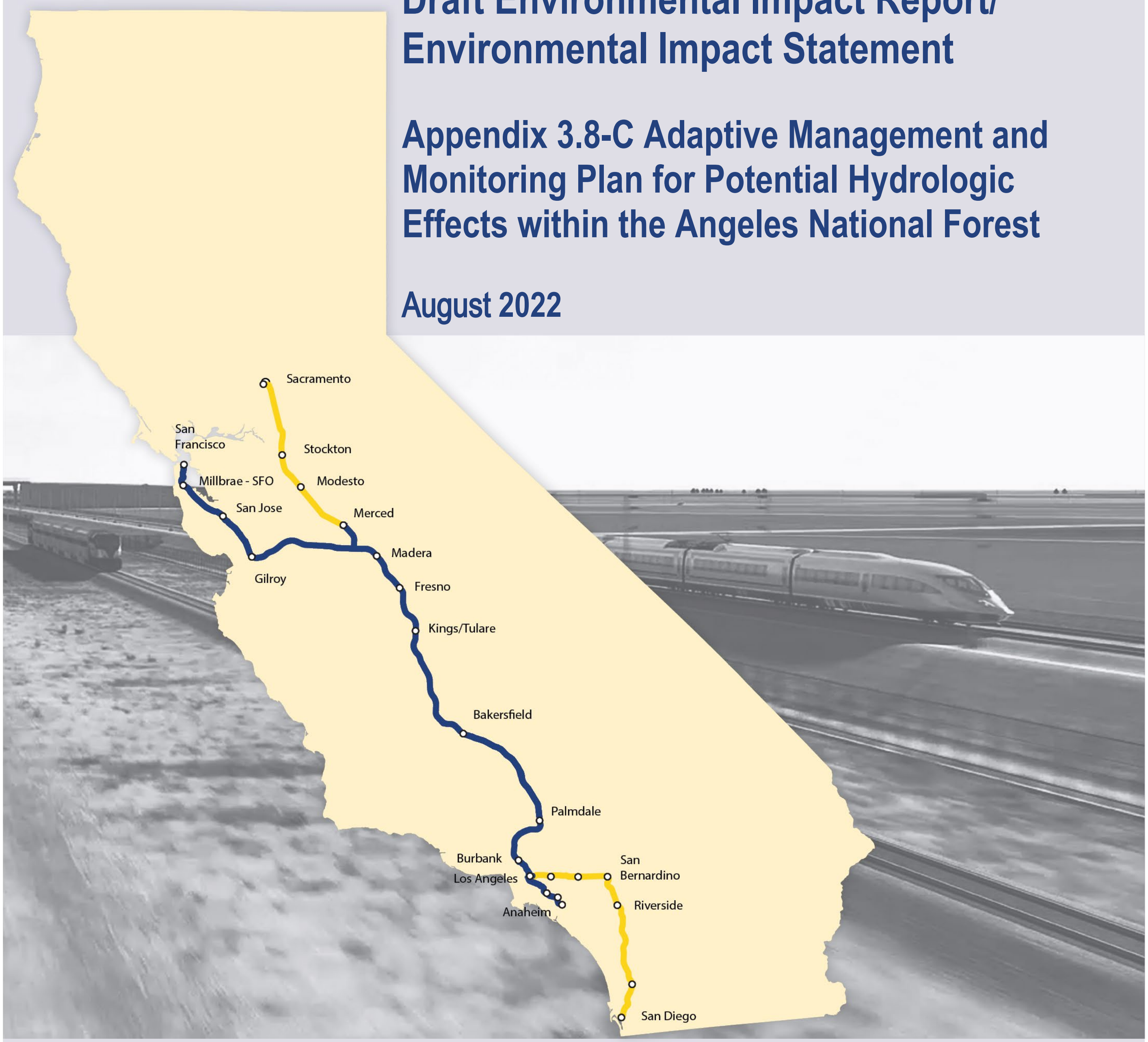
California High-Speed Rail Authority

Palmdale to Burbank Project Section

Draft Environmental Impact Report/ Environmental Impact Statement

Appendix 3.8-C Adaptive Management and Monitoring Plan for Potential Hydrologic Effects within the Angeles National Forest

August 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

3-D	three-dimensional
AMMP	Adaptive Management and Monitoring Plan
ANF	Angeles National Forest
Authority	California High Speed Rail Authority
HSR	High Speed Rail
RSA	Resource Study Area
TEPCS	threatened, endangered, proposed, candidate or sensitive
USFS	U.S. Forest Service

1 INTRODUCTION

The California High Speed Rail Authority (Authority) will implement an Adaptive Management and Monitoring Plan (AMMP) pursuant to mitigation measures HYD-MM#4 and BIO-MM#93 to detect and address adverse changes to subsurface and surface water resources within the Angeles National Forest (ANF), including the San Gabriel Mountains National Monument (SGMNM), that could occur during and after construction of the High Speed Rail (HSR) tunnels for the Preferred Alternative. The purpose of the AMMP is to ensure that adverse effects on subsurface and surface water resources and associated habitat within the ANF caused by tunnel construction activities are identified and that appropriate responses to address those effects are expeditiously implemented. The Authority anticipates that the actions described in this AMMP would provide for timely detection of hydrological changes and implementation of appropriate remediation, if necessary. This AMMP involves a multi-step iterative process to comply with U.S. Forest Service (USFS) standards. The AMMP will be implemented for the Preferred Alternative prior to and during construction, and for a period of 10 years after completion of the portion of the Palmdale to Burbank Project Section within the ANF.

The AMMP advances a flexible strategy to respond to monitoring information that indicates tunnel construction is causing changes to existing hydrologic conditions. The AMMP includes metrics related to hydrologic and biological resources that will be monitored within the ANF to measure compliance with USFS standards identified in the USFS Land Management Plan for Southern California National Forests (USFS 2005). If monitoring of such resources indicates adverse hydrologic effects resulting from tunnel construction activities, response actions will be taken to remedy those effects. Ongoing monitoring would be conducted to measure the effectiveness of the response actions and determine if additional actions are necessary. In addition, if monitoring demonstrates that responsive actions taken to address such changes are not achieving the intended outcomes, the response actions would be modified, or other strategies implemented, to meet the objectives. Implementation of the AMMP will involve a multi-step iterative process, as follows:

1. Evaluate and adopt monitoring and response metrics that are informed by the USFS Standards outlined in the Land Management Plan for Southern California National Forests.
2. Continue existing monitoring (as described in Authority (2020) and conduct more extensive pre-construction monitoring to develop baseline data.
3. Conduct construction monitoring using adopted metrics to assess whether tunnel construction is causing hydrologic changes that are inconsistent with USFS standards.
4. Implement response action(s) to remediate effects and reestablish approximate baseline conditions.
5. Monitor effectiveness of response actions.
6. Evaluate monitoring data to determine if response actions need to be adjusted or if additional response actions are required.

2 STANDARDS FROM THE USFS LAND MANAGEMENT PLAN FOR THE SOUTHERN CALIFORNIA NATIONAL FORESTS

The USFS manages the natural resources of the southern California national forests pursuant to the USFS Land Management Plan for the Southern California National Forests, which was published in 2005. The Land Management Plan consists of three parts: Part 1: Southern California National Forests Vision; Part 2: Angeles National Forest Strategy; and Part 3: Design Criteria for the Southern California National Forests (USFS 2005). In addition, the Land Management Plan has been subject to multiple amendments and revisions since 2005, including the addition of the San Gabriel Mountains National Monument to the Land Management Plan in 2019.

Part 3 of the Land Management Plan contains the standards and guidelines applicable to tunnel construction. They include standards legally required in 36 CFR 219.15(d) and other standards "that are required for sustainable forest management" (USFS 2005). Construction and operations of tunnels is discussed under Soil, Water, Riparian and Heritage Standards 45 and 47 and Fish and Wildlife Standard 11.

2.1 USFS Soil, Water, Riparian and Heritage Standard 45

USFS Standard 45 establishes that activities on USFS land must minimize adverse effects on groundwater (USFS 2005). Standard 45 states: "All construction, reconstruction, operation and maintenance of tunnels on National Forest System lands shall use practices that minimize adverse effects on groundwater aquifers and their surface expressions."

- Authority Objectives Regarding Standard 45:
  - Maintain the minimum baseline range of flows of springs and streams and measured groundwater levels (i.e., measured pressures) within documented seasonal parameters.
  - Maintain minimum baseline spring and stream flows to maintain surface water conditions substantially similar to flows documented during monitoring that support existing habitats and wildlife species.

2.2 USFS Soil, Water, Riparian and Heritage Standard 47

USFS Standard 47 establishes goals for protecting riparian resources (USFS 2005). Standard 47 states: "When designing new projects in riparian areas, apply the Five-Step Project Screening Process for Riparian Conservation Areas as described in Appendix E- Five-Step Project Screening Process for Riparian Conservation Areas." The five-step process described in Appendix E of the LMP is used to ensure that USFS riparian conservation areas (RCAs) are recognized and managed appropriately (e.g., protected, maintained, or restored) during project planning and implementation. Changes in hydrologic conditions caused by tunnel construction may adversely affect riparian resources dependent on groundwater.

- Authority Objective Regarding Standard 47:
  - To ensure that adverse changes in riparian resource values caused by tunnel construction are detected, monitored, and quantified and that response actions are implemented in a timely manner.

2.3 USFS Fish and Wildlife Standard 11

USFS Standard 11 establishes the goals of protecting the habitat and wellbeing of special-status species within USFS lands (USFS 2005). Standard 11 states: "When occupied or suitable habitat for a threatened, endangered, proposed, candidate or sensitive (TEPCS) species is present on an ongoing or proposed project site, consider species guidance documents to develop project-specific or activity-specific design criteria. This guidance is intended to provide a range of possible conservation measures that may be selectively applied during site-specific planning to avoid, minimize, or mitigate negative long-term effects on threatened, endangered, proposed, candidate, or sensitive species and habitat. Involve appropriate resource specialists in the identification of relevant design criteria and appropriate species lists. Include review of species guidance documents in fire suppression or other emergency actions when and to the extent practicable." Changes in hydrologic conditions caused by tunnel construction could result in impacts on special status species dependent on such groundwater.

- Authority Objective Regarding Standard 11:
  - To ensure that adverse changes to habitat supporting TEPCS species caused by tunnel construction are detected, monitored, and quantified and that actions are implemented to avoid, minimize, and mitigate adverse effects.

3 MONITORING

This section describes current monitoring activities and the supplemental monitoring that will be conducted before, during, and after project construction. The monitoring described below will be applied to the Tunnel Construction Resource Study Area (RSA) for the Preferred Alternative within the ANF with particular focus on High-Risk areas as identified in Chapter 3.8 of the EIR/EIS.[1] Selected areas outside the Tunnel Construction RSA will also be monitored as paired control sites to ensure that hydrologic changes attributable to tunnel construction can be detected in a timely manner. These sites are not expected to experience any effects from tunnel construction.

3.1 Development of Effects Indicators for Monitoring

Quantitative triggers that signal the onset of effects on surface water resources and groundwater levels are necessary to determine when and what type of adaptive management measures should be implemented. To account for regional, seasonal, annual, biological, or other factors unrelated to tunnel construction that may cause changes and fluctuations in conditions that may be observed in monitoring data, those potential indicators will be established based on baseline and control site data for each of the USFS standards. Prior to the initiation of tunnel construction, the pre-construction and baseline data will be analyzed using standard statistical approaches, where feasible, to identify a statistically significant value or percent change that will be used to indicate changes in conditions sufficient to warrant an adaptive response. Established metrics will reflect annual, seasonal, or regional factors that may influence changing conditions. Metrics for which specific thresholds or values will be defined are listed in Table 1.

Table 1 Metrics for Potential Effects Indicators

Resource	Monitoring Metric Measurement*
USFS Standard 45	
Water level (i.e. measured pressure)	Reduction below lowest documented pressure in the piezometer pressure database from the previous year
USFS Standards 47 and 11	
Groundwater-dependent plants vegetation community	20% reduction in overall percent cover
	20% reduction in or loss of herbaceous species
	Transition of riparian species to upland species
	Increased signs of stress in oak and other tree species (e.g., browning of leaves, signs of disease)

* Measured against baseline values or associated statistical analysis results.

3.1.1 Existing Monitoring

Current monitoring activities include quarterly (i.e., 3-month intervals) data collection (flows, field measurements, and water quality) at selected springs and downloading of pressure readings from data loggers at six geotechnical drill sites:

7. Monitoring 16 known springs established for the quarterly monitoring program, including National Hydrography Database numbers 27688566, 27688588, 27688568, 27688652, 27688572, 27688574, 27688576, 27688590, 27688582, 27688580, 27688578, 27688584, 27107113, 27087305, 27688564, and unnamed spring in Indian Canyon (U.S. Geological Survey 2016).

[1] The methodology for identifying risk areas within the Tunnel Construction RSA is described in Section 3.8 of the EIR/EIS.

8. Quarterly downloads of water pressure data using data loggers (6 readings per day) at geotechnical core holes FS-B1, E1- B1, E1-B2, Alt-B2, Alt-B3, and C-1.
9. Testing water quality of selected 16 springs to compare with past water quality test results and to help establish baseline conditions. Field parameters consist of measuring dissolved oxygen, electrical conductivity, pH, oxidation-reduction potential, temperature, and turbidity. Laboratory testing includes total hardness, calcium, magnesium, sodium, potassium, total alkalinity, hydroxide, carbonate, bicarbonate, chloride, sulfate, nitrate as nitrogen, fluoride, nitrite as nitrogen, and Title 22 metals (i.e., mercury, antimony, arsenic, barium, beryllium, cadmium, total chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc).

Water resources identification and monitoring is being conducted as part of preliminary geotechnical investigations for use in conceptual design of three potential tunnel alignments: E1/E1A, E2/E2A, and Refined SR14/SR14A. The database developed through 2020 provides information on seasonal changes of groundwater and springs in the general vicinity of the proposed tunnel alignments through the ANF.

3.1.2 Pre-Construction Monitoring

Ongoing water resources monitoring activities will be expanded beyond the existing quarterly monitoring program after the approval by the Authority of a Preferred Alternative. These supplemental monitoring activities will be necessary to establish baseline conditions within the RSA and particularly High-Risk areas identified within the RSA, with seasonal changes to aquatic resources documented at each monitoring site prior to construction. The documentation of baseline conditions for each monitoring site will provide the basis for determinations of changes to aquatic resource conditions that may occur during the construction phase of the project.

The following actions will be implemented as part of ongoing and supplemental monitoring:

1. Continue monitoring existing network of springs and core hole data loggers established for feasibility and preliminary design of tunnels beneath the ANF but increase frequency to monthly monitoring to capture data between previous quarterly monitoring.
2. Expand the network of groundwater monitoring sites within the Tunnel Construction RSA by adding alignment-specific geotechnical borings fitted with VWPT instrumentation.
3. Continue downloading data from data loggers at groundwater monitoring sites outside of the Tunnel Construction RSA for the purpose of establishing baseline conditions at paired control sites.
4. Identify surface water resources (e.g., watersheds, streams, recharge areas, springs/seeps) within the tunnel construction RSA for the Preferred Alternative baseline data development.
5. Select paired drainages outside of the RSA with water resources similar to watershed conditions in the project area. Drainages may or may not be within the same watershed.
6. Select surface water resources (springs and streams), including those within the Tunnel Construction RSA, for monitoring before tunnel construction.
7. Test water quality of selected springs and streams to establish baseline conditions.
8. Establish baseline conditions for ranges of flow rates of springs and streams including supplemental monitoring.
9. Consider diurnal influences on measured fluctuations. Diurnal effects can cause significant fluctuations due to changes in temperature, humidity, and evapotranspiration rates during the day. Incorporate results of diurnal influence into baseline conditions.
10. Modify monitoring frequency, as needed.
11. Build a three-dimensional (3-D) surface-water/groundwater model calibrated with collected baseline data, including structural geology (e.g., faults and fracture trends). The 3-D

groundwater model will be used for estimating changes to baseline conditions caused by the construction of the tunnels and for estimating the time duration for recovery to baseline conditions after tunnel construction.

   a. Inputs: Precipitation gaging, groundwater elevations (pressures, wells), historical rainfall and temperature data, evapotranspiration gaging, spring and stream flow rates, and surface water outflow.
   b. Outputs: Changes to baseline conditions that could be caused by tunnel construction and estimate the duration of recovery to baseline conditions.

12. Reviewing well completion reports associated with public and private water supply wells (if available) in the vicinity of the proposed tunnels and any relevant hydrology data from gaging stations on creeks in the project vicinity. Additional well analysis will include general characteristics (e.g., age of well, depth of pump and screen, production capacity, water level, water flow, water quality, use of water) and locations of private water supply wells, where available.
13. Establish typical responses of water resources to seasonal changes and historical weather fluctuations. The ranges of monitoring measurements documented during the pre-construction monitoring period will be used to establish baseline ranges for each monitoring site.

Monitoring will be conducted to identify riparian resource baseline conditions that will be monitored to evaluate potential effects during and after tunnel construction. This will include establishing criteria or triggers for enacting response actions and adaptively managing response actions.

Pre-construction monitoring will include the following activities:

1. Establish monitoring plots for riparian habitat at all springs and intermittent and perennial streams within the Tunnel Construction RSA.
2. Establish riparian habitat plots outside the Tunnel Construction RSA to serve as control sites for comparative purposes.
3. Establish monitoring plots using ANF standard forest inventory guidelines for baseline data collection and monitoring.
4. Collect baseline data on selected riparian resource features, including a modified stream condition inventory of the extent of riparian vegetation (including structural diversity and seral stages) and aquatic or riparian faunal diversity. Anticipated baseline data collection will use the California Stream Condition Index scoring system to obtain data that can be compared to each study site.

Develop a monitoring and reporting program to identify pre-construction TEPCS and non-TEPCS resource baseline conditions that can be compared to potential effects during and after construction. Non-TEPCS species have been included in the monitoring program because data for populations of more common species can be collected more readily and may reflect effects from changes in surface and groundwater sources earlier than data collected from TEPCS species that are expected to be less likely to be present.

1. Identify TEPCS and non-TEPCS species and habitat with the potential to occur and likely to be present within the Tunnel Construction RSA.
2. Select associated habitat study plots within the Tunnel Construction RSA.
3. Select habitat study plots outside the Tunnel Construction RSA to serve as control sites for comparison purposes.
4. Survey lateral/spatial extent of selected TEPCS habitat study plots.
   a. Conduct TEPCS habitat assessments and focused plant surveys.

   b. Conduct surveys for selected groundwater-dependent TEPCS species based on the presence of suitable habitat (e.g., arroyo chub, Santa Ana speckled dace, California red-legged frog, arroyo toad, two-striped garter snake, southwestern willow flycatcher, least Bell's vireo, western red bat, and pallid bat).

5. Survey lateral/spatial extent of selected non-TEPCS habitat study plots.
   a. Conduct non-TEPCS habitat assessments and focused plant surveys.
   b. Conduct surveys for selected groundwater dependent non-TEPCS species based on the presence of suitable habitat (e.g., freshwater invertebrates, water skippers, Baja California tree frog, western toad, song sparrow, goldfinch, Yuma myotis, and big brown bat).
6. Conduct wildlife surveys bi-annually or annually as appropriate, or as specified below, in project area study plots and in the control study plots. Anticipated surveys include:
   a. Aquatic invertebrate surveys
   b. Amphibian and reptile surveys
   c. Avian point counts (three to four times annually)
   d. Acoustical monitoring to identify sensitive bat species (three to four times annually)

3.2 Construction and Post-Construction Monitoring

Water resources monitoring will continue on a monthly basis or as deemed appropriate, including review of water resources data downloaded from data loggers both inside and outside of the Tunnel Construction RSA (i.e., paired sites and paired watersheds). During construction, if a metric listed in Table 1 is observed, the frequency of monitoring may increase either to weekly or daily depending on the proximity of tunnel construction to each monitoring site and the efficacy of increasing the frequency. The purpose of more frequent monitoring is to capture, in approximate real-time, changes (flow and pressure readings) caused by tunneling construction. Monitoring data collected during construction will be compared to baseline data collected prior to construction.

Water resources monitoring will continue following construction of the HSR tunnels to track recovery or changes to water resources that may have occurred during tunnel construction. The following monitoring actions will be implemented during construction of the tunnels:

1. Continue monitoring existing network of springs and core hole data loggers and streams.
2. Establish a monitoring program to measure water inflow rates within the tunnels (pressure relief valves, leaks, portal water flows, etc.)
3. Test water quality of water inflows into tunnels for comparison to baseline water quality of springs and stream flows. Incorporate water chemistry analysis comparison into 3-D modeling of tunnel water versus surface water resources.
4. Modify and update the 3-D surface-water/groundwater model and calibrate the model with data collected during pre-construction phase. Continue to update and calibrate the 3-D model during tunnel construction, including structural geology (e.g., faults and fracture trends), water pressures, water inflows, water quality, and temporal changes. Use the 3-D model to help predict potential groundwater effects in advance of tunnel construction.
5. Compare changes in water resources and groundwater measurements in Tunnel Construction RSA to changes in paired watershed and paired control sites for groundwater.
6. Establish remotely accessed telemetry system for measuring variations in groundwater pressures and, if possible, in spring/stream flows at monitoring plots to measure surface water variations.
7. Measure groundwater levels (i.e., pressures) to detect any material decreases in those levels that may forewarn of potential effects on surface water flows and available moisture to support vegetation and wildlife communities.

8. Compare minimum flow range of monitored resources to paired control sites outside of construction influence to determine if factors unrelated to tunnel construction are affecting hydrologic conditions (e.g., seasonal changes).
9. Increase frequency of monitoring to daily or weekly as the tunnel boring machine approaches within one-half mile of established monitoring points (piezometers, springs, streams). If effects (e.g., lowering water levels resulting in reduced habitat) are observed, the Authority would implement contingency plans that expand monitoring beyond the representative locations and increase monitoring frequency to capture the extent of potential effects on groundwater-dependent biological resources.
10. Monitor stream flows with recording hydrographs, if practical, to capture diurnal fluctuation.
11. Track groundwater recovery (i.e., pressure transducers, piezometers) after the tunnel boring machine that has passed a pressure transducer location.
12. Continue to monitor water quality of springs and streams using established parameters at each of the monitoring sites. Compare results during construction to baseline conditions from pre-construction monitoring.

The following monitoring activities will continue after tunnel construction to help document continuing changes in water pressure measurements and track recovery of groundwater and surface water conditions to baseline conditions.

1. Continue monitoring groundwater pressures, spring flows, and stream flows during post construction monitoring period.
2. Track spring and stream flow measurements recovery against baseline conditions.
3. Monitor post-construction water pressures (i.e., groundwater levels) to measure and evaluate rates of recovery to baseline conditions after construction impacts, if any. Below-ground pressure measurements will provide early evidence of recovery before surface water measurements.

During and after tunnel construction, riparian resource monitoring will occur on a quarterly basis for all selected riparian resource features. The Authority would determine appropriate monitoring regime in consultation with the USFS.

1. Continue monitoring of existing, previously selected riparian resources.
    a. Continue monitoring typical responses of selected riparian resources to seasonal changes. The range of monitoring measurements documented during the pre-construction monitoring period will establish seasonal baseline ranges for each monitoring site.
    b. Compare pre-construction and post-construction data to identify changes in selected riparian resource features in the Tunnel Construction RSA and paired control sites.
    c. Publish quarterly monitoring memoranda and annual summary reports. Reports will include an analysis of construction and post-construction conditions compared to baseline conditions.

Riparian resource monitoring will include the following components:

1. During construction, and post-construction, monitor riparian conditions to detect changes between baseline data and paired control sites.
    a. Identify species composition in riparian woodlands,
    b. record % cover by riparian species as compared to upland species,
    c. identify the overall health/vigor of riparian trees and herbaceous layer.
2. Wildlife diversity and abundance monitoring will continue for all selected TEPCS and non-TEPCS species and habitats.

a. Continue monitoring of existing, previously selected TEPSC and non-TEPCS species established for expanded monitoring efforts.

b. Continue monitoring typical seasonal responses of selected TEPCS and non-TEPCS species. The ranges of monitoring measurements documented during the pre-construction monitoring period will establish baseline ranges for each monitoring site.

3.3 Effectiveness of Monitoring

The recovery of groundwater and surface water resources will be monitored after tunnel construction. The monitoring will continue until such time that conditions are comparable to the baseline conditions established before construction. Post-action monitoring is anticipated to include the following components:

1. Direct the focus of post-construction monitoring program to areas where impacts on water resources have been documented. Continue such monitoring until such time that the affected resource has fully recovered.
2. Modify and update 3-D surface-water/groundwater model and calibrate it with data collected during tunnel construction, including information regarding structural geology (e.g., faults and fracture trends), water pressures, water inflows, water quality, and temporal changes. Use 3-D surface and groundwater modeling program to help predict rates of recovery for water resources affected during construction.

Riparian resources monitoring will continue after construction of the HSR tunnels to track changes to these resources that may continue after construction. The extent of water losses and changes in riparian resources are not predictable in advance of the tunnel construction, but implementation of the AMMP is intended to monitor and detect hydrological and associated riparian changes within the ANF. Monitoring will continue for 10 years after construction to allow conditions to pass through an average cycle of wet and dry years. If conditions are not comparable to baseline measurements, monitoring will continue as necessary. The duration of monitoring beyond the 10-year timeframe will be mutually agreed to between the USFS and Authority.

TEPCS and non-TEPCS species and wildlife diversity monitoring will continue following construction of the HSR tunnels to track changes to these resources that may occur during tunnel construction or after construction. Monitoring will continue for 10 years after construction to allow conditions to pass through an average cycle of wet and dry years. If conditions are not comparable to baseline measurements, monitoring will continue as necessary. The duration of monitoring beyond the 10-year timeframe will be mutually agreed to between the USFS and Authority.

4 RESPONSE ACTIONS

If adaptive management triggers are reached and response actions are warranted, the Authority will implement appropriate measures, such as actions to arrest or minimize seepage into the tunnels or to compensate for impacts by providing supplemental water as outlined below.

4.1 USFS Standards

Potential actions include increasing monitoring frequency for 3-D hydrogeology model analysis, implementing in-situ grouting programs in the tunnel, and modifying the tunnel boring machine to reduce water inflows. If warranted, additional geotechnical investigations may be implemented during construction to evaluate the extent of the adverse effects and evaluate actions that can more effectively arrest or mitigate water losses. Additional geotechnical investigations could include probe drilling ahead of tunnel boring machine, surface exploratory drilling, or installation of additional monitoring instrumentation. If response actions are not successful in arresting ongoing impacts on water resources, compensatory mitigation measures will be implemented.

The process for establishing adaptive management triggers and selecting and implementing remedial actions involves the following steps:

1. Establish quantitative adaptive management triggers for each water resource being monitored, including triggers associated with potential indirect effects on biological resources caused by changes to water resources (see Table 1).

    a. Implement management actions on a case-by-case basis to prevent or minimize effects on water resources caused by seepage into tunnels.

        i. Add supplemental water to the stream to restore stream flows that trend below baseline minimums.

        ii. Supplement spring water to sustain habitat supported by the spring and to restore baseline conditions.

        Supplemental water would be supplied to affected springs or streams to approximate baseline levels until groundwater recharged naturally. The actual method of distribution of supplemental water would vary according to site specific characteristics. For example, at some locations, a drip irrigation system may be appropriate, whereas at other locations, it may be more effective to discharge water directly to a creek bed. At the specific site, water would be discharged at a point within the creek, or more broadly distributed, as necessitated by site characteristics

        The potential sources of supplemental water and means by which such water would be conveyed and applied is further discussed in Appendix 3.8-D.

        Supplemental water discharged into surface waterbodies must meet water quality standards. Water supply infrastructure would consist of inert materials that have low to no risk of leaching into the supplemental water supply. This infrastructure would also be either shielded or otherwise insulated from solar radiation to prevent substantial increases in water temperature in receiving waterbodies. If conventionally treated potable or recycled water would be used to supplement surface water flows in waterbodies, the water would be aerated, circulated, exposed to ultraviolet light, or otherwise treated to reduce concentrations of chlorine and other byproducts of water treatment prior to discharge.

    b. Implement compensatory mitigation for each affected water resource if effects cannot be arrested or substantially reduced through response actions. This would be accomplished in accordance with the following mitigation measures identified in the EIR/EIS: BIO-MM#46: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat; and, BIO-MM#47: Prepare and Implement a CMP for Impacts on Aquatic Resources.

    c. For affected supply wells, evaluate and determine best approach to address effects on supply. Actions could include modifying the well equipment, such as by lowering the pump within the well, cleaning the pump, or providing a larger pump. Other or additional actions may include providing potable water supplementation until water levels recover in the water supply well.

2. For riparian habitat, Table 1 establishes quantitative adaptive management triggers for each riparian resource being monitored. If the triggers are met, implement a and b as appropriate.
    a. Implement actions that are anticipated to include supplementing water to maintain riparian resources that trend below baseline levels.

       Supplemental water would be supplied to affected riparian resources to approximate baseline levels until groundwater recharged naturally. The actual method of distribution of supplemental water would vary according to site specific characteristics. For example, at some locations, a drip irrigation system may be more appropriate, whereas at other locations, it may be more appropriate to simply discharge water directly to a creek bed.

       The potential sources of supplemental water and the transportation and application of such water is further discussed in Appendix 3.8-D.

       Supplemental water discharged into surface waterbodies must comply with water quality standards. Water supply infrastructure would consist of inert materials that have low to no risk of leaching into the supplemental water supply. This infrastructure would also be either shielded or otherwise insulated from solar radiation to prevent substantial increases in water temperature in receiving waterbodies. If conventionally treated potable or recycled water would be used to supplement surface water flows in waterbodies, the water would be aerated, circulated, exposed to ultraviolet light, or otherwise treated to reduce concentrations of chlorine and other byproducts of water treatment prior to discharge.
    b. Restore any lost riparian or wetland vegetation that is not recovering on its own within 1 year of construction and is determined to be the result of tunnel construction through comparison to baseline conditions. Subject to landowner approval, such restoration would occur on site, or at a suitable location nearby if not feasible on site
    c. Implement compensatory mitigation for affected riparian resources if detected effects cannot be arrested or remediated by adaptive management actions.
3. For species habitat, implement remedial actions on a case-by-case basis to arrest or minimize effects on water resources and associated species as a result of tunnel construction. If remedial actions are not successful in arresting trends of continuing changes in selected TESPC species, then compensatory mitigation measures may be implemented to offset impacts on species and biological resources dependent on the affected water resources.
    a. Establish quantitative adaptive management triggers for each spring, seep, or stream obligate resource being monitored (see Table 1).
    b. Add supplemental water to the stream to maintain riparian resources that deviate from baseline levels as a result of tunnel construction.
    c. Restore any lost riparian or wetland vegetation that is not recovering on its own within 1 year of construction and is determined to be the result of tunnel construction through comparison to baseline conditions. Subject to landowner approval, such restoration would occur on site, or at a suitable location nearby if not feasible on site.
    d. Implement compensatory mitigation for affected species if detected effects cannot be arrested or remediated by response actions. The compensatory mitigation is anticipated to include funding habitat enhancement and restoration actions outside the affected areas.
    e. Establish a refugia program (creating artificial habitat in the field or collecting and caring for species within a zoo/rehabilitation facility for later reintroduction) for federally listed

threatened or endangered and Forest Service Sensitive species, providing temporary habitat during periods of low flow resulting in unfavorable habitat conditions.

The Authority would relocate aquatic species where unavoidable drying of aquatic breeding habitat would occur and maintaining the habitat with supplemental water is not feasible. The Authority would relocate these species, as allowed by USFWS and CDFW. If holding facilities are used, the Authority would return affected wildlife to affected aquatic areas after recovery of baseline hydrologic conditions.

4.1.1 Reporting

The following actions will be implemented as part of ongoing and supplemental reporting:

1. Prepare quarterly monitoring reports, which include the results of monthly data collection.
2. Continue to prepare annual summary reports, adding interpretation of baseline conditions and recovery metrics.

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5 REFERENCES

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