation and meadow impacts. • Place restoration closure signs, and/or • Outside Wilderness, fence meadow perimeters. Within Wilderness, fence meadow perimeters if deemed appropriate after a Wilderness Minimum Requirement Analysis. • De-compact trampled soils. • Salvage plants growing in trail ruts and use as part of re-vegetation to consolidate multiple parallel trails. • Re-contour topography. • Scatter locally gathered seed and organic materials to facilitate new plant growth. • Fill deep headcuts caused by informal trails with native soil and re-contour to natural meadow topography. • Institute closures in individual impacted meadows, and increase visitor education associated with the closures	This value represents the level at which a group of subject matter experts determined meadows to be threatening resource protection and quality of visitor experience.

Indicator 3 – Streambank Stability for ORV 1

Impacts to streambank stability can result from many causes, including both anthropogenic and natural sources that alter sediment-discharge balance (Kondolf et al. 1996), and may be the result of cumulative impacts from both source types (Allen-Diaz et al. 1999). Examples of anthropogenic activities that contribute to destabilization of streambanks (hereafter, streambank alteration) include the following:

- Human foot-traffic (bank shear, compaction, vegetation trampling)
- Stock use (hoofpunching, bank shear, soil compaction, vegetation trampling, vegetation removal from grazing)
- Road/trail construction and/or informal trailing (soil compaction, decreased sheetflow, reduced infiltration/percolation, increased surface routing and flow velocities, vegetation composition changes)

Streambank stability is a long-term indicator of system function over time, and monitoring data on stability conditions can be used to verify the achievement of management objectives. Low ratings for streambank stability would be indicative of reduced system function and diminished biological integrity of riparian areas within the specified river segments.

Streambank stability ratings comprise a combination of habitat type, vegetative cover, and the presence (or absence) of erosion features (Frasier et al. 2005; Burton et al. 2011). Results of quality control tests conducted by Archer et al. (2004) demonstrated that streambank stability ratings had generally low coefficients of variation, were repeatable, and were consistent among different observers (especially for dichotomous ratings – either stable or unstable). Streambank stability has been widely identified as a factor affecting the geomorphic function of stream channels (Kondolf et al. 1996; Kattleman and Embury 1996; Madej et al. 1994; Kauffman et al. 1997).

Standards for streambank stability have been reported in published literature from various survey protocols, including the Pfankuch-Rosgen Channel Stability Assessment (Rosgen 2001), Stream Condition Inventory (Frazier et al. 2005), and Multiple Indicator Monitoring (Burton et al. 2011). Each protocol and corresponding optimal value for streambank stability ratings was considered in the determination of the trigger point, management target, adverse effect, and degradation standard for this ORV.

The following delineations for trigger point, management standard, adverse effects, and degradation standard are described hierarchically—in terms of increasing spatial and/or temporal scale from trigger point and management target, to adverse effects, and lastly to degradation standard. The trigger point and management target are determined at the monitoring site (or designated monitoring area) scale. Adverse effects and the degradation standard are determined at each river segment. In addition, the degradation standard incorporates temporal scale, where this standard is met if streambank stability conditions have not recovered to above the management standard over two monitoring intervals. This hierarchical distinction is consistent with the river discontinuum and continuum concepts, which infer that each river segment is comprised of individual components (Poole 2002) that collectively function as an interconnected riverine system (Vannote et al. 1980, Rosgen 1996).

Management Standard

The management standard for the maintenance of stable streambanks is 50% or greater for the mean observed value at any individual monitoring site.

Preliminary assessment of Multiple Indicator Monitoring data from sites categorically separated by use levels indicated a mean percentage of stable plots as 55% for the highest use sites without adjustment for statistical confidence (n = 3; all located within the upper Lyell Fork of the Tuolumne River—a location similar to the high-elevation meadows in Merced Segment 1—and surveyed between 2009 and 2011). This value is consistent with the findings for nonreference (managed) sites by Frazier et al. (2005). Furthermore, this management target allows for a portion of streambank instability resulting from anthropogenic causes and/or dynamic processes (such as channel migration, erosion, deposition) fundamental to hydrologic function of fluvial river systems.

Despite a reportedly low coefficient of variation (Archer et al. 2004), an inherent level of uncertainty exists within our ability to quantifiably measure changes in streambank stability conditions, owing to variability in observers as well as variation within, and between, sites. Confidence limits developed from monitoring data would facilitate a given level of certainty (i.e., 95%, or 90%, confidence) for comparison of the mean of the

observed values and the management target (i.e., actions taken at the trigger point would occur before streambank stability reaches the management target, and are aimed facilitate the maintenance of streambank stability above the management target). Burton et al. (2011) reported the width of confidence intervals as 5.2% (at 95% confidence) from repeat surveys of streambank stability at 89 sites. Therefore, breach of the management target would be determined by comparing the management target to the value of the upper confidence limit for the mean of the observed data (i.e., the upper confidence limit is the observed value for streambank stability at a site plus the confidence interval value for these data).

Adverse Effect

Adverse impact for streambank stability is a rating significantly less than 50% stable for any one river segment (i.e., all monitoring areas within a river segment) for any single monitoring year, after restoration or use-restriction actions (as described under the Trigger Point section) have been implemented. Potential adverse effects may also be realized when a statistical trend is observed where streambank stability ratings significantly less than 50% stable are likely to occur in subsequent monitoring years without intervening management action.

As with the management target, the decline of streambank stability conditions below adverse effect would be determined by comparing the adverse effect to the value of the upper confidence limit for the mean of the observed data across the river segment.

Degradation Standard

Degradation would occur when rating values for all plots within a river segment are significantly less than 50% stable for two or more consecutive monitoring years after restoration or use-restriction actions (as described in the Trigger Point section) have been implemented.

Degradation of riparian zones and stream channels diminishes their capacity to provide critical functions, including chemical and nutrient cycling, water purification, flood attenuation, maintenance of stream flows and temperatures, groundwater recharge, and habitats for fish and wildlife (Kauffman et al. 1997). Ultimately, adverse consequences of channel instability (or disequilibrium) would be associated with land productivity change, land loss, aquatic habitat deterioration, changes in both short- and long-term channel evolution, and loss of physical and biological function (Rosgen 2001). Extensive or severely degraded streambank stability conditions, manifested from either anthropogenic or natural sources, would likely propagate the loss of functional integrity of the stream channel on site and downstream. Realization of the degradation standard would be indicative of the need for substantial restoration investment.

Monitoring Streambank Stability

An initial condition assessment for streambank stability in this segment is complete, and precise monitoring in focal areas will begin in 2013. Baseline conditions for streambank stability would be established through data collection in 2013; subsequent evaluation of streambank stability conditions would be conducted on a three- to five-year monitoring interval thereafter.

The trigger point for streambank stability would be realized if streambank stability ratings for any monitoring site decline below stable ratings in more than 75% of the plots at a given monitoring site. The trigger point may also be realized when a statistical trend indicating the likelihood for a monitoring site to have less than 75% of plots rated as stable in subsequent monitoring years, without intervening management action, is observed.

Management actions taken at the trigger point would be pro-active actions to facilitate anti-degradation of river segment conditions below the management target. Streambank stability ratings greater than the management target are anticipated to retain some functional capacity. Functioning channels have an inherent resiliency for self-repair of some level of streambank alteration each year (Kauffman et al. 1997). Thus, management actions taken at the trigger point could be minimal in scope compared with efforts necessary for recovery from segment-wide adverse effects or degradation. Recovery would be achieved by restricting the level of use (i.e., access to riparian habitats) and promoting natural recovery processes (Kattelmann and Embury 1996; Kauffman et al. 1997).

The trigger point is consistent with the reported findings for reference streams by Frazier et al. (2005). These authors reported the mean percentage of stable plots as 75.3 and 52.9, for 18 reference and 25 non-reference sites, respectively, from Stream Condition Inventory surveys in the Sierra. Standards for the optimal value of stability ratings have not been reported for the Multiple Indicator Monitoring protocol; however, this protocol has been applied at 20 sites in Yosemite National Park. Preliminary assessment of data for those sites – without separation by use type or magnitude – indicated the mean percentage of stable plots as 76%.

Per the trigger point, if less than 75% of plots at a given monitoring site are rated as stable, management action would be taken to evaluate the level of streambank alteration through more frequent (i.e., annual) and detailed assessments at that site. Annual assessments of alteration would provide data on the level, location, and distribution of use, and would facilitate inference on the degree to which use is affecting streambank stability. Concurrently, assessment of hydrologic conditions within the contributing source area for that monitoring site would be implemented to identify potential anomalies (i.e., excessive alteration at areas upstream of monitoring site, or the occurrence of natural events such as landslides or wildfires) as sources of site instability. In combination, these two management actions would help prioritize subsequent actions necessary for site recovery.

Management actions to facilitate site recovery would restrict use of riparian habitats by a combination of exclosures (access restriction), rest (temporary restriction of specific use types), and/or site restoration, depending on the specific impact. The duration of use restriction would depend on the rates of recovery of streambank stability and could be short- or long-term. Effectiveness monitoring would be initiated if management actions to restrict use levels are implemented. Table 5-9 depicts the triggers at which action would be taken to prevent system degradation.

TABLE 5-9: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR HIGH-ELEVATION RIPARIAN HABITAT (STREAMBANK STABILITY)

Trigger Point(s) at Which Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: The percentage of stable plots observed at any monitoring site declines to less than 75%, or a statistical trend indicating the likelihood for a monitoring site to have less than 75% stable plots in subsequent monitoring years, without intervening management action, is observed.	Conduct assessment of streambank alteration at impacted sites, and conduct hydrologic assessments of the contributing source area for that site. Implement actions to facilitate site recovery through restoration and/or use restriction (such as resource exclosure and site restoration). Implement use-restriction actions if streambank alteration or other anthropogenic activities are identified as causal mechanisms of instability. Increase monitoring frequency to evaluate effectiveness and recovery to the management target, and compare to reference site conditions as available.	The utility of this action would refine our understanding of baseline conditions and causal mechanisms (streambank alteration, natural processes, or cumulative effects) affecting streambank stability, on site and within the greater contributing source area for that monitoring site. Identification of land-use practices that are the most damaging to ecosystems or that prevent recovery is essential for restoration (National Research Council 1992). Comparison of site conditions to reference sites would validate observed conditions and recovery.

Management Concerns and Protective Actions

Using these three indicators, park managers will be able to assess when meadow conditions are declining or management concerns are present; management concerns occur when a trigger point for any one of the three indicators has been exceeded. In 2011, NPS staff conducted a meadow condition assessment using the bare soil indicator to characterize meadow and riparian conditions throughout the Merced River corridor and identify meaningful indicators and specific areas of concern (Ballenger et. al. 2011). This assessment suggests that from a segment-wide perspective, trigger points have not been reached in subalpine and alpine meadows, and adverse effects and degradation are not present in relation to bare soil.

The NPS is currently testing site-specific monitoring protocols for all three high-elevation meadow and riparian indicators. The NPS will establish a baseline for all three indicators using site-specific monitoring protocols by 2013. In relation to fragmentation and streambank stability indicators, the NPS is collecting initial data with the precise monitoring protocol during summer 2012, and baseline data will be available in 2013. After evaluating that baseline data according to the specific standards for the three meadow/riparian indicators, NPS will take management action if needed as prescribed in Table 5-9.

Management Considerations and Enhancement Actions

Several management considerations for this ORV concern Merced Lake-East Meadow, which NPS staff determined had a high level of bare soil, heavily grazed vegetation, and evidence of stock disturbance. There were also site-specific considerations present related to informal trails in meadows and to extirpated or declining meadow- and riparian-related wildlife species. To address these considerations, "Alternatives" (Chapter 8) considers the following actions:

- **Meadow trails:** Alternatives 2-6 would remove informal trails that incise meadow habitat, trails in wet and/or sensitive vegetation, and trails that fragment meadow habitat, including trails in the Triple Peak Fork meadow, wetlands near Echo Valley and Merced Lake shore, mineral springs between Merced Lake and Washburn Lake, and other areas as necessary.

- **Merced Lake—East Meadow:** Alternatives 2 and 4 would prohibit administrative pack stock grazing at Merced Lake— East Meadow and require administrative stock users to pack in pellet feed. Under Alternative 3, 5, and 6, preliminary grazing capacities would be established, monitored, and adapted as necessary.

- **Re-introduce declining amphibian and reptile species:** In accordance with NPS Policy, Yosemite would continue to remove non-native species and reintroduce extirpated or declining species, as opportunities arise. The NPS would prioritize the study of the Western pond turtle and foothill yellow-legged frog. The NPS would also address issues related to fire management and non-native species control through actions prescribed in the *Yosemite National Park Fire Management Plan* (NPS 2004) and the *Invasive Plant Management Plan Update* (NPS 2010).

Conclusion: Protecting and Enhancing Biological ORV 1 (high-elevation meadows and riparian habitat)

The NPS is testing site-specific monitoring protocols for the three indicators in 2012: meadow bare soil, meadow fragmentation resulting from proliferation of informal trails, and streambank stability. The NPS will establish a baseline for all three indicators using site-specific monitoring protocols by 2013 and confirm the presence or absence of adverse effects, degradation, or management concerns in terms of identified standards. The NPS will also determine whether conditions have reached trigger points.

An initial meadow condition assessment (Ballenger 2011) suggested that grazing-related management considerations are present at one site, Merced Lake-East Meadow. Alternatives 3, 5, and 6 would discontinue grazing and allow the Merced Lake-East Meadow to recover until a secondary assessment method (e.g., California Rapid Assessment Method [CRAM, CWMW 2009]) indicates meadow recovery; Alternatives 2 and 4 would discontinue grazing in the meadow altogether and require pelletized feed to be packed in for all stock use. Once Merced Lake-East Meadow has recovered, Alternatives 2-6 consider a range of options to protect and enhance the meadow. Some alternatives would permanently close the meadow, requiring all pack stock passing through the Merced Lake area to carry pellet feed. Some alternatives would develop preliminary grazing capacities for the meadow, and allow administrative grazing at established capacities. Under Alternatives 2-6, the NPS would remove informal trails in wet meadows and those that fragment meadow habitat, and restore to natural meadow conditions under Alternatives 2-6. In accordance with NPS policy, the NPS would continue to remove non-native species and re-introduce extirpated or declining species as priorities and opportunities develop under Alternatives 2-6.

To ensure this ORV is protected and enhanced through time, the NPS will continue to monitor three indicators to assess the condition of the ORV: meadow bare soil, meadow fragmentation due to the proliferation of informal trails, and streambank stability. Monitoring these indicators, in association with the identified standard for the trigger points, would provide early warning of conditions that require management action before impacts occur. The indicators link to triggers that initiate a specific management response resume here.

Biological ORV—Mid-elevation Meadows and Riparian Habitat

ORV 2—The meadows and riparian communities of Yosemite Valley comprise one of the largest mid-elevation meadow-riparian complexes in the Sierra Nevada.
Location: Segment 2 (Yosemite Valley)
Rationale: The large, moist mid-elevation meadows and the riparian vegetation communities of Yosemite Valley owe their existence to river processes that produce regular flooding and sustain high water tables, and past American-Indian burning and current prescribed burns that maintain open conditions for meadows. Yosemite Valley meadows and riparian habitats support rare and endemic species as well as an exemplary diversity of plant and animal species found in a variety of ecological niches.
Management Objective: The NPS would manage public use of meadows and riparian zones within the Merced River corridor to minimize habitat fragmentation, maintain high ecological condition, and protect the integrity of streambanks to conserve ecosystem processes associated with meadow hydrologic and ecological function.

ORV Condition at the Time of Designation (1987)

An estimated 64% of the original meadow (and open forest) habitat in Yosemite Valley has converted to dense forest since the mid-1800s (Ballenger et al. 2011). Scientists hypothesize that this rapid conversion to dense forest had several origins, including suppression of regular burning conducted by California Indians, impacts to natural hydrologic flows, and agricultural practices that disturbed land and created conditions favorable for conifer germination (Cooper 2008). While most meadow loss occurred prior to the 1940s (NPS 1997 Parkwide Vegetation Map; NPS 1937 Type Mapping, Hoffman 1866), infrastructure and development continue to influence the hydrologic regime, reducing the distribution and extent of connected floodplain, level and extent of meadow inundation, and the meadow extent. For example, roads can alter hydrologic flows that sustain meadows, particularly when culverts are too small to accommodate water flow.

California Indians conducted small, low-intensity surface fires for centuries to increase growth and yield of crops, aid in hunting and insect collection, and perform other functions (Gassoway 2007). Systematic burning was likely a component in maintaining the open park-like scenery described by early visitors and explorers (Greene 1987). Since Anglo-American contact in the mid-1800s, park managers steadily eliminated meadow burns conducted in Yosemite Valley by Indians (Gassoway 2007; Anderson 2005).

Anthropogenic impacts to hydrologic flows in Yosemite Valley were both purposeful and inadvertent. For example, in 1879 Galen Clark, Guardian of the Yosemite Grant, used blasting methods to lower the level of the terminal moraine located just downstream of El Capitan Meadow in an effort to drain upstream meadows and enhance access to east Yosemite Valley (Milestone 1978). Most Merced River tributaries in Yosemite Valley were also channelized in part (Milestone 1978), altering the path of water that would naturally flow from cliff walls in a sheet or braided fashion across the meadows.

Historic impacts on riparian communities were also widespread. Madej (1994) reviewed historic photographs and documents related to the Merced River channel and found "banks were well vegetated, except on the outside of meander bends or where humans had already concentrated their activities. Riparian vegetation was typically dense and vigorous." By the late 1970s, there were over 4,000 meters of riprap revetment placed along the banks of Yosemite Valley streams (Milestone 1978; ENTRIX 2012). Madej (1994) documented severe riverbank erosion in specific areas, particularly in sites in proximity to development. There was a strong relationship to accelerated erosion and a lack of riparian vegetation. Based on earlier studies, these impacts remained at the time of designation in 1987.

Through time, many park managers took action to control conifer encroachment in meadows. Galen Clark initiated the first post-contact conifer thinning in Yosemite Valley in the early 1890s (Clark 1894). Conifer clearing continued in the campgrounds and in El Capitan Meadow in 1919 (Greene 1987). Emil Ernst, Yosemite Park Ranger/Forester in the 1930-1950s, championed and conducted large efforts to control conifer encroachment. Efforts to control conifer encroachment with prescribed burning began in 1970.

By the time of designation, the NPS had several fundamental programs and projects in place to address the vegetation changes in Yosemite Valley and to improve the integrity of remaining meadows. Notably, the NPS systematically reintroduced fire into Yosemite Valley meadows. Park staff and volunteers also removed tens of thousands of conifer seedlings and saplings from Yosemite Valley meadows since the time of designation (Ballenger et al. 2011). These practices kept encroaching conifers at bay in many Yosemite Valley meadows. These actions were intended to restore the open scenery and cultural landscape that was changed by the cessation of American Indian burning beginning about 1850, and counter human-initiated changes in hydrologic processes and topography that channelized sheet flow in meadows.

In 1987, riparian areas along the banks of the Merced River in Yosemite Valley demonstrated substantial impacts including erosion, denuded riparian vegetation, and poorly designed riprap revetment (Tucker 1996; Cardno ENTRIX 2012). Madej et al. (1991) found a strong association among levels of human use around campsites and river access points, and loss of riparian cover leading to accelerated bank erosion. Trampled soils with denuded vegetation in the developed, high-use areas of east Yosemite Valley (e.g. Upper Pines, Lower Pines, and North Pines Campgrounds) exposed highly erodible soils on the riverbanks that were vulnerable to accelerated erosion. This condition contributed to substantial widening of the river in some reaches (Madej et al 1991). The potential effects of denuded riparian vegetation on the riverbanks include lack of shading and altered nutrient dynamics in aquatic habitats, reduced riparian habitat for wildlife, increased water temperature, increased suspended sediment, and reduced dissolved oxygen levels (Madej et al. 1994). Other areas in west Yosemite Valley exhibited extensive trampling from visitor use and a

subsequent decrease in riparian vegetation including the former El Capitan Picnic Area, the Lower River Campground/Housekeeping Camp area, Devil's Elbow, and North Pines Campground.

Current ORV Condition

The NPS conducted a number of projects to enhance the condition of meadow and riparian areas in Yosemite Valley since the time of designation. These projects include:

- Extensive removal of high priority non-native species in meadows and riparian areas
- Boardwalks installed in Sentinel and Stoneman Meadows, substantially reducing the dense network of informal trails in these meadows
- Fill removed in Sentinel Meadow from the site of a former movie house and dance hall (Pavilion Square), and natural meadow topography restored at the site
- Comprehensive ecological restoration in Cooks Meadow involving removal of a historic road (abandoned), filling in ditches, and restoration of natural meadow topography; and construction of a boardwalk across sensitive meadow habitat
- Comprehensive riparian habitat restoration at Lower River Campground, Housekeeping Camp, El Capitan Picnic Area, Devil's Elbow, Sentinel Bridge, Swinging Bridge, Clark's Bridge, North Pines Campground, and the Cascades Dam site, after dam removal
- Removal of infrastructure from meadows and riparian habitat including actions to remove buried utility lines in meadows and replace them under existing roadways, removal of underground utility lines that cross the Merced River, and removal of utility lines and lift stations from riparian/riverbank areas

These projects mitigated many meadow- and riparian- related issues, though many remain. The *Baseline Conditions Report* (NPS 2012) reached the following conclusions as regards the current conditions of Yosemite Valley meadows and riparian areas:

- **Informal trails:** Informal trails are visitor-created noticeable tracks that are not managed directly by park staff, as opposed to maintained, formal trails. Informal trails are common in Yosemite Valley meadows. Meadow research demonstrates that impacts associated with trails can extend beyond direct trail impacts, with impacts radiating from the trail's edge into the meadow (Holmquist 2004).
- **Conifer encroachment:** In five of six meadows surveyed, tree seedlings were present in more than 10% of the study plots, indicating that the tree encroachment documented since 1870 (Gibbens and Heady 1964) continues. The extent of tree seedlings was highest in El Capitan and Stoneman Meadows (32% of plots contained seedlings), indicating that nearly one-third of meadow area in El Capitan Meadow and Stoneman Meadow has some degree of tree encroachment (Ballenger et al. 2011).
- **Non-native species:** Non-native species are common across all Yosemite Valley meadows, with the highest extent of non-natives found in El Capitan Meadow and Stoneman Meadow (as inferred from percent of plots with non-native plants present—92-96% of plots contained non-native species) (Ballenger et al. 2011).
- **Meadow vegetation composition:** The mean cover of non-native plants was lower in saturated and inundated soils (by a factor of two to seven) compared with moist to dry soils (Ballenger et al. 2011). As found in other studies (Dwire et al. 2006), the distribution of non-native plants was strongly linked to water table depths in meadows, with a higher presence of non-native species in drier areas. Maintaining meadow water tables to promote areas of wet soil may be a means to sustaining native meadow vegetation composition (Kluse and Allen-Diaz 2005).

- **Meadow topography:** Ditches and other human alterations to meadow topography, remnants of the past agricultural era, remain within Yosemite Valley meadows. Ditches were also constructed during NPS administration beginning in 1929, often referred to as "moral ditches" to keep people from driving into meadows. (Greene 1987). Ditches increase drainage and lower natural water-table levels, favoring non-native meadow vegetation.
- **Sensitive meadow habitat:** Formal trails in the Ahwahnee Meadow, Bridalveil Meadow, and Slaughterhouse Meadow pass through sensitive meadow habitat, some of which is inundated on a regular basis. Trails can alter hydrologic connectivity within the meadow by blocking natural flows.

A recent assessment of riparian vegetation took place in 2010 (Cardno ENTRIX 2012). The *Merced River and Riparian Vegetation Assessment* utilized the California Rapid Assessment Method (CRAM) to assess the condition of eight different reaches of the Merced River in Yosemite Valley. The study found:

- Reaches with high scores (Happy Isles, inter-meadows, and above Pohono Bridge) had lower intensities of visitor use, and were generally characterized as areas with little riprap revetment, less bank erosion, high topographic complexity, and moderately developed vegetation with moderate structural complexity.
- Areas with poor scores (above and below the confluence with Tenaya Creek, and below Pohono Bridge) had higher intensities of visitor use, more riprap, more bank erosion, low topographic complexity, and a poorly developed riparian community.
- Recreational use and infrastructure affected the condition of riparian wildlife habitat. Conditions varied by reach in response to the type of human impact. For example, the reach below Happy Isles was characterized as good wildlife habitat, with wide riparian buffers and a complex physical structure. Conversely, the reach below the confluence with Tenaya Creek was characterized as poor wildlife habitat, with narrow riparian buffers and low vegetation structural complexity.
- The majority of the riparian corridor had few non-native species, and moderate horizontal zonation and vertical overlap among plant layers, indicating a well-developed riparian community.
- The study observed bank erosion throughout the study area, particularly near bridges, recreation facilities, and some meander bends. Areas with moderate to high human use generally had fewer co-dominant species and lower riparian community structure complexity.

The *Wildlife Condition Assessment for the Merced River Corridor in Yosemite Valley* (Espinoza et al. 2011) assessed the health of riparian and meadow habitats in Yosemite Valley in relation to focal bird species. The study suggests that there is greater availability of riparian habitat in the Upper Meadow, Inter-meadow, and Lower Meadow reaches, and that that the structural integrity of the riparian habitat in these reaches may be higher than in other areas of the Sierra Nevada.

Management Program for ORV 2

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. The NPS selected three distinct indicators to monitor the condition of this ORV through time: 1) fragmentation of meadow habitats resulting from proliferation of informal trails, 2) status of riparian habitat, and 3) riparian bird abundance.

Indicator 1 – Meadow fragmentation due to proliferation of informal trails for ORV 2

The NPS would employ the same fragmentation indicator used for ORV 1 in high elevation habitats to monitor meadows in Yosemite Valley, the Largest Patches Index – Five (LPI_5). The NPS would utilize the

same protocols and definitions of adverse effect and degradation as described under ORV 1—high-elevation meadows and riparian habitat—Indicator 1, described earlier in this chapter. The management responses will vary slightly due to differences in access and limitations on structures in Wilderness. The trigger points and management responses for this indicator in Segment 2 are found in Table 5-10.

TABLE 5-10: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR MID-ELEVATION MEADOWS (MEADOW FRAGMENTATION)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Decrease in LPI_5 threshold below 93% at the level of an individual meadow.	• Increase meadow monitoring assessments to one-year interval at each individual meadow that surpasses this value. Target the largest patches in meadow, and analyze trail condition and emergence of new trails. Additional potential management actions include: • Increase enforcement and education of Best Management Practices in meadows. • Implement restoration practices, including visitor messaging, restoration signs if appropriate after Wilderness Minimum Requirement Analysis, delineation of trails determined to be less disturbing to meadow ecology, and closure of selected informal trails.	This action allows increased sensitivity to changes in trails, and would allow managers better opportunities to identify meadows of consideration, and take actions well before adverse effects are incurred. With more frequent assessment, emerging trails and particularly problematic trails would be identified and restoration actions taken.
Trigger Point 2: Data analyses from annual monitoring of fragmentation yields results less than anLPI_5 value of 93% for three consecutive years in an individual meadow or a decrease below 90% at the level of an individual meadow.	Further restoration of disturbed areas and informal trails in specific meadows that exceed trigger. Depending on the degree and extent of impacts, the NPS would enact some or all of the following actions: • Use boardwalks or hardened surfaces to allow access to sensitive areas, • Delineate trails through upland areas and along meadow perimeters to allow access while reducing fragmentation and meadow impacts • Place restoration closure signs, and/or • Fencing along meadow perimeters • De-compact trampled soils. • Salvage plants growing in trail ruts and use as part of revegetation to consolidate multiple parallel trails. • Re-contour topography. • Scatter locally gathered seed and organic materials to facilitate new plant growth. • Fill deep headcuts caused by informal trails with native soil and re-contour to natural meadow topography. • Institute closures in individual impacted meadows and increase visitor education associated with the closures	This value represents the level at which a group of subject matter experts determined meadows to be threatening resource protection and quality of visitor experience.

Indicator 2 – Status of Riparian Habitat for ORV 2

The objective of this indicator is to provide a comprehensive rapid assessment of riverbank (river riparian habitat) status every two to three years. The intent is to detect potential impacts from visitor use at the incipient stage and correct them in a timely manner so as to protect and enhance biological and geologic/hydrologic ORVs. Given the spatial and temporal complexity of riparian systems, this general indicator would be part of a comprehensive river protection implementation program that includes permanent riverbank vegetation monitoring plots and river cross-section analysis in addition to periodic

surveys for total accumulated large wood in the channel. The NPS will also use this indicator to monitor a component of ORV 10, ethnographic resources in Yosemite Valley.

The park would adopt the California Rapid Assessment Method (CRAM) (Collins et al. 2008) for producing condition ratings along approximately 10 miles of alluvial river channel in Yosemite Valley (Happy Isles Bridge to 0.6 mile downstream of Pohono Bridge). This extensively peer-reviewed and validated protocol (e.g., Stein et al. 2009) is intended to provide a general condition index of riparian and wetlands sites using a combination of landscape, hydrology, physical, and biotic structure scores. Both banks of the river would be evaluated in 200-meter reaches (approximately 160 individual sites) every two to three years. Scores range from 0.27 for the poorest condition up to 1.00 for the best. In Yosemite Valley, 20% of sites as evaluated in 2010 were classified in the low-condition class (scores below 0.71) and 20% were classified in the high-condition class (above 0.87) (Cardno ENTRIX 2012).

Necessarily broad in nature, the condition rating integrates substantial information and has been shown to adequately distinguish poor and good site conditions, while allowing for documentation of stressors that may be affecting ecosystem processes. The latter is particularly important for a rapid survey in this setting as it permits a fairly direct connection to possible management actions necessary to protect and enhance the ORV. This indicator would be supported by more rigorous monitoring of riparian vegetation and riverbank condition at permanently established plots in this segment (Yosemite National Park 2010). The park may adopt other protocols to address this indicator that provide more refined metrics of riparian condition as they become available.[21]

Management Standard

The management standard for the status of riparian habitat varies across the alternatives described in "Alternatives" (Chapter 8). Table 5-11 demonstrates the appropriate standard to each alternative. The standard is derived from an assessment of the number of sites currently in a low condition class (Cardno ENTRIX 2012) that will be affected by actions in each alternative of the plan. Of the 20% of sites currently in the low condition rating, approximately half have the potential of being restored to a moderate or high condition class in Alternatives 2 and 3. The remaining 50% of these sites could remain in a low condition class due to their proximity to critical roads and bridges. Therefore, a maximum of approximately 90% of all sites could achieve a moderate- or high-condition rating once restoration actions are taken in Alternatives 2 and 3. Moreover, to ensure that at least a portion of sites are in high condition, a minimum of 20% of sites shall be in high-condition class.

Increased visitor use coupled with placement of additional campgrounds near the river in Alternatives 4, 5, and 6 reduce restoration potential. Substantial restoration actions would be mostly offset by the potential for increased riverbank impacts due to visitor access and proximity to the river. With substantial controls in place such as fencing, designated river access points, and routine monitoring, there is the potential for modest improvements in site condition, though it is difficult to estimate this. For this reason, the management standards reflect the current distribution of sites in high, medium, and low condition classes. Setting management standards to the experiences envisioned in an alternative, as proposed herein, is a practice recommended by noted user capacity experts.[22]

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[21] Note that the streambank stability indicator used to monitor higher elevation meadows (both in this plan and in the Tuolumne River Plan/DEIS) is not suitable for the higher order stream found in Yosemite Valley; CRAM is.

[22] Specifically, by Dave Cole, Bo Shelby, and Doug Whittaker. Wilderness recreation management standards also vary by alternative, both in this plan and in the Tuolumne River Plan/DEIS.

TABLE 5-11: MANAGEMENT STANDARDS FOR THE STATUS OF RIPARIAN HABITAT INDICATOR

Alternatives	Associated Management Standard
Alternative 1	No action
Alternative 2	At least 90% of sites would attain CRAM scores of 0.7 or higher (moderate or high rating) and at least 20% of sites would rate as high condition (greater than 0.87) during any single monitoring period.[23]
Alternative 3	At least 90% of sites would attain CRAM scores of 0.7 or higher (moderate or high rating) and at least 20% of sites would rate as high condition (greater than 0.87) during any single monitoring period.
Alternative 4	At least 80% of sites would attain CRAM scores of 0.7 or higher (moderate or high rating) and at least 20% of sites would rate as high condition (greater than 0.87) during any single monitoring period.
Alternative 5	At least 80% of sites would attain CRAM scores of 0.7 or higher (moderate or high rating) and at least 20% of sites would rate as high condition (greater than 0.87) during any single monitoring period.
Alternative 6	At least 80% of sites would attain CRAM scores of 0.7 or higher (moderate or high rating) and at least 20% of sites would rate as high condition (greater than 0.87) during any single monitoring period.

Adverse Effect

An adverse effect is indicated when thirty percent or more of the river segment is rated in a low condition class, as measured by the CRAM rating system. This is the minimum change below current condition that could be detected given physical metrics and observer variability.

Surveys in 2010 (Cardno ENTRIX 2011) indicated that about 20% of the riparian area along the Merced River in Yosemite Valley was in low condition. Consensus among NPS staff and outside specialists is that this is an unacceptable impact on riparian habitat. However, these impacts are highly localized (almost all of them are between Clark's and Sentinel Bridge), with the remaining 80% of the segment in higher condition (moderate or high). Most riparian habitat in the valley, in other words, is functioning at an acceptable level. Consequently, the segment as a whole is functioning at a level higher than what most ecologists would consider adverse effect (e.g., Poole 2002). Management concerns are clearly present (see below), with the overall river condition approaching adverse effect. This definition of adverse effect, then, defines a point that is the minimum detectable decline in proportion to monitoring sites in the moderate and high condition classes from the 2010 survey.

Currently, 16 of 81 sites (20%) rate in low condition. In order to detect a significant increase (at the 95% confidence level) in the number of sites in low condition, at least 22 sites (27%) would have to fall into the low category. Given the dynamic nature of river systems and the estimated uncertainty in CRAM scores of +/- 6% (Stein et al., 2009), the percentage of sites in the low condition class that constitutes adverse effect is rounded to 30%.

Degradation Standard

Degradation is indicated when 50% or more of sites have CRAM condition ratings of less than 0.71.[24]

[23] The 0.7 and 0.87 values are based on the grouping of such scores in Cardno ENTRIX 2012.

[24] This value is taken directly from Cardno ENTRIX 2012, in which this value delimited the lowest fifth of CRAM scores from the other 80%--those values that were considered "low" in condition.

Extensive or severely degraded streambank stability conditions, manifested from either anthropogenic or natural sources, would likely propagate the loss of functional integrity of the stream channel on site and downstream. Degradation of riparian zones and stream channels diminishes their capacity to provide critical functions, including chemical and nutrient cycling, water purification, flood attenuation, maintenance of stream flows and temperatures, groundwater recharge, and habitats for fish and wildlife (Kauffman et al. 1997). Ultimately, adverse consequences of channel instability (or disequilibrium) would be associated with land productivity change, land loss, aquatic habitat deterioration, changes in both short- and long-term channel evolution, and loss of physical and biological function (Rosgen 2001). Realization of the degradation standard would be indicative of the need for substantial restoration investment.

Monitoring Program for the Status of Riparian Habitat

Monitoring would take place along the entire portion of this segment that is alluvial in nature. This encompasses the stretch of river between Happy Isles Bridge and 0.6 mile downstream of Pohono Bridge. Both left and right banks of the river over this entire length would be divided into 200-meter sites (reaches) and each would be assigned a CRAM score. Monitoring would be conducted every two to three years and after major (greater than 10-year return interval) flood events. Table 5-12 depicts the trigger points and management response to riparian habitat ratings.

TABLE 5-12: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR MID-ELEVATION RIPARIAN HABITAT (STATUS OF RIPARIAN HABITAT)

Trigger Point(s) at Which Action Management Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Routine survey finds the decline of condition class of any reach from high to moderate, high to low, or moderate to low. Alternatively, the surveyors note any localized impact due to visitor use such as an incipient headcut or loss of riverbank vegetation. The scale of impacts and potential restoration is up to 200 meters of riverbank, the maximum single reach length in the CRAM protocol.	Investigation of site conditions and potential factors leading to the decline in condition class or localized impact. Specific mitigating actions could range from continued regular monitoring to restoration and exclusion of the reach from visitor use. Actions could include: • Restore affected area and address causes of impacts • Fencing around campgrounds and designated river access points • Increased monitoring frequency to assure recovery of site	The purpose of this trigger is to allow for immediate site-specific action regarding a potential impact to riparian condition. In addition, this action will refine our understanding of baseline conditions and causal mechanisms (streambank alteration, natural processes, or cumulative effects) affecting streambank condition, on-site and within the greater contributing source area for that site.
Trigger Point 2: Presence of a negative trend indicating that the breach of the management standard is likely without intervening management actions. The scale of impacts here is greater than 200 meters of riverbank. *(Note that this is considered the current state of the riparian area in the Yosemite Valley segment.)*	Action at this level requires a more comprehensive visitor management and restoration response than under Trigger Point 1. Actions at this point must be sufficient to restore river condition at greater than the single reach scale and prevent (or mitigate) displacement of impacts upstream or downstream of the affected area. Actions include: • Fencing around campgrounds and designated river access points • Active patrols of river area to protect riparian vegetation from trampling • Manage access by limiting use adjacent to the river • Close or re-design campgrounds to lessen human impacts to the riparian area	This trigger point indicates that impacts have grown beyond site-specific impacts and now affect multiple reaches of the river. While unforeseen circumstances could manifest this condition, visitor impacts are likely to be the most important factor. The purpose of taking action at this point would be to prevent impacts from coalescing and propagating downstream leading to adverse effect.

TABLE 5-12: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR MID-ELEVATION RIPARIAN HABITAT (STATUS OF RIPARIAN HABITAT)

Trigger Point(s) at Which Action Management Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 3: The condition of the riparian has not improved 10 years after reaching Trigger Point 2 and implementation of major restoration and visitor use management actions.	Reduce use.	Riparian condition may take several years to recover following restoration or visitor use management actions. No measureable improvement 10 years after implementing actions, however, most likely indicates human use is preventing recovery.

The NPS would evaluate the effectiveness of the indicators regularly to assure that the combination of these metrics fully protect the ORV.

Indicator 3 – Riparian Bird Abundance for ORV 2

The riparian bird indicator is based on the relative abundance of five riparian bird species that breed throughout the meadow and riparian habitats in the Yosemite Valley segment each summer. Birds are an effective indicator of overall habitat quality and have been used as indicators of ecological integrity in a variety of habitats (Bradford et al. 1998; O'Connell et al. 2000; Canterbury et al. 2000; Venier and Pearce 2007). Bird monitoring is cost-effective, efficient, and effective because birds advertise their presence through vocalizations, making them relatively easy to detect and identify; also, they can be censused efficiently over various spatial scales. An assemblage of birds with strong ecological ties to riparian habitat, as opposed to a single species, incorporates a wider range of sensitivities to habitat disturbances and modifications (Koskimies 1989). Hence, relative abundance of such an assemblage would be more likely to reflect changes in the ecosystem. Furthermore, consistent causes of change should be easier to identify, and local natural changes in population dynamics of one of the species should be less likely to skew overall data (Zonneveld 1983).[25]

The riparian bird indicator comprises five focal species identified by the Riparian Habitat Joint Venture as being biologically relevant indicator species (RHJV 2004) occurring in Yosemite Valley in abundances that allow collection of an adequate sample size. These five species are spotted sandpiper, warbling vireo, yellow warbler, song sparrow, and black-headed grosbeak (see Table 5-13 for scientific names and associated characteristics). This suite of focal species follows suggestions by Chase and Geupel (2005) to select species that are easy and efficient to monitor and that represent various habitat elements and processes in the riparian ecosystem. All of the selected focal species except for Song Sparrow are neotropical migrants, which are considered sensitive, and declines in neotropical species owing to human disturbance and habitat fragmentation have been well documented (Temple 1986; Terborgh 1989; Wilcove and Terborgh 1984). This indicator includes ways of detecting impacts on the bird populations caused by factors occurring outside of Yosemite Valley or even Yosemite; see below).

[25] Additionally, riparian bird abundance is a better indicator for Yosemite Valley meadows than bare soil because bare soil as an indicator is most appropriate for areas where grazing occurs (there is no grazing in YV), while riparian bird abundance is a direct measure of habitat quality (because the birds chosen for this alternative are directly dependent on such habitat).

TABLE 5-13: RIPARIAN BIRD ASSEMBLAGE IN YOSEMITE VALLEY SEGMENT AND GUILD ASSIGNMENTS

Species	4-Letter code[a]	Scientific name	Neotropical migrant[b]	Nest type[c]	Diet[d]	Foraging type[e]
Spotted sandpiper	SPSA	*Actitis macularius*	Y	GRND	IN	GG
Warbling vireo	WAVI	*Vireo gilvus*	Y	HICUP	IN	FG
Yellow warbler	YEWA	*Setophaga petechia*	Y	LOCUP	IN	FG
Song sparrow	SOSP	*Melospiza melodia*	N	GRND	OM	GG
Black-headed grosbeak	BHGR	*Pheucticus melanocephalus*	Y	LOCUP	OM	FG

NOTE: Data compiled by Bryce 2006 and collected from Terres 1980, Ehrlich et al. 1988, and DeGraaf et al. 1991.

[a] The American Ornithologists' Union 4-letter codes (AOU 2011); provided here for ease in finding them in this source.

[b] Neotropical migrant: N = no; Y = yes

[c] Nest type: GRND = ground nester; LOCUP = cup nest generally 10 feet or less off the ground; HICUP = cup nest generally >10 feet off the ground

[d] Diet: IN = insectivore; OM = omnivore

[e] Foraging type: FG = foliage gleaner; GG = ground gleaner

These focal species' requirements define different spatial attributes, habitat characteristics, and management practices that are representative of a healthy riparian system (Chase and Geupel 2005). By using riparian vegetation as their primary breeding habitat in Yosemite and needing the full range of riparian successional stages for successful breeding, these specialists represent better indicators than habitat generalists (who are also less susceptible to local extinction following environmental change) (Hutto 1998). Population trends of these riparian habitat specialists could indicate whether the integrity of the habitat is improving or deteriorating under the range of possible habitat management regimes (Carignan and Villard 2002).

Although birds have been widely used as indicators (Beintema 1983; Powell and Powell 1986; Bost and Mayo 1993; Daily et al. 1993; Bradford et al. 1998; Hutto 1998), it is still challenging to develop an indicator that discriminates between population declines caused by changes within the local habitat (i.e. the Yosemite Valley meadows and riparian habitat—ORV 2) and declines caused by factors occurring outside of that habitat (i.e. changes in the wintering habitat of such birds in Central America, disease, parasites, competition, predation, conditions in other areas used by migratory species, and/or climate change). This monitoring program would address this need in two complementary ways (Steele et al. 1984; Bryce 2006).

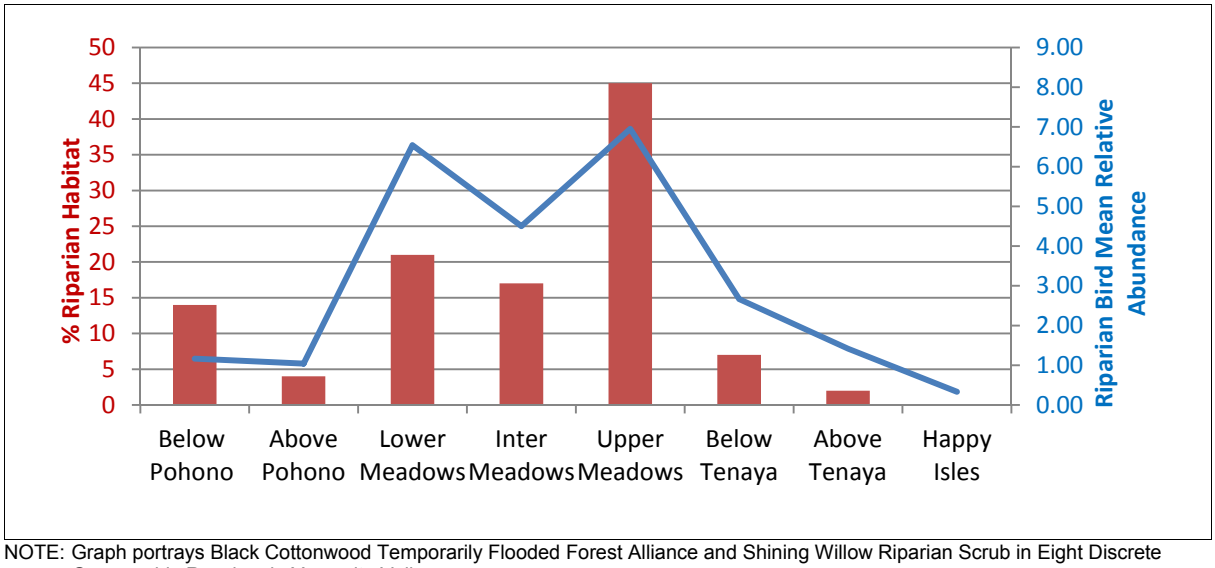
First, the NPS would continue conducting parkwide surveys for these birds done as part of the Sierra Nevada Network bird-monitoring program (and using the peer-reviewed survey protocol developed by Siegel et al. 2010). This annual data collected park-wide would provide an invaluable comparison with population trends detected in Yosemite Valley. For example, if yellow warblers disappear from Yosemite Valley, park ornithologists could turn to the park-wide dataset (collected using exactly the same protocol) to determine if the trend is local or if instead it indicates a more widespread threat.

Second, the NPS would conduct these bird surveys at the same sites (randomly selected) where the Yosemite Visitor Use and Impact Monitoring Program also collects vegetation, riverbank, and human use data (Newburger et al. 2009; Starcevich 2011).[26] If there is a perceived decline in riparian bird abundances,

[26] Vegetation data collected include functional groups related to understory community composition (nonvascular plants, annual biennials, tap-rooted perennials, fibrous-rooted perennials, woody seedlings, and shrubs), physical riverbank characteristics (litter cover, bare ground, large woody debris, substrate size classes, and exposed roots), and canopy characteristics (deciduous trees, evergreen trees, and snags).

then the vegetation data could be used to determine possible effects from any changes that have occurred in vegetation attributes. Several studies have found local vegetation and habitat characteristics to be important in explaining variation in local bird abundance (e.g., Wiens and Rotenberry 1981; Cody 1985; Strong and Bock 1990; Saab 1999; Nur et al. 2008). Such knowledge of a species' life history and habitat requirements enables researchers to relate an observed decline to possible human impacts on specific habitat components or to a flood or other natural event. For example, preliminary data suggest a relationship between the relative abundance of riparian birds in Yosemite Valley and the amount of riparian habitat within specific reaches of the Merced River (Cardno ENTRIX 2012) (Figure 5-2). If a decline in one of the species using these riparian habitat types were detected, park managers would examine those habitats to see if changes were occurring that could account for the decline; they would examine the area's recent history to see if a natural event could have caused the decline.

FIGURE 5-2: MEAN RELATIVE ABUNDANCE OF FIVE RIPARIAN FOCAL SPECIES IN 2010-2011 IN RELATION TO PERCENTAGE OF RIPARIAN HABITAT (CARDNO ENTRIX 2012)



NOTE: Graph portrays Black Cottonwood Temporarily Flooded Forest Alliance and Shining Willow Riparian Scrub in Eight Discrete Geomorphic Reaches in Yosemite Valley

As explained in more detail below, bird surveys would be conducted at 24 randomly selected sites each year during the breeding season (May 15-June 30), with three sets of bird surveys performed at each of the 24 plots. Birds would be tallied both by sight and sound; if observers see or hear a bird, the bird's presence would be noted.

In summary, the riparian bird indicator is based on five riparian specialist bird species that commonly breed in Yosemite Valley's riparian habitat and that represent various life histories and riparian habitat requirements (Table 5-13). The indicator accounts for population changes that could be caused by sources external to the habitat condition of this ORV by including two additional components: (1) comparison with similar data being collected on a wider spatial scale, and (2) matching the sampling plots with concurrent data collection on vegetation attributes and extent of human use. Over the long term, such relative abundance data on riparian-obligate species will be used to assess whether meadow and riparian communities in Yosemite Valley are achieving the management standard.

Management Standard

The management standard is that the abundance of any one of the five species, averaged across the three annual observation periods, exceeds the 25th percentile of its distribution in at least three out of every ten years, or that the average abundance of all five species, averaged again across the three annual observation periods, exceeds their summed 25th percentile, unless a species shows similar declines in other nearby riparian habitat not in Yosemite Valley. For example, for song sparrow populations to meet the management standard, observers would need to see or hear at least four individuals in their three visits to exceed the 25th percentile (4 sightings/3 visits=1.33 birds per visit, which exceeds the 25th percentile value of 1.22), at least three times in a decade. Or, for the sum of all five species, observers would need to see or hear an average of ten or more of any of the five species (any combination that adds to ten) on each of their three annual visits, to exceed the 25th percentile (10 sightings/3 visits=3.33, which exceeds the 25th percentile value of 3.21), again at least three times in a decade.

The riparian bird management standard adopted for the *Merced River Plan/DEIS* was developed from a four-year pilot dataset: a two-year dataset collected by NPS biologists in 2010-2011 at 24 randomly selected monitoring plots (NPS unpublished data) and a two-year dataset collected by other skilled bird observers (Point Reyes Bird Observatory scientists) in 2006-2007 at 20 systematically placed plots in Yosemite (Stillwater Sciences 2008). In the absence of long-running historical data in Yosemite Valley, this standard uses the 4-year pilot dataset to determine expected interannual variation. Percentiles were calculated based on the interannual mean and standard deviation (Table 5-14).

TABLE 5-14: SPECIES SPECIFIC ANNUAL ABUNDANCES*

Species	Average	Variance	Max	Inter-annual Average[a]	Inter-annual Variance[a]	Inter-annual Standard Deviation[a]	Percentiles		
							10%	20%	25%
Spotted Sandpiper	0.42	0.62	5	0.38	0.07	0.26	0.05	0.16	0.21
Warbling Vireo	0.78	0.85	4	0.78	0.08	0.28	0.41	0.54	0.59
Yellow Warbler	0.54	0.83	5	0.50	0.09	0.31	0.11	0.24	0.29
Song Sparrow	1.55	1.65	6	1.50	0.17	0.41	0.97	1.15	1.22
Black-headed Grosbeak	0.84	1.10	5	0.81	0.10	0.32	0.41	0.55	0.60
Sum	**4.13**	**8.37**	**18**	**3.97**	**1.28**	**1.13**	**2.52**	**3.02**	**3.21**

*NOTE: Yosemite Valley point count data were collected by Point Reyes Bird Observatory scientists in 2006-2007 (Stillwater Sciences 2008) and NPS biologists in 2010-2011 (NPS unpublished data). Table 5-13 describes the species codes. Units are the number of detections per plot—the number of birds seen or heard at a plot, averaged across the three annual visits per plot. Species specific annual abundances (average, variance, and maximum abundance); interannual (year to year) average, variance, and standard deviation; and percentiles are based on the interannual average and standard deviation. Values are calculated from four years of point count data (2006, 2007, 2010, and 2011) collected in Yosemite Valley.

[a] Computed by first calculating the within-year average across sites and dates for each year, then taking the average, variation, and standard deviation of those annual averages. (The Interannual average differs from the individual average because it weights years equally while the individual average effectively weights years by the "Plot by Date" effort.)

[b] Percentiles are based on the interannual average and standard deviation, and are the values that abundances are expected to be below N% of the time due to random fluctuations as observed in the four years of pilot data.

In any given year, random population fluctuations may be less than the values for the 25th percentiles. To fall below the management standard, such poor years would have to occur 7 or more times per decade. To fail to meet the management standard for any individual species, the decline would have to be directly associated with ORV 2 in Yosemite Valley. If similar declines were observed in other nearby riparian habitats (e.g., Wawona Meadow, Tuolumne River riparian corridor), the management standard would still be met, though the reasons for the decline would still need to be determined. The management standard is set to safeguard against the chance of falling below the standard due to chance fluctuations while being sensitive enough to be triggered if the riparian ORV in Yosemite Valley becomes ecologically dysfunctional.

There may be certain instances when the management standard needs to be re-evaluated and potentially readjusted: a natural event (flood, fire, or drought) that does not pertain to human use causes the target threshold to be exceeded; another dataset from Yosemite shows more variation than expected annual variation; or any individual species disappears across all sites.

Adverse Effect

An adverse effect would be present when the average abundance of any individual species or the average abundance summed across all species falls below the 20th percentile of the respective distributions in at least four out of 10 years, unless a species shows similar declines in other nearby riparian habitat not in Yosemite Valley. As Table 5-14 indicates, falling below those percentiles would indicate that the bird species are becoming less common. For example, warbling vireo sightings would be declining from 0.59 averaged across all three observation periods in a year (the management standard, to less than 0.54 in a year (the adverse effect level). Or, the summed sightings would fall from 3.21 across all three observation periods in a year (the management standard), to less than 3.02 in a year (the adverse effect level).

Because of the fluctuations that are possible from year to year, the duration of four out of 10 years is used. This accounts for stochastic events, such as flooding or fire (both of which have occurred in Yosemite Valley in the last couple of decades) that could temporarily drop a bird's population. If such an event occurred, it is reasonable to assume that the habitat and bird community would change, but would remain below the 20th percentile threshold in fewer than four out of 10 years. If rebounding did not occur and human-use factors are identified as the cause of adverse effect, then mitigation to reverse impacts would be necessary to restore ecological function.

There may be certain instances when the point of adverse effect needs to be re-evaluated and potentially re-adjusted: a natural event (flood, fire, or drought) that does not pertain to human use causes the adverse effect threshold to be exceeded; another dataset from Yosemite shows more variation than expected annual variation; or any individual species disappears across all sites. As explained in the triggers discussion below, the NPS is committed to ensuring adverse effects or degradation do not occur, through the multiple levels of management triggers.

Degradation Standard

Degradation would be present when the average abundance of any individual species or average abundance summed across all species falls below the 10th percentile of the respective distributions in at least five out of 10 years, unless a species shows similar declines in other nearby riparian habitat not in Yosemite Valley. As Table 5-14 indicates, falling below those percentiles would indicate that the bird species are becoming considerably less common. For example, spotted sandpiper sightings would be declining from 0.21 averaged across all three observation periods in a year (the management standard), to less than 0.05 in a year (the

degradation level)—a decline of more than 75%. Or, the summed sightings would fall from 3.21 across all three observation periods in a year (the management standard), to less than 2.52 in a year (the adverse-effect level).

Because of the fluctuations that are possible from year to year, degradation is reached only when riparian bird abundances drop below the 10th percentile threshold in at least five out of 10 years. The duration of five out of 10 years accounts for stochastic events. If such an event occurred, it is reasonable to assume that the habitat and bird community would rebound above the 10% threshold in more than five out of 10 years. If rebounding does not occur and human use factors are identified as the cause of degradation, then mitigation to reverse degradation would take multiple years and a tremendous amount of effort and resources, but would be necessary to restore ecological function.

There may be certain instances when the point of degradation needs to be reevaluated and potentially readjusted: (1) a natural event (flood, fire, or drought, for example) that does not pertain to human use causes the degradation threshold to be exceeded; (2) another dataset from Yosemite shows more variation than expected annual variation; or (3) any individual species disappears across all sites. The NPS is committed to ensuring adverse effect or degradations levels are never met through the multiple levels of management triggers developed, as explained below.

Monitoring Program for Riparian Bird Abundance

As noted above, bird surveys would be conducted at the same randomly selected sites (N = 24) where vegetation and riverbank data are regularly collected through the Yosemite Visitor Use and Impact Monitoring Program (Newburger et al. 2009; Starcevich 2011). The NPS would conduct point count surveys using the peer-reviewed survey protocol developed by Siegel et al. (2010), and implemented throughout Yosemite each year as part of the Sierra Nevada Network bird-monitoring program. Annual data collected park-wide would provide an invaluable comparison if population trends are detected in impacted sites in Yosemite Valley. Each year during the breeding season (May 15-June 30), the NPS would conduct three sets of bird surveys at each of the 24 plots. In a given year, each set of surveys would be spaced at least ten days apart. To reduce sample bias, observers would be highly trained and have at minimum five years of bird survey experience; survey locations would not change during the season or between years; surveys would begin within ten minutes of official local sunrise and must be completed by 3.5 hours after official local sunrise, because bird activity tends to decrease later in the morning; and surveys would only take place under mild weather conditions. For a more detailed description of the survey protocol, see Siegel et al. (2010). Table 5-15 depicts the trigger points and management response to riparian bird abundance ratings.

While actions under the trigger points should prohibit falling below the management standard, unforeseen circumstances could occur. Plots that exhibit declines that fall below the management standard would require a comprehensive analysis of causal relationships for informing effective restoration actions. Restoration actions would be guided by identifying specific elements or attributes of habitats used by affected bird focal species. Earlier studies on bird-habitat associations emphasized general structural characteristics of vegetation (Wiens 1969; Willson 1974; Cody 1985), while more recent studies have identified the importance of specific tree species for riparian-dependent birds (Strong and Bock 1990; Saab 1999). Nur et al. (2008) reported that local vegetation and habitat characteristics were important in explaining variation in local abundance. Concurrent with active habitat restoration, removal of anthropogenic use of the impacted riparian habitats (e.g., willow and cottonwood stands) adjacent to the river may occur.

TABLE 5-15: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR MID-ELEVATION RIPARIAN HABITAT (RIPARIAN BIRD ABUNDANCE)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Mean abundance of two or more individual species drop below the 10th percentile threshold for one year or the mean abundance summed across species drops below the 20th percentile threshold in two out of three years	For each plot, assess riparian bird assemblage and extent of human impacts. Compare the mean abundance of birds (individual species and summed across species) in pristine versus potentially impacted plots. Pristine versus impacted sites would be identified based on an index of human use and the structural integrity of the riparian vegetation. For those potentially impacted plots that have lower bird abundance, assess any changes in vegetation attributes and human use that may be causing declines in riparian birds. If anthropogenic activities are identified as causal mechanisms of declining riparian bird populations, then implement actions to limit the extent and magnitude of effects (i.e., human impacts or management practices). Actions could include visitor messaging, restoration signs, and targeted vegetation restoration.	Management action to assess vegetation attributes and human use at potentially impacted sites would refine our understanding of baseline conditions and causal mechanisms (altered riparian habitat function, natural processes, external factors, or cumulative effects) affecting localized riparian bird integrity.
Trigger Point 2: Mean abundance of two or more individual species are below the 10th percentile threshold in three out of five years or the mean abundance summed across species is below the 5th percentile threshold in five out of seven years.	For those potentially impacted plots that have lower bird abundance, assess any changes in vegetation attributes and human use that may be causing declines in riparian birds. If anthropogenic activities are identified as causal mechanisms of declining riparian bird populations, then implement actions to limit the extent and magnitude of effects (i.e., human impacts or management practices). Actions could include restoration practices at those impacted sites where riparian birds have declined. Such practices could include visitor messaging, restoration signs, fencing, and habitat restoration to restore vegetation attributes related to higher riparian bird abundances (determine by statistical analyses). Actions may also include hard closures of individual impacted areas, including increased visitor education surrounding closures and riparian vegetation impacts. Closure regulations would be represented within the superintendent's compendium to allow for law enforcement.	If this trigger point is exceeded after 5 years, there would be another 5 years left before the management standard would be exceeded. This would provide enough time for focused visitor education and vegetation restoration to avert failing the management standard.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Tables 5-10, 5-12, or 5-15 above, which present the trigger point values for the three indicators (meadow fragmentation resulting from informal trails, the status of riparian habitat, and riparian bird abundance) used to monitor meadow and riparian conditions for ORV 2: Mid-elevation meadows and riparian habitat in Yosemite Valley.

Management concerns are present in relation to the meadow fragmentation indicator. The fragmentation standard (LPI_5) is a weighted mean of 93% in Segment 2, with no meadow less than 90%. Several Yosemite Valley meadows (Cook's A, El Capitan, Leidig, and Slaughterhouse A) have a fragmentation standard of less than 90%, as shown in Table 5-7. Ensuring that these meadows are in compliance at the individual meadow level will ensure that the ORV is protected at the Segment level. To address the management concerns related to meadow fragmentation triggers, the NPS will take the following actions as specified in Table 5-10 and Alternatives 2-6:

- Remove informal trails in meadows where they fragment meadow habitat or cross through sensitive, wet vegetation communities. Overall, restore six miles of informal trails throughout Yosemite Valley.
- Use boardwalks or hardened surfaces to allow access to sensitive areas

- Delineate trails through upland areas and along meadow perimeters
- Place restoration closure signs, and/or fencing along meadow perimeters
- Fill deep headcuts caused by informal trails with native soil and re-contour to natural meadow topography
- De-compact trampled soils, and use salvaged plants growing in trail ruts and local seed to revegetate area and consolidate multiple parallel trails
- Institute closures in individual impacted meadows, and increase visitor education associated with the closures

Surveys in 2010 indicate that management concerns are also present in terms of the riparian status indicator. These surveys indicated that about 20% of the riparian area along the Merced River in Yosemite Valley was in low condition, and approaching an adverse effect (30% of the riparian habitat in low condition). These impacts are highly localized. To address this management concern, the NPS will:

- Re-vegetate riverbanks between Clark's Bridge and Sentinel Bridge with native riparian shrubs and trees, and strategically place wood to promote bar formation and natural channel narrowing.
- Utilize temporary closures to sensitive resource areas to allow natural recovery along riverbanks.
- Re-direct visitor use to more stable and resilient river access points such as sandbars, and designate formal river access sites. Establish fencing and signage to protect sensitive areas; install boardwalks where appropriate, and actively re-vegetate where needed.
- Construct hardened structures at designated river access points where needed to facilitate and concentrate safe visitor access. Fence and sign sensitive areas and re-establish riparian vegetation.
- Locate any new structures at least 150 feet from the ordinary high-water mark. Relocate or remove all campsites at least 100 feet away from the ordinary high-water mark.

The NPS is beginning to monitor the third indicator in this segment, riparian bird abundance. A baseline for this indicator is in place to monitor the status of the indicator through time. The first status assessments will take place in 2013, after one year of monitoring. The next assessment requires information from two out of three years. In 2013, the NPS will determine if initial triggers are achieved. Confirmation of the presence or absence of adverse effects or degradation requires 10 years of monitoring data.

Management Considerations and Enhancement Actions

In general, actions proposed to address meadow and riparian considerations in Segment 2 would improve meadow hydrology and topography, install or extend boardwalks to reduce meadow trampling, fill drainage ditches not serving current operational needs, remove abandoned infrastructure, and remove conifer seedlings and saplings from meadows. The following actions are common to Alternatives 2-6:

- **Meadow hydrology:** Construct wide box culverts to enhance natural water flows into meadows, and formalize or remove road shoulder parking. Restore hydrologic processes to increase sheet flow into meadows to sustain native meadow vegetation and limit conifer growth where possible. Target areas include Sentinel Meadow, Cook's Meadow, El Capitan Meadow, Stoneman Meadow, and other meadows as necessary.
- **Meadow habitat:** Restore denuded vegetation in Leidig Meadow, El Capitan Meadow, Ahwahnee Meadow, Sentinel Meadow, Stoneman Meadow, and other meadows as necessary. Protect re-vegetated areas with fencing or other natural barriers and install signs to prevent vegetation trampling. Replace a section of paved trail in Leidig meadow (within ordinary high-water mark of the river) with

an elevated boardwalk. Develop or extend boardwalks to accommodate visitors and reduce meadow trampling. Fill ditches not serving current operational needs using adjacent soil or pond-and-plug techniques. Manually or mechanically remove conifer seedlings and saplings from meadows.

- **Riparian habitat buffers:**[27] Relocate or remove all campsites within 100 feet of the ordinary high-water mark. Establish a riparian buffer and prohibit new development along both sides of the Merced River within 150-feet of the ordinary high-water mark. Move the Yosemite Village Day-use Parking Area 150 feet north of the Merced River. Restore riverside areas of Backpackers, North Pines, and Lower Pines campgrounds to natural riparian conditions.
- **Abandoned infrastructure in meadow and riparian habitat:** Remove abandoned infrastructure (including tiles, pipes, and abandoned roads) from meadow, riparian, and floodplain habitat. Decompact soils, remove fill, and re-vegetate with riparian species. Address areas including the former Eagle Creek/Rocky Point Sewage Plant site, Royal Arches Meadow, Cook's Meadow, western (closed) portion of former Lower Pines Campground, and the former lodge cabin/volunteer center at Yosemite Lodge.
- **Riparian restoration and river access:** Use brush layering and other re-vegetation techniques to repair localized riverbank erosion and lessen the scouring effect associated with bridges. Direct visitor use on the banks of the Merced River to stable and resilient river access points such as sandy beaches and low-angle slopes. Install fencing and signs to protect sensitive areas such as steep riverbanks and high use areas that exhibit vegetation loss and eroded soils. Protect re-vegetated areas with closure signs, fencing, and/or natural barriers such as rocks and logs. Riverbanks that would be addressed include those adjacent to Lower Pines and North Pines Campgrounds, Housekeeping Camp, Yosemite Lodge beach access, Swinging Bridge Picnic Area, Sentinel Beach Picnic areas, Cathedral Beach Picnic Area, Devi's Elbow, riverside areas between Pohono Bridge and the El Portal Road/Big Oak Flat Road intersection, and along the Valley Loop Trail. Remove the pack stock trail along the river between the Concessioner Stables and Happy Isles, and re-direct stock use to the Valley Loop Trail. See Appendix E for a detailed description of ecological restoration actions.

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[27] A riparian buffer is a strip of riparian vegetation along the banks of a river that filters runoff and provides a transition zone between the river and human land use (e.g., Osbourne and Kovacic, 1993). The concept of a riparian buffer to protect river resources is well established in the scientific literature and has been applied by numerous federal, state, and local land management agencies (e.g., Welch, 1991; Wenger, 1999; Lee et al., 2004; Mayer et al., 2006).

The primary justifications for employing a riparian buffer along the Merced River are to protect water quality and riparian habitat. In terms of water quality, riparian buffers help trap pollutants that could otherwise directly enter the river. Buffers reduce the magnitude and velocity of overland flow, trap sediment, and attenuate compounds such as nitrogen and phosphorous and pathogens such as E. coli (e.g., Osbourne and Kovacic, 1993; Mayer et al., 2005; Tate et al., 2006; Hoffmann et al., 2009). Riparian buffer vegetation helps to stabilize riverbanks through provision of root cohesion on banks and floodplains, reduce erosion, and allow surface water to infiltrate the soil. Riparian buffer vegetation provides a source of large wood to the river and adjacent floodplain, which dissipates river flow energy and regulates channel form (Montgomery et al., 2003). In terms of habitat, riparian buffers enhance important habitat for birds and other wildlife by allowing establishment of new vegetation and persistence of a complex habitat structure (e.g., Darveau et al., 1995, 2001; Whitaker and Montevecchi, 1999). Buffers also protect aquatic ecosystems by providing organic nutrients, by supplying woody debris that improves habitat complexity, and by moderating water temperatures by vegetative shading of the river (e.g., France et al., 1996; Karr and Schlosser, 1977).

The effective width of a riparian buffer depends on the steepness of the local topography, the floodplain extent, soil type(s), vegetation type(s), local wildlife species, and the nature and extent of human land use (e.g., Lee et al., 2004; Hawes and Smith, 2005; Mayer et al., 2006). As a result of these numerous factors, as well as the inherent variability and complexity of river system processes, there are no singular, generic standards for riparian buffer widths. Review of scientific literature indicates a range of recommended buffer widths, with values generally ranging between a minimum of 30 feet and a maximum of 300 feet (Castelle et al., 1994; Wenger, 1999; Lee et al., 2004; Mayer et al., 2006); typical values fall between 50 and 150 feet. In general, larger buffers afford greater levels of river protection. Because the riparian buffers proposed herein are designed to protect a Wild and Scenic River within a National Park and World Heritage site, a strong level of river protection is desired.

- **Ahwahnee Meadow:** Restore meadow to natural conditions by restoring meadow topography, removing abandoned irrigation lines and associated fill material, filling in ditches, and re-vegetating with native meadow vegetation. Remove the abandoned tennis courts from the black oak woodland. Re-connect fragmented portions of Ahwahnee Meadow by removing conifers and re-contour topography to increase the size of the meadow 5.7 acres.
- **Bridalveil Meadow:** Address the condition of the stream in Bridalveil Meadow, which exhibits "headcutting," by inserting willow cuttings into disturbed sites in the stream channel, banks of the Merced River, and the adjacent meadow. Re-establish the riparian shrub layer in the meadow to restore the diversity of meadow and riparian habitat.
- **Native Plant Communities in River Corridor:** Restore the mosaic of meadow, riparian deciduous vegetation, black oak, and open mixed conifer forest at specific locations in Yosemite Valley (67 potential acres). Management actions could include re-vegetation, prescribed fire, mechanical removal of conifers, and infrastructure re-design.
- **Declining amphibian and reptile species:** In accordance with NPS Policy, continue management toward removal of non-native species, and re-introduction of extirpated or declining species as priorities and opportunities are developed. Prioritize studies of the Western pond turtle and the foothill yellow-legged frog.

The alternatives propose a variety of actions and solutions to address other meadow and riparian considerations. Alternatives 2-6 would restore the Merced River corridor to natural conditions as follows:

Alternative 2: 347 acres ecological restoration
Alternative 3: 302 acres ecological restoration
Alternative 4: 223 acres ecological restoration
Alternative 5: 203 acres ecological restoration
Alternative 6 : 170 acres ecological restoration

- **Ahwahnee Meadow:** Alternatives 2 and 3 would re-route meadow trails outside of wetlands, and consolidate trails with the Housekeeping Footbridge trail where possible. In addition, alternatives would remove associated fill and restore wetland areas where trails are removed, and remove 900 feet of Northside Drive and relocate the parallel bike path to the south to improve connectivity between the meadow and the river. Alternatives 4, 5, and 6 would remove fill from wetlands and sensitive areas, and install a 350-foot boardwalk to traverse wet areas. Northside Drive and the associated bike path would remain in the current configuration, and culverts would be added to improve hydrologic connectivity.
- **Indian Creek / Ahwahnee Row and Tecoya Dorms Concessioner Employee Housing:** Alternative 2 would remove housing and development between the Village Store and Ahwahnee Meadow; recontour topography using 1919 maps as a guide; restore hydrologic functions of Indian Creek; and revegetate the area with native meadow and riparian vegetation. Alternatives 3, 4, 5, and 6 would retain concessionaire employee housing in the area and establish a 50-foot setback from Indian Creek for new development; existing incompatible uses would be removed from the setback.
- **El Capitan Meadow:** Alternative 2 would restore all informal trails in the meadow to natural conditions, reduce roadside parking, and consolidate parking in the west end of the meadow. Parking for search and rescue efforts would remain. Alternatives 3 and 4 would utilize fencing and signage to designate appropriate meadow access points and remove all informal trails in sensitive, frequently inundated, or incised meadow habitat. Alternatives 5 and 6 would install fencing along the northern perimeter of meadow and designate appropriate access points using boardwalks and viewing platforms.
- **Former Upper and Lower Rivers Campground:** Alternatives 2-3 and 5 would restore 35.6 acres of floodplain/riparian/wetland habitat within the 10-year floodplain. This includes actions to remove remnant asphalt, decompact soils, and re-establish seasonal channels and natural

topography. Alternatives 4 and 6 would restore 19.7 acres of floodplain topography and riparian/wetland habitat within 150 feet of the ordinary high-water mark of the Merced River. This includes actions to remove remnant asphalt, decompact soils, and re-establish overflow channels where possible. No development would occur in the former campground site in Alternatives 2-3, but new campsites and related infrastructure would be built in Alternatives 4-6 with minimal impact expected on the landscape. Alternative 5, specifically, would accommodate 30 new walk-in campsites in Upper River Campground and eight picnic tables at the former Lower River Campground. In Alternatives 4 and 6, there would be 30 walk-in campsites and 2 group sites in Upper River and 40 walk-in sites in Lower River. As additional ecological protections in Alternative 5, large box culverts would be installed under the road to accommodate water flows that sustain riparian and wetland habitats, and fencing would be constructed along sections of the riverbank to guide visitor use to less sensitive areas. In Alternatives 4 and 6, the Upper River riparian zone would be fenced and closed to prevent riverbank trampling.

- **Housekeeping Camp:** Alternatives 2 and 3 would remove all lodging units and riverside revetment at Housekeeping Camp from within the 100-year floodplain and restore 19.4 acres of floodplain and riparian habitat to natural conditions. The area would be reconfigured for day-use river access, a rafting put-in, and picnicking. Alternative 4 would remove 166 lodging units at Housekeeping Camp (83 duplex lodging units, 4 restrooms, store and office) out of the ordinary high-water mark retaining a total of 100 units. Restrooms, shower houses, and laundry would remain. Alternatives 5 and 6 would remove a total of 34 units, commensurate with the decision in the Concession Services Plan/ Supplemental Environmental Impact Statement (1992), allowing restoration of about one acre of riparian habitat. The existing fencing along the riverbank would be adjusted to protect restored riparian habitat.
- **Stoneman Meadow and Curry Orchard Parking Area:** Alternatives 2, 3, and 4 would restore hydrologic and habitat connectivity in Stoneman Meadow by removing the 1,335-foot long segment of Southside Drive that bisects Stoneman Meadow and extend the boardwalk to Curry Village up to 275 feet and realign the road through Boys Town. Alternative 5 would remove roadside parking along the road through Stoneman Meadow, allowing removal of unnatural fill re-vegetation of the area. The fenced area on the north end of the meadow near Lower Pines Campground would be expanded to protect wetlands. The NPS would conduct transportation and engineering studies to examine the potential to remove Northside Drive from the meadow under Alternative 5. All alternatives would redesign or improve the Orchard parking area to promote water flows from cliff walls to Stoneman Meadow and to remove apple trees from the Orchard parking area to mitigate human-bear encounters.
- **Valley Loop Trail:** Alternatives 2, 3, and 4 would re-route the portion of the trail in Slaughterhouse Meadow that runs through wetland habitat to an upland area. Alternatives 5 and 6 would construct a boardwalk through this wet area. All alternatives would move a 780-foot segment of the trail through Bridalveil Meadow to the base of the fill slope of the Valley Loop Road.
- **Yosemite Lodge:** Alternative 2 would remove all buildings except for the core portion of the Lodge complex which houses the cafeteria. Alternative 3 would remove four buildings from the 100-year floodplain. All alternatives would restore new undeveloped areas (that differ in size per alternative) to natural conditions; de-compact soils; recontour topography using 1919 maps as a guide, and plant native vegetation.
- **Backpackers Campground:** Under Alternative 5, 10 sites would remain and 15 sites within 100 feet of the ordinary high-water mark would be removed, to be restored with native plant communities. In addition, 16 campsites would be added west of Backpackers Campground.

Additional considerations related to fire management and non-native species control would be addressed through actions prescribed in the Yosemite *National Park Fire Management Plan* (NPS 2004) and the *Invasive Plant Management Plan Update* (NPS 2010). ORV 6—the Merced River as an outstanding example

of a rare, mid-elevation alluvial river—presents additional management considerations and associated actions to enhance riparian habitat.

Conclusion: Protecting and Enhancing ORV 2 (mid-elevation meadows and riparian habitat)

The NPS will monitor three indicators to assess the condition of ORV 2: meadow fragmentation resulting from informal trails, the status of riparian habitat, and riparian bird abundance.

Adverse effects and degradation are not present in relation to the meadow fragmentation indicator. Management concerns are present, as preliminary data collection indicates that a trigger point for the fragmentation standard (LPI_5) has been exceeded. Actions to address informal trailing impacts and fragmentation will be taken at all meadows where these triggers have been tripped. Actions to address these management concerns are found in Table 5-10.

Initial surveys of the riparian status indicator in 2010 indicate that degradation is not present, but management concerns are present, with conditions approaching an adverse effect. To address this management concern, the NPS will re-vegetate riverbanks between Clark's Bridge and Sentinel Bridge with native riparian shrubs and trees, strategically place wood to promote bar formation and natural channel narrowing, utilize temporary closures to allow natural recovery along riverbanks, re-direct visitor use to more stable and resilient river access points and establish fencing and signage to protect sensitive areas, install boardwalks where appropriate, construct hardened structures at designated river access points to concentrate safe visitor access, locate new structures at least 150 feet from the ordinary high-water mark, and relocate or remove all campsites at least 100 feet away from the ordinary high-water mark.

The NPS is beginning to monitor the third indicator in this segment, riparian bird abundance. The first status assessments will take place in 2013, after one year of monitoring. The next assessment requires information from two out of three years. Confirmation of the presence or absence of adverse effects or degradation requires 10 years of monitoring data.

Additional management considerations related to ORV 2 are present. Under Alternatives 2-6, the NPS will fill in ditches and re-contour meadow topography, expand the role of fire in maintaining meadows, and restore the abandoned golf course at The Ahwahnee to natural conditions. Alternatives 2-6 also consider a range of options for large-scale ecological restoration in historic riparian/ meadow/ floodplain complexes, reduce impacts of formal trails in meadows, reduce hydrological impacts of the road that runs through Sentinel Meadow, and reduce meadow impacts that result from roadside parking. In accordance with NPS Policy, management direction would continue toward removal of non-native species, and re-introduction of extirpated or declining species as priorities and opportunities are developed.

To ensure this biological ORV is protected and enhanced through time, the NPS would continue to monitor the condition of the ORV using these three indicators. Monitoring would provide early warning of conditions that require management action before impacts occur. These measurable conditions would trigger specific management responses, as described in Table 5-10, Table 5-12, and Table 5-15.

Biological ORV—Sierra Sweet Bay (*Myrica hartwegii*)

ORV 3—The Sierra sweet bay (*Myrica hartwegii*) is a rare plant found on riverbanks along the South Fork Merced River.
Location: Segments 7 (Wawona) and 8 (South Fork Merced River below Wawona)
Rationale: In Wawona and downstream, the South Fork Merced River provides habitat for a rare plant, the Sierra sweet bay (*Myrica hartwegii*). This special-status shrub is found in only five Sierra Nevada counties. In Yosemite, it occurs exclusively on sand bars and riverbanks along the South Fork Merced River downstream from Wawona and along Big Creek.
Management Objective: Manage the Sierra sweet bay population to protect the abundance of the population along the South Fork Merced River

ORV Condition at the Time of Designation (1987)

At the time of designation, botanists considered the Sierra sweet bay to be rare in Yosemite, but not threatened by local impacts.

Current ORV Condition

The Sierra sweet bay population in Yosemite National Park is in good condition (Colwell and Taylor 2011). The only known human impact is minor localized trampling associated with recreational river access near the Wawona Campground.

Management Program for ORV 3 — Sierra Sweet Bay

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program.

Indicator – Sierra Sweet Bay Population Decline

Permanent photo points would be established to monitor the integrity of the of Sierra sweet bay population along the South Fork Merced River. Comparison of repeat photos can be expected to be a more effective surrogate for assessing human disturbance than more complicated and costly monitoring strategies for this ORV. The health of this ORV would be determined by comparing populations located near Wawona Campground (an area that is likely to be disturbed by humans) with more remote populations that are less likely to receive such disturbance. Monitoring would occur every five years. When photos indicate a decline in sweet bay abundance, the population can be re-mapped and compared to the original mapped extent of Sierra sweet bay completed in 2010 (Colwell and Taylor 2011) to determine if real declines have occurred in the population. Easily accessible potential reference stands are located away from direct effects associated with the Wawona Campground and along Big Creek.

Management Standard

The management standard for Sierra sweet bay would be achieved if the abundance of populations along the South Fork Merced River within Yosemite National Park is maintained at >80% of the reference stands.

The management standard establishes a low tolerance for human-caused decline in population size so that population decline caused by human disturbance can be reversed if detected early. This species is adapted to

spatial and temporal modifications to its habitat resulting from periodic hydrologic events, such as 50- and 100-year floods or periodic fires. Resulting natural fluctuations in population size indicated by all populations declining in size by a similar amount would not be mitigated under this ORV. Also, population declines resulting from global environmental change (e.g., invasive species, disease, changing precipitation patterns), even if anthropogenic in origin, are beyond the scope of this plan and would not be mitigated under this ORV.

Adverse Effect

An adverse effect would be present if there is a human-caused decline of over 40% in Sierra sweet bay abundance along measured reaches of the South Fork Merced River, as compared with reference stands.

Degradation Standard

Degradation would be present if there is a human-caused decline of over 70% in the abundance score of Sierra sweet bay occurs along measured reaches of the South Fork Merced River, as compared with reference stands. A 70% decline in the abundance score is estimated to be a level of decline that would be difficult to mitigate without a significant input of resources.

Monitoring – Sierra Sweet Bay Population Abundance

Permanent photo points would be established to help assess habitat condition and population persistence over time. Monitoring would occur every five years in Segments 7 (Wawona) and 8 (South Fork Merced River below Wawona). The mapped extent of Sierra sweet bay completed in 2010 (Colwell and Taylor 2011) would provide the basis for locating monitoring sampling units and for comparisons through time. Table 5-16 describes the trigger points that would inform managers that a response is required to avoid impacts on the ORV.

TABLE 5-16: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR SIERRA SWEET BAY

Trigger Point(s) at Which Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Decline of 20% in Sierra sweet bay abundance across two monitoring periods.	Reduce localized human use of Sierra sweet bay habitat with the installation of fencing.	Because localized human use is the most likely source of human-caused decline in Sierra sweet bay population abundance along the South Fork Merced River, a reduction in human use is likely to reverse a declining trend.
Trigger Point 2: Decline of 30% in Sierra sweet bay abundance across two monitoring periods.	Reduce localized human use of Sierra sweet bay habitat with the installation of fencing Augment population by planting and protecting using cuttings or seeds from local population	Fence installation will reduce the effects of trampling, and the addition of more individuals derived from this population will enhance population abundance. Both of these management responses are likely to reverse a declining trend.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-16 above. This population is in good condition, and management concerns are not present. Protective management action is not required at this time.

Management Considerations and Enhancement Actions

This population of Sierra sweet bay is in good condition, with management considerations not present. Management action to enhance the population is not required at this time.

Conclusion: Protecting and Enhancing ORV 3 (Sierra sweet bay)

The Sierra Sweet Bay ORV is determined to be absent of adverse effects and degradation and in good condition, based on 2010 surveys (Colwell and Taylor 2011). No immediate management concerns or considerations are present. To ensure that this biological ORV is protected and enhanced through time, the NPS would monitor the condition of the Sierra sweet bay population to ensure early warning of conditions that require management action before impacts occur. The monitoring indicator for Sierra sweet bay is coupled with triggers for specific management responses.

GEOLOGICAL AND HYDROLOGICAL ORVs

This section describes the program to protect and enhance each Geological/Hydrological ORV as proposed in the *Merced River Plan/DEIS*. Four Geological/Hydrological ORVs exist in the Merced River corridor, each related to specific segment(s) of the river (Table 5-17).

TABLE 5-17: GEOLOGICAL/HYDROLOGICAL ORVS AND ASSOCIATED INDICATORS

ORV Number and Key Resource	Segment(s)	Indicator to be Monitored through Time
4. Glacially-carved Canyon in Upper Merced River Canyon	1	None; the ORV is impervious to human disturbance
5. The "Giant Staircase"	2	None; the ORV is impervious to human disturbance
6. A Rare, Mid-elevation Alluvial River	2	1. The California Rapid Assessment Method (CRAM)
7. Boulder Bar in El Portal	4	None; the ORV is impervious to human disturbance

Geological/Hydrological ORV—Glacially-carved Canyon in Upper Merced River Canyon

ORV 4—The upper Merced River canyon is a textbook example of a glacially-carved canyon.
Location: Segment 1 (Merced River above Nevada Fall)
Rationale: This segment of the Merced River is characterized by a large-scale, glacially-carved canyon. The section of the Merced River above Bunnell Point, in particular, illustrates the relationship between geology and river course owing to its sweeping, glacially carved granite canyon cradling the river.
Management Objective: Manage to allow natural processes to shape the landscape and associated geologic values.

ORV Condition at the Time of Designation (in 1987)

This Geologic ORV was unaffected by human activities at the time of designation.

Current ORV Condition

Natural processes would continue to shape the landscape and associated geologic values. Human intervention has not perceptibly modified this Geologic ORV.

Management Program for ORV 4

It is very unlikely that this ORV would ever be affected by human intervention. Because the ORV is essentially impervious to intended human activities, no indicator will be used to monitor it. For the same reason, management standard, adverse effect, and degradation are not defined for this ORV, and the NPS will not monitor the condition of this ORV as part of the *Merced River Plan/DEIS*.

Management Considerations and Enhancement Actions

The NPS has no immediate management considerations with respect to the U-shaped, glacially carved canyon along the Merced River above Nevada Fall. Because there are no considerations regarding the condition of this ORV, no actions other than continued protection under WSRA is necessary.

Conclusion: Protecting and Enhancing ORV 4 (glacially-carved canyon in Upper Merced River Canyon)

This Geologic ORV is determined to be absent of adverse effects and degradation. No immediate management considerations are present, and it is unlikely that this ORV would be affected by human intervention in the future. The NPS would not monitor the condition of this ORV.

Geological/Hydrological ORV—"Giant Staircase"

ORV 5—The "Giant Staircase," which includes Vernal and Nevada Falls, is one of the finest examples in the western United States of stair-step river morphology.
Location: Segment 2 (Yosemite Valley)
Rationale: Dropping over 594-foot Nevada Fall and then 317-foot Vernal Fall, the Merced River creates what is known as the Giant Staircase. Such exemplary stair-step river morphology is characterized by substantial variability in river hydrology, from quiet pools, such as Emerald Pool, to the dramatic drops in the waterfalls.
Management Objective: Manage to allow natural processes to shape the landscape and associated geologic values.

ORV Condition at the Time of Designation (1987)

The rocky cliffs, cascades, and broad valleys along the Merced River represent a nationally significant example of a glaciated landscape. Sierra Nevada landforms were well established before glaciation, and major stream drainages provided the avenues that the glaciers would later follow. The course of the present-day Merced River is determined by the path of glaciers that came and went during the geological epoch known as the Pleistocene (10,000 to 1.8 million years ago). These glaciers transformed valleys from V-shaped to U-shaped, left hanging valleys along their lower reaches, and deposited thick packages of glacial till—ultimately shaping the iconic landscapes for which Yosemite Valley and the upper Merced River are known. Most researchers agree that at least three major glacial advances, or stages, have taken place: the Tioga, the Tahoe, and a much older pre-Tahoe (possibly the Sherwin) (Huber 1989). The Tioga Glaciation is

considered to have peaked around 20,000 years ago, but the precise timing of the earlier stages is still a topic of debate. Because these are massive landscape-wide natural events well beyond human control, this Geologic ORV was unaffected by human activities at the time of designation.

Current ORV Condition

Natural processes would continue to shape the landscape and associated geologic values. Human intervention has not perceptibly modified this geologic ORV.

Management Program for ORV 5

It is very unlikely that this ORV would ever be affected by human intervention. Because the ORV is essentially impervious to intended human activities, no indicator will be used to monitor it. For the same reason, management standard, adverse effect, and degradation are not defined for this ORV, and the NPS will not monitor the condition of this ORV as part of the *Merced River Plan/DEIS*.

Management Considerations and Enhancement Actions

Natural processes would continue to shape the landscape and the geologic value. The NPS has no immediate management considerations with respect to the Giant Staircase characteristic of the geology of Yosemite Valley above Happy Isles.

Because there are no considerations regarding the condition of this ORV, no actions other than continued protection under WSRA are necessary.

Conclusion: Protecting and Enhancing ORV 5 ("Giant Staircase")

This Geologic ORV is determined to be absent of adverse effects and degradation. No immediate management considerations are present, and it is unlikely that this ORV would be affected by human intervention in the future. The NPS would not monitor the condition of this ORV as part of the *Merced River Plan/DEIS*.

Geological/Hydrological ORV—A Rare, Mid-elevation Alluvial River

ORV 6—The Merced River from Happy Isles to the west end of Yosemite Valley provides an outstanding example of a rare, mid-elevation alluvial river.
Location: Segment 2 (Yosemite Valley)
Rationale: In Yosemite Valley, the Merced River is alluvial, characterized by a gentle gradient, a robust flood regime with associated large woody debris accumulation, and complex riparian vegetation. There are few examples in the Sierra Nevada of similar river morphology of this scale at this elevation (about 4,000 feet).
Management Objective: Protect and enhance natural geologic and hydrologic processes, such as overbank flooding and channel migration, which sustain river values such as meadow and riparian communities.

ORV Condition at the Time of Designation (1987) and Current Condition

This ORV integrates geologic/hydrologic processes and the condition of aquatic, riparian, and floodplain communities. For condition of the ORV, see the Free-Flowing Condition section in this chapter, and ORV 2 in this chapter concerning riparian and meadow communities in Yosemite Valley.

Management Program

The status of riparian habitat, as measured by the California Rapid Assessment Method (CRAM) (Collins et al. 2008) would be used to monitor the condition of this ORV through time. This is one of the same indicators used to monitor ORV 2. The indicator, management standard, definitions of adverse effect and degradation, monitoring program, and trigger points for management response are the same as ORV 2, as described earlier in this chapter.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached a trigger point, or when adverse effects or degradation are present. As noted in the discussion of ORV 2, surveys in 2010 indicate that management concerns are present in terms of the riparian status indicator, with about 20% of the riparian area along the Merced River in Yosemite Valley in low condition and approaching an adverse effect (30% of the riparian habitat) in low condition.

To address this management concern, the NPS will:

- Re-vegetate riverbanks between Clark's Bridge and Sentinel Bridge with native riparian shrubs and trees, and strategically place wood to promote bar formation and natural channel narrowing.
- Utilize temporary closures to sensitive resource areas to allow natural recovery along riverbanks.
- Re-direct visitor use to more stable and resilient river access points such as sandbars, and designate formal river access sites. Establish fencing and signage to protect sensitive areas; install boardwalks where appropriate, and actively re-vegetate where needed.
- Construct hardened structures at designated river access points where needed to facilitate and concentrate safe visitor access. Fence and sign sensitive areas and reestablish riparian vegetation.
- Locate any new structures at least 150 feet from the ordinary high-water mark. Relocate or remove all campsites at least 100 feet away from the ordinary high-water mark.
- Move Yosemite Village Day-use Parking Area north more than 150 feet away from the ordinary high-water mark.

Management Considerations and Enhancement Actions

Management considerations regarding fundamental alluvial processes in Yosemite Valley include accelerated riverbank erosion in localized areas, lack of natural levels of large wood in the river system, altered surface and groundwater flow patterns, and alterations to the distribution and extent of connected floodplain. Accelerated riverbank erosion is associated with high levels of foot traffic and resulting loss of riparian vegetation. Without riverbank vegetation, the potential for erosion increases, as vegetation holds unconsolidated soils in place. Since the beginning of the 20th century, the river in Yosemite Valley widened an average of 27% and up to 100% between Clark's Bridge and Sentinel Bridge, compared to widening downstream of this location of just 4% (Madej, 1991 and 1994).

The NPS removed large wood from the river channel for many decades to reduce risks to bridges and other infrastructure during flood stages, and to improve safety by removing in-stream obstacles. The long-term removal of large wood in Yosemite Valley altered the structure and complexity of the river channel (Cardno ENTRIX, in review). Long-term wood removal also affected riparian habitat, as large wood is a source of nutrients, cover, and substrate for aquatic organisms (Montgomery and Piégay 2003). Removal of wood

reduces connectivity between the river and its floodplain (Abbe et al., 2003). The following action would take place under Alternatives 2-6 to address this issue:

- Manage large wood according to the management policy,[28] leaving large wood in the channel that does not compromise visitor safety or infrastructure.
- Incorporate large wood into riverbanks to provide structure for highly eroded riverbanks and increase habitat quality.
- Place large wood in the Merced River to enhance channel complexity and mitigate scouring from bridges.
- Place eight constructed log jams in the river channel between Clark's Bridge and Sentinel Bridge.

Development and infrastructure, such as roads, ditches, trails, and abandoned utility lines, has likely altered surface and subsurface hydrology associated with the Merced River (Cooper and Wolf 2008).

Actions to address these considerations overlap with those listed under ORV 2 and the Free-flowing Conditions sections in this chapter.

Conclusion: Protecting and Enhancing ORV 6 (a rare, mid-elevation, alluvial river)

This ORV integrates geologic/hydrologic processes and the condition of aquatic, riparian, and floodplain communities in Yosemite Valley. Management concerns and considerations are both present. To remedy these, the *Merced River Plan/DEIS* proposes a variety of actions to address specific considerations in "Alternatives" (Chapter 8) to protect river values. In riparian zones under all alternatives, the NPS would direct river use to more stable and resilient access points, protect sensitive areas, and remove or relocate campsites within 100 feet of the ordinary high-water mark. The NPS would explore a range of options among the action alternatives for large-scale ecological restoration in historic riparian/ floodplain complexes, reduce hydrological impacts of the road that runs through Sentinel Meadow, and consider and evaluate a range of options to re-vegetate denuded riverbanks and limit future development directly adjacent to the Merced River.

To ensure this ORV is protected and enhanced through time, the NPS would monitor the condition of the ORV using the status of riparian habitat as an indicator, and the CRAM methodology, and take specific actions should conditions reach trigger points. These trigger points are selected to inform managers well in advance of adverse effects or degradation impacts on this ORV.

[28] "Management of Fallen Trees in the Merced River in Yosemite Valley," NPS, 2012.

Geological/Hydrological ORV—Boulder Bar in El Portal

ORV 7—The boulder bar in El Portal was created by changing river gradients, glacial history, and powerful floods. These elements have resulted in accumulation of extraordinarily large boulders, which are rare in such deposits.
Location: Segment 4 (El Portal)
Rationale: When river gradients lessen, rivers lose the energy needed to transport larger sediments. In such areas, bar-type deposits, such as the large boulder bar at the east end of El Portal, are built up. This is no ordinary boulder bar, however, for it contains massive boulders over a meter in diameter and weighing many tons. It is the combination of boulder availability, the steepness of the river in the gorge, the major change in gradient at El Portal, and the size of the Merced River's peak floods that enables the river to build such a boulder bar. As illustrated by the January 1997 flood, the Merced continues to sort and build this bar, providing evidence in all seasons of its potential power.
Management Objective: Manage to allow natural processes to shape the landscape and associated geologic values.

ORV Condition at the Time of Designation (1987)

This Geologic ORV was unaffected by human activities at the time of designation.

Current ORV Condition

Additional large boulders were deposited by a natural flooding event in 1997.

Management Program for ORV 7

It is very unlikely that this ORV would ever be affected by human intervention. Because the ORV is essentially impervious to intended human activities, no indicator will be used to monitor it. For the same reason, management standard, adverse effect, and degradation are not defined for this ORV, and the NPS will not monitor the condition of this ORV as part of the *Merced River Plan/DEIS*.

Management Considerations and Enhancement Actions

Natural processes would continue to shape the landscape and the geologic value. The NPS has no immediate management considerations with respect to the El Portal boulder bar. Because there are no considerations regarding the condition of this ORV, no actions other than continued protection under WSRA are necessary.

Conclusion: Protecting and Enhancing ORV 7 (the El Portal Boulder Bar)

The El Portal Boulder Bar ORV is determined to be absent of adverse effects and degradation. No immediate management considerations are present, and it is unlikely that this ORV would be affected by human intervention in the future. The NPS would not monitor the condition of this ORV as part of the *Merced River Plan/DEIS*.

CULTURAL ORVs

The continuum of human use along the Merced River and South Fork Merced River encompasses millennia of diverse peoples, cultures, and uses. American Indian and late 19th-century American cultures flourished along these rivers because they provided reliable, year-round water in extraordinary settings. Evidence that reflects trade, travel, and settlement patterns abounds in an intricate and interconnected landscape of archeological sites, traditional use sites, and historic resources representing this cultural history. The ongoing cultural traditions of contemporary American Indians and other ethnic heritages are linked through space and time to their respective prehistoric and historic pasts via these ethnographic and cultural landscapes. This landscape holds outstandingly remarkable scientific, interpretive, and cultural value for traditionally associated peoples and the public. This section describes how the NPS would protect and enhance the Cultural ORVs as proposed in the *Merced River Plan/DEIS*. As the parts of the cultural ORV are a linked landscape, in essence they are one ORV separated into seven parts. Each part is related to specific segment(s) of the river (Table 5-18). They shall be referred to as seven ORVs, from ORV 8 to ORV 14.

TABLE 5-18: CULTURAL ORVS AND ASSOCIATED INDICATORS

ORV Number and Key Resource	Segment	Indicator to be Monitored through Time
8. Yosemite Valley American Indian ethnographic resources	2	1. Meadow fragmentation due to the proliferation of informal trails 2. Status of riparian habitat 3. California black oak – number of adults and ratio of saplings to adults
9. The Yosemite Valley Archeological District	2	1. Condition of Yosemite Valley Archeological District
10. Yosemite Valley Historic Resources	2	1. List of Classified Structures Condition Assessments
11. The El Portal Archeological District	4	1. Condition of El Portal Archeological District
12. Regionally rare archeological features along the South Fork Merced River at archeological sites with rock ring features.	5	1. Condition of archeological sites
13. The Wawona Archeological District	5, 6, 7 and 8	1. Condition of Wawona Archeological District
14. The Wawona Covered Bridge	7	1. List of Classified Structures Condition Assessment

The characteristics of the Cultural ORV related to its condition are based on the same seven aspects of integrity that contribute to the National Register eligibility of each ORV element: location, design, setting, materials, workmanship, feeling, and association. *Location* is the place where the historic property was constructed or where the historic event occurred. *Design* is the combination of elements that create the form, plan, space, structure, and style of a property. *Setting* is the physical environment of a historic property. *Materials* are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property. *Workmanship* is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory. *Feeling* is a property's expression of the aesthetic or historic sense of a particular period of time. *Association* is the direct link between an important historic event or person and a historic property (NPS 1997d). Specific examples of the characteristics evidencing the integrity of the Cultural ORV include, but are not limited to:

***Archeological Site Integrity*:** Archeological sites reflect millennia of human use and cultural evolution in relation to the river. Prehistoric and historic resources in the Yosemite Valley and Wawona Archeological Districts include American Indian villages, camps, and special purpose sites dating from at least 6,000 years

ago to a period of historical occupation. In the El Portal Archeological District, some resources may be as old as 9,500 years. Benchmarks of integrity for archeological sites are primarily concerned with the *in situ* preservation of intact artifacts and features (the attributes of location, design, and setting discussed above), so that spatial associations between site components can be observed in surface and subsurface assemblages. The integrity of features—such as pictographs, rock rings, or rock alignments—are judged on the clarity with which the outlines of such features can be delineated. Additions of cultural elements not related to the site (e.g., modern campfire rings, trails, roads, graffiti, buildings, or structures) can negatively affect the integrity of an archeological site's setting, association, and feeling. Historical remains can provide clear evidence of former use and association and may retain integrity as archeological resources, such as the physical remains of U.S. Army Calvary Camp A.E. Wood.

As a regular part of ongoing archeological research, inventory, and accountability, Yosemite utilizes the Archeological Site Management Information System (ASMIS). Throughout the NPS, ASMIS is the primary monitoring tool for the condition of archeological sites, documenting site conditions, threats, disturbances, treatments, and management actions, as well as providing descriptions and locations for all known archeological sites in the park (NPS 2005, 2007). The ASMIS condition assessment ("good," "fair," "poor," "unknown," or "destroyed") addresses the stability of a site compared to the previous site visits, but is not an indicator of cumulative impacts over time (Middleton [NPS] 2008). The disturbance severity level at a site is determined through the combined assessment of individual disturbances (NPS 2010c). This component of the ASMIS data system is determined independently of site condition and reflects a cumulative impact level that the site has sustained (Darko 2011).

***Ethnographic Resource Integrity*:** Traditionally associated American Indians assign strong spiritual value to the Merced River and Yosemite Valley, continuing their sense of place and cultural association with the river that is both a destination and a place of refuge. American Indians attached names and stories to geologic and other features in the Merced River corridor and consider many of these to be sacred or of spiritual significance. Villages or campsites were sited along the river to take advantage of seasonal resources, riparian plant species, or migrations of game animals. The integrity of the association with the community's cultural practices and beliefs is a critical consideration in assessing the condition of the ethnographic resources in Yosemite Valley. Benchmarks for the integrity of this component of the Cultural ORV in the Yosemite Valley segment could include unobstructed views of and/or access to sacred or significant geologic features, maintenance of and access to healthy populations of traditional ethnobotanical resources, and preservation and access to archeological remains or locations of historic, spiritual, or traditional significance.

***Built Environment Integrity*:** Conditional benchmarks for the integrity of the historic-era built environment include:

- continuity of original uses (association)
- maintenance of original physical form and materials (design, workmanship, and materials)
- a feeling of related association between the resource and contemporaneous elements (location, setting, feeling, and association)

Cultural ORV—Yosemite Valley American Indian ethnographic resources

ORV 8—Yosemite Valley American Indian ethnographic resources include a linked landscape of specifically mapped traditional-use plant populations, as well as the ongoing traditional cultural practices that reflect the intricate continuing relationship between indigenous peoples of the Yosemite region and the Merced River in Yosemite Valley.
Location: Segment 2 (Yosemite Valley)
Rationale: Yosemite Valley Native American ethnographic resources include relatively contiguous and interrelated places that are inextricably and traditionally linked to the history, cultural identity, beliefs, and behaviors of contemporary and traditionally-associated American Indian groups. These areas include specifically mapped traditional plant gathering areas rooted in the history of traditionally associated peoples that are important to maintain and continue their cultural identity (Bibby 1994; Parker and King 1998). The traditional use plants gathered at such areas within Yosemite Valley comprise a complete system that is culturally significant. Both river-related and non-river related traditional use plants are included in this ORV.
Management Objective: Maintain ethnographic resources, and encourage future propagation to meet cultural restoration purposes to the extent ecologically feasible. Support access for traditional practitioners and other traditionally associated American Indians through the administrative elements of the user capacity and non-recreational tribal pass programs, and ongoing consultation with traditionally associated tribal groups to ensure the success of these programs.

ORV Condition at the Time of Designation (1987)

The landscape of Yosemite Valley is a product of both natural and cultural processes. Many of the meadow and riparian species of this landscape are important ethnographic resources. While natural processes, such as those that drive hydrologic functions, have shaped the meadow complexes of the Merced River, cultural processes including American Indian burning to promote hunting and gathering have also shaped the Yosemite Valley landscape. Vista clearing to maintain views of the iconic scenery in Yosemite Valley also affected the condition of the landscape.

The discontinuation of traditionally associated American Indian practices such as seasonal burning, selective pruning, tilling, timely harvesting, and propagation were the primary impacts to ethnographic resources at the time of designation (Anderson 2005), triggered by a federal government policy of Indian removal. Clearing of vegetation for construction of facilities, homesteading, farming, and grazing of range animals occurred historically in traditionally used meadow and oak habitat (Bibby 1994). Effects on oak habitat may have been compounded by an overabundant deer population, leading to overbrowsing of oak seedlings and high mortality rates. The introduction of non-native plant species also encroached on populations of traditional use plants in Yosemite Valley at the time of designation. All of these changes have likely led to alterations in the abundance and integrity of ethnographic resources.

Current ORV Condition

Many of the impacts to this ORV identified at the time of designation continue to the present, though the current NPS preservation mission encourages and seeks to facilitate ongoing cultural connections between traditionally associated American Indian communities and ancestral park lands and resources through the continuation of important cultural practices, religious ceremonies, and unimpeded access to sacred sites (Bibby 1994). Recognition of the ecological and ethnobotanical value of the open meadows found on the Valley floor has begun to result in restoration of some of these sensitive areas to conditions resembling those found in the period before intensive historic-era settlement (NPS 2010a). Several traditional use areas

have been identified within Yosemite Valley, and some of the plant species within them are now actively being managed to encourage healthy plant populations (Bibby 1994; Deur 2007).

Increasing visitation to Yosemite Valley since the time of designation has likely resulted in changes or impediments in access for traditional practitioners and other traditionally associated American Indians.

Management Program for ORV 8

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. Three distinct indicators would be use to protect and enhance the values of the ethnographic ORV: a meadow fragmentation indicator, a riparian indicator, and a California black oak indicator. The meadow and riparian indicators overlap with indicators already described in this chapter under different ORVs. The California black oak indicator is introduced and described in this section. Although each indicator reflects different aspects of the ethnographic ORV and different potential impacts, they would be evaluated on a regular basis to ensure that the combination of these metrics protects the ethnographic ORV.

Indicator 1 – Meadow fragmentation due to the proliferation of informal trails

Some of the plant populations constituting this ORV occur in Yosemite Valley meadows. To monitor the condition of meadow ethnographic resources, the meadow fragmentation indication will be used, as described under biological ORV 1 – Meadow Fragmentation due to the Proliferation of Informal Trails. The management standards, definitions of adverse effect and degradation, monitoring program, and trigger points are the same as described under ORV 1.

Indicator 2 – Status of Riparian Habitat

Other plant populations constituting this ORV occur in Yosemite Valley riparian areas. To monitor these riparian ethnographic resources, the Status of Riparian Habitat indicator will be used, as described under biological ORV 2 – Status of Riparian Habitat. The management standards, definitions of adverse effect and degradation, monitoring program, and trigger points are the same as described under ORV 2.

Indicator 3 – California Black Oak

California black oak acorn has been an important staple food for American Indians in Yosemite Valley for millennia (Anderson 1991; Hull and Moratto 1999). According to Bibby (1994:17), its historic importance is likely one reason why acorn, and the cultural knowledge regarding its preparation, has survived strongly among the contemporary associated tribes and groups. Although black oak acorn is no longer a staple food, it has become symbolic of ancestral traditions and an important aspect of contemporary culture. For example, acorn soup is prepared for special occasions, especially traditional gatherings and ceremonial events. Several of the former inhabitants of the last American Indian village in Yosemite Valley recall gathering acorn with their parents and/or grandparents, attesting to the multi-generational historical and place-based personal connections between black oaks and the people. Certain groups of trees, or even individual trees, continue to be associated with particular individuals who gathered in historic times (Bibby 1994:22).

The current structure of the California black oak population in Yosemite Valley follows a familiar pattern for many oak species throughout California – a frequency distribution with a peak frequency in the medium

adult size class but few, if any, saplings and young adults. For one or more reasons, survivorship from the seedling stage into the larger sapling and young adult stages is very low for many oak species. This apparent lack or regeneration (also known as recruitment) is a widespread pattern in California (Holzman, 1993; Swieki et al., 1993), the United States (Loftis & McGee, 1992; Russell & Fowler, 1999), and other parts of the world (Watt, 1919; Shaw, 1968; Saxena & Singh, 1984; Singh et al., 1997; Abrams et al., 1999). Many factors have been proposed to account for the poor regeneration or lack of survivorship from seedling to sapling, leading to the absence of saplings and young adults (Tyler et al., 2006). Little data exists on the structure of black oak populations throughout its distribution in California and Oregon (Tyler et al., 2006), but some recent data from Yosemite Valley (Angress, 1985; Kuhn & Johnson, 2008; Ripple & Beschta, 2008) and anecdotal accounts indicate the black oak population structure also resembles those of others where regeneration is lacking or very low.

Although black oaks may be an exception, a typical size class frequency distribution for a tree species is one called the reverse-J curve where the smallest size classes (i.e. seedlings and saplings) have the most individual trees, each larger size class (i.e. saplings, adults) has fewer individual trees, and the largest size class (i.e. adults) has the fewest number of trees (Harper, 1977). This demographic structure is caused by density-dependent competition for limited resources such as light, water, and nutrients, and predation. In the early life stages (i.e. smaller size classes), mortality rates are high, with a small proportion of a size class surviving into the next, larger size class. Mortality rates decrease as individuals get older. Once a tree becomes large enough, mortality rates decline considerably and most then live to an old age.

A leading hypothesis to explain the commonly found lack of regeneration in oaks and other species in protected areas is that an overabundant ungulate (deer or elk) population is overbrowsing the seedlings, leading to high mortality rates. This hypothesis is supported by considerable research and observations from Yosemite (Dixon, 1944; Gibbens & Heady, 1964; Heady & Zinke, 1978; Kuhn & Johnson, 2008; Ripple & Beschta, 2008), California (Kuhn, 2010), other parks (Wolf & Cowling, 1981; Hebblewhite et al. 2005; Bestcha, 2005; Ripple & Bestcha, 2006), and the United States (Stromayer & Warren, 1997; Waller & Alverson, 1997). Cote et al. (2004) offer an excellent literature review on the impacts of overabundant deer populations on many forest tree species. It has long been known and documented that protected areas such as national parks contain an overabundance of ungulate species such as deer and elk (Cahalane, 1941; Leopold et al., 1963; Porter & Underwood, 1999).

This indicator has two components that monitor the status and long-term health of adults in two key stands of black oaks in Yosemite Valley (the Schoolyard and El Capitan stands). Status is monitored by tracking the number of adults over time, and long-term health is monitored by measuring saplings and non-saplings (i.e. adults) and calculating the ratio of saplings to non-saplings. Together, these two components provide a quick but informative look at the status and long-term health of the stands.

For the first component, it is important that the number of adults remain within an acceptable range. The number of adults should stay relatively steady in order to maintain the quality and character of the woodlands, as well as to reproduce and create new individuals. Although uncertain and variable, California black oaks likely become reproductive adults when they reach a size of between 10 and 20 cm diameter at breast height (dbh). Although many individuals in the "sapling" stage (<20 cm dbh) produce acorns and are technically adults, adults are defined as individuals > 20 cm dbh. The number of adults has likely been fairly stable over the recent past, though there continues to be slow punctuated adult mortality. The number of adults should not experience a further significant decline.

For the long-term health of the two stands, there should be adequate recruitment into the critical sapling stage. Between 1.3 meters (the height at which dbh measurements can be taken) and 2.0 meters in height, saplings are able to escape deer browsing and survival rates are much higher than for earlier stages of growth. Thus, saplings are defined as individuals > 1.3 meters tall and < 20 cm dbh. Based on the assumption that California black oak follows an expected demographic frequency distribution (based on the common reverse-J curve model), there should be many more saplings than the number of adults in the largest size classes.

The proposed management standards are based on the assumption that a healthy black oak population size structure should follow the common reverse-J curve model. However, it is possible that black oaks and even oaks in general have highly episodic recruitment. This would create a population size structure frequency distribution with multiple peaks and troughs. Existing data indicate that there has not been strong episodic recruitment in at least the last 90 years. While recruitment may still be episodic, it is unlikely that episodes occur on time scales of 90 years or longer. Given the current size structure of the Yosemite Valley black oak population and the extensive research on the effects of ungulates on oak and other tree population demographics, it is likely that the pattern of very low recruitment in the last 90 years is not a naturally occurring pattern.

Management Standard

There are two components to the management standard for two key stands of black oaks in Yosemite Valley (the Schoolyard and El Capitan stands): 1) the number of adults; and 2) the ratio of saplings to non-saplings for all black oaks taller than 1.3 meters. For adult oaks, the proposed management standard is at least 85% of adult oaks, when compared to the 2008 baseline. For the ratio of saplings to non-saplings, the proposed management standard is a ratio greater than 0.5. The expected size class frequency distribution based on data collected by Kuhn & Johnson (2008) is a ratio of saplings to non-saplings of 0.65. Since the management standard applies to the entire segment, the management standard considers the total number of adults and the ratio in the two stands; however, the trigger points described below apply to the individual stands, since trigger points are designed to maintain conditions above the management standard.

Adverse Effect

An adverse effect would be the number of adult California black oaks (i.e. > 20 cm dbh) declining by at least 20% compared to the 2008 baseline.

Degradation Standard

Degradation would be the number of adult California oaks (i.e. >20 cm dbh) declining by at least 25% compared to the 2008 baseline.

Monitoring - California Black Oak

California black oak is a slow growing species, and adult mortality rates are also low (though quite variable year to year), thus monitoring can be conducted on long time scales. The two key stands of black oaks in Yosemite Valley (the Schoolyard and El Capitan stands) would be monitored every five years.

The first trigger point would be a decline in the total number of adult oaks of 15% in either stand compared to 2008 baseline, or a decline in the sapling-to-non-sapling ratio to 0.55 or less (Table 5-19). Management actions to respond to trigger points would be active restoration, including deer and rodent exclusion for

individual seedlings, saplings, parts of the stand, or all of the stand; planting acorns or seedlings; and possibly a reduction in visitor use. Deer protection can be applied to naturally recruited seedlings, and protection from deer and rodents can be applied to planted acorns or seedlings. Methods to protect planted acorns and seedlings have been used successfully in other restoration projects (Swiecki & Bernhardt 1991; Tyler et al. 2008) and can be applied in Yosemite.

TABLE 5-19: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR YOSEMITE VALLEY AMERICAN INDIAN ETHNOGRAPHIC RESOURCES (CALIFORNIA BLACK OAK)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: In either stand, total numbers of adults decline by 10% OR the ratio of saplings to non-saplings falls below 0.55.	Protect existing adults (particularly if the adult trigger is tripped) Protect existing saplings (particularly if the ratio trigger is tripped) Ecological restoration, primarily through planning of seedlings, possibly over a number of years Protect individuals of all age and size classes through fencing, removal of competing plants, fuel reduction, fencing, public awareness, signs, removal of facilities. Reduce deer browsing Reduce rodent pressure Reduce public use	0.65 is the expected ratio, notwithstanding natural variability, and management action when the ratio reaches 0.55 allows for a declining trend to be reversed before the management standard is reached. Similarly, management action when adult decline reaches 10% allows for a declining trend to be reversed before the management standard is reached.

During ecological restoration, the success of management actions will be monitored annually to determine the success and further actions taken to mitigate any failures. Young saplings will require protection from deer until they are tall enough to escape heavy browsing. Mortality rates of all seedlings and saplings will be monitored annually to ensure sufficient survival rates into larger size classes. Periodically (every 3-10 years), the current population structure can be compared to an expected frequency distribution based on data collected by Kuhn & Johnson (2008) to determine relative success of the restoration actions. Saplings and young adults will continue to experience some mortality as they grow larger. Depending on conditions, it will take approximately 55 - 85 years (mean of 69 years) (Kuhn & Johnson, 2008; Ripple & Bestcha, 2008) for California black oak to grow into the adult size classes (> 20 cm dbh) in Yosemite Valley.

Management Concerns and Protective Actions

Management concerns arise when a trigger point is exceeded, indicating a river value does not meet management standards. Recent California black oak data from Yosemite Valley (Angress, 1985; Kuhn & Johnson, 2008; Ripple & Beschta, 2008) indicate that the sapling to non-sapling ratio is less than 0.55, requiring immediate ecological restoration to increase the number of saplings.

Management Considerations and Enhancement Actions

Management considerations related to ethnographic resources involve park operations, crowding, and visitor use.

Park operations have triggered changes in ethnographic resources by disturbing traditional use plant populations or changing access to these places. The *Merced River Plan/DEIS* would address these considerations through the following actions:

- Best management practices would ensure for the continuation of coordination between traditionally associated American Indian tribes, groups, and traditional practitioners (through the Park American Indian Liaison) with law enforcement, fire management, interpretation, invasive species, ecological restoration, and facilities management programs
- Best management practices would include operational guidelines for material staging areas, parking, etc. to protect ethnographic resources
- Crowding and high visitor use in Yosemite Valley during peak season can impact the ability of traditionally associated American Indians to access traditional use areas for various traditional cultural practices. The *Merced River Plan/DEIS* would address these considerations through the following actions: Under Alternatives 2-6, the visitor use management program would ensure access for traditionally associated American Indians for participation in annually scheduled traditional cultural events. In addition, tribal access for the personal conduct of traditional cultural practice would be assured through the Yosemite tribal fee waiver pass program.
- Document the Yosemite Valley Traditional Cultural Property, consisting of traditional use areas, spiritual places and historic villages. Work would build upon other focused mapping and condition assessment for traditional use plants and archeological sites proposed as part of a detailed assessment of the ethnographic component of the Cultural ORV in Segment 2. Work would happen in close collaboration with park-associated Indian tribes and groups, using staff expertise in cultural anthropology, botany, archeology and oral history. Methods would include compiling existing information gathered during previous ethnographic studies, filling gaps in the historical record through research in archival repositories, updating and expanding the oral history documentation, and complete detailed field mapping. Resulting information would be synthesized into a National Register nomination and interpretive summary for the Yosemite Valley Traditional Cultural Property.

Threats to traditionally used plant populations include invasive species such as Himalayan Blackberry (*Rubus armeniacus*), drainage and hydrology impacts to meadows, and erosion and revetments that affect riparian vegetation. The *Merced River Plan/DEIS* would address these considerations through the following actions:

- The ecological restoration actions associated with this planning effort implemented in concert with the existing invasive plant management program would address impacts to some traditionally used plant populations in some locations.
- Restoration actions to protect riparian areas, meadows, and hydrological resources would further contribute to the protection and enhancement of the traditional use plant communities included in this ORV.

Conclusion: Protecting and Enhancing ORV 8 (ethnographic resources in Yosemite Valley)

The ethnographic component of the cultural ORV is determined to be absent of adverse effects and degradation. Management concerns and considerations are present, as a trigger point for the ratio of sapling to adult trees is exceeded. As a response, the NPS will introduce new seedlings in to the affected stands and protect as necessary to ensure high survival rates, with a goal to establish enough saplings so the ratio of saplings to all adults is at least 0.65. To address the management considerations, the *Merced River Plan/DEIS* proposes a variety of actions including continued coordination between traditionally associated American Indian tribes, groups, and traditional practitioners and the NPS; continued access for traditionally associated American Indians for participation in annually scheduled traditional cultural events; and

ecological restoration actions to protect and enhance traditionally used plant populations. To prevent future impacts, the NPS will monitor the condition of the ORV and take specific actions should additional trigger points be exceeded. Trigger points are selected to inform managers well in advance of this ORV's conditions falling to the level of the management standard.

Cultural ORV—Yosemite Valley Archeological District

ORV 9—The Yosemite Valley Archeological District is a linked landscape that contains dense concentrations of resources that represent thousands of years of human settlement along this segment of the Merced River.
Location: Segment 2 (Yosemite Valley)
Rationale: Drawn by the year-round availability of water and the diversity of plants available for sustenance in Yosemite Valley, people have inhabited the valley for thousands of years, leaving behind an exemplary collection of archeological sites in the Yosemite Valley Archeological District. Many pre-contact and historic-era archeological sites are identified in ethnographic literature and native oral traditions, providing a rare example of the long and continuing association of people and places. While the landscape itself provides exemplary documentation of land use practices, many of the individual sites contain exceptional information with the potential to interpret not only ancient lifeways, but also cultural change at the period of contact with Euro-Americans. In addition to this regional and State-wide scientific and interpretive value, the sites have value to American Indian tribes and groups as a connection to their ancestors and an important component of their cultural patrimony. Because the archeological sites within the Yosemite Valley Archeological District comprise a complete system that is culturally and scientifically significant, both river-related and non-river related archeological sites are included in this ORV. Furthermore, archeological sites contained within this district but existing outside of the river corridor boundaries contribute to the significance and integrity of the historic property and are therefore included in this ORV.
Management Objective: Ensure protection and enhancement of the Yosemite Valley Archeological District as a whole, and ensure that human impacts are not adversely affecting the district's essential character and integrity.

ORV Condition at the Time of Designation (1987)

The archeological district nomination completed in 1979 indicates that archeological resources retained integrity despite administrative and facility-related impacts, visitor use-related impacts, and ecological process-related impacts. At the time of designation, the following impacts had been documented to sites within the Yosemite Valley Archeological District:

- Construction of historic and contemporary facilities such as roads, trails, buildings, and utilities.
- Unauthorized excavation at one site - damage assessment determined that the site still contained intact subsurface deposits (Mundy and Hull 1988).
- Informal trails
- Intentional or inadvertent movement of artifacts or feature elements (such as displacement of rock alignments)
- Soil compaction
- Bouldering/rock-climbing and camping impacts that included ground-disturbing actions
- Tree falls
- Bioturbation - The disturbance of soil by living things (e.g., rodent tunneling).
- Erosion
- Rock fall

Current ORV Condition

The same types of impacts that were occurring at the time of designation continue to affect current site conditions. While the majority of archeological sites in Yosemite Valley retain a relatively high degree of integrity, many have been disturbed by human activity and natural processes (Hull and Kelly 1995). The majority (47% or 56 sites) of Yosemite Valley Archeological District sites within the Merced River corridor are rated in "good" condition according to their most recent assessment scores (ASMIS). An additional 33% (39 sites) are in fair condition, and 18% (22 sites) are in poor condition. The corresponding disturbance severity levels for the visited sites show that 39% of the sites (47 sites) have low disturbance severity, with an additional 33% (39 sites) showing moderate disturbance severity, and 25% (29 sites) displaying severe disturbances (Darko 2011). Impacts may include soil compaction, vegetation damage, movement of artifacts, feature disturbance, and vandalism. Impact severity ranges from minor to severe, although most visitor-use impacts were characterized as minor or moderate. Seven sites were identified during recent visits as having experienced a moderate to severe degree of impact from visitor use (Middleton [NPS] 2009, 2010). One of the sites within the River corridor could not be relocated during a recent attempted field assessment (Darko 2011). The same types of impacts that were occurring at the time of designation continue to affect site conditions now.

Management Program for ORV 9

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program.

Indicator – Condition of Yosemite Valley Archeological District

The Yosemite Valley Archeological District is listed on the National Register of Historic Places (NPS 1978). The National Register of Historic Places (NRHP) defines an archeological district as "… a grouping of sites, buildings, structures, or objects that are linked historically by function, theme, or physical development or aesthetically by plan" (NRHP). Within the Yosemite Valley Archeological District, individual prehistoric sites form the collective character and significance of the district. Sites discovered after nomination would be evaluated and may be added to the district.

The NPS selected 'archeological site condition' as an indicator for this ORV. The indicator is the aggregate condition of the collection of archeological sites within the district. Site condition includes the general physical state of the site and associated material remains. Other key components of site condition are site stability, the potential for physical deterioration over time; and site integrity, the potential to convey information, setting, feeling, and association of previous historical eras to researchers, the public, and traditionally associated peoples.

Since 2007, the Archeology Visitor Use Program has annually monitored the range of visitor impacts and changes in site condition at a sample of archeological sites within the Tuolumne and Merced Wild and Scenic River corridors. Program methodology was originally modeled after similar archeology programs at NPS Flagstaff Area Monuments (Donnermeyer 2005; Gossart 2005) and Grand Canyon National Park (Dierker and Leap 2005, 2006), with subsequent modifications specific to Yosemite site types and visitation patterns (Middleton 2009:1). Project protocols were designed to fit within the larger Yosemite Visitor Use and Impact Monitoring Program framework and reporting standards (see NPS 2008a, 2008b, 2009a, 2009b).

The site monitoring protocol uses the NPS Archeological Sites Management Information System (ASMIS) format (NPS 2007a, 2007b), supplemented with data collection specific to human impacts. ASMIS, a management database developed by the NPS, tracks a broad range of information about documented archeological sites: site components, disturbances, current condition, cumulative disturbance effects, and management actions. ASMIS functions as a "tool to support improved archeological resources preservation, protection, planning, and decision-making by parks, regional offices, and the national program offices" (NPS 2007b). Archeological site condition has been assessed in Yosemite for several decades, but prior data collection does not always meet current professional standards. The visitor use protocol was designed to assess site condition and impacts using a systematic, consistent methodology.

ASMIS quantifies impacts (disturbances) in two ways: the effect on site condition and site damage severity levels. Condition effects are ranked on an ascending scale: negligible, partial loss repairable, partial loss irretrievable and total loss irretrievable. Impacts with negligible effects can cause minor damage to the physical condition of the site, with little to no loss of data potential or site integrity. Partial loss repairable effects result in minor damage to the site that can be reversed or ameliorated through treatment or repair, such as careful removal of campfire rings or hand removal of fire fuel buildup. Partial loss irretrievable effects result in more serious damages that are not repairable, such as the partial collapse of a prehistoric rock feature from human alteration, or artifact movement from original context. Total loss irretrievable effects result in complete loss of the resource, as in site destruction from fire or vandalism (NPS 2007a).

Site damage from a disturbance is measured as low, moderate, or severe, based on areal extent or the amount of site integrity compromised (NPS 2007a; Bane 2011). These measurements take into consideration site type, data potential, and impact to site integrity. Destruction of a pictograph, for example, is highly damaging to site data potential even if the pictograph represents only a small physical area of site. Loss of the densest portion of a lithic scatter may be small in areal extent, but critically large for research potential if temporally diagnostic tools had been present in that locus. Previous data recovery at the site may mean some impacts are less damaging for data potential/integrity at the excavated locations.

The Archeology Visitor Use Program augments ASMIS data collection on each site disturbance with an assignment of disturbance causation: natural, park operations, visitor, or unknown. Both park operation and visitor disturbances are included in total site counts of human impacts. Potential park operation disturbances include road construction and maintenance, trail construction and use, utilities installation, building construction, controlled fire, ecological restoration, or scientific research. Unlike natural and visitor impacts, many park operation impacts in the last two decades are considered "undertakings", and are addressed through treatment measures implemented before or during disturbance. The most common types of visitor disturbances include camping impacts, informal trails, climbing, and use by hikers and/or horses. Other less common visitor disturbances include damage to vegetation, damage to archeological ruins, stock use (picketing or corralling), soil compaction, dumping, off-road vehicle use, vandalism, and unauthorized collection of artifacts (looting).

Management Standard

For the Yosemite Valley Archeological District, the management standard is at least 80% of sites free from current serious human impacts that have not otherwise been addressed through treatment measures noted above for sites with low data potential, and at least 85% for sites with high data potential. Serious human impacts are single disturbances with partial or total loss irretrievable disturbance effects at moderate to severe site damage levels, or a series of three or more disturbances with partial or total loss - irretrievable

disturbance effects at low site damage levels. Unmitigated impacts are disturbances that have not been addressed through treatment measures noted above.

Current site conditions and human impact values for a sample of relevant Yosemite Valley Archeological District sites are shown below (Table 5-20). Results are drawn from Archeology Visitor Use site monitoring, 2007-2011, for a sample set of 60 sites (53%) from a total of 113 Yosemite Valley District sites relevant to the Merced River corridor ORV. Over a five year interval (2007-2011), 95% of high data potential sites and 93% of low data potential sites in the sample were considered free of serious human impacts, meeting the target management standards for the indicator.

TABLE 5-20: PERCENTAGE OF YOSEMITE VALLEY ARCHEOLOGICAL SITES FREE OF CURRENT SERIOUS UNMITIGATED IMPACTS[a] IN A MONITORED SAMPLE SET (N=60)

High data	Low data
95%	93%

[a] Note: Impacts with partial loss irretrievable effects with moderate to severe damage levels or multiple (≥3) impacts with low damage levels.

In balancing visitor use and site preservation, some disturbances to resources can be acceptable if the site retains context and integrity (Fairley and Downum 2000). For archeological sites with estimated low data potential (i.e. small sites with few materials and no diagnostic artifacts, sites with a single feature such as a bedrock mortar, sparse lithic scatters, or heavily deteriorated sites), some amount of irretrievable damage may be allowable. This is particularly true for common site types in the district, such as small lithic scatters. The Management Standard allowance for numbers of low data sites with human impacts (20%, or 80% of sites free of serious unmitigated human impacts) represents a realistic management threshold for protection of the largest portion of sites (Donnermeyer 2005:33).

For sites with estimated high data potential (i.e. sites with multiple features, sites with diagnostic artifacts or dense artifact concentrations, documented historical sites, or sites with uncommon or unique attributes), the potential resource loss is greater, as is the impact to the district. A serious human impact or series of minor impacts resulting in irretrievable damage and loss at high data sites is less acceptable (Donnermeyer 2005). The Management Standard allowance for numbers of high data sites with human impacts for these effects (15%, or 85% of sites free of serious unmitigated human impacts) is therefore less.

Adverse Effect

An adverse effect, as defined in this context under WSRA, occurs when the number of sites free from current serious unmitigated human impacts falls to 60% for sites with low data potential, and 70% for sites with high data potential in a ten year monitoring interval.

The adverse effect represents a higher level of serious impact for both low and high data potential sites over a ten year interval of representative site sampling within the district. The 20% increase serves as a warning of long term downward trends in site condition, requiring stronger protective management actions before widespread individual site damages threaten the essential character of the aggregate archeological district (Donnermeyer 2005:33).

Degradation Standard

The ORV would be considered degraded should the archeological district be impacted to the extent that it is no longer eligible for listing in the National Register of Historic Places. This would occur if the district no longer meets the criteria for listing in the NRHP through deterioration and loss of integrity, of the "qualities which caused it to be originally listed have been lost or destroyed" (NPS 1997; 2004). A "degraded cultural resource" would typically no longer have status as a historic property, and its National Register status could not be restored through mitigation efforts, however would continue to exist as tangible cultural remains.[29]

Monitoring – Condition of Yosemite Valley Archeological District

Site condition assessments would be conducted for a representative sample of archeological sites within the district at 5-15 year monitoring intervals, following the assigned assessment (ASMIS) site inspection schedule (NPS 2007:66). The key source of feedback for adaptive archeological site management is the periodic, systematic analysis of collected site data, focused on management objectives (Kintigh et al. 2007). To achieve this feedback and assess trigger points for management actions, summary reporting of site monitoring results for the district would be compiled at five-year intervals to determine maintenance of the management standard. This five year interval for summary reporting and analysis of site data is the minimum reporting period necessary for accurate capture of human impacts over longer time spans (Bane 2011).

District re-evaluations would be completed at minimum of 25-year intervals to verify that the district has not been degraded. Table 5-21 lists triggers and specific management responses that would take place.

TABLE 5-21: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR THE YOSEMITE VALLEY ARCHEOLOGICAL DISTRICT (CONDITION OF DISTRICT)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
The number of individual sites free from serious unmitigated human impacts falls to 90% or less for sites with low data potential, and falls to 95% or less for sites with high data potential in a monitoring interval.	1. Increased monitoring frequency for affected sites. 2. Increased management protection designed to counteract or minimize impacts, crafted to individual site specifications. Examples include: • Site documentation, research, testing, or NRHP evaluation; • Site stabilization, re-vegetation, trail reroutes, trail removal; • Increased public interpretation and education; • Increased education for local user communities such as residents or climbers; • NRHP re-evaluations and/or data recovery at affected sites; • Development of comprehensive site management plans for large, complex sites in developed areas. • Initiate hard closures of individual affected sites, utilizing increased visitor education about human impacts and the necessity for closures. Site closure regulations would be represented within the superintendent's compendium in order to allow legal enforcement. 3. At the district-wide level, NRHP nomination amendments to reflect changes in district integrity.	The trigger range is set at 10% above standard violation, allowing identification of individual problem sites and localized areas and timely prescriptive actions before management standard levels are violated. The trigger range was selected from sampling results for five years of site impact monitoring within the district, and is based on best professional judgment of thresholds necessary to retain desired management standard.

[29] Because this ORV is defined by archeological districts, where the archeological ORV in the Tuolumne River Plan/DEIS is defined corridor-wide, the Merced River Plan/DEIS uses loss of eligibility as degradation. A more precise definition is needed in the Tuolumne River Plan/DEIS because that ORV includes several districts.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-21 below. There are currently no management concerns associated with the Yosemite Valley Archeological District.

Management Considerations and Enhancement Actions

The following site-specific management considerations occur in Yosemite Valley:

- Stock trail through sensitive midden deposit and formal hiking trail near a rock art feature impact sensitive cultural resources on archeological site CA-MRP-0046/47/74. Modern graffiti desecrates the rock art boulder.
- Stock use and operational staging cause impacts to archeological resources at site CA-MRP-0052/H.
- Exceptional site located at the modern-day Yosemite Village encompasses key characteristics of the Archeological District. The location of this site has many complex uses which may impact its integrity; however, the archeological site record has not been comprehensively updated in almost two decades.
- Heavily used formal trails and informal trails, as well as illegal campfires, graffiti, and trampling cause impacts to the prehistoric rock shelter and associated artifacts at archeological site CA-MRP-0057.
- Parking, rock climbing, camping, vandalism, human waste, fire rings and informal trails are impacting a prehistoric rock shelter and associated artifacts at site CA-MRP-0062.
- Camping, trampling, and trash are causing impacts to bedrock mortars (pounding rocks) at site CA-MRP-0080. Impacts to these important archeological features affects continuing use and association with these culturally significant resources.
- Rock climbing activities ("bolt ladder") at a rock shelter boulder cause trampling of the near surface archeological deposit at CA-MRP-0082/H.
- Rock climbing (bouldering) activities on a rock art boulder and informal trails impact the archeological and ethnographic resources at CA-MRP-0158/309.
- Vehicular and bike traffic along a dirt access road affects surface and subsurface archeological resources at CA-MRP-0190/0191.
- Non-technical climbing on a large bedrock mortar (pounding rock) causes impacts to the archeological resource at site CA-MRP-0240/0303/H. This type of visitor use on the bedrock mortar affects continuing use and association with these culturally significant resources.

Archeological resource protection would be achieved through actions in this plan to manage visitor use levels, using natural features to conceal and divert foot traffic around sites, removing informal trails, and formalizing river and meadow access locations, mitigating ecological restoration practices by using noninvasive techniques wherever possible. Many of the actions related to ecological restoration in Segment 2, such as delineating roadside parking, would also help protect archeological sites by diverting foot traffic away from sites and into less sensitive areas.

Site-specific treatment actions would be developed through site management plans, where necessary, to avoid resource loss through park actions (such as development, repair, and maintenance of facilities and underground utilities to support visitor use or natural forces).

Management considerations for this ORV also involve continuing survey and documentation needs. The national register nominations for all three archeological districts require updating to include additional inventory, discussion of archeological studies conducted in the past 30-plus years, refinement of research issues, a list of which sites are contributing elements, a more inclusive approach to the National Register criteria, and development of a more comprehensive approach to management of the district. Although Darko (2011) made substantial progress in bringing site documentation up to current standards for the resources in the corridor, additional work remains for all three of the districts, which the NPS will continue to do.

Conclusion: Protecting and Enhancing ORV 9 (Yosemite Valley Archeological District)

The Yosemite Valley Archeological District is absent of adverse effects, degradation, and management concerns (conditions that exceed management triggers, for example). Management considerations are present. To remedy management considerations, the Merced River Plan/DEIS proposes a variety of actions to address specific considerations in Alternatives 2-6 including removal of informal trails, non-essential roads, and infrastructure that are either causing ongoing impacts to archeological sites or facilitating visitor use that is in turn causing ongoing impacts. The NPS would also delineate bike paths, roads, and other infrastructure away from sensitive cultural and ethnographic resource areas; remove graffiti at rock art and other sensitive features, conduct public education to discourage climbing, and remove climbing hardware from sensitive features. To prevent these considerations, or others, from redeveloping, the NPS would monitor the condition of the ORV, and take specific actions should conditions exceed specific trigger points. Trigger points are selected to inform managers well in advance of adverse effects or degradation impacts.

Cultural ORV—Yosemite Valley Historic Resources

ORV 10—The Yosemite Valley Historic Resources represent a linked landscape of river-related or river-dependent, rare, unique or exemplary buildings and structures that bear witness to the historical significance of the river system.

Location: Segment 2 (Yosemite Valley)

Rationale: Yosemite Valley is an intact and always controversial experiment between people and place, one that began in the mid-19th century within a few years of the arrival of non-native settlers intent on preserving a "natural" landscape through its development and management as a public park. The Yosemite Valley Historic Resources ORV, and the complex Yosemite Valley Historic District cultural landscape it sits within, is the direct result of this profoundly significant experiment. The Yosemite Valley Historic Resources ORV reflects the remarkable historical values of the Merced River, and is tangible evidence of the dynamic relationship between people and place as preserved in the nationally significant Yosemite Valley Historic District.[1] Together, the river corridor, its attendant resources, and the Yosemite Valley Historic District form the cultural landscape of the Yosemite Valley Historic Resources ORV.[2] The Yosemite Valley Historic Resources ORV thus represents a collection of river-related or river dependent, rare, unique or exemplary2[3] buildings and structures. These include The Ahwahnee and the LeConte Memorial Lodge (the National Historic Landmarks within the river corridor) and other important buildings and structures noteworthy for their historic, architectural, engineering, or aesthetic values.[4] Many of the valley's historic bridges, such as Stoneman, Ahwahnee, Sugar Pine, Yosemite Creek, Tenaya Creek, Clarks, and Happy Isles bridges, represent the first series of bridges built by the Bureau of Public Roads specifically for the National Park Service.[5] The following individual elements comprise the collective Yosemite Valley Historic Resources ORV:

- The Ahwahnee (NHL)
- The LeConte Memorial Lodge (NHL)
- Yosemite Valley Chapel
- Vernal Fall Comfort Station
- Nature Center at Happy Isles (Fish Hatchery)
- Sugar Pine Bridge
- Clark's Bridge
- New Happy Isles Bridge
- Tenaya Creek Bridge
- Yosemite Creek Bridge

- Residence 1 (Superintendent's House)
- Ahwahnee Bridge
- Pohono Bridge
- Stoneman Bridge
- El Capitan Bridge
- 3 Bridalveil Fall Trail bridges
- Mist Trail

The ORV is the collective or collection of these character defining elements, which together make up the Yosemite Valley Historic Resources ORV; no single element defines the ORV. The Yosemite Valley Historic Resources ORV is embedded within the larger natural and cultural systems of Yosemite Valley, and therefore represents the river-related or river-dependent elements of the Yosemite Valley Historic District and its landscape characteristics:[6]

Buildings and Structures: The buildings and structures included in the collective are those that lie within the river's corridor and are related to the river through design, siting or function. They continue to support ongoing human use of the river, and represent development spanning the years between the mid-19th and mid-20th centuries related to Euro-American settlement, Army administration, and important stages in development of the National Park Service Rustic Architectural style, chronicling the evolving definition of what is considered "appropriate" park architecture in a prized natural setting.

Circulation: The bridges included in the collective support the looping patterns of circulation north and south, east and west across the Merced River and its tributaries in Yosemite Valley

Spatial Organization: The design, composition, and sequencing of outdoor spaces in Yosemite Valley is reflected in the patterning of historic development

Management Objective: The Yosemite Valley Historic Resources ORV will be managed to ensure protection and enhancement of this historic development system and its setting. Protection and enhancement entails ensuring that human activities do not adversely affect (per WSRA) the collective ORV or the landscape characteristics of the Yosemite Valley Historic District, within the river corridor, described above. While individual elements of the collective ORV may be lost, the collective of elements will continue to represent the important historic patterns of development in Yosemite Valley, and reflect the important landscape characteristics of the Yosemite Valley Historic District.[7]

1 The Yosemite Valley Historic District is a historic property listed in the National Register of Historic Places. The district is comprised of 929 contributing resources: 302 buildings, 16 sites, and 611 structures. Significant character-defining features of this district include its spatial organization, historic land uses, and architecture. The district is nationally significant under Criterion A for its association with the history of natural resource conservation and western expansion and exploration. It is also nationally significant under Criterion C for its nationally significant architecture represented by three National Historic Landmarks, and historic developed areas (Yosemite Village and Camp Curry). The nomination can be accessed online at http://www.nps.gov/yose/historyculture/upload/Yosemite-Valley-Historic-District.pdf.

2 The Yosemite Valley cultural landscape is described in the National Register of Historic Places Nomination for the Yosemite Valley Historic District. The landscape characteristics of natural systems and features, spatial organization, vegetation, circulation, land use, and views and vistas contribute to the historically significant character of the Yosemite Valley Historic District; however, they are not counted as contributing resources in the nomination.

3 These terms reference Wild and Scenic Rivers Act criteria for an outstandingly remarkable value (ORV).

4 These values are defined as the criteria for inclusion in the National Register of Historic Places: The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history.

5 These were designed and constructed as models for bridges in national parks, with review by the Commission of Fine Arts, personal involvement from Stephen Mather and Horace Albright, and careful consideration for their architectural authenticity. Previously (and incorrectly) documented as reinforced concrete with stone veneer (see the 1977 National Register Nomination for the Yosemite Valley Bridges), they were instead constructed using authentic arched stone vaults. They are significant for their engineering, their architecture, and their aesthetics -- as intrinsically beautiful structures, as important vantage points for viewing the river, and as scenic features in a sublime natural setting. (National Park Service: "Historic American Engineering Record: Written Historical and Descriptive Data, Yosemite National Park Roads and Bridges, Yosemite National Park, Mariposa County, California [HAER No. CA-117]." USDI National Park Service, Washington D.C., 1991).

6 The term landscape characteristics is defined in the National Register Bulletin: Guidelines for Evaluating and Documenting Rural Historic Landscapes, available online at http://www.nps.gov/history/nr/publications/. According to the bulletin, "landscape characteristics are the tangible evidence of the activities and habits of the people who occupied, developed, used, and shaped the lands to serve human needs; they may reflect the beliefs, attitudes, traditions, and values of these peoples." The characteristics include both processes influential in shaping the land, and physical components that are evident on the land: Land Uses and Activities; Patterns of Spatial Organization; Response to the Natural Environment; Cultural Traditions; Circulation Networks; Boundary Demarcations; Vegetation Related to Land Use; Buildings, Structures, and Objects; Clusters; Archeological Sites; and, Small-scale elements.

7 The concept of "integrity" used here is defined in relation to the National Register of Historic Places as "the authenticity of a property's historic identity, evidenced by the survival of physical characteristics that existed during the property's prehistoric or historic period. Historic integrity is the composite of seven qualities: location, design, setting, materials, workmanship, feeling, and association."

ORV Condition at the Time of Designation (1987)

The landscape of Yosemite Valley is a continually evolving natural and cultural system that has changed in response to successive American Indian, private, state and federal government management strategies, increasing visitation, and incremental loss of historic features and land uses. At the time of designation (1987), the individual elements of the Yosemite Valley Historic Resources ORV were in essentially the same physical condition and largely served the same function as they did historically. The primary impacts to the Yosemite Valley Historic Resources ORV at the time of designation were incremental changes in the historic setting, such as evolution of the circulation system (e.g., converting the eastern part of the system to shuttle-only, adding bicycle paths, accessible walkways, parking, shuttle stops, etc.), and the addition of new buildings and structures. Two of the buildings within the Historic Resources ORV had been adapted for new uses—the former Fish Hatchery was rehabilitated for public use a Nature Center, and Residence 1 (the Superintendent's House) was abandoned as a residence and used for administrative offices until the 1997 Flood, when all use of it ceased. The Yosemite Valley Historic Resource ORV's setting, consisting of the Yosemite Valley Historic District and cultural landscape, had been altered by changes in vegetation management practices, removal and replacement of bridges and other facilities, and addition of new facilities. Changes in the natural systems and features are documented under other ORV discussions above, largely consisting of conifer encroachment into meadows, scenic vistas, and black oak woodlands.

Current ORV Condition

Many of the changes to this ORV identified above continue to the present. It is important to recognize that change is inherent in the Yosemite Valley landscape, and that the Yosemite Valley Historic Resources ORV cannot be managed as a museum piece. As with any cultural system, change is not only tolerated, but it is also embraced for the system to remain vibrant. For example, The Ahwahnee has undergone initial phases of a planned comprehensive rehabilitation to address code compliance for fire protection, egress, accessibility, and other issues to improve its functionality and operational efficiency as a luxury lodging establishment. The work will adversely affect some aspects of the NHL historic property (for example, introduction of non-historic elements to provide emergency egress, reconfiguration of some significant interior spaces to achieve accessibility); however, measures have been implemented to minimize these effects to the extent feasible, as part of the process for complying with Section 106 of NHPA. Buildings and structures have been added to the setting of the Yosemite Valley Historic Resources ORV as part of the ongoing programs of visitor-use management and park administration in Yosemite Valley. Examples of these are the shuttle stop shelters constructed at The Ahwahnee and the LeConte Memorial Lodge NHLs. These structures were designed to complement the existing historic settings. Other elements of the Historic Resources ORV, most notably the Yosemite Valley Chapel and Residence 1 (the Superintendent's House), were affected by the 1997 winter flood. The Chapel received preservation maintenance treatment to remediate the effects of inundation, while use of the Superintendent's House was discontinued. The building was mothballed until a decision could be made regarding its disposition; it is currently in poor condition. The remaining buildings and structures of the Yosemite Valley Historic Resources ORV receive regular inspection and preservation maintenance.

Management Program for ORV 10

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. This ORV may be influenced by management actions concerning visitor use management,

development and redevelopment, removal, loss or damage through catastrophic natural events, or changes in physical condition due to neglect. Management actions that change the individual elements and/or the larger cultural landscape setting can impact this ORV. The indicator discussed below monitors a primary aspect of the ORV's importance, the physical condition of the individual elements.

Indicator – List of Classified Structures Condition Assessments

Given that the Yosemite Valley Historic Resources ORV is comprised of buildings and structures, this indicator is a collective measure of the physical condition of these individual elements. The NPS' List of Classified Structures (LCS) provides a mechanism that captures physical assessments of the condition of individual buildings and structures. The LCS will be used to obtain individual assessments of each building and structure at five-year intervals, and these individual assessments will be aggregated to form a collective assessment of the condition of the ORV.

The LCS Conditions provide a consistent means for assessing the condition of historic structures on a national basis. Condition levels are defined as follows:

Good: The structure and significant features are intact, structurally sound, and performing their intended purpose. The structure and significant features need no repair or rehabilitation, but only routine or preventative maintenance.

Fair: The structure is in fair condition if either of the following conditions is present:

- There are early signs of wear, failure, or deterioration, though the structure and its features are generally structurally sound and performing their intended purpose; or
- Deterioration or damage affects more than 15% of the structure.

Poor: The structure is in poor condition if any of the following conditions are present:

- The significant features are no longer performing their intended purpose;
- Significant features are missing;
- Deterioration or damage affects more than 25% of the structure; or
- The structure show signs of imminent failure or breakdown.

Management Standard

The management standard for this indicator is protection of at least 70% of the existing elements of the Historic Resources ORV in "good" condition, and none in "poor" condition, as defined by the LCS guidance. The condition of the NHL elements is weighted by a factor of two to account for their elevated level of significance.

Of the elements comprising this ORV, two of the NHL elements are in "good" condition, and 14 non-NHL elements are in "good" condition. Using the weighted factor described above, 60% of the collective's elements are in "good" condition, and one building—Residence 1 (Superintendent's House) —is in "poor" condition.

Adverse Effect

An adverse effect, as defined under WSRA, would be a noticeable deterioration in the condition of the collection of existing elements that comprise the ORV. Adverse effect would occur if either or both of the following conditions were met:

- 50% or more of the individual elements of the Historic Resources ORV assessed in "fair" condition
- Any NHL element assessed to be in "poor" condition, as defined by the LCS guidance
- 15% of the non-NHL elements assessed to be in "poor" condition, as defined by the LCS guidance

Degradation Standard

Degradation is quantified for this indicator as the point at which 50% or more of the ORV elements were assessed to be in "poor" condition.

Monitoring – LCS Condition Assessments

Monitoring would be conducted at all of the contributing elements at a five-year interval, in keeping with NPS standards for List of Classified Structures (LCS) condition assessments. This schedule would be augmented to provide reactive condition assessments at individual buildings and structures in response to unforeseen natural events (such as extreme flooding, fire, etc.) that are likely to have affected their condition. Monitoring results would be summarized and analyzed in this same five-year interval, or in response to any extreme unforeseen natural events.

Management Concerns and Protective Actions

Management concerns occur when the condition of an ORV has reached one of the trigger points identified in Table 5-22 below. The NPS monitors the condition of the individual elements of the Historic Resources ORV to assess whether its condition has reached or exceeded the trigger point value for this indicator.

TABLE 5-22: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR YOSEMITE VALLEY HISTORIC RESOURCES (LIST OF CLASSIFIED STRUCTURES CONDITION ASSESSMENT)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Damage or deterioration of five or more individual buildings or structures (15% of the collective ORV) that results in an LCS condition assessment of "fair"	1. Increase the frequency of condition assessments for buildings and structures in "fair" condition 2. Develop prioritized list of preservation actions based on severity of deterioration (addressing deterioration at NHL buildings and structures first) 3. Preservation maintenance or repair to arrest ongoing deterioration and reverse damage	The rationale for taking action at this threshold is to ensure repairs are made to reverse damage or deterioration noticeable at the collective level, and prevent the condition of buildings or structures from deteriorating to a "poor" condition. These corrective actions should arrest any ongoing deterioration, and return at one or more of the buildings or structures to "good" condition.

A management concern is present regarding the number of buildings and structures that have a currently-assessed condition of "fair." Furthermore, Residence 1 (the Superintendent's House) is in "poor" condition, which is also below the management standard. To address these concerns, general and specific responses would be required. Generally, preservation maintenance and/or repairs would occur, in keeping with the Secretary of the Interior's Standards for Treatment of Historic Properties (NPS 1995), sufficient to return all of the NHL elements to "good" condition, and to arrest ongoing deterioration of other elements. The following specific measures would be implemented to address these management concerns:

- Follow the recommendations from the Ahwahnee Historic Structures Report (1997) and the Ahwahnee Cultural Landscape Report (2010) when redesigning the Ahwahnee Parking Lot to bring the Ahwahnee stone gate house and the Ahwahnee Parking Lot to "good" condition.

- Develop a Historic Structures Report for the LeConte Memorial Lodge NHL to determine the rehabilitation needs to bring the building to "good" condition.
- Rehabilitate Residence 1 (the Superintendent's House) per the Historic Structure Report (Lingo 2012) to bring the building to "good" condition. This rehabilitation of the building will occur under all action alternatives, regardless of whether the building is relocated.

These specific actions would be further developed through consultation with the California State Historic Preservation Office and reflected in detail in the plan-specific programmatic agreement.

Management Considerations and Enhancement Actions

Management considerations related to the Yosemite Valley Historic Resources ORV would target improving the condition of buildings and structures that are currently in "fair" condition, and maintaining the condition of buildings and structures that are currently in "good" condition. There are no specific actions unique to the *Merced River Plan/DEIS* that would address these management considerations. Following is a list of current standard operating procedures that would enhance the contributing elements of the Yosemite Valley Historic Resources ORV:

- Continuing the active program of historic buildings and structures maintenance and repair in Yosemite Valley
- Maintaining the essential qualities of the individual historic developed areas in Yosemite Valley through documentation in the NPS' Cultural Landscape Inventory program as well as by guidance in treatments identified in management documents, such as Cultural Landscape Reports and Historic Structure Reports
- Employing the Design Guidelines for Yosemite National Park's recommendations for Yosemite Valley to ensure new development or redevelopment protects the Yosemite Valley Historic District's essential historic character
- Periodically assessing and updating the National Register documentation for the Yosemite Valley Historic District as EIS-related management actions are implemented, to support its long-term management
- Periodically assessing and updating documentation for individual elements of the Historic Resources ORV or Yosemite Valley Historic District (historic structure reports, cultural landscape reports, individual National Register nominations for historic districts, National Historic Landmark documentation, for example), as management actions are implemented to support their long-term management

Conclusion: Protecting and Enhancing ORV 10 (Yosemite Valley Historic Resources)

The Yosemite Valley Historic Resources ORV is determined to be absent of adverse effects and degradation as defined by WSRA. Management concerns are present, with one structure in poor condition and the aggregate condition of the collection of elements falling below the management standard. As a response, the NPS will rehabilitate the Superintendent's House (Residence 1) in keeping with the Secretary of the Interior's Standards, with a goal of returning the building to "good" condition and utilizing it for a compatible contemporary use. The NPS will also document and interpret any building or structure threatened with removal or relocation. In this manner, while the individual tangible element or elements may be lost or moved, a record of their existence and historical significance will still be available to the public. To address management considerations, the *Merced River Plan/DEIS* does not propose any actions

beyond current standard operating procedures that include continuing the active program of maintenance for historic buildings and structures; employing existing design guidelines to ensure that new development or redevelopment complements the ORV and the Yosemite Valley Historic District; and periodically assessing and updating professional documentation for the historic resources.

Cultural ORV—El Portal Archeological District

ORV 11—The El Portal Archeological District contains dense concentrations of resources that represent thousands of years of occupation and evidence of continuous, far-reaching traffic and trade. This segment includes some of the oldest deposits in the region including the archeological remains of the Johnny Wilson Ranch, a regionally rare historic-era American Indian Homestead.
Location: Segment 4 (El Portal)
Rationale: El Portal's location midway between Yosemite Valley and the San Joaquin Valley made it an important place of settlement, subsistence, and trade along the Merced River. The steep, narrow canyon at El Portal includes river terraces with level lands on which villages were built. The presence of Great Basin and Pacific Coast artifacts indicates that El Portal was a location of continuous, far-reaching traffic and trade. The El Portal Archeological District encompasses an archeological landscape containing dense concentrations of resources representing some of the oldest deposits in the Sierra foothills, with data important to interpreting regional cultural history as old as 9,500 years. Particularly significant are the archeological remains of the Johnny Wilson Ranch, a rare example of an American Indian Homestead, which took advantage of the river as an irrigation source. In addition to the regionally significant scientific and interpretive value of the archeological district, the sites have value to park-associated American Indian tribes and groups as a connection to their ancestors. These groups maintain their rights to practice their religion and ceremonies as they have for thousands of years.
Management Objective: Archeological sites within the El Portal Archeological District would be monitored to ensure protection and enhancement of the district as a whole, and to ensure that human impacts are not adversely affecting the district's essential character and integrity.

ORV Condition at the Time of Designation (1987)

Sites within the El Portal Archeological District have been impacted by from historic development and more recent NPS administrative uses. Construction of the Yosemite Valley Railroad and Highway 140, logging, mining, concession operations, and park facility or residential construction had damaged 30% or more of eight sites listed in the district (NPS 1976). Four sites are known to have experienced particularly severe damage, most notably a large ancient village and cemetery developed for park infrastructure needs.

Sites have also experienced impacts from visitor use. Unauthorized collection of surface artifacts was presumed at several sites, although this type of impact is very difficult to document (NPS 1976). During excavations in 1959-1960, a significant amount of information was intact beneath the surface at some sites within the district (Fitzwater 1962).

Current ORV Condition

The condition of the El Portal Archeological District has not changed significantly from the time of designation (Darko 2011). Recent information suggests that one site in the district exhibits evidence of moderate visitor use impacts. Also, bioturbation and impacts from the 1997 flood have impacted sites within the district.

Management Program for ORV 11

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. This ORV utilizes the same indicator to monitor the aggregate condition of the collection of archeological sites within the district as the indicator described under Cultural ORV 9 – Yosemite Valley Archeological District (Table 5-21). The management standards, definitions of adverse effect and degradation, monitoring program, and trigger points are the same as described under ORV 9.

Human impact values for a sample of relevant El Portal Archeological District sites are shown below (Table 5-23). Results are drawn from archeology visitor use yearly site monitoring for a sample set of six sites (27%) from a total of 22 El Portal District sites relevant to the Merced River corridor ORV. Over a five-year interval (2007-2011), 100% of high data potential sites and 100% of low data potential sites in the sample were considered free of serious human impacts, meeting the management standards for the indicator.

TABLE 5-23: PERCENTAGE OF EL PORTAL ARCHEOLOGICAL SITES FREE OF CURRENT SERIOUS UNMITIGATED IMPACTS[a] IN A MONITORED SAMPLE SET (N=6)

High data potential	Low data potential
100%	100%

[a] Note: Impacts with partial loss irretrievable effects with moderate to severe damage levels or multiple (≥3) impacts with low damage levels.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-21. There are no management concerns associated with the El Portal Archeological District.

Management Considerations and Enhancement Actions

Management considerations for this ORV include abandoned infrastructure located on CA-MRP-0181/H in Rancheria, which impact an exceptional site containing diverse components and extremely sensitive cultural materials that are highly valued by traditionally associated American Indians. Also, informal trails, non-essential gravel roads, and visitor use contribute to archeological site disturbances at CA-MRP-0250/H and CA-MRP-0251/H in Old El Portal. To address these management considerations, the NPS will undertake the following actions:

- In recognition of the high cultural significance of CA-MRP-181 for traditionally associated American Indians, the site will be protected from any further development. A plan of action for addressing the abandoned infrastructure on the site will be developed in consultation with traditionally associated American Indian tribes and groups. Any solution(s) developed will also include a recommended approach for deterring visitor use within the site.
- Informal trails, non-essential roads, and abandoned infrastructure would be removed to protect and enhance the archeological resources contributing to the ORV in Segment 4.
- Remove informal trails and non-essential roads.

Conclusion: Protecting and Enhancing ORV 11 (El Portal Archeological District)

This cultural ORV is absent of adverse effects and degradation. No management concerns are present, but some management considerations are present. These considerations will be remedied by removing informal trails and roads and addressing the abandoned infrastructure in site CA-MRP-181. To protect and enhance this ORV in the future, the NPS will monitor the condition of the ORV and take specific actions should specific trigger points be reached. Trigger points are selected to inform managers well in advance of adverse effects or degradation impacts on this ORV.

Cultural ORV—Regionally Rare Archeological Features, including Rock Rings

ORV 12—This segment includes regionally rare archeological features representing indigenous settlement and use along the South Fork of the Merced River at archeological sites with rock-ring features.
Location: Segment 5 (South Fork Merced River above Wawona)
Rationale: Three regionally rare prehistoric archeological sites are located in this segment of the South Fork of the Merced Wild and Scenic River corridor. The sites contain unique stacked rock ring constructions and rock alignments. Two sites also contain pine timber remains within the ring interiors or incorporated into the stacked rock courses. Stacked rock ring structures are highly uncommon in the park (Hull and Moratto 1999:27) and their function is unknown. The rings may be associated with hunting activities at the nearby soda springs, a natural source of salt for animals (Knieriemen 1976). To date, no sub-surface testing, dendrochronological analysis, or data recovery has been conducted at the rings. Rock constructions are considered fragile and highly subject to human alteration from camping and campfire building disturbances. Two of the South Fork sites are adjacent to formal NPS trails, increasing the likelihood of disturbance. Damage assessments at similar rock ring sites near Johnson Lake in the southern portion of the park over two decades have noted rock ring features disassembled for use in fire rings, alignments cleared for sleeping or tent placement, and recent fire rings within features (Jackson 2005; Curtis 2011; Curtis and Darko, 2012). The latter disturbance is particularly threatening for rare wood elements at the South Fork sites, opening the possibility of opportunistic use as campfire fuel before scientific analysis can be conducted. Human impacts noted, but not formally documented, at Wilderness Historic Resource Survey (WHRS) Structure 53 include campfire rings and garbage within the rock feature, structural alterations, and rock "furniture" constructed near the feature (Montague 2005). Two of the sites, CA-MRP-2296 and CA-MRP-2363, were documented and monitored for site condition in 2010. A third site, WHRS Structure 53, has not been recorded to current Yosemite standards (Snyder 1992; Montague 2005). The vicinity of the sites has not been systematically surveyed, and it is possible that additional rock ring sites may be present along the South Fork. Should additional rock ring sites be discovered in the monitoring process, they will also become a part of the South Fork ORV.
Management Objective: Prehistoric archeological sites with rock rings along the South Fork of the Merced River above Wawona will be monitored to ensure that human impacts do not adversely affect the essential character and integrity of the sites.

ORV Condition at the Time of Designation (1987)

Knierieman (1976) penned a short paper that described stacked rock rings with timbers within this river segment, their locations, associated artifacts, estimated temporal affiliations, and known impacts (1976). At the time, Wilderness campers had reportedly destroyed at least one feature in a different area. Knierieman described the features as being in a "dilapidated condition" from natural processes. To date, no sub-surface testing, dendrochronological analysis, or data recovery has been conducted at the rings.

Current ORV Condition

A Wilderness Historic Resources Survey conducted in 1992 reported that campers had built a bonfire in one of the rock-ring features, destroying any remnants of the wooden timbers (Snyder 1992). No impacts were noted at a second rock-ring feature. Re-visitation and formal documentation as part of the park's archeological assessment program in 2000 (Quinn 2001) and 2002 (Jackson and Hagen 2007) reported two of the sites in fair and good condition, with natural erosional processes and vegetation growth the only sources of impacts. A 2005 visit of the sites noted that one of the features had been partially rearranged by campers to create campfire rings and a rock "table;" this was the same feature that Snyder had earlier reported a bonfire (Montague 2005). Garbage was also noted at this feature, approximately 10 meters from a hiking trail.

Management Program for ORV 12

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. The NPS would monitor the condition of this ORV in conjunction with the Wawona Archeological District (ORV 13), using the same management standards, definitions for adverse effect and degradation, indicators, triggers, and management response to triggers.

Indicator - Condition of Individual Rock-Ring Sites

The indicator is the condition of individual rock-ring sites. Site condition includes the general physical state of the site and associated material remains; site stability, or potential for physical deterioration over time; and site integrity, the potential to convey information, setting, feeling, and association of previous historical eras to researchers, the public, and traditionally associated peoples.

Archeological site condition was chosen as an indicator because this characteristic is sensitive to human disturbance, an observable harmful effect on the integrity or data potential of a site resulting from human activity. There is a direct relationship between the degree of site disturbance and current site condition (NPS 2007a). Site disturbances, or impacts, can lead to the irretrievable loss of archeological resources at the individual site level (NPS 2007b). The cumulative loss of individual site resources within the ORV group can ultimately result in degradation of the ORV as a whole.

Management Standard

The management standard for the sites is to sustain three or fewer serious human impacts to the rock-ring ORV site group in a five-year monitoring interval. This impact maximum may occur at a single site (one site receives three disturbances) or be spread over multiple sites (each site receives one disturbance). Serious unmitigated human impacts are single disturbances with partial or total loss irretrievable disturbance effects at moderate to severe site damage levels, or a series of three or more disturbances with partial or total loss—irretrievable disturbance effects at low site damage levels. Unmitigated impacts are disturbances uncorrected by management action under regulatory context such as Section 106 of the National Historic Preservation Act.

Current site condition and impact numbers are indicated in Table 5-24. Results are drawn from Archeology Visitor Use yearly site monitoring, 2007-2011, Wilderness Historic Resources Survey (WHRS) in 1992, and project field reports in 2005. The two recorded sites are currently in good condition with no reported

human impacts and meet the management standard. A third undocumented prehistoric site, WHRS Structure 53, has 1-2 informally reported human impacts. While the site appears to meet the management standard, the purported impacts may trigger immediate management actions for site preservation.

TABLE 5-24: CURRENT SITE CONDITIONS OF INDIVIDUAL ROCK RING ARCHEOLOGICAL FEATURES

Site No.	Site Condition 2010	Human Impacts
CA-MRP-2296	Good	0
CA-MRP-2363	Good	0
WHRS Structure 53	Unknown	1-2*
* Noted but not formally documented or condition assessed by Montague (2005).		

In balancing visitor use and site preservation, some disturbances to resources can be acceptable if the site retains context and integrity (Fairley and Downum 2000). For sites with estimated high data potential, such as rock ring sites with unique attributes, the potential resource loss is greater, particularly given the small number of sites known to make up the ORV. A serious human impact or series of minor impacts resulting in irretrievable damage and loss at high data sites is less acceptable in such cases (Donnermeyer 2005:43), and the management standard (a maximum of three impacts in a monitoring interval) targets appropriate site protection levels based on professional judgment of condition assessments at similar sites within the southern portion of the park (Jackson 2005; Curtis 2011; Curtis and Darko 2012).

Adverse Effect

Adverse effect occurs when human disturbances to the rock ring ORV site group exceeds three serious human impacts in a five-year monitoring interval. This impact may occur at a single site (i.e. one site receives four disturbances) or be spread over multiple sites (i.e. each site receives one or more disturbances).

The adverse effect represents a 33% increase in site standard violations over a five-year time span. The increase serves as a warning of long term downward trends in site condition, allowing for protective management actions before widespread site damages threaten the essential character of the ORV (Donnermeyer 2005:33).

Degradation Standard

Degradation occurs when two or more sites comprising the ORV show severe disturbance severity levels and poor site conditions due to human impacts.

Severe disturbance levels indicate a prior history of disturbances causing major site damage. Sites or major portions of sites will likely be lost if actions to protect and/or preserve are not taken within two years. Poor site conditions result from multiple current disturbances causing loss of site features or key areas that define primary site function and are critical to site data potential for historical or scientific research. Such losses make it difficult to utilize any remaining site data (NPS 2007). The combination of prior and current damage causes a near total loss of site significance and integrity. When the majority of sites (≥2) within this small collection of rare site types lose significance and integrity, the essential value of the ORV is lost.

Monitoring – Condition of Archeological Sites in High Elevations of the South Fork Merced River

Monitoring would occur in Segment 5, South Fork above Wawona. Site condition assessments will be conducted for the rock ring sites at 5-10 year monitoring intervals, following the assigned ASMIS site inspection schedule. Given the sites' remote locations, a 10 year monitoring interval may be appropriate if site documentation is fully completed (NPS 2007b).Monitoring and full site recording at WHRS Structure 53 will be regarded as a high priority due to lack of formal documentation and unknown condition, and will be conducted at the earliest possible opportunity in the site monitoring schedule.

The key source of feedback for adaptive archeological site management is the periodic, systematic analysis of collected site data, focused on management objectives (Kintigh et al. 2007). To achieve this feedback and assess trigger points for management actions, summary reporting of site monitoring results for the aggregate site group will be compiled at five year intervals to determine maintenance of the management standard and avoidance of adverse effects or degradation. This five year interval for summary reporting and analysis of site data is the minimum reporting period necessary for accurate capture of human impacts over longer time spans (Bane 2011:43). Table 5-25 lists triggers and specific management responses that would take place should conditions reach the trigger points.

TABLE 5-25: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR REGIONALLY RARE ARCHEOLOGICAL FEATURES (INDIVIDUAL ROCK RING SITES)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
A. One (1) serious human impact to a rock ring site in a five-year monitoring interval.	A. Increased monitoring frequency at affected sites and other ORV sites within vicinity. This may include archeological monitoring and /or Law Enforcement/ backcountry ranger monitoring.	A. Extreme component vulnerability and high research potential at rare rock ring sites requires increased monitoring frequencies after single cases of serious disturbances.
B. Two (2) serious human impacts to the rock ring ORV site group in a five year monitoring interval. This impact may occur at a single site (i.e. one site receives two disturbances) or spread over multiple sites (i.e. two sites receive one disturbance each).	B. Increased management protection designed to counteract or minimize impacts, crafted to individual site specifications or to site group. Examples include: • Site documentation, research, testing, or NRHP evaluation; • Dendrochronological analysis of rare wood elements: • Site stabilization, re-vegetation, trail reroutes, trail removal; • Increased outreach/education to permitted users such as backpackers; • Data recovery at affected sites; • Closure of areas to camping, utilizing law enforcement monitoring and increased visitor education about human impacts and the necessity for closures. Area closure regulations will be represented within the superintendent's compendium in order to allow legal enforcement.	B. Extreme component vulnerability and high research potential at rare rock ring sites requires timely management prescriptive actions before management standard levels are violated.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-25 above. There are no management concerns associated with the two recorded sites along the South Fork Merced River. A third undocumented prehistoric site (WHRS Structure 53) has one to two informally reported human impacts. While the site appears to meet the management standard, the purported impacts may meet one or both of the triggers identified in Table 5-25, depending on whether the

human impacts are serious. If they are, management concerns are present at that site, and NPS will take immediate management actions for site preservation.

Management Considerations and Enhancement Actions

Management considerations for this ORV include wilderness camping, which can disturb rock ring features when campers move rocks to create fire pits or use wooden material associated with archeological features for firewood, and informal trails and visitor use, which can cause ground disturbing impacts to surface and sub-surface archeological resources at CA-MRP-0218.

To remedy these considerations, NPS will:

- Complete documentation of the features. Restrict Wilderness camping in the area of the rock rings (camping allowed past particular marker). Remove informal trails and charcoal rings.
- Increase education and outreach to Wilderness travelers.

Conclusion: Protecting and Enhancing ORV 12 (regionally rare archeological features)

This cultural ORVs is determined to be absent of adverse effects and degradation, although management considerations are present. To remedy these considerations, the NPS would complete documentation of rock ring features, evaluate the need for scientific study through dendrochronological analysis, remove informal trails in the vicinity of archeological sites, and increase education and outreach to Wilderness travelers. To prevent future impacts, the NPS would monitor the condition of the ORVs, and take specific actions should specific trigger points be reached. Trigger points are selected to inform managers well in advance of adverse effects or degradation impacts on this ORV.

Cultural ORV—Wawona Archeological District

ORV 13—The Wawona Archeological District encompasses numerous clusters of resources spanning thousands of years of occupation, including evidence of continuous, far-reaching traffic and trade. Segment 7 includes the remains of the U.S. Army Cavalry Camp A. E. Wood documenting the unique Yosemite legacy of the African-American buffalo soldiers and the strategic placement of their camp near the Merced River.
Location: Segments 5 (South Fork Merced River above Wawona), 6 (Wawona Impoundment), 7 (Wawona), and 8 (South Fork Merced River below Wawona)
Rationale: Because there are few springs and no talus shelters in the Wawona area, sites of human activity reaching back thousands of years are concentrated along the river. The presence of Great Basin and Pacific Coast artifacts indicates that Wawona was a location of continuous far-reaching traffic and trade. Sites in this district contain important information relevant to research regarding permanent and semi-permanent settlement along a particularly long mid-elevation meandering river. In addition to the regionally significant scientific and interpretive value of the archeological district, the sites have value to park-associated American Indian tribes and groups as a connection to their ancestors. These groups maintain their rights to practice their religion and ceremonies as they have for thousands of years. Physical remnants of the African-American Buffalo Soldiers' late 19th and early 20th century federal protection of Yosemite National Park are present along the South Fork Merced River in Wawona. These reflect extremely rare African American army troop guardianship of national park lands. These are represented in the archeological remains of Camp A.E. Wood, the first Army headquarters in the park, which was situated near the South Fork and its year-round water source.
Management Objective: Archeological sites within the Wawona Archeological District would be monitored to ensure protection and enhancement of the district as a whole, and to ensure that human impacts are not adversely affecting the district's essential character and integrity.

ORV Condition at the Time of Designation (1987)

When the Wawona Archeological District was determined eligible for listing in the National Register of Historic Places in 1979, it had undergone very little in the way of archeological testing or excavation. The statements of significance on the National Register nomination form were based largely on surface assemblages and the potential for subsurface deposits, rather than explicit knowledge of the nature of such deposits. This potential was confirmed when Ervin (1984) carried out limited auger testing at 24 sites and performed test excavations at nine of the sites during the field seasons of 1983 and 1984 in anticipation of a water/wastewater infrastructure project. The results of this investigation proved that many sites within the Wawona Archeological District contained intact, and in some cases deeply buried, cultural deposits with the potential to reveal much about the pre-contact inhabitants of the area. As a result of this fieldwork, plans for the infrastructure development were modified to avoid or reduce impacts to known sites, which kept them in overall excellent condition. Although substantial historic-period development has occurred within portions of the Wawona Archeological District, Ervin (1984) concluded that impacts mainly affected surface artifact assemblages and only limited portions of subsurface deposits, leaving intact cultural materials with the potential to address important research questions related to the long history of human habitation and use of the Wawona area.

After the departure of U.S. Army troops from Camp A.E. Wood, the area was abandoned for several years until a public campground—known as "Camp Hoyle"— was established in the same location. In 1951, the campground was enlarged, improved, and renamed Camp A.E. Wood (Sargent 1961). The Wawona Campground grew around the site, with the portion known as Camp A.E. Wood eventually incorporated into the popular camping spot. Archeological survey work conducted for the National Register nomination of the Wawona Archeological District noted the presence of significant historic-era cultural materials but did not explicitly connect any of these remains to the early Army camp or to the African-American soldiers assigned to park duty (NPS 1978). Further evaluation of several sites in the district during 1983-1984 fieldwork revealed a wealth of military and domestic artifacts related to Camp A.E. Wood, and possibly the early homestead of 1860s settler Stephan Cunningham, located within and adjacent to the current Wawona Campground (Ervin 1984). Square-cut nails, gun cartridges (a majority dating to 1899-1905), bullets, can fragments, bottle and window glass, and rotting wood were discovered in the top 6 centimeters of one of the test excavation units. During the 1983 field season, Ervin (1984) noted that disturbances to the historic-era component of the site were mainly a result of formal campground construction and maintenance, beginning with campsite and road grading, restroom construction, and other infrastructure development in the 1940s and continuing with the burial of modern campsite trash, casual collection of artifacts, and tent trenching practices. However, Ervin (1984) concluded that despite these impacts, the historic component of the site contained important information related to the U.S. Army's use of the area and possibly to early homesteading activities, as well.

Current ORV Condition

Of the 29 Wawona Archeological District sites visited during the 2007-2009 field seasons, 13 sites were estimated to have experienced severe impacts. Nine additional sites had a moderate degree of disturbance, and seven sites had a low rate of impact. Visitor use impacts were present at all but three of the monitored sites (Middleton [NPS] 2008, 2009, 2010). A recent condition assessment of the total 59 sites in the Wawona Archeological District within the Merced River Corridor found that 33% (19 sites) are in good condition, with an additional 38% (23 sites) in fair condition (Darko 2011). Eleven of the sites are in poor condition,

while four could not be relocated during an attempted field visit, and two with unknown conditions were not visited as part of the project because they were outside the MRP study area. Darko's 2011 report corroborated the earlier estimations of disturbance severity levels, with 20 sites (35%) exhibiting a low level of disturbance, 17 (29%) having a moderate disturbance severity level, and 12 (19%) showing severe impacts. Ten (17%) of the sites within the 2011 Wawona Archeological District study area could not be assessed for disturbance severity levels.

Ongoing use and maintenance of the Wawona Campground continues to present potential impacts to the archeological remains of U.S. Army Calvary Camp A.E. Wood. Extensive flooding in 1997 may also have contributed to impacts. Flood-related impacts to this site and others in the Wawona Archeological District were assessed in 1999 and 2004 (Montague and Valdez 2004). As of the most recent assessment, Camp A.E. Wood and the other examined sites in the district still possessed intact cultural deposits, but additional investigation of these sites was needed to more fully define their horizontal and vertical extent and integrity. Additional historical research was recommended to correlate the historic-era artifacts within the Wawona Campground to the occupation of the site by the U.S. Army Calvary troops (Montague and Valdez 2004).

Impacts seen at archeological sites within this ORV segment fall into largely the same categories as those noted in the Yosemite Valley and El Portal archeological districts: administrative/facilities-related impacts such as campground and infrastructure maintenance, visitor use impacts (including general trampling, artifact collection, and creation of informal trails), and natural impacts such as flooding and erosion.

Management Program for ORV 13

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. This ORV utilizes the same indicator to monitor the aggregate condition of the collection of archeological sites within the district as the indicator described under Cultural ORV 9 – Yosemite Valley Archeological District. The management standards, definitions of adverse effect and degradation, monitoring program, and trigger points are the same as described under ORV 9 (Table 5-21).

Human impact values for a sample of relevant Wawona Archeological District sites are shown below (Table 5-26). Results are drawn from Archeology Visitor Use yearly site monitoring for a sample set of 36 sites (42%) from 86 Wawona District sites relevant to the Merced River corridor ORV. Archeological sites outside of the river corridor judged not to be river-related (Wawona Meadow) and sites completely or mostly on private land are not included in the district site total. Over a five year interval (2007-2011), 92% of high data potential sites and 94% of low data potential sites in the sample were considered free of serious human impacts, meeting the target management standards for the indicator.

TABLE 5-26: PERCENTAGE OF SITES FREE OF CURRENT SERIOUS UNMITIGATED HUMAN IMPACTS[a] FOR A MONITORED SAMPLE SET (N=36), WAWONA ARCHEOLOGICAL DISTRICT, 2007-2011

High data potential	Low data potential
92%	94%

[a] Note: Impacts with partial loss irretrievable effects with moderate to severe damage levels or multiple (≥3) impacts with low damage levels.

Portions of the Wawona Archeological District fall outside of the Merced Wild and Scenic River corridor boundaries. Portions of the Wawona District are also privately owned or in mixed public/private ownership areas. Sites located completely or mostly on private land would not be included in monitoring assessments due to lack of NPS jurisdiction. Monitoring at CA-MRP-168/329/H, the location of historic Camp A. E. Wood, would be regarded as a high priority, and conducted at the earliest possible opportunity in the site monitoring schedule.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-21 under ORV 9, above. There are no management concerns associated with the Wawona Archeological District, as indicated by a five-year monitoring interval between 2007 and 2011.

Management Considerations and Enhancement Actions

There are several management considerations for this ORV: the Wawona Archeological District is subject to site-specific impacts from park operations, visitor use, artifact collection, vandalism, and ecological processes; visitor use at Wawona Campground is potentially causing localized adverse effects to site CA-MRP-168/329/H (Camp A.E. Wood), with ground disturbing activities potentially causing impacts to the shallow deposit of historic artifacts and features and modern campsites sometimes obscuring the historic setting of Camp A.E. Wood; informal trails and variety of operational and visitor uses cause ground disturbing impacts to surface and sub-surface archeological resources at CA-MRP-0008/H; and shoulder and off-road parking causing impacts to archeological resources on archeological site CA-MRP-0171/172/254/516/H. The following actions would help to address these issues:

- Increase monitoring frequency at affected sites.
- Increase management protection designed to counteract or minimize impacts, and craft to individual site specifications.
- At the district-wide level, revise the existing National Register nomination to reflect changes since its original writing, for example, incorporating newly discovered resources and documenting impacts.
- Remove seven campsites from Wawona Campground that cause potential impacts to the archeological site.
- Consider need for archeological site treatment measures to address impacts to shallow deposits of artifacts and features. Remove informal trails and develop site management plan.
- Remove informal trails and fire rings adjacent to shoulder and off-road parking in proximity to the site to prevent continuing disturbance.

Conclusion: Protecting and Enhancing ORV 13 (Wawona archeological district)

The Wawona Archeological District is absent of adverse effects, degradation, and management concerns (conditions that exceed management triggers). Management considerations are present. To address management considerations, the NPS would remove seven campsites that cause impacts to the Camp A.E. Wood archeological site, and initiate a variety of actions to address specific considerations including removal of informal trails, non-essential roads, and infrastructure that impact archeological sites under Alternatives 2-6. To prevent these considerations, or others, from redeveloping, the NPS would monitor the condition of the

ORV, and take specific actions should specific trigger points be reached. These trigger points are selected to inform managers well in advance of adverse effects or degradation impacts on this ORV.

Cultural ORV—Wawona Historic Resources

ORV 14—The Wawona Historic Resources ORV includes one of the few covered bridges in the region and the National Historic Landmark Wawona Hotel complex. The Wawona Hotel complex is the largest existing Victorian hotel complex within the boundaries of a national park and one of the few remaining in the United States with this high level of integrity.

Location: Segment 7 (Wawona)

Rationale: Galen Clark, Yosemite's first guardian, built the original Wawona Covered Bridge in 1868, which became the bridge as it is today. The Bridge boasts state significance within transportation, entertainment, and recreation contexts. The bridge embodies the distinctive characteristic of a unique type of construction and is the only historic covered bridge in the western region of the NPS. The Wawona Covered Bridge is individually listed in the National Register of Historic Places, and is also a contributing resource to the Pioneer Yosemite History Center Cultural Landscape Inventory, determined eligible for listing in the National Register of Historic Places.

The National Historic Landmark (NHL) Wawona Hotel is a complex of buildings and structures built between 1876 and 1918 adjacent to the South Fork Merced River. It was built on the site of Galen Clark's Station, the original stop along one of the main access trails (and later wagon road) to Yosemite Valley. The complex includes seven buildings laid out in a formal pattern along perpendicular axes on a rolling hill, accessed by a circular drive with a central fountain. The complex is unique in its historical integrity – the architectural unity, the formal placement on the rural landscape, the original building materials, and their form and massing. The hotel complex retains exemplary integrity of function given its use as a resort complex for over one hundred years. It is of national significance in architecture, unique as the largest existing Victorian hotel complex within the boundaries of a national park, and rare for its high level of integrity. It is also of national significance in art because it contains the Thomas Hill Studio. Landscape painter Thomas Hill, one of the last painters of the Hudson River School, painted here during summers between 1886 and his death in 1908.

Management Objective: These structures will be managed to ensure the protection and enhancement of their historical integrity. Protection and enhancement will ensure that management actions, including managing for visitor uses, do not adversely impact the ORV.

ORV Condition at the Time of Designation (1987)

The Wawona Covered Bridge is listed in the National Register of Historic Places. At the time of the 1987 Wild and Scenic River designation, the Wawona Covered Bridge had recently undergone structural safety improvements. The NPS had dismantled and restored the bridge in 1956 and 1957, employing hand-hewn timber construction in the same style as the original bridge. Some timbers were replaced in 1961 and again in 1983 when NPS corrected structural safety hazards following an inspection of the bridge (Greene 1987).

The Wawona Hotel, including the Thomas Hill Studio, is listed in the National Register of Historic Places as both a nationally significant historic property and a national historic landmark (NHL). The NHL nomination is included in the larger publication *Architecture in the Parks,*[30] which was published in 1986 - just prior to designation of the Merced as a Wild and Scenic River. Thus, at the time of designation, the hotel complex met the very high standards of integrity necessary to qualify as an NHL. This was the case despite the fact that it had transferred from the private holdings of the Washburn Family to NPS ownership in the 1930s and had undergone recent rehabilitation to install a fire sprinkler system. According to the 1998 condition assessment, the building exteriors "are generally highly intact and are composed of historic wood siding, with original door and window openings and trim. Roof cladding, while not original, is of the original

[30] Laura Soulliere Harrison: Architecture in the Parks: A National Historic Landmark Theme Study. USDI National Park Service, U.S. Government Printing Office, Washington, D.C., 1986.

type."[31] The NHL nomination notes that the buildings of the complex had "undergone certain changes in recent years to improve the quality of the seasonally-offered guest services and to make the structures safer for occupancy."[32] Given these general statements, it is clear that the Wawona Hotel and Thomas Hill Studio had endured incremental change since their construction in the late 19th-century, but survived largely intact and with an extremely high degree of integrity.

Current ORV Condition

Between 2002 and 2005, the Wawona Covered Bridge underwent a restoration effort to improve the deteriorating timber structure. Hand-hewn timbers were used to repair the structure in a manner similar to the original 19th-century construction. Restoration of the bridge also included:

- Constructing shoring to support the 115,000-pound timber-frame of the bridge
- Removing the 8-inch sag from the superstructure, leveling the bridge
- Removing and replacing all seven of the deteriorated 14-square-inch by 30-foot transverse floor beams
- Repairing the bridge pier masonry in the riverbed
- Restoring the structural stability of the upstream and downstream timber-frame truss assemblies
- Replacing the undersized timber components in order to resist wind and snow loading
- Replicating hand-hewed timbers using broad axes and traditional craftsmanship from 19th-century practices

All recent bridge restoration activities were designed to meet the Secretary of the Interior's *Standards for the Treatment of Historic Properties*, thereby ensuring that the bridge retains its historical integrity. (The Secretary's standards were adopted in 1976, and earlier work was not designed to meet these specific standards.) Completion of the bridge restoration project inaugurated the creation of the interpretive Pioneer Yosemite History Center, with the restored bridge as a central feature.

A recent condition assessment of the Wawona Hotel Complex indicates that the hotel complex continues to retain a high degree of historical integrity.[33] Individual buildings within the complex are assessed to be in good condition, with some minor deterioration of historic fabric. The NHL complex has undergone recent upgrades to address seismic stability and ADA compliance as well as a series of cyclic repair and maintenance projects. The Thomas Hill Studio was recently rehabilitated and adapted for use as a visitor contact station. The fountains at the main hotel and the studio were recently restored to their historic appearance and function. Each of these projects has been accomplished consistent with the *Secretary of the Interior's Standards for Treatment of Historic Properties,* thereby ensuring that the complex retains its historical integrity. Interior furnishings and finishes such as paint, wallpaper, carpeting, and some fixtures have been updated to maintain functionality and serviceability.

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31 Carey & Co. Inc., "Wawona Hotel Complex Condition Assessment, Yosemite National Park, California." Report on file, Yosemite National Park Resources Management and Science Library, 1988, p. ii.

32 National Park Service: "National Register of Historic Places Inventory – Nomination Form for the Wawona Hotel and Thomas Hill Studio." USDI National Park Service, n.d.

33 National Park Service: "Wawona Hotel Complex Historic Structures Report." USDI National Park Service, Yosemite National Park, California, 2012.

Table 5-27 details the current condition of the buildings and structures that comprise the Wawona Historic Resources ORV. There are eight buildings and structures, seven of which are in "good" condition, resulting in 87% in good condition.

TABLE 5-27: CURRENT CONDITION OF WAWONA HISTORIC RESOURCES ORV

Building/Structure	Overall Condition	Contributing Elements in "Good" to "Fair" Condition	Contributing Elements in "Poor" Condition	Source
Wawona Covered Bridge	Good	All		
Thomas Hill Studio	Good	All		LCS 2008
Clark Cottage	Fair	Porch Columns, balustrade, and trim Porch flooring and apron Wood window sash Window balance system Exterior wood doors and transoms Exterior door hardware All interior finishes, fixtures, and hardware Roof Wood Shingles and Flashing	Exterior wood siding Porch Ceiling (3-1/4 inch boards) Roof dormers	2012 HSR
Main Hotel	Good	Roof wood shingles and flashings Veranda ceiling boards Veranda trim and balustrade Main entry stair and stone abutments Wood window sash Window balance system Exterior wood doors and transoms Exterior wood channel rustic siding Brick chimneys Exterior door hardware All interior finishes, fixtures, and hardware	Exterior wood doors (with glazing) and transoms	2012 HSR
Manager's Cottage	Good	Porch ceiling 1x4 tongue and groove Porch columns, balustrade, and trim Porch flooring and apron Wood window sash Exterior wood doors and transoms Exterior door hardware Roof wood shingles and flashings Interior finishes, hardware, and fixtures	Exterior wood siding and trim	2012 HSR
Moore Cottage	Good	Exterior wood siding Roof wood shingles and flashings Porch columns, balustrade, and trim Porch flooring and apron Porch ceiling Wood window sash Window latches Exterior wood doors and transoms Exterior door hardware Interior finishes, hardware, and fixtures		2012 HSR
Washburn Cottage	Good	Exterior wood siding and trim Window balance system Roof wood shingles and flashings Porch columns, balustrade, and trim Porch flooring and apron Porch ceiling Wood window sash Exterior wood doors and transoms Exterior door hardware Exterior stairs: north, east, west porch stairs Interior finishes, hardware, and fixtures		2012 HSR

TABLE 5-27: CURRENT CONDITION OF WAWONA HISTORIC RESOURCES ORV

Building/Structure	Overall Condition	Contributing Elements in "Good" to "Fair" Condition	Contributing Elements in "Poor" Condition	Source
Annex Building	Good	Roof wood shingles and flashings Roof gutter and downspouts Chimneys Exterior wood shingle siding Exterior wood doors (4-panel) and transoms Porch columns, balustrade, and exposed timber structure Porch Wood window sash Window lifts and latches, obscure glass at bathrooms Exterior door hardware Interior finishes, hardware, and fixtures	Porch flooring and apron Window balance system Exterior wood doors (with glazing) and transoms	2012 HSR

Management Program for ORV 14

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program.

Indicator – List of Classified Structures Condition Assessment

Given that the Historic Resources ORV is comprised of buildings and structures, this indicator is a measure of the physical condition of the individual elements – the Wawona Covered Bridge, and the Wawona Hotel and Thomas Hill Studio complex. The NPS' List of Classified Structures (LCS) provides a mechanism that captures physical assessments of the condition of the buildings and structures. The LCS will be used to obtain individual assessments of each building and structure at five-year intervals, and these individual assessments will be aggregated to form a collective assessment of the condition of the ORV.

The LCS Conditions provide a consistent means for assessing the condition of historic structures on a national basis. Condition levels are defined as follows:

Good: The structure and significant features are intact, structurally sound, and performing their intended purpose. The structure and significant features need no repair or rehabilitation, but only routine or preventative maintenance.

Fair: The structure is in fair condition if either of the following conditions is present:

- There are early signs of wear, failure, or deterioration though the structure and its features are generally structurally sound and performing their intended purpose; or
- Deterioration or damage affects more than 15% of the structure.

Poor: The structure is in poor condition if any of the following conditions are present:

- The significant features are no longer performing their intended purpose; or
- Significant features are missing; or
- Deterioration or damage affects more than 25% of the structure; or
- The structure show signs of imminent failure or breakdown.

Management Standard

The management standard would be to protect the Wawona Covered Bridge in "good" condition as defined by the LCS guidance. The management standard for the Wawona Hotel Complex is protection of 80% of the elements in "good" condition, and none in "poor" condition, as defined by the LCS guidance. LCS Conditions provide a consistent means to assess the condition of historic structures on a national basis. Condition levels are defined as follows:

Adverse Effect

An Adverse Effect would occur if either of the following situations developed: 1) The Wawona Covered Bridge condition diminished from "Good" to "Fair" using LCS definitions; or 2) Any of the individual buildings within the Wawona Hotel complex diminished to "poor" using LCS definitions.

Degradation

Degradation would occur if either of the following situations developed: 1) The Wawona Covered Bridge condition diminished from "Good" to "Poor" using LCS definitions, or if critical structure failures are allowed to continue without repair for a period of longer than six months; or 2) The condition of more than 50% of the buildings in the Wawona Hotel complex diminished from "good" or "fair" to "poor" using LCS definitions, or if critical structural failures were allowed to continue without repair for a period of longer than six months.

Monitoring – List of Classified Structures

The Park Historical Architect in concert with the Park Historic Preservation Specialist would periodically assess the condition of the Wawona Covered Bridge and Wawona Hotel complex and identify any critical structural system failures or weather impacts. Preservation and Cultural Resources Specialists who assess the structure and buildings must meet the qualifications outlined within NPS Director's Orders 28.

Table 5-28 lists the trigger points and management actions related to the Wawona Covered Bridge and the Wawona Hotel Complex.

TABLE 5-28: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR THE WAWONA HISTORIC RESOURCES (LIST OF CLASSIFIED STRUCTURES CONDITION ASSESSMENT)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Damage or deterioration of 5% or more individual buildings or that results in an LCS condition assessment of "fair"	1. Increase the frequency of condition assessments for buildings and structures in "fair" condition 2. Develop prioritized list of preservation actions based on severity of deterioration (addressing deterioration at NHL buildings and structures first) 3. Preservation maintenance or repair to arrest ongoing deterioration and reverse damage	The rationale for taking action at this threshold is to ensure repairs are made to reverse damage or deterioration noticeable at the collective level, and prevent the condition of buildings or structures from deteriorating to a "poor" condition. These corrective actions should arrest any ongoing deterioration, and return at one or more of the buildings or structures to "good" condition.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-28 above. A management concern is present regarding the number of buildings and structures that have a currently-assessed condition of "fair." To address this concern, general and specific responses would be required. Generally, preservation maintenance and/or repairs would occur, in keeping with the Secretary of the Interior's Standards for Treatment of Historic Properties (NPS 1995), sufficient to return all of the NHL elements to "good" condition, and to arrest ongoing deterioration of other elements. Additionally, the following specific measure would be implemented to address this management concern:

- Follow the recommendations from the Wawona Hotel Historic Structures Report (2012) to bring the Clark Cottage to "good" condition.

Management Considerations and Enhancement Actions

Management considerations related to the Wawona Historic Resources ORV would target improving the condition of contributing elements of the buildings that are currently in "poor" condition and maintaining the condition of buildings and structures that are currently in "good" condition:

- Follow the recommendations from the Wawona Hotel Historic Structures Report (2012) to address contributing elements in "poor" condition at the Main Hotel, Manager's Cottage, and Annex Building.
- Regular and routine preservation maintenance, conducted in accordance with the Secretary of the Interior's Standards, to ensure that this upkeep protects the historic character of the buildings
- Periodic rehabilitation will involve subject-matter specialists in planning, design and implementation to ensure actions do not compromise the historical integrity of the complex
- Concessioner operations will ensure that any operational modifications or updates are appropriate and in keeping with the historic character of the complex

Conclusion: Protecting and Enhancing ORV 14 (Wawona Historic Resources)

The Wawona Historic Resources ORV is absent of adverse effects and degradation. A management concern is present, as are some management considerations; NPS will follow the recommendations of the recent historic structures report for the Wawona Hotel to correct these problems and return the ORV condition to the management standard. To prevent future impacts, the NPS will monitor the condition of the ORV, and take specific actions should conditions exceed trigger points. Trigger points are selected to inform managers well in advance of adverse effects or degradation impacts on the bridge and hotel complex.

SCENIC ORVs

This section describes the program to protect and enhance each Scenic ORV as proposed in the *Merced River Plan/DEIS*. Four Scenic ORVs exist in the Merced River corridor, each related to specific segment(s) of the river (Table 5-29).

TABLE 5-29: SCENIC ORVS AND ASSOCIATED INDICATORS

ORV Number and Key Resource	Segment(s)	Indicator to be Monitored through Time
15. Scenic Views in Wilderness	1	No indicator is proposed, as Wilderness designation precludes development.
16. Iconic Scenic Views in Yosemite Valley	2	Application of the Visual Resource Management System
17. Scenic Views in the Merced River Gorge	3	Application of the Visual Resource Management System
18. Scenic Wilderness Views along the South Fork Merced River	5	No indicator is proposed, as Wilderness designation precludes development.

Scenic ORV—Scenic Views in Wilderness

ORV 15—Visitors to this Wilderness segment experience scenic views of serene montane lakes, pristine meadows, slickrock cascades, and High Sierra peaks.
Location: Segment 1 (Merced River above Nevada Fall)
Rationale: Starting at the headwaters, the Merced River passes through chains of paternoster lakes, enters the upper montane forest, and becomes walled in by a classic U-shaped glacial valley. Scenic landmarks visible from the river or its banks include Washburn and Merced Lakes, Echo Valley, Bunnell Point, and Little Yosemite Valley. The long river segment of great visual variety and its uncompromised natural setting provide diverse, exceptional scenery—all with the river in the foreground.
Management Objective: The NPS will focus efforts primarily on development in the river corridor. While visitor density or encounter rates can affect one's ability to appreciate scenery, visitor use is more appropriately addressed by the Recreation ORV. Similarly, bare soils and river bank erosion can affect foreground views, but are better addressed by the Biological ORV. This high country segment is also susceptible to regional air quality impacts, so the NPS will participate in regional efforts to reduce air pollution. Human activity contributes only to highly localized air quality problems. The NPS would maintain the visitors' ability to experience and appreciate the Scenic ORV by providing a river corridor that is relatively free of development.

ORV Condition at the Time of Designation (1987)

The river and its tributaries flowed through glacially-carved landscapes with very few human-made features, and the scenic ORV was largely unaffected by human activities. The river corridor and adjacent lands were located in protected Wilderness, with the exception of the Merced Lake High Sierra Camp, which was established in the early twentieth century. A recreational trail, initially developed in the 1930s, follows the river corridor as far as the Lyell Fork, then continues up Red Peak Fork. The trail includes wooden foot bridges at multiple locations. Backpackers campgrounds existed at Little Yosemite Valley, Moraine Dome and Merced Lake. A historic ranger station existed, just off the trail, a short distance upstream from Merced Lake. The landscape was otherwise comprised of natural features such as granite rock formations, meadows and forests.

Current ORV Condition

Views from the river and trails along this segment are valued for their isolation from the developed world, their ecological integrity and Wilderness qualities. Trail conditions and opportunities for visitor access remain the same as in 1987. Scenic vistas can sometimes be obscured by regional air pollution, which is manifest in occasional haze during the summer months (NPS and Colorado State University 2002). Local wild and prescribed fires sometimes limit the visual range from higher elevations and vistas or views located within the

river corridor. Existing conditions include rustic structures, trails, footbridges, utility buildings and tents at the historic Merced Lake High Sierra Camp, and primitive campsite development in Little Yosemite Valley.

Management Program for ORV 15

Because Segment 1 is classified as a wild segment and the river corridor—aside from Merced Lake High Sierra Camp—includes designated Wilderness, no further development or resource extraction can occur and scenery will remain unimpaired in perpetuity. Management standard, adverse effect, and degradation are not defined for this ORV because it is essentially impervious to intended human activities, and any structures proposed in the Wilderness would be subject to the Minimum Requirements Analysis (MRA), as well as the contrast analysis discussed below under ORV 16. Therefore, the NPS would not monitor the condition of this ORV as part of the *Merced River Plan/DEIS*. The NPS will continue to participate in regional efforts to monitor air quality throughout the park. Because of the ambient nature of air quality, it cannot be managed exclusively for the river corridor.

Management Considerations and Enhancement Actions

Management considerations regarding this ORV pertain to the Merced Lake High Sierra Camp. The NPS will ensure that Merced Lake High Sierra Camp is maintained in a clean and tidy condition. If the camp remains, as proposed in Alternatives 5 and 6, the NPS will ultimately replace the tent fabric with colors that blend within the landscape, such as gray, brown or green, so as to reduce contrast (the tents are currently white canvas). These changes, as well as any other structures proposed at the camp or elsewhere in Segment 1, would be expected to blend quite well with the native landscape. The extent to which the proposed structure would blend with the native landscape would be assessed using the Visual Resource Management system contrast analysis discussed below in ORV 16, with an allowable contrast rating of only 4 or less (the discussion under ORV 16 provides a lengthy explanation of the contrast analysis; this number indicates that the structure must have very little contrast with the surrounding landscape). If the camp is removed, as proposed in Alternatives 2, 3, and 4 (with a temporary pack camp remaining in Alternative 3), the site would be restored to natural conditions and added to the Yosemite Wilderness. There will be no visual resource contrasts.

Conclusion: Protecting and Enhancing ORV 15 (scenic views in wilderness)

As a segment located almost entirely within protected Wilderness, except for the potential Wilderness addition at Merced Lake High Sierra Camp, the Scenic ORV for Segment 1 will remain wild and will not be affected by human activity. The NPS will not monitor visual resources or conditions at site-specific scenic vista points. The ORV is determined to be in the protected state, as defined by an absence of adverse effects and degradation, although intermittent air quality concerns are present. The NPS will continue to participate in regional air-quality improvements and cooperate with state agencies to manage air quality.

Scenic ORV—Iconic Scenic Views in Yosemite Valley

ORV 16—Visitors to Yosemite Valley experience scenic views of some of the world's most iconic scenery, with the river and meadows forming a placid foreground to towering cliffs and waterfalls.
Location: Segment 2 (Merced River in Yosemite Valley)
Rationale: The Merced River enters Yosemite Valley at Nevada Fall, flowing through Emerald Pool and then over Vernal Fall. Once in the flat valley, the Merced provides the foreground to many of Yosemite's most famous landmarks. From the river or its banks, views consist of Yosemite Falls, Bridalveil Fall, El Capitan, Half Dome, and other named and unnamed parts of the cliffs and hanging valleys rimming Yosemite Valley. Meandering through a sequence of compound oxbows, wetlands, and meadows, the river and its related features provide broadened panoramas. Throughout Yosemite Valley, views from the river or its banks encompass the lower montane forest as it rises up to sheer rock faces of granite cliffs and talus slopes with a flat valley bottom serving as a contrasting foreground. The juxtaposition of granite domes and waterfalls is unique, as is the concentration of river-related views found in Yosemite Valley.
Management Objective: Segment 2 is the most highly accessible portion of the Merced River, visited by the greatest numbers of park visitors. Here the NPS provides the highest levels of service and accommodations for visitor use, and here the NPS has the greatest obligation to manage visual resources and visitors, and to protect and enhance the conditions that provide for the best possible viewing experiences. The NPS will remove unnecessary facilities from the river corridor and ensure that all future development satisfies objectives that provide low contrast ratings under the Visual Resource Management system analysis: form, line, color and texture. A Sense of Place: Design Guidelines for Yosemite Valley (NPS 2004) established architectural and site design guidelines that are intended to promote harmony between the built and natural environments.

Actions intended to manage natural resources may include the use of prescribed fire or controlled burns to thin forests that are encroaching on meadows; cutting trees, tree branches or other vegetation by mechanical means; and the application of herbicides to control invasive species. Related actions intended to protect the Recreation ORV would limit the number of visitors to lessen visitor density and congestion at attraction sites and make improvements to the transportation system that will reduce automobile congestion. The NPS will cooperate with regional authorities to reduce airborne contaminants caused by combustion, including carbon dioxide emissions, smoke caused by fire, particulate matter generated by construction, and to improve air quality conditions.

ORV Condition at the Time of Designation (1987)

Multiple scenic resources and natural landmarks are visible from the river corridor. Scenery was a key reason why Yosemite Valley was set aside as a national park (GMP EIS draft 1978, Olmsted 1865). Numerous roads, buildings and other features were developed with scenic resources in mind (SVMP 2011, DuBarton 2007, Davis 2004, Carr 1998). In the late 1970s, the NPS conducted an assessment for the General Management Plan (GMP) to determine existing and historic viewing conditions and to identify the prominent landscape features in Yosemite Valley (NPS 1980). The most prominent features noted were Half Dome, Yosemite Falls, El Capitan, Bridalveil Fall, Three Brothers, Cathedral Rocks and Spires, Sentinel Rock, Glacier Point, North Dome, Washington Column, and Royal Arches. Other important scenic resources that could be seen from within the Merced River corridor include: Nevada, Illilouette, Vernal, and Ribbon falls; the cliffs at Yosemite Point and Lost Arrow Spire; and the scenic interface of river, rock, meadow, and forested valley floor. Existing viewpoints were identified along with historic viewpoints of paintings and photographs, and the quality of their views and their proximity to roads and trails were noted.

Current ORV Condition

Views from the Merced River corridor, roadside locations, trails and vista points continue to retain high aesthetic value. The built and natural environments have changed subtly since the river was designated as Wild and Scenic. Some structures were damaged by flood or rock fall and removed over time. Meadow and riparian conditions are affected by encroaching vegetation and exotic species, park visitation patterns fluctuate, and conditions at scenic viewpoints are variable.

The 1997 flood caused a general reduction in buildings and facilities that were previously located in the Merced River floodplain. Curbing was installed along Northside and Southside Drives to limit the numbers of cars that could be parked in the foreground of scenic resource views. The Yosemite Falls project removed idling buses from views of the falls.

The NPS protected and restored meadows by removing obsolete or abandoned utility lines, removing non-native vegetation and encroaching conifers, planting and re-establishing native vegetation, constructing meadow boardwalks, and implementing monitoring programs. Direct views of meadows have improved, as have the importance of meadows in foreground views toward prominent scenic assets. However, river bank erosion and vegetation trampling associated with visitor access to river points continues to detract from visitor use and enjoyment of park scenery.

The *Scenic Vista Management Plan for Yosemite National Park Environmental Assessment* (NPS 2010a) described vegetation changes that have intruded on scenic viewpoints, rated and ranked the quality of viewpoints, and defined limits on management actions based on ecological conditions. The *Scenic Vista Management Plan* (SVMP) prioritized sites based on a visual resource assessment (NPS 2009a, 2009b). Descriptions of these vista points, assessment results for sites within the Merced River corridor and for sites that provide views of scenic landmarks, views of the river and river-dependent resources are provided in *Scenic Vista Management in the Merced River Corridor* (Appendix H). The assessment includes recommendations for vegetation management actions that would improve scenic views. Views of scenery are commonly hampered by encroachment of conifers on meadows and in certain cases by exotic species. Scenic vistas can also be obscured by regional air pollution, which results in occasional haze during the summer months (NPS and Colorado State University 2002).

Management Program for ORV 16

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program.

Indicator—Application of the Visual Resource Management System

The NPS will apply the Visual Resource Management (VRM) system developed by the U.S. Forest Service (USDA 1995) and further refined by the Bureau of Land Management (BLM 2007) (Table 5-30) to monitor this ORV. The VRM system has been used for over three decades and has proven to be a process that can articulate and document conditions that viewers consider inappropriate to the natural environment (Galliano 2000). VRM classifies landscapes on a scale from I to IV, with Class I denoting landscapes that merit the highest order of protection for natural scenery. Classes II through IV allow increasingly larger amounts of landscape modification. A final category (V) is sometimes used to describe a landscape that is altered to the extent that it cannot be classified or managed for natural scenic qualities.

TABLE 5-30: VISUAL RESOURCE MANAGEMENT (VRM) SYSTEM

Wild and Scenic Rivers Act (WSRA)	BLM Visual Resource Management (VRM) System Classifications (BLM 2007)	USFS Visual Management System (VMS), Visual Quality Objectives (USDA 1995)
Wild: Free of impoundments, generally inaccessible except by trail with watersheds or shorelines essentially primitive and waters unpolluted; vestiges of primitive America.	Class I Objective – Preserves existing character of the landscape and provides for natural ecological changes, but does not preclude limited management activity. Any changes in the landscape should be minimal and must not attract attention.	Preservation – Provides for ecological changes only. Management activities, except for very low visual-impact recreation facilities or actions, are prohibited. (Wilderness areas, primitive areas, other special classified areas and unique management units)
Scenic: Free of impoundments with shorelines or watersheds still largely primitive and shorelines undeveloped, but accessible in places by roads.	Class II Objective – Retains existing character of the landscape. Any changes in the landscape should be minimized. Management activities may be seen, but should not attract attention. Any changes must repeat or maintain basic elements of form, line, color and texture found in predominant natural features and characteristics of the broader landscape.	Retention – Provides for management activities or actions that are not visually evident. Activities may only repeat aspects of form, line, color and texture, frequently found in the characteristic landscape. Changes in qualities of size, amount, intensity, direction, and pattern should not be evident.
Recreational: Readily accessible by road or railroad, may have some development along shorelines, and may have undergone impoundment or diversion in the past.	Class III Objective – Partially retains existing character of the landscape. Any changes to the landscape should result in moderate differences. Management activities may be noticeable but should not dominate views. Any changes should repeat the basic elements found in the predominant natural features of the landscape.	Partial retention – Management activities or actions remain visually subordinate to the characteristic landscape. Activities and actions may repeat the visual aspects of the characteristic landscape, but changes in the qualities of size, amount, intensity, direction or pattern remain subordinate to the characteristic landscape.
Areas not designated	Class IV Objective – Provides for management activities that result in major modifications of the existing landscape. Changes in the landscape may be significant. Management activities or actions may dominate views or become a focus of viewer attention. Every attempt should be made to minimize the impact of activities or actions through careful location, minimal disturbance, and repetition of basic elements.	Modification – Management activities or actions may visually dominate the original characteristic landscape. Activities of vegetative and land form alteration must borrow from naturally established form, line, color or texture so completely that visual characteristics are those of naturally occurring features of the surrounding area of the same character type. Component parts of these activities (structures, roads, slash, root wads) must remain visually subordinate.
Areas not eligible for designation	Class V – Development or other landform changes predominate; the natural landscape is compromised to the extent that it can no longer be managed for natural scenic qualities.	Maximum Modification – Management activities and landform alterations may dominate the characteristic landscape. Background views must be those of natural occurrences within the surrounding area or character type. Foreground and middle-ground areas may not appear consistent with the characteristic landscape. Alterations may be out of scale or contain detail that is incongruent with natural occurrences in foreground or middle-ground.

There are two steps involved in the application of VRM system: an inventory of the existing landscape and an analysis of the contrast of a potential structure with the affected landscape. The inventory is required to classify current conditions and develop a baseline for comparison over time. In the initial inventory, visual resources and landscapes are qualified through surveys and documented from places or points that provide optimal viewing experience from visitors. River access points and the river itself will provide the primary points of reference for viewing experience and evaluation (the park's *General Management Plan* used historic photographs and landscape paintings to identify the best locations for viewing scenery) (NPS 1980).

Within the context of the Wild and Scenic Merced River, the VRM landscape classification is determined by the river segment designation of Wild, Scenic or Recreational. As presented in Table 5-30, there is a natural parallel between wild and scenic river classifications and VRM classes.

As indicated above, these classifications determine management goals for the protection of scenic areas. The VRM analysis proposed for this indicator also considers naturally-occurring landscape changes (such as fire or rock fall) and cumulative management actions over time.

The contrast analysis is done on proposed developments to ensure the degree of contrast is acceptable for the given landscape class. "Contrast" refers to a difference between the key components of a landscape (form, line, texture, and color, of both the landscape's vegetation and also its land and water) and the same components of the proposed structure. The contrast analysis is systematized, yielding a documented and quantified result ranging from 0 to as high as 36. Higher scores indicate a higher level of potential contrast between the proposed action and the existing surroundings; lower scores indicate that a proposed structure can be said to blend in (or not distract from) and thus preserve the surrounding landscape and its VRM landscape class rating.[34]

For the monitoring program, the contrast analysis will be performed using photographs from vista points. The acceptable contrast varies by landscape class, with those at higher levels (classes III and IV) accommodating a higher level of possible contrast. The analysis will be further refined as the total area of visual human impact is determined and scores are calculated as a percentage using the photographs taken or captured from other points.

Management Standard

The management standard is defined according to river segment classification, with scenic segments meeting VRM Class II definitions and the recreational segment meeting VRM Class III definitions.

Adverse Effect

Scenic river segments managed as VRM Class II would be adversely impacted if human constructions or actions resulted in the segment falling into VRM class III management class. The recreational river segment managed as VRM Class III would be adversely impacted if human constructions or actions resulted in the segment falling into VRM Class IV management class.

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[34] While scores have some subjectivity, variations in scoring between scorers decline with user training and experience (NPS 2009). For example, the NPS in the Blue Ridge Parkway has used this system using large numbers of volunteers to assess scenic value and monitor change over time. Using those results, park managers have been able to successfully communicate the need of adjacent land owners to modify developments to reduce the possible contrasts with the native landscape. Results were also introduced in a 2008 lawsuit case against Tennessee Valley Authority and cited by the judge in the ruling to justify requirements for three coal plants to operate above Clean Air Act standards (NPS 2009).

Degradation Standard

Scenic river segments would be degraded if human constructions or actions resulted in the segment falling into VRM class IV management class. Recreational river segments would be degraded if human constructions or actions resulted in the segment falling into VRM class V management class.

Monitoring ORV 16 — Iconic Scenic Views in Yosemite Valley

An inventory of the Merced River corridor has not yet been performed, but will be no later than the completion of the *Merced River Plan/FEIS*. As noted above, the inventory will classify current conditions and develop a baseline for comparison over time.

Monitoring will occur every four years after completion of the inventory to ensure that any new or modified structures preserved the segment within the management class rating. Further, any new structures or modifications of existing structures would be subject to the contrast analysis as described above. Table 5-31 describes the triggers and mandatory management actions that would take place should the contrast analysis reveal that a proposed structure, or modification thereof, would unacceptably contrast with its native landscape. Acceptable contrast ratings for the scenic river segments in the Merced River corridor are 0-12 with no strong contrast, and acceptable contrast ratings for the recreational segment are 0-21 with no more than two strong contrast ratings per feature.

TABLE 5-31: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR ICONIC SCENIC VIEWS IN YOSEMITE VALLEY (VISUAL RESOURCES MANAGEMENT)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Planned construction of any new structure or exterior modifications to any existing structure	Contrast analysis	The contrast analysis is intended to reveal effects on the outstandingly remarkably scenic value before a new structure is built.
A moderate contrast rating in any category of within the Scenic river segment, or a strong rating for Recreational.	Mitigation, such as change in color, for any a proposed action should be considered. Reductions in the area of visual impacts would occur such as removing signs or other non-historic structures, or reducing temporary impacts.	Actions or structures within this segment should attempt to minimize the contrast to the surrounding landscape to the best extent possible.
Within the Scenic river segment, an overall contrast rating greater than 12, or a strong contrast in any category. In a Recreational segment a contrast rating of 21 or more with two strong contrasting categories.	Mitigations to reduce the contrast rating, or an alternative location found if no mitigation is practical.	A contrast rating above a 12 is beginning to attract more attention than is acceptable to the casual observer. A score over 21 begins to dominate the landscape.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-31. No management concerns are present because no structures are currently proposed for construction or modification in the corridor, though some may be when an alternative in this plan is chosen and implemented, whereupon contrast analyses will be performed on any structures proposed within the Merced River corridor.

Management Considerations and Enhancement Actions

Management considerations pertaining to this ORV include visual intrusions associated with human made structures in Yosemite Valley (including roads and traffic through meadows and the presence of certain visitor and administrative facilities in the river corridor), vegetation growth that has intruded on scenic viewpoints historically available to park visitors, and riverbank erosion, informal trails, and riparian vegetation that affect direct and foreground views of the river, river-dependent resources, and the peaks and walls rising above the river.

NPS will take the following actions to address these considerations:

- To meet WSRA requirements, the NPS will consider the presence of existing structures, major facilities and services provided for visitor use and will eliminate several structures and facilities. Common to all the alternatives are actions that will remove certain structures, such as pools, abandoned bridge footings and infrastructure and rip-rap from riverbanks; and to address denuded, eroded riverbanks through restoration techniques. Alternatives 2-6 in the *Merced River Plan/DEIS* propose modifications to many previously-developed areas or disturbed sites that are located within the river corridor. Some Alternatives propose development in undisturbed sites including a new Upper Pines Walk-in Campground, a dormitory at Yosemite Lodge, and east of Curry Village. Under Alternatives 2-6, campsites would be removed from a minimum 100-foot riparian setback in Yosemite Valley. Alternatives 2-6 consider a range of additional actions at campgrounds, ranging from removal of campsites from the 100-year floodplain to addition of campsites. Under some alternatives, permanent lodging units are proposed in Curry Village to replace units removed from the rock-fall hazard zone. Various modifications are proposed to formalize visitor parking at Yosemite Village Day-use Parking Area and in the vicinity of the Village Store. Alternatives 2-6 consider a range of options to address temporary concessioner employee housing at the Lost Arrow parking facility, Yosemite Lodge, Boys Town, and the Huff House area of Curry Village. Under some alternatives, the need for housing is reduced. Under other alternatives, temporary housing is replaced with permanent housing structures. The existing number of guest lodging units would be reduced at Housekeeping Camp under Alternatives 2-6. An overflow day use parking facility is proposed in west Yosemite Valley in Alternatives 5 and 6, and a campground in Alternative 6. This would be development in previously undisturbed sites. The VRM system will be applied with design guidelines to ensure that future development does not result in VRM scores exceeding 21.
- All alternatives propose a 150-foot riparian buffer, which would generally insulate the river from development and protect views from its bed and banks. Restoration efforts common to Alternatives 2-6 and the 100-foot riparian buffer would provide for the protection and enjoyment of scenery that is river related or river dependent.
- New development or re-development in Yosemite Valley would be designed to be compatible with historic districts and preservation of rustic architecture, using "*A Sense of Place: Design Guidelines for Yosemite Valley*." These design guidelines are intended to promote harmony between the built and natural environments.

Additionally, NPS will proceed with implementation of the *Scenic Vista Management Plan for Yosemite National Park Environmental Assessment* (NPS 2010a). The SVMP initially assessed 83 vista points in the Merced River corridor. Fourteen of the 83 points have prominent views of the river in the foreground:

- Cathedral Beach Picnic Area from river terrace and the beach
- Ferry Bend Turnout from Southside Drive
- Sentinel Beach picnic area from the beach
- Swinging Bridge from the bridge and adjacent picnic area
- Sentinel Bridge from pedestrian sidewalks

- Housekeeping Bridge from the pedestrian bridge
- Stoneman Bridge from pedestrian sidewalks
- Clark's Bridge from pedestrian sidewalks
- Happy Isles Bridge from the Happy Isles Loop Road
- Vernal Falls Footbridge from the pedestrian bridge
- Superintendent's Bridge from the flood interpretive sign on the pedestrian bridge
- Devil's Elbow from the beaches
- Hanging Valley and Bridalveil Fall from Northside Drive
- Valley View from Northside Drive

Another 33 scenic vista points occur within the broader river corridor, involving views of rock formations from the roadside, views from certain buildings or attraction sites, and views of meadows.

For these 47 vista points, NPS will implement the management treatments presented in Appendix H (all actions recommended by the SVMP but falling within the Merced River corridor are included in the *Merced River Plan/DEIS* and are no longer part of the SVMP). Primary actions to manage these vista points are mechanical thinning or removal of conifer trees. No management actions would occur at the other 36 vista points although they will be monitored over time.

Conclusion: Protecting and Enhancing ORV 16 (Scenic Views in Yosemite Valley)

The Scenic ORV for Segment 2 is absent of management concerns, adverse effects, and degradation, though management considerations exist, such as visual intrusions, vegetation growth and loss, and air quality impacts. The *Merced River Plan/DEIS* proposes a range of options to address specific concerns and considerations, including removal of unnecessary major facilities in the river corridor and protection and restoration of natural resources. To prevent these concerns, or others, from redeveloping, the NPS would monitor the condition of the Scenic ORV 16 by inventorying the Yosemite Valley landscape, performing contrast analyses on all new proposed structures, taking action to keep those proposed structures appropriate to VRM Class III for Segment 2A and VRM Class II for Segment 2B, and coordinating with regional air quality authorities. NPS will also implement recommendations developed by the SVMP including removal of conifers encroaching on meadows and vista points.

Scenic ORV—Scenic Views in the Merced River Gorge

ORV 17—The Merced River drops 2,000 feet over 14 miles—it is a continuous cascade under spectacular Sierra granite outcrops and domes.
Location: Segment 3 (Merced River Gorge)
Rationale: Descending from Yosemite Valley, the river becomes a continuous cascade in a narrow gorge littered with massive boulders. Arch and Elephant Rocks and other landmarks rise above, all visible from the river or its banks. Dropping 2,000 feet in 14 miles, canyon walls rise steeply from the river and have many seasonal waterfalls cascading down to the river. Spring and fall bring special parades of colors, from redbuds and other plants warmly flowering in spring to bigleaf maples and other trees turning bright colors in fall.
Management Objective: Segment 3 is classified as a scenic reach of the river, fully accessible by El Portal Road, and will be managed to promote visitor enjoyment from the river, from roadside pullouts, and from the roadway itself. Any further development is precluded.

ORV Condition at the Time of Designation (1987)

El Portal Road was originally built on the edge of the Merced River as a connecting route between Yosemite Valley and the Yosemite Valley Railroad terminal in El Portal. Pullouts allowed for short and long-range views of the river and nearby rock formations. The river and Cascades Fall were visible from passing vehicles using El Portal Road or Big Oak Flat Road when entering or exiting the park. Some structures intruded upon views from within the Merced River corridor in the Gorge, such as the Arch Rock entrance station, Cascades Dam powerhouse, Cascades housing units, and Cascades Diversion Dam.

In 1987, the Cascade Diversion Dam and associated features, including the powerhouse building, were visible from the river and its bank. The dam spanned the entire river, with an intake structure on the right bank of the river, and the associated powerhouse was a short distance downstream. The dam was no longer in use, in a dilapidated state. The powerhouse building was still present, but no longer used to generate power, instead being used as a high voltage substation. Portions of the El Portal Road were visible from the river and its banks, particularly in the Cascades and Arch Rock areas, where the river gradient is less severe and the road is close to the river.

Current ORV Condition

El Portal Road and the underlying sewer main were severely damaged by the 1997 flood. Both were rebuilt soon thereafter, with road conditions updated according to contemporary safety standards. Rock walls and barriers were rebuilt in keeping with the historic character that existed before the flood and new walls were built in keeping with the historic character. Cascades picnic area was developed and river resources were subsequently restored. The dam was removed in 2004, with the historic powerhouse, Arch Rock entrance station and comfort station remaining in place today. The visual or scenic resources in the Merced River Gorge are largely unchanged from those present at the time of Wild and Scenic River designation.

The scenic quality in the area of the river at the Big Oak Flat Road-El Portal Road junction has significantly improved since NPS removed the Cascades Diversion Dam and associated features in 2004 and restored the river to free-flowing conditions. The powerhouse remains and continues to be used as a high voltage substation. The scenic quality in the vicinity of the dam returned to a natural condition within six years.

The SVMP evaluated only one scenic viewpoint at Cascade Falls. Views from the river and roads in the Merced River Gorge continue to have high aesthetic value.

Management Program for ORV 17

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program.

Indicator — Application of the Visual Resource Management System

The program would use the same VRM system as described under ORV 16, which would apply the following definitions of management standard, adverse effect, and degradation.

Management Standard

This segment has a ‘scenic’ classification, which is held to a Class II VRM standard.

Due to the rugged terrain of the gorge, inherent limitations on visitor use and facilities, and the established relationship between the river and El Portal roadway, significant changes are neither proposed nor anticipated. The gorge is subject to rock fall and scenery will evolve with natural processes.

Adverse Effect

This ORV would be adversely affected if human constructions or actions resulted in the segment falling into VRM class III management class.

Degradation

This ORV would be adversely impacted if human constructions or actions resulted in the segment falling into VRM class IV management class.

Monitoring Scenic Views of the Merced River Gorge

Monitoring will occur every four years to ensure that any recommended mitigations and actions are within the management class rating.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-31. There are no management concerns present related to scenic values in the Merced River Gorge, Segment 3. No new development or landscape changes are proposed within the river corridor aside from minor improvements to existing roadside pullouts. The only changes in landscape, except for minor trail reroutes and life-safety upgrades, will occur as natural processes prevail over present conditions.

Management Considerations and Enhancement Actions

Management considerations for this river value include overhead power lines, which are scheduled to be removed from the powerhouse to a point at Wawona Road, below the Tunnel View scenic area. Roadside turnouts will be added to the scenic ORV indicator monitoring program for future analysis and possible treatment.

Conclusion: Protecting and Enhancing ORV 17 (scenic views in Merced River Gorge)

The scenic ORV for Segment 3 is absent of adverse effects, degradation, management concerns, and management considerations. To monitor conditions and protect or enhance scenic ORV 17 in the future, the NPS will inventory the landscape using the VRM system and perform a contrast analysis on any new development anticipated within the selected alternative. Segment 3, however, is unlikely to be affected by human activity in the future, due to the deep topography and rugged terrain of the Merced River Gorge and absent any needs to provide more facilities or visitor services.

Scenic ORV—Scenic Wilderness Views along the South Fork Merced River

ORV 18—The South Fork Merced River passes through a vast area of natural scenic beauty.
Location: Segments 5 and 8 South Fork Merced River, both above and below Wawona
Rationale: The South Fork Merced River in these stretches is largely inaccessible, with just a few trail crossings above Wawona and none below it. The scenery from the river or its banks is that of an undeveloped Sierra Nevada river valley, with views dominated by forest-cloaked hills, distant peaks, and an untamed river. These are some of the wildest views in the Sierra Nevada. The landscape spanning wild Segments 5 and 8 includes distant, dramatic vistas of mountains and waterfalls and close, beautiful views of forests and gorges. Both segments are accessible only by foot, or by mule or on horseback.
Management Objective: The NPS will maintain primitive conditions in Wilderness areas adjacent to the river, within the river corridor and beyond. The NPS will continue to manage visitor use through the Wilderness permit system, and to manage vegetation through prescribed fire and controlled burning practices when necessary and appropriate.

ORV Condition at the Time of Designation (1987)

No visual resource studies were conducted for these segments of the Merced River and none are planned. The wild segments of the South Fork Merced were largely natural and undisturbed at the time of designation, including no roads and few trails.

Scenery viewed from within the Merced River corridor above Wawona, in Segment 5, was limited primarily to views of the South Fork itself at trail crossings, and long range views from the trails to nearby ridges granite features such as Wawona Dome, and forests. Below Wawona, Segment 8 of the Merced River passes into an area of dense montane forest, with limited views of rugged mountains and steep canyons.

Current ORV Condition

Views from the river, banks, and trails in the South Fork Merced River, both above and below Wawona, continue to have high aesthetic value, as they did at the time of designation. Three scenic viewpoints of the South Fork below Wawona, Segment 8, were identified by the Scenic Vista Management Plan. None have views of the river itself, but refer to the gorge and surrounding mountains. No scenic vista viewpoints have been identified in Segment 5, above Wawona.

Both segments are susceptible to regional air quality impacts. The rates of visitor use here are among the lowest in the park. Unlike Segment 1, no trail follows the river. Segment 5 is accessible only from a trail that crosses the river at a perpendicular angle and is not open to rafting. Segment 8 is not accessible by trail and is rarely visited by kayak. Scenic resources are primarily appreciated from a distance.

Management Program for ORV 18

Because Segments 5 and 8 are classified as wild and the river corridor includes designated Wilderness, no further development or resource extraction can occur and scenery will remain unimpaired in perpetuity. Management standard, adverse effect, and degradation are not defined for this ORV because it is essentially impervious to intended human activities, and any structures proposed in the Wilderness would be subject to the Minimum Requirements Analysis (MRA), as well as the contrast analysis discussed above. Therefore, the NPS would not monitor the condition of this ORV as part of the *Merced River Plan/DEIS*.

The NPS will continue to participate in regional efforts to monitor air quality throughout the park. Because of the ambient nature of air quality, it cannot be managed exclusively for the river corridor.

Management Considerations and Enhancement Actions

There are no management considerations present in this Wilderness segment related to this scenic ORV. Project alternatives propose no changes in the river corridor.

Conclusion: Protecting and Enhancing ORV 18 (Scenic Views along the South Fork)

As a segment located almost entirely within protected Wilderness, the Scenic ORV for Segments 5 and 8 will remain wild and will not be affected by human activity. The NPS will not monitor visual resources or conditions at site-specific scenic vista points. The ORV is determined to be in the protected state, as defined by an absence of adverse effects and degradation although intermittent air quality concerns are present. The NPS will participate in regional air quality efforts and cooperate with state agencies to manage air quality.

RECREATIONAL ORVs

This section describes the program to protect and enhance each Recreational ORV as proposed in the *Merced River Plan/DEIS*. Two Recreational ORVs exist in the Merced River corridor, each related to specific segment(s) of the river (Table 5-32).

TABLE 5-32: RECREATIONAL ORVS AND ASSOCIATED INDICATORS

ORV Number and Key Resource	Segment(s)	Indicator to be Monitored through Time
19. Wilderness Recreation above Nevada Fall	1	1. Wilderness Encounters
20. River-related Recreation in Yosemite Valley	2	1. Vehicles at One Time 2. Visitor Densities

Recreational ORV—Wilderness Recreation above Nevada Fall

ORV 19—Visitors to federally designated Wilderness in the corridor engage in a variety of river-related activities in an iconic High Sierra landscape, where opportunities for primitive and unconfined recreation, self-reliance, and solitude shape the experience.
Location: Segment 1 (Merced River above Nevada Fall)
Rationale: Wild segments of the Merced River and South Fork Merced River flow from the heart of the Sierra Nevada, with its towering granite peaks and impressive forests. The spectacular, rugged expanses along these segments provide exemplary landscapes for Wilderness experiences characterized by solitude, personal reflection, closeness to nature, independence, and self-reliance. Activities are oriented toward primitive travel, camping, exploration, and adventure. Of the many exemplary recreational activities, a few are particularly distinctive. Hiking or backpacking close to the river gives visitors the experience of spectacular cascades that vary by season. In spring, visitors experience the sight, sound, and feeling of the powerfully crashing waters. In drier months, the beauty of delicate water plumes becomes the center of attention. Backpacking on a popular segment of the John Muir Trail offers access to a multi-day Sierra Nevada Wilderness trip that is internationally renowned for gorgeous riverside views, undeveloped settings, opportunities for solitude along the trail, and Wilderness camping near the river. Horseback riding is also popular in this segment.
Management Objective: Provide for high quality river-related recreational opportunities oriented toward Wilderness values of unconfined, self-reliant and solitude experiences in a setting that is consistent with the Wilderness character of the area.

ORV Condition at the Time of Designation (1987)

The description of ORV 19 condition at the time of designation is broken into three subject areas: recreational activity participation, setting attributes, and recreational experience quality.

Recreational Activity Participation: The most common visitor activities within the corridor at the time of designation included hiking, backpacking, and lodging at the Merced Lake High Sierra Camp. Both day-use and overnight camping took place within the river corridor, and both dispersed and designated camping opportunities were available. Visitors could also stay in tent cabins at the Merced Lake High Sierra Camp, access restroom and shower facilities, purchase meals, and temporarily keep stock.[35]

As shown in Table 5-33 below, there were 170 daily Wilderness permits issued in 1986 from six trailhead locations for overnight Wilderness use in the Merced River corridor. While the permits identified park visitors' entrance points into the Wilderness, users were free to choose where they wished to recreate. Consequently, the amount of time permit holders spent in the Merced River corridor is unknown. Similarly, some park visitors could have entered the Wilderness from elsewhere and hiked out through the Merced River corridor as part of their Wilderness trip. As a result, Wilderness permit data provide only a limited indication of the actual extent of visitor overnight use for River Segment 1 (Fincher 2010).

TABLE 5-33: TRAILHEAD QUOTAS PRIMARILY FOR MERCED RIVER WILDERNESS ACCESS

Trailhead	Wilderness Permit Quota[a,b] # of People in 1986
Happy Isles (to Little Yosemite Valley)	35
Happy Isles (LYV Pass Through Access)[c]	10
Glacier Point (to Little Yosemite Valley)	25
Mono Meadow	15
Rafferty Creek	35
Lyell Canyon[d]	50
Total	**170**

[a] The Wilderness trailhead quotas were modified in the mid- to late 1990s. Identified trailheads are only those primarily providing direct access to the Merced River corridor Wilderness.
[b] Quotas represent maximum number of people per day permitted.
[c] "Pass Through Access" requires permit holders to hike through Little Yosemite Valley to camp further up river or elsewhere outside of LYV.
[d] Generally, only a minor proportion of Wilderness visitors out of the Lyell Canyon trailhead will travel down to the Merced River corridor as part of their Wilderness trips. Visitors wishing to access the Merced River corridor from Tuolumne Meadows mostly use the Rafferty Creek Trailhead.

SOURCE: Fincher 2010; NPS 2012a

Setting Attributes: At the time of designation, the location of hiking trails and camping areas allowed park users close contact with the river. Other setting attributes included the park's Wilderness permit system, parking capacity at trailheads, and the availability of other transportation services to and from trailheads. Additionally, the recreational experience was influenced by the scenic value of the high-elevation landscape in this segment and by the river itself. The Scenic ORV section provides a description of these scenic values.

[35] The High Sierra Camps are potential Wilderness additions within the Yosemite Wilderness where lodging is operated by the park concessioner. Visitors with horses are permitted to board their animals at the camp's corral during their stay. However, very few visitors with horses stay overnight within this river segment.

Recreational Experience Quality: At the time of Wild and Scenic River designation, the river corridor in these segments provided Wilderness experiences characterized by solitude, personal reflection, immersion in nature, independence, and self-reliance. Although no formal surveys documenting visitor satisfaction, perceptions of crowding, or encounter rates had been conducted, the Yosemite Wilderness (which includes the river corridor) was one of the most highly visited Wilderness areas in the nation (NPS 2005b). Recreationists could expect to encounter other hikers as well as stock users, both on the trail and at some campsite areas.

Current ORV Condition

As with the condition at the time of designation, the current condition description for ORV 19 is broken into three subject areas: recreational activity participation, setting attributes, and recreational experience quality.

Recreational Activity Participation: Similar to Wilderness activities prior to designation, the most common visitor activities within the corridor are hiking, backpacking, stock use, and lodging at the Merced Lake High Sierra Camp. The area continues to see both day and overnight visitation. NPS has reduced the number of Wilderness permits given to visitors for the main access trailheads from 170 in 1989 to 130 under current conditions (Table 5-34), to protect park resources and Wilderness experiences. During the same time period (between designation and today), NPS also formalized the camping area at Little Yosemite Valley and constructed the composting toilet, again to protect park resources (especially water quality in the Merced River).

Table 5-34 displays what these trailhead quotas translate into regarding actual trail use above Little Yosemite Valley in 2010. Additionally, NPS instituted an interim Half Dome permit system in 2010 to manage the number of Half Dome hikers. This change may influence the length of stay and number of backpackers who use the Little Yosemite Valley Campground and the trail from Nevada Fall to Half Dome and Little Yosemite Valley.

TABLE 5-34: TRAIL USE ABOVE LITTLE YOSEMITE VALLEY TO MERCED LAKE (2010) (WILDERNESS-BOUND HIKER TRAFFIC)*

Month	Average People per Day	Total People per Month
July	31	952
August	34	1,063
September	23	677
October[a]	10	117
Season (July to September)	30	2,864

NOTE:
[a] Use counts were taken from October 1 through October 12. SOURCE: NPS 2011a
* As measured by automated counter data at the segment of trail from Little Yosemite Valley to Bunnell Cascade (which omits hikers hiking from the Echo Valley area to Merced Lake).

Setting Attributes: The recreational experience in the river corridor is primarily influenced by the scenic value of the landscape in this river segment and by the river itself. The section on Scenic ORVs above (specifically ORV 16—Iconic Scenic Views in Yosemite Valley) describes the visual qualities that contribute to the recreational experience in the river corridor.

Based on trail/campground use and encounter rates, the majority of users are concentrated in the river corridor between Nevada Fall and the Merced Lake High Sierra Camp. As observed by actual observations from Yosemite staff in 2010, the average rate of encounters with other parties per hour along the Merced River corridor were: 1.9 parties per hour from Little Yosemite Valley Lewis Creek, and 0.63 parties per hour from Lewis Creek to the Lyell Fork (NPS 2011u).[36] Recreational opportunities in Segment 1 have been influenced by Wilderness permit allocations (described above), the Half Dome day-use permit system, and other transportation services to and from trailheads. Since 1987, problems with the Little Yosemite Valley Camping Area toilet have been remedied by installing a composting toilet facility that improved water quality in the area, but also impacted the wilderness nature of the segment by adding a permanent structure. Additionally, in the mid-1990s the Merced Lake Backpackers' Camping Area was converted from dispersed camping to a designated camping area away from the lake to protect the meadow and lakeshore quality. In 2001, the camping area's previous toilet sump and sewer line were also removed. The utility systems at the Merced Lake High Sierra Camp have also been upgraded.

Recreational Experience Quality: A 2001 (Newman & Manning) study conducted at the Yosemite Valley and Tuolumne permit stations indicated that Wilderness users' experience is most negatively impacted by signs of other campers at campsites, encounters with other groups, and encountering stock.

Segment 1 continues to provide a diversity of recreational and educational opportunities in the Merced River corridor. These opportunities have not changed since the time of designation, with the exception that the trailhead quotas have been reduced in response to changing use patterns. The same total number of visitors still access the corridor, though they may access this segment from different locations. These findings, when compared to the findings regarding the condition of this ORV at the time of designation, suggest that visitors today are still able to obtain high quality recreational experiences where they are able to relax and obtain solitude.

Monitoring Program

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program.

Indicator – Wilderness Encounters

One of the components of the Recreational ORV of the Merced River is the opportunity for primitive and unconfined recreation, self-reliance, and solitude. Solitude is an enduring characteristic of a Wilderness experience (Lucas 1964). Expectations for solitude and actual numbers and types of groups encountered have been shown to have a measurable effect on the quality of visitor experiences (Newman and Manning 2002; Patterson and Hammitt 1990; Vaske et al. 1986).

[36] This data is baseline reporting from 2010, representing actual encounter observations by RMS staff. Future evaluations will be made utilizing automated counters (herein referred to as indirect counts). The data reported here also represents the average encounter rate and is not evaluated as a percent of total time observed as is stipulated in the proposed standards. These data indicate that we might be approaching the management standard, but for alternative 2 only. Should Alternative 2 be adopted, and should indirect counts reveal that the management standard is being violated (or any of the triggers in Table 5-32), some or all of the management responses identified in Table 5-32 will be implemented to redue encounter rates below the management standard for that alternative (two parties per hour).

The number of Wilderness encounters has been chosen by Wilderness managers as an indicator for the social setting. Encounters among groups have an effect on solitude and such field measurements are relatively easy to accomplish (Watson, et al. 1998). Researchers and managers have at times chosen to monitor the number of individuals encountered, rather than the number of groups, due to difficulties distinguishing individuals' affiliations with one another, especially in busy areas (Shelby and Heberlein 1986). However, where possible, documenting each group encountered as well as the number of people in the group would provide the most flexibility for subsequent analysis (Broom and Hall 2010).

Encounters are also an excellent way to assess use levels and density, which can affect other ORVs, such as the biological and cultural values identified for the Merced Wild and Scenic River. Although some studies have shown that there is a weak relationship between encounters and visitor perceptions of solitude and crowding (Graefe et al. 1984; Lee 1977; Stewart and Cole 2001), a more substantial body of literature supports the use of encounters as an indicator of solitude opportunities in Wilderness (Broom and Hall 2009; Graefe et al. 1984; Lee 1977; Manning et al. 2000; Stewart and Cole 2001; Vaske and Donnelly 2002).

Management Standard

Table 5-35 shows the range of standards across trail sections in Alternatives 2-6 of the *Merced River Plan/DEIS,* which must be met 80% of the sampled time to be within the management standard (if exceeded more than 20% of the sampled time, the management standard for this ORV would not be met). As is clear, the management standard will vary both by trail segment and by alternative. The management standard varies because trail sections have different degrees of access, with use levels generally dropping by distance from trailheads. As capacities for the corridor will vary across proposed alternatives, the standards for this indicator will also reflect this variation. This threshold takes into account sections of trail that have high, moderate, and low use, which was demonstrated as being an effective sampling schema in a study of encounter rates in the Tuolumne Meadows area (Broom and Hall 2010). All of the proposed standards provide full protection of the ORV 20, while allowing for a range of management objectives across alternatives.

TABLE 5-35: AVERAGE ENCOUNTER RATES (PER HOUR, 80% OF TIME) FOR MANAGEMENT STANDARDS BY TRAIL SECTION

Trail Segment	Alt 1 (No Action)	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Little Yosemite Valley to Lewis Creek	-	2	3	3	3	4
Lewis Creek to Lyell Fork	-	1	1	1	1	1
South Fork Merced	-	1	1	1	1	1

In all cases, this standard would take the mean encounter rate with other groups per hour across all designated trail sections, with that rate being met within any given segment at least 80% of the sampled time. The encounter rates in this table reflect the fact that these trails are all beyond the typical day-hike distance, so most users are backpackers, those taking packstock trips, and High Sierra Camp users. Therefore, these rates are substantially below the management standards proposed in the *Tuolumne River Plan/DEIS*, where most corridor trails experience substantial day-hiker use in addition to overnight users.

The numbers selected as standards for this indicator reflect preferences found in other studies and trends of encounter rates on the selected trail segments in Yosemite. Collectively, these studies represent years of data collection on trails with varying levels of use, both in Yosemite and elsewhere (Broom & Hall, 2009; Broom

& Hall, 2010; Pettebone, Meldrum, Leslie, King, & Meath, 2010; NPS 2010g; and Cole & Hall, 2008). The selection of the management standard also considered the encounter rates on the Half Dome Trail and the trail section from Nevada Fall to the Half Dome Trail Junction, which represent areas of high visitor use (Pettebone et al. 2010).

Adverse Effect

An adverse effect would be present under this ORV should the mean encounter rate exceed 12 parties per hour 20% of the sampled time, across all trail sections sampled within the corridor, is exceeded for three consecutive years. This point is evaluated as the mean encounter rate with other groups per hour across all designated trail sections.

This number takes into account the mean number of parties per hour found along the Wilderness section of the Half Dome Trail on permit days and group encounters along the Dog Lake trail during the 2010 field season (Broom and Hall 2010; Pettebone et al. 2010). This threshold is also consistent with management guidelines at Mount Rainer National Park for the standard for high-use climbing zones (Lah 2000). In the Merced River corridor, 12 encounters would be a "trigger" that denotes adverse effect. The level of adverse effect in the river corridor was determined through multiple years of indirect and direct sampling, use in other areas of the park, and the high use of adjacent trails (Pettebone et al. 2010), and also reflects visitor preferences in studies of high-use destination in Wilderness (Cole and Hall 2008).

Degradation Standard

Degradation would be present under this ORV should a mean encounter rate exceed 20 parties per hour 20% of the sampled time across all designated trail sections in a river segment, for three consecutive years. This point is evaluated as the mean encounter rate with other groups per hour across all designated trail sections.

Degradation for Wilderness encounters is defined at the level at which visitors perceive crowding is beyond an acceptable level. Encounter rates above this level cause displacement of visitors and detract from the visitor experience (Cole and Hall 2008). Cole and Hall found that on moderate use level trails, visitors who identified themselves as encounter tolerant would begin to be displaced at 80 encounters with other parties per day (roughly 20 encounters per hour) (Cole and Hall 2008). This standard is based on observations from several years of encounter data in the Merced River corridor, as well as preferences from hikers in studies of Wilderness use in the Pacific Northwest (NPS 2010g, Cole and Hall 2008, Broom and Hall 2010; Cole et al. 1997).

Monitoring – Wilderness Encounters

Several locations would be monitored within the Merced River corridor, representing varying levels of use along trails within the Merced Wild and Scenic River. A total of three to five trail sections would be monitored in Segment 1. Trail sections along the South Fork Merced River would be monitored for Segment 5. All sites would be monitored during the high-use season. High-use sections of trails would be monitored on annual basis, utilizing automated trail counters. As monitoring will only capture the use on these sections during the busiest season (from May through October), winter and shoulder season use will not be captured. Traffic numbers and wilderness permits indicate substantially less wilderness use within the corridor during that time. Actual encounters or direct counts would be collected on a five-year rotation at low use and moderate-use sites, or with more frequency, depending on trends or trigger points being

reached. Direct counts would be conducted in the high-use sites as needed to ensure that there is no significant downward trend to the level of an adverse effect. Pack stock are counted during actual counts and these numbers are taken into consideration when analyzing encounter rates. Table 5-36 lists trigger points and specific management responses that would take place should conditions reach the trigger points.

TABLE 5-36: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR WILDERNESS RECREATION ABOVE NEVADA FALL (ENCOUNTER RATES)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: Individual trail sections (not the whole segment) demonstrate exceedence of management standard for given trail section more than 20% of the sampled time.	• Increase sampling intervals at low-use and moderate-use sites for direct observation. Increase direct observation sampling interval at high-use trail sections. • Continue to disseminate information to visitors regarding alternative trails within corridor. Encourage visitors to hike during days and times of day at which lower encounter rates occur.	To protect and assure that trail use is in compliance with our desired conditions, the NPS would gather additional information to determine that conditions are not trending toward adverse effects.
Trigger Point 2: Individual trail sections (not the whole segment) demonstrate exceedence of management standard more than 15% of sampled time for three consecutive years.	• Make necessary changes in Wilderness quota system to better manage for opportunities for solitude. • Measures would be put in place that control visitor-use numbers at trailheads that are feeding to trail sections exceeding standards, including establishing day-visitor parking permits, and instituting changes to the shuttle system.	Quotas control the amount of overnight use in the Wilderness segments of the Merced River corridor. This standard would assist in determining if the existing quotas provide sufficient opportunities for solitude.
Trigger Point 3 All sections across the river segment exceed the designated standard more than 20% of the sample time for three consecutive years.	Establish day use permitting system for trailheads feeding trail sections that have exceeded standards. Make necessary changes in Wilderness quota system to better manage for opportunities for solitude. Institute hard closures of trailheads or parking as necessary to regulate use of Wilderness corridor.	If the management standard is exceeded for the segment level, and an opportunity for solitude is not provided, aggressive actions would be necessary to regulate the flow of individuals into Wilderness.

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-36. There are currently no management concerns associated with this ORV.

Management Considerations and Enhancement Actions

The list below is a summary of management considerations associated with this recreational ORV in Segment 1. Proposed management actions are presented immediately below each management consideration.

- Crowding at Little Yosemite Valley Camping Area impacts the Wilderness experience integral to the recreational ORV.

  Alternatives 2 and 3 would reduce visitor use (thus crowding) at Little Yosemite Valley by converting the designated camping area to dispersed camping. Alternatives 2, 3, and 4 would reduce trailhead quotas at trailheads that lead to Little Yosemite Valley.

- High levels of use at the Merced Lake Backpackers Camping Area would affect the Wilderness experience integral to the recreational ORV in this segment.

  Alternatives 2 and 3 would convert the camping area to dispersed camping. Under all alternatives, monitoring would continue for wilderness encounters as described in chapter 5, with actions specified that NPS would take to remedy any encounter rates that exceed standards.

- Merced Lake High Sierra Camp affects the Wilderness experience integral to the recreational ORV in this segment as it affects the undeveloped quality of Wilderness. Additionally, it has a visual impact on the scenery ORV.

  Alternatives 2-5 consider options to reduce, repurpose, or remove the Merced Lake High Sierra Camp. When tents are replaced, the NPS would use fabrics that are either tan, beige, or light gray, so that the tents harmonize with their surroundings, thereby reducing contrast.

- Crowding at Moraine Dome Camping Area impacts the Wilderness experience integral to the recreational ORV.

  Actions to address this consideration range from removal of Moraine Dome Camping Area (in Alternatives 2 and 3) to disperse use, to retention of this camping area as designated to concentrate use.

- High encounter rates on trails between Little Yosemite Valley and Merced Lake indicate that Wilderness experience integral to the recreational ORV in this segment could be experiencing negative effects, particularly on busy weekends. By addressing high levels of use and crowding at Little Yosemite Valley Camping Area and Merced Lake Backpackers Camping Area, a subsequent decrease in encounter rates on the trails is expected.

  Alternatives to reduce encounter rates in this segment include reducing the Wilderness zone capacities in some alternatives from 25 to 100 people per day (current levels are 150 people per day). Also, implementation of the Half Dome permit system will control most day use in this segment.

Conclusion: Protecting and Enhancing ORV 19 (Wilderness Recreation above Nevada Fall)

Based on the analysis conducted for and represented in the Baseline Condition Report, the current condition of this ORV is at or above the management standard. Given the acceptable condition of this ORV, no actions to protect this ORV are necessary at this time. Some alternatives propose reductions in user capacity to reduce encounter rates and increase solitude in this Wilderness segment.

The *Merced River Plan/DEIS* proposes a variety of actions to address specific management considerations. To prevent these considerations and others from redeveloping, the NPS would monitor visitor encounter rates to ensure that they are not exceeding established standards. Should specific trigger points be reached, the NPS would be required to implement a series of specific actions to reduce visitor levels to an acceptable level. These actions increase in severity as the current condition ORV condition moves away from the management standard to ensure proper course correction and re-establishment of the management standard. These trigger points were selected to inform managers in advance of any adverse effects or degradation to this ORV.

Recreational ORV—River-related Recreation in Yosemite Valley

ORV 20—Visitors to Yosemite Valley enjoy a wide variety of river-related recreational activities in the Valley's extraordinary setting along the Merced River.
Location: Segment 2 (Yosemite Valley)
Rationale: Every year millions of visitors from around the world come to Yosemite Valley to recreate in and along the Merced River. Well-known and iconic features such as El Capitan, Yosemite Falls, and Half Dome provide a dramatic backdrop shaping the experience of first-time and return visitors alike. Visitors realize these experiences through a wide variety of activities occurring in and along the river. Activities include active pursuits such as hiking, biking, swimming, floating and water play, climbing, camping, or fishing; creative pursuits such as writing, painting, photography, and other arts; and educational and interpretive pursuits such as attending ranger-led walks and programs. Social elements, such as group camping and picnicking, are integral to many activities, while others offer opportunities for solitude and reflection. Overall, the Yosemite Valley segment offers a variety of outstanding opportunities for front-country river recreation for people of all ages and abilities. The Merced River in this segment allows people to immerse themselves in their surroundings, taking in the sights, sounds, and feel of the river and its dramatic backdrop. These experiences, in turn, relieve stress and promote connection to the natural world.
Management Objective: Provide for a diversity of high quality river-related recreational opportunities that allow visitors to directly connect with the river and its environs amidst the spectacular scenery of Yosemite Valley.

ORV Condition at the Time of Designation (1987)

The description of ORV 20 condition at the time of designation is broken into three subject areas: recreational activity participation, setting attributes, and recreational experience quality.

Recreational Activity Participation: In 1987, recreational opportunities in the Yosemite Valley segment were similar to those currently available. The most common visitor activities in this river segment at the time of designation included sightseeing, scenic driving, day hiking, wildlife viewing, picnicking, floating, creative arts, camping, bicycling, nature study, rock climbing, and engaging in ranger-led programs. In 1987, both day-use and overnight camping were popular in this river segment. In 1987, a larger number of riverside campgrounds were available. As a result of the 1997 flood, some of these areas were damaged and closed.

Setting Attributes: Throughout the Yosemite Valley segment, the river has provided major visual attractions—such as Vernal and Nevada Falls—and the setting for visitor recreational experiences such as fishing, floating, and sightseeing. The natural hydrologic forces that result in periodic Valley flooding have also influenced the Recreational ORV by affecting visitor access and facilities.

Recreational Experience Quality: Since designation, Yosemite Valley has afforded a variety of opportunities to view scenery and to travel along and interact directly with the Merced River. Gramann (1992) reported that at or near the time of the Merced designation, visitors to the park had a relatively high level of overall satisfaction with 93% reporting that their experience was "very good" or better.[37] This study also looked at visitor evaluations of satisfaction specific to Yosemite Valley. In general, most summer visitors to Yosemite Valley in 1991 reported that the level of conditions and facilities in Yosemite Valley was either "the right amount" or "not enough." Two exceptions to this were the amount of vehicle traffic and the number of people. In general, a significant number of respondents felt that there was too much vehicle traffic and too many people in Yosemite Valley. These two issues are indicators of the pervasive capacity issues related specifically to Yosemite Valley at the peak times of day during the park's busy summer season.

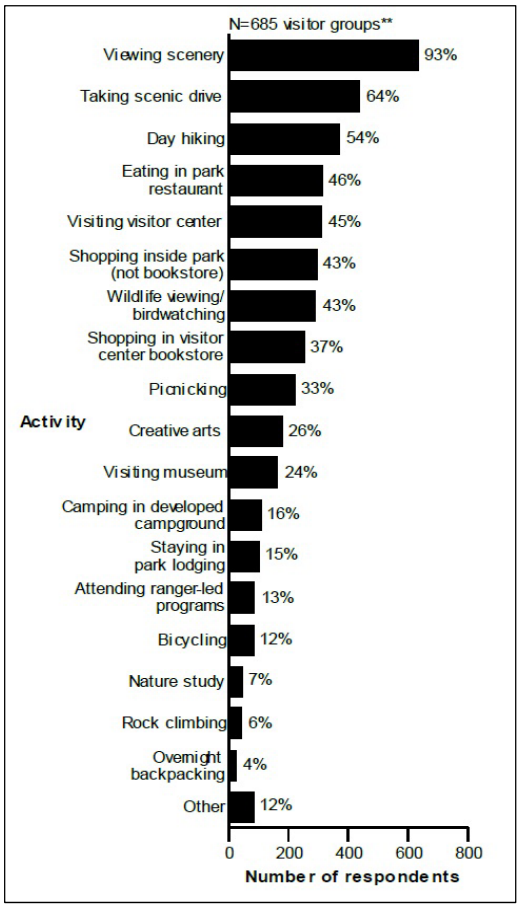
[37] Gramann 1992 presents useful information about the condition of the ORV at time of designation, as the park visitation remained relatively stable between these years (3.2 million in 1987 and 3.4 million in 1991).

Current ORV Condition

As with the condition at the time of designation, the current condition description for ORV 19 is broken into three subject areas: recreational activity participation, setting attributes, and recreational experience quality.

Recreational Activity Participation: Similar to 1987, the river corridor provides for a variety of opportunities to view scenery within Yosemite Valley and to travel along the river and interact directly with it. The most common visitor activities in the Yosemite Valley segment include scenic viewing, day hiking, wildlife viewing, picnicking, creative arts, camping, ranger-led programs, bicycling, floating, nature study, and rock climbing (Figure 5-3). Both day-use and overnight camping and lodging are available in this river segment. Campground sites in Yosemite Valley are in very high demand and often fill to capacity. Within Yosemite Valley, there are recreational opportunities available for visitors of all ages and ability levels. Visitors of all ages tour Yosemite Valley, with about one-fifth comprised of children and youth and 7% comprised of visitors 66 years or older. The uniqueness of Yosemite Valley attracts many visitors, who engage in a wide variety of activities.

FIGURE 5-3: SUMMER VISITOR ACTIVITY PARTICIPATION (BLOTKAMP ET AL. 2010)



Setting Attributes: While the flood of 1997 reshaped parts of the river corridor, the fundamental hydrological and setting components that attract visitors to the Merced River in Yosemite have changed very little since designation.

Recreational Experience Quality: In 2010, Yosemite Valley received approximately 3.56 million visitors (89% of total park recreational visitation during that year) (NPS Public Statistics Office). As part of the NPSwide Visitor Services Project, a survey conducted in summer 2005 recorded visitor perceptions of crowding and, in the absence of facility or visitor population changes, the study's findings may offer a reasonable representation of the 2010 conditions. Approximately 55% of the survey respondents reported feeling crowded by other visitors in Yosemite Valley (Littlejohn et al. 2006, Blotkamp et al. 2010). In a 2008 visitor survey, 40% of the park's winter visitors stated that they chose to visit Yosemite during the wintertime to avoid crowds (Le et al. 2008), providing another indication of perceived Yosemite Valley crowding.

The river and related attraction sites are focal points for visitor use and provide opportunities to experience Yosemite Valley's Recreational ORVs. Visitor perceptions of crowding were measured as part of several past visitor surveys (Manning 1998, 1999; White and Aquino 2008; Lawson et al. 2009).[38] While

[38] NPS is currently undertaking an additional river-specific use study during summer 2011, the results of which should be available late in 2012.

methodologies and results varied between these surveys, all of these studies found some perceptions of crowding among the visitors sampled. Notably, up to 80% of those sampled in one survey (regarding Bridalveil Fall) stated that they felt crowded during their visit (Manning 1998, 1999). Across these studies, that span more than a decade of research, all visitors surveyed reported a perception of crowding though the specifics of each of these studies varied depending on the visitor, place, and time of survey.

Currently, visitors to the Merced River in Yosemite Valley continue to report a relatively high level of overall satisfaction. According to the most recent visitor survey, most visitor groups (92%) rated the overall quality of facilities, services, and recreational opportunities at Yosemite National Park as "very good" or "good" (Blotkam et al. 2010).

Management Program for ORV 20

This section discusses the proposed management program for this ORV, including the indicator(s) to be used; the definitions of management standard, adverse effect, and degradation; and the monitoring program. A recent study of river recreational users suggests that crowding resulting from the current transportation system had the most negative effect on their recreational experience (Whittaker and Shelby 2012). If users are negatively affected in how they access the river, then this may directly impact their experience of this ORV. In other words, if visitors are not able to reach the river in an efficient manner to engage in their preferred recreational activities, then their experience of—and therefore the quality of—the recreational ORV is diminished. To monitor the conditions of this ORV, two distinct indicators will be used across a variety of settings in Yosemite Valley. The number of vehicles parked at one time in Yosemite Valley is the first indicator; this indicator will provide managers with information about users' experience accessing the river. The second indicator will evaluate densities of people at iconic destinations known to be visited by most Valley visitors, as a way of understanding use conditions. This array of indicators is thought to be most effective in understanding the dimensions of Recreational ORV 20 that most, if not all, people would interact with while visiting Segment 2. This information can be compared to visitor perceptions of crowding at particular sites. The compilation of this evaluative social science data can be applied to further understand how visitor use is occurring along the river segment as a whole.

Indicator 1 – Vehicles at One Time

Transportation is considered an important part of the visitor experience in Yosemite and other National Parks (White et al. 2008), because it is the means of access to ORV 20. Sixty-four percent of summer visitors reported taking a scenic drive, and 11% considered it their primary activity while in the park (Littlejohn et al. 2009). Additionally, the Yosemite Valley transportation experience (perhaps the most-studied system in the national parks) is multi-dimensional, with three major roads terminating in Yosemite Valley. The experience can be influenced by travel times, parking availability, entrance station queuing, and a variety of other measurable experiential factors, most of which can be influenced by park management.

Vehicles at one time (VAOT) is the total number of vehicles on the ground at any one time in Yosemite Valley. This figure, along with parking utilization rates (the percentage of available parking spots occupied by vehicles), constitutes this indicator. Through both traffic volume counters and direct observation, this single indicator evaluates the total vehicles at one time in all river segments and compliance with authorized parking locations. Vehicles at one time would be assessed in two ways: 1) through automated traffic counters that factor inbound and outbound travel to the river segment; and 2) through direct observation of parking utilization, which would determine if parking is occurring at unauthorized locations.

This indicator builds from Yosemite Valley parking inventories conducted in 2004 and updated in 2011. Given the current configurations of the roadway and parking locations, daily accumulations of 5,000 vehicles arriving in east Yosemite Valley appear to provide for sufficient parking and manageable traffic circulation (DEA 2012). Parking availability for this level would meet supply if 5,091 spaces are available (total), with employee/administrative parking comprising 670 of those parking spaces. (The exact locations of formal parking outlined in the plan may change depending on which alternative is selected.)

This indicator would document any parking shortages during the busiest days of the year and determine management effectiveness in keeping overflow parking out of unauthorized, inappropriate locations. Additionally, vehicle accumulations will be documented for both overall Yosemite Valley and East Valley locations through an automated traffic counting system. To ensure consistency across alternatives, standards would be communicated through proportions of parking supply at peak hour. Monitoring sites will include a representative sample of parking locations and may occur during the most crowded times of the year. This sampling approach is consistent with scientific literature and allows the park to understand any variability in parking occurring at site specific levels (such as seasonal fluctuations to access river or climbing sites, etc.) while understanding its relation to larger Yosemite Valley vehicle accumulations.

Management Standard

Vehicles parked in east Yosemite Valley during the summer season would not exceed supply more than 10% of the time at peak hours (defined for this indicator as 10 a.m. to 4 p.m.) including the holiday weekends of Memorial Day, Fourth of July, and Labor Day.

Adverse Effect

An adverse effect would occur should the vehicles parked in east Yosemite Valley exceed the parking supply 25% of the time at peak hours, or a change of 20% in exceeding parking supply over a three-year sample period, including the holiday weekends of Memorial Day, Fourth of July, and Labor Day.

Degradation Standard

Degradation would be present under this ORV should vehicles parked in east Yosemite Valley exceed parking supply 50% of the time at peak hours, including the holiday weekends of Memorial Day, Fourth of July, and Labor Day.

Monitoring – Vehicles at One Time

The NPS would monitor vehicles at one time annually for the first three years of implementation. Implementation of the plan may change the configuration of the parking and the baseline for parking supply may have to be adapted to account for these infrastructure and associated behavioral changes. After three years of initial monitoring, it would take place every three years to detect change. This monitoring schedule would ensure that both segment-wide and site-specific information is gathered. Unauthorized parking that occurs in sensitive resource areas would be monitored, particularly during busier times of the peak visitor season. Table 5-37 lists triggers and specific management responses that would take place should conditions reach the trigger points.

TABLE 5-37: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR RIVER-RELATED RECREATION IN YOSEMITE VALLEY (VEHICLES AT ONE TIME)

Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
Trigger Point 1: For three consecutive monitoring periods, vehicles parked would not exceed parking supply 5% of the time between the hours of 10 am and 4 pm.	• Increase monitoring efforts to further investigate vehicle volumes, parking, and travel time conditions. • Develop suggested itineraries to re-direct visitors to other areas of the park during systematic and empirically based diversions of vehicles at the El Capitan crossover. • Increase natural barriers, communication, and signage emphasizing compliance with endorsed parking locations. • Increase delineation of parking type (short-term and long-term) to ensure parking availability to a greater number of visitors but for shorter periods of time.	Exceeding this trigger point routinely warrants further identification of the issue, or assurances that visitors are not parking in unendorsed locations.
Trigger Point 2: For three consecutive monitoring periods, vehicles parked would not exceed parking supply 9% of the time between the hours of 10 am and 4 pm.	• Establish visitor day use permitting system for Yosemite Valley prior to the management standard is exceeded.	If the management standard is exceeded for the segment level, parking is not available for the amount of vehicles being allowed into Yosemite Valley.

Traffic conditions as measured in 2011 from the Chapel Straight vehicle counter indicate that conditions are below the management standard, trending toward an adverse effect. For this one summer, parking exceeded endorsed parking 25% of the time between 10 am and 4 pm during the summer season (Memorial Day to Labor Day weekends) (*three* summers exceeding 25% of the parking supply would constitute an adverse effect). As discussed in more detail below, Alternatives 2-6 consider a variety of management responses to address this adverse effect.

Indicator 2 – Visitor Densities

This indicator serves as a proxy for the quality of the visitor experience in the Yosemite Valley segment. Visitor densities refers to the number of people in a given area; it is a common measure for the degree to which the amount of use causes crowding or negative impact to aspects of a visitors' experience. Densities would be monitored at various locations depending on the activity type in the area (e.g. the number of people per area at a beach versus the number of boats at one time on the river). In some cases, two metrics would be implemented at the same location to ensure that accurate levels of use are captured, especially at more complex locations where use levels are high and a variety of different activities take place. The site locations have been chosen from many years of data collection and evaluation of the relationships between person densities at specific locations and overall use levels. Namely, the attraction sites of Bridalveil Fall and Yosemite Falls are iconic, visited by more than half (52% and 59% respectively)of all visitors to the park in the summer (Blotkamp et al 2010), and are documented to exhibit some of the highest levels of visitation in Yosemite Valley (Pettebone et al 2008).

The following definitions are important to the explanation of this indicator:

- **Person Densities:** Densities are a calculation of people or boats within a known geographic space displayed as X feet^2 per person. Not all locations have been measured spatially, so at one time counts are still used in those instances.
- **BAOT:** Boats at one time is the number of boats visible in a geographically defined section of the river at one point in time.

These measures have been chosen to reflect crowding and related recreational experience quality impacts at the key activity areas in and along the river. As such, they serve as proxies for the quality of the recreational ORV. Crowding, in terms of people or boats, has been shown to negatively affect a visitors' experience (Whittaker and Shelby 2010). To address this consideration, the use of at-one-time measures at popular destinations at specified intervals can give park managers a full understanding of the temporal and spatial use of the site. Normative research has found that an ideal site-crowding condition exists for visitors' recreational experiences and that these norms can help inform social indicators and standards (Manning et al. 1999; Shelby et al. 1983; Shelby et al. 1989). BAOT is commonly used as an indicator in river recreation (Hannon et al. 2002), and has been used to determine how many boats are on a larger (than the geographically defined area) river segment (Whittaker and Shelby 2010). BAOT has also been shown to strongly influence perceived crowding and encounter norms (Needham et al. 2011).

Two studies conducted in Yosemite Valley utilized normative research and compared the differences among attraction sites, forming the basis for the development of the at-one-time indicators in Yosemite, (Lawson et al. 2008; Manning et al. 1999). Research data were collected through a survey-based photo evaluation technique in which the visitor was presented with a set of images depicting different amounts of use at a given location (see chapter 6, part III). At-one-time measures like this collect data on visitor use in the same fashion, counting only individuals within the constraints of the area in the photo frame. These ways of quantifying visitor use levels allow us to correlate use levels across locations (Lawson et al. 2009). Management standards for this indicator have been developed based on the analysis of current use and previous research, both within Yosemite NP and in other like locations.

Management Standard

No more than three (50%) locations exceed their site level standard, provided in Table 5-38, 50% of the time for three consecutive years. This standard for social preference is based on peer-reviewed literature (Lawson et al. 2008; Manning and Lawson 2003) and professional judgment. Management would take action at those specific site level standards that are exceeded and/or increase segment-wide monitoring

Adverse Effect

An adverse effect would occur when four or more locations exceed their site level standard, provided in Table 5-38, 50% of the sampled time for three consecutive years. Management would take action at those specific sites that are exceeded and/or increase segment-wide monitoring. Adverse effect for social standards is based on peer-reviewed literature (Lawson et al. 2008; Manning and Lawson 2003) and professional judgment.

Degradation Standard

Degradation would be present under this ORV when four or more (66% of) locations exceed their site level standard, provided in Table 5-38, 80% of the sampled time for three consecutive years. Using the level of adverse effect and adjusting the percentage of time that this use level occurs, allows for visitor experience to remain at a specified level, until there is little opportunity for that experience to occur. Increasing the percentage of time that the standard is violated decreases visitor acceptability, leading to visitor displacement. Degradation for social standards is based on peer-reviewed literature (Lawson et al. 2008; Manning and Lawson 2003) and professional judgment.

TABLE 5-38: SITE-LEVEL STANDARDS FOR THE RECREATION ORV AT-ONE-TIME AND PERSON DENSITY INDICATOR, COMPARISON ACROSS ALTERNATIVES

Alternatives		1	2	3	4	5	6
		Current condition	Self-reliant experiences and extensive floodplain restoration	Dispersed experiences and extensive riverbank restoration	Resource-based experiences and targeted restoration	Enhanced experiences and essential riverbank restoration	Diversified experiences and selective riverbank restoration
Visitor density indicators							
Primary viewing areas / attraction sites	**(ft^2/person)**	50	70	70	60	50	40
Vernal Fall trail	**(ft^2/person)**	40	60	60	50	40	35
Multi-use trails / East Valley hiking trails	**(ft^2/person)**	40	60	60	50	40	35
West Valley hiking trails	**(ft^2/person)**	100	140	120	100	80	80
Shore use East Valley (High use)	**(Linear feet / person)**	10	20	20	10	5	5
Shore use East Valley (Medium use)	**(Linear feet / person)**	10	20	20	10	5	5
Shore use West Valley (Low use)	**(Linear feet / person)**	10	10	10	10	10	10
Boating indicators							
Boats at One Time: Stoneman Bridge to Sentinel Beach	**BAOT per 400 feet**	6	1	2	6	3	9
1. Standard: average cannot violate standard more than 10% of time between 10 a.m. and 4 p.m.							

Monitoring – Visitor Densities

All monitoring sites are located within Yosemite Valley segment 2 and are considered river dependent and related. The Vernal Fall trail site is a 50-meter section approximately 0.25 mile up the paved trail to the fall. The beaches at Devil's Elbow and Housekeeping East are two other sites, each of which would have one PAOT count. The Superintendent's River Section, still another sites, is monitored using a BAOT count. Each site has an area of a different size that is sampled, and each site has been geo-referenced so that the area of each site can be quantified in terms of the amount of area afforded to each person in that space. Additionally, the sites described above were chosen because they are Valley attraction sites and are important in determining the quality of visitor experiences in Yosemite Valley (Lawson et al. 2008; Manning et al. 1999). The trail sites also provide areas where counters can be utilized with greatest accuracy for predicting visitor-use estimates (Pettebone et al. 2010). Monitoring would take place on randomly selected sample days throughout the summer field season (defined as at least 10 days between Memorial Day to Labor Day weekends) annually. Table 5-39 lists segment-level triggers and specific management responses that would take place should conditions reach the trigger points.

TABLE 5-39: MANAGEMENT ACTIONS AND TRIGGER POINTS TO MAINTAIN DESIRED CONDITIONS FOR RIVER-RELATED RECREATION IN YOSEMITE VALLEY (VISITOR DENSITIES)

	Trigger Point(s) at Which Management Action Would Be Taken	Possible Management Actions	Rationale for Management Actions
	Two locations exceed their site level standard 10% of the time over a three-year interval between the hours of 10 a.m. and 4 p.m.	Increase monitoring interval. Educate visitors about crowding issues and inform them of alternate recreation opportunities.	To protect and assure that recreation use is in compliance with NPS target conditions, the NPS can gather additional information to determine that conditions are not trending toward the management target. To maintain the level of acceptable preferences, as reported by Lawson et al. (2008), management actions, such as education and outreach to the visitors, would help to maintain the level of use within the target condition.
	Five locations exceed their site level standard 10% of the time over a three-year interval.	Permitting of affected areas (restrict east or west Valley). Segment-wide permit system.	

Management Concerns and Protective Actions

Management concerns occur when the condition of a resource has reached one of the trigger points identified in Table 5-37 or Table 5-39. As noted above, this ORV is not currently meeting the management standard, as indicated by the parking indicator. See the next section for a discussion of the actions proposed in the alternatives in this plan to address this situation.

Management Considerations and Enhancement Actions

In addition to the management concern that is occurring, there are also several management considerations pertaining to this ORV. The list below presents these considerations, each of which is followed by a discussion of the actions proposed in this plan to address them. There are also actions proposed in this plan that would improve aspects of the visitor experience that affect recreation activities in the Merced River corridor, including actions affecting restoration of the natural and scenic setting, paddling and boating, camping, picnicking, and wayfinding. However, this analysis of the recreational ORV is focused on the management considerations and corrective actions that affect the measurable indicators, which are targeted to vehicles present at any one time and people present at any one time on trails, at attraction sites, in boats, and along riverbank sites. For this reason, the following list only includes actions that would affect transportation and visitor-use management in Segment 2.

- Throughout the peak summer season, significant delays in outbound traffic flow are experienced at the intersection of Northside Drive and Village Drive (Yosemite Village Day-use Parking Area intersection). Yosemite Village Day-use Parking Area, formally called Camp 6, is a six-acre dirt lot currently used to park a maximum of 517 vehicles on peak days, with the use of directed parking. Demand for visitor day parking exceeds supply during summer peak-use periods. This unimproved parking area, which is in the 5- to 10-year floodplain, has no design mitigations to protect water quality. In addition, it is a former meadow and is located in the channel migration zone. Some areas of the Yosemite Village Day-use Parking Area are constructed with fill, decreasing the extent of overbank flooding. To address this management consideration, Alternatives 2-6:

  Consider options that range from locating the parking to the north of the road, to constructing a vehicle roundabout and a pedestrian undercrossing to address congestion of the intersection and pedestrian/vehicle conflicts.

Consider options that range from ecological restoration of the 10-year floodplain to restoration within a 150-foot buffer from the ordinary high water mark.

Consider parking capacity options that range from a lot with 550 to 850 spaces.

- Throughout the peak summer season, significant delays in outbound traffic flow are experienced at the intersection of Northside Drive and Village Drive (Yosemite Village Day-use Parking Area).

  Actions at this intersection range from realigning this intersection to a proper four-way in Alternatives 2 to 4, to construction of a roundabout under Alternatives 5 and 6. Alternative 6 also considers an additional roundabout at Northside Drive and Sentinel Drive (Bank 3-Way).

- Demand for day-visitor parking exceeds supply during summer peak-use periods.

  Alternatives consider different amounts of day use parking and related management actions. Some alternatives expand day use parking supply and alternative transportation, while others limit day use to levels lower than current demand.

  Additional parking proposed across the alternatives is provided at an area west of Yosemite Lodge (Alternatives 2 and 4 would accommodate 150 spaces, Alternatives 5 and 6 would accommodate 300 spaces), West Valley (alternative 5 provides 100 parking spaces and alternative 6 provides 250 spaces), and at a remote parking lot in El Portal (200 spaces in alternatives 4 to 6).

- The shoulder of Sentinel Drive is used for overflow day-use parking. Sensitive habitat in this location is being trampled and destroyed.

  Under Alternatives 2-6, roadside parking along Sentinel Drive would be removed and restored to natural conditions.

- Wilderness-related parking area was not designed as a formal parking area and therefore does not include Best Management Practices.

  Under Alternatives 2-6, the Curry Village former landfill site at the Wilderness parking lot would be remediated and parking would be formalized in such a way that provides for proper drainage.

- Parking supply at The Ahwahnee is inadequate to meet overnight and day-visitor demand.

  Under Alternatives 2-6, the existing parking lot would be redesigned and parking would be formalized to provide for proper drainage. Parking would also be expanded to the area west of the hotel to accommodate current demand and make up for the parking lost in the recent rock fall event.

- Crowding is common during peak season along the river and at popular attraction sites.

  Crowding, as it pertains to the Recreation ORV in Segment 2, is managed through the day-visitor capacity management strategies outlined in Chapter 8. Not all actions are required in the current state of each alternative, but could be leveraged in the future of any alternative as directed by indicators and ongoing monitoring efforts. Specific actions as they apply to each Alternative are outlined in Chapter 8 and may include the following tools:

  - Utilize parking and traffic management staff to improve parking efficiency and traffic flow in Yosemite Valley and other locations throughout the river corridor where needed. (This may include limiting day-use parking to West Valley overflow or diverting traffic to checkpoints throughout the park and at entrance stations.)
  - Expand public transit to additional corridors and the Yosemite Valley shuttle to West Valley locations.
  - East Valley day-use parking permits would be issued by advanced reservation and on a first-come-first-serve basis—checked at park entrance stations and secondarily at Valley locations or parking areas.

Visitors participating in boating and other river-based recreation activities have caused localized impacts to the riverbanks at the put-in and take-out locations (Cardno ENTRIX 2012). Additionally, local impacts to riverbanks have been caused by allowing easy access for non-boating visitors to sensitive riverbanks all along the river. The riverbank is highly eroded and widened at rafting put-in below Stoneman Bridge. Public comment also has indicated a desire to have more boating opportunities in the river corridor.

- Under all alternatives, swimming and waterplay are allowed in all segments, except short sections where noted in the Superintendent's Compendium due to health and safety risks. Private boating is by permit only in Alternatives 2-6.
- Alternatives range from private-use boating only to a combination of private and commercial use.
- Chapter 8 provides more detailed descriptions of the range of actions to address this management consideration under each alternative.

Conclusion: Protecting and Enhancing ORV 20 (River-related Recreation in Yosemite Valley)

Based on the analysis conducted for and represented in the Baseline Condition Report, the current condition of this ORV is below the management standard, with a management concern present. To return the condition of this ORV to the management standard, a variety of actions are proposed in Alternatives 2-6. The *Merced River Plan/DEIS* proposes a variety of other actions to address the management considerations pertaining to this ORV. To prevent these considerations, and others, from redeveloping, the NPS will monitor parking rates and vehicles at one time to ensure that they are not exceeding the management standard. Should specific trigger points be reached, the NPS would implement a series of specific actions to improve parking to an acceptable level. Similarly, should visitor densities begin to approach specific triggers, NPS would take steps to keep such densities within the management standard.

CONCLUSION

Protecting and enhancing the river values will be accomplished through the means identified in this chapter. To ensure that visitation does not adversely affect or degrade those river values, the *Merced River Plan/DEIS* also specifies the user capacity of each alternative as well as the means by which those capacities will be enforced. This user-capacity discussion is the subject of the next chapter.

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