

CHAPTER 4

Hydrology

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HYDROLOGY

This chapter describes the existing surface water hydrology and groundwater conditions, the applicable regulations, and potential impacts from implementation of the Proposed Project Alternative and other alternatives on the hydrologic resources in the Project Area.

4.1 ENVIRONMENTAL SETTING

This section describes aspects of the environmental setting related to the hydrology of the Project Area that may be affected if the Proposed Project Alternative or one of the other alternatives is implemented. A map and general description of the geographic features (e.g., Lake Mary, Lake Mamie, Twin Lakes, Mammoth Creek and Hot Creek) and District facilities within the Project Area are presented in Chapter 1 – Introduction (see Figure 1-2). Additional details regarding the environmental setting, focused specifically on hydrology, are discussed below.

4.1.1 SURFACE WATER HYDROLOGY

The seasonal snowpack is the primary water source for the hydrology of the Mammoth Lakes Basin. Mammoth Mountain forms an orographic barrier to the numerous Pacific storms that deposit large volumes of snow east of the Mammoth Crest (Burak et al. 2006). At least 85% of average annual precipitation results from storms that originate over the Pacific Ocean during the winter months (DWR 1973 and Vorster 1985 in Burak et al. 2006). Spring snow storms generated over the Great Basin (Tonopah lows) and summer thunderstorms triggered by monsoonal southerly flow account for the remaining annual precipitation, although summers can be dry with little precipitation.

Annual precipitation varies considerably within the area, ranging from less than 10 inches in the northeastern area to over 80 inches in the Mammoth Mountain area on the west. Average annual precipitation for Mammoth Pass is approximately 43 inches and it is approximately 28 inches at Lake Mary. In the Town of Mammoth Lakes, precipitation averages approximately 23 inches.

Snow water content (SWC) is a major index of spring and summer runoff from Sierra Nevada watersheds. April 1 data historically reflects the magnitude of the snowpack at or near the maximum seasonal accumulation (Stewart et al. 2004; Cayan et al. 1993 in Burak et al. 2006).

As previously discussed in Chapter 3 – Overview of Analytical Approach, hydrologic data was required to develop the MCWD Model that is used as the foundation for the quantitative impact analyses presented in this Draft EIR. Data used in the model were obtained from hydrologic monitoring stations within the Project Area and are listed in **Table 4-1**. Additional information regarding pertinent monitoring activities, by location, is presented in subsequent sections of this chapter and also are discussed in Chapter 3 – Overview of Analytical Approach.

Datasets from the various monitoring locations were scrutinized for completeness (i.e., presence and extent of missing data) and quality (i.e., detection of potential erroneous recordings) in consideration of their applicability as inputs into the model. Inspection of the daily records identified missing data for short periods extending from one to a few days, and longer periods extending for one or more weeks. Annotations in some of the records also identified suspect readings caused by external forces (e.g., frozen gages, debris obstructing measurements, power

or mechanical failures of the installed equipment). Following this technical review, including statistical analyses of the reliability of the data, a final monitoring dataset was used in the development of the MCWD Model (see Appendix C).

Table 4-1. Key Hydrologic Monitoring Stations within the Project Area

Location	Gage Type	Gage Operator	Period of Record
Mammoth Pass	Precipitation	LADWP	1989 – Present
	Snowpack Water Content	LADWP	1990 – Present
Mammoth Ranger Station	Precipitation	USGS	1982 – Present
Lake Mary	Inflow	District	1982 – Present
	Storage	District	1982 – Present
	Outflow	District	1982 – Present
	Diversions ¹	District	1982 – Present
Twin Lakes	Outflow	District	1982 – Present
Twin Falls Diversions	None	USFS	None Identified
Bodle Ditch at the DWP Weir	Flow	District	Late 1970s – Present
OMR Gage	Flow	District	1982 – Present
OLD395 Gage	Flow	LADWP	1935 – Present
Hot Creek Flume Gage	Flow	USGS	1982 – Present
¹ Diversions to the Lake Mary WTP			
Sources: MCWD 2005; CDEC 2010; USGS 2010			

Although the period of record for some of the monitoring stations listed in Table 4-1 extends over a longer duration, the hydrological period used in the MCWD Model extends from April 1, 1988 through March 30, 2008, because this time period:

- Represents the Existing Condition for CEQA purposes because it generally corresponds to the duration of existing fish population monitoring and analyses.
- Represents recent operations and current demands.
- Is of sufficient duration to capture the range of climatologic and hydrologic variability, particularly regarding the Dry runoff year designation, present in the historical period of record.
- Reflects flow gains/losses that occurred during the period representing the Existing Condition.
- Provides consistency of database applications (e.g., Existing Condition, fish population analyses, water availability, demands, flows, runoff year (SWC)) for analyses in this Draft EIR.

The 20-year hydrological period (April 1, 1988 through March 30, 2008) was classified into runoff year types to facilitate resolution of data issues to refine the operations and hydrologic analyses according to water availability. The runoff year was defined as beginning on April 1 and extending through March 31 of the following calendar year. Runoff year types are identified as Wet, Normal, or Dry.

April 1 SWC data for the Mammoth Pass station was used to delineate the runoff year types for the modeled hydrological period. LADWP measures the SWC at this station on or about April 1 of each year, and reports both the “raw” measurement and a “revised” measurement. The “revised” records consist of the SWC adjusted to the first of the month based on estimated precipitation between the actual measurement date and April 1. At the time of development of the MCWD Model, the “revised” records were available only until April 1, 2000. Therefore, the “revised” April 1 snowpack water contents for 1988 through 2000 and the “raw” SWC since 2001 were used for the runoff year type characterization.

The runoff year type definitions (i.e., Dry, Normal and Wet) are based on a 20/80 frequency demarcation of Mammoth Pass SWC, which is consistent with the frequency demarcation that CDFG recommended and the SWRCB adopted for the Mono Basin Decision D-1631. Consequently, the upper Dry year boundary was calculated as the 80th percentile of the LADWP April 1 SWC data, the Normal year boundaries were calculated as between the 20th and 80th percentiles, and the lower Wet year boundary was calculated as the 20th percentile for the years 1988 through 2007 (see **Figure 4-1**). These calculations lead to the following runoff year type classification:

- ❑ **Wet Year** - April 1 SWC > 60.2 inches
- ❑ **Normal Year** - April 1 SWC \geq 25.6 inches but \leq 60.2 inches
- ❑ **Dry Year** - April 1 SWC < 25.6 inches

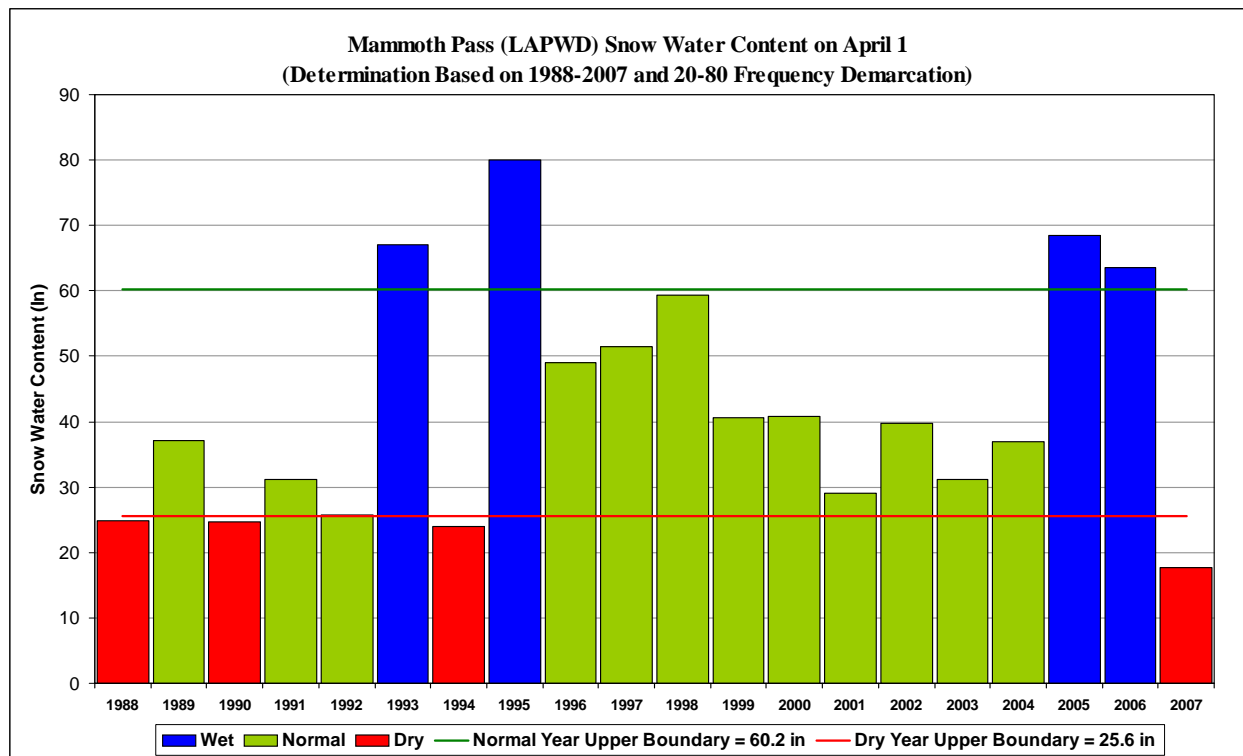


Figure 4-1. Classification of Runoff Years during the Modeled Hydrologic Period

4.1.1.1 LAKE MARY HYDROLOGIC DATA SOURCES

Surface inflow rates entering Lake Mary are monitored at Mammoth Creek, Coldwater Creek, Coldwater Creek diversion, and George Creek using flumes and continuous chart recorders during the spring, summer, and fall months. The chart recorders are removed during winter months when snow accumulations can result in equipment damage and safety concerns.

Water released at the Lake Mary Dam is measured at the outlet of Lake Mamie, just upstream of Twin Falls, using a combination flume/weir structure. Flow rates at this site are continuously monitored and recorded using a chart recorder. A USFS diversion is located on Lake Mamie, to serve several USFS lease cabins. Flow rates at this diversion are generally consistent and are estimated at 0.5 cfs. Besides supplying water to the District's water treatment plant, water from Lake Mary is also diverted on a seasonal basis into the Bodle Ditch, normally from May through October.

From Lake Mary, Mammoth Creek flows into Lake Mamie, then over Twin Falls, and into Twin Lakes.

4.1.1.2 TWIN LAKES HYDROLOGIC DATA SOURCES

Surface water discharge from Twin Lakes is monitored at the dam using a level sensing instrument and chart recorder. Discharge is calculated using depth of water, length of the crest of the dam, and the shape of the crest (MCWD 2005). According to the District, the current flow measurement method is inaccurate due to the physical layout of the outlet structure. At high flows, the outlet structure acts as a poorly constructed weir due to the wide crest in the direction of flow, and shallow depth over the crest. At low flows, most of the water goes over the two flashboard bays, which act more akin to proper sharp-crested weirs that have a robust relationship between the flow rate and the depth of flow over the crest. During the fall and winter seasons when flows are relatively minimal, stream flows measured at Twin Lakes are generally close to those measured at the OMR Gage, and the differences are so small that they are in the scale of measurement errors.

4.1.1.3 MAMMOTH CREEK HYDROLOGIC DATA SOURCES

Although intra- and inter-annually variable, Mammoth Creek flows as measured at the OMR Gage and the OLD395 Gage follow a consistent seasonal pattern with highest flows (associated with snowmelt runoff) occurring during the spring and early summer, and lowest flows occurring during the fall and winter.

VALENTINE RESERVE

Flow losses and gains along Mammoth Creek may be attributable to influences such as tributary inflow, water table accretions and depletions, evapotranspiration and springflow contributions. Several springs occur within the Valentine Reserve, which is located in the reach extending from Twin Lakes to the OMR Gage.

As reported by Ken Schmidt & Associates (2009), flow emanating from a spring in the Valentine Reserve was monitored from 1993-2001. The springflow correlated well with Mammoth Creek streamflow during the period of record (see **Figure 4-2**). Springflow often increased in the fall prior to winter precipitation, primarily due to lower air temperatures and decreased evapotranspiration of shallow groundwater.

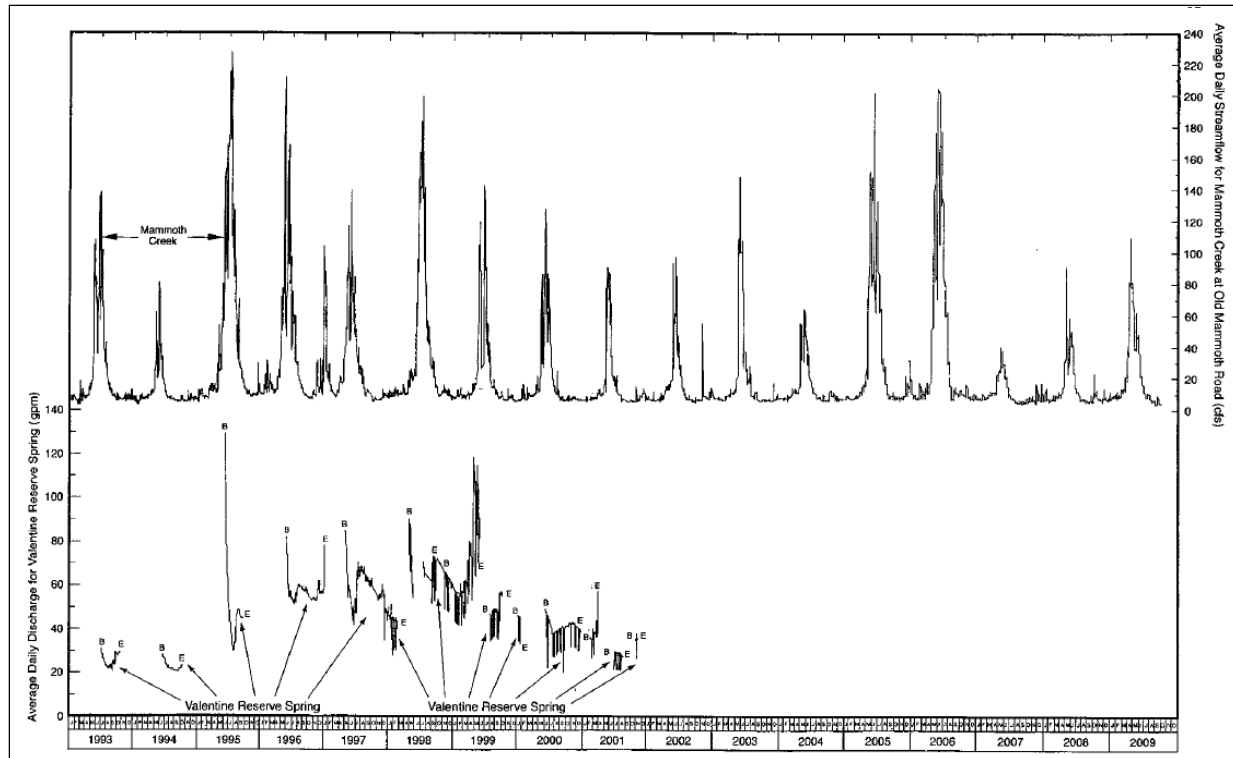


Figure 4-2. Springflow for Valentine Spring (1993-2001) and Mammoth Creek Flow (1993-2009) (Ken Schmidt & Associates 2009)

Commencing in 2001, springflow measurements at the Valentine Reserve were extended to another spring, which has a considerably larger flow than the previously monitored spring. However, no springflow records have been provided since 2001. The Valentine Reserve is responsible for monitoring and annual reporting of the spring flows, under the terms of a 1993 agreement between the District, CDFG, and Valentine Reserve.

OMR GAGE

The District maintains a flow monitoring station (OMR Gage) in Mammoth Creek located near the Old Mammoth Road crossing within the Town of Mammoth Lakes. This station includes a combination flume/weir structure with a continuous chart recorder. It is at this site that the District presently determines whether there is sufficient flow in the creek to allow for surface water diversion and/or storage at Lake Mary per its water rights licenses and permit.

OLD395 GAGE

LADWP maintains a flow monitoring station (OLD395 Gage) in Mammoth Creek located downstream of the Highway 395 crossing. This station includes a flume structure with a continuous chart recorder. Permit 17332 specifies that this gage is the point of measurement for the fishery bypass flow requirements in Mammoth Creek. However, Preliminary C&D No. 9P.2 stipulates that the OMR Gage is to be used for the point of measurement. Although the District is not responsible for the maintenance of the OLD395 Gage, the Proposed Project Alternative includes a mean daily 4 cfs year-round fishery bypass flow requirement as measured at this gage.

MAMMOTH CREEK FLOOD FLOW CONSIDERATIONS

In assessing project-specific stormwater drainage runoff within the Town of Mammoth Lakes, two indicators have been used to characterize storm flows in Mammoth Creek: (1) a 20-year storm intensity; and (2) a 100-year storm intensity (Triad/Holmes Associates 2007; Town of Mammoth Lakes 2008; Boyle 2005).

According to the Town of Mammoth Lakes Storm Drain Master Plan Update (Boyle 2005), the Mammoth Area drainage basin was divided into six distinct major watersheds (see **Figure 4-3**). Watershed 1 encompasses the Lake Mary Basin, which is the most distinct and complex tributary area within the Mammoth Creek drainage system. It is the only watershed for which lake storage is a significant factor because it contains the largest and most numerous lakes within the Mammoth Basin. Watershed 2 is immediately downstream of Watershed 1, and includes portions of the Mammoth Lakes community and Mammoth Mountain, which are directly tributary to Mammoth Creek. Watershed 3 encompasses a separate drainage system, known as Murphy Gulch, which is eventually tributary to Mammoth Creek near Highway 395. Watersheds 4 through 6 are natural watersheds, which are part of the Mammoth Basin, having drainage contributions downstream of the Town of Mammoth Lakes. Therefore, the methodology in this Draft EIR focuses on Watersheds 1 and 2.

The Town of Mammoth Lakes Storm Drain Master Plan Update (Boyle 2005) calculated design flows to accommodate drainage using a mean daily flow rate. The Q_{20} design flow for Watershed 1 was 81 cfs and was 60 cfs for Watershed 2, for a combined Q_{20} design flow of 141 cfs. The Q_{100} design flow for Watershed 1 was 166 cfs and was 69 cfs for Watershed 2, for a combined Q_{100} design flow of 235 cfs.

4.1.1.4 HOT CREEK HYDROLOGIC DATA SOURCES

Spring-fed Hot Creek originates less than one mile southwest of its confluence with Mammoth Creek. It receives flows from Little Hot Creek and the Headsprings (see below). Hot Creek flow concentrates in the Headsprings meadow area and flows through the central portion of the Long Valley Caldera from the southwest to the northeast. As much as 75% of the current hydrothermal outflow occurs in the thermal springs at Hot Creek (Suemnicht and Sorey 2007). Flow accelerates through the Hot Creek Gorge, followed by a decreased gradient and slower flow in the Owens River floodplain. The lower section of Hot Creek divides into multiple smaller channels before its confluence with the Owens River.

HOT CREEK HEADSPRINGS

Although the USGS quadrangle map labels Hot Creek as beginning at hot springs located about 1.7 miles upstream of the Hot Creek Fish Hatchery, current usage considers Hot Creek to originate at a series of springs that flow from between a basalt flow and alluvial gravels near the hatchery complex (Jellison et al. 2007; USFS 1990). The springs identified as “AB” and “CD” springs (see **Figure 4-4**), are two of four major headwater spring groups used as a water source by the Hot Creek Fish Hatchery (also see **Appendix E**). Instantaneous discharge measurements have been made at various times and locations to determine the relative spring flow from each spring group, and discharge from the spring groups varies by location and season (USFS 1990). The large (16-25 cfs) year-round source of warm (57.2-68°F) water is ideal for fish hatchery operations (Jellison et al. 2007). Waters from the two largest hatchery source springs flow a short distance in natural springbrooks before being piped through hatchery production raceways.

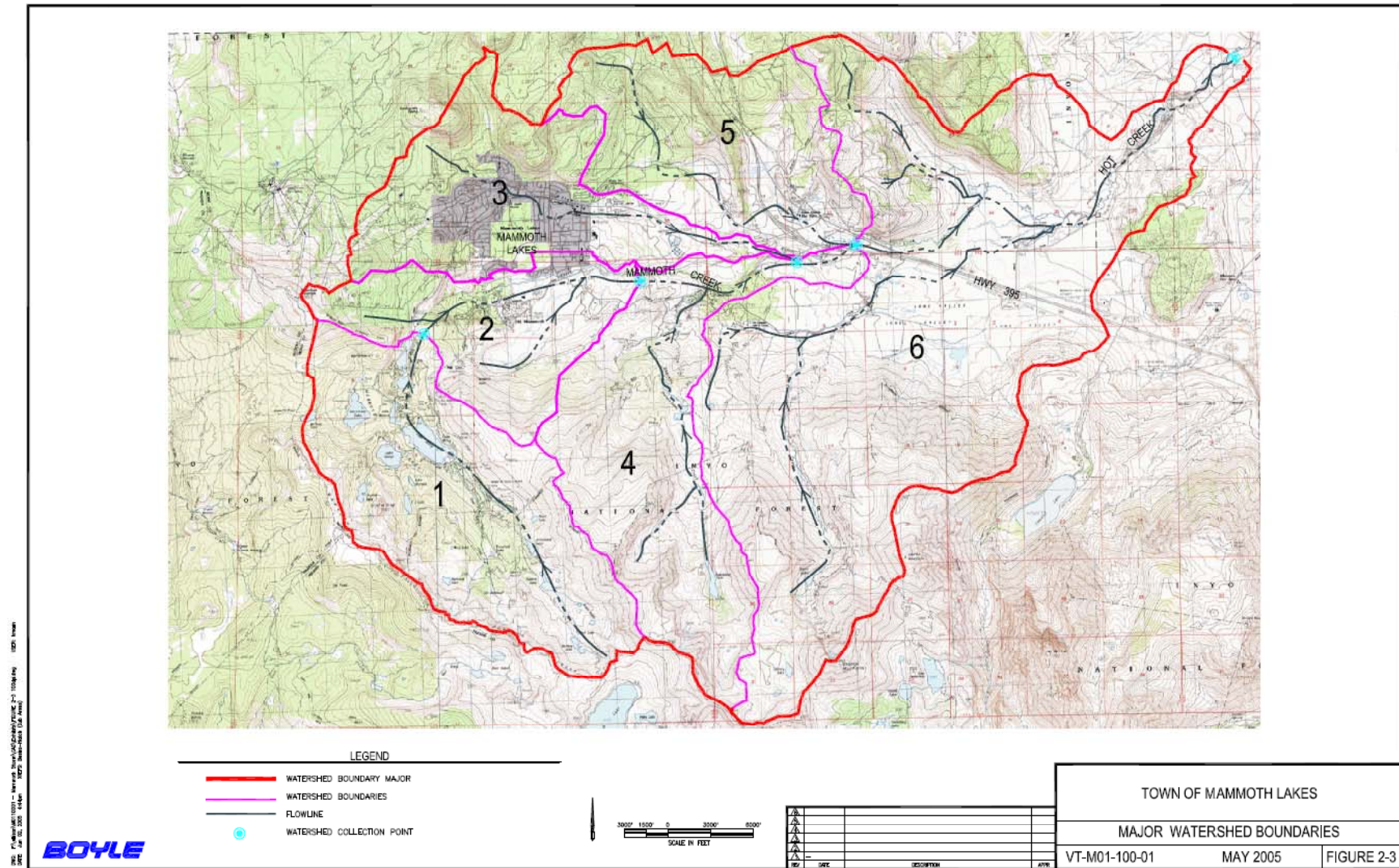


Figure 4-3. The Six Distinct Major Watersheds of the Mammoth Area Drainage Basin (Boyle 2005)

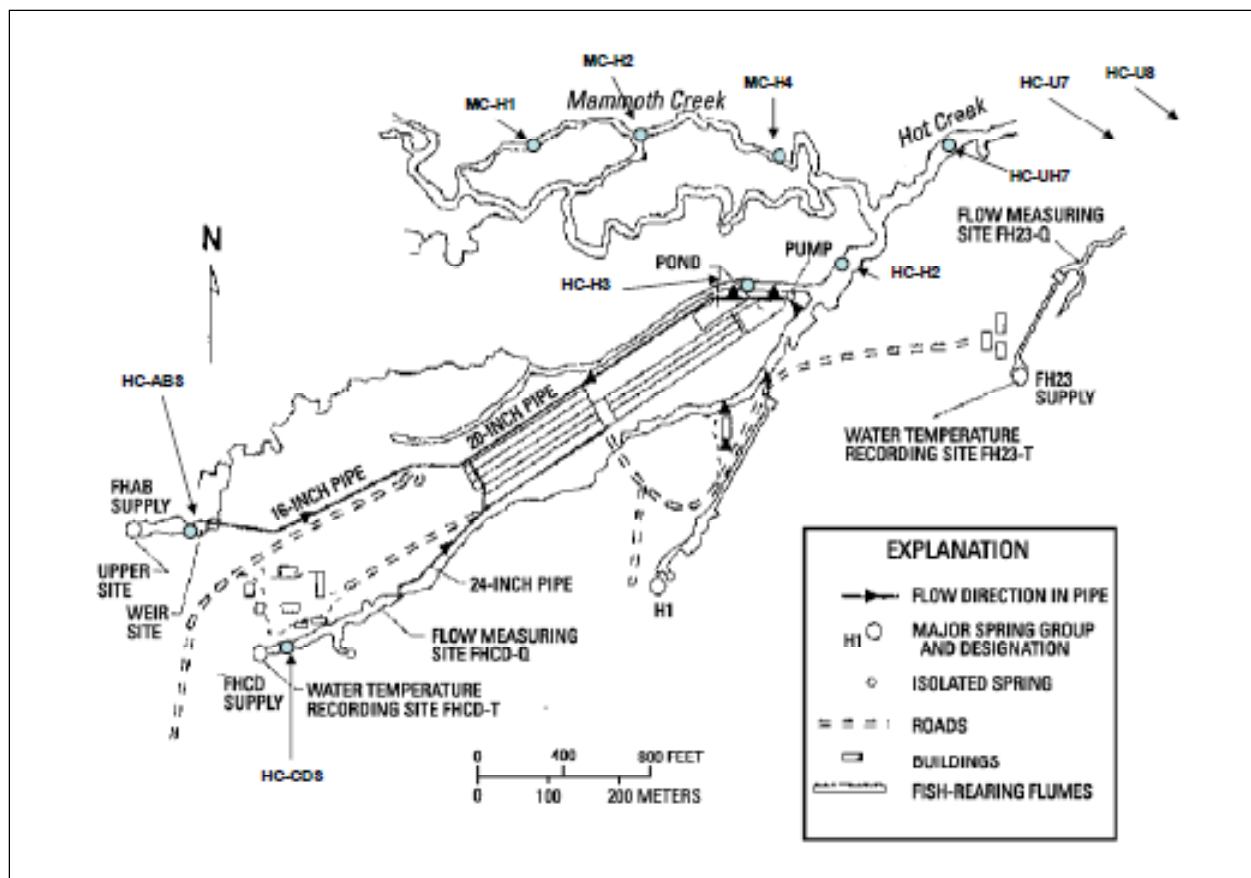


Figure 4-4. Hot Creek Fish Hatchery (Jellison et al. 2007)

The total flow from Hot Creek is monitored at a flume (USGS Hot Creek Flume Gage) below Hot Creek Gorge. The total flow measured at this point includes the flow from Mammoth Creek, the flow from the Headsprings, and the discharge from hot springs within the Hot Creek Gorge. Stream flow measurements at the flume have been taken since 1982.

Although Mammoth Creek contributes tributary flow to Hot Creek, the magnitude of potential project-related change diminishes in the downstream direction due to spring and tributary inflow, and diversions downstream of the District's area of influence are beyond the District's control. Nevertheless, potential project impacts in Hot Creek are addressed where appropriate in this Draft EIR.

4.1.2 GROUNDWATER HYDROLOGY

As previously described, there is a considerable history of work related to groundwater resource investigations in the Project Area, including numerous groundwater studies and monitoring activities conducted by the District and others (e.g., USGS) over the past several decades. Using information obtained from those studies, provided below is a summary of the physical features of the Mammoth groundwater basin, a description of the District's groundwater production and monitoring well locations, and other pertinent information regarding the use and management of groundwater resources within the Project Area.

4.1.2.1 DESCRIPTION OF THE GROUNDWATER BASIN

Underlying the Mammoth Lakes Basin is a groundwater regime that does not correspond to the boundaries of the surface drainage systems. Previous studies in the vicinity have implied that the Mammoth groundwater regime is a part of the Long Valley Caldera groundwater system. It is doubtful, however, that a single system prevails throughout the caldera and/or the Mammoth Lakes Basin considering the complex geology, hydrology, and hydro-geology of the area. Unless otherwise cited, much of the following discussion regarding the Mammoth groundwater basin presented below is taken directly from Wildermuth 2009.

MAMMOTH GROUNDWATER BASIN BOUNDARIES

The Mammoth groundwater basin lies largely within the central part of the Mammoth Lakes Basin watershed. The southern boundary of the Long Valley Caldera appears to closely parallel the southern groundwater basin boundary (see **Figure 4-5**). The width of the basin varies from about 1.5 to 4.0 miles along its 11 mile east-west course, encompassing about 28 square miles.

Groundwater in the Mammoth Lakes Basin is related to the water-bearing characteristics of the underlying rock formations. The underlying geology is very complex. Generally, water-bearing capacity is high in local glacial deposits and fractured volcanic rock formations. Glacial deposits vary in thickness from a few feet to more than 100 ft, whereas the volcanic formations range in depth to more than 3,000 ft. As reported in Wildermuth (2009), the physical boundaries to the Mammoth groundwater basin include:

- ❑ **Sierra Nevada/Long Valley Caldera to the South:** The Sierra Nevada is composed of a wide variety of igneous and metamorphic impermeable rocks, which are not considered water bearing. In some locations, the faulting associated with the Long Valley Caldera is assumed to be the groundwater basin boundary.
- ❑ **Mammoth Mountain to the West:** The rock that comprises Mammoth Mountain is permeable and contributes underflow to the Mammoth groundwater basin. The geology of Mammoth Mountain is very complicated due to its dynamic state, which contributes uncertainty to the connectivity and quantity of flow from the Mammoth Mountain area. The boundary of the Mammoth groundwater basin was defined as the contact between Mammoth Mountain volcanics and the known water-bearing material of the Mammoth groundwater basin.
- ❑ **Resurgent Dome to the North:** The Resurgent Dome is comprised of volcanic bedrock and is an effective barrier to groundwater flow along the northern boundary of the Mammoth groundwater basin.
- ❑ **Bedrock Constriction at Hot Creek to the North and Northeast:** This boundary is the gap between the rhyolite hills near Hot Creek Narrows and the outlet of the Mammoth groundwater basin. These hills are composed of low permeability volcanic bedrock and are an effective barrier to groundwater flow along the northern and eastern boundaries of the Mammoth groundwater basin.
- ❑ **Groundwater Divide to the East:** A flattened mound of groundwater exists beneath the area between the Mammoth Yosemite Airport and Convict Creek, and acts as a groundwater divide between the Mammoth groundwater basin and the rest of the Long Valley Basin. This assumption is based on historical water level elevations in wells in the eastern portion of the basin. This mound of groundwater extends from the bedrock hills east of the airport to south of the glacial moraine near the entrance to Convict Lake.

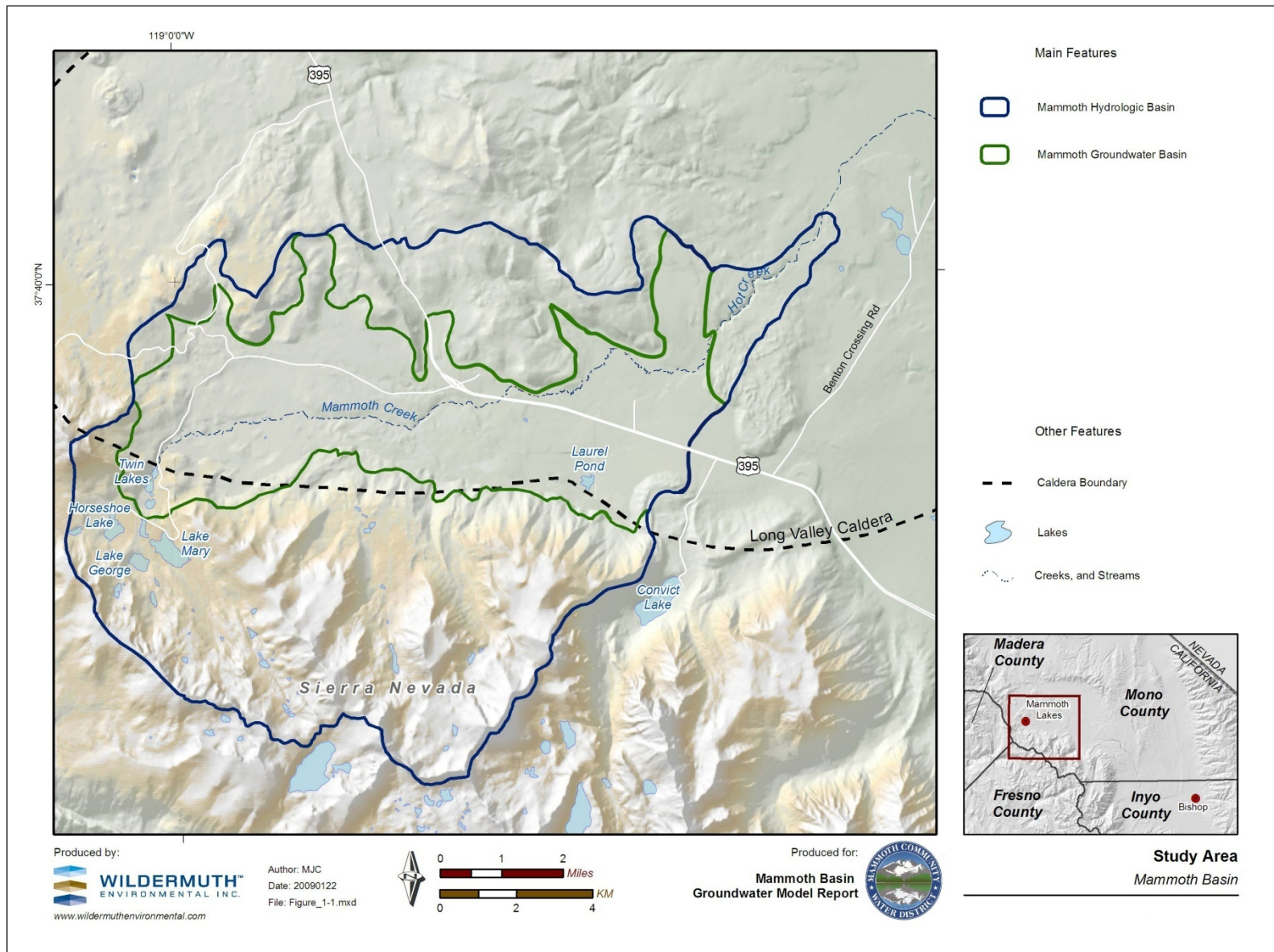


Figure 4-5. Mammoth Groundwater Basin (Modified from Wildermuth 2009)

- ❑ Groundwater to the west of this divide flows westward within the Mammoth groundwater basin, and groundwater to the east of this divide flows eastward toward Crowley Lake.

DWR (1973) divided the Mammoth groundwater basin into eastern and western areas. The point of demarcation used by DWR is located near the Los Angeles YMCA Camp along the northern boundary of Section 7, T4S/R28E. The western area was established as the groundwater basin to the eastern extent of the glacial till, or approximately 4,500 ft east of District Well 24. Based on pumping responses, well logs, and other data, two distinct aquifer systems exist in the area where the District produces groundwater.

- ❑ In the western portion of the Mammoth groundwater basin, there are two aquifer systems: (1) a deep volcanic system that is tapped for the District's groundwater production; and (2) a shallow system that is not impacted by the District's groundwater production.

The surface area of the western portion of the groundwater basin is approximately 5 square miles, and includes Mammoth Creek and Bodle Ditch. The western shallow system is characterized as the glacial till and alluvium that overlies the basin and is generally less than 100 ft in depth, although there also are some deeper areas. The deep system consists of fractured basalts and other water yielding rock that underlies the shallow system in the west. This same deep system is an unconfined single aquifer unit in the eastern portion of the aquifer where there is no overlying glacial till but occasional overlying thin alluvium and lacustrine deposits. The District has constructed numerous production and monitoring wells in this area. Typically, the production wells were drilled to depths of more than 350 ft.

- ❑ In the eastern portion of the Mammoth groundwater basin, what constitutes the deep aquifer in the western portion of the basin is no longer capped by the shallow aquifer. This system, in the eastern portion of the basin, is often unconfined and has little response to the District's groundwater production.

The surface area of the eastern portion of the groundwater basin is approximately 13 square miles. Some small, non-District production wells and test wells have been constructed within the eastern area. Geothermal groundwater is extracted and re-injected in the vicinity of Casa Diablo. Casa Diablo facility operations occur in the central portion of the Mammoth groundwater basin and appear outside or below the hydraulic influence of the District's wells, which are located about three miles to the west (Wildermuth 2009).

PRODUCTION AND MONITORING WELLS

Production Wells

Within the Mammoth groundwater basin, the District is the primary extractor of groundwater resources, which are used primarily for municipal purposes. Historically, water needs in the Project Area were met primarily by surface water supplies. Beginning in the late 1980s the District expanded the development of groundwater supplies to supplement variable surface water supplies. Well use increases in dry surface water years, and is lower in years of normal or above normal surface water availability.

The District maintains nine groundwater production wells, which contribute to the municipal water supply system. These production wells tap the deep aquifer system, consisting of fractured basalts and other water yielding rock. A shallow and generally highly transmissive system of glacial till and alluvium with interbedded volcanics lies over the deep system, and appears to range from less than 100 ft to 200 ft in total thickness (MCWD 2005). Information regarding the production wells is presented in **Table 4-2**.

Table 4-2. Production Wells Located Within the District's Service Area

Production Well No.	Year Drilled	Drilled Depth (ft)	Pumping Level (ft)	Pumping Rate (gallons per minute)
1	1979	382	191-295	350-800
6	1988	670	77-200	700-1,000
10	1988	700	41-200	900-1,500
15	1994	720	183-297	900-1000
16	1995	710	471-492	350-500
17	1995	710	370-386	700-850
18	1994	710	82-156	350-500
20	1995	710	429-489	900-1,000
25	2002	700	400-500	400-500

Maximum potential production capability for these nine wells has been estimated at 4,000 AF per year, depending on aquifer conditions. Aquifers tapped by production wells appear to be generally confined due to alternating layers of glacial till and alluvial material, clays and volcanic rock (Ken Schmidt & Associates 1997). A summary of annual District groundwater pumping from 1992 through 2009 is presented in **Table 4-3**.

Table 4-3. Annual District Groundwater Pumping in Acre-Feet Per Year

Year	Total Groundwater Production
1992	2,484
1993	1,744
1994	1,572
1995	1,331
1996	1,115
1997	1,095
1998	876
1999	1,144
2000	1,326
2001	2,368
2002	2,757
2003	2,604
2004	1,999
2005	2,254
2006	1,143
2007	2,469
2008	2,386
Total	30,667
Minimum	876
Maximum	2757
Average	1,804

Sources: Ken Schmidt & Associates 2007, 2008, 2009; Wildermuth 2009.

The District has a comprehensive water-level monitoring program for its production wells. Production wells are connected to a computerized data system that allows personnel to monitor pumping water levels, and pumping rates at the District office. The District maintains historical data relating to static levels, pumping levels and production volumes for each water supply well. Water level sensors on all production wells are connected to the District's SCADA system.

The Mammoth groundwater basin has not been adjudicated or identified by the California Department of Water Resources (DWR) as being over-drafted. To prevent the basin from being over drafted, the District monitors groundwater levels in nine production wells and in 22 shallow and deep monitoring wells (see **Figure 4-6**). The District prepares an annual groundwater monitoring report that provides an evaluation of groundwater level, surface flow, and water quality monitoring data accumulated throughout the year.

Monitoring Wells

Water level measurements at each monitoring well are recorded monthly, and data are summarized for the District in an annual groundwater monitoring report. In 1992, the District initiated a groundwater monitoring program and has prepared groundwater monitoring reports annually since 1993 (Wildermuth 2009).

The shallow monitoring wells located in the District's production well area have piezometric (water elevation) levels that are less than 50 ft below ground surface. Shallow system piezometric level variations within the year are generally less than ten feet, and follow the snowmelt pattern with increasing levels in late spring and early summer, and mild decreases thereafter until the next snowmelt (Wildermuth 2009).

The piezometric levels of the District's deep monitoring and production wells are typically more than 150 ft below the ground surface—one notable exception is Well 5A, which is perforated in the deep and the shallow aquifer. Deep system local changes in groundwater levels (piezometric level variations) within the year can be as large as 50 to 75 ft due to production stresses. Over the long term, groundwater levels show the impacts of lower recharge in a Dry year, or Dry years with accompanying larger pumping stresses, as well as the impacts of increased recharge in Wet years and the subsequent reduction in pumping stresses (Wildermuth 2003).

The hydraulic impact of the District's groundwater production does not appear to extend east of Well 24 to the springs at the Hot Creek Fish Hatchery, nor does it appear to affect the piezometric levels of the monitoring wells that are perforated in the shallow system and located in the same area as the District's production wells (Wildermuth 2009; Ken Schmidt & Associates 2002; Wildermuth 2003). The deep system generally shows a progressive drawdown from the summer through the fall and generally recovers during the rest of the year. There have been two periods of progressive drawdown in the deep system from 1990 through 1995 and again from 2000 through 2005, corresponding to drought periods wherein groundwater production was increased to replace surface water supplies (Wildermuth 2009).

Other Groundwater Uses and Management Activities

Unrelated to the District's groundwater pumping operations, other groundwater extraction operations and geothermal uses of water also occur in the Mammoth groundwater basin. In the Basalt Canyon/Resurgent Dome area, adjacent to the eastern edge of the District's service area, high-temperature geothermal water is extracted from a deeper hydrothermal system and piped to the Casa Diablo Power Plant, located just east of the intersection of Highway 395 and

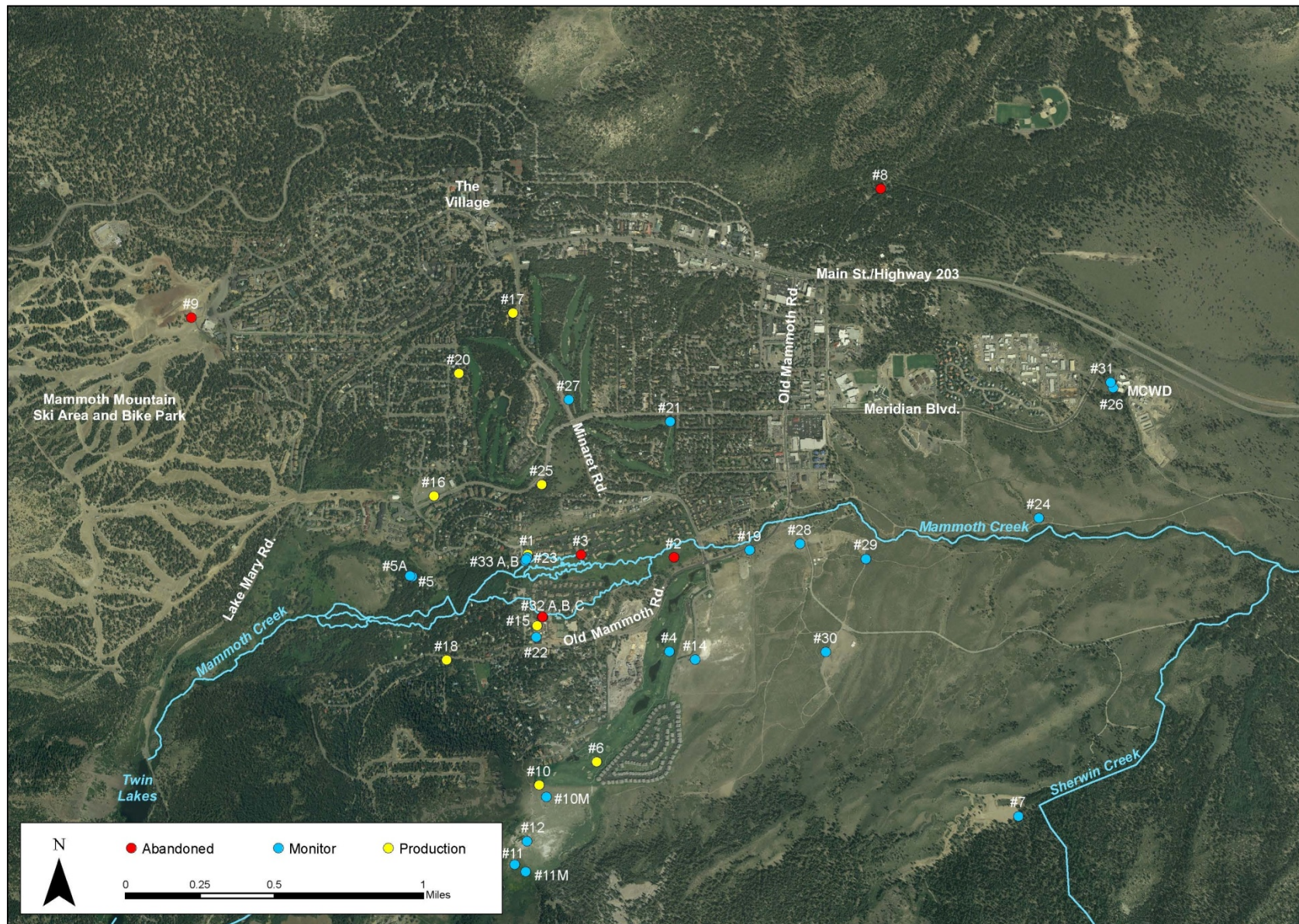


Figure 4.6. MCWD Well Locations

Highway 203. The plant has a capacity of 29 MW, and is anticipated to undergo an expansion that will double its current capacity in the next several years. The amount of water pumped annually for use at the power plant is proprietary, due to the commercial use, and not publicly distributed by the plant's owner. The geothermal heat source water is re-injected to the deep water aquifer, following its use at the power plant.

In 1986, following the implementation of the Casa Diablo power plant project, the Mono County Board of Supervisors passed a resolution establishing the Long Valley Hydrologic Advisory Committee (LVHAC). A mission of the committee is to implement a monitoring program for tracking changes in hydrologic features that could be impacted by geothermal or water resource developments. The LVHAC program is directed at monitoring discharge changes at Mammoth Creek, springs at the Hot Creek Fish Hatchery, and springs at Hot Creek Gorge (Wildermuth 2009). The Hot Creek Fish Hatchery was identified by LVHAC as one of the key hydrologic sites to be protected (USGS 2009). The LVHAC meets quarterly to make specific recommendations to the various member agencies based upon data collected from a maintained sampling network.

It has been suggested that the current and proposed groundwater extraction projects may have the potential to lower the water table or affect the supply spring water temperature for Hot Creek Fish Hatchery (SWRCB 2005). Although SWRCB (2005) suggests that the zone of pumping and reinjection from these geothermal projects may affect flow or water temperature to the Hot Creek Fish Hatchery Headsprings, such impacts have not been documented. The USGS (2003) reports that wells drilled on the southwest side of the resurgent dome at Casa Diablo tap into the caldera's hydrothermal system by pumping hot water to supply three hydrothermal power plants that generate about 40 MW of electricity. Cooled geothermal water is re-injected underground. The USGS hydrologic monitoring program has detected changes in the hydrologic system caused by geothermal development and variations in precipitation and recharge (Howle and Farrar 1997 in USGS 2003). Although no changes have as yet been detected in the springs in Hot Creek Gorge, decreases in thermal-spring discharge at sites within about 3 miles to the east of Casa Diablo caused by subsurface pressure declines at the geothermal well field have been detected (USGS 2003).

4.1.2.2 GROUNDWATER MONITORING PROGRAM

In 2004, the District received a Local Groundwater Assistance grant from DWR. This grant enabled the District to complete a comprehensive groundwater management plan (see Section 4.1.2.5 below), expand the groundwater monitoring program which began in 1992, and begin developing a Mammoth Basin Groundwater Model.

The following management activities describe how the District monitors and regulates groundwater pumping to determine a safe yield of extraction, provide for conjunctive use with surface water, and determine any potential impact on surface water from groundwater pumping.

- Monitor the static and pumping water levels of production wells on a continuous basis.
- Monitor water levels at the 22 monitor well sites.
- Monitor the water content of snow pack at the Mammoth Pass measuring station to base potential groundwater pumping projections for the season.
- Establish rotational well pumping protocol to calculate potential recharge of groundwater basin.

4.1.2.3 SUMMARY WATER BALANCE ESTIMATION FOR THE MAMMOTH GROUNDWATER BASIN

A hydrologic budget should include all significant inputs and outputs to the basin. As previously discussed, recharge to a hydrologic system occurs naturally from direct precipitation, stream inflow, and groundwater underflow from an up-gradient basin. Discharge occurs through evaporation, transpiration via vegetation, stream drainage, and groundwater underflow into a down-gradient basin.

A groundwater basin model developed by Wildermuth (2009) applied a groundwater budget for the Mammoth Lakes Basin for calendar year 1992 through calendar year 2006. The water budget accounted for all Mammoth groundwater basin recharge and discharge components, and values in the water budget were derived from a combination of measurements and estimates. The key components of the water budget, with regard to recharge, groundwater flow, discharge, and hydrostratigraphy are described in their report.

Between 1992 and 2006, groundwater pumping from the District's production wells averaged about 1,640 AF; more than 50% of the District's groundwater pumping can be accounted for by Production Wells 10 and 15. The maximum extraction occurred in 1992 and amounted to 2,385 AF.

During about half of the years evaluated during the 1992 through 2006 period, the estimated total recharge exceeded the total discharge for the Mammoth groundwater basin, resulting in a positive change in groundwater storage.

The response of groundwater levels to pumping of District production wells over time indicates that groundwater levels recover almost completely each year, even during periods of lower than normal precipitation (Wildermuth 2009).

4.1.2.4 GROUNDWATER/SURFACE WATER INTERACTIONS

Beginning in the 1970s, the surface water and groundwater hydrology of the Mammoth Lakes Basin has been a topic of focused attention, primarily due to the growth of the resort community of Mammoth Lakes and the need to protect water resources in the Mammoth Lakes Basin. The first hydrologic study was completed in 1973 by DWR, which attempted to characterize and estimate components of the hydrologic balance (Burak et al. 2006). Values for mean annual precipitation were derived from an elevation-precipitation relationship that assumed a nearly linear increase in snow water equivalent based on isohyets of rainfall (a line drawn on a map connecting points that receive equal amounts of rainfall). However, as reported in Burak et al. (2006), this method overestimates snow water equivalent in mountainous terrain due to orographic effects and wind redistribution of snow (Burak and Davis 1989; Fetter 1994; and Molotch et al. 2004 in Burak et al. 2006). For additional, more recent information regarding the Mammoth Lakes Basin hydrologic balance, see Section 4.1.2.3.

The 1986 Gram Phillips report titled "Mammoth County Water District Water System Master Plan" provided a comprehensive report on the hydrology, water quality, groundwater and operational procedures of the Mammoth Lakes Basin. Hydrologic balances for years of about 63%, 85% and mean precipitation are included in report. Area capacity curves were used to calculate amounts of water storage based on lake level heights in Lake Mary, Lake George and Lake Mamie. Extensive discharge and water quality records also were included, as well as flow data for Sherwin Creek (Burak et al. 2006).

During the early 1990s, some stakeholders expressed concerns regarding potential impacts of the District's groundwater pumping program on wildlife, vegetation, and fishery resources of Mammoth Creek, the Hot Creek Headsprings, and Valentine Reserve (MCWD and USFS 2000). Prior investigations by the USFS in 1990 presumed that groundwater production in the western part of the Mammoth Basin would cause a comparable reduction in spring flow at the headwater springs (Wildermuth 2003). As described in Wildermuth (2003), the presumption of this impact was based on the assumption that groundwater storage is small and that all groundwater eventually leaves the basin as surface flow in Hot Creek. If these assumptions were correct, then streamflow changes in Mammoth Creek attributable to District groundwater production should have been observed.

As a result of settlement agreements between the District, CDFG and the University of California (Valentine Reserve) concerning the District's proposed groundwater development project, an aquifer test of the District's Well No. 15 was conducted from August 31 – September 30, 1993 by Ken Schmidt & Associates. One purpose of the well test was to determine whether the District's groundwater pumping affected certain springs in the Valentine Reserve area. During the testing period, Well No. 15 was pumped continuously, and measurements of flow at the North Spring at the Valentine Reserve, streamflow in Mammoth Creek and water levels in several shallow and deep observation wells were collected. Ken Schmidt & Associates (1993) concluded that the results of the test “...indicate that pumping of Well No. 15 does not influence streamflow in Mammoth Creek, reduce flow of the North Spring at the Valentine Reserve, or lower water levels in other wells in the area.”

Under the settlement agreements with CDFG and the University of California, the District also initiated a groundwater monitoring program in 1992 to assess the potential hydrologic connectivity between groundwater and surface water. In response to the concerns over potential impacts to streamflow and spring flow rates from groundwater pumping, the District has prepared groundwater monitoring reports annually since 1993 that provide an evaluation of groundwater level, surface flow, and water quality monitoring data accumulated throughout the year. Hydro-geologic evaluations have been conducted annually for the District by Ken Schmidt & Associates from 1993 through 2009. These evaluations attempted to discern, through well monitoring and aquifer tests, whether groundwater pumping from the District's production wells affected flows from North Spring at Valentine Reserve, flows from the Headsprings, and stream flows in Mammoth Creek. From data collected as part of the monitoring program, Ken Schmidt & Associates (1993, 1994, 1995, 1996, 1997, 1998 and 1999) concluded that groundwater pumping from the District's production wells did not influence flows in North Spring at Valentine Reserve, at the Headsprings, or in Mammoth Creek. The results from each of the subsequent reports prepared from 2000 through 2009 also have been unable to detect a connection between District groundwater pumping and streamflows in Mammoth Creek or springs within the Mammoth Lakes Basin.

Springflow measurements for the period of record used in Ken Schmidt & Associates (2001) indicate that the pattern of springflow is related to runoff. For most years, springflow was lowest in July or August, and then increased near the end of the water year. This could have been due to lower air temperatures, which would result in decreased evapotranspiration of water by plants in the area. Another possible factor is increased runoff from higher land on Mammoth Mountain. Monitoring results for previous years indicate no noticeable impact of District pumping on springflow at the Valentine Reserve. No flow data were provided for 2001 for the spring at Valentine Reserve (Ken Schmidt & Associates 2001).

A study of local groundwater was undertaken by Wildermuth (1996) for the proposed Snowcreek Golf Course expansion project. This study evaluated the potential effects of groundwater pumping expected under the golf course expansion project on the Hot Creek Headsprings. Based on a review of the data available, Wildermuth (1996) concluded that *“historical groundwater extraction in the western part of the Mammoth basin has not noticeably impacted the discharge at the AB and CD headspring [the Hot Creek Headsprings].”* Wildermuth (1996) also analyzed stream flows in Mammoth Creek as measured at the OLD395 Gage and found no evidence of an influence of groundwater pumping on flows in Mammoth Creek, concluding that *“groundwater extraction has not impacted the surface discharge measured at this location - groundwater levels are too deep to influence streamflows.”*

In October of 1997, at the request of CDFG, the District also conducted a short-term aquifer test involving Production Well No. 15. This was in addition to the District’s regular groundwater monitoring program. In his review of the data from that test, Ken Schmidt & Associates (1997) determined that there were no effects on streamflow, groundwater levels, or the springs at the Valentine Reserve. On behalf of CDFG, the USGS reviewed the available data, as well as Schmidt’s annual reports and the opinions expressed therein. As reported in MCWD and USFS (2000) Chris Farrar of the USGS commented (Farrar 1995, 1996, 1997) that in his opinion, the results of the annual groundwater monitoring and aquifer tests are inconclusive in proving or disproving a causative connection between the District’s groundwater pumping and discharge rates of springs at Valentine Reserve, the Hot Creek Headsprings and Mammoth Creek.

Farrar has contended that patterns in spring and stream flows may indicate some correlation to groundwater pumping, but that the available data could not definitively distinguish between a change in spring or stream flows due to groundwater pumping or due to natural variation in precipitation. In addition, he has suggested that interpretation of the results of the aquifer test undertaken in summer 1993 was complicated by variations in releases to Mammoth Creek, groundwater pumping at wells other than the test well, and variations in pumping rates before, during, and after the aquifer test at the test well and other nearby wells. In his 1997 review, Farrar suggested that a different aquifer test plan *“could provide data that might prove or disprove hydrologic connections and effects of pumping on springs and stream flows.”*

Farrar also noted that the wet hydrologic conditions of the period following the winter of 1992 through 1993 would greatly affect groundwater conditions in the area. He further noted in his 1997 report that *“in any year with precipitation comparable to 1996, it is unlikely that groundwater pumpage in Mammoth basin at rates similar to past MCWD pumpage would cause any measurable effect in flow or water temperature at the fish hatchery springs.”*

In 2003, Wildermuth Environmental, Inc. conducted an investigation to estimate the potential impact of historical and future District production on spring discharge in the Valentine Reserve and the Hot Creek headwater springs area. Analysis of piezometric level data at District wells suggested that a groundwater barrier exists between the Valentine Reserve and the deep production wells operated by the District (Wildermuth 2003). Wildermuth (2003) concluded that historic production at District wells has not influenced spring discharge at the Valentine Reserve, and future production at District wells will not influence spring flow at the Valentine Reserve. Another component of the study was conducted that used discharge data for Mammoth Creek at the OLD395 Gage and Hot Creek at the USGS Hot Creek Flume Gage to determine whether groundwater production could have impacted the discharge in Mammoth Creek and spring discharge into Hot Creek. Double-mass curves (cumulative plots of one hydrologic variable versus another over time) were developed for these two stream discharge stations and used to examine time series trends. Wildermuth (2003) used double-mass curves to

determine if significant changes have occurred at precipitation and stream discharge gages due to activities such as relocation of gages or construction of stream diversions. Review of curve plots comparing Mammoth Creek flows at the OLD395 Gage and Hot Creek flows at the USGS Flume Gage to April snow survey data showed little to no significant divergence (Wildermuth 2003). If groundwater pumping was depleting spring discharge, divergence would have indicated the accumulation of stream discharge at a reduced rate than before significant groundwater production occurred. The lack of a downward divergence at the USGS Hot Creek Flume Gage indicated that there has been no detectable decrease in discharge due to District groundwater production and no observed depletion of spring flows as a result of past groundwater pumping (Wildermuth 2003).

The previous studies by Wildermuth (1996 and 2003) and Ken Schmidt & Associates (1993-2004) support the District's conclusions that the available information shows that there is no connection between District groundwater pumping and Mammoth Creek flows.

In 2006, CalTrout funded a study titled "Preliminary Evaluation of a Hydrologic Connection Between Mammoth Creek and Mammoth Community Water District Supply Wells, Mono County, California" (Burak et al. 2006). Burak et al. (2006) use streamflow records, well water levels and production well pumpage data, as well as isotope and geochemistry information to qualitatively assess stream-aquifer relationships, and suggest that pumpage from production wells located close to Mammoth Creek may influence water levels in monitoring wells and Mammoth Creek discharge primarily during the fall and winter. However, Burak et al. (2006) acknowledge that relating specific land-use activities such as groundwater pumping to changes in flow is inconclusive owing to the size and geologic complexity of the basin. They further state that in consideration of the pattern of flow gains and losses in Mammoth Creek between the OMR and the OLD395 gages, detecting an unambiguous signal in flow regimes that could be attributed to pumping is extremely difficult, and that the analysis does not show a conclusive cause-and-effect relationship between stream flow losses at the OMR Gage, precipitation year type and groundwater pumping. One component of the Burak et al. (2006) analysis included application of a PART model. Burak et al. (2006) state that PART is not designed for flow systems dominated by leakage to or from regional flow systems, snowmelt runoff, recharge from losing streams, or groundwater withdrawals, and that the model is also unable to identify trends in streamflow that might be attributed to groundwater pumping. Because of the limitations associated with the aforementioned analytical procedures, Burak et al. (2006) also conducted naturally occurring isotopes and geochemical analyses to investigate possible hydrologic connections between surface water and groundwater. Although they identified similar geochemical characteristics between surface water and groundwater, they also stated that a definitive correlation and relationship between surface and groundwater cannot be established without additional isotope sampling. In consideration of these issues, the District conducted additional tests and evaluations of potential groundwater pumping and surface flow relationships in Mammoth Creek.

In 2009, Ken Schmidt & Associates published another annual report evaluating the potential interaction between groundwater pumping and surface water flows. They evaluated potential relationships between groundwater pumping and springflows in the Valentine Reserve, using data from 1993 to present, as available. As reported by Ken Schmidt & Associates (2009) flow measurements were taken at a spring in Valentine Reserve from 1993 to 2001. Commencing in 2001, flow measurements at the Valentine Reserve were extended to another spring, which has a considerably larger flow than the previously monitored spring (Ken Schmidt & Associates 2009). However, no flow measurement data at the springs located in Valentine Reserve have

been provided since 2001. Ken Schmidt & Associates (2009) examined potential relationships between flow at the previously monitored spring (1993-2001) and Mammoth Creek streamflow at Old Mammoth Road (see Figure 4-2). The springflow correlated well with Mammoth Creek streamflow during the period of record. The lowest springflows were in 1993, 1994 and 2001, following periods of low water precipitation. Springflow often increased in the fall prior to winter precipitation, primarily due to lower air temperatures and decreased evapotranspiration of shallow groundwater. Monitoring results for the previous years indicate no noticeable impact of District pumping on springflow at the Valentine Reserve (Ken Schmidt & Associates 2009).

To further evaluate whether there are interactions between District well pumping and streamflow in Mammoth Creek, a comprehensive aquifer test was conducted during a 14-day period extending from October 24 through November 7, 2007, which used District Well No. 15 as the pumped well. As part of the test, pumpage of Well No. 15, Mammoth Creek flows at the OMR Gage, and water levels in three District production wells (Nos. 1, 15 and 17), seven District monitoring wells (Nos. 4, 5A, 5M, 22, 23, 28 and 30), and a shallow private monitoring well near Mammoth Creek were measured. The results indicated no noticeable influence of pumping Well No. 15 on streamflow in Mammoth Creek (Ken Schmidt & Associates 2008).

During the 2009 water year, the District pumped 1,724 AF of water from eight supply wells, which was 28% less than the pumpage for the previous water year (Ken Schmidt & Associates 2009). A comprehensive water-level monitoring program was conducted for District supply wells and monitoring wells. Additionally, water-level measurements were available for two other monitoring wells east of the District wells. Flow measurements were not available for the springs at Valentine Reserve during the 2009 water year (Ken Schmidt & Associates 2009).

Ken Schmidt & Associates (2009) found that water levels in most shallow wells were relatively stable during 2008/2009, due to the near normal average precipitation. Groundwater was generally present in the uppermost strata only in the westerly and central part of the area, in the meadow and near Mammoth Creek. Water levels in seven of the District supply wells (No. 1, 6, 10, 15, 16, 17 and 18) were shallower in 2009 than in 2008, primarily due to the decreased pumpage in 2009. Water levels in two other deep wells near the District well field were stable during the 2009 water year (Ken Schmidt & Associates 2009). Water levels in deep wells just to the east of the District well field were generally stable during the 2009 water year. Water levels in the farthest east wells that were monitored fell during 2009. A water-level elevation contour map was prepared for September 2009. This map and other information indicate that the extent of the cone of depression due to pumping of District wells was limited in size, and did not extend to the east to District Monitor Wells No. 24 and No. 26 (Ken Schmidt & Associates 2009).

The results of the 2008-2009 monitoring indicate that District pumping did not influence Mammoth Creek streamflow (Ken Schmidt & Associates 2009). Flow data for the springs at the Valentine Reserve during the 2002 through 2009 water years are not available and, thus, the District presently is not able to conduct more detailed analyses. District pumping was not indicated to have influenced flows at the Valentine Reserve springs through the 2001 water year (the last year of available records). In addition, Ken Schmidt & Associates (2009) report that water-level declines due to pumping did not extend beyond the vicinity of the well field. Thus, there was no observed influence on the Hot Creek Headsprings, which are much more distant from the District water supply wells than the monitor wells utilized for the District's monitoring program (Ken Schmidt & Associates 2009).

As reported by Wildermuth at the September 17, 2009 District Board Meeting “...available monitoring data and reports prepared to date based on these data have demonstrated that there is no relationship between groundwater production by the District or others in the western part of the basin and stream discharge to the east. In fact, groundwater levels measured at wells east of District Wells Nos. 24 and 25 show no relationship to the fluctuating groundwater levels at District production wells located in the far western end of the basin. Groundwater levels measured at wells east of District Wells Nos. 24 and 25 are relatively constant with small fluctuations. Groundwater levels measured at District production wells in the west vary as much as 100 to 200 feet over time in response to both seasonal production patterns and climatic variability. This means that the pressure fluctuations in the aquifer created by the District groundwater production do not propagate very far east of their well field.”

The need for a groundwater model that could be used to evaluate sustainable groundwater pumping in the District’s service area was identified in the District’s Groundwater Management Plan. In 2009, the Mammoth Basin Groundwater Model Report was completed and describes the development, calibration and application of the first generation groundwater model for the Mammoth groundwater basin. The model serves as a tool to simulate current and projected future groundwater pumping levels, and can be used to assess potential changes to water levels and production sustainability over a wide range of climatic conditions (Wildermuth 2009). The ability to simulate surface and groundwater interactions is not presently a functional capability of the model, but opportunity exists to improve the model and incorporate such features in the future. Although the Mammoth Basin Groundwater Model and the simulations presented in Wildermuth (2009) represent the best available information to date, significant new hydrogeologic characterization investigations are required to incorporate a reliable groundwater/surface water interaction capability into the model. Ongoing monitoring of surface and groundwater conditions by the District, as well as any future drilling data from production and/or monitoring wells, will add to the understanding of the hydrogeologic system and contribute to the accuracy of subsequent model scenarios and assessments (Wildermuth 2009).

4.1.2.5 MANAGEMENT OF GROUNDWATER RESOURCES

In 2005, the District adopted a comprehensive Groundwater Management Plan (GWMP), which describes a monitoring and operation plan for the long-term use of local groundwater and surface water resources. The intent of the GWMP is to ensure that groundwater resources are managed in a manner that ensures sufficient, high quality groundwater resources for the community of Mammoth Lakes while minimizing potential environmental impacts (MCWD 2006). As described in the District’s GWMP, the District monitors and regulates surface water flows, where permitted, to provide for conjunctive use of surface water and to help determine whether potential impacts on surface water from groundwater pumping are occurring.

The 2005 GWMP recommended a series of actions that would help protect existing groundwater resources and improve the detailed understanding of basin hydrogeology in support of eventually developing specific management strategies and sustainable yield targets. These included expanded monitoring and data collection for surface water and groundwater, increased conservation, well head protection zone and recharge zone delineations, standards for well construction and abandonment, and the development of a groundwater model.

Pursuant to the Groundwater Management Act (AB 3030), the 2005 GWMP identified the following priorities for groundwater management: (1) obtaining sustainable yields from the groundwater basin; (2) protecting the environment; and (3) meeting the water supply needs of the community. A primary element of the management strategy is the effective conjunctive

management of available water resources, including surface water, groundwater, recycled water, and water conservation. This conjunctive management approach would vary the use of each resource based on the hydrologic conditions of each year or series of years.

It is anticipated that the District will conduct a 5-year update to the GWMP during 2010. As part of this process, the Mammoth Groundwater Basin Model will be used to simulate potential future groundwater pumping scenarios, and the results generated from the model will be used to evaluate the sustainability of groundwater pumping in the Mammoth groundwater basin.

Changes to the District's groundwater management activities are not proposed as part of this Draft EIR, and the preponderance of available information demonstrates the lack of cause-and-effect relationships between groundwater pumping and flows in Mammoth Creek. Moreover, this proposed project is not an integrated water master plan. While water supply planning, identification of alternate supply sources, sustainability and management of available water resources (including groundwater) to meet increased future demands within the District's service area are important considerations, these issues are beyond the scope of the project proposed in this Draft EIR. Therefore, groundwater resources are not further addressed in this Draft EIR.

4.2 REGULATORY SETTING

4.2.1 WATER RIGHT PERMITS

Since December 19, 1914, the appropriation of water in surface streams and other surface bodies of water and in subterranean streams flowing through known and definite channels has been governed by the California Water Commission Act (Statutes 1913, Chapter 586) and is contained in the provisions of the California Water Code (SWRCB 1999). In California, any person or entity that intends to divert water from surface waters, either: (1) directly to use on land which is not riparian to the source; (2) to storage in a reservoir for later use on either riparian or nonriparian land; or (3) for direct use of water which would not naturally be in the source, is required to file an application for a water right permit (or a use registration for small scale domestic use) with the SWRCB (SWRCB 2000). An application for a new water appropriation is approved if it is determined to be for a beneficial purpose and if water is available for appropriation (SWRCB 2010; BLM 2001).

Water right permits specify the amounts, conditions, and construction timetables for a proposed water project. Before the SWRCB issues a permit, it must take into account all prior rights and the availability of water in the watercourse. The SWRCB also must consider the flows needed to preserve instream uses such as recreation and fish and wildlife habitat (SWRCB 2007). The SWRCB (1999) recognizes that the flow of water in most streams is variable and cannot be predicted with accuracy. Thus, issuance of a water right permit by the SWRCB does not guarantee that unappropriated water will be available at all times in the full amount specified in the water right permit. In some cases, there may be times during the authorized diversion season when no unappropriated water will be available. The holder of a water right permit may be limited to divert only to the extent and at such times as will not impair the prior rights of others, regardless of the amount or season named in the permit.

In June of 1978, the SWRCB approved the District's water right Application 25368 and issued Permit 17332 (see Chapter 2 - Proposed Project and Alternatives).

4.2.2 WATER RIGHT LICENSES

A water right license is a certificate issued to confer the right to appropriate water under certain conditions. A license is issued to the appropriator when the water development project is completed, the terms of the permit have been met, and the largest volume of water authorized under the permit has been put to beneficial use. A license is issued for only that water that has been reasonably and beneficially used (SWRCB 2009).

As previously discussed in Chapter 2 - Proposed Project and Alternatives, the District holds two water right licenses issued by the SWRCB - Water Right License 5715 and Water Right License 12593.

4.2.3 SWRCB CEASE AND DESIST ORDER NO. 9P.2

Under Section 1831 of the California Water Code, the SWRCB is authorized to issue a cease and desist order when it determines that any person is violating or threatening to violate any of the following:

- (1) The prohibition set forth in Section 1052 against the diversion or use of water subject to Division 2 (commencing with Section 1000) of the Water Code other than as authorized by Division 2.
- (2) Any term or condition of a permit, license, certification, or registration issued under Division 2 of the Water Code.
- (3) Any decision or order of the board issued under Part 2 (commencing with Section 1200) of Division 2 of the Water Code, Section 275, or Article 7 (commencing with Section 13550) of Chapter 7 of Division 7 of the Water Code, in which decision or order the person to whom the cease and desist order will be issued, or a predecessor in interest to that person, was named as a party directly affected by the decision or order.

As previously described in Chapter 1 - Introduction, the SWRCB has issued preliminary cease and desist orders (C&D No. 9P, C&D No. 9P.2) to the District regarding Mammoth Creek fishery bypass flow requirements. The District petitioned the SWRCB to reconsider its 1994 decision regarding C&D No. 9P.2, requesting that the Beak Fishery Bypass Flow Requirements be included in C&D No. 9P.2. When the District's petition was denied by the SWRCB, the District petitioned the Mono County Superior Court to instate the Beak Fishery Bypass Flow Requirements. The Mono County Superior Court issued a ruling in favor of the District, requiring that the Beak Fishery Bypass Flow Requirements be included in C&D No. 9P.2. Current District diversions from Mammoth Creek are consistent with these requirements, pending action on the petition to amend Permit 17332, which is proposed as part of the Proposed Project Alternative.

4.2.4 GROUNDWATER MANAGEMENT ACT (AB 3030)

The Groundwater Management Act, AB 3030, became effective on January 1, 1993. This legislation is designed to provide local public agencies with increased management authority over groundwater resources.

AB 3030 (California Water Code Section 10750 et seq.) allows certain defined existing local agencies to voluntarily develop a groundwater management plan in groundwater basins defined in DWR Bulletin 118. Twelve technical components (e.g., identification and

management of wellhead protection areas and recharge areas, replenishment of groundwater extracted by water producers, monitoring of groundwater levels and storage, facilitating conjunctive use operations, mitigation of conditions of overdraft) are identified in the Water Code, and others may be included in a groundwater management plan (DWR 2010). A groundwater management plan can be developed only after a public hearing and adoption of a resolution by the local agency of its intention to adopt a groundwater management plan. AB 3030 groundwater management plans cannot be adopted in adjudicated basins or in basins where groundwater is managed under other sections of the Water Code without the permission of the court or the other agency (DWR 2010). Once the plan is adopted, rules and regulations must be adopted by the local agency to implement the program called for in the plan. If multiple local agencies within the same basin adopt groundwater management plans, AB 3030 requires that these agencies must meet at least annually to coordinate their activities (DWR 2010).

As described in Section 4.1.2.5, the District completed and adopted a groundwater management plan in 2005, in coordination with an advisory committee comprised of representatives from the USGS, CDFG, Valentine Reserve, CalTrout, the Town of Mammoth Lakes, Mammoth Pacific LP, Snow Survey Associates, California Geological Survey Department of Conservation, and Mammoth Mountain Ski Area.

4.3 ENVIRONMENTAL CONSEQUENCES

This section describes the impact assessment methods, presents the impact indicators and significance criteria, and evaluates potential impacts on surface water hydrology.

4.3.1 HYDROLOGIC ASSESSMENT METHODS

To evaluate the potential hydrologic changes associated with the Proposed Project Alternative and other alternatives, the MCWD Model was used to simulate District operations under each of the alternatives and the Existing Condition over a 20-year period based on runoff years (from April 1988 through March 2008). Typically, existing or synthesized flow records of 20 years or longer adequately represent the long-term with respect to flow (Schmidt and Potyondy 2004).

Modeled daily data produced for various locations (output nodes) provides a basis for comparing the hydrologic conditions potentially occurring under each of the alternative scenarios, relative to the Existing Condition. Model assumptions reflect the operational differences among alternative scenarios (see Chapter 2 – Proposed Project and Alternatives). Because the MCWD Model relies on data collected for the Mammoth Creek system, it operates within a realistic range of hydrologic conditions for the Mammoth Creek system. Although the model provides a means of comparing the relative differences among the alternatives under a range of realistic hydrologic conditions, model output is not intended to predict actual Lake Mary storage or water surface elevations, or flows in Mammoth and Hot creeks on a particular day. Model results are used for comparative purposes rather than for absolute predictions, and the focus of the analysis is on differences in the results among comparative scenarios. A detailed description of the model and model assumptions is presented in Appendix C.

The District diverts water for municipal uses directly from Lake Mary inflow and/or from water stored in the lake. Because the District is required to operate in compliance with the WOCs, the MCWD Model applies the operational priorities of: (1) meet the fishery bypass flow requirements; (2) meet the requirement that Lake Mary shall be full by the specified date

according to the alternative scenario; and (3) the other WOCs specific to each alternative scenario, while attempting to meet the District's demand for water diverted at Lake Mary.

The relationship between storage and water surface elevation for the range of calculated Lake Mary storages in the MCWD Model is linear, thus interpolation between the known points of Lake Mary storage and water surface elevation is used to simulate Lake Mary water surface elevations for impact assessment purposes in this Draft EIR.

The MCWD Model does not characterize USFS storage operations at either Lake Mamie or Twin Lakes, although daily accretion/depletion calculations representing these lakes are used for all modeled scenarios, including the Existing Condition. The fishery bypass flow requirement of 1.5 cfs in the stream reach between Lake Mary and Lake Mamie from June 1 to November 1 is recognized in the model. The model also recognizes that there are adjustments to this requirement based on Lake Mary inflow.

Simulated flows in Mammoth Creek also serve as input to estimate flows in Hot Creek at the USGS Hot Creek Flume Gage. Chance Ranch is located along Mammoth Creek downstream of Highway 395. Mammoth Creek flows through the ranch property for several miles until it joins Hot Creek, near the lower extent of the ranch. Although daily diversion data to the ranch are not available, the existing diversion of water by the Chance Ranch and resultant flows in Hot Creek (at the USGS Hot Creek Flume Gage) are accounted for in the accretion/depletion components in the MCWD Model of the Existing Condition. The same accretion/depletion components are used in the remaining alternative scenarios to estimate flows at the USGS Hot Creek Flume Gage. Because the MCWD Model used the mass balance procedure, unmeasured inflow or diversions, evaporation, and evapotranspiration are implicitly included in the accretion/depletion values.

An index of unimpaired flows also was simulated. "Unimpaired" flows represent flows at the OMR, OLD395 and USGS Hot Creek Flume gages without District direct surface water diversion or diversion to Lake Mary storage, and without any fishery bypass flow requirements.

4.3.1.1 LAKE MARY

Permit 17332 authorizes District storage of 606 AF from April 1 to June 30, but requires Lake Mary to be full prior to June 1. To address the variation in the timing of snowmelt runoff among years and, consequently, the timing of filling of Lake Mary, the District seeks to change the WOC to be consistent with its authorized storage season, by changing the date to July 1.

In this chapter, output from MCWD model is used to directly evaluate the proposed change to the timing of the filling of Lake Mary, as follows.

- ❑ The date on which maximum storage (and associated WSEL) is obtained for each of the 20 years included in the evaluation.
- ❑ The duration at which Lake Mary is at the minimum WSEL level (8,909.0 ft msl) from April 1 to September 15 each year

4.3.1.2 MAMMOTH CREEK AND HOT CREEK

Output from the MCWD Model is used to evaluate potential impacts on hydrologic parameters for Mammoth and Hot creeks. These hydrologic parameters are evaluated because they are associated with broad ecological concepts that encompass several resource categories.

Streamflow quantity and timing are critical components of water supply, water quality, and the ecological integrity of river systems (Poff et al. 1997). Streamflow, which is strongly correlated with many critical physicochemical characteristics of rivers, can be considered a master variable that limits the distribution and abundance of riverine species (Power et al. 1995 and Resh et al. 1988 in Poff et al. 1997) and regulates the ecological integrity of flowing water systems.

Components of the flow regime can be used to characterize the entire range of flows and specific hydrologic phenomena (e.g., floods and low flows) that are vital to the integrity of river ecosystems. The five components of the flow regime include: (1) magnitude; (2) frequency; (3) duration; (4) timing; and (5) rate of change of hydrologic conditions (Poff et al. 1997). Furthermore, Poff et al. (1997) report that by defining flow regimes in these terms, the ecological consequences of particular human activities that modify one or more components of the flow regime can be considered explicitly. The following discussion regarding these components is taken directly from Poff et al. (1997).

□ **Magnitude**

The magnitude and frequency of high and low flows regulate numerous ecological processes. Frequent, moderately high flows effectively transport sediment through the channel (Leopold et al. 1964). This sediment movement, combined with the force of moving water, exports organic resources, such as detritus and attached algae, rejuvenating the biological community and allowing many species with fast life cycles and good colonizing ability to reestablish (Fisher 1983). Consequently, the composition and relative abundance of species that are present in a stream or river often reflect the frequency and intensity of high flows (Meffe and Minckley 1987; Schlosser 1985).

Flows of low magnitude also provide ecological benefits. Periods of low flow may present recruitment opportunities for riparian plant species in regions where floodplains are frequently inundated (Wharton et al. 1981). Streams that dry temporarily, generally in arid regions, have aquatic (Williams and Hynes 1977) and riparian (Nilsen et al. 1984) species with special behavioral or physiological adaptations that suit them to these harsh conditions.

□ **Frequency**

The frequency of occurrence refers to how often a flow above a given magnitude recurs over some specified time interval. Frequency of occurrence is inversely related to flow magnitude. For example, a 100-year flood is equaled or exceeded on average once every 100 years – and the median flow over a specified time period has a 50% probability of occurrence.

□ **Duration**

Duration is the period of time associated with a specific flow condition. Duration can be defined relative to a particular flow event (e.g., a floodplain may be inundated for a specific number of days by a ten-year flood), or it can be defined as a composite expressed over a specified time period (e.g., the number of days in a year when flow exceeds some value).

The duration of a specific flow condition often determines its ecological significance, and changes in the duration of flow conditions have significant biological consequences (Poff et al. 1997). For aquatic species, prolonged flows of particular levels can be damaging. For example, differences in tolerance to prolonged flooding in riparian plants (Chapman et al. 1982) and to prolonged low flow in aquatic invertebrates (Williams and Hynes

1977) and fishes (Closs and Lake 1996) allow these species to persist in locations from which they might otherwise be displaced by dominant, but less tolerant, species. Changes in duration of inundation, independent of changes in annual volume of flow, can alter the abundance of plant cover types (Auble et al. 1994).

❑ **Timing**

The timing, or predictability, of flows of defined magnitude refers to the regularity with which they occur. This regularity can be defined formally or informally, and with reference to different time scales (Poff 1996). For example, annual peak flows may occur with low seasonal predictability or with high seasonal predictability. The timing, or predictability, of flow events is critical ecologically because the life cycles of many aquatic and riparian species are timed to either avoid or exploit flows of variable magnitudes. For example, the natural timing of high or low stream flows provides environmental cues for initiating life cycle transitions in fish, such as spawning (Montgomery et al. 1983; Nesler et al. 1988), egg hatching (Naesje et al. 1995), rearing (Seegrist and Gard 1978), movement onto the floodplain for feeding or reproduction (Junk et al. 1989; Sparks 1995; Welcomme 1992), or migration upstream or downstream (Trepanier et al. 1996).

❑ **Rate of Change**

The rate of change, or “flashiness”, refers to how quickly flow changes from one magnitude to another. At the extremes, “flashy” streams have rapid rates of change, whereas “stable” streams have slow rates of change. The rate of change, or “flashiness”, in flow conditions can influence species persistence and coexistence.

VARIABILITY AND NATURAL FLOW REGIME CONSIDERATIONS

Naturally variable flows create and maintain the dynamics of in-channel and floodplain conditions, and habitats that are essential to aquatic and riparian species (Poff et al. 1997).

Fish and other aquatic organisms require habitat features that cannot be maintained by minimum flows alone. A range of flows is necessary to scour and revitalize gravel beds, to import wood and organic matter from the floodplain, and to provide access to productive riparian wetlands. Inter-annual variation in these flow peaks is also critical for maintaining channel and riparian dynamics (Poff et al. 1997).

The natural flow regime of virtually all rivers is inherently variable, and that this variability is critical to ecosystem function and native biodiversity. Recognizing the natural variability of river flow and explicitly incorporating the five components of the natural flow regime (i.e., magnitude, frequency, duration, timing, and rate of change) into a broader framework for ecosystem management would constitute a major advance over most present management, which focuses on minimum flows and on just a few species (Poff et al. 1997). Components of a natural flow-regime can be characterized using various time series and probability analyses of, for example, extremely high or low flows, or of the entire range of flows expressed as average daily discharge (Dunne and Leopold 1978 in Poff et al. 1997).

To address variability and natural flow regime considerations, the impact assessment includes comparison of the time series of daily flows at the OMR, OLD395 and USGS Hot Creek Flume gages under each of the project alternatives and the No Project Alternative, relative to the Existing Condition and to the index of unimpaired flows, during each runoff year over the 20-year evaluation period.

CHANNEL MAINTENANCE AND FLUSHING FLOWS

Channel maintenance and flushing flows are important in maintaining the streambed conditions necessary for supporting fish populations over the long-term. In the absence of high flushing flows, species with lifestages that are sensitive to sedimentation, such as the eggs and larvae of many invertebrates and fish, can suffer high mortality rates (Poff et al. 1997).

Scoping comments received on the proposed project have suggested that flows in Mammoth Creek, and in Hot Creek below its confluence with Mammoth Creek: (1) may be insufficient to flush fine sediments from the streambed that reduce substrate interstitial spaces for benthic macroinvertebrate production; and (2) may contribute to the proliferation of rooted aquatic macrophytes resulting from deposition and accumulation of organic materials, particularly in Hot Creek.

However, according to the report prepared for CDFG (Jellison et al. 2007), a lack of flushing flows cannot explain the changes in benthic macroinvertebrate (BMI) metrics and taxon-specific indicators occurring immediately above and below the Hot Creek Hatchery upstream of the confluence with Mammoth Creek, as these reaches experience the same flow regime. Nor can the frequency and magnitude of flushing flows explain differences between Mammoth Creek reference sites and downstream Hot Creek sites as they too experience similar flushing flows. Thus, flushing flow considerations in Hot Creek were eliminated as a potential cause due to the "Lack of Spatial Co-occurrence."

Potential project impacts regarding the occurrence of channel maintenance and flushing flows are addressed for Hot Creek, as well as Mammoth Creek, although the magnitude of potential project-related change diminishes in the downstream direction due to spring and tributary inflow, and diversions downstream of the District's area of influence.

Although the recurrence interval (frequency of occurrence) providing channel maintenance and flushing flows varies among streams, these flows typically have a return interval of 1 to 2 years (Knighton 1984). For this Draft EIR, the maximum average daily flow under the unimpaired index that occurs during each of the 20 years of the evaluation period was identified. Then, consistent with the method employed for Rush Creek in the Mono Basin SWRCB hearing process (Kondolf 1993), the maximum average daily flow with a return interval of 1.75 years ($Q_{1.75}$) was used to define the channel maintenance and flushing flows at the OMR Gage in Mammoth Creek, and at the USGS Flume Gage in Hot Creek. To identify the $Q_{1.75}$ maximum average daily flow at each of the gages, the Gumbel Method (Santner 1973) which was used for Rush Creek (Kondolf 1993) also was used for analyses in this Draft EIR.

The frequency of occurrence of channel maintenance and flushing flows is evaluated by comparing the number of $Q_{1.75}$ flow events (irrespective of duration) that occur under each of the alternatives, relative to the Existing Condition, over the 20-year period of evaluation.

The duration of channel maintenance and flushing flows is evaluated by comparing the number of days that flows equal or exceed $Q_{1.75}$ under each of the alternatives, relative to the Existing Condition, over the 20-year period of evaluation.

The MCWD Model was used to provide the following hydrologic information for Mammoth and Hot creeks.

- ❑ Cumulative exceedance probability distributions of daily flows at the OMR, OLD395 and USGS Hot Creek Flume gages under each of the alternatives, and under the Existing Condition, during each month of the 20-year evaluation period.

- Time series of daily flows at the OMR, OLD395 and USGS Hot Creek Flume gages under each of the alternatives, under the Existing Condition, and under the index of unimpaired conditions as a benchmark reference, during each month of the 20-year evaluation period.
- The number of days that daily flows equal or exceed the flood flow value (Q_{20}) at the OMR Gage over the 20-year evaluation period.
- Total number of events (irrespective of duration) that daily flows equal or exceed the channel maintenance and flushing flow value ($Q_{1.75}$) at the OMR and USGS Hot Creek Flume gages over the 20 years included in the evaluation period.
- Total number of days that daily flows equal or exceed the channel maintenance and flushing flow value ($Q_{1.75}$) at the OMR and USGS Hot Creek Flume gages over the 20 years included in the evaluation period.

4.3.2 SURFACE WATER HYDROLOGY IMPACT INDICATORS AND SIGNIFICANCE CRITERIA

Included in Appendix G of the CEQA Guidelines, a potentially significant impact on surface hydrology would occur if the project would:

- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Cause inundation by seiche, tsunami, or mudflow.
- Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

The proposed project does not include alteration or modification of the integrity of infrastructure, Lake Mary or the Mammoth Creek streambed. The proposed project would not: (1) place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map; (2) place within a 100-year flood hazard area structures that would impede or redirect flood flows; (3) substantially alter the existing drainage pattern of the area in a manner that would result in substantial erosion or siltation; (4) substantially alter the existing drainage pattern of the area in a manner that would result in substantially increase the rate or amount of surface runoff in a manner which would result in flooding; (5) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial

additional sources of polluted runoff; or (6) cause inundation by seiche, tsunami, or mudflow. Therefore, impacts associated with these six criteria would not occur.

To further evaluate potential hydrologic impacts in this Draft EIR, the following impact indicators and significance criteria were developed for specific geographic locations, described below.

4.3.2.1 LAKE MARY

Potential impacts to Lake Mary would be considered significant if substantial differences in the following occur.

- The date on which maximum storage (and associated WSEL) is obtained for each of the 20 years included in the evaluation.
- The duration at which Lake Mary is at the minimum WSEL level (8,909.0 ft msl) from April 1 to September 15 each year.

4.3.2.2 MAMMOTH CREEK AND HOT CREEK

Potential impacts to Mammoth and Hot creeks would be considered significant if substantial differences in the magnitude, frequency, duration, timing and rate of change of hydrologic conditions occur under the project alternatives or the No Project Alternative relative to the Existing Condition in consideration of the following.

- Monthly cumulative exceedance probability distributions of daily flows at the OMR, OLD395 and USGS Hot Creek Flume gages over of the 20-year evaluation period.
- Trends in the time series of daily flows at the OMR, OLD395 and USGS Hot Creek Flume gages relative to the Existing Condition, and to the index of unimpaired conditions as a benchmark reference, during each runoff year over the 20-year evaluation period.
- The number of days that daily flows equal or exceed the flood flow value (Q_{20}) at the OMR Gage over the 20-year evaluation period.
- Total number of events (irrespective of duration) that daily flows equal or exceed the channel maintenance and flushing flow value ($Q_{1.75}$) at the OMR and USGS Hot Creek Flume gages over the 20 years included in the evaluation period.
- Total number of days that daily flows equal or exceed the channel maintenance and flushing flow value ($Q_{1.75}$) at the OMR and USGS Hot Creek Flume gages over the 20 years included in the evaluation period.

4.3.3 ANALYSIS OF ALTERNATIVE COMPARISONS

4.3.3.1 ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT ALTERNATIVE COMPARED TO THE EXISTING CONDITION

Model output for the comparison of the Proposed Project Alternative relative to the Existing Condition is presented in **Appendix D-1**, and is summarized below.

Impact Consideration 4.3.3.1-1. Potential to Change Lake Mary Storage

For both the Existing Condition and the Proposed Project Alternative, Lake Mary fills (3,260 AF) each year for each of the 20 years included in the evaluation. The average date on which full pool

occurs is May 21 under the Existing Condition, compared to May 9 under the Proposed Project Alternative. Lake Mary drawdown reaches the 8,909.0 ft msl constraint prior to September 15 in only one of the 20 years (for one day) under the Proposed Project Alternative, compared to only two years (one day each) under the Existing Condition.

Therefore, because Lake Mary fills each year, because substantial differences do not occur for the date on which full pool is obtained or in the duration at which Lake Mary is at minimum WSEL prior to September 15, potential impacts to Lake Mary hydrology are less than significant under the Proposed Project Alternative, relative to the Existing Condition.

Impact Determination 4.3.3.1-1 – Less Than Significant

Mitigation Measure 4.3.3.1-1 – None Required¹

Impact Consideration 4.3.3.1-2. Potential to Change Mammoth Creek Flows

OMR Gage

Exceedance distributions (probability of occurrence) are one way to represent the magnitude and frequency of flows. Examination of monthly exceedance distributions of daily flow at the OMR Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the Proposed Project Alternative and Existing Condition for three different groups of months. Flows under the Proposed Project Alternative are somewhat higher (typically nearly 1 to over 3 cfs) than those under the Existing Condition over portions or most of the range of flows from May through October. From November through March, the flow distributions are similar under the Proposed Project Alternative and the Existing Condition. During April, the flow distributions oscillate about each other (over different portions of the distribution, it is higher or it is lower).

Flows exceed the fishery bypass flow requirements at the OMR Gage under the Proposed Project Alternative with a nearly 60 to over 80% probability for the all months of the year.

Daily time series of flows are another way to represent flow magnitude and frequency, and also allow examination of flow duration, timing and rate of change. Examination of the flows that occur at the OMR Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between the Proposed Project Alternative and the Existing Condition. Thus, the Proposed Project Alternative and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. There are infrequent occasions of short duration (one or more weeks), when flows are stable and approximate the fishery bypass flow requirements under both the Proposed Project Alternative and under the Existing Condition. During such occasions, unimpaired flows remain variable and are slightly higher to the extent that they exceed the fishery bypass flow requirements. Although these occasions are relatively infrequent and vary annually, when they do occur they characteristically take place from July through September and from February through April. Overall, the pattern of flows at the OMR Gage under the Proposed Project Alternative generally mimics the pattern under the index of unimpaired flows.

¹ For all resource-specific evaluations, the term “None Required” is used when the Proposed Project Alternative concludes a less than significant impact. For alternatives other than the Proposed Project Alternative, the term “None Required” is used because mitigation measures are not required for these alternatives.

The potential to exacerbate flooding in Mammoth Creek is evaluated by comparing the difference in the number of days of flows at the OMR Gage exceeding the Q_{20} value (141 cfs) that would occur under the Proposed Project Alternative compared to the Existing Condition. Over the 20-year evaluation period, 1 more day of flows equal to or exceeding 141 cfs would occur under the Proposed Project Alternative compared to the Existing Condition.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the OMR Gage equal to or exceeding the $Q_{1.75}$ value (109.7 cfs) that would occur under the Proposed Project Alternative compared to the Existing Condition. A total of 27 channel maintenance and flushing flow events would occur under the Proposed Project Alternative and a total of 28 events would occur under the Existing Condition over the entire 20-year period of evaluation. Flows would equal or exceed 109.7 cfs under the Proposed Project Alternative a total of 207 days over the entire 20-year period of evaluation, compared to 205 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the Proposed Project Alternative or the Existing Condition.

OLD395 Gage

Examination of monthly exceedance distributions of daily flow at the OLD395 Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the Proposed Project Alternative and Existing Condition for three different groups of months. Flows under the Proposed Project Alternative are somewhat higher (typically about 0.5 to 2 cfs) than those under the Existing Condition over portions or most of the range of flows during May, July, and August. From September through March, and during June, the flow distributions are similar under the Proposed Project Alternative and the Existing Condition. During April, the flow distributions oscillate about each other.

Examination of the flows that occur at the OLD395 Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between the Proposed Project Alternative and the Existing Condition. Thus, the Proposed Project Alternative and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. The OLD395 Gage rarely exhibits the infrequent occasions of short duration (one or more weeks) when flows are stable and approximate the fishery bypass flow requirements under both the Proposed Project Alternative and under the Existing Condition, but are variable under the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the OLD395 Gage under the Proposed Project Alternative generally mimics the pattern under the index of unimpaired flows.

In conclusion, substantial differences would not occur between the Proposed Project Alternative and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the OMR and OLD395 gages.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the OMR and OLD395 gages.
- ❑ The occurrence of flood flows represented by the flood flow index value (Q_{20}) at the OMR Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the OMR Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Mammoth Creek hydrology are less than significant under the Proposed Project Alternative, relative to the Existing Condition.

Impact Determination 4.3.3.1-2 – Less Than Significant

Mitigation Measure 4.3.3.1-2 – None Required

Impact Consideration 4.3.3.1-3. Potential to Change Hot Creek Flows at the USGS Hot Creek Flume Gage

Examination of monthly exceedance distributions of daily flow at the USGS Hot Creek Flume Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the Proposed Project Alternative and Existing Condition for two different groups of months. Flows under the Proposed Project Alternative are somewhat higher (typically up to about 1.5 cfs) than those under the Existing Condition over portions or most of the range of flows from April through September. From October through March, the flow distributions are similar under the Proposed Project Alternative and the Existing Condition.

Examination of the flows that occur at the USGS Hot Creek Flume Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between the Proposed Project Alternative and the Existing Condition. Thus, the Proposed Project Alternative and the Existing Condition demonstrate similar flow magnitude, frequency, duration, timing and rate of change. Similar to the OLD395 Gage, the USGS Hot Creek Flume Gage rarely exhibits the infrequent occasions of short duration (one or more weeks) when flows are stable and approximate the fishery bypass flow requirements under both the Proposed Project Alternative and under the Existing Condition, but are variable under the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the USGS Hot Creek Flume Gage under the Proposed Project Alternative generally mimics the pattern under the index of unimpaired flows.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the USGS Hot Creek Flume Gage equal to or exceeding the $Q_{1.75}$ value (129.4 cfs) that would occur under the Proposed Project Alternative compared to the Existing Condition. A total of 34 channel maintenance and flushing flow events would occur under the Proposed Project Alternative over the entire 20-year period of evaluation, compared to 35 events under the Existing Condition. Flows would equal or exceed 129.4 cfs under the Proposed Project Alternative a total of 295 days over the entire 20-year period of evaluation, compared to 286 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the Proposed Project Alternative or the Existing Condition.

In conclusion, substantial differences would not occur between the Proposed Project Alternative and the Existing Condition for the following.

- The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the USGS Hot Creek Flume Gage.
- Flow variability, relative to the natural flow regime as a benchmark reference, at the USGS Hot Creek Flume Gage.
- The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the USGS Hot Creek Flume Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Hot Creek hydrology at the USGS Hot Creek Flume Gage are less than significant under the Proposed Project Alternative, relative to the Existing Condition.

Impact Determination 4.3.3.1-3 – Less Than Significant

Mitigation Measure 4.3.3.1-3 – None Required

4.3.3.2 ENVIRONMENTAL IMPACTS OF BYPASS FLOW REQUIREMENTS ALTERNATIVE NO. 2 COMPARED TO THE EXISTING CONDITION

Model output for the comparison of the Bypass Flow Requirements Alternative No. 2 (BFR Alt 2) relative to the Existing Condition is presented in **Appendix D-2**, and is summarized below.

Impact Consideration 4.3.3.2-1. Potential to Change Lake Mary Storage

For both the Existing Condition and BFR Alt 2, Lake Mary fills (3,260 AF) each year for each of the 20 years included in the evaluation. The average date on which full pool occurs is May 21 under both the Existing Condition and BFR Alt 2. Lake Mary drawdown reaches the 8,909.0 ft msl constraint prior to September 15 in only two of the 20 years, and only for one day during each of those two years, under both BFR Alt 2 and the Existing Condition.

Therefore, because Lake Mary fills each year, because substantial differences do not occur for the date on which full pool is obtained, and because there is no difference in the duration at which Lake Mary is at minimum WSEL prior to September 15, potential impacts to Lake Mary hydrology are less than significant under BFR Alt 2, relative to the Existing Condition.

Impact Determination 4.3.3.2-1 – Less than Significant

Mitigation Measure 4.3.3.2-1 – None Required

Impact Consideration 4.3.3.2-2. Potential to Change Mammoth Creek Flows

OMR Gage

Examination of monthly exceedance distributions of daily flow at the OMR Gage over the 20-year evaluation period demonstrates similar trends in the magnitude and frequency of flows under BFR Alt 2 and Existing Condition from March through August, with the exception of April (when the flow distributions oscillate about each other). However, flows under BFR Alt 2 are somewhat higher (up to about 1 cfs) than those under the Existing Condition over portions of the range of flows from September through February. Flow differences during these occasions reflect the differences in the fisheries bypass flow requirements between BFR Alt 2 and Existing Condition during these months.

Flows exceed the fishery bypass flow requirements at the OMR Gage under BFR Alt 2 and the Existing Condition generally with about a 60 to over 80% probability from March through August, and about a 50% probability from September through February.

Examination of the flows that occur at the OMR Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between BFR Alt 2 and the Existing Condition. Thus, BFR Alt 2 and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. However, there are observable albeit relatively infrequent differences in the pattern of flows between BFR Alt 2 and the Existing Condition when flows remain stable (for periods of 1 to several weeks) and approximate the

fishery bypass flow requirements under BFR Alt 2, during which time flows are more variable (and generally lower) under the Existing Condition. Although these occasions are relatively infrequent and vary annually, when they do occur they characteristically take place from September through February. During such occasions, unimpaired flows remain variable and are slightly higher to the extent that they exceed the fishery bypass flow requirements. Overall, the pattern of flows at the OMR Gage under BFR Alt 2 generally mimics the pattern under the index of unimpaired flows.

The potential to exacerbate flooding in Mammoth Creek is evaluated by comparing the difference in the number of days of flows at the OMR Gage exceeding the Q_{20} value (141 cfs) that would occur under BFR Alt 2 compared to the Existing Condition. Over the 20-year evaluation period, 1 more day of flows equal to or exceeding 141 cfs would occur under BFR Alt 2 compared to the Existing Condition.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the OMR Gage equal to or exceeding the $Q_{1.75}$ value (109.7 cfs) that would occur under BFR Alt 2 compared to the Existing Condition. A total of 28 channel maintenance and flushing flow events would occur under both BFR Alt 2 and under the Existing Condition over the entire 20-year period of evaluation. Flows would equal or exceed 109.7 cfs under BFR Alt 2 a total of 206 days over the entire 20-year period of evaluation, compared to 205 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either BFR Alt 2 or the Existing Condition.

OLD395 Gage

Examination of monthly exceedance distributions of daily flow at the OLD395 Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under BFR Alt 2 and the Existing Condition. Flows under BFR Alt 2 are somewhat higher (typically up to about 1 cfs) than those under the Existing Condition over portions of the range of flows from May through February. During March the flow distributions are similar, and during April the flow distributions oscillate about each other.

Examination of the flows that occur at the OLD395 Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between BFR Alt 2 and the Existing Condition. Thus, BFR Alt 2 and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. The OLD395 Gage rarely exhibits the infrequent occasions of short duration (one or more weeks) when flows are stable and approximate the fishery bypass flow requirements under BFR Alt 2, but are variable under the Existing Condition, as well as under the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the OLD395 Gage under BFR Alt 2 generally mimics the pattern under the index of unimpaired flows.

In conclusion, substantial differences would not occur between BFR Alt 2 and the Existing Condition for the following.

- The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the OMR and OLD395 gages.
- Flow variability, relative to the natural flow regime as a benchmark reference, at the OMR and OLD395 gages.
- The occurrence of flood flows represented by the flood flow index value (Q_{20}) at the OMR Gage.

- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the OMR Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Mammoth Creek hydrology are less than significant under BFR Alt 2, relative to the Existing Condition.

Impact Determination 4.3.3.2-2 – Less Than Significant

Mitigation Measure 4.3.3.2-2 – None Required

Impact Consideration 4.3.3.2-3. Potential to Change Hot Creek Flows at the USGS Hot Creek Flume Gage

Examination of monthly exceedance distributions of daily flow at the USGS Hot Creek Flume Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under BFR Alt 2 and the Existing Condition. During April, the flow distribution under BFR Alt 2 oscillates about the distribution under the Existing Condition. Flows under BFR Alt 2 slightly are slightly higher (typically up to about 1.5 cfs) than those under the Existing Condition over portions of the range of flows from May through October. From November through March, the flow distributions are generally similar under BFR Alt 2 and the Existing Condition.

Examination of the flows that occur at the USGS Hot Creek Flume Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between BFR Alt 2 and the Existing Condition. Thus, BFR Alt 2 and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. The USGS Hot Creek Flume Gage does not exhibit periods of stable flows approximating the fishery bypass flow requirements under BFR Alt 2, when flows are variable under the Existing Condition and under the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the USGS Hot Creek Flume Gage under BFR Alt 2 generally mimics the pattern under the index of unimpaired flows.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the USGS Hot Creek Flume Gage equal to or exceeding the $Q_{1.75}$ value (129.4 cfs) that would occur under BFR Alt 2 compared to the Existing Condition. A total of 33 channel maintenance and flushing flow events would occur under BFR Alt 2 over the entire 20-year period of evaluation, compared to 35 events under the Existing Condition. Flows would equal or exceed 129.4 cfs under BFR Alt 2 a total of 292 days over the entire 20-year period of evaluation, compared to 286 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either BFR Alt 2 or the Existing Condition.

In conclusion, substantial differences would not occur between BFR Alt 2 and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the USGS Hot Creek Flume Gage.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the USGS Hot Creek Flume Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the USGS Hot Creek Flume Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Hot Creek hydrology at the USGS Hot Creek Flume Gage are less than significant under BFR Alt 2, relative to the Existing Condition.

Impact Determination 4.3.3.2-3 – Less Than Significant

Mitigation Measure 4.3.3.2-3 – None Required

4.3.3.3 ENVIRONMENTAL IMPACTS OF THE PERMIT 17332 BYPASS FLOW REQUIREMENTS ALTERNATIVE COMPARED TO THE EXISTING CONDITION

Model output for the comparison of the Permit 17332 Bypass Flow Requirements Alternative (P-17332 BFR Alt) relative to the Existing Condition is presented in **Appendix D-3**, and is summarized below.

Impact Consideration 4.3.3.3-1. Potential to Change Lake Mary Storage

Meeting the fishery bypass flow requirements associated with each alternative is the highest priority, followed by Lake Mary WOCs and District diversions to the Lake Mary WTP. Because of the relatively high fishery bypass flow requirements during spring associated with the P-17332 BFR Alt, Lake Mary does not fill during the summer over the 5-year sequence of dry years extending from runoff year 1988 through 1992. During this period, maximum storage ranges from 2,873 AF (1990) to 3,093 AF (1991) by the fourth of July holiday, even in the absence of District diversions from April 1 through the July 4th holiday weekend each of the years.

For the remaining 15 years included in the evaluation, under the P-17332 BFR Alt Lake Mary fills (3,260 AF) on the average date of May 14, compared to May 14 for the same years under the Existing Condition.

Under the P-17332 BFR Alt, Lake Mary reaches the minimum WSEL prior to September 15 during 7 of the 20 years included in the evaluation. For these years, the duration (extending from April 1) ranges from 37 to 167 days, and averages 68 days. By contrast, Lake Mary drawdown reaches the 8,909.0 ft msl constraint prior to September 15 in only two of the 20 years, and only for one day during each of those two years under the Existing Condition.

Therefore, because substantial differences occur in the frequency of filling Lake Mary, and in the duration at which Lake Mary is at minimum WSEL prior to September 15, impacts to Lake Mary hydrology are potentially significant under the P-17332 BFR Alt, relative to the Existing Condition.

Impact Determination 4.3.3.3-1 – Potentially Significant

Mitigation Measure 4.3.3.3-1 – None Required

Impact Consideration 4.3.3.3-2. Potential to Change Mammoth Creek Flows

OMR Gage

Examination of monthly exceedance distributions of daily flow at the OMR Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the P-17332 BFR Alt relative to the Existing Condition. During April, the flow distribution under the P-17332 BFR Alt oscillates about the distribution under the Existing Condition. The P-17332 BFR Alt exhibits higher flows (up to about 5.0 cfs) than the Existing Condition over a portion or most of the range of exceedance values from May through July, and up to about 1.5 cfs from August

through December. However, from January through March, the P-17332 BFR Alt exhibits lower flows (up to about 1.0 cfs) than the Existing Condition during approximately the lowest (i.e., driest) 25% of the flow distributions during January and March, and the lowest (i.e., driest) 15% of the flow distribution during February.

Examination of the flows that occur at the OMR Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the P-17332 BFR Alt and the Existing Condition. Thus, the P-17332 BFR Alt and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. However, there are some observable albeit relatively infrequent differences in the pattern of flows between the P-17332 BFR Alt and the Existing Condition, when flows remain stable (for periods of 1 to several weeks) and approximate the fishery bypass flow requirements under the Existing Condition, but remain variable (and somewhat higher) under the P-17332 BFR Alt and under the index of unimpaired flows. When these differences in the pattern of flows between the P-17332 BFR Alt and the Existing Condition do occur, they most often occur from January through May, and July through September. Overall, the pattern of flows at the OMR Gage under the BFR Alt 2 generally mimics the pattern under the index of unimpaired flows.

The potential to exacerbate flooding in Mammoth Creek is evaluated by comparing the difference in the number of days of flows at the OMR Gage exceeding the Q_{20} value (141 cfs) that would occur under the P-17332 BFR Alt compared to the Existing Condition. Over the 20-year evaluation period, 1 less day of flows equal to or exceeding 141 cfs would occur under the P-17332 BFR Alt compared to the Existing Condition.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the OMR Gage equal to or exceeding the $Q_{1.75}$ value (109.7 cfs) that would occur under the P-17332 BFR Alt compared to the Existing Condition. A total of 28 channel maintenance and flushing flow events would occur under both the P-17332 BFR Alt and under the Existing Condition over the entire 20-year period of evaluation. Flows would equal or exceed 109.7 cfs under the P-17332 BFR Alt a total of 204 days over the entire 20-year period of evaluation, compared to 205 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the P-17332 BFR Alt or the Existing Condition.

OLD395 Gage

Examination of monthly exceedance distributions of daily flow at the OLD395 Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the P-17332 BFR Alt relative to the Existing Condition. During April, January and March, the flow distribution under the P-17332 BFR Alt oscillates about the distribution under the Existing Condition. The P-17332 BFR Alt exhibits higher flows (up to over 5.0 cfs) than the Existing Condition over about the lowest (i.e., driest) 40% the flow distributions during May and June. During July through October, the P-17332 BFR Alt exhibits higher flows (generally 0.5 up to 4.0 cfs) over most of the range of flows. During November, December and February, the P-17332 BFR Alt exhibits slightly higher flows (up to about 1.0 cfs) than the Existing Condition over the lowest (i.e., driest) portion of the flow distributions.

Flows exceed the fishery bypass flow requirements at the OLD395 Gage under the P-17332 BFR Alt with generally about a 50 to 70% probability for all months of the year.

Examination of the flows that occur at the OLD395 Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the P-17332 BFR Alt and the Existing Condition. Thus, the P-17332 BFR Alt and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. Relatively infrequent differences occur in the patterns of flow at the OLD395 Gage, when flows remain stable reflecting the fishery bypass flow requirements under P-17332 BFR Alt, yet are more variable (and somewhat lower) under the Existing Condition. These occasions of 1 to several weeks in duration are relatively infrequent and vary annually, and typically do not occur during May through July. During such occasions, unimpaired flows remain variable and are slightly higher to the extent that they exceed the fishery bypass flow requirements. Overall, the pattern of flows at the OLD395 Gage under the P-17332 BFR Alt generally mimics the pattern under the index of unimpaired flows.

In conclusion, substantial differences would not occur between the P-17332 BFR Alt and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the OMR and OLD395 gages.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the OMR and OLD395 gages.
- ❑ The occurrence of flood flows represented by the flood flow index value (Q_{20}) at the OMR Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the OMR Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Mammoth Creek hydrology are less than significant under the P-17332 BFR Alt, relative to the Existing Condition.

Impact Determination 4.3.3.3-2 - Less Than Significant

Mitigation Measure 4.3.3.3-2 - None Required

Impact Consideration 4.3.3.3-3. Potential to Change Hot Creek Flows at the USGS Hot Creek Flume Gage

Examination of monthly exceedance distributions of daily flow at the USGS Hot Creek Flume Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the P-17332 BFR Alt and Existing Condition. During April, the flow distribution under the P-17332 BFR Alt oscillates about the distribution under the Existing Condition. The P-17332 BFR Alt exhibits higher flows (up to about 4.5 cfs) than the Existing Condition over most of the range of the flow distributions from May through July. From August through October, the P-17332 BFR Alt exhibits slightly higher flows (generally up to 1.5 cfs) over the range of flows. Flows under the P-17332 BFR Alt are generally similar to those under the Existing Condition over the range of flows from November through March.

Examination of the flows that occur at the USGS Hot Creek Flume Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between the P-17332 BFR Alt and the Existing Condition. Thus, the P-17332 BFR Alt and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. By contrast to the OLD395 Gage, the USGS Hot Creek Flume Gage does not exhibit periods of

stable flows approximating the fishery bypass flow requirements under P-17332 BFR Alt, when flows are variable under the Existing Condition and under the index of unimpaired flows. Overall, the pattern of flows at the USGS Hot Creek Flume Gage under the P-17332 BFR Alt generally mimics the pattern under the index of unimpaired flows.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the USGS Hot Creek Flume Gage equal to or exceeding the $Q_{1.75}$ value (129.4 cfs) that would occur under the P-17332 BFR Alt compared to the Existing Condition. A total of 32 channel maintenance and flushing flow events would occur under the P-17332 BFR Alt over the entire 20-year period of evaluation, compared to 35 events under the Existing Condition. Flows would equal or exceed 129.4 cfs under the P-17332 BFR Alt a total of 290 days over the entire 20-year period of evaluation, compared to 286 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the P-17332 BFR Alt or the Existing Condition.

In conclusion, substantial differences would not occur between the P-17332 BFR Alt and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the USGS Hot Creek Flume Gage.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the USGS Hot Creek Flume Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the USGS Hot Creek Flume Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Hot Creek hydrology at the USGS Hot Creek Flume Gage are less than significant under the P-17332 BFR Alt, relative to the Existing Condition.

Impact Determination 4.3.3.3-3 - Less Than Significant

Mitigation Measure 4.3.3.3-3 - None Required

4.3.3.4 ENVIRONMENTAL IMPACTS OF THE NO PROJECT ALTERNATIVE COMPARED TO THE EXISTING CONDITION

As discussed in Chapter 2 - Proposed Project and Alternatives, the No Project Alternative in this Draft EIR is analyzed at the existing level of development (i.e., current utilization of permitted surface water supplies) and at a future level of development (i.e., projected utilization of permitted surface water supplies at maximum buildout in 2025) to address conditions that would reasonably be expected to occur in the foreseeable future if the proposed project was not approved.

Model output for the comparison of the No Project Alternative (Existing Level of Demand) relative to the Existing Condition is presented in **Appendix D-4**, and model output for the comparison of the No Project Alternative (Future Level of Demand) relative to the Existing Condition is presented in **Appendix D-5**. Model outputs are summarized below.

NO PROJECT ALTERNATIVE (EXISTING LEVEL OF DEMAND) COMPARED TO THE EXISTING CONDITION

Impact Consideration 4.3.3.4-1. Potential to Change Lake Mary Storage

For the No Project Alternative (Existing Level of Demand), Lake Mary fills (3,260 AF) in all but two of the 20 years included in the evaluation. For these two years, maximum storage obtained by the fourth of July holiday is 3,207 AF (1990) and 3,223 AF (1991), representing a change in WSEL from full pool of 0.5 ft and 0.3 ft, respectively. For the remaining 18 years (90%) included in the evaluation, under the No Project Alternative (Existing Level of Demand) Lake Mary fills on the average date of May 20, compared to May 17 under the Existing Condition. Lake Mary drawdown reaches the 8,909.0 ft msl constraint prior to September 15 in only two of the 20 years, and only for one day during each of those two years under both the No Project Alternative (Existing Level of Demand) and the Existing Condition.

Therefore, because substantial differences do not occur in Lake Mary storage or the date on which full pool is obtained, and because there is no difference in the duration at which Lake Mary is at minimum WSEL prior to September 15, potential impacts to Lake Mary hydrology are less than significant under the No Project Alternative (Existing Level of Demand), relative to the Existing Condition.

Impact Determination 4.3.3.4-1 - Less than Significant

Mitigation Measure 4.3.3.4-1 - None Required

Impact Consideration 4.3.3.4-2. Potential to Change Mammoth Creek Flows

OMR Gage

Examination of monthly exceedance distributions of daily flow at the OMR Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the No Project Alternative (Existing Level of Demand) and Existing Condition. Similar trends occur in the magnitude and frequency of flows under the No Project Alternative (Existing Level of Demand) and Existing Condition from October through April. Flows under the No Project Alternative (Existing Level of Demand) are somewhat lower (up to about 2.5 cfs) than those under the Existing Condition over portions or most of the range of flows during May and June. From July through September, the flow distributions under the No Project Alternative (Existing Level of Demand) and the Existing Condition oscillate about each other.

Flows exceed the fishery bypass flow requirements at the OMR Gage under the No Project Alternative (Existing Level of Demand) and the Existing Condition with a nearly 60 to over 80% probability for the all months of the year.

Examination of the flows that occur at the OMR Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between the No Project Alternative (Existing Level of Demand) and the Existing Condition. Thus, the No Project Alternative (Existing Level of Demand) and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. Relative to the index of unimpaired flows, there are infrequent occasions of short duration (one or more weeks) when flows are stable and approximate the fishery bypass flow requirements under both the No Project Alternative (Existing Level of Demand) and under the Existing Condition. During such occasions, unimpaired flows remain variable and are slightly higher to the extent that they exceed the fishery bypass flow requirements. Although these occasions are relatively infrequent and vary annually, when they do

occur they typically take place from July through September and from February through April. Overall, the pattern of flows at the OMR Gage under the No Project Alternative (Existing Level of Demand) generally mimics the pattern under the index of unimpaired flows.

The potential to exacerbate flooding in Mammoth Creek is evaluated by comparing the difference in the number of days of flows at the OMR Gage exceeding the Q_{20} value (141 cfs) that would occur under the No Project Alternative (Existing Level of Demand) compared to the Existing Condition. Over the 20-year evaluation period, 10 less days of flows equal to or exceeding 141 cfs would occur under the No Project Alternative (Existing Level of Demand) compared to the Existing Condition.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the OMR Gage equal to or exceeding the $Q_{1.75}$ value (109.7 cfs) that would occur under the No Project Alternative (Existing Level of Demand) compared to the Existing Condition. A total of 30 channel maintenance and flushing flow events would occur under the No Project Alternative (Existing Level of Demand) and a total of 28 events would occur under the Existing Condition over the entire 20-year period of evaluation. Flows would equal or exceed 109.7 cfs under the No Project Alternative (Existing Level of Demand) a total of 199 days over the entire 20-year period of evaluation, compared to 205 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the No Project Alternative (Existing Level of Demand) or the Existing Condition.

OLD395 Gage

Examination of monthly exceedance distributions of daily flow at the OLD395 Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the No Project Alternative (Existing Level of Demand) and the Existing Condition. Similar trends occur in the magnitude and frequency of flows under the No Project Alternative (Existing Level of Demand) and Existing Condition from October through April. From May through July, flows under the No Project Alternative (Existing Level of Demand) are slightly lower (from about 1 to 2.5 cfs) than those under the Existing Condition over portions or much of the range of exceedance probabilities. During August and September, flows under the No Project Alternative (Existing Level of Demand) oscillate about those under the Existing Condition over the range of exceedance probabilities.

Examination of the flows that occur at the OLD395 Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between the No Project Alternative (Existing Level of Demand) and the Existing Condition. Thus, the No Project Alternative (Existing Level of Demand) and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. By contrast to the OMR Gage, the OLD395 Gage rarely exhibits the occasions when flows approximate the fishery bypass flow requirements under both the No Project Alternative (Existing Level of Demand) and the Existing Condition, but are variable under the index of unimpaired flows. Overall, the pattern of flows at the OLD395 Gage under the No Project Alternative (Existing Level of Demand) generally mimics the pattern under the index of unimpaired flows.

In conclusion, substantial differences would not occur between the No Project Alternative (Existing Level of Demand) and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the OMR and OLD395 gages.

- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the OMR and OLD395 gages.
- ❑ The occurrence of flood flows represented by the flood flow index value (Q_{20}) at the OMR Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the OMR Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Mammoth Creek hydrology are less than significant under the No Project Alternative (Existing Level of Demand), relative to the Existing Condition.

Impact Determination 4.3.3.4-2 - Less Than Significant

Mitigation Measure 4.3.3.4-2 - None Required

Impact Consideration 4.3.3.4-3. Potential to Change Hot Creek Flows at the USGS Hot Creek Flume Gage

Examination of monthly exceedance distributions of daily flow at the USGS Hot Creek Flume Gage over the 20-year evaluation period reflects the trends observed at the OLD395 Gage. Similar trends occur in the magnitude and frequency of flows under the No Project Alternative (Existing Level of Demand) and Existing Condition from October through April. From May through July, flows under the No Project Alternative (Existing Level of Demand) are slightly lower (up to about 2.5 cfs) than those under the Existing Condition over portions or much of the range of exceedance probabilities. During August and September, flows under the No Project Alternative (Existing Level of Demand) oscillate about those under the Existing Condition over the range of exceedance probabilities.

Examination of the flows that occur at the USGS Hot Creek Flume Gage each day of the year, for all 20 years included in the evaluation period, demonstrate similar patterns of flows between the No Project Alternative (Existing Level of Demand) and the Existing Condition. Thus, the No Project Alternative (Existing Level of Demand) and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. The USGS Hot Creek Flume Gage does not exhibit the relatively infrequent occasions when flows approximate the fishery bypass flow requirements under the No Project Alternative (Existing Level of Demand) and the Existing Condition, but are variable under the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the USGS Hot Creek Flume Gage under the No Project Alternative (Existing Level of Demand) generally mimics the pattern under the index of unimpaired flows.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the USGS Hot Creek Flume Gage equal to or exceeding the $Q_{1.75}$ value (129.4 cfs) that would occur under the No Project Alternative (Existing Level of Demand) compared to the Existing Condition. A total of 33 channel maintenance and flushing flow events would occur under the No Project Alternative (Existing Level of Demand) over the entire 20-year period of evaluation, compared to 35 events under the Existing Condition. Flows would equal or exceed 129.4 cfs under the No Project Alternative (Existing Level of Demand) a total of 270 days over the entire 20-year period of evaluation, compared to 286 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the No Project Alternative (Existing Level of Demand) or the Existing Condition.

In conclusion, substantial differences would not occur between the No Project Alternative (Existing Level of Demand) and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the USGS Hot Creek Flume Gage.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the USGS Hot Creek Flume Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the USGS Hot Creek Flume Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Hot Creek hydrology at the USGS Hot Creek Flume Gage are less than significant under the No Project Alternative (Existing Level of Demand), relative to the Existing Condition.

Impact Determination 4.3.3.4-3 - Less Than Significant

Mitigation Measure 4.3.3.4-3 - None Required

NO PROJECT ALTERNATIVE (FUTURE LEVEL OF DEMAND) COMPARED TO THE EXISTING CONDITION

Impact Consideration 4.3.3.4-4. Potential to Change Lake Mary Storage

For the No Project Alternative (Future Level of Demand), Lake Mary fills (3,260 AF) or is within 14 AF (0.4%) of full in all but two of the 20 years included in the evaluation. For these two years, maximum storage obtained by the fourth of July holiday is 3,137 AF (1990) and 3,221 AF (1991), representing a change in WSEL from full pool of 1.1 ft and 0.4 ft, respectively. For the remaining 18 years included in the evaluation, under the No Project Alternative (Future Level of Demand) the Lake Mary fill date averages June 10, compared to May 17 under the Existing Condition. Lake Mary drawdown reaches the 8,909.0 ft msl constraint prior to September 15 in 5 of the 20 years, but only for one day each during 2 of the 5 years. For these 5 years, the annual duration at which Lake Mary is at minimum pool ranges from 1 to 38 days, and averages 15 days. Over all 20 years, the annual duration averages 4 days.

Therefore, because differences are not substantial in the frequency of filling Lake Mary, the date on which Lake Mary is filled, or the duration at which Lake Mary is at minimum WSEL prior to September 15, potential impacts to Lake Mary hydrology are less than significant under the No Project Alternative (Future Level of Demand), relative to the Existing Condition.

Impact Determination 4.3.3.4-4 - Less than Significant

Mitigation Measure 4.3.3.4-4 - None Required

Impact Consideration 4.3.3.4-5. Potential to Change Mammoth Creek Flows

OMR Gage

Examination of monthly exceedance distributions of daily flow at the OMR Gage over the 20-year evaluation period demonstrates that the No Project Alternative (Future Level of Demand) exhibits slightly lower flows (typically less than 1 cfs) than the Existing Condition over about the 10 to 70% range of the exceedance values for most months of the year. However, during April and May, flow differences over this range generally are about 3 cfs or less, although they occur when flows exceed

the fishery bypass flow requirements (9.8 cfs during April and 18.7 cfs during May). A similar situation occurs during the high snowmelt runoff month of June, when flow differences over about the 5 to 80% range of the exceedance values generally are about 1 to 5 cfs, and they occur when flows exceed the fishery bypass flow requirement of 20.8 cfs. During June, flows exceed 30 cfs over 60% of the time under the No Project Alternative (Future Level of Demand).

Flows exceed the fishery bypass flow requirements at the OMR Gage under the No Project Alternative (Future Level of Demand) with about a 40% probability from January through March, and with about a 50 to over 70% probability for the remaining months of the year.

Examination of the flows that occur at the OMR Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the No Project Alternative (Future Level of Demand) and the Existing Condition. Thus, the No Project Alternative (Future Level of Demand) and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. However, there are some observable differences in the pattern of flows between the No Project Alternative (Future Level of Demand) and the Existing Condition, when flows remain relatively stable (for periods of 1 to several weeks) and approximate the fishery bypass flow requirements under the No Project Alternative (Future Level of Demand), but remain more variable (and typically somewhat higher) under the Existing Condition and under the index of unimpaired flows. When these differences in the pattern of flows between the No Project Alternative (Future Level of Demand) and the Existing Condition do occur, they typically take place during the low flow months extending from September through April. Overall, the pattern of flows at the OMR Gage under the No Project Alternative (Future Level of Demand) generally mimics the pattern under the index of unimpaired flows.

The potential to exacerbate flooding in Mammoth Creek is evaluated by comparing the difference in the number of days of flows at the OMR Gage exceeding the Q_{20} value (141 cfs) that would occur under the No Project Alternative (Future Level of Demand) compared to the Existing Condition. Over the 20-year evaluation period, 16 less days of flows equal to or exceeding 141 cfs would occur under the No Project Alternative (Future Level of Demand) compared to the Existing Condition.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the OMR Gage equal to or exceeding the $Q_{1.75}$ value (109.7 cfs) that would occur under the No Project Alternative (Future Level of Demand) compared to the Existing Condition. A total of 29 channel maintenance and flushing flow events would occur under the No Project Alternative (Future Level of Demand) over the entire 20-year period of evaluation, compared to 28 events under the Existing Condition. Flows would equal or exceed 109.7 cfs under the No Project Alternative (Future Level of Demand) a total of 189 days over the entire 20-year period of evaluation, compared to 205 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the No Project Alternative (Future Level of Demand) or the Existing Condition.

OLD395 Gage

Similar to the OMR Gage, examination of monthly exceedance distributions of daily flow at the OLD395 Gage over the 20-year evaluation period demonstrates that the No Project Alternative (Future Level of Demand) exhibits somewhat lower flows (typically less than 1.5 cfs) than the Existing Condition over about the 10 to 80% range of the exceedance values for most months of the year. However, during April, flow differences over this range are generally about 2.5 cfs or less,

and they occur when flows exceed the fishery bypass flow requirement of 9.8 cfs. A similar situation occurs during the high snowmelt runoff months of May and June, when flow differences over this range generally are between 1 and 5 cfs, and they occur when flows exceed the fishery bypass flow requirements (18.7 cfs during May and 20.8 cfs during June).

Examination of the flows that occur at the OLD395 Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the No Project Alternative (Future Level of Demand) and the Existing Condition. Thus, the No Project Alternative (Future Level of Demand) and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. The OLD395 Gage does not exhibit the relatively infrequent occasions when flows are stable and approximate the fishery bypass flow requirements under the No Project Alternative (Future Level of Demand), but are variable under the Existing Condition and the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the OLD395 Gage under the No Project Alternative (Future Level of Demand) generally mimics the pattern under the index of unimpaired flows.

In conclusion, substantial differences would not occur between the No Project Alternative (Future Level of Demand) and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the OMR and OLD395 gages.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the OMR and OLD395 gages.
- ❑ The occurrence of flood flows represented by the flood flow index value (Q_{20}) at the OMR Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the OMR Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Mammoth Creek hydrology are less than significant under the No Project Alternative (Future Level of Demand), relative to the Existing Condition.

Impact Determination 4.3.3.4-5 - Less than Significant

Mitigation Measure 4.3.3.4-5 - None Required

Impact Consideration 4.3.3.4-6. Potential to Change Hot Creek Flows at the USGS Hot Creek Flume Gage

Examination of monthly exceedance distributions of daily flow at the USGS Hot Creek Flume Gage over the 20-year evaluation period demonstrates that the No Project Alternative (Future Level of Demand) exhibits similar flow probabilities from August through November, and slightly lower flows (typically less than about 1.5 cfs) than the Existing Condition over most of the range of the exceedance values during July, and from December through March. Flow differences over most of the range of flows are generally about 2.5 cfs or less during April, and 5 cfs or less during May and June. Under the No Project Alternative (Future Level of Demand), flows exceed 40 cfs with an 80% probability during April, a 90% probability during May, and a 100% probability during June.

Examination of the flows that occur at the USGS Hot Creek Flume Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the No Project Alternative (Future Level of Demand) and the Existing Condition. Thus, the No Project Alternative (Future Level of Demand) and the Existing Condition demonstrate

generally similar flow magnitude, frequency, duration, timing and rate of change. The USGS Hot Creek Flume Gage does not exhibit the relatively infrequent occasions when flows are stable and approximate the fishery bypass flow requirements under the No Project Alternative (Future Level of Demand), but are variable under the Existing Condition and the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the USGS Hot Creek Flume Gage under the No Project Alternative (Future Level of Demand) generally mimics the pattern under the index of unimpaired flows.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the USGS Hot Creek Flume Gage equal to or exceeding the $Q_{1.75}$ value (129.4 cfs) that would occur under the No Project Alternative (Future Level of Demand) compared to the Existing Condition. A total of 34 channel maintenance and flushing flow events would occur under the No Project Alternative (Future Level of Demand) over the entire 20-year period of evaluation, compared to 35 events under the Existing Condition. Flows would equal or exceed 129.4 cfs under the No Project Alternative (Future Level of Demand) a total of 256 days over the entire 20-year period of evaluation, compared to 286 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the No Project Alternative (Future Level of Demand) or the Existing Condition.

In conclusion, substantial differences would not occur between the No Project Alternative (Future Level of Demand) and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the USGS Hot Creek Flume Gage.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the USGS Hot Creek Flume Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the USGS Hot Creek Flume Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Hot Creek hydrology at the USGS Hot Creek Flume Gage are less than significant under the No Project Alternative (Future Level of Demand), relative to the Existing Condition.

Impact Determination 4.3.3.4-6 - Less than Significant

Mitigation Measure 4.3.3.4-6 - None Required

4.4 MITIGATION MEASURES

No potentially significant hydrologic-related adverse impacts would occur under the Proposed Project Alternative. Thus, no mitigation measures are required.

4.5 POTENTIALLY SIGNIFICANT UNAVOIDABLE IMPACTS

No potentially significant unavoidable hydrologic-related adverse impacts would occur under the Proposed Project Alternative.

4.6 CUMULATIVE IMPACTS

For CEQA, the purpose of the cumulative impact analysis is to determine whether the incremental effects of the Proposed Project Alternative would be expected to be “cumulatively considerable” when viewed in connection with the effects of past projects, other current projects, and probable future projects (PRC Section 21083, subdivision (b)(2)).²

For those projects that cannot be quantitatively assessed by application of the MCWD Model, a supplemental, qualitative cumulative impact analysis was conducted to evaluate potential cumulative impacts to hydrology. For analytical purposes of this Draft EIR, the projects that are considered well-defined and “reasonably foreseeable” are described in Chapter 3 – Overview of Analytical Approach (also see Chapter 3 for a full description of the cumulative impact assessment methods). Only projects that could affect hydrology are considered in this section.

Although many of the proposed projects/programs described in Chapter 3 could have project-specific impacts that will be addressed in future project-specific environmental documentation, future implementation of these projects/programs is not expected to result in cumulative impacts to water supply operations, or water-related and water-dependent resources that also could be affected by the Proposed Project Alternative. For this reason, only the limited number of projects that have the potential to cumulatively impact hydrology in the Project Area are specifically considered qualitatively in the cumulative impacts analysis for hydrology. The manner in which these projects could contribute to potentially significant cumulative impacts to hydrology are briefly summarized below.

4.6.1 QUALITATIVE ANALYSIS OF PAST, PRESENT AND FUTURE PROJECTS

❑ 2005 District Urban Water Management Plan

As described in Chapter 1 – Introduction and Chapter 5 – Water Quality, the District has been placing an emphasis on locating sources of water loss in the system through a leak detection program, main pipeline replacement program, and meter replacement and new meter-reading program (MCWD 2005). Ongoing efforts to reduce leaks in the distribution system, could result in a significant decrease in future water demand requirements (MCWD 2005), and potentially thereby result in additional water available that may affect Lake Mary storage and WSEL, and flows in Mammoth and Hot creeks.

❑ 2007 Town of Mammoth Lakes General Plan Update

The District utilizes zoning and both residential and commercial growth projections provided in the Town of Mammoth Lakes General Plan to estimate future service demand (Mono County LAFCO 2009). The General Plan Update states that the District currently has enough supplies to meet demand projections through the buildout of the community during normal and wet years. However, in the event of an extended dry period (i.e., multiple dry years), it is expected that there would be a shortfall between supply and demand unless additional supplies are developed or more stringent conservation measures are implemented (Town of Mammoth Lakes 2003). If additional supplies are developed or more stringent conservation measures are implemented, then

² The “Guide to the California Environmental Quality Act” (Remy et al. 1999) states that “...although a project may cause an “individually limited” or “individually minor” incremental impact that, by itself, is not significant, the increment may be “cumulatively considerable”, and thus significant, when viewed against the backdrop of past, present, and probably future projects.” (CEQA Guidelines, Section 15064, subd. (i)(1), 15065, subd. (c), 15355, subd. (b)).

additional water may be available and could affect Lake Mary storage and WSEL, and flows in Mammoth and Hot creeks.

Quantitative analysis is presented in 4.6.2.1 below.

❑ **Mono County Local Agency Formation Commission Municipal Service Review And Sphere of Influence Recommendation**

The District has analyzed projected future water demand data and current supply reliability data and concluded that the third and fourth years of multiple dry years could result in a supply deficiency as the Town nears buildout (Mono County LAFCO 2009). As part of future planning efforts, Mono County LAFCO (2009) reports that the District has identified several means of reducing supply impacts resulting from drought years, including: (1) reducing demand through water restrictions, primarily restrictions on irrigation; (2) use of recycled water for golf course and park irrigation; (3) decreasing the percentage of water losses in the system; and (4) potentially developing new groundwater sources in the Dry Creek and Mammoth Basin watersheds. If these measures are implemented, then additional water may be available and could affect Lake Mary storage and WSEL, and flows in Mammoth and Hot creeks.

❑ **Groundwater Monitoring and Management**

As previously discussed, there are no other sources of surface water supply available to the District, nor is there planned development of additional surface water supplies. While preliminary modeling conducted by Wildermuth (2009) for the District suggests that groundwater pumping is sustainable for both the current and buildout demand scenarios, it is anticipated that additional sources of supply, including the modification of existing wells to improve capacity and drilling new wells (e.g., Well 11 and Well 25) in the Mammoth Lakes Basin, will be required to meet future water demands. If additional groundwater production is implemented, then additional water may be available and could affect Lake Mary storage and WSEL, and flows in Mammoth and Hot creeks.

❑ **USFS Applications for Storage at Mamie and Twin Lakes**

The USFS, Inyo National Forest, has filed Applications 31365 and 31366 with the SWRCB for water right permits to confirm the installation of dams and the long-standing storage of water behind dams that were installed in 1968 in Lake Mamie and 1953 in Twin Lakes. Water collected to storage at Lake Mamie and Twin Lakes is to be used for fish and wildlife enhancement and recreational purposes. The SWRCB considers these to be a “minor” projects (the proposed diversion is 3 cfs or less by direct diversion or 200 AF or less per year by storage) as defined by Section 1348 of the Water Code. If these applications are to confirm historic operations by the USFS, then there should be no change in operations that would result in cumulative hydrologic impacts in the Mammoth Creek system.

❑ **Ongoing Mammoth Meadows Restoration Project**

The Inyo National Forest is in the process of completing environmental documentation for the proposed Mammoth Meadows Restoration Project, located in the meadow west of the Snowcreek Condominiums and Golf Course. Proposed treatments would include restoration activities in Mammoth Meadow to reduce soil erosion and protect meadow function. It would also repair or replace grade stabilization structures in Bodle Ditch. It is anticipated that the initial proposed treatment would occur during the summer of

2010, although meeting the USFS' long-term objectives of returning hydrologic function to the Mammoth Meadows will require multiple project phases (USFS 2009). It is not anticipated that this project as presently defined would affect water availability for the Mammoth Creek system.

❑ **Suggested Declaration of Mammoth Creek as a Fully Appropriated Stream System**

During the scoping process for this Draft EIR, the issue of declaring Mammoth Creek to be a fully appropriated stream system was raised. As previously discussed, issues associated with downstream water rights and determining whether Mammoth Creek is fully appropriated are separate water right issues that are not related to the CEQA compliance process for this Draft EIR. Regardless, pertaining to the cumulative condition, declaration of Mammoth Creek as a fully appropriated stream system would preclude future permitted diversions along the creek.

4.6.2 QUANTITATIVE ANALYSIS OF PAST, PRESENT AND FUTURE PROJECTS

4.6.2.1 FUTURE DISTRICT SURFACE WATER DIVERSIONS

Model output for the comparison of the Proposed Project Alternative Future Level of Demand relative to the Existing Condition is presented in **Appendix D-6**, and is summarized below. Potential cumulative impacts to hydrology can be identified and characterized using the same quantitative methods, impact indicators and significance criteria as those identified for the direct impact analyses discussed above in Section 4.3.

Cumulative Impact Consideration 4.6.2.1-1. Potential to Change Lake Mary Storage

For both the Existing Condition and the Proposed Project Alternative Future Level of Demand, Lake Mary fills (3,260 AF) each year for each of the 20 years included in the evaluation. The average date on which full pool occurs is May 21 under both the Existing Condition, and June 9 under the Proposed Project Alternative Future Level of Demand. Lake Mary drawdown reaches the 8,909.0 ft msl constraint prior to September 15 in only two of the 20 years under both the Proposed Project Alternative Future Level of Demand and the Existing Condition – one day each of the two years under the Existing Condition, and for one day during one year and for 15 days during one year under the Proposed Project Alternative Future Level of Demand.

Therefore, because Lake Mary fills each year, because substantial differences do not occur for the date on which full pool is obtained and in the duration at which Lake Mary is at minimum WSEL prior to September 15, potential impacts to Lake Mary hydrology are less than significant under the Proposed Project Alternative Future Level of Demand, relative to the Existing Condition.

Cumulative Impact Determination 4.6.2.1-1 – Less than Significant

Mitigation Measure 4.6.2.1-1 – None Required

Cumulative Impact Consideration 4.6.2.1-2. Potential to Change Mammoth Creek Flows

OMR Gage

Examination of monthly exceedance distributions of daily flow at the OMR Gage over the 20-year evaluation period demonstrates that the Proposed Project Alternative Future Level of Demand

exhibits somewhat lower flows (typically less than 1 cfs) than the Existing Condition over about the 10 to 70% range of the exceedance values for most months of the year. However, during April and May, flow differences over this range generally are about 3 cfs or less, although they occur when flows exceed the fishery bypass flow requirements (9.8 cfs during April and 18.7 cfs during May). A similar situation occurs during the high snowmelt runoff month of June, when flow differences over the 10 to 80% range of exceedance probabilities generally are about 1 to 5 cfs, and they occur when flows exceed the fishery bypass flow requirement of 20.8 cfs. During June, flows exceed 30 cfs over 60% of the time under the Proposed Project Alternative Future Level of Demand.

Flows exceed the fishery bypass flow requirements at the OMR Gage under the Proposed Project Alternative Future Level of Demand with about a 40 to 50% probability from January through April, and with about a nearly 60 to 80% probability for the remaining months of the year.

Examination of the flows that occur at the OMR Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the Proposed Project Alternative Future Level of Demand and the Existing Condition. Thus, the Proposed Project Alternative Future Level of Demand and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. There are some observable albeit relatively infrequent differences in the pattern of flows between the Proposed Project Alternative Future Level of Demand and the Existing Condition, when flows remain relatively stable (for periods of 1 to several weeks) and approximate the fishery bypass flow requirements under the Proposed Project Alternative Future Level of Demand, but remain more variable (and somewhat higher) under the Existing Condition (and under the index of unimpaired flows). When these differences in the pattern of flows between the Proposed Project Alternative Future Level of Demand and the Existing Condition do occur, they typically take place during the low flow months extending from September through April. There also are infrequent occasions when flows are similar and relatively stable under both the Proposed Project Alternative Future Level of Demand and under the Existing Condition, but are more variable (and somewhat higher) under the index of unimpaired flows. Overall, the pattern of flows at the OMR Gage under the Proposed Project Alternative Future Level of Demand generally mimics the pattern under the index of unimpaired flows.

The potential to exacerbate flooding in Mammoth Creek is evaluated by comparing the difference in the number of days of flows at the OMR Gage exceeding the Q_{20} value (141 cfs) that would occur under the Proposed Project Alternative Future Level of Demand compared to the Existing Condition. Over the 20-year evaluation period, 10 less days of flows equal to or exceeding 141 cfs would occur under the Proposed Project Alternative Future Level of Demand compared to the Existing Condition.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the OMR Gage equal to or exceeding the $Q_{1.75}$ value (109.7 cfs) that would occur under the Proposed Project Alternative Future Level of Demand compared to the Existing Condition. A total of 28 channel maintenance and flushing flow events would occur under both the Proposed Project Alternative Future Level of Demand and the Existing Condition over the entire 20-year period of evaluation. Flows would equal or exceed 109.7 cfs under the Proposed Project Alternative Future Level of Demand a total of 196 days over the entire 20-year period of evaluation, compared to 205 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the Proposed Project Alternative Future Level of Demand or the Existing Condition.

OLD395 Gage

Examination of monthly exceedance distributions of daily flow at the OLD395 Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the Proposed Project Alternative Future Level of Demand and Existing Condition. During April and May, flows under the Proposed Project Alternative Future Level of Demand are lower by 2 cfs or less over the 20 to 70% range of exceedance probabilities. A similar situation occurs during the high snowmelt runoff month of June, when flows under the Proposed Project Alternative Future Level of Demand are lower by 2.5 cfs or less over the 10 to 80% range of exceedance probabilities. From July through November, flows under the Proposed Project Alternative Future Level of Demand and the Existing Condition are very similar over the most of the flow range. From December through March, flows over the 5 to 75% range of the exceedance values are lower by 1 cfs or less under the Proposed Project Alternative Future Level of Demand.

Examination of the flows that occur at the OLD395 Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the Proposed Project Alternative Future Level of Demand and the Existing Condition. Thus, the Proposed Project Alternative Future Level of Demand and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. The OLD395 Gage does not exhibit the relatively infrequent occasions when flows are stable and approximate the fishery bypass flow requirements under the Proposed Project Alternative Future Level of Demand, but are variable under the Existing Condition and the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the OLD395 Gage under the Proposed Project Alternative Future Level of Demand generally mimics the pattern under the index of unimpaired flows.

In conclusion, substantial differences would not occur between the Proposed Project Alternative Future Level of Demand and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the OMR and OLD395 gages.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the OMR and OLD395 gages.
- ❑ The occurrence of flood flows represented by the flood flow index value (Q_{20}) at the OMR Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the OMR Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Mammoth Creek hydrology are less than significant under the Proposed Project Alternative Future Level of Demand, relative to the Existing Condition.

Cumulative Impact Determination 4.6.2.1-2 - Less than Significant

Mitigation Measure 4.6.2.1-2 - None Required

Cumulative Impact Consideration 4.6.2.1-3. Potential to Change Hot Creek Flows at the USGS Hot Creek Flume Gage

Examination of monthly exceedance distributions of daily flow at the USGS Hot Creek Flume Gage over the 20-year evaluation period demonstrates variable trends in the magnitude and frequency of flows under the Proposed Project Alternative Future Level of Demand and Existing Condition

for two different groups of months. From July through October, the flow distributions are similar under the Proposed Project Alternative Future Level of Demand and the Existing Condition. Flows under the Proposed Project Alternative Future Level of Demand are somewhat lower (typically about 1 to 2 cfs) than those under the Existing Condition over portions or most of the range of flows from November through June.

Examination of the flows that occur at the USGS Hot Creek Flume Gage each day of the year, for all 20 years included in the evaluation period, demonstrate generally similar patterns of flows between the Proposed Project Alternative Future Level of Demand and the Existing Condition. Thus, the Proposed Project Alternative Future Level of Demand and the Existing Condition demonstrate generally similar flow magnitude, frequency, duration, timing and rate of change. The USGS Hot Creek Flume Gage does not exhibit the relatively infrequent occasions when flows are stable and approximate the fishery bypass flow requirements under the Proposed Project Alternative Future Level of Demand, but are variable under the Existing Condition and the index of unimpaired flows, as observed at the OMR Gage. Overall, the pattern of flows at the USGS Hot Creek Flume Gage under the Proposed Project Alternative Future Level of Demand generally mimics the pattern under the index of unimpaired flows.

Channel maintenance and flushing flows are evaluated by comparing the frequency (total number of events, irrespective of duration) and the duration (total number of days) of flows at the USGS Hot Creek Flume Gage equal to or exceeding the $Q_{1.75}$ value (129.4 cfs) that would occur under the Proposed Project Alternative Future Level of Demand compared to the Existing Condition. A total of 32 channel maintenance and flushing flow events would occur under the Proposed Project Alternative Future Level of Demand over the entire 20-year period of evaluation, compared to 35 events under the Existing Condition. Flows would equal or exceed 129.4 cfs under the Proposed Project Alternative Future Level of Demand a total of 272 days over the entire 20-year period of evaluation, compared to 286 days under the Existing Condition. For Dry runoff year types, $Q_{1.75}$ does not occur under either the Proposed Project Alternative Future Level of Demand or the Existing Condition.

In conclusion, substantial differences would not occur between the Proposed Project Alternative Future Level of Demand and the Existing Condition for the following.

- ❑ The magnitude, frequency, duration, timing and rate of change of hydrologic conditions at the USGS Hot Creek Flume Gage.
- ❑ Flow variability, relative to the natural flow regime as a benchmark reference, at the USGS Hot Creek Flume Gage.
- ❑ The frequency and duration of channel maintenance and flushing flows represented by the index value of $Q_{1.75}$ at the USGS Hot Creek Flume Gage.

Therefore, in consideration of the entire suite of analyses and evaluations described above, potential impacts to Hot Creek hydrology at the USGS Hot Creek Flume Gage are less than significant under the Proposed Project Alternative Future Level of Demand, relative to the Existing Condition.

Cumulative Impact Determination 4.6.2.1-3 – Less than Significant

Mitigation Measure 4.6.2.1-3 – None Required

No potentially cumulatively significant hydrologic-related adverse impacts would occur. Thus, the Proposed Project Alternative does not have an incremental effect that is “cumulatively considerable”.