

By contrast, **Alternative A** (No Action) is not the environmentally preferable alternative because although there would be no construction or ground disturbing activities that would affect previously undisturbed elements of the biological and physical environment 1) the existing pipeline is considered an eyesore which detracts from the visual resources of the area; 2) there is an ever-present danger of the pipeline freezing or being subjected to wildfire which would impact the visitor's health and safety; 3) the pipeline may suffer leakage due to natural events which may impact cave/karst resources, and waste precious water.

For similar reasons, **Alternative B** (to repair existing pipeline) and **Alternative C** (to replace the damaged existing pipeline with similar, in-kind above-ground pipeline) are not environmentally-preferable alternatives.

Alternative E (the constant pressure pump system) is not environmentally preferable because of the tremendous amount of electricity that would be needed to maintain adequate water pressure. Over time, pump replacement would be necessitated and would be expensive in terms of maintenance, staff time, and replacement parts/supplies. Also, this alternative would require removal of the storage tank, which provides back up water supply in case of fire emergency or if the pump system were to go down.

PREFERRED ALTERNATIVE

No new information came forward from public scoping or consultation with other agencies to necessitate the development of alternatives other than those described and evaluated in this document. **Alternative D** is the environmentally-preferable alternative and better meets the project objectives; therefore it is also considered the NPS preferred alternative. For the remainder of the document, **Alternative D is referred to as the preferred alternative.**

SUMMARIES/COSTS COMPARISON

Alternative A-No Action

The existing pipeline is functional. No immediate investment required. However, this above-ground pipeline has partially frozen twice in the last 3 years – once in February, 2011 prior to the destruction of the insulation jacket, and again in 2013 after the jacket burned. Worthy of note, the winter of 2013 was a milder-than-normal winter. The pipeline freeze in 2011 shut down the park's water service for a couple of days. In 2013, the park lost pressure for a few hours on a particularly cold morning. Fortunately, the line did not freeze solid enough to rupture the pipeline. At some future point, the weather will get cold enough to freeze the pipeline completely. Not only would such an event cause the park to close, but employees in government housing would have to be relocated to other accommodations. It is also likely that the pipeline would be heavily damaged and would require extensive repairs – or complete replacement.

Asset value at risk: **over \$1 million.** This is a high-risk alternative in terms of lost investment, damage to infrastructure, and many months of extended park closure.

Alternative B (Repairs to Above-ground Pipeline):

Existing ductile iron pipeline would be stabilized and re-insulated against freezing. Insulation wall thickness would be sufficiently thick/dense to protect the pipeline from freezing, as well as fire-resistant, to help protect it from damage by future wildfires. A rigid exterior jacket would be employed to protect from damage by hail or other impacts. The approximate costs are broken out as follows:

Stabilize pipeline, replace damaged wood support blocks:	\$ 75,000
Repair damaged concrete supports/erosion areas:	\$ 34,000
Install fire-resistant pipeline insulation sleeve (2" extruded/closed-cell)	\$ 443,000
Install protective outer jacket (24 ga. aluminum)	<u>\$ 198,000</u>
	\$ 750,000

This alternative replaces the insulation system on the original 50 year-old pipeline. Advantages to this alternative are:

- Relatively low cost
- Relatively little impact to resources

Disadvantages to this alternative are:

- Future risk of damage by freezing remains possible
- Future risk of damage by fire remains possible
- Eyesore on the landscape remains

Alternative C (Replacement In-kind Above-ground Pipeline):

Existing ductile iron pipeline would be replaced with a new pipeline, including concrete support saddles and a new, fire-resistant insulation jacket. The new pipeline would be constructed immediately adjacent to the existing pipeline to prevent interruption of water service. The new pipeline would be constructed using in-kind materials, equipment and construction methods, including the use of fire-resistant insulation. The work would be conducted along the existing pipeline location, within the same corridor and footprint.

Fabricate/install 700 new concrete support saddles:	\$ 280,000
Install 6,800 feet of new, 8" ductile iron pipeline:	\$ 680,000
Install fire-resistant pipeline insulation sleeve (2" extruded/closed-cell)	\$ 443,000
Install protective outer jacket (24 ga. aluminum)	\$ 198,000
Demolish/remove 6,800 feet of 8" ductile iron water pipeline & concrete saddles	<u>\$ 77,000</u>
	\$ 1,677,000

Alternative D: (Install New Buried Pipeline)

Under Alternative D, the existing pipeline would be replaced with a *new, buried pipeline*. The estimated cost of this alternative would be \$937,000. The pipeline would be constructed and buried along the existing pipeline location, within the same corridor and footprint.

Ground-Penetrating Radar Survey (Pre-Work):	\$ 40,000
Excavate (rock trench) 12" wide X 24" deep X 6,800 feet :	\$ 520,000
Install 6,800 feet of new, HDPE 8" pipeline:	\$ 260,000
Demolish/remove 6,800 feet of 8" ductile iron water pipeline & concrete saddles	\$ 77,000
Demolish, remove, and abate ACM and 2,100 feet of 8" ductile iron pipeline.	<u>\$ 40,000</u>
	\$ 937,000

Alternative E: (Install New Buried Pipeline)

Excavate/install 3,000 feet of new, 6" epoxy-coated steel pipeline:	\$ 900,000
Install two continuous-feed pumps (main and backup) for domestic pressure	\$ 240,000
Install one emergency fire pump (fire hydrant/fire service)	\$ 225,000
Modify Treatment Bldg./Install standby electrical generator & fuel storage system	\$ 220,000
Install hydro-pneumatic pressure control system.	\$
115,000	
Demolish Entire Abandoned Surface Water System	<u>\$ 550,000</u>
	\$ 2,250,000

Table 1: Comparison of How Each Alternative Will Meet the Objectives

Objective	Alternative A: No Action	Alternative B: Repair/reinsulate existing pipeline with in-kind materials, in same location, above-ground.	Alternative C: Replace entire surface pipeline, with in-kind materials, including asbestos mitigation and removal of old line.	Alternative D: Replace entire existing pipeline with a new, buried pipeline, including removal of old line.	Alternative E: Remove the existing pipeline and storage from mesa top and use pressure-regulated pumping system to bring water up to the park's distribution system
1. To restore a permanent, reliable source of water to the park; for many years of reliable service.	<p>Description: The existing fire-damaged pipeline would <i>remain</i> in its present condition. The current level of management would be maintained. The pipeline is currently providing adequate amounts of water to the park's facilities. The reliability of the pipeline in its current state is Low to Moderately-Low (not very reliable). The longevity is estimated <5 years</p> <p>Objective would not be met.</p> <p>Could be compromised as additional damage from freeze or wildfire is probable. NPS would respond to future needs and conditions associated with the pipeline without major actions or changes in course.</p>	<p>Description: The existing pipeline would be <i>repaired</i>. The pipeline would be stabilized by replacing approximately 700 fire-damaged wooden support blocks along its length. The fire-damaged asbestos-containing insulation jacket would be replaced with a new jacket. The reliability of the pipeline in Alt.B is Moderate to medium-High (moderately reliable). The longevity is estimated <10 years</p> <p>Objective would be met. The repaired pipeline would provide adequate water to the park's facilities. Could be compromised as recurring damage from freezing temperatures or wildfire is possible.</p>	<p>Description: The existing pipeline would be <i>replaced</i> with a new, <i>in-kind</i> pipeline, including asbestos mitigation and removal of old line. The new, in-kind pipeline would provide adequate water to the park's facilities. The reliability of the pipeline in Alt.C is Moderate to moderately-high (moderately reliable). The longevity is estimated <10 years. There would be cost-savings from reduced future maintenance.</p> <p>Objective would be met. The new (in-kind) above-ground pipeline would provide adequate water to the park's facilities. Could be compromised as recurring damage from freezing temperatures or wildfire is possible.</p>	<p>Description: The existing pipeline would be <i>replaced</i> with a new, <i>buried</i> pipeline. The new pipeline would be installed in an excavated trench, immediately adjacent to the existing above-ground pipeline. Upon completion of work, the old pipeline would be demolished and removed. The reliability of the pipeline in Alt.D is High (very reliable). The longevity is estimated >40 years.</p> <p>Objective would be met. The buried pipeline would provide adequate water to the park's facilities. Pipeline would be protected from the natural elements such as fire and freezing temperatures.</p>	<p>Description: The existing pipeline and storage tank would be <i>completely removed</i> from the top of the escarpment. A <i>pressure-regulated system would pump the water</i> from below the escarpment to the park's water distribution system on top. The reliability of the system in Alt.E is Low to medium (moderately reliable) due to high pump- maintenance requirements. The longevity is <10 years.</p> <p>Objective would be met. The pressure-regulated system would provide adequate water to the park's facilities.</p>
2. Address the probability and estimated degree of risk to the park from pipeline failure, due to natural events such as wildfire and freezing weather.	There is a HIGH probability of the occurrence of future natural events such as wildfire and freezing weather. The degree of risk to the park's water service would be Very High .	There is a HIGH probability of the occurrence of future natural events such as wildfire and freezing weather. The degree of risk to the park's water service would be Moderately high to High .	There is a HIGH probability of the occurrence of future natural event such as wildfire and freezing weather. The degree of risk to the park's water service would be Moderately high to High (similar to Alt B).	There is a HIGH probability of the occurrence of future natural event such as wildfire and freezing weather. The degree of risk to the park's water service would be Low .	There is a HIGH probability of the occurrence of future natural events such as wildfire and freezing weather. The degree of risk to the park's water service would be moderate to moderately High, due to lack of

Objective	Alternative A: No Action	Alternative B: Repair/reinsulate existing pipeline with in-kind materials, in same location, above-ground.	Alternative C: Replace entire surface pipeline, with in-kind materials, including asbestos mitigation and removal of old line.	Alternative D: Replace entire existing pipeline with a new, buried pipeline, including removal of old line.	Alternative E: Remove the existing pipeline and storage from mesa top and use pressure-regulated pumping system to bring water up to the park's distribution system
					storage. \\
3. To restore the disturbed natural and cultural resources to a more natural state.	The existing disturbed natural and cultural resources will remain in present state.	The disturbed natural and cultural resources will largely remain in their present state. Some temporary disturbance may occur from the repair work.	The disturbed natural and cultural resources will remain in present state. Some additional disturbance may occur from the new work and removal of old pipeline.	New temporary disturbances to the soils, plants and wildlife will occur. Cultural landscapes will improve as well as the visual resources.	New temporary disturbances to the soils, plants and wildlife will occur. Cultural landscapes will improve as well as the visual resources.
4. To minimize impacts to cave/karst resources.	There is low possibility of additional impacts to cave/karsts resources.	There is low possibility of additional impacts to cave/karsts resources.	There is low possibility of additional impacts to cave/karst resources.	There is high possibility of impacts to cave/karst resources as this is a new trench construction.	There is moderate possibility of impacts to cave/karst resources. The trench will be located alongside an existing trench so impacts to cave/karst resources are not expected.

Table 2: Comparison of Environmental Impacts by Alternative

Impact Topics	Alternative A: No Action	Alternative B: Repair/reinsulate existing pipeline with in-kind materials, in same location, above-ground.	Alternative C: Replace entire surface pipeline, with in-kind materials; including asbestos mitigation and removal of old line.	Alternative D: Replace existing line with new, buried pipeline, including removal of old line.	Alternative E: Remove existing line and storage; and replace with pressure-regulated pump system.
Visitor use and Experience	<p>No-Action: For the short-term, the No-Action Alternative would have beneficial effects on visitor use and experience because the waterline is functional at the present time. Water would be made available for visitor use through minimal repairs and maintenance.</p> <p>Over the long-term, the No Action Alternative could lead to moderate adverse effects. This is because there is a chance of below freezing temperatures or wildfires which could cause additional damage to the existing waterline and could cause a major disruption to the visitor center drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to a reduction in visitor use and diminished experiences.</p>	<p>Alternative B: For the short-term, Alternative B would have a moderate, beneficial effect on visitor use and experience. The waterline would provide adequate water for drinking and sewer system operations. Minor repairs would be made to the waterline to keep it operational. As long as natural events do not affect the waterline, water would be available to the visitors.</p> <p>Over the long-term, impacts to visitor use would be moderate and beneficial as long as water is available and the pipeline is repaired. Alternative B could result in moderate adverse effects to the visitor use. This is because there is a chance freezing temperatures or wildfires could cause similar damage as evidenced by the existing waterline. This could cause a moderate disruption to visitor center drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to diminished visitor experiences.</p>	<p>Alternative C: For the short-term, Alternative C would have a minor, adverse on visitors from noise and dust of the construction. Until the waterline is constructed and connected to the system, the visitor's water would be provided through the existing system.</p> <p>Over the long-term, Alternative C could provide moderate, beneficial effects of providing water to visitors. However, natural events such as freezing temperatures or wildfires, could cause similar damage as evidenced by the existing waterline. This could cause a moderate disruption to visitor center drinking water and sewer system operations. Health and safety concerns could become significant issues; this could lead to diminished visitor experiences. These impacts would be moderate and adverse.</p>	<p>Alternative D: For the short-term, Alternative D would have a minor, adverse impact on visitors from noise and dust of the construction. Until the waterline is constructed and connected to the system, the visitor's water would be provided through the existing system; therefore visitors would not notice any changes to water service.</p> <p>Long-term moderate, beneficial effects would be realized once the project is completed. Burying the pipeline would improve the viewshed and cultural landscape for visitor experience. Water availability would be more secure, and maintenance requirements would be reduced as the pipeline is protected from the natural elements. Natural events such as fire or freezing temperatures, would not cause effects similar to the existing waterline's present condition, i.e. the buckling and twisting of the pipeline's support structure. Future park proposed projects requiring water would be allowed to proceed with this assurance of dependable water source. Health and safety, including fire protection, would be maintained at the highest level due to the increased dependability of the waterline. The longevity of the pipeline would be</p>	<p>Alternative E: For the short-term, Alternative E would have a minor, adverse effect on visitors from the noise and dust of the construction. There would be no noticeable effect on visitor use and experience during installation of the pumps as water would temporarily be available to the park from existing waterline. The viewshed would be temporarily negatively impacted by the presence of construction equipment and materials at the pump house.</p> <p>Long-term moderate, beneficial effects would be realized once the project is completed. Removal of the existing pipeline would improve the viewshed and cultural landscape for visitor experience. Water availability would be restored, and maintenance requirements would be reduced as the pumps could be inspected on a regular schedule at the pump house. Protection from natural events would be afforded by locating the pumps in the pump house.</p> <p>Over the long-term, moderate, adverse effects could also occur to health and safety, including fire protection, due to the removal of the storage tank, which provides</p>

				increased at least two-fold and probably would last more than 50 years. Visitor use and experience would be maintained at a higher level for a longer period of time, with minimum disruption to the park's water service.	needed back-up supply of water for fire protection, visitor safety and health use.
Geology and Soils (Surface) Resources	<p>No Action: For the short-term, there would be a negligible adverse impact to geologic resources.</p> <p>Over the long-term, there would be minor adverse impacts due to water leaks which could cause soil erosion.</p>	<p>Alternative B: For the short-term, there would be a negligible adverse impact to geologic resources.</p> <p>Over the long-term, there would be minor adverse impacts due to water leaks which could cause soil erosion.</p>	<p>Alternative C: For the short-term, geologic resources would receive negligible to minor effects, due to soil compaction caused during pipeline installation.</p> <p>Over the long-term, susceptibility of the replacement waterline to failure could lead to minor adverse effects if water leaks cause soil erosion.</p>	<p>Alternative D: Geologic resources would receive moderate adverse impacts due to irreversible bedrock and soil loss caused by waterline trenching.</p> <p>Long-term adverse effects would be negligible to minor, depending on potential erosion of adjacent soil sites as a delayed effect of trenching.</p>	<p>Alternative E: Geologic resources would receive moderate adverse impacts due to irreversible bedrock and soil loss caused by waterline trenching.</p> <p>Long-term adverse effects would be negligible to minor, depending on potential erosion of adjacent soil sites as a delayed effect of trenching.</p>
Cave/Karst (Subsurface) Resources	<p>No Action: Cave/karst resources would receive short-term negligible effects.</p> <p>Over the long-term, continuing degradation of the waterline could lead to minor adverse impacts if water leaks into the subsurface of the Carlsbad Cavern.</p>	<p>Alternative B: For the short-term, Cave/karst resources would receive negligible adverse effects by repairs/re-insulation of the existing pipeline.</p> <p>Over the long-term, there would be minor to moderate adverse effects if repaired waterline is susceptible to future natural events which may cause leaks into subsurface.</p>	<p>Alternative C: For the short-term, Cave/karst resources would receive negligible adverse effects by the replacement of the existing pipeline.</p> <p>Over the long-term, there would be minor to moderate adverse effects if replacement waterline is susceptible to future natural events which may cause leaks into subsurface.</p>	<p>Alternative D: For the short-term, Cave/karst resources would have short-term, moderate adverse effects on cave/karst resources, depending on whether bedrock excavation intersects a void space that is determined to be a previously unknown cave or cave passage.</p> <p>Mitigation measures such as a Ground-Penetrating Radar (GPR) surveys can be conducted, void spaces can be detected in advance and water line route can be adjusted to avoid these features. In this case, effects would be minor and adverse.</p> <p>Long-term negative effects would be negligible to minor adverse. Water leaks could be more difficult to detect on the buried waterline.</p>	<p>Alternative E: For the short-term, Alternative E would have moderate, adverse effects on cave/karst resources, depending on whether bedrock excavation intersects a void space that is determined to be a previously unknown cave or cave passage.</p> <p>Mitigation measures such as a Ground-Penetrating Radar (GPR) surveys can be conducted, void spaces can be detected in advance and water line route can be adjusted to avoid these features. In this case, effects should be minor and adverse.</p> <p>Long-term negative effects would be negligible to minor adverse. Water leaks could be more difficult to detect on the buried waterline.</p>
Threatened and Endangered Species and Migratory Birds	No Action: This alternative would cause negligible to	Alternative B: If the work was conducted during winter, and if	Alternative C: If the work was conducted during winter, and if	Alternative D: If the work was conducted during winter, and if all listed	Alternative E: If the work was done during winter, and if all listed

	<p>minor, short-term adverse impacts as long as the old waterline remains functional.</p> <p>Long-term impacts from repairs could be negligible to moderate and adverse.</p>	<p>all listed cacti were strictly avoided, short-term impacts would be negligible and adverse. If the work was done outside the winter season, and if disturbance near the bird nests is avoided, all listed cacti are strictly avoided, impacts would be negligible and adverse.</p> <p>There would be negligible long-term adverse impacts.</p>	<p>all listed cacti were strictly avoided, short-term impacts would be negligible and adverse. If the work was done outside the winter season, and if disturbance near the bird nests is avoided, all listed cacti are strictly avoided, impacts would be negligible and adverse.</p> <p>There would be negligible long-term adverse impacts.</p>	<p>cacti were strictly avoided, short-term impacts would be negligible and adverse. If the work was done outside the winter season, and if disturbance near bird nests is avoided, and all listed cacti were strictly avoided, and a qualified biologist monitored the trench and remove trapped wildlife, short-term impacts would be negligible to minor and adverse.</p> <p>There would be negligible long-term adverse impacts.</p>	<p>cacti were strictly avoided during the construction of the waterline and demolition of the old line and tank, impacts would be negligible.</p> <p>If the work were conducted outside the winter season, and if all listed cacti and migratory bird nests were avoided, impacts would be negligible to minor. Impacts would be reduced through mitigation measures.</p> <p>There would be negligible long-term adverse impacts.</p>
Vegetation and Wildlife	<p>No Action: This alternative would cause negligible to minor, short-term adverse impacts as long as the old waterline remains functional.</p> <p>Long-term impacts would be negligible to moderate and adverse.</p>	<p>Alternative B: In the short-term, if the work was done during the winter, the adverse impacts would be negligible. In other seasons, if nests are not disturbed, adverse impacts would be negligible to minor.</p> <p>Long-term impacts would be negligible and adverse.</p>	<p>Alternative C: This alternative would cause negligible to minor, short-term adverse impacts. Because the above-ground pipeline is relatively low to the ground and yet raised above the ground, wildlife can crawl under it or jump over it with relative ease.</p> <p>Long-term impacts would be negligible and adverse.</p>	<p>Alternative D: In the short-term, if the work was done during the winter this alternative would cause negligible to minor short-term adverse impacts during construction.</p> <p>Impacts would be reduced through mitigation measures.</p> <p>Long-term impacts would be negligible and adverse.</p>	<p>Alternative E: In the short-term, if the work was done during the winter this alternative would cause negligible to minor short-term adverse impacts during construction.</p> <p>Impacts would be reduced through mitigation measures.</p> <p>Long-term impacts would be negligible and adverse.</p>
Visual Resources	<p>No Action: The existing pipeline would remain a visual intrusion, as seen from the Carlsbad Caverns Historic District and Cultural Landscape.</p> <p>There would be no change to the visual resources.</p>	<p>Alternative B: The existing pipeline would remain a visual intrusion, as seen from the Carlsbad Caverns Historic District and Cultural Landscape.</p> <p>The short-term impacts from repairs will be minor to moderately adverse due to construction equipment, materials, and activity that would be visible.</p> <p>Long-term adverse impacts from vegetation removal would be minor adverse as vegetation recovers from the disturbance.</p>	<p>Alternative C: The existing pipeline would remain a visual intrusion, as seen from the Carlsbad Caverns Historic District and Cultural Landscape.</p> <p>The short-term impact will be minor to moderately adverse due to construction, dust, equipment, and the materials that would be visible. Mitigation measures will be taken to reduce impacts.</p> <p>Long-term impacts from vegetation removal would be minor adverse depending on</p>	<p>Alternative D: The short-term impact will be minor to moderately adverse from the construction due to reduction in vegetation, the change in color and texture of the landscape because of the mechanical cutting of the rock, dust from machinery, staging area of materials, and dust on the Scenic Loop Road from equipment being driven on the road.</p> <p>Long-term adverse impacts from vegetation removal would be reduced to minor levels through rehabilitation of the construction site, including revegetation per mitigation measures.</p>	<p>Alternative E: The short-term impact will be minor to moderately adverse from the construction due to reduction in vegetation, the change in color and texture of the landscape because of the mechanical cutting of the rock, dust from machinery, and staging area of materials.</p> <p>Long-term adverse impacts from vegetation removal would be reduced to minor levels through rehabilitation of the construction site, including revegetation per mitigation measures.</p>

		Adverse impacts would be reduced to minor as the pipeline is painted a mosaic of browns and green per mitigation measures	mitigation measures. Adverse impacts would be reduced to minor as the pipeline is painted a mosaic of browns and green per mitigation measures.	Long-term beneficial impacts would be realized by removing the existing pipeline. There would be no visual intrusions as seen from Carlsbad Caverns Historic District and Landscape	Long-term beneficial impacts would be realized by removing the existing pipeline and storage tank. There would be no visual intrusions as seen from Carlsbad Caverns Historic District and Landscape.
Cultural Resources/ Landscapes	No Action Alternative would be a major long-term adverse impact. There would be no improvement to the landscape, and the existing pipeline would remain an intrusive element.	Alternative B would include short-term, moderate, adverse impacts. The long-term impacts would be moderate, adverse impacts. The impacts could be reduced to minor, adverse levels by using mitigation measures. Existing pipeline would remain an intrusive element.	Alternative C would include short-term moderate, adverse impacts. The long-term impacts would be moderate, adverse impacts. The impacts could be reduced to minor, adverse levels by using mitigation measures. Existing pipeline would remain an intrusive element	Alternative D would include short-term moderate, adverse impacts. Long-term impacts would be moderate and beneficial after construction and mitigation is completed. Waterline would no longer be a visual intrusion.	Alternative E would include short-term moderate, adverse impacts. Long-term impacts would be moderate and beneficial after construction and mitigation is completed. Waterline would no longer be a visual intrusion.
Native American Concerns	No Action would be a moderate, adverse, long-term impact and would remain a man-made element in the natural landscape.	Alternative B would have short-term and long-term moderate, adverse, impacts. The existing waterline would remain a man-made element in the natural landscape.	Alternative C would have short-term and long-term moderate, adverse, impacts. The existing waterline would remain a man-made element in the natural landscape.	Alternative D would have short-term moderate impacts from construction activities. Long-term impacts would be moderate and beneficial. Existing water line would no longer remain a man-made element in the cultural landscape.	Alternative E would have short-term moderate, adverse impacts from construction activities. Long-term impacts would be moderate and beneficial. Existing water line would no longer remain a man-made element in the cultural landscape.
Park Operations & Fire Management	No Action would allow the existing pipeline to remain in its present state of disrepair. Short-term and long-term impacts would be beneficial as long as water is available. Long-term impacts could become major adverse due to the possibility of damage from freezing temperatures and wildfire.	Alternative B would include short-term and long-term impacts and would be moderate and beneficial as long as water is available. Long-term impacts could become adverse due to the possibility of damage from freezing temperatures and wildfire. Long-term moderate, adverse impacts would include diminished water availability and possible extreme adverse impacts from pipe failure including	Alternative C would have short-term, moderate and adverse impacts on park operations during construction activities. Also, there would be short-term and long-term impacts and would be moderate and beneficial as long as water is available. Long-term impacts could become adverse due to the possibility of damage from freezing temperatures and wildfire.	Alternative D would have short-term, moderate and adverse impacts on park operations from construction activities. Long-term beneficial impacts would include water availability and protection from pipe failure due to natural climatic events. Long-term impacts would include increased reliability water availability and protection from pipe failure due to freezing temperatures and wildfire.	Alternative E would have short-term, moderate and adverse impacts on park operations from construction activities. Long-term beneficial impacts would include water availability and protection from pipe failure due to natural climatic events. Diminished fire-suppression capability would be a long-term major adverse impact, due to removal of water tank.

		diminished fire suppression capability.	Long-term moderate, adverse impacts would include diminished water availability and possible extreme adverse impacts from pipe failure including diminished fire suppression capability.		
Air Quality	No Action Alternative would have negligible adverse impacts on air quality due to current level of maintenance upkeep to waterline.	Alternative B would include short-term adverse, minor impacts due to dust and exhaust from construction. Long-term impacts would be minor, adverse impacts during repairs. Air quality would improve after the repairs.	Alternative C would include short-term adverse, minor impacts due to dust and exhaust from construction. Long-term impacts would be negligible to minor. Air quality will return to what it was prior to construction.	Alternative D would include short-term moderate adverse impacts due to dust and exhaust from construction due to trenching equipment. These impacts could be reduced to minor level by using mitigation measures. Air quality will return to what it was prior to construction Long-term impacts would be negligible to moderate, adverse if repairs are needed in the future.	Alternative E would include short-term moderate adverse impacts due to dust and exhaust from construction due to trenching equipment. These impacts could be reduced to minor level by using mitigation measures. Long-term impacts would be negligible to moderately adverse, if repairs are needed in the future.
Soundscape Management	No Action would have negligible impacts on soundscape.	Alternative B would include short-term negligible to minor adverse impacts on park visitors due to the noise of the construction equipment. Construction noise impacts on bats could be reduced to negligible adverse levels through mitigation measures. Long-term adverse impacts would be negligible if maintenance repairs are needed.	Alternative C would include short-term minor adverse impacts on park visitors due to the noise of the construction equipment. Construction noise impacts on bats could be reduced to negligible adverse levels through mitigation measures. Long-term adverse impacts would be negligible if no maintenance repairs are needed. Long-term adverse impacts would be minor if maintenance repairs are needed.	Alternative D would include short-term moderate adverse impacts due to the noise of the equipment. Construction noise impacts on bats could be reduced to negligible adverse levels through mitigation measures. Long-term adverse impacts would be negligible if no further maintenance repairs are needed. Long-term adverse impacts from construction would be moderate if repairs are needed, due to noise of the equipment.	Alternative E would include short-term moderate adverse impacts due to the noise of the equipment. Construction noise impacts on bats could be reduced to negligible adverse levels through mitigation measures. Long-term adverse impacts would be negligible if no further repairs are needed. Long-term impacts would be moderate if repairs are needed, due to the noise of the equipment.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

This chapter describes the affected environment (existing setting or baseline conditions) and analyzes the potential environmental impacts that would be affected as a result of implementing the proposed project.

AFFECTED ENVIRONMENT

Visitor Use and Experience

More than 400,000 visitors utilize bathrooms in the park. Most visitors frequent the concessions and restaurant areas. Normally, not much attention is paid to water availability. Visitors are rarely inconvenienced by lack of adequate water supply. The park maintains plenty of water and in a safe and healthy state. Most of the utilities have been in place several years. Visitors appreciate the efforts the park staff makes to maintain the facilities in good, clean working order.

Climate

The annual precipitation average is 14.4 inches, occurring mostly as high intensity, short-duration afternoon thunderstorms from July through September. The annual air temperature average is 63 degrees F. Annual weather patterns, influenced by global climate events, such as El Niño and La Niña, affect and alter production and composition of vegetation. In general, because precipitation is minimal through the winter, but increases during the summer, warm-season plants dominate the landscape. But from year to year, the production and composition of plants can greatly shift due to variable weather patterns. The years that produce the most species richness and production are those that get slow, steady moisture through the months of May, June, and July. Late summer thunderstorms may induce heavy runoff on this site, creating flash-flooding in the draws, drainages, and canyons.

Geology and Soils

The surface geology of the park is characterized by Permian age carbonate rock (limestone and dolomite) formed in a reef environment between 250 and 280 million years ago. In the Mesa Top Waterline area, the geologic unit exposed at the surface is primarily the Tansill Formation, with some nearby exposures of the underlying Yates Formation. The Tansill and Yates Formations are both thick carbonate units (100 feet to greater than 300 feet thick), representing the backreef environment of the Permian sea associated with the Delaware Basin. The Tansill and Yates Formations both serve as parent rock for soils of the Very Shallow Ecological Site.

The soils are described as Ector series stony loam soils and consist of very shallow to shallow, well-drained, calcareous, stony and extremely rocky soils that are underlain by limestone. The project site lies within the Very Shallow Ecological Site. The soil is not associated with a wetland or riparian system; it is an upland ecological site. These soils are subject to water erosion if the vegetative cover is destroyed, but the many stones and rock outcrops help to stabilize them in level to gently sloping areas. There is little or no surface water, except for brief periods after infrequent heavy rains. Runoff is rapid after soils become saturated. Permeability is very low to low. Soil depth plays a role with plant production and diversity. The underlying bedrock undulates in depth from being exposed at the surface to a depth of 50 cm in a few places. The deeper the soil, the greater the ability for different plant species to access water and utilize other resources. (NRCS, 2013)

Cave/Karst Resources

Cave and karst resources are abundant throughout Carlsbad Caverns National Park and the Guadalupe Mountains in which the park is located. Many of the caves in this mountain range are world-class sites due to their large passage sizes and significant lengths. Carlsbad Cavern contains the largest known underground chamber in the United States, and Lechuguilla Cave is the one of the ten longest caves in the world, at over 135 miles of surveyed cave passage. The caves are also well-known as some of the most decorated in the world, with abundant secondary deposits such as stalactites, flowstone, helictites, cave pearls, and more unique formations such as gypsum chandeliers and large cave pool basins. The genesis of the caves in the Guadalupe Mountains is also unique, as unlike most caves that form by carbonic acid associated with meteoric water entering the ground from above, the caves in this area were formed by sulfuric acid formed at the water table, deep beneath the surface. The unique geologic history of these caves, along with spectacular passages and formations, has earned Carlsbad Cavern and other nearby caves world recognition among visitors, cave explorers, and speleologists.

Within the park, there are known caves that occur in the general area of the Mesa Top Waterline. Most caves in the park are considered sensitive resources, and to ensure their protection, locations and other data for these caves are not made publicly available. Spider Cave, however, is a publicly advertised cave that includes a guided “wild caving” tour route that visits a portion of this extensive cave. Spider Cave is situated near the waterline, with the closest known cave passages occurring within 1000 feet of the waterline. Exploration in Spider Cave is still occurring, so there could be additional passages that extend even closer to the waterline.

Due to the long history of visitation and cave exploration in the developed area of the park, it is unlikely, though possible, that new cave entrances remain to be discovered near the waterline. Undiscovered caves and cave passages could, however, be situated in the subsurface near the waterline. The development of caves in the park, and generally in the Guadalupe Mountains, is unrelated to the modern landscape, i.e., existence of underlying cave passages cannot be predicted by surface features such as mesas, drainages, etc. The type of cave genesis in the Guadalupe Mountains is associated with sulfuric acid dissolution occurring at or near the water table, as opposed to the more common type of speleogenesis in which underground portions of streams and rivers contribute to cave development. For this reason, cave development in the Guadalupe Mountains occurred without the existence of cave entrances. Entrances to caves are often formed long after cave development ceased and are the result of surface processes such as canyon development, erosion, and collapse. Therefore, caves without entrances do exist and are likely abundant throughout the Guadalupe Mountains, suggesting the potential presence of unknown cave resources beneath the Mesa Top Waterline.

Vegetation

Essentially all of the existing waterline between the water storage tank and the park’s developed area lies within the Very Shallow Ecological Site, as documented in the Soil Survey for Carlsbad Caverns National Park (draft NRCS, 2013). This ecological site contains a mix of grass, shrubs, forbs, and succulents. It is often dry, due to rapid infiltration and runoff of rain, and it is subject to many dry, windy days.

According to the park's vegetation map (Muldavin et al. 2003), the vegetation in the waterline area is composed almost entirely of three plant communities: Pinchot Juniper Shrubland, Curlyleaf Muhly Grassland with Pinchot Juniper, and Curlyleaf Muhly Grassland. The primary plant species in these communities are Pinchot juniper (*Juniperus pinchotii*), a shrub, and curlyleaf muhly (*Muhlenbergia setifolia*), a grass.

Other commonly occurring plants in the vicinity include lechuguilla (*Agave lechuguilla*), green sotol (*Dasylirion leiophyllum*), several grasses such as sideoats grama (*Bouteloua curtipendula*) and black grama (*B. eriopoda*), various globemallows (*Sphaeralcea* spp.), verbenas (*Verbena* spp.), blackfoot daisy (*Melampodium leucanthum*); and a variety of cacti.

Other shrubs found on the site include mariola (*Parthenium incanum*), indigo bush (*Dalea formosa*), and javelina bush (*Condalia ericoides*). Some half-shrubs found in the area are dyssodia (*Dyssodia* spp.), desert zinnia (*Zinnia acerosa*), and trailing krameria (*Krameria lanceolata*).

Wildlife

Native wildlife species which have been documented or are likely to occur in the area include mammals

such as the desert shrew, Texas antelope ground squirrel, black-tailed jackrabbit, rock squirrel, Botta's pocket gopher, silky pocket mouse, white-ankled mouse, eastern white-throated woodrat, coyote, common gray fox, ringtail, northern raccoon, long-tailed weasel, hog-nosed skunk, striped skunk, western spotted skunk, mountain lion, bobcat, javelina (collared peccary), and mule deer.

Nesting birds such as the rufous-crowned sparrow, scaled quail, Scott's oriole, blue grosbeak, northern mockingbird, black-throated sparrow, and cactus wren, other birds such as the white-crowned sparrow, chipping sparrow, black-chinned sparrow, dark-eyed junco, meadowlark, ladder-backed woodpecker, turkey vulture, red-tailed hawk, peregrine falcon, northern harrier, canyon towhee, spotted towhee, rock wren, greater roadrunner, house finch, Say's phoebe, ash-throated flycatcher, black-chinned hummingbird, and great-horned owl may be present.

Reptiles such as the ornate box turtle, eastern collared lizard, Texas horned lizard, northern crevice spiny lizard, southwestern fence lizard, Chihuahuan greater earless lizard, several species of whiptail lizards, Great Plains skink, several species of snakes, including the Trans-Pecos rat snake, ring-necked snake, western coachwhip, western diamond-backed rattlesnake, mottled rock rattlesnake, and northern black-tailed rattlesnake may be found in this habitat.

Invertebrate animals including termites, ants, centipedes, millipedes, tarantulas and other species of spiders, and numerous species of beetles, native bees, wasps, butterflies and moths, and flies are likely to be present.

Threatened and Endangered Species and Migratory Birds

Early consultation on federally-listed species was conducted with the U.S. Fish and Wildlife Service was conducted on April 23, 2013. A complete survey would be conducted before any construction work or driving along the waterline begins. If any federally-listed cacti are found to be in the path of any construction disturbance, further consultation with USFWS would take place. This would result in a minimum of informal consultation with an opinion of Not Likely to Adversely Affect, or a maximum of formal consultation and an opinion of Likely to Adversely Affect.

According to its management policies, "the National Park Service will... manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible" and "will include consultation with lead federal and state agencies as appropriate." (NPS, 2006)

The New Mexico Department of Game and Fish has stated it will review and comment when it receives this EA. The Forestry Division of New Mexico Energy, Minerals, and Natural Resources Department is invited to comment on state-listed plants.

Lee's Pincushion Cactus (*Coryphantha sneedii* var. *leei*)

--Federally Threatened

--New Mexico Endangered

Lee's Pincushion Cactus could possibly occur on the site, especially along the portion north of the Desert Loop Drive Road, which occurs on a north-facing slope. An earlier but incomplete survey of the area did not find it. The site does not match all the plant's prime habitat characteristics, but it does fit some: the site is composed of Tansil Limestone, this species' preferred substrate, and the elevation of the project area (4,439-4,573 feet) is within their preferred range. Further, two of the Lee's Pincushion Cactus plants have been documented just over 300 feet away from the project area. This cactus is federally listed as Threatened under the Endangered Species Act (under the scientific name *Coryphantha sneedii* var. *leei*). It is listed as Endangered by the state of New Mexico (under the scientific name *Escobaria sneedii* var. *leei*). This cactus grows only in southeastern New Mexico, with most of its range within Carlsbad Caverns National Park (CCNP).

Lee's Pincushion Cactus primarily inhabits cracks and shallow soils on broken limestone shelves and north-facing steep slopes of Chihuahuan Desert scrub, though small populations have been found outside of these strict parameters, including on ridgetops and south-facing slopes.

A complete survey for this cactus would be conducted before any work commences. The survey would cover an additional 10 feet on either side of the proposed construction corridor limits. Among the mitigation measures to protect the cacti, if found, would be:

Consultation: If any of the cacti are found, the park would engage in consultation with the U.S. Fish and Wildlife Service, and mitigation measures would be needed to protect the cacti from damage.

Plant Avoidance: A biologist will mark sensitive areas and individual cacti for avoidance before the crew works in the area. When work approaches areas known to have the federally listed cacti, the work manager will notify park Resource Management staff in advance so they can monitor work and ensure the plants are unharmed.

Crew Orientation: Resource Management staff would provide orientation briefings to the work leaders and crews before the project. Briefings will discuss the importance of the park's rare, threatened, and endangered plants and work methods that must be used to avoid damaging them.

Monitoring: A biological monitor would be with the crew when they are working in areas with the listed cacti present. Follow-up monitoring of the plants' condition, including being inundated with dust, would be carried out by biologists after the project.

Gray-Banded Kingsnake (*Lampropeltis alterna*)

--New Mexico Endangered

Gray-Banded Kingsnakes inhabit broken, rocky areas where they can access deep fissures and crevices for shelter and in pursuit of food. They are rarely found above ground during daylight hours.

Within New Mexico, the Gray-Banded Kingsnake has one of the smallest ranges of any of the snakes native to the state – Carlsbad Caverns National Park and a nearby site are the only documented locations of this animal. As a result, the biology and population status of Gray-Banded Kingsnakes are poorly documented in the state. The species is believed to be very rare in New Mexico because of the large number of collectors who routinely visit the potential habitat and the small number of specimens actually encountered. It is likely that loss of even a small number of individuals from the New Mexico population could negatively impact the population status.

These snakes, and most wildlife using the area, would be at great risk for death if a trench was left open for more than a few hours without regular monitoring and safe removal of trapped animals. A not-for-profit scientific research organization in Carlsbad (Center of Excellence for Hazardous Materials Management) monitored a nearby trench on BLM land twice a day for less than two months. During that time, they removed 279 individual animals of 27 different species, including endangered and sensitive species (CEHMM report, pers. comm.). This is an average of 5.8 animals per day, including numerous snakes and lizards, tarantulas, toads, turtles, deer, mice, kangaroo rats, a woodrat, and a cottontail.

The report states: "Our findings conclusively demonstrated that a trench left unattended for more than three (3) hours has greater than 92% likelihood of incurring more entrapped animals. If left to extended periods of exposure to direct sunlight, in addition to the stress of falling in a deep trench, an animal will stress and dehydrate quickly, creating a detrimental condition. Many times... this can result in the death of the entrapped animal."

The report adds: "Results from these activities graphically illustrate the impact trenches impose on the immediate and peripheral environments. Based on our observations, we strongly recommend conducting trench surveillances with trained, qualified personnel experienced in safe animal handling and species identification."

In two other CEHMM trench monitoring efforts, few or no animals were found in the trenches. In one case, this was "attributed to the trenching crew's ability to trench in short sections and backfill often. This method prevented long open stretches of trench for any extended amount of time." In the other case, it was due to the trenching being done at a better time of year (winter) for avoiding animals.

There is also a risk during trenching of encountering animals that have burrowed underground for hibernation for a shorter period. If a qualified biologist is not on site before and during this process to mitigate damage by relocating the animals, some wildlife could be killed.

Mottled Rock Rattlesnake (*Crotalus lepidus lepidus*)

--New Mexico Threatened

The Mottled Rock Rattlesnake is found only in New Mexico, Texas, and Chihuahua, Mexico. In New Mexico, the rattlesnake is limited to the southern Guadalupe Mountains and exists within all canyons throughout the Guadalupe Ridge. It is rather common within the park, being the most frequently encountered rattlesnake in Carlsbad Caverns National Park (CCNP). It is found around exposed bedrock, where it feeds on lizards, snakes, and small mammals.

The discussion above (see Gray-Banded Kingsnake) about an open trench applies to this species as well.

Gray Vireo (*Vireo vicinior*)

--New Mexico Threatened

The Gray Vireo is a small gray songbird, found in the dry foothills and bajadas west of the Great Plains in New Mexico. In southern parts of New Mexico, the bird uses juniper-oak woodlands and desert riparian communities. In 2003, some park canyons and ridges were surveyed, and a minimum of 42 probable nesting territories were located. Thus, the park probably contains the largest nesting group in the state of New Mexico.

While Gray Vireos may not nest immediately adjacent to the trench, they will feed in that area, and many other bird species are potential nesting species. To protect this species and all migratory birds that might choose to nest in the area, professional biologists should use a nest search protocol to determine the presence of any nesting species within the project area, unless construction is accomplished entirely during the non-breeding season (October-February). Too much human activity near a nest would result in nest failure.

Varied Bunting (*Passerina versicolor*)

--New Mexico Threatened

The Varied Bunting frequents desert canyons, thorn-scrub, and riparian edge habitats in the extreme southern portion of New Mexico. Very small breeding populations exist at three locations in southern New Mexico, including within the park. The 2003 bird survey in the park detected the presence of at least eight nesting pairs of Varied Buntings in five canyons, indicating that there were a larger number within Eddy County than previously known.

Varied Buntings are extremely rare in the state, and a high percentage of the state population is found in the park. While most of their nests have been found in canyon bottoms, some have been found at the crest level, and they feed actively on the top when the nests are close by in the canyons. They are found in the park regularly by the first week of May. While they are less common in open desert with dense vegetation, they do occur there. They are often present in the area and very difficult to find until some monsoon rains occur.

To protect this species and all migratory birds that might choose to nest in the area, professional biologists should use a nest search protocol to determine the presence of any nesting species within the project area, unless construction is accomplished entirely during the non-breeding season. Too much human activity near a nest would result in nest failure.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA, 16 U.S.C. 703-712) prohibits, among other actions, the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior through a permit or other regulation. Protected species of birds are listed under Title 50, Code of Federal Regulations, Part 10. Currently 1,007 species of birds are protected by the MBTA, including nearly all species that are native to the United States.

Activities that involve modification of habitats in which birds are nesting, or occurring adjacent to habitats in which birds are nesting, might result in the taking of protected birds through direct mortality of eggs, nestlings, or adults, or indirectly by causing nest abandonment, thereby leading to death of eggs or nestlings. Mitigating actions that the park would consider to minimize or eliminate the potential for take during construction activities include:

- Conduct the activity between October and February outside the local nesting season (March-September), so there are no active nests of birds that may be inadvertently damaged or destroyed by the project actions, and thus, no need to conduct surveys for active nests.

- If a proposed project or action may take migratory birds through disturbance or alteration of nesting habitat, and work cannot occur outside the local nesting season, the park should provide the USFWS with an explanation for why work has to occur during the migratory bird nesting season. The park should make every effort to complete the work outside the migratory bird-nesting season.

- To determine if migratory birds are nesting on-site and therefore potentially at risk by the activity, the park should conduct initial general surveys of the project area during the best

biological time frame for detecting the presence of the locally nesting birds (to locate potential territories that may be in harm's way), followed by nest searches in the project area shortly before the disturbance will occur.

--If no migratory birds are found nesting in the proposed project or action areas immediately prior to the time when construction and associated activities are to occur, then the project activity may proceed as planned.

--If protected species of birds are present and nesting in the proposed project or action area when project activities are slated to occur, it is necessary to contact the USFWS Ecological Services Field Office and the USFWS Regional Division of Migratory Birds for guidance on appropriate next steps for minimizing risk of violating the MBTA.

Visual Resources

Visual resources are an important component of the visitor experience at Carlsbad Caverns National Park. The view from the visitor center to the south and west has been identified as a key visual resource of the park, which is classified as a mandatory Class I clean area in the Clean Air Act. This includes the New Mexico and Texas plains to the south and the Guadalupe Escarpment. Other important visual resources in the park are views along the Walnut Canyon Road and the Desert Scenic Loop Drive.

The proposal for the replacement of the park's water line on the Mesa Top is in a scenic portion of the Desert Scenic Loop Road. The visual quality along the Desert Scenic Loop Road is already somewhat compromised by the presence of a million gallon water tank at west end of the water line that is to be replaced. The water line is visible from the Desert Scenic Loop Road. The existing waterline is partially visible from the National Register Carlsbad Caverns Historic District and Cultural Landscape and is a visual intrusion to the Historic District and Cultural Landscape.

Cultural Resources

Cultural Resources occur in the general area, but not within the project corridor. Locations are not described here because that is sensitive information. Archeological surveys have been conducted for this project. An **Assessment of Effect** has been conducted for this project. There are no known ethnographic resources located in or near the proposed project site area.

Regarding Archival Studies, park staff conducted an archival search of the State Register of Cultural Properties, the National Register of Historic Places, the Archaeological Records Management Section of the State Historic Preservation Division, the Carlsbad Caverns Cultural Resources records, and the Guadalupe Mountains National Park Fire Management Office Records. The Search revealed four previously recorded sites near but not within 300 feet (100 meters) of the project corridor and one low density, low frequency non-diagnostic lithic surface scatter adjacent to the corridor.

Native American Concerns

The project area is within a natural landscape, and the United States has a unique legal and political relationship with Indian tribal governments, (Barack Obama. Executive Order November 9, 2009). Traditional Associated Tribes and Pueblos of the park have expressed their views as "...being taught not to disturb the natural world in a significant way and that to do so may cause harm...Natural resources can best be protected by managing the land as natural as it was..." (Pawnee letter of consultation, 2013). Impacts from the project would be of concern to the Native Americans.

Cultural Landscape

The Carlsbad Caverns Historic District and Cultural Landscape (including the Visitor Center and park headquarters) is near but not in the project area, and 36 archeological sites are within one mile (1.6 kilometer) of the project. The historic district includes the parking terraces (IDLCS 61740), stone curbs (IDLCS 61747), masonry stone culverts (IDLCS 61745) and other non-continuous fieldstone masonry retaining walls (IDLCS 61746) along the entrance road (Biallas, n.d.).

The existing above-ground waterline is partially visible from the National Register Carlsbad Caverns Historic District and Cultural Landscape as a visual intrusion.

Air Quality

Carlsbad Caverns is located within a mandatory Class I clean area, as defined in by the Clean Air Act. This classification directs the park to preserve air quality including the characteristics of visibility and human health. Also, the park is located within New Mexico's Pecos-Permian Basin, Intrastate Air Quality Control Region with a goal of maintaining national air quality standards.

Soundscape Management

The natural soundscape of national parks is identified as a quality that needs to be preserved, as stated in NPS Management Policies 2006, and Directors Orders #47. The natural sounds in a park that can be identified include air movement (wind) and wildlife sounds. Visitors have the opportunity to appreciate these sounds outside the Visitor Center, walking the trail to the natural entrance, and hiking along other park trails. The soundscape for this developed area of the park prior to project construction is described as the natural ambient sound level, that is, the environment of sound that exists in the absence of human-caused noise. This is the baseline condition, and the standard against which current conditions in a soundscape will be measured and evaluated.