Sequoia and Kings Canyon National Parks

NPS
U.S. Department of the Interior

Sequoia and Kings Canyon
National Parks
California

REHABILITATION OF A WATER DISTRIBUTION SYSTEM

Giant Forest, Wolverton, Lodgepole, Wuksachi, and Red Fir areas

Environmental Assessment / Assessment of Effect

April 2011

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U.S. Department of the Interior
National Park Service

Environmental Assessment/ Assessment of Effect
To Address the Rehabilitation of a Water Distribution System

Sequoia and Kings Canyon National Parks
Tulare and Fresno Counties, California

SUMMARY

The National Park Service (NPS), Sequoia and Kings Canyon National Parks (parks) has prepared an environmental assessment/ assessment of effect (EA/AoE) that analyzes long-term options for addressing deficiencies in the existing water distribution system that serves the Giant Forest, Wolverton, Lodgepole, Wuksachi, and the Red Fir maintenance area, within Sequoia National Park. The purpose of this project is to develop a comprehensive plan and design that considers the overall water system and prioritizes work elements based on the most critical needs, while providing for public health and safety, improving resource efficiency, and protecting park resources and values, in accordance with legal requirements and NPS policies.

Sections of the existing water distribution system range from 30 to 70 years old. The system is in poor and deteriorating condition, fails on a regular basis, and does not comply with current state drinking water regulations. The water distribution system suffers from severe leakage, dead ends, low or excessively high pressure zones, non-working valves, and other system deficiencies. Frequent breaks and leaks in the water lines have contributed to nearly a million gallons of water loss annually. The Environmental Protection Agency (EPA) and the California Department of Public Health (CDPH) set drinking water standards to protect public health by limiting levels of contaminants permissible in drinking water. Results of water quality testing, at some locations, have shown that the parks' are not in compliance with current state drinking water regulations.

The parks' 2007 *Final General Management Plan and Comprehensive River Management Plan / Environmental Impact Statement* (GMP) provides direction for desired future conditions for park resources and visitor experiences. A key element of the approved GMP is to make facilities, including utilities, more resource-efficient and to implement water conservation measures. In accordance with the vision of the GMP, action alternatives in this environmental document consider sustainable design elements to achieve water conservation goals and resource-efficiency.

The EA/AoE evaluates alternatives to address the deteriorating and non-compliant water distribution system, and analyzes the potential effects of the alternatives. There are a number of project elements that would be common to all action alternatives; the key difference among alternatives is the consideration of a new water supply source. The EA/AoE analyzes three alternatives, including the no-action alternative. Under the no-action alternative (alternative A), the park would keep the existing water distribution system and perform routine maintenance and repairs to the water system. Over the long-term, repairs and maintenance would no longer be effective and other measures would need to be considered, such as closing areas to various uses, until such time as a permanent solution could be implemented. The water system would continue to be out of compliance with state levels of contaminants permissible in drinking water.

Under alternative B, the parks' would perform deferred maintenance and improve the existing water distribution system to be compliant with state drinking water standards. No new water supply source would be developed under this alternative. Instead, there would be additional rehabilitation to the existing system and additional water disinfection treatment.

Under alternative C, the preferred alternative, the parks' would perform deferred maintenance and improve the existing water distribution system to be compliant with state drinking water standards. A new

groundwater source would be developed at the Pinewood picnic area and would supply water to facilities in the Giant Forest area, thereby improving drinking water quality by reducing the age of water and isolating nearly one mile of existing water main.

This proposal considers actions that would require obtaining federal permits and permits from the state of California; therefore, this environmental document has been prepared to satisfy the requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). In addition, the process and documentation required for preparation of this environmental document would be used to comply with section 106 of the National Historic Preservation Act (NHPA) resulting in an EA/AoE.

Notes to Reviewers and Respondents

If you wish to comment on this EA/AoE, you may post comments online at http://parkplanning.nps.gov/seki or mail comments to Superintendent, Sequoia and Kings Canyon National Parks, Attn: Water Distribution Rehab, 47050 Generals Highway, Three Rivers, CA 93271, or fax comments to (559) 565-4202. This EA/AoE will be on public review for 30 days.

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we would be able to do so. We make all submissions from organizations and businesses, and individuals identifying themselves as representatives or officials of organizations or businesses, available for public inspection in their entirety.

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ACRONYMS AND ABBREVIATIONS

AoE	Assessment of Effect
BMPs	Best Management Practices
CBA	Choosing By Advantages
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CDFG	California Department of Fish and Game
CNRA	California Natural Resources Agency
COE	United States Army Corps of Engineers
DBP	Disinfection byproduct
EA	Environmental Assessment
EPA	Environmental Protection Agency
FHA	Fire hydrant assembly
gpd	gallons per day
gpm	gallons per minute
HAA5	Haloacetic Acids
HDPE	High-density polyethylene
LCC	Life Cycle Costs
LT1ESWTR	Long Term 1 Enhanced Surface Water Treatment Rule
MCL	Maximum contaminant level
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NFPA	National Fire Protection Association
NPS	National Park Service
NRHP	National Register of Historic Places
ppb	parts per billion
PRV	Pressure reducing valve
PSV	Pressure sustaining valve
§106	Section 106 of the NHPA
SEKI	Sequoia and Kings Canyon National Parks
state	State of California
SWRCB	California Regional Water Quality Control Board
TTHM	Total Trihalomethanes
USFWS	United States Fish and Wildlife Service
VA	Value Analysis

GLOSSARY

Biofilm- Biofilm is a complex mixture of microorganisms, organic and inorganic materials that form a layer on and coat various surfaces. In a water distribution system, biofilm may form on the inner surface of the water distribution piping.

Disinfection byproducts- Disinfection byproducts are formed when disinfectants used in a water treatment react with bromide and/or natural organic matter (i.e., decaying vegetation) present in the source water. Different disinfectants produce different types or amounts of disinfection byproducts. Disinfection byproducts for which regulations have been established have been identified in drinking water, including trihalomethanes, haloacetic acids, bromate, and chlorite (EPA 2010).

Haloacetic Acids (HAA5)- A group of chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring organic and inorganic matter in water. The regulated haloacetic acids, known as HAA5, are: monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid. The Environmental Protection Agency regulates HAA5 at a maximum allowable annual average level of 60 parts per billion (EPA 2010).

Pigging- Line pigging is an internal pipe-cleaning process that uses a small device, known as a pig, that is inserted into the lines and pushed through them to remove biofilm or other foreign matter.

Pipe bursting- Pipe bursting is a well-established method for trenchless replacement of worn out and undersized gas, water, and sewer pipes. An existing pipe is replaced size-for-size or up-sized with a new pipe in the same location.

Pressure reducing valve (PRV)-Reduces pressure to a preset level downstream of the valve.

Pressure sustaining valve (PSV)-Maintains pressure at a preset level upstream of the valve.

Slipline- Sliplining is a method for rehabilitating buried pipelines (water, sewer and gas) by pushing and/or pulling a new liner pipe into the existing pipe.

Trihalomethanes (TTHM)- Trihalomethanes are a group of four chemicals that are formed along with other disinfection byproducts when chlorine or other disinfectants used to control microbial contaminants in drinking water react with naturally occurring organic and inorganic matter in water. The four trihalomethanes are chloroform, bromoform, bromodichloromethane, and dibromochloromethane. The Environmental Protection Agency regulates total TTHMs at a maximum allowable annual average level of 80 parts per billion (EPA 2010).

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INTRODUCTION

PURPOSE AND NEED

BACKGROUND

The water distribution systems in the developed areas of Sequoia and Kings Canyon National Parks (parks or park) serve over 1.6 million visitors and employees annually. The majority of visitors spend time in the developed areas of the parks' located on the western slope of the Sierra Nevada. This project is located within Sequoia National Park, and encompasses the water distribution systems in and around Giant Forest, Wolverton, Lodgepole, Wuksachi, and the Red Fir maintenance facility (Figure 1). It is the largest water distribution system within the parks; serving the most people. During the summer months, when visitation is at its peak, this water distribution system serves approximately 2,900 visitors and employees daily.

Sequoia National Park was established in 1890, and infrastructure development to support visitor and park activities began shortly thereafter. Sections of the existing water distribution system are from the 1930s when they were first installed to support park facilities. Throughout the years, upgrades and extensions to the water system were completed as water system demands changed; responding to reduced infrastructure in some areas and added infrastructure in other areas. There was never an overall comprehensive plan completed for the entire water system. As a result, the sizing of the water lines may not be appropriate for the use and need in some areas and have resulted in problems with water quality and water delivery capabilities.

The Environmental Protection Agency (EPA) and the California Department of Public Health (CDPH) set drinking water standards to protect public health by limiting the levels of contaminants permissible in drinking water. All utilities using surface water sources are required by EPA to disinfect the water prior to delivery to their consumers. When disinfectants, such as chlorine, are used in the treatment of drinking water, they can react with naturally-occurring organic and inorganic matter to form disinfection byproducts (DBPs). EPA has set monitoring requirements and maximum contaminant levels (MCLs) for some of the more common DBPs, such as total trihalomethanes (TTHM) and haloacetic acid 5 (HAA5). Water quality can also be affected by the age of the water in the system. The extensive water system in the park consists of miles of piping. If the demand for water is low at the final destination, the water does not turnover adequately and continues to age in the water system. As the water ages, the chlorine residual in the water system is depleted which can lead to potential biological growth and the formation of DBPs. Results of water quality testing have shown that the park has exceeded the MCLs for TTHMs and HAA5s in some locations, and is out of compliance with current State of California (state) drinking water standards.

Sections of the existing water distribution system are between 30 and 70 years old. The water system is in poor and deteriorating condition, fails on a regular basis, and does not comply with current state drinking water standards. The water distribution system suffers from severe leakage, dead ends, low or excessively high pressure zones, non-working valves, and other system deficiencies. Records indicate that breaks and leaks result in approximately one million gallons of water loss annually; of which 90 percent of the water leakage is in the Giant Forest area. An inordinate amount of staff time is spent fixing numerous breaks and failures, causing additional deferred maintenance to other park facilities and systems. For the water distribution system to continue to support visitor services, park and concessioner employees, and residents; and, to meet state drinking water standards, fire suppression codes, and NPS policy; rehabilitation and replacement of the water system is critical.

The intent of this environmental document is to develop a comprehensive water system design and rehabilitation plan prioritized by the most critical needs. This environmental document evaluates the environmental impacts associated with the full development of all project components identified in each alternative. Project components would occur in phases and be implemented as funding becomes available.

The process and documentation required for preparation of this environmental document would be used to comply with section 106 of the National Historic Preservation Act (NHPA), in accordance with section 800.8(3)(c) of the Advisory Council on Historic Preservation's regulations (36 CFR Part 800), and would be submitted to the California State Historic Preservation Office (SHPO) for review and comment. This environmental assessment/assessment of effect (EA/AoE) has been prepared to meet the requirements of the National Environmental Policy Act (NEPA), the NHPA, and the California Environmental Quality Act (CEQA).

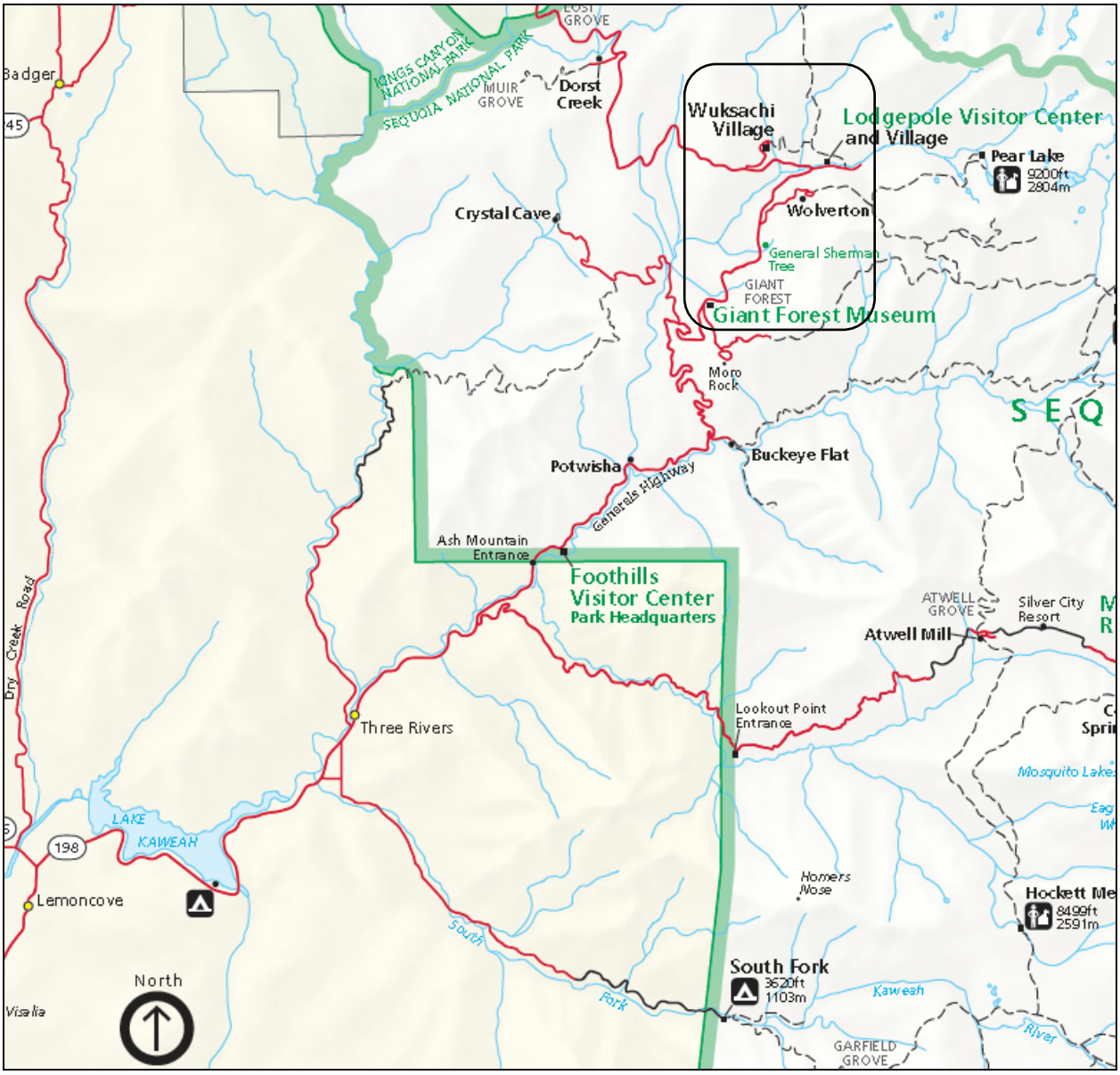

Figure 1. General Project Area

PROJECT PURPOSE AND NEED

The purpose of this project is to improve water quality to address code compliant issues with state drinking water standards and provide a dependable potable water supply, by rehabilitating the deteriorated water system in a manner that minimizes impacts to visitors and park and concessions staff; improves resource efficiency and sustainability; meets legal requirements; and, protects park resources.

There is a need to meet state drinking water quality regulations.
Due to the extensive water system and miles of piping, the demand for water at some of the more remote locations may not turn over adequately and water continues to age in the water system. As the water ages, the chlorine residual in the water system is depleted and can lead to biofilm growth and the formation of DBPs. Consequently, park staff has to maintain excessive chlorine residuals to retain potability. The high chlorine residuals have resulted in contributing to TTHM and HAA5 formation. In addition, the aging water lines create a chlorine demand themselves due to contamination caused by deterioration of the piping materials.

The CDPH has cited the parks' numerous times for exceeding MCLs for TTHMs and HAA5s, and has requested that a permanent solution be engineered to address water quality issues.

The Lodgepole water treatment plant is over 50 years old and is an older style pressure filter that does not comply with the two-log removal of cryptosporidium as per the enhanced surface water treatment rule #1 enacted January 14, 2002 (Long Term 1 Enhanced Surface Water Treatment Rule – LT1ESWTR, 67 FR 1812, January 14, 2002, Vol. 67, no.9). The state has allowed interim operation of the facility as a "grandfathered" technology, however, officials could mandate replacement based on any future excursions from the water quality standards.

There is a need to rehabilitate the aging and deteriorating water distribution system.
Emergency repairs and maintenance to the deteriorated water distribution system are very costly. Frequent response to water line breaks is an inefficient use of staff time and defers work on other maintenance projects.

Frequent breaks and leaks in the water distribution system have resulted in system shutdowns for extended periods of time. Shutting the system down creates the potential for multiple points of direct contamination due to depressurization of the system and subsequent backflow.

There is a need to reduce the risks associated with operating the water system.
Confined spaces, high pressure exposure, and locating emergency breaks in sometimes adverse conditions over uneven and steep terrain, result in increased risks to employee safety.

NPS staff working on the water distribution system could be exposed to hazardous materials since these water distribution systems consist of a variety of materials used in the plumbing industry over the past 70 years, including leaded joint pipe.

Breaks and leaks in the water lines most often occur in the winter when staff is limited and it is very difficult for staff to locate and access the leaks in sometimes adverse weather conditions under up to eight feet of snow.

There is a need to ensure uninterrupted potable water service and protect the health and safety of visitors and NPS and concessioner employees.
The increasing difficulty of maintaining fire hydrants in fully operational status could result in danger to visitors, employees, and infrastructure resulting from the NPS's inability to respond to structural fires within the parks.

Periodic repairs to the water system results in shutdowns that inconvenience visitors, NPS and concession operations, and NPS and concessioner employee residents and their families.

There is a need to establish a comprehensive plan and design of the water distribution system to be resource efficient.
There was never an overall comprehensive planning design completed on the entire water system that serves the Giant Forest, Wolverton, Lodgepole, Wuksachi, and Red Fir maintenance facility.

Development of the water distribution system responded to water demands from reduced infrastructure in some areas and increased infrastructure in other areas, which resulted in inappropriately-sized water lines for the end use and need in some areas.

The design and operation of the water distribution system needs to consider future build-out.

There is a need to protect park resources.
Emergency response and repairs can damage park resources from access to water line breaks in areas of difficult terrain and in ecologically sensitive areas.

Park resources need to be protected from pipes leaking chlorinated water.

Records indicate that breaks, leaks, and other deficiencies in the water system result in one million gallons of water loss annually.

In accordance with NPS *Management Policies 2006*, "water systems will be designed and maintained to provide sufficient water to operate fire sprinkler systems and fire hydrants. . .water supply systems . . . must comply with all applicable state and federal health standards" (section 9.1.5.1). The *Safe Drinking Water Act*, *2007 Final General Management Plan/ Environmental Impact Statement* (GMP), and *Director's Order 83: Public Health* and *Reference Manuals* reinforce the need for this project.

PROJECT OBJECTIVES

The objectives of the proposed project to rehabilitate the water distribution system are to:

- Provide high quality drinking water that meets or exceeds state drinking water regulations.
- Determine the most appropriate life-cycle solution that is durable and low in maintenance, and is the best solution to reduce operational and maintenance costs and inefficiencies.
- Develop a comprehensive design and plan that addresses immediate deficiencies, considers future build-out, and prioritizes work elements.
- Design the water system to be sustainable, resource efficient, and minimize impacts on park resources.

- Provide adequate and dependable water delivery to meet fire suppression capabilities.

- Ensure an uninterrupted potable water supply to minimize inconveniences to visitors, park and concessioner operations, and employee residents and their families.

- Provide a safe and healthy work environment.

PLANNING CONTEXT: OVERVIEW OF EXISTING INFRASTRUCTURE AND DEFICIENCIES

The overall water system is integrated and consists of two sources: Lodgepole and Wolverton. The two water sources are physically interconnected; however, Lodgepole functions as an independent system under existing conditions (Figure 2). The Lodgepole water system is fed by water diverted from Silliman Creek, treated at the Lodgepole water treatment plant, and distributed to facilities within the Lodgepole developed area. The Wolverton water system is fed by water diverted from Wolverton Creek; a groundwater well located in Wolverton meadow can be utilized in emergencies when surface water turbidity is too high for the water treatment plant during summer storms. Water is treated at the Wolverton water treatment plant before being distributed to facilities within the Wolverton area, the Giant Forest water storage tank, and the water storage tanks in Wuksachi. For ease of explanation, summaries of the existing infrastructure and deficiencies are separated into the following four areas: Lodgepole, Wolverton, Giant Forest, and Wuksachi/ Red Fir maintenance area.

Lodgepole

Overview of Existing Infrastructure

The Lodgepole water system was originally constructed in 1933, substantially reconstructed in 1963 (NPS 1980), and is over 40 years in age. It is an independent water system with a water treatment plant, water storage tank, and approximately 26,000 feet of distribution lines. A water diversion structure on Silliman Creek conveys water approximately two miles to the Lodgepole water treatment plant, which is located within the NPS employee housing area (Photos 1 and 2). The Lodgepole water treatment plant is a mixed media pressure filter system (two filters) with a capacity of approximately 64,800 gallons per day (gpd) or 45 gallons per minute (gpm) (Arber 2010a). Sodium hypochlorite disinfection is the technology currently used to treat the water. The water treatment technology does not meet current standards and is out of compliance; however, the state has granted continued operation under a “grandfather” clause. A 200,000 gallon, buried concrete storage tank is located approximately 400 vertical feet above the water treatment plant. Distribution piping, 3-inch through 8-inch, provides water to facilities within the Lodgepole developed area, including the visitor center, market, service station, nature center, park residences, and campgrounds and comfort stations.

Until five years ago, the water system at Lodgepole was looped (hydraulically more efficient); however, the line was crushed by a shifting boulder and the line was closed with a gate valve. Currently, a water main installed under the Marble Fork of the Kaweah River serves as the only Lodgepole system supply. Recent storms in summer 2010 caused substantial channel erosion that created two risks for future failure of the water main. The first is substantial erosion of the channel bank on the south side of river that has left the water main less than five feet from the edge of the bank for over 100 lineal feet. The second is that the recent storms exposed and damaged a sewer line in close proximity to the water main. The water main is approximately the same depth as the sewer line and installed 50 lineal feet downstream of the sewer line. Emergency repairs to the sewer line and channel stabilization occurred in fall 2010. The park engineer expects that another significant water event will have a high potential to expose and damage the water line within the next five years.

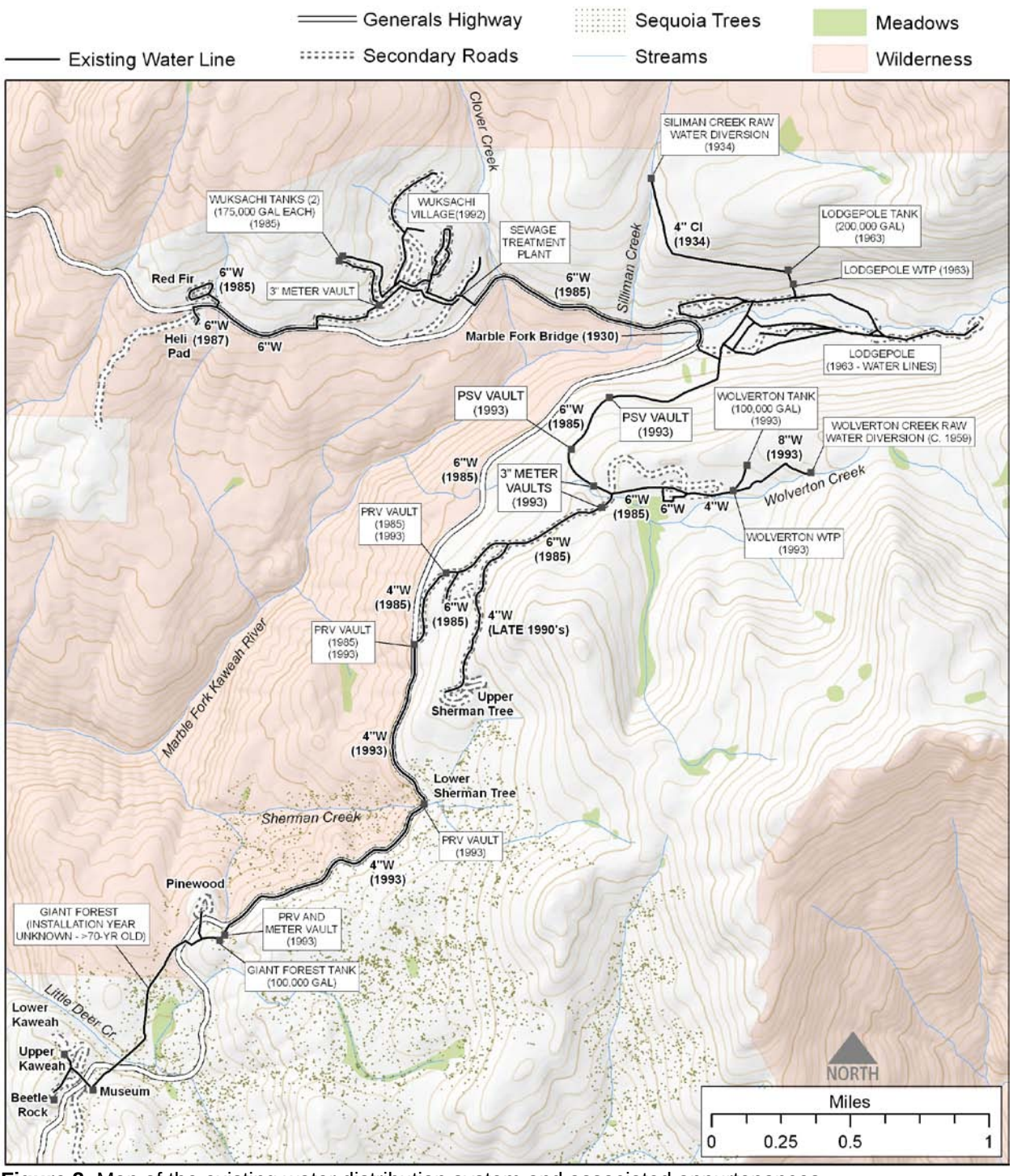

Figure 2. Map of the existing water distribution system and associated appurtenances.

In the 1990s, some improvements were made to the water distribution system including installation of pressure reducing valves (PRVs) and upgraded services (Arber 2010a). The system is interconnected with the Wolverton water distribution system via a PRV/valve vault, but the interconnecting valve is currently never opened due to pressure balancing issues. Under previous emergencies, where the Wolverton

interconnect was opened, residents and staff complained about varying taste and high pressures damaged plumbing fixtures.

Photo 1. Water intake structure in Silliman Creek.

Photo 2. Lodgepole water treatment plant.

Deficiencies

- There are numerous deficiencies with the water diversion structure and piping at Silliman Creek and include the following.
    - Clogging of the intake screen with organic matter. The screen is difficult to clean, remove, and reinstall.
    - Rocks and sand accumulate near the intake pipe and flushing valve, and requires annual maintenance to keep the intake clear of debris.
    - The 4-inch water line isolation valve near the dam is inoperable.
    - The concrete dam is undermined, reducing effectiveness.
    - The 4-inch water line from the intake to the sedimentation settling structure has clogged several times with sand. The line does not have cleanouts, so the operators must cut into the line to remove the clogged material.
    - The sedimentation settling structure is approximately 300 linear feet downstream of the water intake and the functionality of the structure is questionable.
- The existing Lodgepole water treatment plant is over 50 years old and is "grandfathered" in as an acceptable water treatment technology. However, state officials could mandate replacement based on any future excursions from water quality standards.
- The Lodgepole/Wolverton interconnection valve vault is currently isolated. The functionality of the PRV is questionable, and operators have indicated that maintenance can be difficult due to the high inlet pressures and confined space. The valve is likely beyond its useful life cycle.
- A 4-inch water main between the Lodgepole water treatment plant and the Log Bridge campground is broken, preventing the water distribution system from being a looped system. The only existing line connecting both sides of the river is buried under the Marble Fork of the Kaweah River, and is subject to damage by storm events.
- An 8-inch water main north of the Lodgepole Market is very close to an eroding slope along the south side of the Marble Fork of the Kaweah River.

Wolverton

Overview of Existing Infrastructure

The Wolverton water source provides most of the water for the system as a whole. In 1959, a water system, consisting of a concrete diversion dam, a storage reservoir, and pipelines, was constructed and

water was diverted from Wolverton Creek to support the former Wolverton ski area (NPS 1980). During the 1980s, the decision to replace the historical water supply, Wolverton Creek, with a groundwater source was made due to changing federal and state regulations requiring a higher level of treatment for surface water (NPS 1992). The NPS implemented a groundwater supply; however, the only well drilled of sufficient quality did not provide the quantity to meet demands. Therefore, in 1992 a plan was developed to construct a water treatment facility to once again divert water from Wolverton Creek, and replace and add new water lines to serve Giant Forest, the Sherman Tree area, and Wuksachi.

Today, the Wolverton water system consists of a water treatment plant, water distribution lines, and an underground water storage tank. A water diversion structure in Wolverton Creek conveys water to a 20,000 gallon water sedimentation tank, then to the water treatment plant (Photo 3). In addition, a groundwater well in Wolverton Meadow (within the Wolverton developed area) is capable of providing water to the water treatment plant, when needed. For example, the well can be utilized if a heavy rain event increases the turbidity in the creek and the surface water intake must be shut down, or when the water storage tank does not have enough water to support demand. Between November 2009 and November 2010, the well ran for 135 hours, and produced approximately 345,000 gallons of water. The slow sand filter water treatment plant was constructed in 1993 (Photo 4). It has three parallel slow sand filters with sodium hypochlorite disinfection. The capacity of the water treatment plant with two of the three slow sand filters in operation is approximately 90,000 gpd or 62.5 gpm (Arber 2010a). In an emergency, all three filters can be run at a total capacity of 130,000 gpd (Arber 2010a). A 100,000 gallon, partially buried, concrete reservoir tank stores the finished water for distribution.

The water distribution system is widespread and provides water to facilities in the Wolverton developed area, the Giant Forest water storage tank, Wuksachi water storage tanks, and the emergency connection at Lodgepole. From the Wolverton water treatment plant, a 6-inch water main follows the Wolverton access road to the “Old Army Road” northeast, and connects with the Wolverton/Lodgepole interconnection PRV vault. From this point, a 6-inch water main continues east along the Generals Highway to the Wuksachi water storage tanks.

From the Wolverton water treatment plant, a 6-inch water main follows the Wolverton access road to the intersection with the corrals (currently used for administrative purposes). Two water lines spur from the Wolverton access road; a 4-inch water main provides water to the upper Sherman Tree comfort station; and, a 6-inch water line provides water to the corrals. A 4-inch water main continues along the Wolverton access road to the intersection with the Generals Highway. Water is provided to the lower Sherman Tree comfort station and drinking fountain, and the 4-inch water main continues south along the Generals Highway to the Giant Forest water storage tanks. This section of water main was installed within the past 10-20 years, and there is no history of failures.

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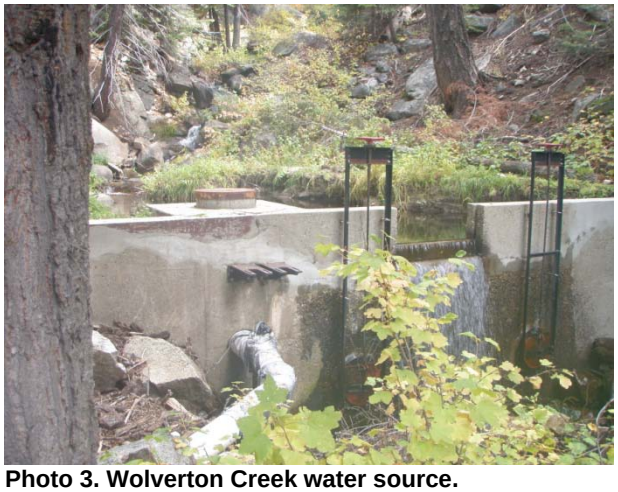

Photo 3. Wolverton Creek water source.

Photo 4. Wolverton water treatment plant.

Deficiencies

- The sodium hypochlorite disinfection system at the Wolverton water treatment plant is currently only capable of providing enough chlorine for a finished water pumping rate of 45 gpm. The capacity of the water treatment plant with two of the slow sand filters in operation is approximately 62.5 gpm.
- The existing flow metering stations of the main lines toward the Lodgepole developed area and Giant Forest are not operational.
- The pressure sustaining valves (PSVs) along the 6-inch main on the "Old Army Road" between Wolverton and Lodgepole currently do not function and appear to be beyond their useful life.
- The existing PRV vaults along Generals Highway between Wolverton and the Giant Forest are all flooded, and the PRV's appear to be beyond their useful life.
- The park is currently unable to monitor water usage at upper Sherman, lower Sherman, and the corrals because there are no flow monitoring devices. Without flow monitoring, the park has difficulty identifying the location of main breaks and leaks throughout the system.

Giant Forest

Overview of Existing Infrastructure

Major development occurred within the Giant Forest in the 1920s and 1930s. Construction of the water system at the Giant Forest began in 1936, and was followed by a major expansion and improvement project in 1939. The expansion included the installation of a 100,000 gallon buried concrete tank with two 50,000 gallon compartments to hold finished water, and approximately 17,000 feet of piping for transmission of water from Wolverton Creek to facilities in the Giant Forest. At one time, the water distribution system served a lodge, tent cabins, staff housing, and other facilities. In 1980, an environmental impact statement was prepared to determine the appropriateness of these facilities in the delicate environment of the sequoia groves. It was determined that the facilities would be removed and relocated to Wuksachi, and the Giant Forest area would be rehabilitated. Following removal of facilities from the Giant Forest area, most of the secondary water distribution lines that serviced those facilities were capped and abandoned in place.

Currently, water is delivered from the Wolverton water treatment plant to a 100,000 gallon buried concrete water tank in the Giant Forest (Photo 5). From the tank, a 2-inch water line veers north and provides water to a comfort station, drinking fountain, and hose bib in the Pinewood picnic area. Also from the tanks, a 6-inch water main heads south, crosses over Generals Highway into the restoration area of the Giant Forest, to a water fountain near the Big Tree Trail parking area (Photo 6). From the water

fountain, the 6-inch water main crosses the Generals Highway and distributes water to existing facilities, including the Giant Forest Museum; the comfort station near the Giant Forest shuttle stop; the Beetle Rock educational center; one employee residence; and, a comfort station at Lower Kaweah Camp.

Photo 5. Giant Forest water storage tank.

Photo 6. Giant Forest area with location of existing water line alignment.

Deficiencies

- The 70 year old distribution piping from the Giant Forest tank to the Giant Forest museum experiences frequent line breaks, and there may be considerable water loss through unknown leaks. Most breaks occur during winter months when access is difficult.
- Chlorine residuals are often depleted by the time water is conveyed from the Wolverton area to the Giant Forest. DBP sampling results are elevated in the Giant Forest area and may be attributed to a biofilm layer that has been observed in the interior of the existing distribution line.
- Some of the distribution lines, that served facilities previously located in the Giant Forest, may not be properly isolated.
- An existing isolation valve vault, near the Big Tree Trail parking area, is difficult to access, particularly during the winter.
- An existing 6-inch water main services the Lower Kaweah comfort station and is too large for the low demand.
- The integrity of a water meter downstream of the Giant Forest water tank is questionable.
- The Giant Forest water storage tank is over 70 years old and is in need of rehabilitation or replacement.

Wuksachi/ Red Fir maintenance area

Overview of Existing Infrastructure

The 1980 *Final Environmental Impact Statement Development Concept Plan for Giant Forest/ Lodgepole* (DCP) determined that facilities would be removed from Giant Forest and relocated to Wuksachi. During the 1980s and 1990s, the NPS constructed the Red Fir maintenance building, the Clover Creek wastewater treatment plant, fire station, seasonal and permanent staff housing, bathhouse for concessioner use, interpretive structures, roads and parking areas, recreational vehicle (RV) housing area, pedestrian bridges, walks/ service drives, propane fuel area/ distribution system, and utility infrastructure. Concession facilities that have been built include three lodges with 102 rooms, a restaurant/ store/ administration building, a bathhouse, and staff cabins. Additional development may occur at Wuksachi in the future.

The Wuksachi water distribution system is approximately 26 years old. The system consists of two 175,000 gallon, above-ground, steel water storage tanks; 6-inch and 10-inch main line piping; and, pressure controlling PRV vaults. The Wolverton water treatment plant supplies water to the Wuksachi water storage tanks. From the Wolverton water treatment plant, a 6-inch water distribution line follows the Wolverton access road where it veers north along the "Old Army Road" to the Lodgepole developed area. From Lodgepole, the water main follows the Generals Highway east to the Wuksachi water storage tanks (Photo 7). These tanks are slightly lower than the Wolverton water storage tank, and the tanks' water levels are controlled with two-way altitude valves. In emergency situations, if the Wolverton water tank becomes empty, the altitude valves could allow flow in the opposite direction to serve water down to the Giant Forest area. Ten-inch and 6-inch piping distributes water to existing facilities in Wuksachi Village (lodge, motels, residences, etc), and the Clover Creek wastewater treatment plant.

From the Wuksachi water storage tanks, a 6-inch main line follows the Wuksachi access road to the intersection with Generals Highway and continues east to the Red Fir maintenance facility. A 2-inch water line continues east along Generals Highway to the helipad where it terminates.

Photo 7. Wuksachi water storage tanks.

Deficiencies

- The Wuksachi water storage tanks were designed to accommodate full build-out at Wuksachi. Currently, only one of the two water storage tanks is in operation due to low demand.
- There are four large valve vaults at the site of the Wuksachi storage tanks (one for altitude valves, two for tank inlet valves, and one for tank outlet valves). Operators access the vaults via manhole covers. The vaults are considered confined space entry and the size of the manhole cover openings does not allow for easy valve/piping removal and maintenance.

- Near the Wuksachi tanks, a 6-inch water line splits off the 10-inch main line and delivers water to the Red Fir maintenance facility. At this intersection, there is a 3-inch water meter that currently does not function properly and makes it difficult to determine the location of potential leaks.
- The chlorine boosting station at Wuksachi is currently not functioning, making it difficult to maintain chlorine residuals downstream of the tanks. The existing in-line injection vault is inaccessible during winter months, and access to the vault presents safety concerns.
- The 10-inch main line that extends beyond the Wuksachi Lodge continues out to several empty parking lots. With no services beyond the Lodge, this line remains stagnant.
- DBP sampling results are elevated in the Red Fir maintenance area and need to be addressed.
- The Wuksachi area currently has buried fire hydrant assemblies which are inaccessible during the winter months.

PROJECT HISTORY AND DEVELOPMENT

Deficiencies in the water distribution system have been documented for years; spot repairs on the system have kept it functional. As the system continues to age and deteriorate, breaks, leaks, and the need for repairs have increased drastically throughout the years. In 1999, a fire flow analysis and preliminary design analysis to rehabilitate select water distribution systems in the parks was completed (Arber & Associates Inc.). The results of that engineering report identified serious deficiencies with numerous water systems in the parks and determined that a major water line rehabilitation / replacement would be needed, noting that the water distribution system serving the Lodgepole, Giant Forest, Wuksachi, and Wolverton areas was in critical need of rehabilitation. The CDPH- Drinking Water Program has cited the park every quarter for the last three years and is aware that the temporary mitigation measures have not been fully successful. They have requested the park to engineer a permanent solution. In the interim, the NPS posts water quality results and advises the public about the potential health risks associated with the potable water system.

In March 2010, a hydrogeologist from the NPS Water Resources Division met with park staff, NPS Pacific West Regional staff, and an independent engineer (Arber & Associates) to discuss project planning needs, and the feasibility and potential locations for drilling a test well in the Giant Forest area. The intent was to explore a possible groundwater source capable of serving the Giant Forest area. If a reliable groundwater source could be found in this area, it could be isolated from the Wolverton water distribution system, thereby reducing water age in the system and improving water quality. In October 2010, a successful test well was drilled at the Pinewood picnic area in the Giant Forest area, and development of this well is considered in this environmental analysis.

In August and October of 2010, NPS staff and contractor conducted site visits to verify the location of the water lines and appurtenances of the water delivery system, identify and prioritize the most critical needs, and explore potential solutions and alternatives for resolving the water system deficiencies. In October 2010, a topographical survey was completed in order to provide missing data for mapping needs. Schematic designs and field report memorandums (Arber 2010a) were used to address the water system deficiencies and are instrumental in the preparation of this environmental document.

On December 7, 2010 and January 12, 2011, a team of subject matter experts from the parks used the NPS Value Analysis (VA) process as the decision-making tool to select a preferred alternative. Due to the extent of the project, two separate VAs were completed. The VA consists of two independently executed processes; the choosing by advantages (CBA), and the life-cycle costs analysis (LCC). The CBA process is a selection and ranking exercise that is based on the relative advantages of each project component in accomplishing NPS-wide and park-specific goals and objectives. The LCC is a combination of initial construction costs plus costs to operate and maintain the water system over a specific period of time, typically 25 years. In using these processes, the NPS determined the parks' preferred alternative.

LEGISLATION, GUIDANCE, AND PREVIOUS PLANNING

LEGISLATION, POLICIES, AND OTHER GUIDANCE

While there are numerous laws that affect the management of these parks, those laws that are most applicable to this planning effort include: the *Organic Act of 1916* (16 USC 1), the *General Authorities Act of 1970* (16 USC 1a–8), the *Redwood Act* of 1978 (16 USC 1a-1), the *Clean Water Act of 1972* (33 USC § 1251 et seq.), the *Safe Drinking Water Act of 1974* (42 USC 7401 et seq.) the *National Environmental Policy Act of 1969* as amended (42 USC 4321 et seq.), the *Wilderness Act of 1964* (16 USC § 1131 et seq.), the *Wild and Scenic Rivers Act* of 1968 (16 USC § 1271-1287), the *Endangered Species Act of 1973* (16 USC § 1531, *et seq.*, the NPS *Management Policies 2006* (NPS 2006), and the parks' enabling legislation (primarily 26 Stat. 478, 26 Stat. 650, 44 Stat. 818, 54 Stat. 41).

NPS Related Laws and Legislation

The *NPS Organic Act of 1916* (Organic Act) (16 USC 1, 2–4) and the *General Authorities Act* (16 USC 1a–8) direct the NPS to conserve the scenery, natural and historic objects, and wildlife, and to provide for the enjoyment of those resources in such a manner as to leave them unimpaired for future generations. The *Redwood Act* (16 USC 1a-1) reaffirmed the mandates of the *Organic Act* and provided additional guidance on the national park system management as follows:

> The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the national park system and shall not be exercised in derogation of the values and purposes for which these various areas have been established. (16 USC 1a-1)

Impairment of National Park Resources

In addition to determining the environmental consequences of implementing the preferred and other alternatives, NPS *Management Policies 2006* (section 1.4) requires analysis of potential effects to determine whether or not proposed actions would impair a park's resources and values.

The fundamental purpose of the national park system, established by the *Organic Act* and reaffirmed by the *General Authorities Act*, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the NPS the management discretion to allow impacts on park resources and values when necessary and appropriate to fulfill the purposes of the park. That discretion is limited by the statutory requirement that the NPS must leave resources and values unimpaired unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values (NPS *Management Policies 2006*). Whether an impact meets this definition depends on the particular resources that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.

An impact on any park resource or value may, but does not necessarily, constitute impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or

- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to preserve or restore the integrity of park resources or values and it cannot be further mitigated.

Impairment may result from visitor activities; NPS administrative activities; or activities undertaken by concessioners, contractors, and others operating in the park. Impairment may also result from sources or activities outside the park.

Impairment findings are not necessary for visitor experience, socioeconomics, public health and safety, environmental justice, land use, and park operations, etc., because impairment findings relate back to park resources and values. The determination of impairment for the preferred alternative is found in Appendix A.

Other Relevant Laws and Legislation

The *Clean Water Act* (33 USC § 1251 et seq.), passed in 1972 as amendments to the *Federal Water Pollution Control Act*, and significantly amended in 1977 and 1987, was designed to restore and maintain the integrity of the nation's water. It furthers the objectives of restoring and maintaining the chemical, physical and biological integrity of the nation's waters and of eliminating the discharge of pollutants into navigable waters. It establishes effluent limitation for new and existing industrial discharge into U.S. waters; authorizes states to substitute their own water quality management plans developed under section 208 of the act for federal controls; provides an enforcement procedure for water pollution abatement; and requires conformance to permits required under section 404 for actions that may result in discharge of dredged or fill material into a tributary, wetland, or associated water source for a navigable river.

The *Safe Drinking Water Act*, as amended (42 USC 7401 et seq.) (SDWA) is the main federal law that ensures the quality of Americans' drinking water. SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires actions to protect drinking water and its sources: rivers, lakes, reservoirs, springs, and groundwater wells. The SDWA authorizes the EPA to set national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water.

EPA finalized the *Long Term 1 Enhanced Surface Water Treatment Rule* (67 FR 1812) (LT1ESWTR) on January 14, 2002. The purposes of the LT1ESWTR are to improve control of microbial pathogens, specifically the protozoan Cryptosporidium, in drinking water, and address risk trade-offs with disinfection byproducts (EPA 2002).

NPS Policies and Guidance

NPS *Management Policies 2006* (NPS 2006) provides guidance on the design and operation of water supply systems to be used efficiently and sustainably. Water systems will be designed to maximally conserve water and the energy used in its treatment and distribution. Water and delivery systems will be designed and maintained to provide sufficient water to operate fire sprinkler systems and fire hydrants. Water efficient devices will be installed in retrofitting structures and building new structures. Water

supply systems and their operators must comply with all applicable state and federal health standards (section 9.1.5.1).

Director's Order 12: Conservation Planning, Environmental Impact Analysis and Decision-Making (DO-12), and accompanying Handbook, set forth the policy and procedures by which the NPS carries out its responsibilities under the *National Environmental Policy Act of 1969* (NEPA). DO-12 is the governing policy and procedures for how the NPS complies with NEPA. The DO-12 and Handbook lay the groundwork for the way the NPS approaches environmental analysis, public involvement, and resource-based decision-making.

Director's Order 83: Public Health, outlines what the NPS will do to ensure compliance with prescribed public health policies, practices, and procedures with respect to all public health activities within areas of NPS jurisdiction (NPS 2004). *Reference Manual 83: Drinking Water Standards* (NPS 2004) provides additional guidance on how NPS managers will reduce the risk of waterborne diseases and provide safe drinking water to employees, the visiting public, and park partners by assuring that drinking water systems are properly operated, maintained, monitored, and deficiencies are promptly corrected.

Relevant State Legislation

The *California Environmental Quality Act* (CEQA) (California Public Resources Code, Section 21000 et seq.), was passed in 1970, in response to the passage of the NEPA. CEQA is California's broadest environmental law and requires state and local agencies to identify the significant impacts of their actions and to avoid or mitigate those impacts, if feasible (CNRA 2010). CEQA applies to all discretionary projects proposed to be conducted or approved by a California public agency, including private projects requiring discretionary government approval (CDFG 2010a). Federally sponsored and financed projects involving a state or local agency and a federal agency are subject to both NEPA and CEQA review. This project will be reviewed under both NEPA and CEQA because action alternatives would require obtaining permits from the state.

The *Porter-Cologne Water Quality Control Act* established the State Water Resources Control Board (SWRCB) and each Regional Water Quality Control Board (RWQCB) as the principal state agencies for having primary responsibility in coordinating and controlling water quality in California. The SWRCB has the ultimate authority over state water rights and water quality policy. The Act also established nine RWQCBs to oversee water quality on a day-to-day basis at the local/regional level.

PREVIOUS PLANNING AND OTHER GUIDANCE

The key park planning documents that are relevant to this project are the parks' *Final General Management Plan and Comprehensive River Management Plan / Final Environmental Impact Statement* (GMP) (NPS 2007); the *Environmental Assessment for the Wolverton Treatment Plant* (NPS 1992); the *Aquatic/ Water Resources Management Plan* (NPS 1989);the 1996 *Giant Forest Interim Management Plan* (NPS 1996); and, the *Final Environmental Impact Statement Development Concept Plan for Giant Forest/ Lodgepole* (DCP) (NPS 1980).

The 2007 GMP establishes a vision for what the parks' should be, including desired future conditions for natural and cultural resources, as well as for visitor experiences, and includes a comprehensive river management plan for rivers within the parks' that have been designated by Congress as components of the national wild and scenic rivers system. A key element of the approved GMP is to make facilities, including utilities, more resource-efficient and to implement water conservation measures. The GMP states that "future utility replacements, repairs or new systems are to be located so as to minimize resource damage and to be inconspicuous." The proposal considered in this environmental document is

consistent with actions described in the GMP, in that utilities would be replaced as necessary, more stringent water standards would be met, and park resources would be protected.

The *Environmental Assessment for the Wolverton Treatment Plant* (1992) authorized the construction of a water treatment facility and upgrades to the water intake facilities at the Wolverton developed area. The environmental assessment included replacing and adding new water lines to service Giant Forest, the upper Sherman Tree parking area, and Wuksachi.

The *Aquatic/ Water Resources Management Plan (*1989) for SEKI describes the parks' water resources information base and problems, along with park-specific objectives for the management of aquatic and water resources. Data collection efforts include developing water quality monitoring programs, identifying impacts in both front- and backcountry areas, and monitoring species. Management actions include managing visitor use, managing wet meadows, mitigating acidic deposition, and fostering public education, as well as conducting research. The plan is scheduled to be updated based on the issues and concerns identified in the 2005 *Water Resources Information and Issues Overview Report,* which was prepared by the NPS Water Resources Division (NPS 2005).

The Sequoia and Kings Canyon National Parks *Architectural Character Guidelines* (NPS 1989) define the appropriate architectural style for new development and replacements of old facilities within the parks in an attempt to reinforce the integral identity of the parks.

In 1980, the *Final Environmental Impact Statement Development Concept Plan for Giant Forest/ Lodgepole* (DCP) (NPS 1980) was approved. The DCP set the direction for removing facilities from the Giant Forest and converting it to a day-use area in order to 1) reduce development-associated impacts on the giant sequoia grove; 2) eliminate the adverse general environmental impacts resulting from the present inadequate waste water disposal system which served extensive overnight lodging, food service and maintenance facilities; and, 3) improve the delivery of information and enhance interpretive experiences for park visitors.

The 1996 *Giant Forest Interim Management Plan* (NPS 1996) finalized the planning to remove facilities from Giant Forest and convert it to a day-use area. It identified the need to maintain, renovate, or construct utility systems and fully accessible comfort stations at the Giant Forest museum, lower Kaweah, Moro Rock, Crescent meadow, Pinewood, General Sherman Tree, and lower Wolverton. It also included the construction of a new water line to the upper Sherman Tree parking area. Actions connected to the conversion of Giant Forest to a day-use area included the construction of facilities in the Wuksachi area to replace those removed from Giant Forest, ecological restoration of the Giant Forest, and development of new visitor facilities. The *Design Concept for Wuksachi Village* (NPS 1994) was completed in 1994, and is a plan that defines the NPS goals and objectives for developing Wuksachi Village.

ISSUES AND IMPACT TOPICS

SCOPING

Deficiencies in the water distribution system have been documented for years, and previous analyses on the fire flow capabilities and system design were performed on water distribution systems throughout the parks. These analyses determined that the water system servicing the Lodgepole, Giant Forest, Wolverton, and Wuksachi areas was in critical need of rehabilitation. Subsequently, as the need for rehabilitation and repairs to the water system was further discussed, it was determined that a comprehensive design and plan was needed to address the deficiencies of the overall system. The proposal was presented to the parks' interdisciplinary planning team and internal scoping for this project began in 2010. Numerous meetings and site visits were conducted in 2010 and 2011 with NPS staff, the

contractor (Arbor & Associates, Inc.), and survey teams to help determine the scope of the project and identify potential issues and impacts.

A press release describing the project and initiating the 30-day public scoping period was issued on September 2, 2010 (Appendix B). The press release was emailed to 429 addressees on the parks' mailing list, and a letter was sent to an additional 200 media outlets, interest groups, public officials, agencies, and individuals in the central California area. Letters were also sent to 33 area American Indian Tribes or tribal representatives. Public scoping notices were published in two newspapers and internet sites, including the Visalia Times-Delta (newspaper and website) on September 3; and, the Kaweah Commonwealth (newspaper and website) on September 10. Interagency scoping was also conducted and included agencies such as the California Department of Public Health and the California State Historic Preservation Office (SHPO).

During the 30-day public scoping period, which ended on October 2, 2010, the parks received three correspondences; one additional correspondence was received after the public scoping period ended. One correspondence was from an individual who was in support of the project. The second correspondence requested more information and details on the project proposal. The NPS responded with some additional information, however, specific project details were not known at the time of scoping. A third correspondence was from a business interested in submitting an engineering proposal. The fourth correspondence, received after the public scoping period ended, requested to be on the parks' mailing list, and receive copies of documents and notification of opportunities for public comment. No additional comments were received.

DERIVATION OF ISSUES AND IMPACT TOPICS

Specific impact topics were developed for discussion and to allow comparison of the environmental consequences of each alternative. These impact topics were identified based on internal and external scoping; federal laws, regulations, and executive orders; NPS *Management Policies 2006* (NPS 2006); site visits; and NPS knowledge of limited or easily impacted resources. A brief rationale for the selection of each impact topic is given below, as well as the rationale for dismissing specific topics from further consideration.

The resources which could be affected and the impacts that could occur are described in detail in the "Affected Environment" and "Environmental Consequences" sections of this document.

ISSUES AND IMPACT TOPICS SELECTED FOR DETAILED ANALYSIS

In this section and the following section on *Impact Topics Dismissed from Further Analysis*, the NPS takes into account all potential impacts by considering the direct, indirect and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. The NPS defines "measurable" impacts as moderate or greater effects. It equates "no measurable effects" as minor or less effects. "No measurable effect" is used by the NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of "no measurable effects" in this environmental document pertains to whether the NPS dismisses an impact topic from further detailed evaluation. The reason the NPS uses "no measurable effects" to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question rather than amassing needless detail in accordance with CEQ regulations at 1500.1(b).

It was determined that there would be a measurable effect on the following impact topics: geology and soils; vegetation; water resources; historic resources; public health and safety; visitor experience and recreational opportunities; and, park and concessioner operations and employee safety (see Table 1).

Table 1. Impact Topics Retained for Further Evaluation and Relevant Laws, Regulations, and Policies

Impact Topic	Reasons for Retaining Impact Topic	Relevant Laws, Regulations, and Policies
Geology and Soils	The alternatives considered in this document include the potential for trenching in previously disturbed and undisturbed areas, removal and replacement of in-ground structures and piping, and other ground-disturbing activities. Natural erosion has the potential to affect the integrity of water system components. Construction activities can increase erosion and sedimentation in the project area. Therefore, impacts on geology and soils will be further analyzed in this document.	NPS *Organic Act of 1916*; NPS *Management Policies 2006* (NPS 2006); *Director's Order 77 Natural Resource Management Guidelines* (NPS 1991); *Natural Resource Management Reference Manual* #77 (NPS 2004)
Vegetation	Project activities associated with rehabilitating and/or replacing components of the water distribution system could result in the removal of vegetation from previously disturbed areas, areas where restoration activities have occurred, and from undisturbed areas. Work is proposed in the Giant Forest area in close proximity to giant sequoia trees. Therefore, impacts on vegetation will be further evaluated in this document.	NPS *Organic Act of 1916*; NPS *Management Policies 2006* (NPS 2006); *Director's Order 77 Natural Resource Management Guidelines* (NPS 1991)
Water Resources	Existing water diversions structures are located in Silliman Creek and Wolverton Creek, and could be replaced under the action alternatives. Construction activities could increase erosion and sedimentation, and affect water quality. A new groundwater supply, at the Pinewood picnic area, is being considered in this project proposal. Leaks and inappropriate water pressure wastes water, increases the electrical and chemical costs for additional water treatment, and affects water conservation efforts. For these reasons, water resources will be retained as an impact topic for further analysis in this document.	NPS *Organic Act of 1916*; *Clean Water Act of 1972* (33 USC 1251, P.L. 92-500); *Director's Order 77 Natural Resource Management Guidelines* (NPS 1991)
Historic Resources	Sections of the existing water distribution system, water storage tanks, water intake structures and dams, and other water system appurtenances are between 30 and 70 years old. The action alternatives consider replacement or modification of the Lodgepole water treatment plant, which was constructed during the NPS "Mission 66" era. Elements of the action alternatives consider water line installation within the roadbed of the National Register-eligible Generals Highway. Similarly, a short segment of the water line would be placed within the roadbed of the Generals Highway as it crosses the Marble Fork Bridge; which is a National Register-listed property. For these reasons, historic resources will be retained as an impact topic.	*National Historic Preservation Act of 1966* (NHPA) (16 USC 470 et seq., P.L. 89-665); Chapter 5 of NPS *Management Policies 2006* (NPS 2006); *Director's Order 28: Cultural Resource Management* (NPS 1998)

Impact Topic	Reasons for Retaining Impact Topic	Relevant Laws, Regulations, and Policies
Public Health and Safety	Noncompliance with state water quality standards, inadequate water delivery for fire suppression, and the potential for shutdowns of the water system, affects the health and safety of park visitors, employees, and residents. Therefore, health and safety will be addressed as an impact topic in this document.	NPS *Management Policies 2006* (NPS 2006)
Visitor Experience and Recreational Opportunities	Activities associated with rehabilitation of the water distribution system may impede visitor access to certain areas, and could result in road closures and traffic delays during project activities. Therefore, visitor experience and recreational opportunities will be addressed as an impact topic in this EA/AoE.	NPS *Organic Act*; the *Redwood Act of 1978*; and, NPS *Management Policies 2006* (NPS 2006)
Park and Concessioner Operations and Employee Safety	Replacing and/or rehabilitating components of the water system would affect the efficiency and effectiveness of park operations and employee safety. Temporary inconveniences to park and concessioner operations during construction activities would occur. The health and safety of park personnel working on the water system and of fire personnel that are responsible for structural and wildland fire response would be impacted by this project. Therefore, park and concessioner operations and employee safety will be retained as an impact topic for further analysis.	NPS *Management Policies 2006* (NPS 2006)

IMPACT TOPICS DISMISSED FROM DETAILED ANALYSIS

Special-Status Species and Species of Management Concern

Section 7 of the *Endangered Species Act of 1973* (ESA, as amended, 16 U.S.C. 1531–1544; P.L. 93-205) directs all federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the USFWS, to ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat. As defined in section 3 of the Act, an endangered species is any species which is in danger of extinction throughout all or a significant portion of its range, and a threatened species is any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Additionally, NPS *Management Policies 2006* mandates that state and locally listed species would be managed in the same manner as federally listed species, where feasible.

On April 7, 2011, the NPS accessed the USFWS website to obtain an official species list for endangered and threatened species that may be in the project area and could be affected by project activities (USFWS 2011). NPS biologists reviewed the USFWS list and lists of state-listed species (CDFG 2010c and 2010d) and species of concern (CDFG 2011a and 2011b), to determine which species could potentially be affected by implementation of the proposed project.

Special Status Wildlife Species

NPS biologists identified 32 wildlife species with special status that have been known to occur in or travel through the project vicinity (Appendix C). These include one federally listed endangered wildlife species, the California condor (*Gymnogyps californianus)*, and three candidate species for federal listing, the Sierra Nevada yellow-legged frog (*Rana sierrae)*, the wolverine (*Gulo* gulo), and the Pacific fisher (*Martes pennanti*). The California state listed species include four state endangered species: the California condor, bald eagle (*Haliaeetus leucocephalus*), great gray owl (*Strix nebulosa*), and willow flycatcher

(*Empidonax traillii*); and, three state threatened species: Swainson's hawk (*Buteo swainsonii*), Sierra Nevada red fox (*Vulpes vulpes necator*), and California wolverine (*Gulo gulo*). The remaining species of concern include those listed by the Bureau of Land Management (BLM), U.S. Forest Service (USFS), CDFG, California Department of Forestry and Fire Protection (CDF), and other organizations.

The federally- and state-listed California condor; and, the candidates for federal listing: Sierra Nevada yellow-legged frog and wolverine, appear to be extirpated from the project area and there would be no effect on these species from project implementation (Werner, pers. comm., November 22, 2010). The Pacific fisher inhabits forests with substantial canopy cover and tends to be rather shy and solitary, generally avoiding large open areas. The fisher is known to occur within the project vicinity and could be disturbed during construction activities from noise or potential den disturbance. The probability of the fisher to be in the project area, however, is unlikely since most construction activities would occur within park developed areas where human activity is common. The fisher tends to avoid these areas, and potential impacts to the fisher are anticipated to be negligible. For these reasons, the California condor, Sierra Nevada yellow-legged frog, wolverine, and fisher have been dismissed from further analysis.

The state listed bald eagle, Swainson's hawk, and great gray owl, are rare visitors, and would unlikely be in the project area more than momentarily. Observations of the state listed red fox are rare; however, they could be present in the project area. Even if present, these species would not be affected by the project, as they generally stay away from human occupied areas. Although survey information is limited, the state listed willow flycatcher is thought to be extirpated from the project area (Werner, pers. comm., November 22, 2010). For these reasons, these species have been dismissed from further analysis.

Bird species of concern that could occur in the project area include the northern goshawk (*Accipiter gentilis)*, California spotted owl (*Strix occidentalis occidentalis)*, Cooper's hawk (*Accipiter cooperii*), sharp shinned hawk (*Accipiter striatus*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus anatum*), prairie falcon (*Falco mexicanus*), short-eared owl (*Asio flammeus*), long-eared owl (*Asio otus*), black swift (*Cypseloides niger*), purple martin (*Progne subis*), and the yellow warbler (*Dendroica petechia brewsteri)*. Other species of concern include the American marten (*Martes americana*), the American badger (*Taxidea taxus*), and nine bat species (Appendix C). None of these species are federally or state listed; they are considered species of concern by either the state, USFS, USFWS, BLM, or other organizations.

Most of the proposed project work would occur within park developed areas, within previously disturbed areas, and where noise and human activity are prevalent. Effects from noise and presence of work crews would be temporary and localized, and last only as long as construction activities. Areas disturbed by construction activities would be rehabilitated and reclaimed to pre-construction conditions. Behavior and habitat preference would exclude most of the special status species from being in the project area during construction activities. While these species could be present in or near the project area, it is likely that they would be present for a short period of time (i.e. an occasional flyover). After further review of park data and using professional judgment, special status wildlife species was dismissed as an impact topic because they either do not occur within the project area, or project implementation would not affect these species.

Listed Plants and Plant Species of Concern

Of over 1,500 species of vascular plants in the parks, no species are listed as federally threatened or endangered. Six federally- or state-listed species were identified on the USFWS official list that could occur within the project vicinity, and include: Hoover's spurge (*Chamaesyce hooveri*), Springville Clarkia (*Clarkia springvillensis*), San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*) critical habitat; San Joaquin adobe sunburst (*Pseudobahia peirsonii*), Keck's checker-mallow (*Sidalcea keckii*), and Ramshaw Meadows abronia (*Abronia alpine*). Hoover's spurge, Springville Clarkia, San Joaquin Valley Orcutt

grass, San Joaquin adobe sunburst and Keck's checker-mallow occur in the lowlands of the San Joaquin Valley west of the park. None of these taxa are known to occur within the park, and based on habitat requirements and known distribution, are not expected to occur within the parks or the project area. Ramshaw Meadows abronia is known from only one extant, extended occurrence at Ramshaw Meadows and Templeton Meadows, which is south of Sequoia National Park. Based on survey results and habitat requirements, this plant is not expected to occur in the proposed project area.

There is only one state-listed rare plant species, Tompkins sedge (*Carex tompkinsii*), that is known to occur in SEKI. Tompkins sedge reaches the southern edge of its distribution in the South Fork of the Kings River, and would not be affected by this project. For these reasons, special status plant species have been dismissed from further analysis in this environmental document.

On October 28, 2010, a vegetation survey was conducted in the Giant Forest area to determine whether there were any special status species in the vicinity where project work could occur. Of the fifty-five taxa observed, no plant species of management concern or special consideration under the California Native Plant Society were found. As this initial survey was conducted late in the growing season, a follow up site visit will be made in late spring/early summer, prior to any ground disturbance. The giant sequoia tree, however, is a tree of special natural and historical significance, and any impacts to this species are considered under the impact topic *Vegetation*.

Wildlife

According to the NPS *Management Policies 2006*, the NPS strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals (NPS 2006). The project area is inhabited by a large variety of wildlife. The majority of the project work would occur within park developed areas where human noise and presence is common. Most of the project work would occur within previously disturbed areas, such as existing road/utility corridors. Under the no action alternative, routine repairs and maintenance on the existing water system would occur as long as replacement parts can be obtained and the park can meet current state regulations. Repairs and maintenance would occur intermittently on the existing water system and impacts to wildlife would be localized and temporary, lasting only as long as the repairs take place. While there could be temporary displacement of wildlife during construction activities, the impacts would be localized, temporary, and not outside the natural range of variability for wildlife species, their habitats, or the natural processes sustaining them. Population numbers and structure would remain stable and viable. Occasional responses to disturbance by some individuals are expected, but without measurable interference with survival, reproduction, or other factors affecting population levels. Sufficient habitat remains to maintain viability of all species. Therefore, this impact topic has been dismissed from further evaluation.

Wilderness Resource

The *Wilderness Act of 1964* (16 USC 1131–1136, P.L. 88-577) established the national wilderness preservation system in order to secure for the American people of present and future generations the benefits of an enduring resource of wilderness. Under the provisions of this act, wilderness areas are to be administered for the use and enjoyment of the American people in such a manner as to leave them unimpaired for future use and enjoyment as wilderness.

Sequoia and Kings Canyon National Parks' original wilderness designation occurred under the *California Wilderness Act of 1984* (16 USC 1131, P.L. 98-425, 98 Stat. 1619); additional acreage was designated as wilderness by the *Omnibus Public Land Management Act of 2009* (H.R. 146). The total designated and managed wilderness for the parks' is 837,962 acres—approximately 96.8% of the parks' total acreage.

The activities proposed in this environmental document would occur outside of proposed and designated wilderness and would have no impact on the wilderness resource. Therefore, this impact topic has been dismissed from further evaluation.

Air Quality and Greenhouse Gas Emissions

The 1977 amendment to the *Clean Air Act of 1963* (42 USC 7401 et seq., P.L 88-206) requires federal land managers to protect park air quality. Sequoia and Kings Canyon National Parks were designated Class I under the 1970 *Clean Air Act*, as amended. A Class I area is subject to the most stringent regulations of any designation. Further, the 1970 *Clean Air Act* provides the federal land manager (the Assistant Secretary for Fish and Wildlife and Parks and the Park Superintendent) with an affirmative responsibility to protect the parks' air-quality-related values (including visibility, plants, animals, soils, water quality, cultural and historic properties and objects, and visitor health) from adverse air-pollution impacts. Section 118 of the *Clean Air Act* requires the parks to meet all federal, state, and local air-pollution standards.

The proposed project is located within the San Joaquin Valley Air Pollution Control District (SJV Air District). This air district is susceptible to air pollution given its climate, topography, and human activities. Most of the air pollutants within the parks originate outside the park boundaries. Non-point sources continue to be the major contributor of air pollutants in the SJV Air District, including cars, trucks, farm equipment, and other agricultural activities. According to 2006 air-quality monitoring data, the main contributor in the park to the criteria air pollutants (CAPs) and greenhouse gases (GHGs) is transportation, contributing 66%. The largest portion of this is from visitor vehicle miles travelled. Most of the air pollution found in the parks originates outside park boundaries. However, emissions from construction equipment would produce particulate matter (PM), nitrogen oxides (NOx), and hydrocarbons, precursors to the formation of ozone.

During construction activities, fugitive dust would be emitted into the air by activities that disturb the soil, such as earthmoving and vehicular/equipment traffic on unpaved surfaces. Dust generated during construction activities can degrade visibility and affect sensitive receptors near the project area. To mitigate these potential effects, the contractor would be required to implement dust control mitigation procedures to reduce the potential for particulate matter; and, would be allowed to idle up to, but not exceed, five minutes when parked to reduce emissions from idling vehicles. Overall, there would be a slight and temporary degradation of local air quality due to dust generated from earthmoving activities and emissions from construction equipment, resulting in negligible, adverse impacts. Project components would be phased over a number of years and would be dependent on funding. Impacts to air quality and GHG emissions would last only as long as construction activities occurred. There would be no long-term, adverse impacts to air quality from implementing any alternative. Therefore, the impact topic of air quality was dismissed from further analysis.

Wetlands

For regulatory purposes under the *Clean Water Act*, as amended (33 USC § 1251 et seq.), the term wetlands means "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." Executive Order 11990, (*Protection of Wetlands,* 42 FR 26961), requires federal agencies to avoid, where possible, adversely impacting wetlands. Further Section 404 of the *Clean Water Act* authorizes the U.S. Army Corps of Engineers to prohibit or regulated, through a permitting process, discharge or dredged or fill material or excavation within waters of the United States. NPS policies for wetlands, as stated in NPS *Management Policies 2006, Director's Order 77-1: Wetlands Protection,* and

Procedural Manual 77-1: Wetland Protection, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In accordance with NPS policies, a Statement of Findings is required if the preferred alternative would result in adverse impacts on wetlands, unless the actions are exempted.

Alternative B proposes the development of a new groundwater source in the Pinewood picnic area of the Giant Forest. One of the reasons the well site was selected, by a technical specialist from the NPS Water Resources Division, because the nearest wet meadow (Round Meadow) is approximately 2,000 feet south of the site and is almost certainly beyond the area of influence of a low-yield well at Pinewood (NPS 2010). The anticipated low pumping rate and the distance to the headwaters of adjacent drainages would result in minimal to no streamflow reduction.

Alternatives B and C propose the replacement of two water intake structures and associated concrete dams in Silliman Creek and in Wolverton Creek. The concrete dams have been subjected to continuous freeze/thaw cycles and the concrete has exceeded its life cycle under these conditions. Damage to the water intake structures have occurred during high water events when large debris is washed down the creeks and collides with the water diversions. The existing water intake structures have been damaged from storm events, are deteriorating and undermined, and need to be replaced to function properly. Activities associated with replacing the surface water diversions at Silliman Creek and Wolverton Creek would result in less than 0.1 acre deviation in the structure's configuration or fill footprint. Therefore, exemption 4.2.A.1.g, *Maintenance, Repair, or Renovation of Currently Serviceable Facilities or Structures . . .*, (*Director's Order 77-1: Wetlands Protection*) applies to these actions as long as Best Management Practices (BMPs) (Appendix D) are implemented. The NPS would implement BMPs and actions associated with dam replacement are exempted from a Statement of Findings. Since impacts to wetlands are anticipated to be less than minor, the impact topic of wetlands has been dismissed from further consideration.

Floodplains

Executive Order 11988 (*Floodplain Management*, 42 FR 26951), requires an examination of impacts to floodplains and the potential risk involved in placing facilities within floodplains. NPS *Management Policies2006*, *Director's Order 77-2: Floodplain Management*, and *Procedural Manual 77-2: Floodplain Management*, provide guidelines for proposed actions in floodplains. It is NPS policy to preserve floodplain values and minimize potentially hazardous conditions associated with flooding.

The action alternatives propose the replacement of two surface water intake structures and associated concrete dams: in Silliman Creek and in Wolverton Creek. Floodplain values in these two creeks have been previously altered by the existing dam structures below each water intake. Project activities would be designed so not to compromise floodplain values, stream morphology, or the natural river values. None of the actions considered in this environmental document would adversely affect the natural resources and functions of floodplains or increase flood risks, therefore, a Statement of Findings will not be prepared. Furthermore, BMPs would be implemented to ensure there are no adverse effects to floodplain values. For these reasons, the impact topic of floodplains has been dismissed from further consideration in this EA/AoE.

Wild and Scenic Rivers

The Marble Fork of the Kaweah River has been found eligible and suitable for Wild and Scenic River status. There are two surface water diversions located in Silliman Creek and Wolverton Creek; these creeks are tributaries of the Marble Fork of the Kaweah River. There is also an existing water line buried under the Marble Fork of the Kaweah River. Proposed project activities include replacing the water

diversion structures and capping and abandoning the existing water line that is buried under the Marble Fork of the Kaweah River. Potential effects from implementation of these project activities would be temporary and localized, and would not threaten the outstanding remarkable values and resources associated with the eligibility and suitability of the Marble Fork of the Kaweah River wild and scenic river designation.

Soundscapes

In accordance with NPS *Management Policies 2006* and Director's Order-47: *Sound Preservation and Noise Management*, an important part of the NPS mission is preservation of natural soundscapes associated with national park units. Natural soundscapes exist in the absence of human-caused sound. The natural ambient soundscape is the aggregate of all the natural sounds that occur in park units, together with the physical capacity of transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive and can be transmitted through air, water, or solid materials. The frequencies, magnitudes, and durations of human-caused sound considered acceptable varies among NPS units, as well as potentially throughout each park unit, being generally greater in developed areas and less in undeveloped areas.

The majority of project elements associated with the action alternatives would occur within the park developed areas of Giant Forest, Lodgepole, Wuksachi, Wolverton, and the Red Fir maintenance area, where human-generated noise is common. Some project components would occur in low-use and high-use frontcountry zones, in close proximity to trails and popular visitor use areas. Visitors recreating in these areas may be more sensitive to construction noise because they are recreating away from the center of the developed area and may expect more opportunity for natural quiet.

Project components would be phased over a number of years and would be dependent on funding. Noise and the presence of work crews would be temporary and only last as long as the construction activity. Noise associated with rehabilitating the water distribution system would be short-term and localized, and construction activities would be scheduled to minimize effects on visitors, staff, and residents to the greatest extent practicable. Visitors would be notified of scheduled construction activities to plan accordingly. Where possible, visitors would be told of alternatives to avoid noise and access instructions. To the extent practicable, most construction work would be limited to daylight hours. Some night work may be necessary for installation of the waterline within the roadbed of Generals Highway. To minimize visitors' and residents' exposure to unnatural sounds, construction near campgrounds, lodging, and employee housing areas would occur during daylight hours. Contractors would be required to properly maintain construction equipment (e.g., mufflers) to minimize noise from use of equipment. Consideration of the potential effects of noise on wildlife is addressed under the wildlife impact topic. The potential effects of noise on visitors are addressed under the visitor experience and recreational opportunities impact topic. Because there would be less than minor effects on the soundscape from project implementation, this impact topic has been dismissed from further analysis.

Visual Resources and Lightscapes

NPS *Management Policies 2006* (NPS 2006) states that scenic views and visual resources are considered highly valued associated characteristics. It is NPS policy to preserve, to the greatest extent possible, the natural landscapes and visual qualities of the parks. Sequoia and Kings Canyon National Parks have developed aesthetic guidelines for park buildings. The parks' *Architectural Character Guidelines* for building design stipulate that:

> . . .new construction must be sensitive to its context. It must defer to and respect the natural setting. It should not be overly sophisticated nor should it create a sense of human domination over the landscape.

In accordance with *Management Policies 2006* (NPS 2006), the NPS will preserve, to the greatest extent possible, the natural lightscapes of parks, which are natural resources and values that exist in the absence of human-caused light. The NPS will restrict the use of artificial lighting in parks to those areas where security, basic human safety, and specific cultural resource requirements must be met; use minimal-impact lighting techniques; and shield artificial lighting where necessary to prevent the disruption of the night sky, natural cave processes, physiological processes of living organisms, and other similar natural processes.

The majority of project activities associated with action alternatives would occur within park developed areas where structures and artificial features are expected. Under alternative B, a well house would be constructed within the Pinewood picnic area. The well house would sit mostly below the view of visitors traveling along the Generals Highway, and there would be a minimal effect on the visual quality of those visitors. For those picnicking in the area, the structure would be visible; however, there are other structures in the area including a comfort station, picnic tables, and log fencing. Other proposed minor structures and appurtenances are within the center of the developed areas, are outside the viewscape of most visitors, and would be designed to blend into the surrounding terrain. All structures considered in the alternatives would conform to the parks' *Architectural Character Guidelines* and would have a negligible impact on visual resources. Any security lighting needed on structures would be consistent with NPS policy and would have a negligible effect on night sky values. For these reasons, visual resources and lightscapes have been dismissed from further analysis.

Archeological Resources

Approximately 78,000 acres of the parks (approximately 9%) has been systematically surveyed for the presence of cultural resources, both historic and prehistoric. A total of 536 archeological sites and 135 historic sites have been recorded as of the end of 2010. Historic sites are at least 50 years old by definition and can extend back to the early 1800s in this part of California. The prehistoric sites are by definition Native American in nature; the oldest Native American artifacts (projectile points) recovered in the parks are approximately 5,000 to 7,000 years old. These resources document prehistoric, ethnographic, and historic use of park areas.

The majority of the work associated with the project proposal would occur on previously disturbed land within existing utility corridors or along roadways. An examination of archeological files suggests that no archeological sites would be affected by the proposed project activities. Should previously unknown archeological resources be uncovered during construction, all work would immediately cease in the discovery area and the NPS would consult according to 36 CFR 800.11 and, as appropriate, provisions of the *Native American Graves Protection and Repatriation Act* (25 U.S.C. 3001 et seq). For these reasons, the impact topic of archeological resources has been dismissed from further examination in this environmental document.

Ethnographic Resources

The NPS Director's Order 28: *Cultural Resource Management*; and, NPS-28: *Cultural Resource Guideline,* defines ethnographic resources as any site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. There are no known ethnographic resources in proposed project area; therefore, this topic has been dismissed from further analysis.

Museum Collections

According to the NPS Director's Order 24: *Museum Collections*, the NPS requires the consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material) and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, NPS museum collections. Actions considered in this environmental document would have no impact on museum collections; therefore, this topic has been dismissed from further evaluation.

Cultural Landscapes

According to the NPS's *Cultural Resource Management Guidelines* (Director's Order 28), a cultural landscape is ". . . a reflection of human adaptation and use of natural resources and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. The character of a cultural landscape is defined by both physical materials, such as roads, buildings, walls, and vegetation, and by use reflecting cultural values."

In 1998 the Cultural Landscapes Automated Inventory Management System database indicated that 10 parent landscapes and 13 component landscapes were identified in the parks. Generals Highway was one of the parent landscapes and is listed as a Level II documented landscape. The National Register nomination lists landscape architecture as an area of significance for Generals Highway. The stone masonry retaining wall, parapet walls, and culvert headwalls are all contributing features to the National Register nomination and the landscape architectural interpretation of the parent landscape. The two action alternatives considered in this environmental document would include installation of new water line within the Generals Highway. The water line would be underground and within the road corridor, and would not interfere with the contributing features or the landscape architectural interpretation of the Generals Highway parent landscape. No other cultural landscapes are documented within the area of potential affect. For these reasons, the impact topic of cultural landscapes is dismissed from further analysis.

Socioeconomic Environment

Alternatives associated with this project would neither have measurable effects on local businesses nor would appreciably change local or regional land use. There may be a minor influence on socioeconomics associated with availability for construction work during project implementation, but no long-term or substantial change to the socioeconomic environment would result from any of the alternatives. Actions considered in this proposal would have minimal impact on the socioeconomic environment; therefore, this topic has been dismissed from further analysis.

Other Impact Topics

There would be no effect from the project to Indian Trust Resources and Prime and Unique Farmland because there are none of these resources in the project area. There would be no effect to health or environmental effects on minorities or low-income populations or communities as defined in the EPA's *Final Guidance For Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses* (EPA 1998). No areas within the project sites are designated as critical habitat or ecologically critical areas. The alternatives being considered in this document would not affect the parks' status as an international biosphere reserve. For these reasons, these topics are therefore dismissed from further analysis.

ALTERNATIVES

INTRODUCTION

This chapter describes the no action alternative, and two action alternatives that consider a comprehensive design and rehabilitation plan for the overall water system serving the Giant Forest, Lodgepole, Wolverton, Wuksachi, and the Red Fir maintenance facility, followed by a discussion of alternatives considered but dismissed from further evaluation.

The no-action alternative provides a baseline from which action alternatives can be compared, magnitudes of proposed changes can be evaluated, and environmental impacts of those changes can be measured. While each action alternative provides similar opportunities to address immediate deficiencies in the existing water system and considers future growth, the key difference between the action alternatives is the option to develop a new groundwater source that would make the Giant Forest area a separate groundwater system. A summary table comparing alternative components is presented at the end of the chapter.

ALTERNATIVE A: NO ACTION

Under the no action alternative, no comprehensive design and plan would be developed to address the immediate deficiencies of the water system, prioritize work elements and rehabilitation needs, or consider potential future expansion. Under this alternative, no extraordinary management action or rehabilitation effort would be taken. Maintenance and repairs to the existing water system would be on a case-by-case basis as leaks and failures are detected; in response to emergencies; and, as long as replacement parts are available. The parks' water system would continue to degrade and be non-compliant with state drinking water regulations, fire codes, and NPS policies.

There would be no improvements made to the water disinfection system at the Wolverton water treatment plant, and no upgrades to the Lodgepole water treatment plant. State officials could mandate replacement of the Lodgepole water treatment plant or discontinue its use should future excursions from water quality standards occur. The Lodgepole water system would remain isolated from the Wolverton water system, because the interconnection valve would not be replaced. In addition, the water main installed under the Marble Fork of the Kaweah River would continue to serve as the only Lodgepole system supply. Likewise, a section of water main, located less than five feet from an eroded bank of the Marble Fork of the Kaweah River, would not be rerouted and would be susceptible to failure.

In the event of a water system failure, the NPS would enact an emergency contingency plan. At some point, repairs and rehabilitation would not be feasible or possible, and sections of the water systems could be shutdown, thereby limiting use and access to certain areas until a permanent fix could be implemented. No improvements would be made to the underground fire hydrant assemblies in the Wuksachi area, which are currently inaccessible during the winter months.

ELEMENTS COMMON TO ACTION ALTERNATIVES

Each action alternative considers the immediate deficiencies of the water system, and incorporates design elements that achieve a comprehensive design and plan that addresses future growth. Elements common to both action alternatives include the rehabilitation and replacement of critical components of the water system, including valves, piping, and other appurtenances. Rehabilitation and construction of all the identified components is not possible at this time due to funding limitations. Consequently, project components would be implemented in phases and would be dependent on priority and acquiring

additional funding. Specific project elements common to alternatives B and C are distinguished by location and are listed below, followed by a short description of the methods and techniques to implement project work.

Giant Forest

Install, approximately 6,000 linear feet of new 6-inch water line from the Giant Forest tank to Giant Forest Museum within the roadbed of the Generals Highway (Photo 8). The existing 6-inch water line that traverses the Giant Forest would be capped and abandoned in place.

Photo 8. Generals Highway in the Giant Forest area.

Replace the existing Giant Forest water storage tank with a new storage tank.

Replace the 6-inch water line from the Giant Forest Museum to the upper Kaweah parking lot.

Replace the 6-inch water line from the Upper Kaweah parking lot to Beetle Rock.

Replace the 6-inch water line from the Upper Kaweah parking lot to the Lower Kaweah comfort station with a slip-lined 2-inch water line.

Isolate the abandoned 6-inch water line over to the old lodge area. Cut and cap the valve vault near the Big Tree Trail parking area, and replace the valve vault with buried valves.

Lodgepole

Replace the Silliman water intake structure, concrete dam, and associated 300 linear feet of piping; and, replace or rehabilitate the sediment settling structure ("sandbox") (Photo 9).

Photo 9. Silliman Creek surface water diversion.

Relocate the 8-inch water line north of the Lodgepole Market that is close to an eroding slope along the south side of the Marble Fork River. Relocation would be approximately 20 feet to the south of the existing route.

Repair the 4-inch water line between the campground and residences to reestablish a looped distribution system.

Install a new 6-inch water line over the Marble Fork Bridge along Generals Highway and abandon in place the existing water line that crosses under the Marble Fork of the Kaweah River.

Replace the existing Lodgepole-Wolverton interconnection valve vault with a new direct feed connection from Wolverton to the Lodgepole tank fill line at the Lodgepole water treatment plant. This would be used as a back-up water source for the Lodgepole area and allow for the Lodgepole water treatment plant to be shut-down in the winter when there is low water demand in the Lodgepole area.

Replace the existing Lodgepole water treatment plant with a new facility capable of meeting state water quality regulations (Photo 10).

Photo 10. Lodgepole water treatment plant.

Wolverton

Install a new disinfection system at the Wolverton water treatment plant to minimize DBP formation and extend the life of the disinfectant in the distribution system.

Clean out water lines (pigging).

Replace three PRVs along Generals Highway between Wolverton and the Giant Forest.

Replace two PSVs and associated check valves along the old Army Road between Wolverton and Lodgepole.

Provide flow meters for all distribution systems that utilize the Wolverton water supply, including Wuksachi, Wolverton corrals, Upper Sherman, and Lower Sherman.

Slipline the existing 6-inch water line from the Lodgepole-Wolverton split, up to the Wuksachi water storage tanks with a 3-inch line to reduce water age.

Replace the surface water diversion structure in Wolverton Creek (Photo 11).

Photo 11. Wolverton Creek surface water diversion.

Wuksachi/ Red Fir maintenance area

Clean the Wuksachi tanks.

Replace the utility-hole cover entry and provide large traffic rated vault covers for the four buried valve vaults near the Wuksachi water tanks to eliminate confined space entry and to facilitate removal of valves and piping.

Isolate with a gate valve, the 10-inch water line that extends beyond the Wuksachi Lodge and continues out to several empty parking lots originally designed for future expansion of the Wuksachi services area.

Rehabilitate the Wuksachi and Red Fir meter vaults that are located at the bottom of the road leading to the Wuksachi tanks.

Replace all below-ground FHAs in the Wuksachi area with conventional above-ground FHAs and flag marking for locating in winter snow conditions for (approximately 17).

Provide a FHA blow-off at the helipad near Red Fir to help maintain residuals at the Red Fir area.

Clean the distribution line from the Red Fir maintenance area to the meter vault at the bottom of the access road near the Wuksachi tanks.

Install a new disinfectant dosing station at the bottom of the access road to the Wuksachi tanks to reduce chlorine requirements at the Wolverton water treatment plant and to improve the residual at Wuksachi and the Red Fir maintenance facility (Photo 12).

Photo 12. Proposed site for disinfectant dosing station.

Methods and Techniques

Rehabilitation and Replacement of Water Distribution System Components
Replacement and rehabilitation of water lines, water storage tanks, valves, vaults, FHAs, and other water system appurtenances would be within previously disturbed locations or existing utility corridors. Water system components would be replaced "in kind" or upgraded to current industry standards. Rehabilitation methods include sliplining, pipe-bursting, and "pigging" (cleaning out the waterlines). Sliplining and pipe-bursting would be used to replace and rehabilitate existing lines at their current locations. The sliplining method would be used to rehabilitate buried pipelines where the existing pipe is large enough for a smaller, more adequately sized pipe to be inserted. The pipe-bursting method would be used where the replacement pipe is the same size as the existing pipe. Pipe-bursting breaks the old pipe by applying force against the pipe and pushes pipe fragments into the surrounding soil, while simultaneously pulling a new pipe in its place. The "pigging" technique is an internal pipe-cleaning process that pushes a small device through the interior of the pipes to clean them. In all three methods, excavation would occur at insertion and receiving pits, and where valves, bends, or appurtenances are located. The dimension of the excavation pits would be approximately 10' long × 5' deep × 4' wide. The material of the new water piping would be high density polyethylene pipe (HDPE).

Trenching and excavation would be needed to access and extract existing appurtenances (e.g. valves, vaults, tanks, piping), and to access the existing water lines for rehabilitation methods. The work zone, for installation of new piping (e.g. pipe along the Generals Highway), would be approximately 15-feet wide (to accommodate for equipment passage and spoils placement), and 5-feet deep to achieve the necessary depth below the frost line.

New Proposed Buildings
New buildings, common to alternatives B and C, include a chlorine dosing station near the Wuksachi water tanks access road, and a new building to replace the existing Lodgepole water treatment plant. The chlorine dosing station would be approximately 12' × 20' (240 square feet). The new water treatment plant (720 square feet) would be 20% larger than the existing building, to accommodate a new water disinfection system. Both buildings would be located within previously disturbed areas requiring minor grading and other site preparation. The old water treatment plant would be dismantled and disposed of appropriately. New structures would adhere to the parks' *Architectural Character Guidelines* (NPS 1989), with the purpose of maintaining the rustic park architecture and character.

Replace Surface Water Diversion Structures
The surface water diversion assemblies at Silliman Creek and Wolverton Creek would be replaced. Wedgewire screen structures would replace the existing water intake structures (Photo 13), the concrete dams would be removed and reconstructed, and associated clogged piping and appurtenances would be replaced. During construction activities, water would be diverted around the work site to a point below the construction area. The existing water intake structures and dams would be dismantled and removed from the project area and a new dam and water intake would be constructed. The temporary diversion would be removed and the area restored as necessary.

Photo 13. Example photo of a wedgewire screen water intake structure *(photo courtesy of www.hydroscreen.com).*

Access, Staging Areas, and Equipment
Equipment and materials would be staged in previously disturbed areas, such as parking areas, to the greatest extent practicable. Access to most work areas is possible from roadways and trails, or existing utility corridors. A variety of equipment, including backhoe, loader, excavator, and forklift, would be utilized during rehabilitation and replacement activities. An all terrain vehicle (ATV), helicopter, or pack stock may be used to transport materials and equipment needed for actions associated with replacing the surface water diversion structures.

Sustainability and Design

The NPS has adopted the concept of sustainable design as a guiding principle of facility planning and development. The objectives are to minimize adverse effects on natural and cultural values; reflect their environmental setting; maintain and encourage biodiversity; construct and retrofit facilities using energy-efficient materials and building techniques; operate and maintain facilities to promote their sustainability; and, illustrate and promote conservation principles and practices through the sustainable design and ecologically sensitive use. The action alternatives consider a plan for a sustainable water system that incorporates resource efficient design elements. New structures would adhere to the parks' *Architectural Character Guidelines* (NPS 1989), with the purpose of maintaining the rustic park architecture and character.

Water System Design
The CDHP has adopted regulations on water system demand, storage, supply, piping, and pressure. The regulations are defined under Title 22- Social Security (Title 22) Division 4, Chapter 16- California Waterworks Standards. These regulations were used in the basis of design and evaluation of the water system project (Arber 2010a). Modeling of the water system considered the following:

Water Demands. Water demands are used to size and evaluate supply storage, and distribution requirements. The average day domestic demand, peak day domestic demand, and fire demand were used to evaluate the Wolverton and Lodgepole water systems. Water production records from the Wolverton and Lodgepole water treatment plants were used to develop the average day and peak day domestic demands from the system (Arber 2010a). Typically, municipalities would reference the California Fire code to establish fire flow and duration requirements; however, a rural system, such as the Wolverton water system, would have difficulty achieving the fire flow and duration requirements of this code (Arber 2010a). Therefore, fire demand and duration were developed based on National Fire Protection Association (NFPA) 1142 with the assistance of the NPS Fire Protection Engineer (Arber 2010a).

Water Supply and Storage. The water supply capacity should not be less than the peak demand of the water system. Combined domestic and fire storage was used to evaluate the capacities of the existing water storage tanks (Arber 2010a).

Water Distribution and System Pressure. The criteria for the distribution piping system followed the general recommendations for pipe size to the greatest extent practicable. However, because of the rural nature of the water system, Title 22 allows for a reduction in the pipe size when a Registered Engineer designs the piping and confirms that minimum pressures are maintained according to relevant regulations (Arber 2010a).

ALTERNATIVE B: REPLACE DISTRIBUTION LINES AND IMPROVE WATER DISINFECTION

Alternative B focuses on optimizing distribution line sizes and water velocities to help prevent future buildup of biofilm in the water distribution system. No new water source would be developed under alternative B; instead, the primary components of this alternative include cleaning and replacing older/biofilmed water distribution lines throughout the Wolverton water system, improving water disinfection, and installing new water lines at Wuksachi.

Under this alternative, TTHM formation would be reduced by cleaning and/or removing and replacing older biofouled piping and the corresponding organic source. A new chlorine dosing station would be constructed near the Giant Forest water tank to reduce chlorine requirements at the Wolverton water treatment plant and to improve the residual at the water tank. Water lines at Wuksachi are proposed to be replaced in order to optimize the water line sizes. Specific components of this alternative include (Figure 3):

Construct a new 12’ × 20’ (240 square feet) chlorine dosing station near the existing Giant Forest water tank.

Install approximately 5,500 linear feet of new 6-inch and 10-inch distribution piping from the Wuksachi tanks throughout the Wuksachi development.

Use the “pigging” technique to clean the distribution line from the intersection of the Generals Highway and the Wolverton access road to the Giant Forest water tank.

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Alternative B- Replace Distribution Lines and Improve Water Disinfection

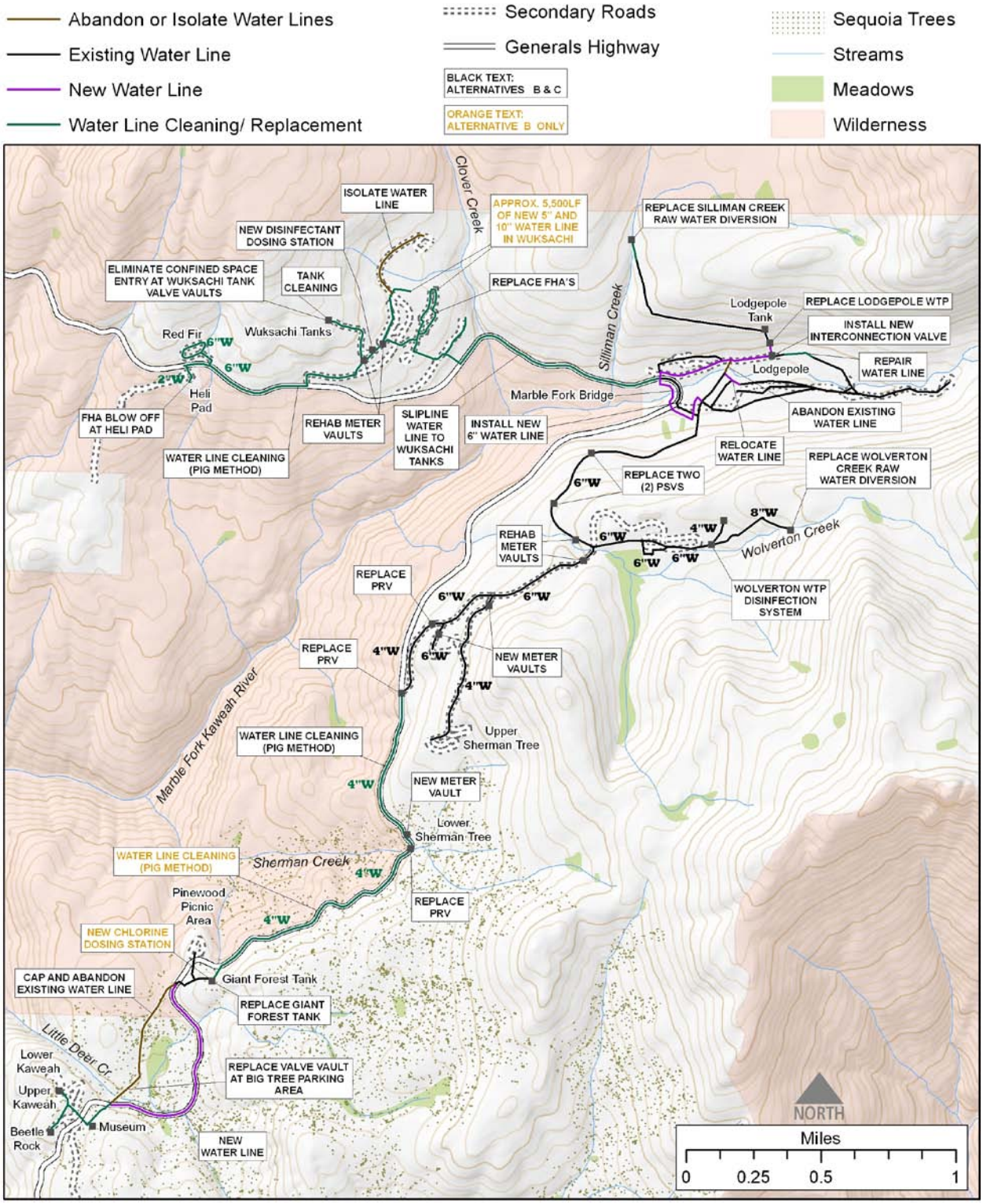

Figure 3. Map of Alternative B project components.

ALTERNATIVE C: IMPROVE WATER SUPPLY (PREFERRED ALTERNATIVE)

This alternative focuses on water supply improvements in an effort to improve water quality through decreasing the water age and controlling TTHM formation. The key feature associated with this alternative is the development of a new groundwater supply well at the Pinewood picnic area, located within the Giant Forest. The Giant Forest area is the most remote area served by the Wolverton water treatment plant, which is approximately three miles away, and water age can exceed 30 days. In October 2010, a successful test well was drilled with a yield of 18 gpm, which would provide sufficient water for demands in this area. Development of a separate well supply would eliminate the need to maintain the length of water line from the lower Sherman Tree parking area to the Giant Forest tank, and greatly reduce the water age and potential for TTHM formation. As a result, the water line from the lower Sherman Tree parking area to the Giant Forest tank would be isolated, but an emergency connection to the Wolverton water supply would be maintained for system redundancy.

Project work would include installing a new well house with disinfection, and constructing a direct supply line to the Giant Forest water storage tank along the dirt access road. The existing 4-inch water main along Generals Highway near the Lower Sherman parking area would be isolated. The emergency connection to the Wolverton water system would be maintained. Under this alternative, the NPS would obtain a domestic water supply permit from the CDPH, for operation of the new drinking water system (CDPH 2007).

The water distribution systems at Wuksachi and the Red Fir maintenance area are also far away from the Wolverton water source, approximately 2-3 miles away. However, this piping is only 20 to 25 years old (versus the 70 year old piping in the Giant Forest area) and does not warrant replacement under this alternative. Therefore, these pipes would be cleaned rather than replaced. Specific elements of this alternative include the following actions (Figure 4):

Develop a new well at the Pinewood picnic area and provide a 2-inch water line from the well directly to the Giant Forest water tank. The well house would be approximately 12’ × 20’ (240 square feet), and the well head would be adjacent to the building.

Isolate the existing 4-inch water line along the Generals Highway at the Lower Sherman parking area.

Clean water distribution lines in the Wuksachi area.

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Alternative C- Improve Water Supply (Preferred Alternative)

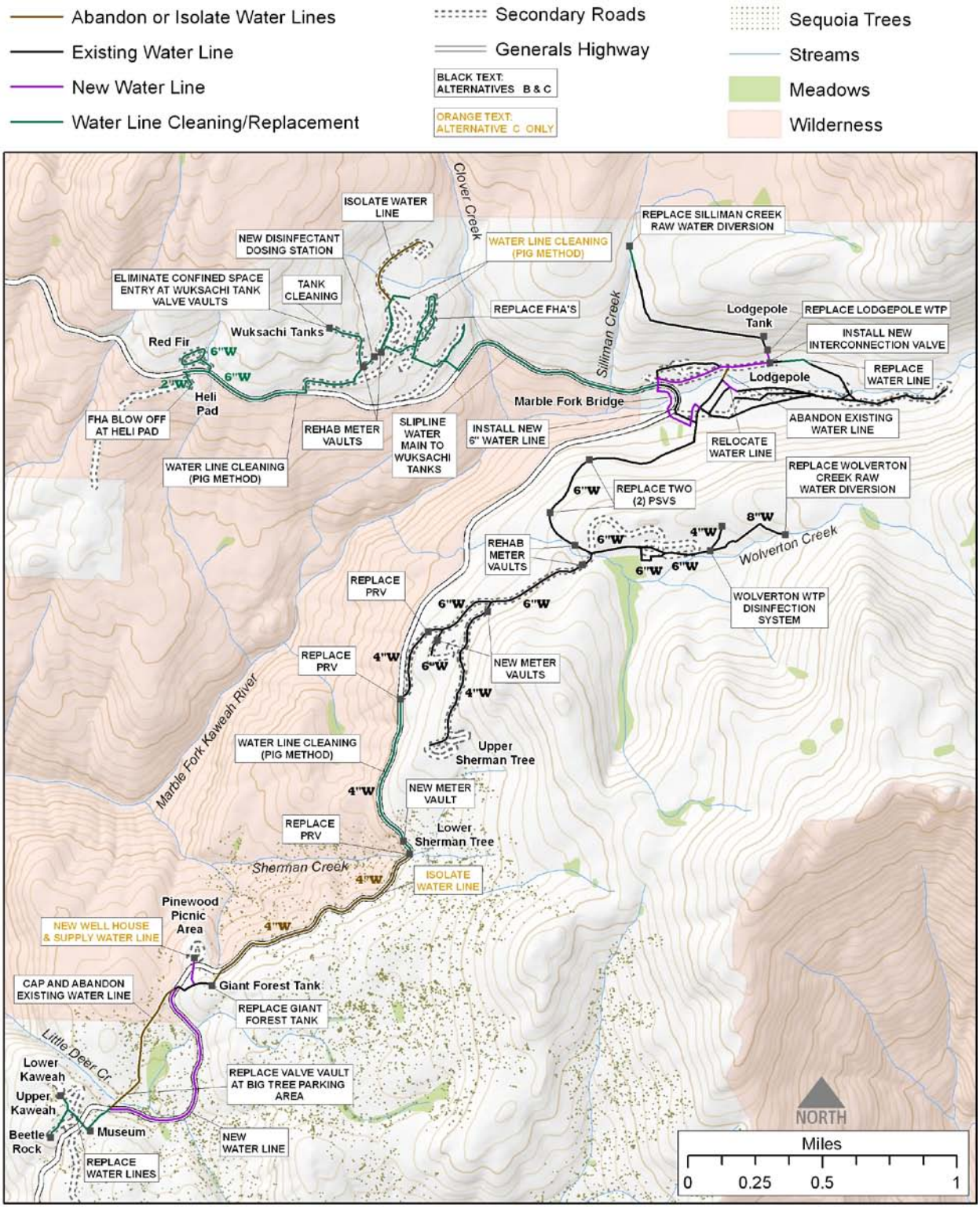

Figure 4. Map of Alternative C project components.

MITIGATION COMMON TO ALTERNATIVES B AND C

Mitigation measures are designed to prevent or minimize adverse impacts or to contain impacts within acceptable limits during and after project implementation. The following are guidance and mitigation measures that would be incorporated into project implementation.

General Measures

Construction zones outside of the existing disturbed area would be identified and fenced with construction tape or some similar material prior to any construction activity. The fencing would define the construction limits and confine activity to the minimum required for construction.

All protection measures would be clearly stated in the construction specifications/ special construction requirements, and workers would be instructed to avoid conducting activities beyond the construction limits, as defined. This does not exclude necessary temporary structures such as erosion control fencing.

All tools, equipment, barricades, signs, surplus materials and rubbish would be removed from the project work limits upon project completion. Any asphalt surfaces damaged due to work on the project would be repaired to original condition. All demolition debris (e.g., old water lines, appurtenances, water tanks, valves, packaging materials, trash) would be disposed of at appropriate areas outside the parks' or stockpiled at approved locations within the parks' to be used in future projects. When possible, debris would be disposed of at a materials recycling facility.

A hazardous spill plan would be in place, stating what actions would be taken in the case of a spill, notification measures, and preventive measures to be implemented, such as the placement of refueling facilities, storage, and handling of hazardous materials, etc. Any spills of hazardous materials, fuel, etc., would be immediately reported to the parks' hazardous material spills and safety officer.

Where appropriate and available "environmentally friendly" grease, hydraulic oil, and bar and chain oil would be used. These lubricants are vegetable or mineral oil based, less toxic, and biodegradeable.

All equipment on the project would be maintained in a clean and well-functioning state to avoid or minimize contamination from automotive fluids and inspected prior to entering the parks. All equipment would be checked daily by the contractor and documented in daily reports.

Site designs and plans for future actions identified in this EA/AoE, would be reviewed for consistency. Additional compliance would be initiated if activities go beyond the scope of this document, or if unforeseen issues arise.

Soils and Vegetation

Staging areas for materials and construction equipment, storage, and turnarounds would utilize previously disturbed areas to the greatest extent practicable.

Pressure wash equipment to remove all dirt and plant parts before entering the park for the first time, paying special attention to undercarriage and grill/radiator; subsequent entries would not require pressure washing unless the vehicle shows signs of mud, plant material, or other substances that could be considered harmful. The NPS Project Manager would inspect equipment for compliance prior to entry into the park, and reject equipment that is not adequately clean.

Remove existing populations of invasive non-native vegetation prior to project activities, and conduct appropriate monitoring and follow-up treatment after project completion.

Sources of rock, sand, gravel, earth, soil, or other imported natural material may be inspected for invasive non-native plants prior to acceptance. The contractor shall submit to the NPS Contracting Officer a list of proposed sources for import materials 30 calendar days in advance of importing material. The list shall also include the end use and any temporary storage requirements of those materials. NPS Natural Resources staff would inspect sources of materials that pose a risk, either by their end use or storage requirements, of allowing invasive non-native plants (also known as noxious weeds) to establish in the park. Materials may be rejected if non-native invasive plants are present at the source and seeds could be present in the material. At the discretion of the NPS Contracting Officer, potentially contaminated materials may be accepted if mitigating measures are implemented. Mitigation might include stripping the top 12 inches of source material, requiring fresh material stored less than 1 month, or sterilizing the material. Contaminated materials that contain fines and have an end-use on the surface would require sterilization before importing to the park. Import material shall be shipped directly from the source to the park without intermediary storage or staging. Shipping vessels shall be covered to prevent spillage or blowing of their contents while in transit. Materials must also be transported and stored such that they would not acquire invasive non-native plant seeds from adjacent vegetation.

Damage to residual vegetation would be avoided or minimized by: proper type and size of equipment; pre-identification of travel routes; protective barriers around individual and group of trees; hand-digging under high value (e.g. sequoia) trees; and, contract penalty clauses for tree and vegetation damage.

Any trenching operations (e.g. installing and accessing water lines, replacing water storage tanks and vaults) would be located to minimize disturbance to established vegetation and avoid large diameter trees to the extent possible. Equipment would be used that allows the operator to detect the presence of tree roots prior to damaging them. Roots less than 4 inches in diameter would be given a clean straight cut to prevent root rot. When roots 4 inches in diameter and larger are encountered during trenching operations, they would be retained by hand-digging the trench beneath the root. As the trench is dug, the excavated material would be stored adjacent to the disturbed areas. After trenching is completed, bedding would be placed and compacted in the bottom of the trench and the pipe installed in the bedding. Backfilling and compaction would begin immediately after the pipe is placed into the trench, and the trench surface would be returned to preconstruction contours.

All trenching restoration operations would follow guidelines approved by park staff. These guidelines would minimize disturbance to soils and vegetation from construction activities, and would restore affected areas to their original form wherever possible. Excavated material would be windrowed in the construction zone. Although soil windrowed during construction is susceptible to some erosion, such erosion would be minimized by placing silt fencing, as required, adjacent to the excavated soil. Excavated soil would be windrowed only as long as it takes to dig the trench and install the water line. Further, once construction is completed and disturbed surfaces recontoured, erosion mats or other erosion control measures would be used to protect bare, exposed soils from erosion until revegetation takes place.

Standard erosion control measures such as silt fences and/or sand bags would be used to minimize any potential soil erosion. Silt fencing fabric would be inspected weekly or after every major storm. Accumulated sediments would be removed when the fabric is estimated to be approximately 75% full. Silt removal would be accomplished in such a way as to avoid spillage.

Excess material removed (e.g. water line pipes, appurtenances, rock, soil) would be disposed of at appropriate areas outside the park or stockpiled at park approved upland locations within the park to be used in future projects. Fill material needed beyond that produced from construction activities would be

taken from park-approved sources outside the park. If there is a need to import topsoil, such topsoil would be certified free of noxious plant species and imported from sources approved by park resource management staff.

Vegetation impacts and potential compaction and erosion of bare soils would be minimized by salvaging topsoil from disturbed areas. Topsoil would be removed from these areas of construction, stored, and replaced at the end of the project. Soil would be de-compacted without harming major tree roots, before placing topsoil. The topsoil would be re-spread in as near the original location as possible.

Litter and duff would be removed from project areas and stored for later replacement over topsoil.

In an effort to avoid introduction of non-native plant species, no hay bales would be used during revegetation or for temporary erosion control.

A revegetation strategy would be developed for disturbances outside of existing road corridors. All disturbed areas would be restored as nearly as possible to preconstruction conditions shortly after construction activities are completed. The NPS Natural Resources staff would be consulted prior to any reseeding or replanting efforts.

Revegetated areas would be frequently monitored for success rates and to ensure that erosion is not occurring. Remedial actions would be implemented, as necessary, and could include installation of additional erosion control structures, reseeding and/or replanting areas, and controlling non-native species.

Prior to construction activities associated with the water diversion structures, a vegetation survey would be completed to identify the presence of any plant species of management concern.

Staging areas and project work areas would be surveyed for invasive non-native plants one to three years after project completion.

Water Resources

Storing of hazardous materials and fueling of all tools and equipment would be restricted to park-approved equipment staging areas. Spilled hazardous materials would be cleaned up immediately and would not be allowed to seep into the soil or reach open water sources.

Construction crews would use appropriate methods for human waste treatment.

Standard erosion-control measures and sedimentation control would be implemented to minimize impacts to water quality.

Water needed for construction and dust control would come from the existing developed water systems within the parks and would not be diverted from streams.

A monitoring strategy would be developed for the water systems on Silliman and Wolverton Creeks. Current technology would be integrated into the design of the new structures to allow for the monitoring of water flows. This monitoring program would help the parks determine the levels of acceptable withdrawals under different precipitation regimes.

Wetlands

Wetland Protection Best Management Practices (Appendix D) would be adhered to.

Wildlife

A litter control program would be implemented during construction to eliminate the accumulation of trash. All food would be stored in bear proof containers except when it is being consumed. Food stored in vehicles would be in bear proof containers. Spilled food would be cleaned up. Visitors in traffic delays would be educated by NPS staff, when available, to not approach or feed wildlife.

Air Quality

Dust control would occur, as needed, on active work areas where dirt or fine particles are exposed.

Idling regulations must be followed and exceeded if possible. The Contractor would not leave vehicles idling for more than five minutes when parked or not in use.

Soundscapes

Most construction activity would be limited to daylight hours. Some night work may be necessary for installation of the waterline within the roadbed of Generals Highway. To minimize visitors' and residents' exposure to unnatural sounds, construction near campgrounds, lodging, and employee housing areas would occur during daylight hours.

Construction-related noise would be mitigated through use of state-of-the-art noise reduction technology on construction equipment to the maximum extent possible, to minimize the amount of noise from construction activities.

Contractors would be required to properly maintain construction equipment (i.e., mufflers) to minimize noise from use of the equipment.

Visual Resources

Any appurtenances and buildings would have design features to soften their appearance and blend into the surrounding terrain. Areas disturbed by project activities would be revegetated and rehabilitated to pre-work conditions. New structures would comply with the parks' *Architectural Character Guidelines*.

Recycled products would be used when possible. Nontoxic products would be used and design would strive for a high level of energy efficiency.

Any lighting, such as security lighting, would be directional and shielded to prevent intrusions into the night sky.

Cultural Resources

Construction workers and supervisors would be informed of the special sensitivity of park values, regulations, and appropriate housekeeping. All contractors would be informed of the penalties for illegally collecting artifacts or intentionally damaging any archeological or historic property by construction crews. Construction workers and supervisors would be advised of the laws and guidelines and special sensitivity to ensure protection of cultural resources.

Should unknown archeological resources be encountered during project implementation, work would be halted in the discovery area, the site secured, and the parks' archeologist notified. The parks' archeologist or a qualified representative will examine the area as soon as possible and will follow the requirements of the NHPA, and any other applicable cultural resource laws, as needed. Work could resume only after an appropriate mitigation strategy is developed in consultation with the California SHPO and after archeological clearances are obtained.

The water diversion dams at Silliman and Wolverton creeks, as well as the "Mission 66" water treatment plant at Lodgepole, would be evaluated for their National Register eligibility prior to the start of project activities. The water diversion dams are at least 50 years of age and potentially eligible for listing in the National Register; as per NPS policy, "Mission 66" structures are likewise to be treated as "potentially eligible" pending their formal evaluation.

In compliance with the *Native American Graves Protection and Repatriation Act* (NAGPRA), the NPS would notify and consult concerned Native American tribal representatives for the proper treatment of human remains, funerary, and sacred objects should these be discovered during the project.

Should construction activities or project work inadvertently harm a cultural resource, work would stop in the area and the Cultural Resource Specialist would be contacted. Consultation with the SHPO, tribes, and/or other interested parties would be conducted, as necessary and appropriate.

Visitor Safety and Experience

Construction activities would be planned to minimize any procedure that might displace normal visitor access or impact their experience.

During project implementation, visitors would be informed of construction activities via press release, visitor center postings, and other educational contacts. Where possible, visitors would be told of alternatives to avoid noise and access intrusions.

One lane of traffic would remain open during the installation of a new waterline within the Generals Highway, in the Giant Forest area. Traffic delays would be a maximum of one hour. When delays are necessary, traffic would be released through the construction zone on the hour. Closures would be limited to weekday closures from 6 a.m. Monday to 12 p.m. Friday with weekend closures limited to short delays to account for the possibility of single lane travel. Some night work may be required, but would be limited to the greatest extent practicable.

The parks would provide information (e.g. brochures, signs, news releases) to inform visitors, concessioners, USFS, and employees of alternative routes and project schedule.

Construction activities occurring near residential or visitor overnight-use areas would be scheduled to occur during the daytime.

Visitors would be notified when road closures or traffic delays would occur and information would be posted in neighboring communities, on the park websites, at visitor centers, and entrance stations.

Park Operations

Delays for emergency response vehicles would be kept to a minimum by having the emergency responders notify the traffic monitors via park radio/frequency immediately when the vehicle is dispatch, thus allowing approximately ten minutes to clear the road before the arrival of the emergency vehicle.

The appropriate volume of water to maintain water supply use by visitors, residents, and employees, would be stored and available during construction activities.

ALTERNATIVES CONSIDERED BUT DISMISSED FROM DETAILED ANALYSIS

WOLVERTON WATER TREATMENT PLANT TO SUPPLY ALL WATER

An improvement option was explored to have the Wolverton water treatment plant supply all water to facilities in the Giant Forest, Wolverton, Lodgepole, and Wuksachi, and the Red Fir maintenance facility. Water modeling results and a separate evaluation of water system demands and supply capabilities were used to determine the viability of this water system improvement option. This option was eliminated from further analysis because water modeling results determined that Wolverton water treatment plant cannot provide adequate supply of water to meet peak day demands to include any potential build-out of the Wuksachi visitor services area by the concession operator. The evaluation of supply and demand indicated that the Lodgepole water treatment plant must remain functional (Arber 2010a). Therefore, this option was dismissed from further analysis.

SLIP LINE THE WATER MAIN FROM LODGEPOLE/ WOLVERTON INTERCONNECTION TO WUKSACHI TANKS

Water modeling was used to evaluate the existing water supply and distribution system and to determine its capabilities for future growth. To accommodate future growth at Wuksachi, a scenario was used to determine the Wuksachi tank fill capacity when compared to existing conditions. The scenario assumed that a 3-inch HDPE water line would be slip-lined into the existing 6-inch water main from the Lodgepole-Wolverton interconnection to the Wuksachi water tanks. The results of the scenario indicated that the Wuksachi tanks would be able to fill at a rate of 30 gpm, which is slightly less than the existing peak day demand from the Wuksachi tanks of approximately 33 gpm. Given the possibility of future expansion at Wuksachi, slip-lining to the Wuksachi tanks with a 3-inch line has been eliminated from further analysis because the filling capacity of the Wuksachi tanks decreases to less than the existing and future projected demands.

EXTEND WATER LINE FROM UPPER SHERMAN TREE TO LOWER SHERMAN TREE AREA

During the internal scoping phase of the project, an alternative was being considered to extend the water line from the upper Sherman Tree area to the lower Sherman Tree area. Because the test well was deemed a viable groundwater source, the water main on the Wolverton access road would be cut/ capped at the intersection where the lateral line branches off to the upper Sherman Tree area. The water line from the upper Sherman Tree area would be extended to the lower Sherman Tree area. After further investigation, reviews of as-built drawings, and discussions with NPS water treatment operators, it was determined that the existing water line along the Wolverton access road and Generals Highway was a newer water line with no history of failures. In addition, the existing 4-inch water line follows the road corridor and is easy to access and service in the winter if a future failure should occur. Therefore, this alternative was considered but dismissed from further evaluation because it added little to no value for the complexity, cost, and unnecessary resource disturbance.

OTHER WATER LINE ROUTES FROM THE GIANT FOREST TANK TO THE GIANT FOREST MUSEUM

Originally, two additional routes were considered for the installation of a new water main from the Giant Forest tank to the Giant Forest Museum. One option included replacing the existing pipe along its current route using the pipe bursting method. The second option considered installing a new water line along a former road corridor that was restored during the ten-year restoration effort in the Giant Forest. On January 12, 2011, a VA was conducted to look at three specific routes for the water main from the Giant Forest tank to the Giant Forest Museum through the sequoia grove. As a result of the VA, and after consideration of potential impacts to resources by subject matter experts, both routes were dismissed from further analysis for the following reasons:

- The *Omnibus Public Land Management Act of 2009 (*P.L. 111-11, HR 146*)* designated additional wilderness in Sequoia and Kings Canyon National Parks. Subsequently, approximately 750 linear feet of the existing water line and approximately 1,100 linear feet of the restored former road corridor are now within designated wilderness. Wilderness legislation and NPS policies allow for an installation within wilderness only if it is necessary to meet the minimum requirements for administration of the area as wilderness. Installing a new water line within wilderness to support frontcountry operations is inconsistent with this requirement.

- During the 1920s and 1930s, extensive development occurred in the Giant Forest area. At that time, Giant Forest was a major attraction that included encampments and villages. In 1980, an environmental impact statement was completed to remove the facilities from the area to reduce development-associated impacts on the giant sequoia grove. From 1997-2005, hundreds of structures were removed and the area was restored. In 2000, the former road corridor was demolished and restored to natural contours; small trees and shrubs are reestablishing in the corridor. The two routes considered but dismissed would traverse cross-country through this restored sequoia grove. The installation of new water lines and the trenching actions necessary for the pipe bursting alternative, are not consistent with the goal of reducing impacts on the giant sequoia grove, and would hamper ongoing restoration efforts.

- Another consideration was the potential for short-term and long-term impacts from the routes on sequoia tree roots, and to meadows and watercourses. All three routes considered for installation of a new water line would be within the giant sequoia grove, and trenching and ground disturbance would be required. However, the two routes dismissed from further consideration were anticipated to cause more disturbance to giant sequoia roots and to new vegetation growth than the route within the Generals Highway road corridor. A combination of pipe bursting, rerouting around significant roots, and trenching was proposed for installing a new water main in the existing pipe route. The method for installing a new water main in the restored former road corridor would involve trenching. Both methods would involve significant ground disturbance and adverse impacts to the giant sequoia groves. Damage to the roots would be unavoidable and could result in the loss of several monarch trees. One of the primary purposes of Sequoia and Kings Canyon National Parks, as stated in the enabling legislation, is to protect these unique trees (16 USC 41, 26 Stat. 478). Therefore it is unacceptable to cause harm to these trees when other options are available. In addition, the existing water line route crosses through a meadow, and both routes would cross a creek. NPS policies strive to prevent the loss or degradation of wetlands and floodplains and to preserve and enhance the natural beneficial values of wetlands and floodplains. While neither alternative would be anticipated to result in unacceptable adverse effects to wetlands and water courses, avoidance of wetlands and water courses, when possible, is most favorable.

For the reasons stated above, the option to install a new pipe main in the existing location and the option to install a new pipe main along the restored former road corridor were dismissed from further consideration because they are not consistent with wilderness legislation; NPS policies; past and present park planning documents; and, would result in unavoidable adverse impacts to resources, including giant sequoia trees, in ecologically sensitive areas.

ALTERNATIVE WELL LOCATIONS IN THE GIANT FOREST AREA

A number of locations, within the Giant Forest area, were initially considered for a possible groundwater source. In May 2010, technical expert(s) from the NPS Water Resources Division in Fort Collins conducted a site visit to the Giant Forest area, to review area geology and hydrology for a new well. Potential well locations were severely limited by topography, the desire to limit access to previously disturbed areas, avoidance of restored areas, wilderness area boundaries, and sensitive ecological features such as wet meadows and sequoia groves. Initially, a site near the Giant Forest Museum was considered a potential site for a test well because it would be near the area where the largest amount of water is used. Upon closer inspection, it was determined that the well site would need to be located off the edge of the overflow parking area. This would place the well some distance from existing electrical service, far from the road corridor, and at a significantly lower elevation than the museum or the Pinewood picnic area. A well at this location would require construction of a new site for a water storage tank above the museum and a booster pump, resulting in an increase in carbon footprint and operations and maintenance. Other sites within the Giant Forest area were considered, but were dismissed from further consideration after a site, selected by technical experts, in the Pinewood picnic area yielded successful results.

ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is determined by applying the criteria suggested in the NEPA, which guides the CEQ. The CEQ provides direction that "the environmentally preferable alternative is the alternative that will promote the national environmental policy as expressed in the NEPA's §101."

> [Section 101 states that] it is the continuing responsibility of the Federal Government to:
>
> (1) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
>
> (2) Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
>
> (3) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
>
> (4) Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
>
> (5) Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and
>
> (6) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

The identification of the environmentally preferred alternative was based on an analysis that balances factors such as physical impacts on various aspects of the environment, mitigation measures to deal with

impacts, and other factors, including the statutory mission of the NPS and the purposes for the project. (For a comparison of the alternatives and the potential environmental effects under each alternative, see Tables 2 and 3. A full discussion of impacts is presented later in this document).

Alternative A, No Action, does not fully meet the above six criteria because it retains a water system that does not meet health and safety standards in terms of it not being in compliance with state drinking water standards. Hence, the no action alternative does not assure safe and healthful surroundings (criteria 2), nor does it attain the widest range of beneficial uses of the environment without degradation, risk to health and safety (criteria 3), or achieve a balance between population and resource use that permits NPS and concessioner employees, residents, and visitors, to experience a wide sharing of life's amenities (criteria 5). Retaining a deteriorated water system does not fulfill the responsibilities of trustee of the environment (criteria 1) nor does it meet the criteria for improving renewable resources (criteria 6), because the existing water system is inefficient with regards to energy use and water loss from breaks and leaks in the system. The no action alternative would continue to require repairs and maintenance to the portion of water line traversing the restored area of the Giant Forest, an ecologically sensitive area, thereby not fully realizing the preservation of important natural aspects of our national heritage (criteria 4).

Alternatives B and C both meet the six criteria as stated in section 101 of NEPA. Actions associated with these alternatives would improve the water system to be in compliance with state drinking water standards, thereby protecting public health, safety, and welfare. These alternatives would preserve the environment for future generations; protect employee safety and welfare; improve operations efficiency and sustainability; and, conserve water resources. Alternative C would provide a slightly greater benefit because a new well would be developed at Pinewood picnic area, which would allow for a greater diversity in the number and types of water sources available to the overall water system, further improving reliability and drinking water, thus improving operational efficiency and sustainability beyond that of alternative B. For this reason, alternative C has been chosen as the environmentally preferred alternative.

Table 1. Alternatives Comparison

Project Objectives	Alternative A: No Action	Alternative B: Rehabilitate System and Improve Water Disinfection	Alternative C: Develop a New Well
Provide high quality drinking water that meets or exceeds state drinking water regulations.	Does not achieve objective.	Fully achieves objective.	Fully achieves objective.
Reduce operational and maintenance costs and inefficiencies.	Does not achieve objective.	Partially meets objective.	Fully achieves objective.
Establish a comprehensive design and plan that addresses immediate deficiencies, considers future build-out, and prioritizes work elements.	Does not achieve objective.	Partially meets objective.	Fully achieves objective.
Supports a water system that is sustainable, resource efficient, and minimizes impacts on park resources.	Does not achieve objective.	Partially meets objective.	Fully achieves objective.
Provides adequate and dependable water delivery to meet fire suppression capabilities.	Does not achieve objective.	Partially meets objective.	Fully achieves objective.
Ensures an uninterrupted potable water supply to minimize inconveniences to visitors, park and concessioner operations, and employee residents and their families.	Does not achieve objective.	Partially meets objective.	Fully achieves objective.
Provide a safe water and healthy work environment.	Does not achieve objective.	Fully achieves objective.	Fully achieves objective.

Table 2. Impact Summary Table

Note: This is a summary table only. The full descriptions of impacts are found in Chapter 4, Environmental Consequences Section.

	Alternative A: No Action	Alternative B:	Alternative C:
Geology and Soils	Impacts to soils and geology from the no action alternative would be negligible to minor, adverse, temporary, and localized. When considered with past, present, and reasonably foreseeable future actions, the no action alternative would contribute slightly to the minor to moderate adverse cumulative effects to soils and geology in the project area from past, present, and future foreseeable projects.	Most of the project components associated with alternative B would occur within park developed areas, within existing utility and/or road corridors, and in areas where soils have been previously disturbed. There would be short-term minor adverse impacts to localized areas from construction activities and long-term minor adverse impacts to soils and geology from constructing new buildings and trenching. Long-term beneficial effects to soils and geology would result from relocating the line from an eroding riverbank, abandoning the water line under the Marble Fork of the Kaweah River, abandoning the existing water line that traverses the Giant Forest area, and from fewer leaks and emergency repairs associated with the existing lines. Alternative B would have additional long-term minor adverse impacts on soils and geology in a localized area from construction of the chlorine dosing station and installation of new piping at Wuksachi. There would be no measurable cumulative effects on soils and geology from implementation of alternative B.	Alternative C has the same impacts as alternative B, except that alternative C would have additional long-term minor adverse impacts on soils and geology in a localized area at the Pinewood picnic area from the construction a new well house and well development. There would be no measurable cumulative effects on soils and geology from implementation of alternative C.
Vegetation	Continued maintenance and repairs to the water distribution system would likely occur more frequently in the future, and would result in short- and long-term minor adverse impacts on vegetation, including giant sequoias, in the vicinity of water line breaks from the use of heavy equipment and digging. When considered with past, present, and reasonably foreseeable future actions, the no action alternative would contribute slightly to overall adverse cumulative effects on	Most of the project components associated with alternative B would occur within park developed areas, within existing utility and/or road corridors, and in areas where soils have been previously disturbed. There would be short-term minor adverse impacts in localized areas from construction activities. There would be long-term beneficial effects to vegetation and the giant sequoia ecosystem from capping and abandoning the existing water line that traverses through the Giant Forest,	Same as alternative B.

	Alternative A: No Action	Alternative B:	Alternative C:
	vegetation and the giant sequoia ecosystem.	thereby eliminating any future disturbances from emergency repair work. There would be less leakage of treated water. When considered with past, present, and reasonably foreseeable future actions, alternatives B and C would have no measurable contribution to adverse cumulative effects on vegetation.	
Water Resources	The no action alternative would result in short-term, minor, adverse, localized impacts on water resources from impacts to water resources associated with breaks in the water lines; and, long-term, moderate, adverse impacts on water resources from the continued loss of water and the subsequent need for increased water diversion. The no action alternative when combined with past, present, and reasonably foreseeable future actions, results in a short-term minor adverse cumulative impact on water resources in the project area.	Short-term minor adverse impact on water resources would occur in a localized area during construction activities. Replacement of the water diversions in Silliman and Wolverton creeks would create disturbance in a riparian wetland area, and there would be adverse effects downstream associated with sedimentation from instream activities, but impacts would be short-term and BMPs would be implemented to reduce impacts to resources. Long-term beneficial effects to water resources would occur from avoiding work in watercourses and meadows associated with the existing water line traversing the Giant Forest, and from reducing water loss from repairing the leaking water system. Alternative B would result in short- and long-term minor adverse and long-term beneficial cumulative effects on water resources in the project area.	Short-term minor adverse impact on water resources would occur in a localized area during construction activities. Replacement of the water diversions in Silliman and Wolverton creeks would create disturbance in a riparian wetland area, and there would be adverse effects downstream associated with sedimentation from instream activities, but impacts would be short-term and BMPs would be implemented to reduce impacts to resources. Long-term beneficial effects to water resources would occur from avoiding work in watercourses and meadows associated with the existing water line traversing the Giant Forest, and from reducing water loss from repairing the leaking water system. A new groundwater well would be developed at the Pinewood picnic area under alternative C. The anticipated low pumping rate and the distance to the headwaters of adjacent drainages would result in minimal to no streamflow reduction. Alternative C would result in short- and long-term minor adverse and long-term beneficial cumulative effects on water resources in the project area.
Historic Resources	The no action alternative would result in no impacts on historic resources. When considered with past, present, and reasonably foreseeable future actions, the no action alternative would have no measurable cumulative effects on historic resources because there would be no change to the	The existing water line that traverses the Giant Forest area would be capped and abandoned in place and the replacement water line would be installed within the roadbed of the National Register-eligible Generals Highway. Similarly, a short segment of current line within the riverbed of the Marble Fork of the Kaweah	Same as alternative b.

	Alternative A: No Action	Alternative B:	Alternative C:
	water system and appurtenances.	River (Lodgepole area) would be abandoned in place and the line would be re-located to the Generals Highway and placed within the roadbed as it crosses the Marble Fork Bridge. All associated disturbance would be within the existing Generals Highway roadbed, which contains a number of buried utilities, and there would be *no adverse effect* to the Marble Fork Bridge or the Generals Highway. The "Mission 66" water treatment plant at Lodgepole would be replaced or modified and the water diversion structures in Silliman Creek and Wolverton Creek would be replaced. The NHPA section 106 determination would likely be either *no effect* or *no adverse effect*, pending the results of the National Register evaluations of the two dam structures and the "Mission 66" water treatment plant at Lodgepole. Removal of historic resources, if they are determined to be National Register eligible, would result in a long-term minor adverse effect When combined with past, present, and reasonably foreseeable future actions, alternative B may add slightly to the loss of historic resources, if those resources are determined to be National Register eligible.	
Public Health and Safety	The no action alternative would result in short-term minor to moderate adverse impacts on public health and safety during water system shutdowns. Long-term moderate adverse impacts on public health and safety would result because state drinking water quality standards would not be met, water disinfection would not be addressed, the water system would not be optimized for dependable fire suppression, and system shutdowns and interrupted water delivery would become more frequent. The cumulative effects to overall public health and safety in the project area would be long-term minor and adverse.	Implementation of alternative B would result in long-term beneficial effects on public health and safety by providing high quality drinking water, meeting state water quality standards, and providing an uninterrupted potable water supply for fire suppression and domestic needs. There would be short-term adverse minor localized impacts to public health and safety during construction activities. When added to past, present, and reasonably foreseeable future actions, alternative B would result in long-term beneficial cumulative effects on public health and safety.	Same as alternative B.

	Alternative A: No Action	Alternative B:	Alternative C:
Visitor Experience and Recreational Opportunities	The potential for system shutdowns and subsequent closures of facilities and visitor use areas as a result of water system failures could result in short-term and long-term moderate to major adverse impacts on visitor experience and recreational opportunities depending on the severity and extent of the failure and the desired visitor experience and level of expectation. When considered with past, present, and reasonably foreseeable future actions, the cumulative effects on visitor experience and recreational opportunities would be short- and long-term, moderate to major, and adverse.	Construction activities associated with alternative B would result in short-term minor to moderate adverse impacts on visitor experience and recreational opportunities from area closures, traffic delays, and potential interruption in services. Long-term beneficial effects to visitor experience and recreational opportunities would result from ensuring uninterrupted potable water delivery for domestic and fire suppression, and providing high quality drinking water. When considered with past, present, and reasonably foreseeable future actions, the cumulative effects would be short-term moderate and adverse, and long-term and beneficial.	Same as alternative B.
Park and Concessioner Operations and Employee Safety	Under the no action alternative, there would be no major improvements made to the water system and it would remain noncompliant with state water quality standards. Failures would increase as the system continues to deteriorate, resulting in a higher probability for water system failures and system shutdowns. This would result in long-term moderate to major adverse impacts on park and concessioner operations and employee safety. When combining this alternative with past, present, and reasonably future activities, the cumulative effects on park and concessioner operations and employee safety would be long-term, moderate and adverse.	A comprehensive design and plan of the water system would be implemented to address immediate deficiencies, consider future build-out, and prioritize work elements. Rehabilitation of the water system would improve drinking water quality, provide uninterrupted potable water delivery to NPS and concessioner operated facilities and residences, provide adequate water delivery for fire suppression, and, improve working conditions for employees, resulting in long-term beneficial effects to park and concessioner operations and employee health. Construction activities would result in short-term minor to moderate adverse impacts to park and concessioner operations, and NPS and concessioner employees and their families during construction activities on the Generals Highway and in Wuksachi, and if water shutdowns are necessary during project work. The cumulative effects would be short-term minor and adverse, and long-term and beneficial.	Mostly the same as alternative B, however, alternative C would result in additional long-term beneficial cumulative effects to park and concessioner operations and employee safety from the construction of the well at Pinewood picnic area, which would improve water quality at Giant Forest by further reducing water age in the system, and would provide more diversity and flexibility in the number and type of water sources available, thereby improving reliability.

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AFFECTED ENVIRONMENT

This section provides a summary of the resources associated with the alternatives and the environmental consequences of the alternatives. It is organized by impact and resource topics that were derived from internal park and external public scoping, and is limited to those topics that may be affected by the alternatives. More detailed information on resources in Sequoia and Kings Canyon National Parks can be found in the GMP (NPS 2007) and in the Giant Forest/ Lodgepole DCP (NPS 1980).

LOCATION AND GENERAL PROJECT AREA DESCRIPTION

Sequoia and Kings Canyon National Parks are located in the eastern part of central California (Figure 5). Although established by separate acts of Congress, the two parks are contiguous and managed jointly. Sequoia and Kings Canyon National Parks occupy approximately 1,350 square miles within the central and southern portion of the Sierra Nevada. Included in the parks' rugged landscape is the highest peak in the contiguous United States, Mount Whitney, which rises to about 14,497 feet above sea level. In Kings Canyon National Park, prominent ridges extend westward from the crest creating the Goddard and Monarch divides and rising to over 13,000 feet. In Sequoia National Park, a second prominent ridge of mountains, the Great Western Divide, parallels the Sierra crest. Both parks occupy the western slope of the Sierra Nevada. Combined acreage of the two parks is 865,964. The project areas under consideration are within Sequoia National Park, and include the developed areas of Lodgepole, Wolverton, Giant Forest, Wuksachi, and the Red Fir maintenance facility. Access to these developed areas is from the Generals Highway; the main thoroughfare through Sequoia National Park.

GIANT FOREST/ PINEWOOD PICNIC AREA

The Giant Forest area is a very popular destination in the parks. Visitors travel to this area to view the giant sequoias, meadows, and abundant wildlife. Visitors hike trails through the big trees, visit the Giant Forest Museum, the General Sherman Tree, Moro Rock, Crescent Meadow, Pinewood picnic area, and catch the shuttle bus to other park destinations. Historically, the Giant Forest area was a major attraction that included visitor lodging and other visitor services. From 1997-2005, a major restoration effort occurred, and nearly all facilities were removed with the purpose of protecting sequoia groves and other park resources. Today, the Giant Forest is a day-use only area.

Location of Water Distribution System

From the Wolverton water treatment plant, the water distribution line predominately follows the Generals Highway south to the Giant Forest water storage tanks. From the tanks, the water line enters the restoration area of the Giant Forest, and predominately follows the historic roadbed. The distribution system supplies water to the Giant Forest Museum; the comfort station near the Giant Forest shuttle stop; the Beetle Rock educational center; one employee residence; a comfort station at Lower Kaweah Camp; a comfort station, drinking fountain, and hose bib at Pinewood picnic area; and, a drinking fountain and hose bib at Round Meadow.

LODGEPOLE

Lodgepole lies within Tokopah Canyon of the Marble Fork of the Kaweah River. Lodgepole is a camping destination for tents and recreational vehicles with 214 sites open year-round. The Lodgepole area is a popular river recreation site, provides access to wilderness and other trailheads, shuttle access in the summer, and is a principal employee residential area. Other facilities and services include the Lodgepole Visitor Center, food service and gift shop, laundry, showers, and a post office.

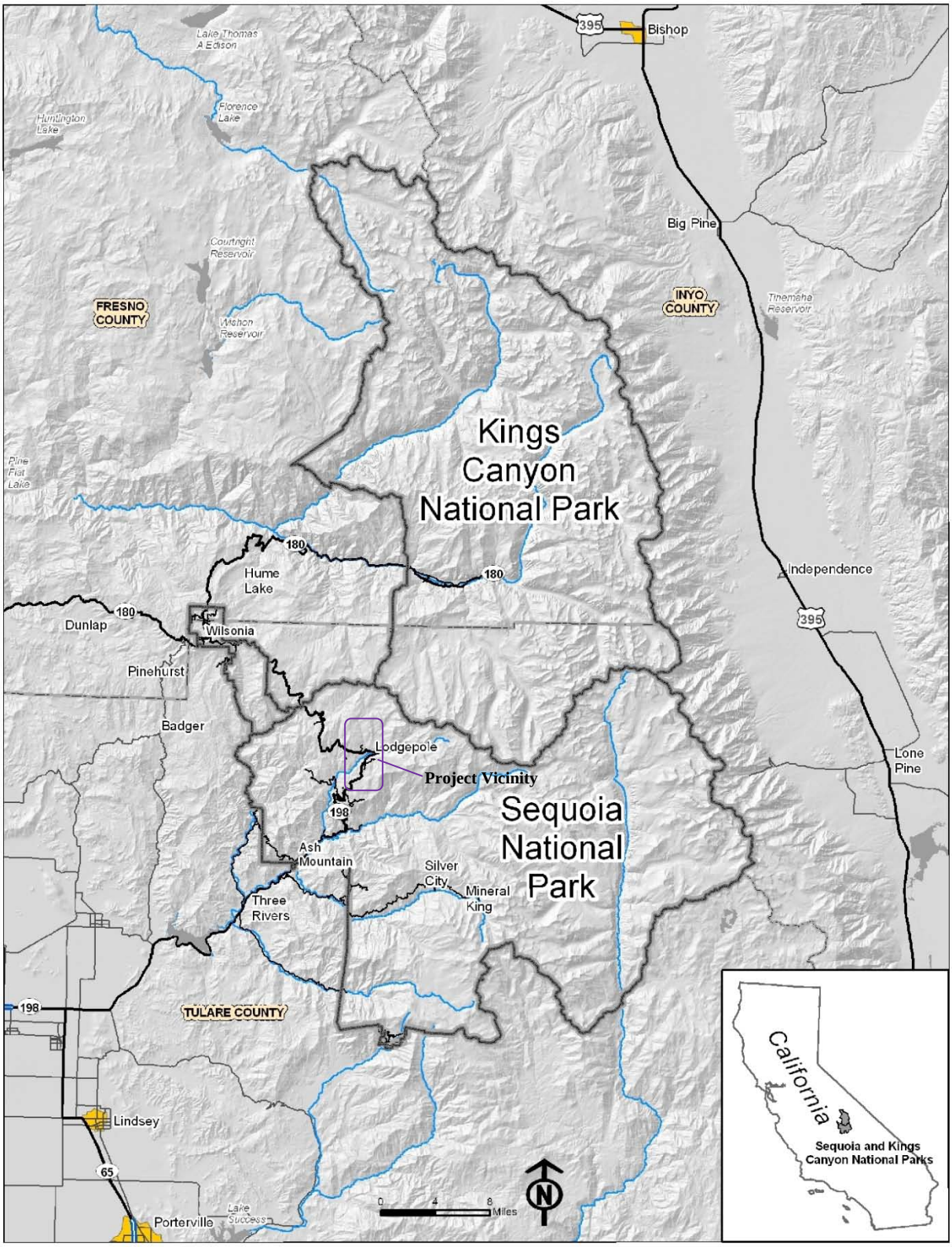

Figure 5. Area Map

Location of Water Supply and Distribution System
Silliman Creek, a tributary of the Marble Fork of the Kaweah River, is the source of water supporting the Lodgepole area. A surface water intake pipe is located behind a concrete dam within the creek. Water is treated at the water treatment plant, located within the NPS employee housing area, and stored in a storage tank above the plant. The water system is a looped system and crosses the Marble Fork of the Kaweah River at two locations. Water is distributed to facilities within the Lodgepole developed area.

WOLVERTON

The Wolverton area is located within a large open meadow in a forested valley, and provides summer picnicking, winter activities, access to hiking trails, and a backcountry trailhead. A 1.4 mile road from the Generals Highway provides access to the Wolverton area, with turn-offs to the Wolverton corrals and the upper Sherman Tree parking area. The Wolverton corrals are used for administrative purposes only (e.g. trail crew staging area).

Location of the Water Supply and Distribution System
Wolverton Creek, a tributary of the Marble Fork of the Kaweah River, is the source of water for the Wolverton water distribution system. A water intake pipe in the creek conveys water to the Wolverton water treatment plant where it is treated, stored, and distributed. A water line follows the Wolverton access road where it is distributed to the upper Sherman Tree comfort station and the Wolverton corrals. Once the water line meets with the Generals Highway, it follows the road corridor south to the Giant Forest water storage tanks. From the Wolverton area, the water line follows the "Old Army Road" to the Lodgepole developed area, where it continues along the Generals Highway to the Wuksachi storage tanks.

WUKSACHI AND RED FIR MAINTENANCE FACILITY

Wuksachi is a new developed area set amid rocky outcrops and surrounded by evergreen forest. Wuksachi provides year-round facilities for lodging and food service, plus residential and park operation areas in accordance with the concession contract. The Red Fir maintenance facility is the primary NPS maintenance site for the area.

Location of the Water Distribution System
From the Wolverton water treatment plant, a water distribution line follows the "Old Army Road" north to the Lodgepole developed area, where it continues along the Generals Highway west to the Wuksachi water storage tanks. Water is distributed to existing facilities in Wuksachi. From the Wuksachi storage tanks, a water line continues west along Generals Highway and provides water to the Red Fir maintenance facility and helipad.

GEOLOGY AND SOILS

The Giant Forest, Lodgepole, Wolverton, Wuksachi, and Red Fir areas are situated in the western mountainous terrain of the Sierra Nevada and the elevation ranges from 5,500 feet to 10,000 feet. The actual project area ranges in elevation from 6,000 feet to 8,000 feet. The area is composed of three distinctive geological units; from oldest to youngest, they include a granodiorite basement complex (pre-Tertiary period), glacial till composed of poorly sorted sediments (Pleistocene epoch), and recently deposited alluvium (Holocene epoch). The basement complex is dominated by vast exposures of light-colored granite. Massive domes are common, as are perpendicular cliffs, exfoliated slabs, rectangular blocks, and talus. On top of the igneous basement complex are metamorphic rocks such as marble, schist, and quartzite. The metamorphic formations contain numerous caves; one of the best known is Crystal Cave, which is in the Giant Forest area (NPS 1980). Erosion by streams and glaciers has created a rugged and steep terrain, and level land is limited to a few small areas.

Soil and water chemistry characteristics in the Sierra Nevada are largely geologically controlled. Sierran soils tend to be shallow and young, showing little development. They also tend to have high infiltration rates due to high sand and rock content. The soils in the project area are of two general types- glaciated and non-glaciated. Both are primarily granitic in origin and have developed through combinations of glaciation, stream sedimentation, and in-place weathering and decomposition of rock (NPS 1980). Soil depth varies from several feet in forested, hilly upland areas to very thin or nonexistent in open, rocky exposures, especially at higher elevations (NPS 1980). Typically, the glaciated soils consist of unsorted silt, sand, and gravel of relatively low permeability. Postglacial sediments consist mainly of unconsolidated sandy and gravelly stream alluvium that is generally more permeable (NPS 1980).

Most of the project components associated with the action alternatives would occur within park developed areas; within existing utility and/or road corridors; and, areas where soils have been previously disturbed. One alternative considers developing a new well within the Giant Forest area. The proposed site, the Pinewood picnic area, is bounded on the east and west by north-trending valleys. Most of the soils in the Giant Forest area are a deep variant of the Shaver series, which are forest soils that have developed as residual from granitic rocks in moist portions of the region and can vary in depth from 54 inches to well over 6 feet in some areas (NPS 1980). The Pinewood/ Giant Forest area is underlain by grandiorite and has no primary permeability.

VEGETATION

The proposed project area has a range in elevation from approximately 6,000 to 8,000 feet, and vegetation has developed in response to dry summers and cool, moist winters when most of the precipitation falls as snow. Vegetation in the project area can be classified as: coniferous without sequoia, coniferous with sequoia, coniferous with lodgepole pine, meadow, and riparian (NPS 1980).

The coniferous without sequoia is the most dominate vegetation type distributed throughout the project area, and is dominated by white and red fir. Other common species include the Jeffery pine, sugar pine, white bark pine, incense cedar, lodgepole pine, mountain hemlock, and Sierra juniper. Shrubs associated with this vegetative community include manzanita, bitter cherry, chinquapin, snowbrush, littleleaf ceanothus, coffeeberry, and mountain gooseberry (NPS 1980).

Groves of sequoias are a resource of great importance to the historic and natural scene. Certain individual sequoias have been identified as historically significant, such as the General Sherman Tree and the Sentinel Tree. There is one sequoia grove associated with this project, the Giant Forest sequoia grove, and the vegetation type associated with this area can be described as coniferous with sequoia. White fir is usually the dominant tree species growing with sequoias. Other tree species include red fir, sugar pine, Jeffrey pine, and incense cedar. The understory is open, with limited cover of American dogwood and greenleaf manzanita, and a diverse mix of herbaceous species occurring on mesic soil (NPS 2010x). Fifty-five taxa were observed in the Giant Forest area during a vegetation survey in October 2010 (NPS 2010x).

The coniferous with lodgepole pine vegetation type is found throughout the park within the 6,700 to 11,000 foot elevational range. Within the project area, this vegetation type can be found in the Lodgepole developed area. It often occupies glaciated soils, and it is more common on north-facing slopes and edges of meadows and stream channels. Mountain gooseberry shrub is often found in this vegetative community (NPS 1980).

The brush vegetation type can be found near Lodgepole and Wuksachi developed areas, in areas where the predominant cover is brush and where less than 10 percent is trees, exposed rock, or barren. The brush species depends on the amount of moisture available. Xeric sites (areas with shallow soils and little moisture retention) are characterized by manzanita, snowbrush, and littleleaf ceanothus. Mesic sites (areas

with deeper soils and more moisture) are characterized by bitter cherry, chinquapin, coffeeberry, littleleaf ceanothus, and mountain misery (NPS 1980).

Meadows are found throughout the project vicinity and are typically open areas of predominantly perennial sedges, herbs, rushes, and grasses that are associated with willow, aspen, and lodgepole pine (NPS 1980). Riparian vegetation, found along streams and adjacent to springs, seeps, and other wet areas, include willow, creek dogwood, alder, aspen, and lodgepole pine (NPS 1980).

Most of the project components associated with the action alternatives would occur within developed areas; and, most of the proposed work would be within existing utility and/or road corridors and areas that have been previously impacted. The existing water line that traverses the Giant Forest supplied water to numerous structures that have since been removed in an extensive restoration project that occurred from 1997 to 2005. Today, the water line supports the few remaining structures. No special status plant species were observed during a plant survey conducted in October 2010. Orchard grass, an invasive species, was documented near Round Meadow within the Giant Forest (NPS 2010b).

WATER RESOURCES

The four large river systems with headwaters within the parks are the North Fork of the Kern River, the five forks of the Kaweah River, the South and Middle Forks of the Kings River, and the South Fork of the San Joaquin River. Surface water occurs primarily as rivers and streams at lower elevations, with a greater occurrence of lakes and ponds at higher elevations. The quantity of surface flow follows an annual cycle, with the lowest flows typically occurring in August and the highest flows in May or June. Spring flows are primarily snowmelt from glaciers and snowpack at higher elevations; by late August, the source is primarily groundwater.

Groundwater is common in alluvial deposits in meadows and wherever decomposed or fractured granite is suitable to form an aquifer. Precipitation appears adequate to recharge the groundwater, but the actual quantity of stored water in aquifers is unpredictable. Rainfall and melting snow tend to rapidly infiltrate weathered and fractured rock. Even in areas of relatively solid rock, runoff tends to channel into the nearest fractures and crevices. These characteristics mean that much of the streamflow is a result of interflow, or shallow groundwater movement, rather than direct surface runoff. Groundwater supplies many meadows, seeps, springs, creeks, and perennial streams. Most of the water consumed in the parks comes from surface sources such as streams and springs. There are a few shallow wells with good water quality.

Water Quality
The proposed project would occur within the Upper Kaweah River watershed. The state considers the surface water quality of this river, above Lake Kaweah, to be beneficial for wildlife; cold and warm freshwater habitat; freshwater replenishment; habitat for rare, threatened and endangered species; habitat for spawning; contact and non-contact recreation; hydropower generation; and, municipal and domestic water supply, as indicated in California Water Quality Control Board's Central Valley Regional *Water Quality Control Plan for the Tulare Lake Basin* (SWRCB 1995). Upstream from the foothills, water quality of surface waters is considered good to excellent (SWRCB 1995).

Water Supply
Currently, there are two primary water supplies that provide water to facilities in the project area. A water diversion in Wolverton Creek provides water to the Giant Forest, Wolverton, Wuksachi, the Red Fir maintenance facility, and the emergency connection at Lodgepole. In addition, a groundwater well within Long Meadow, at Wolverton, is capable of supplementing the Wolverton water system if necessary. A

water diversion in Silliman Creek provides water to facilities in the Lodgepole area. This water system cannot hydraulically provide water to the rest of the water system.

In the parks, there are both public and private ownership of water supply systems. Many of the water supply systems are in need of upgrades or rehabilitation. Within the project vicinity, there are five public water sources that supply water to various facilities in the area (Table 4).

Table 3. Water Supply Sources and Locations

Location	Water Source	Source Type	Approximate Year of Construction
Cabin Creek	Cabin Creek	Surface	1940
Crescent Meadow	Creek	Surface	1940
Crystal Cave	Creek	Surface	Unknown
Wolverton	Wolverton Creek	Surface	1959
Wolverton	Long Meadow	Well	1967
Lodgepole	Silliman Creek	Surface	1934

HISTORIC RESOURCES

Within the project area, there are a number of historic resources that could potentially be affected by the alternatives described in this document. The following historic resources are within the project area:

- The Marble Fork Bridge, located in the Lodgepole area, is listed in the National Register of Historic Places (National Register)(1978).

- In 1992, the Generals Highway was determined to be eligible for inclusion in the National Register.

- The water treatment plant at Lodgepole was constructed in 1963 during the NPS "Mission 66" era which spanned the years from 1956-1966. As per NPS policy, "Mission 66" structures are to be treated as "potentially eligible" pending a formal determination of eligibility.

- The water diversion in Wolverton Creek was constructed around 1959 and the water diversion in Silliman Creek (near Lodgepole) was constructed in 1934. These structures are over 50 years in age, and thus are viewed currently as potentially eligible; a formal determination of eligibility will be undertaken for each structure.

- Sections of the water lines and associated appurtenances range between 30 and 70 years in age. The water distribution piping through the Giant Forest was constructed in the 1930s and supported numerous structures that have since been removed in an extensive restoration project that occurred from 1997 to 2005.

PUBLIC HEALTH AND SAFETY

Drinking Water

The EPA and the CDPH set drinking water standards to protect public health by limiting the levels of contaminants permissible in drinking water. The state limits for TTHM is 80 ppb and the limits for HAA5 is 60 ppb. Over the past few years, portions of the integrated water system have been out of compliance with state drinking water standards. Levels of TTHM at the Red Fir maintenance area and the Giant Forest exceed state limits (Figure 6). However, data indicates that TTHM and HAA5 are not likely formed at the Wolverton water treatment plant; instead, the data indicates that formation is likely

attributed to a different carbon source. It is likely that the DBPs are forming from the combination of biofilm layer and chlorine in the distribution system (Arber 2010a).

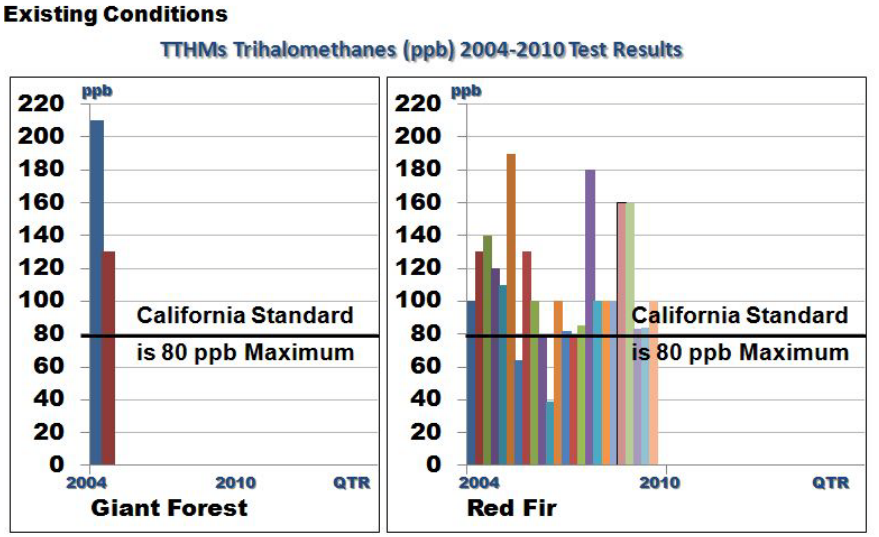

Figure 6. Available Quarterly Test Results of TTHMs at Giant Forest and Red Fir, 2004-2010.

Fire Flow and Storage

Rural systems, such as the Wolverton and Lodgepole water systems, often have trouble meeting fire flow and storage requirements used for larger municipalities due to the large flows and storage volumes required, relative to the normal domestic demands of rural systems; thus NFPA 1142 was used to calculate fire flow and storage requirements. Most NPS and concessioner facilities are equipped with fire sprinkler systems and FHAs are located at intervals throughout the majority of the developed areas. The Wolverton water system provides water to facilities and FHAs within the Giant Forest, Wolverton, Wuksachi, and the Red Fir maintenance area. The Lodgepole water system supplies water to facilities and FHAs in the Lodgepole area. Existing fire hydrants within the Wuksachi area are underground and are inaccessible during the winter months. Sections of the water distribution system are not sized appropriately to allow for the necessary flow for fire suppression needs. Water loss from breaks and leaks in the existing lines and system shut-downs can also have an effect on the capability of the water system to provide the water necessary for successful firefighting efforts.

VISITOR EXPERIENCE AND RECREATIONAL OPPORTUNITIES

Sequoia and Kings Canyon National Parks offer numerous backcountry and frontcountry opportunities to experience a spectrum of recreational, interpretive, and educational activities. In 2010, Sequoia and Kings Canyon National Park had more than 1.6 million visitors; nearly 1 million of those visited Sequoia National Park. Activities range from picnicking, walking/hiking, accessing trails to the backcountry, snow activities in the winter including snowshoeing and cross country skiing, attending interpretive talks and programs, swimming/wading, fishing, wildlife viewing, and sightseeing.

The project area, within Sequoia National Park, is a popular destination, and the Giant Forest is the best known and one of the most visited feature in the parks. A shuttle bus service is available in the busy summer months and transports visitors from Visalia to the park headquarters, and to destinations in the Giant Forest, Sherman Tree, Lodgepole, and Wuksachi areas. The Giant Forest Museum shuttle bus stop is the largest park shuttle system hub between the three shuttle bus routes (External, Crescent Meadow/Moro Rock, Wuksachi). Visitors are offered a range of activities including frontcountry and

backcountry trail access, information and interpretive opportunities at the Lodgepole visitor center and the Giant Forest Museum, lodging options at Wuksachi Village, recreational vehicle and tent camping at Lodgepole, and food and comfort opportunities at Lodgepole and Wuksachi. There is a winter snow play area at Wolverton, and many winter visitors snowshoe or cross country ski the trails in the Giant Forest. In 2010, approximately 61,639 people lodged at Wuksachi Village and 18,552 people camped at Lodgepole. There are 203 camping sites at Lodgepole that are available for campers, and eleven spots set aside for emergencies and administrative use.

PARK OPERATIONS AND EMPLOYEE SAFETY

Within the project area, NPS facilities include approximately 13 visitor use facilities, 36 comfort stations, two administration buildings, 25 maintenance-related facilities, four garages, and a fire station, plus residential facilities. Most use in the project area is seasonal, requiring extensive preparation to open facilities and to close them down for the winter. Residential facilities include an NPS employee housing area at Lodgepole, which consists of approximately 41 housing units. Housing can accommodate approximately 125 employees at full capacity. In addition, there are fifteen recreational trailer pads at Wuksachi, five at Lodgepole, and two at Wolverton. Housing reaches full capacity during the summer months when visitation is at its peak, and decreases considerably during the winter months.

Concessioner-operated facilities in the project area include three lodges, a restaurant and gift shop, and employee housing at Wuksachi; and, a market with food service, public laundry, and showers at Lodgepole.

The Division of Maintenance and Construction carries out vital park functions, including maintaining buildings and grounds; inspecting and maintaining water, electrical, and wastewater systems; maintaining roads, trails, and campgrounds; snow removal; operating heavy equipment and machinery; and, providing janitorial services. Maintaining aging infrastructure and facilities require frequent repairs and rehabilitation, and seasonal closures of facilities affect maintenance operations, and other park operations. During the busy summer season, there are up to fourteen individuals within the parks' Utility Systems Branch, charged with operating, maintaining, and repairing the water systems. Five of these employees are stationed in the Lodgepole/ Giant Forest/ Red Fir areas.

There are currently 19 NPS employees that are involved with structural fire response. There are a total of three engines - located at Ash Mountain, Lodgepole, and Grant Village. Due to staffing constraints, every engine company assists the other sub-districts as needed. Typically, each engine company responds every quarter to a structural fire-related incident within the parks.

ENVIRONMENTAL CONSEQUENCES

This section contains the environmental impacts, including direct and indirect effects, and their significance to the alternatives. Impacts are evaluated based on context, duration, and intensity, and on whether they are direct, indirect, or cumulative impacts. The analysis is based on the assumption that the mitigation measures identified in the "Mitigation" section of this EA would be implemented for the action alternatives. NPS policy also requires that potential impairment of all resources be evaluated in environmental documents, except for visitor experience and recreation, safety, and park operations, which require no impairment determination. A discussion of impairment can be found in Appendix A.

Under each impact topic, the impacts common to both action alternatives are discussed under the heading "Impacts Common to Alternatives B and C." The heading "Impact Differences in Alternatives B and C" identifies the impacts that are different between the two action alternatives, namely the potential impacts associated with developing a well. The conclusion statement takes into account the impacts common to alternatives B and C, the cumulative effects, and the impacts specific to each action alternative. If not otherwise noted, impacts associated with implementing alternative B and C would be similar.

METHODOLOGY

Overall, the NPS based these impact analyses and conclusions on a review of existing literature and park studies; information provided by subject matter experts and technical experts in the NPS Water Resources Division; other federal, state, and county agencies; professional judgment; and, public input.

There are several terms used within the "Environmental Consequences" section to assess the impacts of each alternative on each impact topic. It should be noted that the terms 'impact' and 'effect' are interchangeable in this document. The following terms were used to define the nature of impacts associated with project alternatives:

Type: Impacts can be beneficial or adverse.

Context: Context is the setting within which an impact would occur, such as local, parkwide, or regional.

Impact intensity: Impact intensity is defined individually for each impact topic. There may be no impact, or impacts may be negligible, minor, moderate, or major.

Duration: Depending on the resource, impacts may last for the construction period, a single year or growing season, or longer. For purposes of this analysis, impact duration is described as short term or long term.

Direct and indirect impacts: Direct impacts are caused by an action and occur at the same time and place as the action. Indirect impacts are caused by the action and occur later or farther away, but are still reasonably foreseeable. Direct and indirect impacts are considered in this analysis, but are not specified in the narratives.

A table of impact intensity definitions (negligible, minor, moderate, and major) for each impact topic is included within each impact topic description.

CUMULATIVE IMPACTS

The Council on Environmental Quality regulations, which implement NEPA, requires assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. Cumulative impacts are considered for all alternatives and are presented in the impact topic discussion.

CUMULATIVE IMPACT SCENARIO

Cumulative impacts were determined by combining the impacts of the alternatives with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at Sequoia and Kings Canyon National Parks and, if applicable, the surrounding region. Potential projects identified as cumulative actions included any past projects that currently affect the same resources as the alternatives, and development or projects that are currently being implemented or that would be implemented in the reasonably foreseeable future that could impact the same resources as any of the alternatives. Since the scope of this project is relatively small, the geographic and temporal scope of the cumulative analysis is similarly small. The geographic scope for this analysis includes actions within Sequoia National Park, specifically those that would occur in the vicinity of the Giant Forest, Lodgepole, Wolverton, Wuksachi, and Red Fir areas. The temporal scope includes projects within a range of approximately ten years.

Since the project area and area of potential effect are within frontcountry areas with high visitation, there are numerous planned actions for future projects with varying levels of complexity. Identified actions include road maintenance and rehabilitation, utility system repairs and maintenance, sustainability, future build-out at Wuksachi Village, and factors affecting health and safety. These actions were then assessed in conjunction with the impacts of each alternative to determine if they would have any adverse or beneficial additive effects on a particular park resource, including natural and cultural resources, public health and safety, visitor use and recreational opportunities, and park operations and employee safety. Because some of the future activities are in the early planning stages, the evaluation of cumulative effects may be based on preliminary descriptions of those projects.

Past, Current, and Future Actions

The following actions occurred in the past, will likely occur in the present, or potentially would occur or are planned to occur in the future, and could contribute to the cumulative impacts of the alternatives.

Removal of Facilities and Structures from the Giant Forest Area

The 1980 *DCP* (NPS 1980) and the 1996 *Giant Forest Interim Management Plan* (NPS 1996) called for removing concession and NPS facilities from the Giant Forest and relocating them to Wuksachi, so that the giant sequoia forest could be restored to more natural conditions. The demolition was phased over five major projects, spanning the years 1997-2005. During 1997-99 hundreds of structures in two historic districts were removed in accordance with an agreement with the California SHPO. The project included the removal of hundreds of concession lodging buildings, roads, and 18 parking lots. Historic buildings that are being adaptively reused include the market, which is now the Giant Forest Museum (opened in 2002) and the Beetle Rock Education Center, which is being reused as a community building and education center. Other historic buildings (ranger residence and restrooms) have been rehabilitated. Museum exhibits, waysides, and trail centers have been built. Limited parking is available within the Giant Forest, while other visitors arrive to the area via the shuttle system.

Sustainability and Planning Design

The parks are committed to operating and maintaining facilities, utilities, and equipment to be more "climate friendly" and to promote their sustainability, and conservation principles and practices. Facilities would continue to be retrofitted with energy-efficient materials, such as replacing older plumbing fixtures with more sustainable fixtures that are low-flow and use less water. The parks would continue to strive to reduce GHG emissions by implementing the *Climate Friendly Parks: Sequoia and Kings Canyon National Parks Action Plan.* The parks have adopted *Architectural Character Guidelines* (NPS 1989) with the purpose of maintaining the rustic park architecture and character. New structures would continue to incorporate these design guidelines.

Utility Infrastructure Projects

The parks' water distribution systems and wastewater distribution systems are old and deteriorating. In 2010, emergency repairs to an exposed and damaged sewer line within the Marble Fork of the Kaweah River were made after a severe storm caused substantial erosion and exposed and damaged the line. Utilities will continue to be replaced as needed and more stringent water and wastewater standards will be incorporated into design and planning.

Road Maintenance and Reconstruction

The reconstruction of the historic Generals Highway has been ongoing since the 1980s, with reconstruction beginning at the southern portion of the parks' boundary near the community of Three Rivers and continuing north into the parks. The overall reconstruction of the Generals Highway is being phased over many years. Work has been completed from Ash Mountain to Amphitheater Point. In 2010, rehabilitation was completed on the section of Generals Highway from the Wolverton Road intersection to the Little Baldy pullout. Currently, reconstruction is occurring on the section of Generals Highway from Amphitheater Point to Deer Ridge.

Current and future planning includes addressing the rehabilitation of 6.6 miles of the historic Generals Highway between Deer Ridge and the Wolverton Road intersection. and rehabilitation and resurfacing of the remaining 17.4 miles of the Generals Highway from Little Baldy to one mile south of the Grant Grove Road. Work would entail replacing guardrails, retaining walls, cut walls, drainage structures, base material, and asphalt. Existing signage and interpretive waysides would be upgraded and replaced as necessary. Revegetation would occur where disturbed areas were adjacent to the road. These projects would most likely be phased over several years starting in 2013 or 2014.

A park-wide chip and seal of 95% of the roads and parking areas is scheduled to occur in summer 2011.

Future Build-out at Wuksachi Village

Facilities were constructed in the 1980s and 1990s in the Wuksachi Village area to replace those removed from the Giant Forest, based on the 1980 DCP (NPS 1980). NPS facilities that have been constructed include the Red Fir maintenance building, Clover Creek wastewater treatment facility, seasonal housing, bathhouse for concessioner use, road system, utilities, permanent staff housing, parking lots, propane fuel area/ distribution system, and a firehouse. Concession facilities that have been constructed include three lodges with 102 rooms, a restaurant/store/administration building, a bathhouse, and staff cabins. Future build-out at Wuksachi Village could include additional facilities and services.

IMPACTS TO CULTURAL RESOURCES AND SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT

In this EA/AoE, impacts to cultural resources (historic structures and historic buildings) are described in terms of type, context, duration, and intensity, which is consistent with the regulations of the CEQ that implement the NEPA. These impact analyses are intended, however, to comply with the requirements of both NEPA and §106 of the NHPA. In accordance with the Advisory Council on Historic Preservation (Advisory Council) regulations implementation §106 of the NHPA (36 CFR Part 800, Protection of Historic Properties), impacts to historic resources were identified and evaluated by 1) determining the area of potential effects; 2) identifying historic resources present in the area of potential effects that were either listed in or eligible to be listed in the National Register of Historic Places; 3) applying the criteria of adverse effect to affected historic resources either listed in or eligible to be listed in the National Register; and 4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the Advisory Council's regulations, a determination of either adverse effect or no adverse effect must also be made for affected National Register eligible cultural resources. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualify it for inclusion in the National Register (e.g. diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the preferred alternative that would occur at a later time, be farther removed in distance or be cumulative (36 CFR Part 800.5, Assessment of Adverse Effects). A determination of no adverse effect means there is an effect, but the effect would not diminish in any way the characteristics of the cultural resource that qualify it for inclusion in the National Register.

CEQ regulations and NPS DO-12 also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g. reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of an impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. It does not suggest that the level of effect as defined by §106 is similarly reduced. Although adverse effects under §106 may be mitigated, the effect remains adverse.

A §106 summary is included in the impact analysis section for "historic resources" under the preferred alternative only. The §106 summary is intended to meet the requirements of §106 and is an assessment of the effect of the undertaking (implementation of the preferred alternative) on cultural resources, based upon the criterion of effect and criteria of adverse effect found in the Advisory Council's regulations.

GEOLOGY AND SOILS

METHODOLOGY

Available information on potentially impacted soils in the project was compiled. Potential impacts from the alternatives were based on professional judgment and experience with similar actions. Definitions of the impact intensities are defined in Table 5.

Table 4. Geology and Soils Impact and Intensity Definitions

Impact Intensity	Intensity Description
Negligible	Impacts would be at or below the level of detection, and the changes would be so slight that they would not be of any measurable or perceptible consequence.
Minor	Impacts would be detectable, localized, small, and of little consequence. Mitigation measures, if needed, would be simple and likely successful.
Moderate	Impacts would be readily detectable, localized, measurable and of consequence. Mitigation measures, if needed to offset adverse impacts, would be extensive and likely successful.
Major	Impacts would be obvious and would have substantial regional consequences. Impacts would be severely adverse or major and beneficial. Extensive mitigation measures would be needed to offset any adverse impacts, and their successes would not be guaranteed.

Short-term—recovers in less than 3 years
Long-term—takes more than 3 years to recover

ALTERNATIVE A: NO ACTION

Under the no action alternative, there would be no extensive rehabilitation work on the existing water distribution system and there would be no new ground disturbance associated with replacement or relocation of large sections of water line or from construction of appurtenances and support facilities. Soils would be disturbed during routine maintenance and repairs to the existing water system; however, these impacts would occur within the footprint of the existing water system, resulting in temporary, negligible to minor adverse impacts to soils and geology in a localized area.

More frequent breaks in the deteriorated water distribution piping could result in an increase in erosion and potential sedimentation of nearby waterways. Impacts on soils from erosion would be adverse and localized (where the break and water loss occurs). The intensity of the impact would range from negligible to minor, depending on the quantity of water loss, the time it takes to detect and locate the line break, the time of year the break occurs, when the repair could occur (i.e. if replacement parts are available, staff availability), and the difficulty in accessing the area needing repair.

Cumulative Effects of Alternative A

Soils and geology in the developed areas of the parks, and more specifically in the project area, have been affected by past and present activities, such as the initial construction of the built environment, and from routine maintenance and repairs to the existing infrastructure. These actions have resulted in minor to moderate long-term adverse effects on soils and geology from the permanent modification of these resources for roads and facilities. Beneficial effects on soils and geology have also resulted from the restoration of the Giant Forest area. Foreseeable future activities, such as build-out at Wuksachi, could further impact soils and geology in the project area. The no action alternative includes ongoing maintenance and repairs to the waterline that would occur within previously disturbed corridors and within the Giant Forest area where utilities and infrastructure currently exist, resulting in a slight contribution to adverse cumulative effects on soils and geology in the area.

Conclusion Statement for Alternative A
Impacts to soils and geology from the no action alternative would be negligible to minor, adverse, temporary, and localized. When considered with past, present, and reasonably foreseeable future actions, the no action alternative would contribute slightly to the minor to moderate adverse cumulative effects to soils and geology in the project area from past, present, and future foreseeable projects.

IMPACTS OF ALTERNATIVE B AND ALTERNATIVE C (PREFERRED)

Impacts Common to Alternative B and Alternative C (Preferred)
Replacement and rehabilitation of water lines, water storage tanks, valves, vaults, FHAs and other water system appurtenances would occur within existing road and utility corridors, or within previously disturbed corridors. Under alternatives B and C, soils within the construction limits would be compacted during project work by the presence of heavy equipment. Areas disturbed during construction would be susceptible to erosion until revegetation efforts are successful, resulting in short-term adverse minor impacts to soil resources. In the long-term, rehabilitation of the water system would have beneficial effects on soils because breaks in the waterlines would be greatly reduced and erosion created from water loss due to breaks would be reduced.

Excavation pits, approximately 10’ long × 5’ deep × 4’ wide (200 cubic feet), would be dug to access the water piping to perform sliplining, pipe-bursting, or “pigging” activities. There would be at least two excavation pits – the insertion and receiving pits. Additional pits may be dug, depending on the number of valves, bends, or the need to access other water line appurtenances. Impacts to soils from the excavation of pits would be localized short-term adverse and minor.

Trenching would occur in areas where new water piping would be installed, such as the Generals Highway roadbed (from the Giant Forest tank to the Giant Forest Museum), and at Lodgepole. Trenching would occur within existing roadways and in existing utility corridors. Approximately 6,000 linear feet of new pipe would be installed within the Generals Highway roadbed, resulting in approximately 97,950 cubic feet disturbance in a previously disturbed area, resulting in no new impacts to soils and geology. Installing new pipe within an already disturbed corridor would eliminate the need to access and repair the deteriorated existing water line that traverses through an ecologically sensitive area within the Giant Forest, resulting in long-term beneficial effects to the overall restoration of the Giant Forest.

At Lodgepole, a section of water line that is close to an eroding riverbank would be relocated approximately 20 feet away from its current location. In addition, a new water line would be installed adjacent to an existing water line and would cross over the Marble Fork Bridge. Minimal impacts to geology and soils would occur from the trenching and relocation of the waterline, resulting in short-term, minor adverse impacts in a localized area. In the long-term, there would be beneficial effects to soils and geology from relocating the line further away from the eroding riverbank to more stable soils, which would result in less erosion potential.

New buildings would be constructed in previously disturbed areas adjacent to existing access roads. Soils would be disrupted from grading and site preparation, and associated trenching to nearby utilities. The proposed new water treatment plant at Lodgepole would be approximately 20% larger than the existing building and would impact adjacent disturbed land. The new building proposed at Wuksachi would impact approximately 240 square feet of land directly adjacent to an access road. Impacts to soils and geology associated with constructing new buildings would result in long-term minor adverse impacts.

The water diversion structures at Silliman Creek and Wolverton Creek would be replaced. In total, approximately 2.4 acres would be disturbed from accessing the sites, dismantling and removing existing infrastructure, and replacing infrastructure. The actual permanent structure replacing the existing structure

would be similar in size to what currently exists. Impacts to soils and geology during construction activities would be short-term minor and adverse. Best Management Practices would be adhered to and soil erosion and siltation controls would be implemented to minimize impacts from construction activities.

Impact Differences in Alternative B and Alternative C (Preferred)
Alternative B: A new chlorine dosing station would be constructed near the existing Giant Forest water tank in a previously disturbed area. Approximately 240 square feet of soil would be disturbed from grading and site preparation for the new building. Approximately 5,500 linear feet of new distribution piping would be installed throughout the Wuksachi developed area within existing utility corridors. Since the project is located within previously disturbed soils in developed areas, alternative B would result in long-term minor adverse impacts on soils and geology in the project area.

Alternative C: A new well would be developed and a well house would be constructed within the Pinewood picnic area. The borehole for the well would be approximately 10 inches in diameter to a depth of approximately 700 feet, resulting in a long-term minor adverse and localized impact on geology. Approximately 240 square feet would be disturbed from grading and site preparation for the new well house, and would result in long-term minor adverse impacts on soils in a localized area.

Cumulative Effects of Alternative B and Alternative C (Preferred)
As stated under alternative A, soils and geology in the project area have been affected by the initial construction of the built environment, from maintenance and repairs, and may be affected in the future by activities such as an expansion of Wuksachi. Project work under alternatives B and C would occur within previously disturbed corridors and would result in the stabilization of soils in the long-term due to fewer leaks and fewer emergency repairs; therefore, there would be no contribution to adverse cumulative effects.

Conclusion Statements for Alternative B and Alternative C (Preferred)
In summary, most of the project components associated with alternatives B and C would occur within park developed areas, within existing utility and/or road corridors, and in areas where soils have been previously disturbed. There would be short-term minor adverse impacts to localized areas from construction activities and long-term minor adverse impacts to soils and geology from constructing new buildings and trenching. Long-term beneficial effects to soils and geology would result from relocating the line from an eroding riverbank, abandoning the water line under the Marble Fork of the Kaweah River, abandoning the existing water line that traverses the Giant Forest area, and from fewer leaks and emergency repairs associated with the existing lines.

Alternative B: Alternative B would have additional long-term minor adverse impacts on soils and geology in a localized area from construction of the chlorine dosing station and installation of new piping at Wuksachi. There would be no measurable cumulative effects on soils and geology from implementation of alternative B.

Alternative C: Alternative C would have additional long-term minor adverse impacts on soils and geology in a localized area at the Pinewood picnic area from the construction a new well house and well development. There would be no measurable cumulative effects on soils and geology from implementation of alternative C.

VEGETATION

METHODOLOGY

Impacts to vegetation types or plant communities are typically focused on direct and indirect effects. These effects are evaluated and assessed in terms of duration, intensity, and type in site-specific and regional contexts. Two important parameters used to evaluate impact intensity on vegetation are: 1) the size and continuity of the plant community; and, 2) the structure, productivity, diversity, integrity, and rarity of the plant community.

Predictions about short- and long-term impacts were based on site surveys, professional judgment, the use of the park vegetation lists and maps, and experience gained from previous projects in the same general project areas. Impacts were assessed qualitatively (Table 6). The assessment includes the potential to cause adverse impacts on native plants or populations and the potential to introduce or promote non-native species in the area.

Table 5. Vegetation Impact and Intensity Definitions

Impact Intensity	Intensity Description
Negligible	The impacts on vegetation (individuals or communities) would not be measurable. The abundance or distribution of individuals would not be affected or would be slightly affected. The effects would be on a small scale and no species of special concern would be affected. Ecological processes and biological productivity would not be affected.
Minor	The alternative would not necessarily decrease or increase the project area's overall biological productivity. The alternative would affect the abundance or distribution of individuals in a localized area, but would not affect the viability of local or regional populations or communities. Mitigation to offset adverse effects, including special measures to avoid affecting species of special concern and introducing non-native species, could be required and would be effective. Mitigation may be needed to offset adverse effects, it would be relatively simple to implement, and it would likely be successful.
Moderate	The alternative would result in effects on some individual native plants and could also affect a sizeable segment of the species' population over a relatively large area. Permanent impacts could occur to native vegetation but in a relatively small area. Some species of special concern could also be affected. Mitigation measures would be necessary to offset adverse effects and would likely be successful.
Major	The alternative would have considerable effects on native plant populations, including species of special concern, and would affect a relatively large area in and out of the park. Extensive mitigation measures to offset the adverse effects would be required; success of the mitigation measures would not be guaranteed.

Short-term—recovers in less than 1 year.

Long-term—takes more than 1 year to recover.

ALTERNATIVE A: NO ACTION

Under the no action alternative, there would be no extensive rehabilitation work on the existing water distribution system and there would be no new ground disturbance associated with replacement or relocation of large sections of water line or from the construction of appurtenances and support facilities. Vegetation would be disturbed during maintenance and repairs to the existing water system; however, these impacts would occur within the footprint of the existing water system, resulting in negligible to minor adverse impacts to vegetation in localized areas within the project area.

The existing water line that traverses the Giant Forest is susceptible to breaks and leaks due to its age and because the roots of the sequoia trees wrap around the piping and may snap the pipes during high wind events. Breaks in lines conveying treated water would impact vegetation in the vicinity of the break. While chlorine in the treated water leaked from the water system is in a relatively small concentration, the impact created by leakage over a long period of time could harm vegetation. In addition, excessive availabilities of water in environments that are normally mesic (moderately moist) could create changes in plant communities over time.

Depending on the magnitude of the break and need for emergency repairs, access to work sites in the Giant Forest area would have an adverse impact on the ongoing restoration efforts. The intensity of the impact would range from minor to moderate, and depend on the quantity of water loss, the time it took to detect and locate the line break, the time of year the break occurred, when the repair could occur (i.e. replacement parts availability and staff availability), and the difficulty in accessing the area needing repair. Breaks in water lines conveying raw water would not result in treated water affecting vegetation, however, soil erosion and subsequent loss of vegetation could occur, resulting in short-term minor adverse impacts on vegetation in the breakage area. Maintenance and repairs to an already deteriorated water distribution system would likely occur more frequently in the future, and could result in minor adverse long-term impacts on vegetation in and around the project areas.

Cumulative Effects of Alternative A
Vegetation in the developed areas of the parks, and more specifically in the project area, has been affected by past and present activities, such as the initial construction of the built environment and from maintenance and repairs to the current infrastructure. The Giant Forest restoration project resulted in beneficial effects to vegetation, including giant sequoias, in the area. Foreseeable future activities, such as build-out at Wuksachi and future road construction, could further impact vegetation in and around the project area. Under this alternative there would be no rehabilitation and replacement of the water distribution system. Frequent maintenance and emergency repairs, including the use of heavy equipment in utility corridors and leakage would continue to adversely affect vegetation in localized areas, contributing slightly to the overall cumulative adverse effects from past, present, and future foreseeable actions.

Conclusion Statement for Alternative A
Continued maintenance and repairs to the water distribution system would likely occur more frequently in the future, and would result in short- and long-term minor adverse impacts on vegetation, including giant sequoias, in the vicinity of water line breaks from the use of heavy equipment and digging. When considered with past, present, and reasonably foreseeable future actions, the no action alternative would contribute slightly to the overall adverse cumulative effects on vegetation and the giant sequoia ecosystem.

IMPACTS OF ALTERNATIVE B AND ALTERNATIVE C (PREFERRED)

Impacts Common to Alternative B and Alternative C (Preferred)
Replacement and rehabilitation of water lines, water storage tanks, valves, vaults, FHAs and other water system appurtenances would occur within existing road and utility corridors, or previously disturbed corridors. However, vegetation has grown back in some of these areas. Vegetation adjacent to the construction would be trampled by the presence of construction equipment and workers. Construction activities have the potential to introduce non-native seeds and plant species into areas where none exist. Mitigation measures would be implemented to help prevent the introduction or spread of non-native species.

Excavation pits, approximately 10’ long × 5’ deep × 4’ wide (200 cubic feet), would be dug to access the water piping to perform sliplining, pipe-bursting, or “pigging” activities. There would be at least two excavation pits, at the insertion and receiving pits; additional pits would depend on the number of valves, bends, or the need to access other water line appurtenances. Best Management Practices would be adhered to and topsoil salvage, plantings, and seeding, would be implemented, as appropriate, to minimize impacts from construction activities. Construction activities would have short-term minor adverse impacts on vegetation in localized areas.

Under alternatives B and C, the existing water line that traverses through the Giant Forest area would be capped and abandoned in place and no further disturbance to the giant sequoia ecosystem would occur, resulting in long-term beneficial effects to vegetation and the giant sequoia ecosystem. Alternatively, approximately 6,000 linear feet of new water line would be installed within the Generals Highway roadbed. Mitigation would be implemented to prevent damage to giant sequoia roots during trenching activities, and impacts to vegetation are anticipated to be long-term, minor, and adverse.

The surface water diversion structures at Silliman Creek and Wolverton Creek would be replaced. In total, approximately 2.4 acres would be disturbed from accessing the sites, dismantling and removing existing infrastructure, and replacing infrastructure. Prior to construction activities, site specific vegetation surveys would be completed to identify the presence of any plant species of management concern. Best Management Practices would be implemented to minimize impacts to riparian vegetation and wetland values.

While rehabilitation of the water system would result in short-term adverse effects to vegetation around the construction sites, in the long-term, there would be beneficial effects on vegetation because breaks in the water lines would be greatly reduced, resulting in fewer emergency repairs, and the quantity of treated water leaking on nearby vegetation would be reduced.

Impact Differences in Alternative B and Alternative C (Preferred)
Alternative B: There would be no additional impacts to vegetation beyond what is stated above under “Impacts Common to Alternatives B and C.” Replacement of approximately 5,500 linear feet of water line at Wuksachi, water line cleaning, and the construction of a 240 square foot building adjacent to the Giant Forest water tank would have no measurable impacts on vegetation.

Alternative C: Under alternative C, a new well would be developed at the Pinewood picnic area. The Pinewood picnic area was selected as the preferred location for a well for a number of reasons; including that it is accessible by an existing road, it is in a previously disturbed area with little vegetation at the well site, it is beyond the groves of large sequoia trees, and it avoids restored areas and wet meadows. The nearest wet meadow ecosystem, Round Meadow, is approximately 2000 feet south of the well site, and is too far from the meadow to notably affect the hydrology of the wet meadow ecosystem (NPS 2010a). Other components of alternative C, such as water line cleaning and isolating a water line, would have no measurable impact on vegetation. Mitigation measures, as identified above, would be implemented during construction activities to prevent non-native species introduction or spread.

Cumulative Effects of Alternative B and Alternative C (Preferred)
As stated under alternative A, past and ongoing activities, such as maintenance and development of facilities, roads, and trails, has adversely impacted vegetation in the developed areas of the parks. Foreseeable future activities, such as build-out at Wuksachi and future road construction, could further impact vegetation in and around the project area. The Giant Forest restoration project resulted in beneficial effects to vegetation, including giant sequoias, in the project area. The action alternatives include project work within previously disturbed corridors where utilities and infrastructure currently exist. Installing a new water line adjacent to existing utilities and within the Generals Highway roadbed

would result in no measurable contribution to cumulative effects on vegetation. The replacement of the diversion structures at Silliman and Wolverton creeks could result in impacts in a localized area to riparian vegetation. Impacts to riparian vegetation have occurred from past projects including the replacement of culverts and drainage structures on the Generals Highway. However, in the long-term, these areas would be restored and riparian vegetation would return, resulting in no cumulative adverse effects.

Conclusion Statements for Alternative B and Alternative C (Preferred)
In summary, most of the project components associated with alternatives B and C would occur within park developed areas, within existing utility and/or road corridors, and in areas where soils have been previously disturbed. There would be short-term minor adverse impacts in localized areas from construction activities. There would be long-term beneficial effects to vegetation and the giant sequoia ecosystem from capping and abandoning the existing water line that traverses through the Giant Forest, thereby eliminating any future disturbances from emergency repair work. There would be less leakage of treated water. When considered with past, present, and reasonably foreseeable future actions, alternatives B and C would have no measurable contribution to adverse cumulative effects on vegetation.

Alternative B: Implementation of alternative B would result in no additional impacts and no cumulative effects to vegetation other than as stated above.

Alternative C: Implementation of alternative C would result in no additional impacts or cumulative effects to vegetation other than as stated above.

WATER RESOURCES

METHODOLOGY

This section considers the effects of the alternatives on water resources, including hydrologic function, water supply, demand, and capacity. Park documents, field reports, and documents prepared by Arber & Associates and information from the NPS Water Resources Division were used to help assess potential effects. Definitions of the impact intensities are defined in Table 7.

Table 6. Water Resources Impact and Intensity Definitions

Impact Intensity	Intensity Description
Negligible	Neither water quality nor hydrology would be affected, or changes would be either non-detectable or if detected, would have effects that would be considered slight, local, and short-term.
Minor	Changes in water quality or hydrology would be measurable, although the changes would be small, likely short-term, and the effects would be localized. Mitigation measures associated with water quality or hydrology may be necessary and the measures would most likely succeed.
Moderate	Changes in water quality or hydrology would be measurable and long-term but would be relatively local. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed.
Major	Changes in water quality or hydrology would be readily measurable, would have substantial consequences, and would be noticed on a regional scale. Mitigation measures would be necessary and their success would not be guaranteed.

Short-term—following project completion, recovery would take less than 1 year.

Long-term—following project completion, recovery would take more than 1 year.

ALTERNATIVE A: NO ACTION

Under the no action alternative, there would be no extensive rehabilitation work on the existing water system and there would be no change to the water supply. Surface water intake structures in Silliman Creek and Wolverton Creek would remain the primary water supplies and the groundwater source at Long Meadow would remain available if needed. The water system would continue to deteriorate, breaks in the water lines would be more frequent, and subsequent water loss would be more prevalent.

Breaks in the lines conveying treated water could impact natural water systems in the vicinity of the break should treated water enter a natural water system, or if excessive erosion or sedimentation occurs before the leak is discovered. Currently, approximately one million gallons of water are lost annually due to leakage or breaks in the system; a disproportionate amount of water is diverted from the creeks to make up for water loss in the system. Increased diversion of water from the watershed could potentially result in changes to water chemistry, aquatic biota, and may disrupt various natural processes. The no action alternative would result in short-term minor adverse localized impacts on water resources from the effects associated with breaks in the water lines; and, long-term moderate adverse impacts on water resources from the continued loss of water and the subsequent need for increased water diversion.

Cumulative Effects of Alternative A

Past, present, and reasonably foreseeable future actions that have affected or could affect water resources in the project area include the restoration of the Giant Forest, utility infrastructure projects, road projects, and potential future build-out of Wuksachi. The restoration of the Giant Forest resulted in reduced infrastructure and water use in this area. Roads and parking areas were removed. Natural drainages have been restored in many areas, resulting in improved hydrologic function. Utility infrastructure projects are ongoing and could affect water resources. Emergency repairs to water and sewer lines have resulted in instream work (there is currently a water and sewer line within the Marble Fork of the Kaweah River). In the future, the sewer line would be relocated outside the river corridor, eliminating the potential for spill and emergency repairs in the river. Past, ongoing and future road work includes replacing undersized and damaged culverts with adequately sized culverts to improve drainage and hydrologic function. If Wuksachi is expanded in the future, water use would increase but it still would be within acceptable levels. Cumulatively these projects result in short-term adverse minor to moderate effects during construction or emergency actions, and long-term beneficial effects to park resources from the restoration of the hydrological function. The overall minor to moderate long-term adverse effect of the no-action alternative combined with the beneficial and adverse effects from past, ongoing, and future projects results in short-term minor adverse cumulative effects on water resources in the project area.

Conclusion Statement for Alternative A

The no action alternative would result in short-term, minor, adverse, localized impacts on water resources from impacts to water resources associated with breaks in the water lines; and, long-term, moderate, adverse impacts on water resources from the continued loss of water and the subsequent need for increased water diversion. The no action alternative when combined with past, present, and reasonably foreseeable future actions, results in a short-term minor adverse cumulative impact on water resources in the project area.

IMPACTS OF ALTERNATIVE B AND ALTERNATIVE C (PREFERRED)

Impacts Common to Alternative B and Alternative C (Preferred)

Replacement and rehabilitation of water lines, water storage tanks, valves, vaults, FHAs, and other water system appurtenances, would occur within existing road and utility corridors, or previously disturbed areas. Mitigation measures, such as erosion and sedimentation controls, would be implemented to reduce impacts to park waters. Even with the mitigation measures, construction activities associated with the

replacement and rehabilitation of water system components could have short-term minor adverse impacts on water quality in a localized area due to run off and erosion.

Under alternatives B and C, the existing surface water diversions in Silliman Creek and Wolverton Creek would be removed and replaced. Project work would consist of constructing a new water intake screening structure and diversion dam. Water would be diverted around the work area and rerouted downstream below the work area. At the Silliman site, a 325-foot stretch of water piping would be replaced to connect the water intake structure to the sediment settling structure. Soil disturbance associated with project activities could create temporary adverse effects from erosion by introducing sediments to park waters and would alter streamflow in portions of Silliman and Wolverton creeks during construction. Riparian wetland resources would be impacted by ground disturbance during construction activities. After construction is completed, the stream would be restored back to its original channel and the riparian wetland resources would be restored and revegetated. A combined total of approximately 2.4 acres would be disturbed for mobilization and construction of the new water diversion structures. The actual footprint of the new dam structures would be similar to what currently exists. There would be no increase in the permanent footprint of the dam and diversion structures.

The dam structures would be designed to protect water resources and minimize impacts to wetlands and BMPs would be implemented (Appendix D). A monitoring strategy would be developed for the water systems on Silliman and Wolverton Creeks. Current technology would be integrated into the design of the new structures to allow for the monitoring of water flows. This monitoring program would help the parks determine the levels of acceptable withdrawals under different precipitation regimes. With the implementation of mitigation measures, construction activities would have short-term minor adverse impacts on water resources in the project areas and downstream at Silliman and Wolverton creeks. There would continue to be long-term moderate adverse effects on water resources from the existence of the dams and water diversion facilities in Silliman and Wolverton creeks.

The existing water line that traverses the Giant Forest area would be capped and abandoned in place, and there would be no need to access or make repairs to the existing line. Installing the replacement water line within the Generals Highway would avoid any future impacts to meadows and watercourses that the existing water line travels through or adjacent to. This would have long-term beneficial impacts on water resources within the Giant Forest area.

Alternatives B and C would adopt a water system design that would improve water conservation efforts. Rehabilitation of the deteriorating and leaking water system would greatly reduce or eliminate water loss associated with breaks and leakage, resulting in long-term beneficial effects to water resources in the project area.

Impact Differences in Alternative B and Alternative C (Preferred)

Alternative B: Under alternative B, no new water supply would be developed. Surface water intake structures in Silliman Creek and Wolverton Creek would remain the primary water supplies and the groundwater source at Long Meadow would remain available if needed. Other project work associated with alternative B includes replacing approximately 5,500 linear feet of water line at Wuksachi, water line cleaning, and the construction of a 240 square foot building adjacent to the Giant Forest water tank. Mitigation measures to protect water resources would be employed during project activities, and no additional measurable affect to water resources would occur under this alternative.

Alternative C: Under alternative C, a new groundwater well approximately 700 feet deep would be developed at the Pinewood picnic area. The new well would introduce groundwater pumping in an area where none currently exists. The well would have steel casing and a cement grout annular seal to at least 50 feet below ground surface to prevent surface water and shallow groundwater from entering the well

(NPS 2010a). The nearest wet meadow ecosystem is Round Meadow, approximately 2,000 feet south of the well site and is considered beyond the area of influence of a low-yield well at the Pinewood picnic area (NPS 2010a). The valleys on either side of the Pinewood picnic area are the headwaters of intermittent or low-flow perennial streams (NPS 2010a). There is a chance that pumping groundwater from a well at Pinewood would cause a small decrease in streamflow, however, the low projected pumping rate and the horizontal and vertical separation between the well and streams would lessen the direct impact on streamflow (NPS 2010a). Additionally, pumping groundwater from a deep well that obtains water from fractures in the granite bedrock would spread the impact over a large, but unknown area (NPS 2010a). There may be infiltration of streamflow over some length of the adjacent creeks; in practice, there would be no observable or measurable effect on streamflow in the adjacent creeks (NPS 2010a). The anticipated low pumping rate and the distance to the headwaters of adjacent drainages would result in minimal to no streamflow reduction (NPS 2010a), and therefore, negligible impacts are expected.

Cumulative Effects of Alternative B and Alternative C (Preferred)
As stated under alternative A, there are a number of past, present, and reasonably foreseeable future actions affect water resources in the project area. Under alternatives B and C, water line breaks and leakages would be greatly reduced or eliminated, thereby conserving water resources. In addition, no work would be done to the existing water line that traverses the Giant Forest and there would be no impacts to watercourses and meadows in that portion of the project area. There would be short- and long-term adverse impacts from the replacement of the water diversion structures at Silliman and Wolverton creeks. The overall effects of past, ongoing, and future actions in combination with the effects from alternatives B and C would result in short- and long-term minor adverse and long-term beneficial cumulative effects on water resources in the project area.

Conclusion Statements for Alternative B and Alternative C (Preferred)
Short-term minor adverse impact on water resources would occur in a localized area during construction activities. Replacement of the water diversions in Silliman and Wolverton creeks would create disturbance in a riparian wetland area, and there would be adverse effects downstream associated with sedimentation from instream activities, but impacts would be short-term and BMPs would be implemented to reduce impacts to resources. Long-term beneficial effects to water resources would occur from avoiding work in watercourses and meadows associated with the existing water line traversing the Giant Forest, and from reducing water loss from repairing the leaking water system. Alternatives B and C would result in short- and long-term minor adverse and long-term beneficial cumulative effects on water resources in the project area.

Alternative B: Implementation of alternative B would result in no additional impacts or cumulative effects to water resources other than as stated above.

Alternative C: A new groundwater well would be developed at the Pinewood picnic area under alternative C. The anticipated low pumping rate and the distance to the headwaters of adjacent drainages would result in minimal to no streamflow reduction. For these reasons, implementation of alternative C would result in no additional impacts or cumulative effects to water resources other than as stated above.

HISTORIC RESOURCES

METHODOLOGY

In order for a structure or building to be listed in the National Register of Historic Places, it must meet one or more of the following criteria of significance: A) associated with events that have made a significant contribution to the broad patterns of our history; B) associated with the lives of persons significant in our past; C) embody the distinctive characteristics of a type, period, or method of

construction, or represent the work of a master, or possess high artistic value, or represent a significant and distinguishable entity whose components may lack individual distinction; D) have yielded, or may be likely to yield, information important in prehistory or history. In addition, the structure or building must possess integrity of location, design, setting, materials, workmanship, feeling, association (*National Register Bulletin, How to Apply the National Register Criteria for Evaluation*).

The information used in this assessment was obtained from relevant literature and documentation, maps, consultation with NPS archeologists, historians, historical architects, and site visits. For purposes of analyzing potential impacts to historic structures/buildings, the thresholds of change for the intensity of an impact are defined below (Table 8).

Table 7. Historic Resources Impact and Intensity Definitions

Impact Intensity	Intensity Description
Negligible	The effects would be at the lowest levels of detection, barely measurable without any perceptible consequences, and either beneficial or adverse to historic buildings or structures. For the purposes of section 106 of the NHPA, the determination of effect would be *no adverse effect.*
Minor	The effects would be perceptible or measurable, but would be slight and localized within a relatively small area. The action would not affect the character or diminish the features of an NRHP eligible or listed historic structure or building, and it would not have a permanent effect on the integrity of any such resources. For the purposes of section 106 of the NHPA, the determination of effect would be *no adverse effect*.
Moderate	The effects would be perceptible and measurable. The action would change one or more character-defining features of a historic resource, but would not diminish the integrity of the resource to the extent that its NRHP eligibility would be entirely lost. For the purposes of section 106 of the NHPA, the historic resource's NRHP eligibility would be threatened; the determination of effect would be *adverse effect*. An MOA would be executed between the NPS and the applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures identified in the agreement to minimize or mitigate adverse impacts would reduce the intensity of impact under NEPA from major to moderate.
Major	The effects on historic resources would be substantial, discernible, measurable, and permanent. For NRHP eligible or listed historic structures or building, the action would change one or more character-defining features, diminishing the integrity of the resource to the extent that it would no longer be eligible for listing in the NRHP. For purposes of section 106, NRHP eligibility would be lost; the determination of effect would be *adverse effect*. The NPS and the applicable state or tribal historic preservation officer and/or the Advisory Council are unable to negotiate and execute an MOA in accordance with 36 CFR 800.6(b).

ALTERNATIVE A: NO ACTION

Under this alternative there are no proposed activities that would result in new impacts to historic structures and buildings within the project area.

Cumulative Effects of Alternative A

The primary past action that has affected historic resources in the project area was the removal of historic structures from the Giant Forest area. This was done under a memorandum of agreement with the State Historic Preservation Officer (SHPO). Reconstruction of the Generals Highway has the potential to affect historic resources, but a programmatic agreement with SHPO was completed for that project to reduce adverse effects. When considered with past, present, and reasonably foreseeable future actions, the no action alternative would have no measurable cumulative effects on historic resources because there would be no change to the water system and appurtenances.

Conclusion Statement for Alternative A
The no action alternative would result in no impacts on historic resources and no cumulative effects.

IMPACTS OF ALTERNATIVE B AND ALTERNATIVE C (PREFERRED)

Impacts Common to Alternative B and Alternative C (Preferred)
Under alternatives B and C, the existing water line that traverses the Giant Forest area would be capped and abandoned in place and the replacement water line would be installed within the roadbed of the National Register-eligible Generals Highway. Similarly, a short segment of current line within the riverbed of the Marble Fork of the Kaweah River (Lodgepole area) would be abandoned in place and the line would be re-located to the Generals Highway and placed within the roadbed as it crosses the Marble Fork Bridge. All associated disturbance would be within the existing Generals Highway roadbed, which contains a number of buried utilities, and there would be *no adverse effect* to the Marble Fork Bridge or the Generals Highway.

The action alternatives propose replacement of the Lodgepole water treatment plant to better accommodate contemporary water treatment technology. The water treatment plant was constructed in 1963 during the NPS "Mission 66" era which spanned the years from 1956-1966. In addition, two water diversion structures would be replaced. The water diversion structure in Silliman Creek, near Lodgepole, was constructed in 1934. The water diversion in Wolverton Creek was constructed around 1959. Both structures have been damaged and modified by past flood events. The NHPA section 106 determination would likely be either *no effect* or *no adverse effect*, pending the results of the National Register evaluations of the two dam structures and the "Mission 66" water treatment plant at Lodgepole.

Other project activities associated with alternatives B and C include the replacement and/or rehabilitation of water lines, valves, and associated water system appurtenances. Sections of the water lines and associated appurtenances range between 30 and 70 years in age. Various work elements would include excavation; demolition and disposal of old piping and valves; installation of new piping, valves, and appurtenances; backfilling and compaction; and re-vegetation of areas disturbed by construction activities. The water line through the Giant Forest was constructed in the 1930s and supported numerous structures that have since been removed in an extensive restoration project that occurred from 1997 to 2005; this water line would be capped and abandoned in place. Thus, there would be *no effect* to these resources.

Impact Differences in Alternative B and Alternative C (Preferred)
The components that differ between alternatives B and C would have no additional impacts to historic resources and impacts are as described above.

Cumulative Effects of Alternative B and Alternative C (Preferred)
The primary past actions that have affected historic resources in the project area include the removal of historic structures from the Giant Forest. Two historic dams and a Mission 66 structure would be removed and replaced under alternatives B and C. In both alternatives, these historic features would be evaluated for their National Register eligibility prior to implementation of the project. In addition, the section of historic water line that traverses the Giant Forest area would be retained. When combined with past, present, and reasonably foreseeable future actions, alternatives B and C may add slightly to the loss of historic resources, if those resources are determined to be National Register eligible.

Conclusion Statements for Alternative B and Alternative C (Preferred)
The NHPA section 106 determination would likely be either *no effect* or *no adverse effect*, pending the results of the National Register evaluations of the two dam structures and the "Mission 66" water treatment plant at Lodgepole. Removal of historic resources, if they are determined to be National

Register eligible, would result in a long-term minor adverse effect. However, any potential adverse effect would be mitigated through documentation, including photo-documentation. For purposes of section 106 of the NHPA, the determination would thus be *no adverse effect*. When combined with past, present, and reasonably foreseeable future actions, alternatives B and C may add slightly to the loss of historic resources, if those resources are determined to be National Register eligible.

PUBLIC HEALTH AND SAFETY

METHODOLOGY

Public health and safety, for the purposes of this analysis, refers to the potential for each alternative to directly or indirectly affect the health and safety of visitors' and park and concessioner staff. The project alternatives have the potential to affect public health and safety in three ways:

Drinking water quality and compliance with state water quality standards.

The capability of the parks to provide adequate water delivery for fire suppression needs.

Construction activities occurring on Generals Highway and in visitor use areas.

For purposes of analyzing potential impacts to public health and safety, the thresholds of change for the intensity of an impact are defined below (Table 9).

Table 8. Public Health and Safety Impact and Intensity Definitions

Impact Intensity	Impact Description
Negligible	Public health and safety would not be affected, or the effects would be at the lowest levels of detection and would not have an appreciable effect on the health and safety of visitors', and/or park and concessioner staff.
Minor	The effect would be detectable but short-term, would be limited to a relatively small number of visitors and/or park and concessioner staff at a localized area, and would not have an appreciable effect on public health and safety.
Moderate	The effects would be readily apparent, short-term or long-term, would affect a relatively large number of visitors and/or park and concessioner staff on a local scale, and result in substantial, noticeable effects on public health and safety.
Major	The effects would be apparent, long-term, would affect public health and safety on a regional scale, and result in substantial, noticeable effects on public health and safety.

Short-term—effects last one year or less.

Long-term—effects last more than one year.

ALTERNATIVE A: NO ACTION

Under the no action alternative, there would be no extensive rehabilitation work on the existing water system. The water system would remain noncompliant with state water quality standards, it would continue to age and deteriorate, water system failures would increase, and system shutdowns would be more common.

Under the no action alternative, the parks would continue to be noncompliant with state water quality standards and NPS policy to provide for safe drinking water. The water system would not be optimized and would continue to fail state testing of MCLs for TTHMs and HAA5s. No improvements would be made to the method of water disinfection at the Lodgepole water treatment plant or the Wolverton water

treatment plant. The state could mandate replacement and/or shutdown of the Lodgepole water treatment plant if there are any future excursions from water quality standards.

The water system would continue to age and deteriorate, becoming less reliable for providing uninterrupted potable water to facilities in the project area. More frequent breaks in the water lines and shutdowns of the system would be expected. Shutdowns of the water system presents multiple points of potential direct contamination due to depressurization of the system, and can result in such consequences as waterborne illness, regulatory compliance violations, and bacteriological re-growth in the water distribution lines. Breaks in the water lines prevent the public, NPS, and concessioner employees from bathing, sanitizing, and providing fire protection; closure of facilities may be required until the problem could be remedied.

The water system would not be optimized, and inconsistencies with water demand and the end use would continue to affect water quality and fire suppression capabilities. Water loss in the system and the undersized water lines would continue to create inappropriate water pressure and water delivery capabilities for dependable fire suppression efforts, potentially resulting in an elevated risk to visitors, NPS and concessioner staff and residents', and park staff responding to structural fires.

Alternative A would result in short-term minor to moderate adverse impacts on public health and safety during water system shutdowns. Long-term moderate adverse impacts on public health and safety would result because state drinking water quality standards would not be met, water disinfection would not be addressed, the water system would not be optimized for dependable fire suppression, and system shutdowns and interrupted water delivery would become more frequent.

Cumulative Effects of Alternative A

The primary past, present, and reasonably foreseeable project occurring within the parks that have an impact on public health and safety has been the ongoing rehabilitation of the Generals Highway. This work is expected to continue for the next five to ten years. Road construction activities, including the transportation of heavy equipment, road closures or delays, and lane closures, can result in slower emergency response time which could adversely affect public health and safety. However, slow driving conditions associated with one lane traffic through construction zones could result in improved public safety on that section of roadway. In the long-term, once construction is completed, improved road surfaces and design would result in beneficial effects to public health and safety. Overall, the effects of these ongoing activities are beneficial and long-term.

The no action alternative, when considered with past, present, and reasonably foreseeable future actions, would contribute moderate adverse cumulative effects to public health and safety because the parks would not attain state drinking water standards, system shutdowns would become more frequent. Considering the beneficial results of road constructions added to the adverse results from not rehabilitating the water systems, the overall cumulative effects to public health and safety would be long-term, minor and adverse.

Conclusion Statement for Alternative A

The no action alternative would result in short-term minor to moderate adverse impacts on public health and safety during water system shutdowns. Long-term moderate adverse impacts on public health and safety would result because state drinking water quality standards would not be met, water disinfection would not be addressed, and system shutdowns and interrupted water delivery would become more frequent. The cumulative effects to overall public health and safety in the project area would be long-term minor and adverse.

IMPACTS OF ALTERNATIVE B AND ALTERNATIVE C (PREFERRED)

Impacts Common to Alternative B and Alternative C (Preferred)

Under alternatives B and C, the water system would be designed and rehabilitated to comply with state water quality standards, provide adequate water delivery for fire suppression capabilities, and provide uninterrupted potable water service. Biofouled water lines would be replaced or rehabilitated, and DBP formation would be reduced or eliminated. The water disinfection used in the Wolverton and Lodgepole water treatment plants would be improved. Consequently, the Lodgepole water treatment plant would be in compliance with current state water quality regulations. Improvements to water quality would have long-term beneficial effects on public health and safety.

Alternatives B and C would provide an uninterrupted potable water supply to minimize inconveniences to visitors, park and concessioner operations, and employee residents and their staff. Water lines would be appropriately sized and designed to provide adequate and dependable water delivery. The Lodgepole-Wolverton interconnection valve vault would be replaced and could be used as a back-up water source for the Lodgepole area, thereby allowing the Lodgepole water treatment plant to be shut-down in the winter or draw water from the Wolverton water supply, if necessary. Providing quality drinking water, meeting state water quality standards, providing uninterrupted potable water for fire suppression and other domestic uses would have long-term beneficial effects on public health and safety.

Construction activities present potential hazards and risks to the public. Approximately 1 ½ miles of new water line would be installed along the Generals Highway road corridor, a busy thoroughfare, between the Giant Forest Museum and the Pinewood picnic area. Emergency response and evacuation procedures could be delayed during construction activities along this stretch of the highway. In addition, construction activities associated with other project components could create potential safety risks to visitors, employees, and construction workers. Safety protocols and mitigation measures would be adhered to in order to ensure that health and safety are paramount during construction activities. There would be short-term adverse minor localized impacts to public health and safety during construction activities.

Impact Differences in Alternative B and Alternative C (Preferred)

Alternative B: Additional project components associated with alternative B include the replacement of approximately 5,500 linear feet of water line at Wuksachi, water line cleaning, and the construction of a 240 square foot building adjacent to the Giant Forest water tank. There would be no additional measurable impacts to public health and safety beyond what is stated above under “Impacts Common to Alternatives B and C.”

Alternative C: Under alternative C, a new groundwater water source would be developed at the Pinewood picnic area and supply water to facilities in the Giant Forest area. One of the major factors in the formation of THMs is water age in the system. The Giant Forest is the farthest area served by the Wolverton water source at a distance of three miles. The development of a separate well in the Giant Forest area would greatly reduce the water age (approximately 4 days at seasonal average day demand) (Arber 2010a), thereby improving drinking water quality by isolating nearly one mile of existing water main. In addition, alternative C would provide more diversity in the water supply sources available because the overall water system would have two surface water sources and one groundwater source (plus the seldom used groundwater source in Long Meadow). Alternative C would result in additional long-term beneficial effects to public health and safety from improved water quality at Giant Forest by reducing water age in the system, and providing more diversity in the number and type of water sources available in the overall water system, thereby improving reliability.

Cumulative Effects of Alternative B and Alternative C (Preferred)
The primary past, present, and reasonably foreseeable project occurring within the parks that have an impact on public health and safety has been the ongoing rehabilitation of the Generals Highway. This work is expected to continue for the next five to ten years. Road construction activities, including the transportation of heavy equipment, road closures or delays, and lane closures, can result in slower emergency response time which could adversely affect public health and safety. However, slow driving conditions associated with one lane traffic through construction zones could result in improved public safety on that section of roadway. In the long-term, improved road surfaces and design would result in beneficial effects to public health and safety. Overall, the effects of these ongoing activities are beneficial and long-term.

Under alternatives B and C, the most extensive water system in the parks would be rehabilitated to meet state water quality requirements, fire codes, and to provide an uninterrupted potable water supply for domestic and fire suppression needs. When considering past, present, and reasonably foreseeable future actions, and the actions under alternatives B and C, the overall cumulative effect to public health and safety would be long-term and beneficial.

Cumulative Effect of Alternative B: There would be no additional cumulative effect to public health and safety from implementation of alternative B other than stated above.

Cumulative Effect of Alternative C: Alternative C would add slightly more beneficial effects to the overall cumulative effect to public health and safety because a new well would be developed which would allow for greater diversity in the number and types of water sources available to the overall water system, further improving reliability and drinking water quality.

Conclusion Statements for Alternative B and Alternative C (Preferred)
In summary, implementation of alternatives B and C would result in long-term beneficial effects on public health and safety by providing high quality drinking water, meeting state water quality standards, and providing an uninterrupted potable water supply for fire suppression and domestic needs. There would be short-term adverse minor localized impacts to public health and safety during construction activities. When added to past, present, and reasonably foreseeable future actions, alternatives B and C would result in long-term beneficial cumulative effects on public health and safety.

VISITOR EXPERIENCE AND RECREATIONAL OPPORTUNITIES

METHODOLOGY

Each alternative was examined to determine its effect on visitor enjoyment of park resources and opportunities for recreation. The potential for change in visitor experience proposed by the alternatives was evaluated by identifying projected increases or decreases in access and other visitor uses, and determining whether or how these projected changes would affect the desired visitor experience, to what degree, and for how long (Table 10).

Table 9. Visitor Experience and Recreational Opportunities Impact and Intensity Definitions

Impact Intensity	Intensity Description
Negligible	Changes in visitor experience and recreational opportunities would be below or at the level of detection. The visitor would not likely be aware of the effects associated with the alternative.
Minor	Changes in visitor experience and recreational opportunities would be detectable, although the changes would be slight. The visitor would be aware of the effects associated with the alternative, but the effects would be slight.

Impact Intensity	Intensity Description
Moderate	Changes in visitor experience and recreational opportunities would be readily apparent. The visitor would be aware of the effects associated with the alternative and would likely express an opinion about the changes.
Major	Changes in visitor experience and recreational opportunities would be readily apparent and severely adverse or exceptionally beneficial. The visitor would be aware of the effects associated with the alternative and would likely express a strong opinion about the changes.

Short-term—occurs only during project work.

Long-term—continues after project work.

ALTERNATIVE A: NO ACTION

Under the no action alternative, there would be no major improvements made to the water system. State water quality standards would not be met and system shutdowns would become more common. The parks would continue to post water quality results and advise the visitor about the potential health risks associated with drinking the potable water. The parks' noncompliance with state water quality standards would continue to impact the quality of the visitor experience. Frequent breaks and leaks in the water distribution system have resulted in system shutdowns for extended periods of time, and visitors could be subjected to lengthy disruptions and other inconveniences.

System shutdowns and water system failures could potentially affect 2,900 visitors and employees visiting and working in the project area, and could result in closures of both NPS and concessioner-operated facilities. The Wuksachi Lodge has capacity for up to 250 people a night. Should a water failure affect the lodge, hotel guests would be relocated to other lodging units within or near the parks, if desired. Visitors staying overnight in campgrounds would also be affected if potable water service is not available, from restroom closures and lack of drinking water. Day-use visitors would be impacted by potential closures of restrooms, visitor centers, drinking fountains, and concessioner-operated facilities. In addition, system shutdowns affect the ability of the NPS to respond to structural fire incidents, which could also negatively impact visitor experience. Depending on the severity and extent of the water system failure, and the type of desired visitor experience and visitor's level of expectation, there could be short- and long-term moderate to major adverse impacts to visitor experience and recreational opportunities from the no action alternative.

Cumulative Effects of Alternative A

There are a number of past, present, and reasonably foreseeable projects occurring within the parks that have an impact on visitor experience and recreational opportunities. Reconstruction and rehabilitation of the Generals Highway has been ongoing and is expected to continue for the next five to ten years. Road construction activities; including the transportation of heavy equipment, road closures or delays, and lane closures, can impact visitor experience and recreational opportunities. In the long-term, the visitor experience could be improved with better road conditions. Reconstruction, repairs, and routine maintenance to roads, trails, utilities, restrooms, facilities, and other infrastructure, can affect visitor experience and recreational opportunities if work disturbs visitors or if there is an associated closure or services are unavailable. The impacts from the no action alternative, when added to the past, present, and future actions, could result in long-term moderate to major adverse cumulative effect on visitor experience and recreational opportunities from resulting closures or reduction in services.

Conclusion Statement for Alternative A

The potential for system shutdowns and subsequent closures of facilities and visitor use areas as a result of water system failures could result in short-term and long-term moderate to major adverse impacts on visitor experience and recreational opportunities depending on the severity and extent of the failure and

the desired visitor experience and level of expectation. When considered with past, present, and reasonably foreseeable future actions, the cumulative effects on visitor experience and recreational opportunities would be short- and long-term, moderate to major, and adverse.

IMPACTS OF ALTERNATIVE B AND ALTERNATIVE C (PREFERRED)

Impacts Common to Alternative B and Alternative C (Preferred)

Under alternatives B and C, the majority of the project activities would occur within developed areas and areas of high visitor use. Construction activities could result in short-term minor to moderate adverse impacts on visitor experience and recreational opportunities. Long-term beneficial effects to visitor experience and recreational opportunities would result from ensuring uninterrupted potable water delivery and high quality drinking water.

Project components associated with alternatives B and C would occur in phases and impacts to visitor experience and recreational opportunities would be interspersed over a number of years. The most disruptive action to visitors would occur during installation of the new water line within the Generals Highway road corridor. Approximately 1½ miles of new water line would be installed within the roadbed between the Giant Forest Museum and the Pinewood picnic area. The Generals Highway is a major thoroughfare for visitors both in personal vehicles and for the summer shuttle bus operations. Construction activities would take approximately 2-4 months to complete. During construction activities, lane closures and traffic delays would occur, and travel times through construction zones could increase. Shuttle bus routes and schedules would be affected, and visitors could experience longer wait times or shuttle delays.

Mitigation measures would be implemented to help alleviate construction-related impacts on visitors. However, even with mitigation measures in place, construction activities could have a higher degree of impact on a visitor depending on the desired experience and the level of expectation. While construction activities are considered temporary, if it is the visitor's first and potentially only experience at the parks, it could have a lasting impact on that individual. In general, construction activities would have short-term minor to moderate adverse impacts on visitor experience and recreational opportunities.

Rehabilitation activities, such as pipe bursting and water line cleaning, may require periodic water system shut downs, resulting in short-term minor adverse impacts to visitor experience and recreational opportunities from the lack of water and restroom facilities. Mitigation measures would offset this impact.

Project components associated with alternatives B and C would result in a fully rehabilitated water system which would provide high quality drinking water and uninterrupted potable water delivery for domestic use and fire suppression, resulting in long-term beneficial effects to visitor experience and recreational opportunities.

Impact Differences in Alternative B and Alternative C (Preferred)

Alternative B: Specific project components associated with alternative B include the replacement of approximately 5,500 linear feet of water line at Wuksachi, water line cleaning, and the construction of a 240 square foot building adjacent to the Giant Forest water tank. Construction activities would result in additional short-term minor adverse localized impacts to visitor experience and recreational opportunities due to traffic control, temporary area closures, and the potential for an interrupted water supply during this phase of the project.

Alternative C: A new well would be developed and a well house would be constructed within the Pinewood picnic area. Construction activities at the Pinewood picnic area would result in short-term minor adverse localized impacts to visitor experience and recreational opportunities from noise and the

presence of construction equipment and crews. The well would result in the loss of one picnic space; however, other picnic spaces are available and this action would result in a negligible effect on the visitor opportunities in this area. Water age would be reduced because a new groundwater well would be developed; however, this would probably go unnoticed by the average visitor and would have negligible effects to the visitor experience.

Cumulative Effects of Alternative B and Alternative C (Preferred)
The primary past, present, and future projects within the parks that have had an impact on visitor experience and recreational opportunities has been the reconstruction and rehabilitation of the Generals Highway. This project has been ongoing for several years, and is expected to continue for the next five to ten years. Road construction activities impact visitor experience and recreational opportunities by delaying access to areas of the park to full road closures during certain periods (i.e. night work). Foreseeable future activities, such as additional build-out at Wuksachi, could benefit visitor opportunities and experience by providing additional recreational opportunities.

Alternatives B and C would result in additional short-term minor to moderate adverse effects to the visitor experience and recreational opportunities due primarily to the installation of the water line within the Generals Highway corridor and associated traffic delays. However, in the long-term, the rehabilitation of the water system would greatly reduce or eliminate system shutdowns and interruptions in potable water availability resulting in long-term beneficial effects to the visitor experience. When considered with past, present, and reasonably foreseeable future actions, the overall cumulative effects from these projects on visitor experience and recreational opportunities, when combined with the proposed actions in alternatives B and C would be short-term moderate and adverse, and long-term and beneficial.

Conclusion Statements for Alternative B and Alternative C (Preferred)
Construction activities associated with alternatives B and C would result in short-term minor to moderate adverse impacts on visitor experience and recreational opportunities from area closures, traffic delays, and potential interruption in services. Long-term beneficial effects to visitor experience and recreational opportunities would result from ensuring uninterrupted potable water delivery for domestic and fire suppression, and providing high quality drinking water. When considered with past, present, and reasonably foreseeable future actions, the cumulative effects would be short-term moderate and adverse, and long-term and beneficial.

Alternative B: Implementation of alternative B would result in no additional impacts or cumulative effects to visitor experience and recreational opportunities other than as stated above.

Alternative C: Implementation of alternative C would result in no additional impacts or cumulative effects to visitor experience and recreational opportunities other than as stated above.

PARK AND CONCESSIONER OPERATIONS AND EMPLOYEE SAFETY

METHODOLOGY

Park and concessioner operations and employee safety, for the purpose of this analysis, refers to the quality and effectiveness of the infrastructure, the ability to maintain the infrastructure to adequately protect and preserve park resources, worker safety, the ability for the park and concessioner to provide visitor services, and the quality of life for residents and employees in the project area. Impact analysis is based on the current description of park and concessioner operations presented in the Affected Environment section of this document. For purposes of analyzing potential impacts to park and concessions operations, and employee safety, the thresholds of change for the intensity of an impact are defined below (Table 11).

Table 10. Park and Concessioner Operations/Employee Safety Impact and Intensity Definitions

Impact Intensity	Intensity Description
Negligible	Park operations and employee safety would not be affected, or the effects would be at low levels of detection and would not have an appreciable effect on park operations.
Minor	The effect would be detectable and would be of a magnitude that would not have an appreciable effect on park operations. If mitigation was needed to offset adverse effects, it would be simple and likely successful.
Moderate	The effects would be readily apparent and result in a substantial change in park operations and employee safety in a manner noticeable to staff and the public. Mitigation measures would be necessary to offset adverse effects and would likely be successful.
Major	The effects would be readily apparent, result in a substantial change in park operation and employee safety in a manner noticeable to staff and the public, and be markedly different from existing operations. Mitigation measures to offset adverse effects would be needed, extensive, and success could not be guaranteed.

Short-term—occurs only during project work.

Long-term—continues after project work.

ALTERNATIVE A: NO ACTION

Under alternative A, the parks would continue to be noncompliant with state water quality standards and NPS policy to provide safe drinking water. The water system would not be optimized and would continue to fail state testing of MCLs for TTHMs and HAA5s. No improvements would be made to the method of water disinfection at the Lodgepole water treatment plant or the Wolverton water treatment plant. The state could mandate replacement and/or shutdown of the Lodgepole water treatment plant until compliance with state regulations is achieved. NPS relations with the state of California could be hampered from continued noncompliance with state water quality regulations.

The water system would continue to deteriorate, becoming less reliable for providing uninterrupted potable water service to facilities in the project area. Breaks in the water lines would occur more frequently, and park and concessioner operations would be affected until such time when the system could be brought back to service. Subsequently, portions of the project area could be closed for unknown periods of time. This would disrupt park and concessioner operations and could lead to an inability to serve the visitor.

Under the no action alternative, the park would not be fully achieving conservation-related goals or sustainability efforts to reduce water usage and to be more energy efficient. Water loss from leaks caused by breaks in the deteriorating water lines and energy expended on maintaining inappropriate pressure in the existing water system would persist. Operational and maintenance costs would increase as further age and deterioration set-in. Costs associated with the no action alternative include penalties for violating state of California drinking water standards, greater maintenance and operation costs, costs associated with visitor dissatisfaction due to water issues, and potential loss of property due to inadequate fire suppression capabilities. Frequent responses to water line breaks are an inefficient use of staff time and defer work on other maintenance projects.

Water system operators would continue to be challenged with repairing and rehabilitating an already degraded and deteriorated water system. Finding replacement parts to the water system would become more difficult as the water system continues to age and parts become less common. Confined spaces, high pressure exposure, and locating emergency breaks in sometimes adverse conditions and over uneven and steep terrain are examples of risks that park employees currently face when working on these waterlines. Park staff working on the water distribution system could be exposed to hazardous materials since the water system consists of a variety of materials, including leaded joint pipe. The increasing difficulty in maintaining the underground fire hydrants in fully operational status elevates risk to visitors, employees,

and NPS- and concessioner-owned infrastructure. In addition, the health and safety of employees that serve on the structural fire brigades could be at risk if the water system cannot fully support fire suppression capabilities.

Periodic repairs to the water system and potential shutdowns would inconvenience NPS and concessioner employee residents and their families. Depending on the severity of the water failure, NPS and concessioner employee residents and their families living within the failure area could potentially be relocated to other lodging alternatives until repairs could be made. Overall alternative A would result in short- and long-term moderate to major adverse impacts to employee health and safety.

Cumulative Effects of Alternative A

Park and concessioner operations have been affected by past activities such as the removal of park and concessioner operations from the Giant Forest, and relocation of park maintenance operations to Red Fir, and concessioner operations to Wuksachi. Maintenance and repairs to existing utilities, facilities, roads, trails, and other park and concessioner operated infrastructure is ongoing. Some of these actions, such as the relocation of facilities to Wuksachi and Red Fir, have resulted in improved park and concessions operations, and improved safety by upgrading the facilities. Others, like ongoing maintenance and repairs to park facilities and utilities, result in similar risks to employee safety as stated in the previous section, because other facilities are also outdated and in need of rehabilitation (e.g. wastewater systems). Overall, the cumulative impacts of no action on park and concessions operations, and employee safety, when combined with the past, present, and future foreseeable actions, would be long-term moderate and adverse.

Conclusion Statement for Alternative A

Under the no action alternative, there would be no major improvements made to the water system and it would remain noncompliant with state water quality standards. Failures would increase as the system continues to deteriorate, resulting in a higher probability for water system failures and system shutdowns. This would result in long-term moderate to major adverse impacts on park and concessioner operations and employee safety. When combining this alternative with past, present, and reasonably future activities, the cumulative effects on park and concessioner operations and employee safety would be long-term, moderate and adverse.

IMPACTS OF ALTERNATIVE B AND ALTERNATIVE C (PREFERRED)

Impacts Common to Alternative B and Alternative C (Preferred)

Under alternatives B and C, a comprehensive design and plan of the water system would be implemented to address immediate deficiencies, consider future build-out, and prioritize work elements, resulting in a long-term beneficial effect to park and concessioner operations. Components of alternatives B and C would be phased-in as project funding is acquired and would be prioritized based on the most critical components.

Construction activities would result in short-term minor to moderate adverse impacts to park and concessioner operations, and NPS and concessioner employees and their families residing in the project area. Project activities could result in closures or interruption of services and may require that the water is temporarily shut-off until the specific project activity is completed.

Approximately 1 ½ miles of new water line would be installed within the Generals Highway road corridor and construction activities are anticipated to take 2-4 months. During construction, lane closures and traffic delays would occur, resulting in short-term minor adverse effects to on- and off-duty park and concessioner employees traveling on the roads during this time.

The Sequoia Shuttle uses the Giant Forest Museum as the primary shuttle system hub between the three shuttle routes (External, Crescent Meadow/Moro Rock, and Wuksachi). Shuttle bus routes and schedules would be affected during construction activities, resulting in short-term moderate adverse impacts to shuttle bus operations.

Rehabilitating the water system would have beneficial effects on park and concessioner operations and employee safety by providing high quality drinking water and reducing the potential for system shutdowns. The parks' water system would become compliant with state water quality regulations. Overall, the new water system would result in long-term beneficial effects on park and concessioner operations and employee health.

Existing underground fire hydrant assemblies would be improved to allow for year-round accessibility. Long-term beneficial effects would result from providing dependable and adequate water delivery allowing for a safer work environment for fire personnel responding to structural fires, and the ability of the NPS to protect life and property in case of a fire.

Alternatives B and C would provide a safer work environment for water system operators because confined spaces would be eliminated, system pressure would be corrected, and, access to valves, vaults, and water distribution lines would be easier and safer. In addition, the section of existing water line that traverses the Giant Forest would be abandoned. This would eliminate the need for water system operators to access the water line over steep and uneven terrain, resulting in safer working conditions. A new water line would be installed within the Generals Highway road corridor which would allow easier and safer access to the water line should repairs or maintenance be needed. Standard safety protocols and traffic controls would be implemented if maintenance or repairs to this new section of water line would be needed, to ensure the safety of staff working on the repairs. Overall, long-term beneficial, effects to employee health and safety would result from making the water system more efficient and functional, and eliminating potential risks associated with the existing system.

The water system would be designed to be hydraulically more efficient and provide redundancy, allowing more flexibility by water system operators. For instance, the Lodgepole-Wolverton interconnection valve vault would be replaced and could be used as a back-up water source for the Lodgepole area, thereby allowing the Lodgepole water treatment plant to be shut-down in the winter or draw water from the Wolverton water supply, if necessary. One new building, a chlorine dosing station at Wuksachi, would be constructed under alternatives B and C. The long-term maintenance of this building would not adversely affect park operations.

Alternatives B and C would provide a durable, efficient, and low-maintenance water system that enables funding and employee time to be dedicated to deferred maintenance and other park projects, resulting in a long-term beneficial effect to park operations.

Impact Differences in Alternative B and Alternative C (Preferred)

Alternative B: Specific project components associated with alternative B include the replacement of approximately 5,500 linear feet of water line at Wuksachi, water line cleaning, and the construction of a 240 square foot building adjacent to the Giant Forest water tank. There would be additional short-term, minor adverse localized impacts to park and concessioner operations in the Wuksachi area during water line replacement activities. The long-term maintenance of the new proposed building would be negligible, and would not adversely affect park operations. Similarly, other project components of alternative B would result in negligible effects to park and concessioner operations and employee health.

Alternative C: Under alternative C, a new groundwater water source would be developed at the Pinewood picnic area and supply water to facilities in the Giant Forest area. The development of a separate well in

the Giant Forest area would greatly reduce the water age (approximately 4 days at seasonal average day demand) (Arber 2010a), thereby improving drinking water quality by isolating nearly one mile of existing water main. In addition, alternative C would provide more diversity in the water supply sources available because the overall water system would have two surface water sources and one groundwater source (plus the seldom used groundwater source in Long Meadow). An additional water source would provide greater flexibility for park staff to utilize in response to supply and demand, seasonal fluctuations, and emergency response. The long-term maintenance of the well house would be negligible, and would not adversely affect park operations. Alternative C would result in additional long-term beneficial effects to park and concessioner operations and employee safety from improved water quality at Giant Forest by reducing water age in the system, and providing more diversity and flexibility in the number and type of water sources available, thereby improving reliability.

Cumulative Effects of Alternative B and Alternative C (Preferred)
Park and concessioner operations have been affected by past activities such as the removal of park and concessioner operations from the Giant Forest, and relocation of park maintenance operations to Red Fir, and concessioner operations to Wuksachi. Maintenance and repairs to existing utilities, facilities, roads, trails, and other park and concessioner operated infrastructure is ongoing. Some of these actions, such as the relocation of facilities to Wuksachi and Red Fir, have resulted in improved park and concessions operations, and improved safety by upgrading the facilities. Others, like ongoing maintenance and repairs to park facilities and utilities, result in similar risks to employee safety as stated in the previous section, because other facilities are also outdated and in need of rehabilitation (e.g. wastewater systems).

Under alternatives B and C, there would be some short-term adverse impacts associated with construction activities, but in the long-term, there would be beneficial effects to park and concessioner operations, and employee safety from the rehabilitation of the water system. When adding the past, present, and reasonably foreseeable future activities to the elements on alternatives B and C, the cumulative effects would be short-term minor and adverse, but long-term and beneficial.

Cumulative Effect of Alternative B: There would be no additional cumulative effect to park and concessioner operations and employee safety from implementation of alternative B other than stated above.

Cumulative Effect of Alternative C: Alternative C would result in a slight addition to the overall beneficial cumulative effects to park and concessioner operations due to the development of a new well which would allow for greater diversity in the number and types of water sources available to the overall water system, further improving reliability and drinking water quality.

Conclusion Statements for Alternative B and Alternative C (Preferred)
In summary, a comprehensive design and plan of the water system would be implemented to address immediate deficiencies, consider future build-out, and prioritize work elements. Rehabilitation of the water system would improve drinking water quality, provide uninterrupted potable water delivery to NPS and concessioner operated facilities and residences, provide adequate water delivery for fire suppression, and, improve working conditions for employees, resulting in long-term beneficial effects to park and concessioner operations and employee health. Construction activities would result in short-term minor to moderate adverse impacts to park and concessioner operations, and NPS and concessioner employees and their families during construction activities on the Generals Highway and in Wuksachi, and if water shutdowns are necessary during project work. The cumulative effects would be short-term minor and adverse, and long-term and beneficial.

Alternative B: Implementation of alternative B would result in no additional impacts or cumulative effects to visitor experience and recreational opportunities other than as stated above.

Alternative C: Alternative C would result in additional long-term beneficial cumulative effects to park and concessioner operations and employee safety from the construction of the well at Pinewood picnic area, which would improve water quality at Giant Forest by further reducing water age in the system, and would provide more diversity and flexibility in the number and type of water sources available, thereby improving reliability.

CONSULTATION AND COORDINATION

SCOPING

Public Scoping
Public scoping began for this project on September 2, 2010, when Sequoia and Kings Canyon National Parks posted a press release describing the project and requesting public comment on the parks' website and the NPS Planning, Environment, and Public Comment (PEPC) website (Appendix B). An email was sent to 429 individuals, agencies, organizations, and media outlets on the parks' mailing list. In addition, approximately 200 letters were sent to those without an email address, and 33 letters were sent to area American Indian Tribes or tribal representatives. Public scoping notices were published in two newspapers and internet sites, including the Visalia Times-Delta (newspaper and website) on September 3; and, the Kaweah Commonwealth (newspaper and website) on September 10. Three individuals responded during the 30-day public scoping period, which ended October 2, 2010. One individual was in support of the project; one requested more detailed information about the project proposal; and the third was from a business interested in working on the project. One additional correspondence was received after the public scoping period ended, and requested to be on the parks' mailing list and receive notification of documents related to this project proposal.

CONSULTATION AND PERMITTING REQUIREMENTS

On December 8, 2010, the NPS accessed the USFWS website to obtain an official species list for endangered and threatened species that may be in the project area and could be affected by project activities (USFWS 2010). NPS biologists reviewed the USFWS list and lists of state-listed species (CDFG 2010c and 2010d) and species of concern (CDFG 2009 and 2011), to determine which species could potentially be affected by implementation of the proposed project. The NPS has determined that there would be *no effect* on threatened or endangered species from implementation of the preferred alternative.

In January 2011, the NPS sent a letter to the California SHPO to seek preliminary comments on the project proposal. The NHPA section 106 determination would likely be either *no effect* or *no adverse effect*, pending the results of the National Register evaluations of the two dam structures and the "Mission 66" water treatment plant at Lodgepole. The NPS will continue to consult with SHPO.

Permitting Requirements
California Department of Public Health, Drinking Water Program- Domestic Water Supply Permit and amendments for a new water supply and change in the method of water treatment.

U.S. Army Corps of Engineers- Section 404 Nationwide Permit for work within waterways.

California State Water Resources Board- Section 401 water quality certification for working in waterways.

AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONSULTED

Agencies and organizations contacted to assist in identifying issues and provided with an opportunity to review or comment on this EA include, but are not limited to, the following.

FEDERAL AGENCIES

U.S. Army Corps of Engineers: Lake Kaweah; Pine Flat Lake
National Park Service: Rivers, Trails, and Conservation Program; Yosemite National Park
U.S. Bureau of Management, Field Manager- Bakersfield
U.S. Fish and Wildlife Service
U.S. Geological Survey, Biological Resources Division, Western Ecological Research Center
U.S. Forest Service: Inyo, Sequoia, and Sierra National Forests

CONGRESSIONAL REPRESENTATIVES

U.S. Senator Barbara Boxer
U.S. Senator Dianne Feinstein
U.S. Congressman Jim Costa
U.S. Congressman Devin Nunes
California State Governor Jerry Brown
California State Senator Tom Berryhill
California State Senator Jean Fuller
California Assemblymember Linda Halderman
California Assemblymember Connie Conway

STATE, COUNTY, AND LOCAL AGENCIES

California State Historic Preservation Officer
California Department of Fish and Game
California Department of Forestry and Fire Protection
California Department of Transportation
Chamber of Commerce: Central Sierra; Clovis; Dinuba; Exeter; Fresno; Greater Reedley; Kingsburg; Lindsay; Lone Pine; Porterville; Sanger; Sequoia Foothills; Visalia; Central California Hispanic Chamber of Commerce; Fresno Area Hispanic Chamber of Commerce; San Joaquin Valley Black Chamber of Commerce; Tulare Kings Hispanic Chamber of Commerce
City Council of: Reedley; Woodlake
City of: Clovis; Dinuba; Exeter; Fowler; Fresno; Kingsburg; Orange Cove; Parlier; Sanger; Selma;Visalia
City of Visalia- Visalia Shuttle
Colonel Allensworth State Historic Park
Fresno City and County Convention and Visitors Bureau
Fresno County: Board of Supervisors; Parks and Recreation; Office of Tourism; Chairperson
Inyo County District Supervisors
Sierra Nevada Conservancy, Bishop Office
State of California Clearinghouse
Tulare County: Board of Supervisors; Community Development; Planner
Visalia Convention Center
Visalia Visitor Center and Convention Bureau

AMERICAN INDIAN TRIBES, ORGANIZATIONS, AND INDIVIDUALS

Big Pine Paiute Tribe of the Owens Valley
Big Sandy Rancheria of Mono Indians
Bishop Indian Tribal Council
California Basketweavers Association
California Native American Heritage Commission

Cold Springs Rancheria of Mono Indians
Dunlap Band of Mono Indians
Fort Independence Paiute Indians
Kern Valley Indian Community
Native American Heritage Commission
North Fork Rancheria of Mono Indians
Paiute–Shoshone of Lone Pine
Santa Rosa Rancheria
Sierra Foothill Wuksachi Tribe
Sierra Nevada Native American Coalition
Table Mountain Rancheria
Tubatulabals of Kern Valley
Tule River Indian Reservation
Wukchumni Tribal Council
Wuksachi Indian Tribe

NPS CONCESSIONERS

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Sequoia and Kings Canyon Park Services Company

OTHER GROUPS AND ORGANIZATIONS

Backcountry Horsemen of California
Californians for Western Wilderness
California Preservation Foundation
California Travel and Tourism Commission
Center for Biological Diversity, California and Pacific Office
Fresno Audubon Society
Friends of the Earth
High Sierra Hiker's Association
Mineral King District Association
Mineral King Preservation Society
National Audubon Society; Tulare Audubon Society
National Parks and Conservation Association
The Nature Conservancy, California Field Office
Pacific Crest Trail Association
PEER
SCA Northwest Office
Sequoia Natural History Association
Sequoia Riverlands Trust
Sequoia Parks Foundation
Sierra Club- National Headquarters; Tehipite Chapter; Kern-Kaweah Chapter; Sacramento Field Office
The Wilderness Society
Wilderness Land Trust
Wilderness Watch
The Wildlife Society, San Joaquin Valley Chapter
Wilsonia Historic District Trust

AREA LIBRARIES AND UNIVERSITIES

California State University: San Joaquin Sierra Unit
Fresno County Libraries
- Bear Mountain Branch Library
- Central Branch Library
- Sunnyside Branch Library
- Fowler Branch Library
- Kingsburg Branch Library
- Orange Cove Branch Library
- Parlier Branch Library
- Reedley Branch Library
- Sanger Branch Library
- Selma Branch Library

San Joaquin Valley College: Hanford Extension; Visalia Campus; Fresno Campus
Tulare County Law Library
Tulare County Libraries: Exeter Branch; Lindsay Branch; Three Rivers Branch

MEDIA

Bakersfield Californian
Fresno Bee
Kaweah Commonwealth
Kern Valley Sun
Noticiero Semanal
Porterville Recorder
Reedley Exponent
Sanger Herald
San Francisco Chronicle

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APPENDIX A. DETERMINATION OF IMPAIRMENT

A determination of impairment is made for each of the resource impact topics carried forward and analyzed in the environmental assessment for the preferred alternative. The description of park significance is found below and was used as a basis for determining if a resource is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, or
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park, or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

Impairment determinations are not necessary for visitor experience, socioeconomics, public health and safety, environmental justice, land use, and park operations, etc., because impairment findings relate back to park resources and values. These impact areas are not generally considered to be park resources or values according to the *Organic Act*, and cannot be impaired the same way that an action can impair park resources and values.

Description of Park Purpose and Significance
Sequoia National Park was established on September 25, 1890. The primary purpose for establishing the park is described in the act's preamble:

> *Whereas, the rapid destruction of timber and ornamental trees in various parts of the United States, some of which trees are the wonders of the world on account of their size and limited number growing, makes it a matter of importance that at least some of said forests should be preserved. (26 Stat. L., 478)*

The legislation further stated that Sequoia National Park is to be a place "dedicated and set apart as a public park, or pleasuring ground, for the benefit and enjoyment of the people," and shall be managed "for the preservation from injury of all timber, mineral deposits, natural curiosities and wonders … [and for] their retention in their natural condition."

The purpose of Sequoia and Kings Canyon National Parks as defined in the parks' FGMP/FEIS (NPS 2007) is as follows:

> Protect the greater Sierran ecosystem—including the sequoia groves and high Sierra regions of the park—and its natural evolution forever.
>
> Provide appropriate opportunities to present and future generations to experience and understand park resources and values.
>
> Protect and preserve significant cultural resources.
>
> Champion the values of national parks and wilderness.

Sequoia and Kings Canyon National Parks are significant because they contain the following resources (FGMP/FEIS):

> The largest giant sequoia trees and groves in the world, including the world's largest tree, the General Sherman tree

An extraordinary continuum of ecosystems arrayed along the greatest vertical relief (1,370 to 14,497 feet in elevation) of any protected area in the lower 48 states

The highest, most rugged portion of the high Sierra, which is part of the largest contiguous alpine environment in the lower 48 states

Magnificent, deep, glacially carved canyons including Kings Canyon, Tehipite Valley, and Kern Canyon

The core of the largest area of contiguous designated wilderness in California—the second largest in the lower 48 states

The largest preserved southern Sierra foothills ecosystem

More than 300 known marble caverns, many inhabited by cave wildlife that is found nowhere else

A wide spectrum of prehistoric and historic sites documenting human adaptations in their historical settings throughout the Sierran environments

NATURAL RESOURCES TOPICS

Geology and Soils

Sequoia and Kings Canyon National Parks occupy approximately 1,350 square miles within the central and southern portion of the Sierra Nevada. Included in the parks' rugged landscape is the highest peak in the contiguous United States, Mount Whitney, which rises to about 14,497 feet above sea level. The Giant Forest, Lodgepole, Wolverton, Wuksachi, and Red Fir areas are situated in the western mountainous terrain of the Sierra Nevada and the elevation ranges from 5,500 feet to 10,000 feet. The actual project area ranges in elevation from 6,000 feet to 8,000 feet. The area is composed of three distinctive geological units; from oldest to youngest, they include a granodiorite basement complex (pre-Tertiary period), glacial till composed of poorly sorted sediments (Pleistocene epoch), and recently deposited alluvium (Holocene epoch). Erosion by streams and glaciers has created a rugged and steep terrain, and level land is limited to a few small areas.

The soils in the project area are of two general types- glaciated and non-glaciated. Both are primarily granitic in origin and have developed through combinations of glaciation, stream sedimentation, and in-place weathering and decomposition of rock.

The project would occur primarily in previously disturbed corridors, or in developed areas. While there would be short-term minor adverse effects associated with trenching for the new water lines and facility construction, in the long term there would be beneficial effects from the new water line as there would be fewer leaks and less erosion. Because of these beneficial effects, the preferred alternative would not result in impairment to geology and soils.

Vegetation

Extreme topographic differences and a striking elevation gradient (ranging from 1,360 feet in the foothills to 14,497 feet along the Sierra crest) create a rich tapestry of environments in the two parks, from the hot, dry lowlands along the western boundary to the stark, snow-covered alpine high country. This topographic and environmental diversity supports over 1,500 vascular plant taxa, including subspecies and varieties, which make up dozens of unique plant communities. These vegetation types can be

categorized into six broad vegetation zones: oak woodland, chaparral shrubland, lower montane, upper montane, subalpine, and alpine. Vegetation in the project area can be classified as: coniferous without sequoia, coniferous with sequoia, coniferous with lodgepole pine, meadow, and riparian. There is one sequoia grove associated with this project, the Giant Forest sequoia grove.

Healthy, native terrestrial and riparian vegetation is necessary to fulfill the purposes for which the parks were established, and is key to the natural integrity and enjoyment of the parks.

The preferred alternative would result in adverse impacts during construction work such as trampling and trenching, but would result in fewer disturbances to the giant sequoia ecosystem due to abandoning the existing water line in the Giant Forest, reducing the need for emergency repairs and trenching/digging in the long-term.

Riparian vegetation would be disturbed in the short-term during the replacement of the intake facilities at Wolverton and Silliman Creek. Mitigation would offset the adverse effects, and site rehabilitation would occur, resulting in no long-term adverse effects.

Overall, because there would be beneficial effects to the giant sequoia ecosystem by capping and abandoning the water line, and only minor adverse effects from the replacement of the existing water lines and the construction of associated facilities, the preferred alternative would not result in impairment.

Water Resources

The four large river systems with headwaters within the parks are the North Fork of the Kern River, the five forks of the Kaweah River, the South and Middle Forks of the Kings River, and the South Fork of the San Joaquin River. Surface water occurs primarily as rivers and streams at lower elevations, with a greater occurrence of lakes and ponds at higher elevations. The quantity of surface flow follows an annual cycle, with the lowest flows typically occurring in August and the highest flows in May or June. Spring flows are primarily snowmelt from glaciers and snowpack at higher elevations; by late August, the source is primarily groundwater.

Groundwater is common in alluvial deposits in meadows and wherever decomposed or fractured granite is suitable to form an aquifer. Precipitation appears adequate to recharge the groundwater, but the actual quantity of stored water in aquifers is unpredictable. Rainfall and melting snow tend to rapidly infiltrate weathered and fractured rock. Even in areas of relatively solid rock, runoff tends to channel into the nearest fractures and crevices. These characteristics mean that much of the streamflow is a result of interflow, or shallow groundwater movement, rather than direct surface runoff. Groundwater supplies many meadows, seeps, springs, creeks, and perennial streams. Most of the water consumed in the parks comes from surface sources such as streams and springs. There are a few shallow wells with good water quality.

Water resources are critical to the preservation of park resources, and to allow for visitor use and enjoyment of park resources. The replacement and rehabilitation of existing water lines and associated facilities would occur primarily in previously disturbed corridors and in developed areas. There could be localized run off and erosion if digging occurs near streams and water resources, however, this impact would be short-term minor and adverse due to mitigation measures including erosion control. In the long-term there would be fewer emergency repairs, thus digging and related erosion would be reduced, reducing potential adverse effects on water resources.

Under the preferred alternative, a new groundwater well approximately 700 feet deep would be developed at the Pinewood picnic area. The new well would introduce groundwater pumping in an area where none currently exists. The nearest wet meadow ecosystem is Round Meadow, approximately 2,000 feet south

of the well site and is considered beyond the area of influence of a low-yield well at the Pinewood picnic area (NPS 2010a). The valleys on either side of the Pinewood picnic area are the headwaters of intermittent or low-flow perennial streams (NPS 2010a). There is a chance that pumping groundwater from a well at Pinewood would cause a small decrease in streamflow, however, the low projected pumping rate and the horizontal and vertical separation between the well and streams would lessen the direct impact on streamflow (NPS 2010a). Additionally, pumping groundwater from a deep well that obtains water from fractures in the granite bedrock would spread the impact over a large, but unknown area (NPS 2010a). There may be infiltration of streamflow over some length of the adjacent creeks; in practice, there would be no observable or measurable effect on streamflow in the adjacent creeks (NPS 2010a). The anticipated low pumping rate and the distance to the headwaters of adjacent drainages would result in minimal to no streamflow reduction (NPS 2010a), and therefore, negligible impacts are expected.

The improvements to the water intake and distributions systems in the project area would have short-term adverse effects to water resources during construction. This includes increased turbidity during instream work; primarily there would be a surge in sediment when the temporary water diversions are constructed, and when they are removed and streamflows are restored. This adverse effect would be short-term until the area is stabilized. A monitoring strategy would be developed for the water systems on Silliman and Wolverton Creeks. Current technology would be integrated into the design of the new structures to allow for the monitoring of water flows. This monitoring program would help the parks determine the levels of acceptable withdrawals under different precipitation regimes. Mitigation would offset the adverse effects during construction, but there would continue to be long-term moderate adverse effects on water resources at Silliman and Wolverton creeks from the alteration of stream functions due to the presence of dams and water diversion facilities in these creeks. However, this project is a replacement in kind and less than 1 acre would be permanently affected.

Water conservation would be improved due to capping and abandoning the deteriorating water distribution system, resulting in fewer leaks, resulting in long-term beneficial effects.

Most of the adverse effects from this project are short-term and can be effectively mitigated. The long-term adverse effects to Silliman and Wolverton creeks result in less than 1 acre of permanent loss of stream habitat combined. There would be beneficial long-term effects from water conservation and fewer emergency actions. Therefore, there would be no impairment as a result of implementing the preferred alternative.

HISTORIC RESOURCES

The following historic resources are within the project area:

- The Marble Fork Bridge, located in the Lodgepole area, is listed in the National Register of Historic Places (National Register)(1978).
- In 1992, the Generals Highway was determined to be eligible for inclusion in the National Register.
- The water treatment plant at Lodgepole was constructed in 1963 during the NPS “Mission 66” era which spanned the years from 1956-1966. As per NPS policy, “Mission 66” structures are to be treated as “potentially eligible” pending a formal determination of eligibility.
- The water diversion in Wolverton Creek was constructed around 1959 and the water diversion in Silliman Creek (near Lodgepole) was constructed in 1934. These structures are over 50 years in age, and thus are viewed currently as potentially eligible; a formal determination of eligibility will be undertaken for each structure.
- Sections of the water lines and associated appurtenances range between 30 and 70 years in age. The water distribution piping through the Giant Forest was constructed in the 1930s and

supported numerous structures that have since been removed in an extensive restoration project that occurred from 1997 to 2005.

The NHPA section 106 determination would likely be either *no effect* or *no adverse effect*, pending the results of the National Register evaluations of the two dam structures and the "Mission 66" water treatment plant at Lodgepole. Removal of historic resources, if they are determined to be National Register eligible, would result in a long-term minor adverse effect. However, any potential adverse effect would be mitigated through documentation, including photo-documentation. For purposes of section 106 of the NHPA, the determination would thus be *no adverse effect*. There would be no impairment to historic resources as a result of implementing the preferred alternative because any potential adverse effect would be mitigated, in consultation with the SHPO, before project implementation.

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APPENDIX B. PUBLIC SCOPING PRESS RELEASE

National Park Service
U.S. Department of the Interior

Sequoia and Kings Canyon
National Parks

47050 Generals Hwy.
Three Rivers, CA 93271

559 565-3341 phone
559 565-3730 fax

Sequoia and Kings Canyon National Parks News Release

For Immediate Release: September 2, 2010
Contact: Public Affairs Office, (559) 565-3131

The National Park Service Seeks Public Comments about Proposed Rehabilitation of a Water Distribution System at Sequoia and Kings Canyon National Parks

The National Park Service (NPS) is seeking public comments about potential issues related to the proposed rehabilitation of a deteriorated water-distribution system within Sequoia and Kings Canyon National Parks. This water-distribution system serves approximately 2,900 visitors and staff daily in the developed areas of Giant Forest, Lodgepole, Wolverton, and Wuksachi in Sequoia National Park. The system is over 60 years old, is in poor condition, fails regularly, and does not provide reliable structural fire suppression capabilities or comply with current fire and plumbing codes. This project is needed to provide a viable water source that meets/exceeds state and federal water-quality requirements and meets potable water demands in developed areas. Project activities being considered include the replacement and rehabilitation of approximately 23,000 linear feet of water line, valves, and associated equipment. To obtain additional information about the proposed project, visit the NPS Planning, Environment and Public Comment (PEPC) website at: http://parkplanning.nps.gov/seki or request more information from Environmental Protection Specialist Nancy Hendricks at (559) 565-3102. All public comments must be received by **October 2, 2010.**

Public comments may be submitted via the PEPC website at http://parkplanning.nps.gov/seki. In addition, you may direct comments regarding this project to the park in writing by e-mail to seki_planning@nps.gov or by either hand-delivering or mailing your comments to:

Superintendent
Attn: Rehabilitate Water Distribution System
Sequoia and Kings Canyon National Parks
47050 Generals Highway
Three Rivers, CA 93271

- continued –

[redacted]

Public comments, including personal identifying information (name, address, phone number, e-mail address, etc.) may be made available to the public at any time. Even if a commenter requests to have personal identifying information withheld, the National Park Service cannot guarantee this will be done. The National Park Service will always make submissions from organizations or businesses, and from individuals identifying themselves as representatives of or officials of organizations or businesses, available for public inspection in their entirety. *Anonymous comments will not be accepted.*

–NPS–

APPENDIX C. SPECIAL STATUS SPECIES

Federal Agencies
FE= Federal Endangered Species
FT= Federal Threatened Species
FC= Federal Candidate Species
X= Critical Habitat
USFS-S= Federal Forest Service: Sensitive
BLM-S= Bureau of Land Management Sensitive
USFWS-BCC= Bird of Conservation Concern

California State Agencies
SE= State Endangered Species
ST= State Threatened Species
SC= State Candidate Species
CDFG-FP= CA Dept. of Fish & Game: Fully Protected
CDFG-SSC= CA Dept. of Fish & Game: Species of Special Concern
CDFG-WL= CA Dept of Fish & Game: Watch List
CDF-S= CA Dept. of Forestry & Fire Protection: Sensitive

Other Organizations
ABC= American Bird Conservancy
WBWG= Western Bat Working Group
IUCN= International Union for Conservation of Nature
AFS= American Fisheries Society

		T&E Listed		Sensitive Listing		
Birds		Federal	State	Federal	State	Other
California Condor; and critical habitat	*Gymnogyps californianus*	FE; X	SE	-	CDF-S	ABC, IUCN
Bald Eagle	*Haliaeetus leucocephalus*	Delisted	SE	USFS-S; USFWS-BCC	CDF-S; CDFG-FP	IUCN
Swainson's Hawk	*Buteo swainsonii*	-	ST	USFWS-BCC; USFS-S	-	ABC, IUCN
American Peregrine Falcon	*Falco peregrinus anatum*	Delisted	Delisted	USFWS-BCC	CDF-S; CDFG-FP	-
Cooper's Hawk	*Accipiter cooperii*	-	-	-	CDFG-WL	IUCN
Northern Goshawk	*Accipiter gentilis*	-	-	BLM-S; USFS-S	CDFG:SSC ; CDF-S	IUCN
Sharp Shinned Hawk	*Accipiter striatus*	-	-	-	CDFG-WL	-
Golden Eagle	*Aquila chrysaetos*	-	-	USFWS-BCC	CDF-S; CDFG-FP; CDFG-WL	IUCN
Prairie Falcon	*Falco mexicanus*	-	-	USFWS-BCC	CDFG-WL	IUCN
Short-eared Owl	*Asio flammeus*	-	-	-	CDFG-SSC	ABC; IUCN
Long-eared Owl	*Asio otus*	-	-	-	CDFG-SSC	IUCN
Great Gray Owl	*Strix nebulosa*	-	SE	USFS-S	CDF-S	IUCN
California Spotted Owl	*Strix occidentalis occidentalis*	-	-	BLM-S; USFS-S; USFWS-BCC	CDFG-SSC	ABC; IUCN
Black Swift	*Cypseloides niger*	-	-	USFWS-BCC	CDFG-SSC	ABC; IUCN
Willow Flycatcher	*Empidonax traillii*	-	SE	USFS-S; USFWS-BCC	-	ABC; IUCN
Purple Martin	*Progne subis*	-	-	-	CDFG-SSC	IUCN
Yellow Warbler	*Dendroica petechia brewsteri*	-	-	USFWS-BCC	CDFG-SSC	-

		T&E Listed		Sensitive Listing		
Mammals		Federal	State	Federal	State	Other
Pallid Bat	*Antrozous pallidus*	-	-	BLM-S; USFS-S	CDFG-SSC	IUCN; WBWG
Townsend's Big-eared Bat	*Corynorhinus townsendii*	-	-	BLM-S; USFS-S	CDFG-SSC	IUCN; WBWG
Spotted Bat	*Euderma maculatum*	-	-	BLM-S	CDFG-SSC	IUCN; WBWG
Western Red Bat	*Lasiurus blossevilii*	-	-	USFS-S	CDFG-SSC	IUCN; WBWG
Western Small-footed Myotis	*Myotis ciliolabrum*	-	-	BLM-S	-	IUCN; WBWG
Long-eared Myotis	*Myotis evotis*	-	-	BLM-S	-	IUCN; WBWG
Fringed Myotis	*Myotis thysanodes*	-	-	BLM-S	-	IUCN; WBWG
Yuma Myotis	*Myotis yumanensis*	-	-	BLM-S	-	IUCN; WBWG
Western Mastiff Bat	*Eumops perotis*	-	-	BLM-S	CDFG-SSC	WBWG
Sierra Nevada Red Fox	*Vulpes vulpes necator*	-	ST	USFS-S	-	-
California Wolverine	*Gulo gulo*	FC	ST	USFS-S	CDFG-FP	IUCN
American Marten	*Martes americana*	-	-	USFS-S	-	IUCN
Pacific Fisher (West Coast DPS)	*Martes pennanti*	FC	-	BLM-S; USFS-S	CDFG-SSC	-
American Badger	*Taxidea taxus*	-	-	-	DFG-SSC	IUCN
Amphibians						
Sierra Nevada yellow-legged frog	*Rana sierrae*	FC	SC	USFS-S	DFG-SSC	IUCN

Sources: California Natural Diversity Database, State & Federal Listed Endangered & Threatened Animals of Calif., July 2010, (CDFG 2010c) and *California Natural Diversity Database, Special Animals (898taxa), January 2011*. (CDFG 2011b).

APPENDIX D. BEST MANAGEMENT PRACTICES AND CONDITIONS FOR PROPOSED ACTIONS WITH THE POTENTIAL TO HAVE ADVERSE IMPACTS ON WETLANDS

The following serve as Best Management Practices (BMPs) for National Park Service (NPS) actions that may have adverse impacts on wetlands. Additional BMPs may be appropriate depending on local conditions or special circumstances. These also serve as "conditions" that must be met for the actions listed in Section 4.2.1 of these procedures to qualify as "excepted."

1. **Effects on hydrology:** Action must have only negligible effects on site hydrology, including flow, circulation, velocities, hydroperiods, water level fluctuations, and so on. Care must be taken to avoid any rutting caused by vehicles or equipment.

2. **Water quality protection and certification:** Action is conducted so as to avoid degrading water quality to the maximum extent practicable. Measures must be employed to prevent or control spills of fuels, lubricants, or other contaminants from entering the waterway or wetland. Action is consistent with state water quality standards and Clean Water Act Section 401 certification requirements (check with appropriate state agency).

3. **Erosion and siltation controls:** Appropriate erosion and siltation controls must be maintained during construction, and all exposed soil or fill material must be permanently stabilized at the earliest practicable date.

4. **Effects on fauna:** Action must have only negligible effects on normal movement, migration, reproduction, or health of aquatic or terrestrial fauna, including at low flow conditions.

5. **Proper maintenance:** Structure or fill must be properly maintained so as to avoid adverse impacts on aquatic environments or public safety.

6. **Heavy equipment use:** Heavy equipment use in wetlands must be avoided if at all possible. Heavy equipment used in wetlands must be placed on mats, or other measures must be taken to minimize soil and plant root disturbance and to preserve preconstruction elevations.

7. **Stockpiling material:** Whenever possible, excavated material must be placed on an upland site. However, when this is not feasible, temporary stockpiling of excavated material in wetlands must be placed on filter cloth, mats, or some other semipermeable surface, or comparable measures must be taken to ensure that underlying wetland habitat is protected. The material must be stabilized with straw bales, filter cloth, or other appropriate means to prevent reentry into the waterway or wetland.

8. **Removal of stockpiles and other temporary disturbances during construction:**
Temporary stockpiles in wetlands must be removed in their entirety as soon as practicable. Wetland areas temporarily disturbed by stockpiling or other activities during construction must be returned to their pre-existing elevations, and soil, hydrology, and native vegetation communities must be restored as soon as practicable.

9. **Topsoil storage and reuse:** Revegetation of disturbed soil areas should be facilitated by salvaging and storing existing topsoil and reusing it in restoration efforts in accordance with NPS policies and guidance. Topsoil storage must be for as short a time as possible to prevent loss of seed and root viability, loss of organic matter, and degradation of the soil microbial community.

10. **Native plants:** Where plantings or seeding are required, native plant material must be obtained and used in accordance with NPS policies and guidance. Management techniques must be implemented to foster rapid development of target native plant communities and to eliminate invasion by exotic or other undesirable species.

11. **Boardwalk elevations:** Minimizing shade impacts, to the extent practicable, should be a consideration in designing boardwalks and similar structures. (Placing a boardwalk at an elevation above the vegetation surface at least equal to the width of the boardwalk is one way to minimize shading.)

12. **Wild and Scenic Rivers:** If the action qualifies as a water resources project pursuant to Section 7(a) of the Wild and Scenic Rivers Act, then appropriate project review and documentation requirements under Section 7(a) are required.

13. **Coastal zone management:** Action must be consistent, to the maximum extent practicable, with state coastal zone management programs.

14. **Endangered species:** Action must not jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, including degradation of critical habitat (see *NPS Management Policies 2006* and guidance on threatened and endangered species).

15. **Historic properties:** Action must not have adverse effects on historic properties listed or eligible for listing in the National Register of Historic Places.

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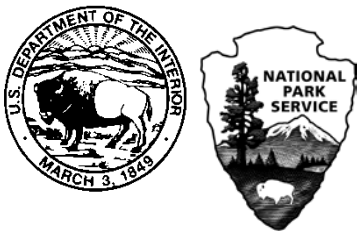

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS SEKI (April 2011)