California High-Speed Rail Authority

Palmdale to Burbank Project Section

Draft Environmental Impact Report/ Environmental Impact Statement

Appendix 3.8-D Supplemental Water Demand Analysis for Potential Impacts within the Angeles National Forest / San Gabriel Mountains National Monument

February 2022

CALIFORNIA
High-Speed Rail Authority

The environmental review, consultation, and other actions required by applicable federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.

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ACRONYMS AND ABBREVIATIONS

AMMP	Adaptive Management and Monitoring Plan
ANF	Angeles National Forest
Authority	California High Speed Rail Authority
SGMNM	San Gabriel Mountains National Monument

1 INTRODUCTION

The California High Speed Rail Authority (Authority) will implement an Adaptive Management and Monitoring Plan (AMMP) pursuant to mitigation measure HYD-MM#4 to address certain hydrologic impacts that could occur within the Angeles National Forest (ANF), including the San Gabriel Mountains National Monument (SGMNM). The purpose of the AMMP is to detect and respond to adverse effects on subsurface and surface water resources and associated habitat within the ANF caused by tunnel construction activities associated with the project. The AMMP is set out in Appendix 3.8-C. This Supplemental Water Demand Analysis discusses the options, logistics, and feasibility of implementing the response actions that may be implemented in accordance with the AMMP. Specifically, this analysis describes the methodology used to estimate potential remedial water needs and discusses various scenarios that would necessitate that supplemental water, the potential sources of that supplemental water, and the logistical considerations regarding the conveyance and delivery of that supplemental water.

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2 SUPPLEMENTAL WATER DEMAND ANALYSIS

As discussed in the AMMP (Appendix 3.8-C), an approach and methods have been developed for determining water requirements to potentially sustain surface water resources and associated habitat that are adversely affected by changes to the quantity and availability of water resources caused by tunnel construction.

2.1 Use of Regional Scientific Data

Subwatersheds for Risk Areas identified in the Administrative Draft EIR/EIS were delineated and the acreages of the vegetation communities within those subwatersheds were identified and quantified using GIS. Available literature was reviewed to estimate the transpiration rates of the identified vegetation communities in similar arid southwest communities. Transpiration is the process of water vapor loss through the leaves that allows the plant to absorb water from the soil. The transpiration rate is the amount of water loss/uptake as a percentage of available water. Where such studies were not available, studies on other vegetation communities whose conditions were expected to be similar and that align with the conditions in the Risk Areas were used. This information was used to approximate community transpiration rates for those vegetation communities within Risk Areas as a percentage of annual precipitation. Average monthly rainfall totals were identified using data from weather stations closest to the Risk Areas, and average monthly and daily transpiration rates were established for the vegetation community. A conservative value for the estimated water demand in acre-feet per year was calculated for the Risk Area, which allowed for a determination of the potential volume of supplemental water that may be needed for response actions in the case of identified effects on vegetation communities.

2.2 Methods

1. Subwatersheds within the Risk Area and the vegetation communities within each subwatershed of the Risk Area were identified (Figure 3.8-D-1), and the acreages of each vegetation community per subwatershed were calculated using GIS.
2. The oak woodland and montane hardwood-conifer communities were the focus of the analysis, as those communities would most likely be affected by disruption in groundwater availability. The other native community—mixed chaparral—is more drought-tolerant than the two woodland communities and would not be as affected by disruption in groundwater availability.
3. A search was conducted for transpiration rate studies conducted for southern California vegetation communities similar to those that occur in the project alignment, but relevant information was not available. One paper by Folliott et al. (2008), “Transpiration of Oak Trees in the Oak Savannahs of the Southwest Borderlands Region,” provided information for a study of transpiration rates for mature oak woodlands that was conducted in southwestern New Mexico, an area that generally aligned with the conditions in the Risk Area. This information was used to approximate the oak woodland and montane hardwood-conifer community transpiration rates in the Risk Area, which are expected to be the most sensitive to precipitation levels of the vegetation communities identified within this Risk Area, further described below. Folliott et al. found that transpiration rates of mature oak woodland communities are approximately 50 percent of annual precipitation.
4. Information regarding average monthly rainfall totals for between 1932 and 2016 in the Big Tujunga Dam (closest weather station to the High-Risk Area) was collected.
   a. Annual precipitation at Big Tujunga Dam = 26.73 inches.
   b. Using the monthly rainfall totals and the transpiration rate of oak woodland, the estimated transpiration amounts of oak woodland and montane hardwood-conifer will be 13.36 inches per year (50 percent of annual precipitation). From this, the daily transpiration rates were also calculated, shown in Table 1.
   c. Table 1 breaks down the rainfall amounts per month, transpiration rates per month, and transpiration amounts per day (in inches).

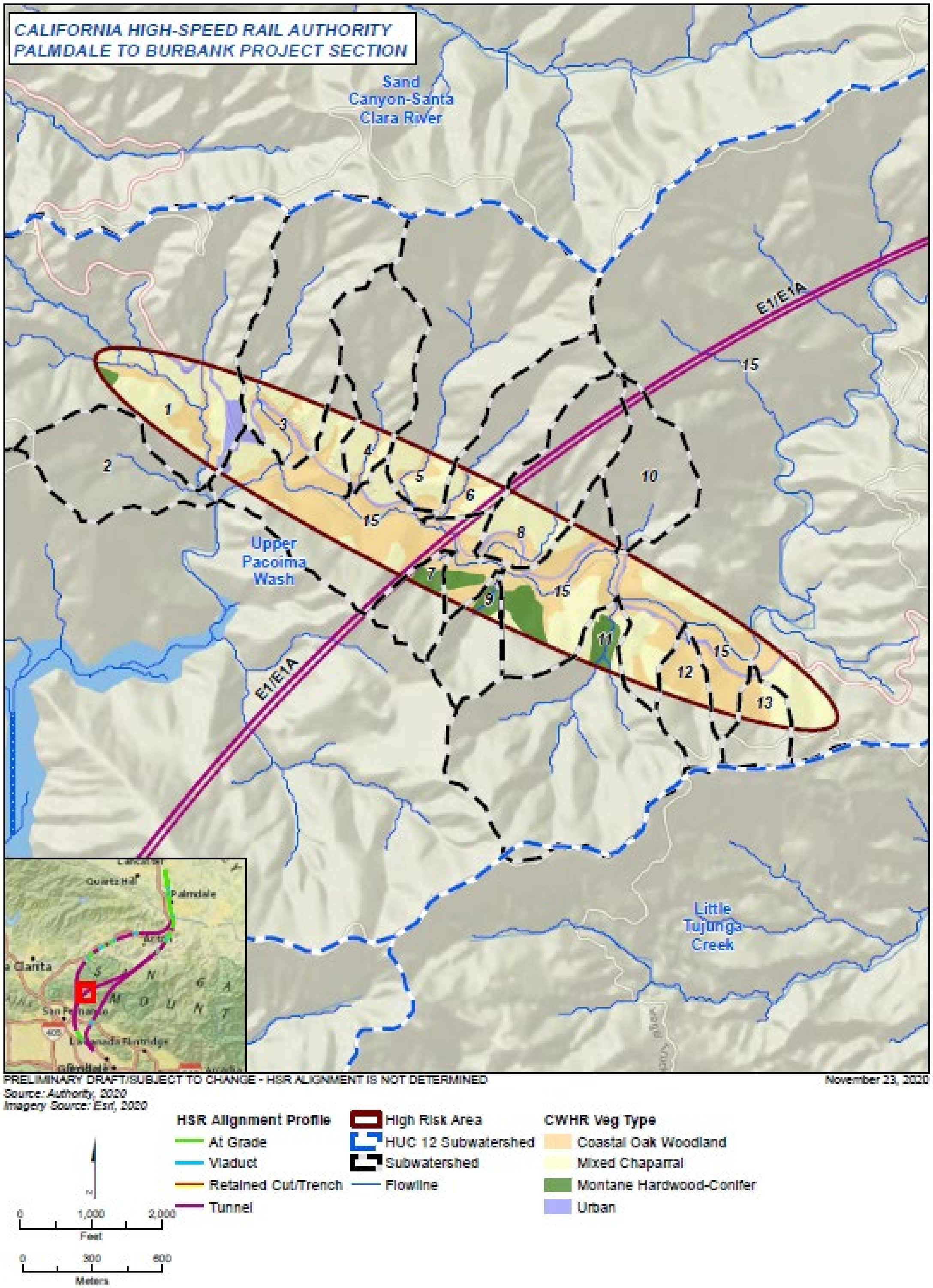

Figure 3.8-D-1 Subwatershed Impacts – Sample Risk Area

Table 1 Annual Precipitation at Big Tujunga Dam and Estimated Transpiration Rates of Oak Woodland

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Precipitation/ month[1]	5.55[3]	6.08	4.61	1.86	0.56	0.09	0.03	0.13	0.36	0.85	2.55	4.06	**26.73**
Transpiration/ month[2]	2.78	3.04	2.30	0.93	0.28	0.04	0.01	0.07	0.18	0.43	1.27	2.03	**13.36**
Transpiration/ day	0.09	0.11	0.07	0.03	0.01	0.00	0.00	0.00	0.01	0.01	0.04	0.07	**--**

[1]Precipitation totals came from the Big Tujunga Dam, which is in the southern part of the study area. Rainfall totals were inferred at the High Risk Areas based on these amounts. *Source: Western Regional Climate Center, 2020.*
[2]Estimated transpiration rates are estimated at 50% of annual precipitation.
[3]Quantities shown are in inches.

5. Using the information in Table 1, the following formula was used to determine the number of gallons per day for each subwatershed within Figure 3.8-D-1 per month.
    a. [(X*Y)*A] = W

       X = # acres of oak woodland and montane hardwood-conifer in subwatershed

       Y = # inches of transpiration per day per month

       A = 27,154.25 gallons (1 acre-inch of water)

       W = # gallons of water per day per watershed
    b. Using these totals, the total amount of gallons per month and per year, by subwatershed were calculated (W*#days in month) = gallons of water per month per subwatershed.
    c. The sum of the monthly totals provided the number of gallons of water per year per subwatershed.
    d. The sum of the monthly totals divided by 365 days provided the average number of gallons per day per subwatershed.
    e. Example for Subwatershed 1 (beginning with January):
        – (Coastal oak woodland = 13.3 acres + Montane Hardwood-Conifer = 1.2 acres) = 14.5 acres.
        – (14.5 acres*0.09 inches/day) = 1.305 acre inch/day *27,154.25 = 35,436 gallons/day (in January)
        – 35,436*31 = 1,098,516 gallons for January
        – Repeat for all other months
        – 5,209,136 gallons per year / 365 days = 14,272 gallons of water per day

Table 2 shows the number of gallons per day and per year for each subwatershed identified in Figure 3.8-D-2 along with the average number of gallons per day per subwatershed. The estimate for the entire Risk Area for oak woodlands and montane hardwood-conifer communities is 70,053,892 gallons of water per year, or approximately 191,928 gallons of water per day.

Table 2 Estimated Number of Gallons of Water per Day for Each Subwatershed and For Each Month

Subwatershed[1]	1	3	4	5	6	7	8	9	10	11	12	13	15
Acres in subwatershed[2]	14.5	8.1	2.7	5.6	3.3	4.4	6.8	3.9	0.1	6.3	9.8	5.1	124.4
January (gallons/day)	35,436	19,795	6,598	13,686	8,065	10,753	16,618	9,531	244	15,396	23,950	12,464	304,019
February	43,311	24,194	8,065	16,727	9,857	13,143	20,311	11,649	299	18,818	29,272	15,234	371,579
March	27,562	15,396	5,132	10,644	6,273	8,364	12,925	7,413	190	11,975	18,628	9,694	236,459
April	11,812	6,598	2,199	4,562	2,688	3,584	5,539	3,177	81	5,132	7,983	4,155	101,340
May	3,937	2,199	733	1,521	896	1,195	1,846	1,059	27	1,711	2,661	1,385	33,780
June–August	0	0	0	0	0	0	0	0	0	0	0	0	0
September	3,937	2,199	733	1,521	896	1,195	1,846	1,059	27	1,711	2,661	1,385	33,780
October	3,937	2,199	733	1,521	896	1,195	1,846	1,059	27	1,711	2,661	1,385	33,780
November	15,749	8,798	2,933	6,083	3,584	4,779	7,386	4,236	109	6,843	10,644	5,539	135,120
December	27,562	15,396	5,132	10,644	6,273	8,364	12,925	7,413	190	11,975	18,628	9,694	236,459
Gallons/year	5,209,136	2,909,931	969,977	2,011,804	1,185,527	1,580,703	2,442,905	1,401,078	35,925	2,263,280	3,520,657	1,832,179	44,690,791
Average gallons/day[3]	14,272	7,972	2,657	5,512	3,248	4,331	6,693	3,839	98	6,201	9,646	5,020	122,441

[1] Subwatersheds 2 and 14 do not occur in Figure 3.8-D-1.
[2] Acres of oak woodland and montane hardwood-conifer in subwatershed.
[3] Daily average is for comparison between subwatersheds. Monthly daily requirements should be followed as they more accurately show how the daily water requirements change throughout the year.

Using this approach and methodology, examples of supplemental water volumes have been calculated for two High Risk Areas ranging in size—High Risk Areas E1/E1A-4 and E2/E2A-4 (Figure 3.8-D-2)—to demonstrate the range of water supply that may be required.

Table 3 shows estimated supplemental water volumes that may be needed for the two High Risk Area examples.

Table 3 Estimated Water Demand for Supplemental Water at Two High Risk Areas within the Angeles National Forest

Subsection	Estimated Water Demand	
	acre-feet/year	gallons/year
E1/E1A		
E1/E1A-4	215.00	70,053,892.00
With 10% contingency	236.50	77,059,281.20
E2/E2A (includes areas within the SGMNM)		
E2/E2A-4	1.98	646,651.00
With 10% contingency	2.18	711,316.10

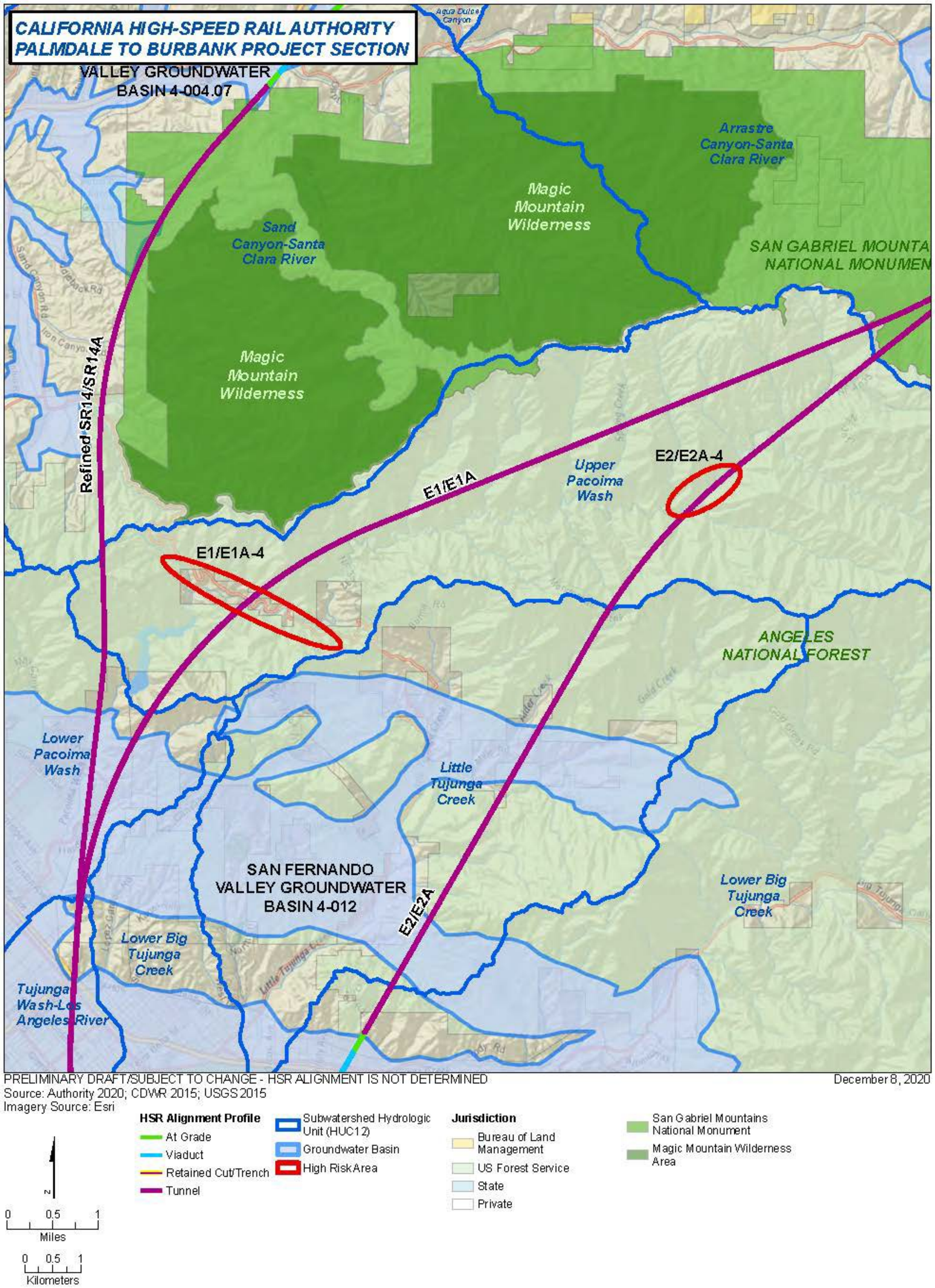

Figure 3.8-D-2 High Risk Areas

3 POTENTIAL SOURCES OF SUPPLEMENTAL WATER

This section assesses various potential sources of supplemental water to determine their practicability. Among other things, sources of supplemental water must have the capacity to provide quantities of water as determined by the supplemental water demand analysis and the quality and water chemistry of the water must be compatible with the naturally occurring water at a specific location. Three options are considered below as potential sources of supplemental water.

3.1 Existing Regional Water Supply Infrastructure and Facilities

Water required for the construction or operation of the portion of the project in the Central Subsection, regardless of the alternative, is reasonably assumed to be provided by agencies such as wholesale water and retail domestic potable water agencies that serve the area (Table 4). None of this water would be drawn from natural water sources in the ANF. The water demand analysis prepared for project construction and operation does not take into account the potential need for supplemental water to address hydrologic impacts within the ANF, as discussed in the AMMP and this analysis.

Without construction of the high-speed rail project, water providers predict that sufficient water supplies would be available to meet demands in 2020, assuming normal water year conditions. However, in the event of single or multiple dry year conditions, demands would exceed supplies in 2020 (Table 5). Additional water supplies would be needed to meet demands under such conditions, with or without construction of the project. Without the allocation of additional water during dry years there may not be water supplies available from these providers for AMMP purposes.

Water for construction would be delivered by domestic and wholesale providers to construction sites (primarily portal and adit locations) via pipelines that would be constructed as part of the project. These pipelines have been incorporated into the project footprint and have been evaluated in the impact analysis (See various Admin Draft EIR/EIS chapters). Many of the portal and adit locations where domestic and wholesale water supplies would be piped in for construction are either within or near the ANF and SGMNM. These sources would be relatively close to Risk Areas that may require supplemental water pursuant to the AMMP.

Table 4 Water Distributors and Suppliers in the Central Subsection and Maintenance Facility Resource Study Area

Water Agency	Agency Activity					Sources of Water Supply	Service Area (square mile)	Average Daily Demand (mgd)	Maximum Day Demand (mgd)	Average Annual Demand (ac-ft/yr)	Applicable Subsections
	Retail Domestic Potable Water	Wholesale Water	Water Treatment	Recycled Water	Groundwater Management						
Antelope Valley-East Kern Water Agency		X	X			▪ State Water Project	2,300	47.6	83.3	56,400	Central Subsection (all Six Build Alternatives)
Castaic Lake Water Agency		X	X	X		▪ State Water Project	195	38.0	67.0	45,000	Central Subsection (Refined SR14/SR14A Build Alternative)
Santa Clarita Water Division	X				X	▪ Castaic Lake Water Agency ▪ Saugus Formation and Alluvial Aquifer ▪ Buena Vista Water Storage	50	12.6	24.9	24,558	Central Subsection (Refined SR14/SR14A Build Alternative)
Los Angeles County Waterworks District 37, Acton	X		X	X	X	▪ Metropolitan Water District ▪ Los Angeles Aqueduct ▪ Central Basin	473	N/A	N/A	659,000	Central Subsection (all Six Build Alternatives)

Water Agency	Agency Activity					Sources of Water Supply	Service Area (square mile)	Average Daily Demand (mgd)	Maximum Day Demand (mgd)	Average Annual Demand (ac-ft/yr)	Applicable Subsections
	Retail Domestic Potable Water	Wholesale Water	Water Treatment	Recycled Water	Groundwater Management						
Los Angeles County Waterworks District 40, Lancaster	X			X	X	▪ Antelope Valley-East Kern Water Agency ▪ Antelope Valley Basin ▪ Colorado River Aqueduct	660	N/A	N/A	2,402	Maintenance Facility (all Six Build Alternatives)

Sources: Antelope Valley-East Kern Water Agency, *2016; Santa Clarita Valley Family of Water Suppliers, Maddaus Water Management, and Western Policy Research, 2015; Los Angeles Department of Public Works, 2015; Los Angeles Department of Public Works, 2017*

Los Angeles County Waterworks District 40, Lancaster would be used for both construction-period and operation demand. Antelope Valley-East Kern Water Agency would be used for construction only.

ac-ft/yr = acre-feet per year; mgd = million gallons per day; N/A = not applicable

Table 5 Estimated Construction Phase Water Demand Summary – Central Subsection and Maintenance Facility area

Water Providers	Water Supply – Normal Water Year 2020 (ac-ft/yr)	Water Supply – Single Dry Year 2020 (ac-ft/yr)	Water Supply – Multiple Dry Years 2020 (ac-ft/yr)	Predicted Annual Demand 2020 (ac-ft/yr)	Construction Water Demand (ac-ft/yr)
Central Subsection					
Antelope Valley-East Kern Water Agency	89,010	46,750	74,350	83,670	Refined SR14/SR14A: 928/1,266 E1/E1A: 743/1,064 E2/E2A: 498/840
Maintenance Facility[1]					
Los Angeles County Water District 40, Lancaster	110,090	96,490	96,490	96,490	N/A

Sources: Antelope Valley-East Kern Water Agency, 2016; Authority, 2017; Los Angeles County Waterworks Districts, 2017
[1] Water demand estimates for the construction of the Maintenance Facility would be determined during a later stage in the design process.
ac-ft/yr = acre-feet per year

3.2 Recycled Construction Water

Recycled construction water would be a potential source of supplemental water for AMMP purposes. The volume of water that may be needed for tunnel construction under the ANF would be determined using the water requirements for construction that were estimated in the Tunnel Design and Construction Report. As an example, the volume of water necessary for construction of the SR14A and Refined SR14 Build Alternative alignment has been estimated as a total of 193,680,000 gallons for the entire construction period. It is assumed that between 10 and 20 percent of the water supply used during construction would return to the portal and be treated for reuse. The portals associated with the tunnels under the ANF are located near or within the boundaries of the ANF and SGMNM, which would provide a convenient and relatively close source of water for AMMP purposes.

Any potential secondary use or discharge of this water must be preceded by water treatment for conditions such as hydrocarbon separation, settling of solids, and PH neutralization. After treatment, the recycled construction water could be used as supplemental water to meet AMMP needs.

3.3 Dedicated Water Supply Wells

An additional potential source of supplemental water for AMMP purposes could be groundwater derived from dedicated water well(s). To be suitable for supplementing surface water, the quantity of water would need to be sufficient to meet the calculated supplement water demand without interruption. The quality of the water would also need to be consistent with the natural water chemistry of the application area.

In order to best match the quantity and quality requirements for supplemental water needs, the dedicated well should be located within the groundwater basin associated with the watershed of the affected Risk Area. For example, the watersheds containing the High Risk Areas identified in the Admin Draft EIR/EIS ultimately drain into two alluvial groundwater basins—the Santa Clara River Valley Groundwater Basin and the San Fernando Valley Groundwater Basin. Table 6 identifies the High Risk Areas identified in the Administrative Draft EIR/EIS and their associated ground water basin(s). For maintaining water quality and natural recharge into each of the basins, dedicated water supply wells should be constructed in one or both of the two basins, depending on the location of the affected area in the upstream watershed.

Table 6 Risk Areas and Associated Groundwater Basins

Alignment	High Risk Area No.	Basin Name
Refined SR14/SR14A	4	Santa Clara River Valley Groundwater Basin 4-4.07 and San Fernando Valley Groundwater Basin 4-12
E1/E1A	2, 4	San Fernando Valley Groundwater Basin 4-12
E2/E2A	2, 4, 5, 6, 7, 8	San Fernando Valley Groundwater Basin 4-12

For practical purposes of filling tanks or water trucks, or pumping via a pipeline, a production well would need to produce several hundred gallons of water per minute. Most of the bedrock wells in the vicinity of the tunnel alignments are low yield wells for private uses and are not capable of producing the quantity of water needed for supplementing affected surface water resources. A large yielding well would need to be in an alluvial groundwater basin rather than in bedrock areas. This would likely result in wells being located outside the ANF and likely at a greater distance from the potentially affected areas than the other sources of water discussed above.

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4 ACCESS AND INFRASTRUCTURE FOR CONVEYANCE AND TRANSPORT OF SUPPLEMENTAL WATER

The supplemental water needed for AMMP purposes would need to be transported to the affected site for application. Delivery of water could occur through different methods, depending on quantity, location of water source, and location of the affected area. As a result, the method of conveyance or transport would be specific to each affected area.

Notwithstanding the above, and because most of the potential water sources identified are either within or close to the ANF, conveyance or transport of supplemental water to an affected Risk Area would likely involve either water truck service or pumps and pipelines. Selection of the appropriate method of delivery would require consideration of the following factors:

- Volume of water to be delivered
- Frequency in which the water would need to be applied or discharged
- Distance between the source and application area
- Existing infrastructure between the water source and application area (e.g., existing roads, utility corridors)
- Location, topography, and accessibility of the affected site

The volume of water needed pursuant to the AMMP may dictate whether the use of water trucks to deliver water would be adequate or whether conveyance through pipelines would be required.

To illustrate how the factors listed above would be applied to determine appropriate conveyance and transport methods, specific method(s) have been evaluated for Risk Areas E1/E1A High Risk Area 4 and E2/E2A High Risk Area 4. These sites provide two scenarios that illustrate how water may be delivered under different circumstances such as size, location, and accessibility (Figure 3.8-D-2). E1/E1A High Risk Area 4 is approximately 366.4 acres and 11,500 feet at the length of the centerline. It is easily accessible via Little Tujunga Road, a paved two-lane road that generally travels through the center of the entire Risk Area and can be accessed from main roads and freeways in the cities of Santa Clarita, Newhall, and Sylmar. The volume of supplemental water estimated for this area is very large and would require an average of 27 water truck trips per day (Table 7). This amount of truck trips is not feasible. As such, the conveyance method most suitable for this location and amount of water necessary would be via a pipeline from the nearby adit entrances, which are within and adjacent to the Risk Area and are approximately 500 and 620 linear feet from Little Tujunga Canyon Road (at the most direct connection), respectively. Constructing a water pipeline along this existing road would have minimal impact, not requiring substantial removal of vegetation, grading, or other substantially disruptive construction activities. Water tanks and irrigation systems could be established at specific locations along the road to facilitate application to the affected areas.

E2/E2A High Risk Area 4 is approximately 171.8 acres and 4,800 feet at the length of the centerline; this Risk Area may be partially accessible by the unpaved and unmaintained Pacoima Road, which is only accessible by Forest Service roads. The volume of supplemental water estimated for this Risk Area (Table 7) could be transported using less than one to two water truck trips per day. The closest water source locations would be from Intermediate Window IW2 or from Portal 4. At both of these locations, the project would be constructing pipelines to bring municipal or wholesale water for construction purposes. Portal 4 would also be a potential source for recycled water from construction. Given the volume of supplemental water potentially needed for this Risk Area and its remote location, trucking water to the Risk Area is most feasible. Access to the limits of E2/E2A-4 from the nearby Intermediate Window IW2 or from Portal 4 would consist of an approximately 24-mile or 31-mile one-way drive, made up of approximately 16 miles on Forest Service roads and an additional 9 and 15 miles on paved or urban roads, respectively, per visit.

A water tank and irrigation systems could be established near the Risk Area to facilitate application to the affected areas. The water would be trucked to the site at a frequency that would have minimal impact. Installation of water tank in irrigation systems at the risk site would likely have minimal effects, such as those caused by minor grading and brush removal.

Table 7 Water Truck Needs and Accessibility for Example Risk Areas

Subsection	Estimated Water Demand (ac-ft/yr)[1]	Approximate Number of Trucks/Day to Meet Annual Water Demand[2]	Proximity of Closest Known Usable Road to Risk Area
E1/E1A			
E1/E1A-4	236.50	27[3]	Little Tujunga Canyon Road (a paved two-lane road) travels generally through the center for the length of the Risk Area.
E2/E2A			
E2/E2A-4	2.18	<1–2	May be accessible by Pacoima Road (an unpaved and unmaintained road) that may extend through the northeastern two-thirds of the Risk Area. Pacoima Road is only accessible by Forest Service roads.

[1] Includes 10% contingency
[2] Assumes water truck with 8,000-gallon capacity per trip.
[3] For E1/E1A-4, the amount of trucks/day needed to meet the annual water demand would be a considerable. In this case, a pipe to direct water to the area would be more appropriate.

5 REFERENCES

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