APPENDIX D
Avoidance and Minimization Measures

This appendix contains the full text of the avoidance and minimization measures.

Impact Avoidance and Minimization Feature	Description
AESTHETICS AND VISUAL RESOURCES	
AVR-IAMF#1: Aesthetic Options	Prior to construction the Contractor shall document, through issue of a technical memorandum, how the Authority's aesthetic guidelines have been employed to minimize visual impacts. The Authority seeks to balance providing a consistent, project-wide aesthetic with the local context for the numerous high-speed rail non-station structures across the state. Examples of aesthetic options would be provided to local jurisdictions that can be applied to non-standard structures in the high-speed rail system. Refer to Aesthetic Options for Non-Station Structures, 2017.
AVR-IAMF#2: Aesthetic Review Process	Prior to construction, the Contractor shall document that the Authority's aesthetic review process has been followed to guide the development of non-station area structures. Documentation shall be through issuance of a technical memorandum to the Authority. The Authority would identify key non-station structures recommended for aesthetic treatment, consult with local jurisdictions on how best to involve the community in the process, solicit input from local jurisdictions on their aesthetic preferences, and evaluate aesthetic preferences for potential cost, schedule and operational impacts. The Authority would also evaluate compatibility with project-wide aesthetic goals, include recommended aesthetic approaches in the construction procurement documents, and work with the contractor and local jurisdictions to review designs and local aesthetic preferences and incorporate them into final design and construction. Refer to Aesthetic Options for Non-Station Structures, 2017.
AGRICULTURAL FARMLAND AND FOREST LAND	
AG-IAMF#1: Restoration of Important Farmland Used for Temporary Staging Areas	Prior to any ground disturbing activities at the site of a temporary construction staging area located on Important Farmland, the Contractor shall prepare a restoration plan addressing specific actions, sequence of implementation, parties responsible for implementation and successful achievement of restoration for temporary impacts. Actions shall include removing and stockpiling the top 18 inches of soil for replacement on-site during restoration activities. Before beginning construction use of sites on Important Farmland, the Contractor shall submit the restoration plan to the Authority for review and obtain Authority (and if applicable, the landowner) approval. The restoration plan shall include time-stamped photo documentation of the pre-construction conditions of all temporary staging areas. All construction access, mobilization, material laydown, and staging areas on Important Farmlands would be returned to a condition equal to the pre-construction staging condition. This requirement is included in the design-build construction contract requirements.
AG-IAMF#3: Farmland Consolidation Program	The Authority would establish and administer a farmland consolidation program to sell remnant parcels to neighboring landowners for consolidation with adjacent farmland properties. In addition, the program would assist the owners of remnant parcels in selling those remnants to adjacent landowners, upon request. The goal of the program is to provide for continued agricultural use on the maximum feasible amount of remnant parcels that otherwise may not be economic to farm. The program would focus on severed remainder parcels, including those that were under Williamson Act or Farmland Security Act contract at the time of right-of-way acquisition and have become too small to remain in the local Williamson Act or Farmland Security Act program. The

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	program would assist landowners in obtaining lot line adjustments where appropriate to incorporate remnant parcels into a larger parcel that is consistent with size requirements under the local government regulations. The program will operate for a minimum of 5 years after construction of the section is completed. The Authority shall document implementation of this measure through issuance of a compliance memorandum- after the minimum operation period of 5 years has elapsed. The document shall be filed with Environmental Mitigation Management and Assessment system (EMMA).
AG-IAMF#4: Notification to Agricultural Property Owners	Prior to the start of any construction activity adjacent to farmland, the Authority shall provide written notification to agricultural property owners or leaseholders immediately adjacent to the disturbance limits for the HSR project section. The notification is to indicate the intent to begin construction, including an estimated date for the start of construction. In order to provide agricultural property owners or leaseholders sufficient lead time to make any changes to their operations due to project section construction, this notification shall be provided at least 3 months, but no more than 12 months, prior to the start of construction activity.
AG-MM#1: Conserve Important Farmland (Prime Farmland, Farmland of Statewide Importance, Farmland of Local Importance, and Unique Farmland).	The Authority has entered into an agreement with the DOC California Farmland Conservancy Program to implement agricultural land mitigation for the HSR system. The Authority would fund the California Farmland Conservancy Program's work to identify suitable agricultural land for mitigation of impacts and to fund the purchase of agricultural conservation easements from willing sellers. The performance standards for this measure are to preserve Important Farmland in an amount commensurate with the quantity and quality of converted farmlands in the same agricultural regions as the impacts occur, at a replacement ratio of not less than 1:1 for lands that are permanently converted to nonagricultural use by the project. In addition to mitigation for Important Farmlands that are permanently converted to nonagricultural use, the Authority would fund the purchase of an additional increment of acreage for agricultural conservation easements at a ratio of not less than 0.5:1 for Important Farmland within a 25-foot-wide area adjacent to permanently fenced HSR infrastructure. The Authority would document implementation of this measure through annual issuance of a compliance memorandum.
AIR QUALITY	
AQ-IAMF#1: Fugitive Dust Emissions	During construction, the Contractor shall employ the following measures to minimize and control fugitive dust emissions. The Contractor shall prepare a fugitive dust control plan for each distinct construction segment. At a minimum, the plan shall describe how each measure would be employed and identify an individual responsible for ensuring implementation. At a minimum, the plan shall address the following components unless alternative measures are approved by the applicable air quality management district. ▪ Cover all vehicle loads transported on public roads to limit visible dust emissions, and maintain at least 6 inches of freeboard space from the top of the container or truck bed. ▪ Clean all trucks and equipment before exiting the construction site using an appropriate cleaning station that does not allow runoff to leave the site or mud to be carried on tires off the site. ▪ Water exposed surfaces and unpaved roads at a minimum three times daily with adequate volume to result in wetting of the top 1 inch of soil but avoiding overland flow. Rain events may result in adequate wetting of top 1 inch of soil thereby alleviating the need to manually apply water.

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	▪ Limit vehicle travel speed on unpaved roads to 15 miles per hour (mph). ▪ Suspend any dust-generating activities when average wind speed exceeds 25 mph. ▪ Stabilize all disturbed areas, including storage piles that are not being used on a daily basis for construction purposes, by using water, a chemical stabilizer/suppressant, hydro mulch or by covering with a tarp or other suitable cover or vegetative ground cover, to control fugitive dust emissions effectively. In areas adjacent to organic farms, the Authority would use non-chemical means of dust suppression. ▪ Stabilize all on-site unpaved roads and off-site unpaved access roads, using water or a chemical stabilizer/suppressant, to effectively control fugitive dust emissions. In areas adjacent to organic farms, the Authority would use non-chemical means of dust suppression. ▪ Carry out watering or presoaking for all land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities. ▪ For buildings up to 6 stories in height, wet all exterior surfaces of buildings during demolition. ▪ Limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at a minimum of once daily, using a vacuum type sweeper. ▪ After the addition of materials to or the removal of materials from surface or outdoor storage piles, apply sufficient water or a chemical stabilizer/suppressant.
AQ-IAMF#2: Selection of Coatings	During construction, the Contractor shall use: ▪ Low-volatile organic compound (VOC) paint that contains less than 10 percent of VOC contents (VOC, 10%). ▪ Super-compliant or Clean Air paint that has a lower VOC content than that required by the Bay Area Air Quality Management, the San Joaquin Valley Unified Air Pollution Control District, and the Monterey Bay Air Resources District, when available. If not available, the Contractor shall document lack of availability, recommend alternative measure(s) to comply with Rule 1113 and 4601 (note: update to name relevant air district and rules as appropriate) or disclose absence of measure(s) for full compliance and obtain concurrence from the Authority.
AQ-IAMF#4: Reduce Criteria Exhaust Emissions from Construction Equipment	Prior to issuance of construction contracts, the Authority would incorporate the following construction equipment exhaust emissions requirements into the contract specifications: 1. All heavy-duty off-road construction diesel equipment used during the construction phase would meet Tier 4 engine requirements. 2. A copy of each unit's certified tier specification and any required CARB or air pollution control district operating permit would be made available to the Authority at the time of mobilization of each piece of equipment. 3. The contractor would keep a written record (supported by equipment-hour meters where available) of equipment usage during project construction for each piece of equipment. 4. The contractor would provide the Authority with monthly reports of equipment operating hours (through the Environmental Mitigation Management and Assessment [EMMA] system) and annual reports documenting compliance.

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AQ-IAMF#5: Reduce Criteria Exhaust Emissions from On-Road Construction Equipment	Prior to issuance of construction contracts, the Authority would incorporate the following material-hauling truck fleet mix requirements into the contract specifications: 1. All on-road trucks used to haul construction materials, including fill, ballast, rail ties, and steel, would consist of an average fleet mix of equipment model year 2010 (update model year as appropriate) or newer, but no less than the average fleet mix for the current calendar year as set forth in the CARB's EMFAC 2014 database. 2. The contractor would provide documentation to the Authority of efforts to secure such a fleet mix. 3. The contractor would keep a written record of equipment usage during project construction for each piece of equipment and provide the Authority with monthly reports of VMT (through EMMA) and annual reports documenting compliance.
AQ-MM#1: Offset Project Construction Emissions in the San Francisco Bay Area Air Basin	Prior to issuance of construction contracts, the Authority would enter into a memorandum of understanding (MOU) with the Bay Area Clean Air Foundation (Foundation), a public non-profit and supporting organization for the BAAQMD, to reduce VOC and NOX to the required levels. The required levels in the SFBAAB are: 1. For emissions in excess of the General Conformity de minimis thresholds (NOX): net zero. 2. For emissions not in excess of de minimis thresholds but above the BAAQMD's daily emission thresholds (VOC and NOX): below the appropriate CEQA threshold levels. The mitigation offset fee amount would be determined at the time of mitigation to fund one or more emissions reduction projects within the SFBAAB. The Foundation would require an additional administrative fee of no less than five percent. The mitigation offset fee would be determined by the Authority and the Foundation based on the type of projects available at the time of mitigation. When the CEQA threshold is exceeded, these funds may be spent to reduce either VOC or NOX emissions ("O3 precursors"). When the General Conformity threshold is exceeded, these funds may be spent to reduce O3 precursors, provided this is allowed by the federal CAA provisions addressing General Conformity. This fee is intended to fund emissions reduction projects to achieve reductions, with the estimated tonnage of emissions offsets required starting in 2022. Documentation of payment would be provided to the Authority or its designated representative. The MOU would include details regarding the annual calculation of required offsets the Authority must achieve, funds to be paid, administrative fee, and the timing of the emissions reductions projects. Acceptance of this fee by the Foundation would serve as an acknowledgment and commitment by the Foundation to: (1) implement an emissions reduction project(s) within a timeframe to be determined based on the type of project(s) selected after receipt of the mitigation fee designed to achieve the emission reduction objectives; and (2) provide documentation to the Authority or its designated representative describing the project(s) funded by the mitigation fee, including the amount of emissions reduced (tons per year) in the SFBAAB from the emissions reduction project(s). To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emission reductions in the SFBAAB that are real, surplus, quantifiable, enforceable, and would not otherwise be achieved through compliance with existing regulatory requirements or any other legal

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	requirement. Pursuant to 40 C.F.R. Section 93.163(a), the necessary reductions must be achieved (contracted and delivered) by the applicable year in question. Funding would need to be received prior to contracting with participants and should allow enough time to receive and process applications to fund and implement off site reduction projects prior to commencement of project activities being reduced. This would roughly equate to 1 year prior to the required mitigation; additional lead time may be necessary depending on the level of off-site emission reductions required for a specific year.
AQ-MM#2: Offset Project Construction Emissions in the North Central Coast Air Basin	Prior to issuance of construction contracts, the Authority would enter into a MOU with the MBARD to reduce PM10 to the required levels. The required levels in the NCCAB are: ▪ For emissions above the MBARD's daily emission thresholds (PM10): below the appropriate CEQA threshold levels. The mitigation offset and administrative fee amount would be determined at the time of mitigation. The fee would be determined by the Authority and MBARD and based on the type of projects available at the time of mitigation. This fee is intended to fund emissions reduction projects to achieve reductions with the estimated tonnage of emissions offsets required. Documentation of payment would be provided to the Authority or its designated representative. The MOU would include details regarding the annual calculation of require offsets, funds to be paid, administrative fee, and the timing of the emissions reductions project. Acceptance of this fee by the MBARD would serve as an acknowledgment and commitment by the MBARD to: (1) implement an emissions reduction project(s) within a timeframe to be determined based on the type of project(s) selected after receipt of the mitigation fee to achieve the emission reduction objectives; and (2) provide documentation to the Authority or its designated representative describing the project(s) funded by the mitigation fee, including the amount of emissions reduced (tons per year) in the NCCAB from the emissions reduction project(s). To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emission reductions in the NCCAB that are real, surplus, quantifiable, enforceable, and would not otherwise be achieved through compliance with existing regulatory requirements or any other legal requirement. Funding would need to be received prior to contracting with participants and should allow enough time to receive and process applications to fund and implement off site reduction projects prior to commencement of project activities requiring offset. This would roughly equate to 1 year prior to the required mitigation; additional lead time may be necessary depending on the level of off site emission reductions required for a specific year.
AQ-MM#3: Offset Project Construction Emissions in the SJVAB	On June 19, 2014, the SJVAPCD and the Authority entered an MOU that establishes the framework for fully mitigating to net-zero construction emissions of NOx, VOC, PM10, and PM2.5 from the entire HSR Project within the SJVAB. Emissions generated by construction of the portion of the project within the SJVAB are subject to this MOU and therefore must be offset to net zero. Pursuant to the MOU, the Authority and the SJVAPCD would enter into a Voluntary Emissions Reduction Agreement (VERA) to cover the portion of the project approved and funded for construction within the SJVAB. The project-level VERA must be executed prior to commencement of construction and the mitigation fees and offsets delivered and achieved according to the requirements of the VERA and MOU.

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BIOLOGICAL RESOURCES	
BIO-IAMF#1: Designate Project Biologist, Designated Biologists, Species-Specific Biological Monitors and General Biological Monitors	At least 15 business days prior to commencement of any ground disturbing activity, including but not limited to geotechnical investigations, utility realignments, creation of staging areas, or initial clearing and grubbing, the Authority will submit the name(s) and qualifications of Project Biologists, Designated Biologists, Species-Specific Biological Monitors, and General Biological Monitors retained to conduct biological resource monitoring activities and implement avoidance and minimization measures. No ground disturbing activity will begin until the Authority has received written approval from the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), where applicable, and the California Department of Fish and Wildlife (CDFW) that the biologists and monitors have been approved to conduct the specified work. The Project Biologist is responsible for ensuring the timely implementation of the biological avoidance and minimization measures as outlined in the Biological Resources Management Plan (BRMP), and for guiding and directing the work of the Designated Biologists and Biological Monitors. Designated Biologists will be responsible for directly overseeing and reporting the implementation of general and species-specific conservation measures. In some instances, Designated Biologists will only be approved for specific species, in which case they will only be authorized to conduct surveys and implement measures for the species for which they have been approved. Species-Specific Biological Monitors will be responsible for implementation of species-specific measures for the species for which they have been approved, and will report directly to a Designated Biologist. General Biological Monitors will report directly to a Designated Biologist or to the Project Biologist. General Biological Monitors will be responsible for conducting Worker Environmental Awareness Program (WEAP) training, implementing general conservation measures, conducting general compliance monitoring, and reporting on compliance monitoring activities. The term Project Biologist is used in these IAMFs to mean the Project Biologist, Designated Biologists, Species-Specific Biological Monitors, and General Biological Monitors, as appropriate. When the Authority is specified as implementing an IAMF, it is assumed that the Authority, or its contractor or agent, is implementing the IAMF under the supervision of biologists and biological monitors, as appropriate.
BIO-IAMF#3: Prepare WEAP Training Materials and Conduct Construction Period WEAP Training	Prior to any ground disturbing activity, the Project Biologist will prepare a Worker Environmental Awareness Program (WEAP) for the purpose of training construction crews to recognize and identify sensitive biological resources that may be encountered in the vicinity of the project footprint. The WEAP training materials will be submitted to the Authority for review and approval. A video of the WEAP training prepared and presented by the Project Biologist and approved by the Authority may be used if the Project Biologist is not available to present the training in person. At a minimum, WEAP training materials will include the following information: key provisions of the federal Endangered Species Act (federal ESA), the California Endangered Species Act (CESA), the Bald and Golden Eagle Protection Act (BGEPA), the Migratory Bird Treaty Act (MBTA), California Fish and Game Code 1600, Porter-Cologne Water Quality Control Act (Porter-Cologne), and the Clean Water Act (CWA); the consequences and penalties for violation or noncompliance with these laws and regulations and project authorizations; identification and characteristics of special-status plants, special-status wildlife, jurisdictional waters, and special-status plant communities and explanations about their ecological value; hazardous substance spill prevention

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	and containment measures; the contact person in the event of the discovery of a dead or injured wildlife species; and review of avoidance, minimization, and mitigation measures. The Project Biologist will present WEAP training to all construction personnel before they work in the project footprint. As part of the WEAP training, construction timing in relation to species' habitat and life-stage requirements will be detailed and discussed on project maps, which will show areas of planned minimization and avoidance measures. Crews will be informed during the WEAP training that, except when necessary as determined in consultation with the Project Biologist, travel within the project footprint is restricted to established roadbeds, which include all pre-existing and project-constructed unimproved and improved roads. A fact sheet conveying this information will be prepared by the Project Biologist for distribution to the construction crews and to others who enter the project footprint. Fact sheet information will be duplicated in a wallet-sized format and will be provided in other languages as necessary to accommodate non-English speaking workers. All construction staff will attend the WEAP training prior to beginning work on-site, and will attend the WEAP training on an annual basis thereafter. Upon completion of the WEAP training, each member of the construction crew will sign a form stating that they attended the training, understood the information presented, and agreed to comply with the requirements set out in the WEAP training. The Project Biologist will submit the signed WEAP training forms to the Authority on a monthly basis. On an annual basis, the Authority will certify that WEAP training had been provided to all construction personnel. On a monthly basis, the Project Biologist will provide updates relevant to the training to construction personnel during the daily safety ("tailgate") meeting.
BIO-IAMF#4: Conduct Operation and Maintenance Period WEAP Training	Prior to initiating operation and maintenance (O&M) activities, O&M personnel will attend a WEAP training session arranged by the Authority. At a minimum, O&M WEAP training materials will include the following information: key provisions of the ESA, CESA, the BGEPA, the MBTA, Porter-Cologne, and the CWA; the consequences and penalties for violation or noncompliance with these laws and regulations and project authorizations; identification and characteristics of special-status plants, special-status wildlife, jurisdictional waters, and special-status plant communities and explanations about their ecological value; hazardous substance spill prevention and containment measures; and the contact person in the event of the discovery of a dead or injured wildlife species. The training will include an overview of provisions of the biological resources management plan, annual vegetation, and management plan, weed control plan and security fencing and wildlife exclusion fencing maintenance plans pertinent to O&M activities. A fact sheet prepared by the Authority environmental compliance staff will be prepared for distribution to the O&M employees. The training will be provided by the Authority environmental compliance staff. The training sessions will be provided to employees prior to their involvement in any O&M activity and will be repeated for all O&M employees on an annual basis. Upon completion of the WEAP training, O&M employees will, in writing, verify their attendance at the training sessions and confirm their willingness to comply with the requirements set out in those sessions.
BIO-IAMF#5: Prepare and Implement a Biological Resources Management Plan	Prior to any ground disturbing activity, the Project Biologist will prepare the BRMP, which would include a compilation of the biological resources avoidance and minimization measures applicable to the HSR section. All project

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	environmental plans, such as the Restoration and Revegetation Plan (RPP) and Weed Control Plan (WCP), will be included as appendices to the BRMP. The BRMP is intended to serve as a comprehensive document that sets out the range of avoidance and minimization measures to support the appropriate and timely implementation of those measures. The implementation of these measures will be tracked through final design, construction, and operation phases. The BRMP will contain, but not be limited to, the following information: ▪ A master schedule that shows construction of the project, pre-construction surveys, and establishment of buffers and exclusions zones to protect sensitive biological resources. ▪ Specific measures for the protection of special-status species. ▪ Identification (on construction plans) of the locations and quantity of habitats to be avoided or removed, along with the locations where habitats are to be restored. ▪ Identification of agency-approved Project Biologist(s) and Biological Monitor(s), including those responsible for notification and report of injury or death of federally or State-listed species. ▪ Measures to preserve topsoil and control erosion. ▪ Design of protective fencing around Environmentally Sensitive Areas (ESAs) and the construction staging areas. ▪ Locations of trees to be protected as wildlife habitat (roosting sites) and locations for planting replacement trees. ▪ Specification of the purpose, type, frequency, and extent of chemical use for insect and disease control operations as part of vegetative maintenance within sensitive habitat areas. ▪ Specific measures for the protection of vernal pool habitat and riparian areas. These measures may include erosion and siltation control measures, protective fencing guidelines, dust control measures, grading techniques, construction area limits, and biological monitoring requirements. ▪ Provisions for biological monitoring during ground disturbing activities to confirm compliance and success of protective measures. The monitoring will: (1) identify specific locations of wildlife habitat and sensitive species to be monitored; (2) identify the frequency of monitoring and the monitoring methods (for each habitat and sensitive species to be monitored); (3) list required qualifications of biological monitor(s); (4) identify the reporting requirements; and (5) provide an accounting of impacts to special-status species habitat compared to pre-construction impact estimates. The BRMP will be submitted to the Authority for review and approval prior to any ground disturbing activity.
BIO-IAMF#6: Establish Monofilament Restrictions	Prior to any ground disturbing activity, the Project Biologist will verify that plastic monofilament netting (erosion control matting) or similar material is not being used as part of erosion control activities. The Project Biologist will identify acceptable material for such use, including: geomembranes, coconut coir matting, tackified hydroseeding compounds, and rice straw wattles (e.g., Earthsaver wattles: biodegradable, photodegradable, burlap). Within developed or urban areas, the Project Biologist may allow exceptions to the restrictions on the type of erosion control material if the Project Biologist determines that the construction area is of sufficient distance from natural areas to ensure the avoidance of potential impacts to wildlife.

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BIO-IAMF#7: Prevent Entrapment in Construction Materials and Excavations	At the end of each work day during construction, the Authority will cover all excavated, steep-sided holes or trenches more than 8 inches deep and that have sidewalls steeper than 1:1 (45 degree) slope with plywood or similar materials, or provide a minimum of one escape ramp per 100 feet of trenching (with slopes no greater than 3:1) constructed of earth fill or wooden planks. The Project Biologist will thoroughly inspect holes and trenches for trapped animals at the start and end of each work day. The Authority will screen, cover, or elevate at least 1 foot above ground, all construction pipe, culverts, or similar structures with a diameter of 3 inches or greater that are stored overnight within the project footprint. These pipes, culverts, and similar structures will be inspected by the Project Biologist for wildlife before such material is moved, buried, or capped.
BIO-IAMF#8: Delineate Equipment Staging Areas and Traffic Routes	Prior to any ground disturbing activity, the Authority will establish staging areas for construction equipment in areas that minimize effects to sensitive biological resources, including habitat for special-status species, seasonal wetlands, and wildlife movement corridors. Staging areas (including any temporary material storage areas) will be located in areas that would be occupied by permanent facilities, where practicable. Equipment staging areas will be identified on final project construction plans. The Authority will flag and mark access routes to ensure that vehicle traffic within the project footprint is restricted to established roads, construction areas and other designated areas.
BIO-IAMF#9: Dispose of Construction Spoils and Waste	During ground disturbing activities, the Authority may temporarily store excavated materials produced by construction activities in areas at or near construction sites within the project footprint. Where practicable, the Authority will return excavated soil to its original location to be used as backfill. Any excavated waste materials unsuitable for treatment and reuse will be disposed at an off-site location, in conformance with applicable State and federal laws.
BIO-IAMF#10: Clean Construction Equipment	Prior to any ground disturbing activity, the Authority will ensure that all equipment entering the Work Area is free of mud and plant materials. The Authority will establish vehicle cleaning locations designed to isolate and contain organic materials and minimize opportunities for weeds and invasive species to move in and out of the project footprint. Cleaning may be done by washing with water, blowing with compressed air, brushing, or other hand cleaning. The cleaning areas will be located so as to avoid impacts to surface waters and appropriate Stormwater Pollution Prevention Plan (SWPPP) best management practices (BMPs) will be implemented so as to further control any potential for the spread of weeds or other invasive species. Cleaning stations will be inspected regularly (at least monthly).
BIO-IAMF#11: Maintain Construction Sites	Prior to any ground disturbing activity, the Authority will prepare a construction site BMP field manual. The manual will contain standard construction site housekeeping practices required to be implemented by construction personnel. The manual will identify BMPs for the following topics; temporary soil stabilization, temporary sediment control, wind erosion control, non-storm water management, waste management and materials control, rodenticide use, and other general construction site cleanliness measures. All construction personnel will receive training on BMP field manual implementation prior to working within the project footprint. All personnel will acknowledge, in writing, their understanding of the BMP field manual implementation requirements. The BMP field manual will be updated by January

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	31st of each year. The Authority will provide, on an annual basis, training updates to all construction personnel.
BIO-IAMF#12: Design the Project to be Bird Safe	Prior to final construction design, the Authority will ensure that the catenary system, masts, and other structures such as fencing, electric lines, communication towers and facilities are designed to be bird and raptor-safe in accordance with the applicable recommendations presented in Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 2006 (APLIC 2006) and Reducing Avian Collisions with Power Lines: State of the Art in 2012 (APLIC 2012). Applicable APLIC recommendations include, but are not limited to: ▪ Ensuring sufficient spacing of phase conductors to prevent bird electrocution ▪ Configuring lines to reduce vertical spread of lines and/or decreasing the span length if such options are feasible ▪ Marking lines and fences (e.g. Bird Flight Diverter for fencing and lines) to increase the visibility of lines and reduce the potential for collision. Where fencing is necessary, using bird compatible design standards to increase visibility of fences to prevent collision and entanglement. ▪ Installing perch deterrents guards to discourage bird avian presence on and near project facilities ▪ Minimizing the use of guywires. Where the use of guywires is unavoidable, demarcating guywires using the best available methods to minimize avian strikes (e.g. line markers). ▪ Reusing or co-locating new transmission facilities and other ancillary facilities with existing facilities and disturbed areas to minimize habitat impacts and avoid collision risks ▪ Structures will be monopole or dual-pole design versus lattice tower design to minimize perching and nesting opportunities. Communication towers will conform to Recommended Best Practices for Communication Tower Design, Siting, Construction, Operation, Maintenance, and Decommissioning (UFWS 2018). ▪ Use of facility lighting that does not attract birds or their prey to project sites. These include using non-steady burning lights (red, dual red and white strobe, strobe-like flashing lights) to meet Federal Aviation Administration requirements, using motion or heat sensors and switches to reduce the time when lights are illuminated, using appropriate shielding to reduce horizontal or skyward illumination, and avoiding the use of high-intensity lights (e.g., sodium vapor, quartz, and halogen). Lighting will not be installed under viaduct and bridge structures in riparian habitat areas. Additional bird operational actions would be required for dry lakes and playas, Audubon Important Bird Areas and documented avian movement corridors. These measures include: ▪ Avoid, to the extent feasible, siting transmission lines across canyons or on ridgelines to prevent bird and raptor collisions. ▪ Install bird flight diverters on all facilities spanning or within 1,000 feet of stream and wash channels, canals, ponds, and any other natural or artificial body of water. ▪ Fencing or other type of flight diverter will be installed on all viaduct structures to encourage birds and raptors to fly over the HSR and avoid flying directly in the path of on-coming trains.

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	▪ Ensure poles do not have openings that could entrap birds. Measures may include sealing or capping all openings in poles or providing for escape routes (e.g. openings accommodating escape for various species). ▪ Design aerial structures (e.g. viaducts and bridges) and tunnel portals to discourage birds and bats from roosting in expansion joints or other crevices.
BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan	Prior to any ground-disturbing activity, the Project Biologist would prepare a restoration and revegetation plan (RRP) to address temporary impacts resulting from ground-disturbing activities within areas that potentially support special-status species, wetlands, and/or other aquatic resources. Restoration activities may include, but not be limited to: grading landform contours to approximate pre-disturbance conditions, stockpiling and spreading topsoil, removing invasive plant species, revegetating disturbed areas with native plant species, and using certified weed-free straw and mulch. The Authority would implement the RRP in all temporarily disturbed areas outside of the permanent right-of-way that potentially support special-status species, wetlands, and/or other aquatic resources. Consistent with Section 1415 of the Fixing America's Surface Transportation Act (FAST Act) restoration activities would provide habitat for native pollinators through plantings of native forbs and grasses. The Project Biologist would obtain a locally sourced native seed mix. The restoration success criteria would include limits on invasive species, as defined by the California Invasive Plant Council, to an increase no greater than 10 percent compared to the pre-disturbance condition, or to a level determined through a comparison with an appropriate reference site consisting of similar natural communities and management regimes. The RRP would outline at a minimum: Procedures for documenting pre-construction conditions for restoration purposes. ▪ Sources of plant materials and methods of propagation. ▪ Specification of parameters for maintenance and monitoring of re-established habitats, including weed control measures, frequency of field checks, and monitoring reports for temporary disturbance areas. ▪ Specification of success criteria for re-established plant communities. ▪ Specification of the remedial measures to be taken if success criteria are not met. ▪ Methods and requirements for monitoring restoration/replacement efforts, which may involve a combination of qualitative and/or quantitative data gathering. ▪ Maintenance, monitoring, and reporting schedules, including an annual report due to the Authority by January 31st of the following year. The RRP would be submitted to the Authority and regulatory agencies, as defined in the conditions of regulatory authorizations, for review and approval.
BIO-MM#2: Prepare and Implement a Weed Control Plan	Prior to any ground-disturbing activity during the construction phase, the Project Biologist would develop a weed control plan (WCP), subject to review and approval by the Authority. The purpose of the WCP is to establish approaches to minimize and avoid the spread of invasive weeds during ground-disturbing activities during construction and O&M. The WCP would include, at a minimum, the following: ▪ A requirement to delineate environmentally sensitive areas (ESA) in the field prior to weed control activities. ▪ A schedule for weed surveys to be conducted in coordination with the BRMP.

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	▪ Success criteria for invasive weed control. The success criteria would be linked to the BRMP standards for on-site work during ground-disturbing activities. In particular, the criteria would establish limits on the introduction and spread of invasive species, as defined by the California Invasive Plant Council, to less than or equal to the pre-disturbance conditions in the area temporarily affected by ground-disturbing activities. If invasive species cover is found to exceed pre-disturbance conditions by greater than 10 percent or is 10 percent greater than levels at a similar, nearby reference site, a control effort would be implemented. If the target, or other success criteria identified in the WCP, has not been met by the end of the WCP monitoring and implementation period, the Authority would continue the monitoring and control efforts, and remedial actions would be identified and implemented until the success criteria are met. ▪ Provisions for consistency between the WCP and the RRP, including verification that the RRP includes measures to minimize the risk of the spread and/or establishment of invasive species and reflects the same revegetation performance standards as the WCP. ▪ Identification of weed control treatments, including permitted herbicides and manual and mechanical removal methods. ▪ Timeframes for weed control treatment for each plant species. ▪ Identification of fire prevention measures.
BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones	Prior to any ground-disturbing activity in a work area, the Project Biologist would use flagging to mark ESAs that support special-status species or aquatic resources and are subject to seasonal restrictions or other avoidance and minimization measures. The Project Biologist would also direct the installation of wildlife exclusion fencing (WEF) by the contractor to prevent special-status wildlife species from entering work areas. The WEF would be installed below grade (e.g., 6–10 inches below grade) and would have exit doors to allow animals that may be inside an enclosed area to leave the area. The Project Biologist would also direct the installation of construction exclusionary fencing (exclusionary fencing) at the boundary of the work area, as appropriate, to avoid and minimize impacts on special-status species or aquatic resources outside of the work area during the construction period. The Project Biologist would delineate the ESAs, WEF, and exclusionary fencing based on the results of habitat mapping or modeling and any pre-construction surveys, and in coordination with the Authority. The Project Biologist would regularly inspect and maintain the ESA, WEF, and exclusionary fencing. The ESA, WEF, and exclusionary fencing locations would be identified and depicted on an exclusion fencing exhibit. The purpose of the ESAs and WEF would be explained at WEAP training and the locations of the ESA and WEF areas would be noted during worker tailgate sessions.
BIO-MM#4: Conduct Monitoring of Construction Activities	During any initial ground-disturbing activity, the Project Biologist would be present in the work area to verify compliance with avoidance and minimization measures, to establish ESAs, and to direct the installation of WEF and construction exclusion fencing by the contractor.
BIO-MM#5: Limit Vehicle Traffic and Construction Site Speeds	Prior to any ground-disturbing activities, the Project Biologist would check that appropriate measures have been instituted to restrict project vehicle traffic within the project footprint to established roads, construction areas, and other permissible areas. The Project Biologist would establish vehicle speed limits of no more than 15 mph for unimproved access roads and for temporary and

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	permanent construction areas within the project footprint. The Project Biologist would also direct that access routes be flagged and marked and that measures be adopted to prevent off-road vehicle traffic.
BIO-MM#6: Establish and Implement a Compliance Reporting Program	The Project Biologist would prepare monthly and annual reports documenting compliance with all IAMFs, mitigation measures, and requirements set forth in regulatory agency authorizations. The Authority would review and approve all compliance reports prior to submittal to the regulatory agencies. Reports would be prepared in compliance with the content requirements outlined in the regulatory agency authorizations. Pre-activity survey reports would be submitted within 15 days of completing the surveys and would include: ▪ Location(s) of where pre-activity surveys were completed, including latitude and longitude, Assessor Parcel Number, and HST parcel number. ▪ Written description of the surveyed area. A figure of each surveyed location would be provided that depicts the surveyed area and survey buffers over an aerial image. ▪ Date, time, and weather conditions observed at each location. ▪ Personnel who conducted the pre-activity surveys. ▪ Verification of the accuracy of the Authority's habitat mapping at each location, provided in writing and on a figure. ▪ Observations made during the survey, including the type and locations (written and GIS) of any sensitive resources detected. ▪ Identification of relevant measures from the BRMP to be implemented as a result of the survey observations. Daily compliance reports would be submitted to the Authority via the Environmental Mitigation Management and Assessment system (EMMA) within 24 hours of each monitoring day. Noncompliance events would be reported to the Authority the day of the occurrence. Daily compliance reports would include: ▪ Date, time, and weather conditions observed at each location where monitoring occurred. ▪ Personnel who conducted compliance monitoring. ▪ Project activities monitored, including construction equipment in use. ▪ Compliance conditions implemented successfully. ▪ Noncompliance events observed. Daily compliance reports would also be included in the monthly compliance reports, which would be submitted to the Authority by the 10th of each month and would include: ▪ Summary of construction activities and locations during the reporting month, including any noncompliance events and their resolution, work stoppages, and take of threatened or endangered species. ▪ Summary of anticipated project activities and work areas for the upcoming month. ▪ Tracking of impacts on suitable habitats for each threatened and endangered species identified in USFWS and CDFW authorizations, including: – An accounting of the number of acres of habitats for which we provide compensatory mitigation that has been disturbed during the reporting month, and

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	– An accounting of the cumulative total number of acres of threatened and endangered species habitat that has been disturbed during the project period. ▪ Up-to-date GIS layers, associated metadata, and photodocumentation used to track acreages disturbed. ▪ Copies of all pre-activity survey reports, daily compliance reports, and noncompliance/work stoppage reports for the reporting month. ▪ Annual reports would be submitted to the Authority by the 20th of January and would include: ▪ Summary of all monthly compliance reports for the reporting year. ▪ A general description of the status of the project, including projected completion dates. ▪ All available information about project-related incidental take of threatened and endangered species. ▪ Information about other project impacts on the threatened and endangered species. ▪ A summary of findings from pre-construction surveys (e.g., number of times a threatened or endangered species or a den, burrow, or nest was encountered, location, if avoidance was achieved, if not, what other measures were implemented). ▪ Written description of disturbances to threatened and endangered species habitat within work areas, both for the preceding 12 months and in total since issuance of regulatory authorizations by USFWS and CDFW, and updated maps of all land disturbances and updated maps of identified habitat features suitable for threatened and endangered species within the project area. In addition to the compliance reporting requirements outlined above, the following items would be provided for compliance documentation purposes: ▪ If agency personnel visit the project footprint in accordance with BIO-IAMF#2, the Project Biologist would prepare a memorandum within one day of the visit that memorializes the issues raised during the field meeting. This memorandum would be submitted to the Authority via EMMA. Any issues regarding regulatory compliance raised by agency personnel would be reported to the Authority and the contractor. ▪ Compliance reporting would be submitted to the Authority via EMMA in accordance with the report schedule. The Project Biologist would prepare and submit compliance reports that document the following: – Implementation and performance of the RRP described in BIO-MM#1 – Summary of progress made regarding the implementation of the WCP described in BIO-MM#2 – Compliance with BIO-MM#3 – Compliance with BIO-IAMF#6 – Compliance with BIO-IAMF#7 – Compliance with BIO-IAMF#8 – Compliance with BIO-IAMF#10 – Compliance with BIO-MM#5 – Compliance with BIO-IAMF#12 – Compliance with BIO-IAMF#9

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	– BMP field manual implementation and any recommended changes to construction site housekeeping practices outlined in BIO-IAMF#11 ▪ Work stoppages and measures taken under BIO-MM#13 would be documented in a memorandum prepared by the Project Biologist and submitted to the Authority within 2 business days of the work stoppage.
BIO-MM#7: Conduct Botanical Field Surveys for Special-Status Plant Species and Special-Status Plant Communities	Prior to any ground-disturbing activity, the Project Biologist would conduct presence/absence botanical field surveys for special-status plant species and special-status plant communities within a work area consistent with *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018c) and *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 2000) in all potentially suitable habitats. The Project Biologist would flag and record in GIS the locations of any observed special-status plant species and special-status plant communities.
BIO-MM#8: Prepare and Implement Plan for Salvage, Relocation, and/or Propagation of Special-Status Plant Species	Where relocation or propagation of special-status plant species is required by authorizations issued under FESA and/or CESA, the Project Biologist would collect seeds and plant materials and stockpile and segregate the top 4 inches of topsoil from locations within the work area prior to any ground-disturbing activities where special-status plant species were observed during surveys conducted under BIO-MM#1. Special-status plant species are those listed as threatened, endangered, or candidate under FESA; threatened, endangered, or candidate for listing under CESA; state-designated "Rare" species; and CRPR 1B and 2 species that were observed during surveys for use on off-site locations. Restoration locations would be chosen based on the Policy on Mitigation Guidelines Regarding Impacts to Rare, Threatened, and Endangered Plants (CNPS 1998). Suitable sites that may receive salvaged material include Authority mitigation sites, refuges, reserves, federal or state lands, and public/private mitigation banks. The Project Biologist would prepare a plant species salvage plan to address monitoring, salvage, relocation and/or seed banking of special-status plant species. The plan would include provisions that address the techniques, locations, and procedures required for the collection, storage, and relocation of seed or plant material; collection, stockpiling, and redistribution of topsoil and associated seed. The plan would also include requirements related to outcomes such as the percent absolute cover of invasive species rated as "high" by the California Invasive Plant Council to be equal to or less than documented baseline conditions as well as maintenance, monitoring, implementation, adaptive management and the annual reporting. The plan would reflect conditions required under regulatory authorizations issued for federal or state-listed species. The Project Biologist would submit the plan to the Authority for review and approval.
BIO-MM#9: Prepare and Implement a Groundwater Adaptive Management and Monitoring Plan	To avoid, minimize and mitigate for potential impacts on wetlands, creeks, ponds, springs, riparian vegetation, special-status plant and wildlife species and protected trees, the Authority would prepare and implement a groundwater adaptive management and monitoring plan (GAMMP) prior to, during, and after tunnel construction to implement the requirements described under HYD-MM#1 and as described below concerning biological resources. Prior to construction, the GAMMP would be submitted to the USFWS, CDFW, SWRCB, and Regional Water Quality Control Board (RWQCB) for review (and approval where applicable).

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	The purpose of the GAMMP relative to biological resources is to monitor groundwater-dependent biological resources within the tunnel groundwater study area to detect and remediate adverse effects on habitat function in a timely manner. Implementation of the GAMMP would provide information and data to identify hydrological, hydrogeological, and biological effects that may arise during HSR construction, if any, and trigger actions to offset any such impacts. The GAMMP would include the following components, at a minimum, to avoid or minimize and address impacts on habitat for special-status species, aquatic resources, and protected trees: ▪ **Baseline inventory**—As allowed by private property owners, the Authority would establish baseline hydrologic conditions within the groundwater resource study area (approximately 1 mile north and south of the tunnel alignment) through baseline data collection. Baseline surveys would characterize potential aquatic resources, including but not limited to mapping of wetland and riparian vegetation; hydroperiod (the duration of inundation); flow rates; area of feature; pond depth; the potential for special-status plant and animal species (e.g., California tiger salamander, California red-legged frog, foothill yellow-legged frog, western pond turtle, least Bell's vireo, tricolored blackbird, and yellow-headed blackbird) and steelhead to occur; and potential groundwater dependent protected trees (e.g. oaks). ▪ **Groundwater modeling**—The Authority would model groundwater hydrologic conditions and potential tunnel infiltration to further identify specific areas of probable effect on the water table, facilitate selection of appropriate monitoring locations, and prepare for the potential need to provide supplemental water infrastructure in advance of tunneling. ▪ **Pre-tunneling supplemental water infrastructure provision**—To maintain baseline water supply, the Authority would install water storage tanks or water lines in advance of tunneling on or near properties with wetlands, creeks, ponds, and springs subject to landowner approval. Water infrastructure may also be provided for upland protected trees susceptible to groundwater lowering in areas of predicted groundwater effects, but direct watering of protected trees may be utilized instead. ▪ **Construction monitoring**—The Authority would designate monitoring locations and methodologies for monitoring water levels, vegetation cover, special-status species habitat, and protected trees most likely to be affected by tunnel construction as indicated by hydrologic modeling. The Authority would monitor representative locations during periods when effects are most likely to occur. 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. ▪ **Supplemental water**—The Authority would prepare contingency plans to provide supplemental water as necessary to support riparian/aquatic vegetation, wildlife breeding cycles, aquatic wildlife, or protected tree health within the area of predicted effects determined through modeling or monitoring to be potentially affected by groundwater lowering. Seasonal variation as documented during the preconstruction baseline monitoring would be considered in establishing the amount of supplemental water. For all features, supplemental water would provide minimum flows and periods of inundation to match baseline conditions. The periods of supplemental water,

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	in general, would likely be in periods of baseflow, which occurs in late spring, summer, and early fall outside of rain periods. For breeding habitats, the Authority would, at a minimum, supplement breeding habitat where necessary to maintain adequate depths for completion of the reproduction cycle (defined as the time by which juveniles are viable and mobile such that they can feasibly leave the breeding location). However, where breeding habitat is perennial or long-seasonal, then supplemental water would be provided as necessary to maintain the entire wetted period as determined through baseline monitoring. For nonbreeding movement and foraging habitat in creeks and streams, water would be provided to maintain seasonal flow similar to baseline conditions. Water would be provided as needed to sustain habitat conditions up to the point of baseline conditions until the qualified biologist determines it is appropriate to cease its provision. If supplemental water is provided from wells, the effects on water supply and habitat features would be managed to avoid and minimize potential disruption by the selection of well location, depth, flow rate, and the use of alternative supplies. ▪ **Contingency plan for supplemental water in areas outside of predicted area of effect**—The Authority would establish contingency procedures to provide supplemental water to wetlands, creeks, ponds, and springs to support riparian/aquatic vegetation, wildlife breeding cycles, and aquatic wildlife as well as supplemental water to protected trees outside the area of predicted effects, if warranted by monitoring. ▪ **Temporary relocation**—The Authority would relocate aquatic species (e.g., California tiger salamander, California red-legged frog, foothill yellow-legged frog, western pond turtle) where unavoidable drying of aquatic breeding habitat would occur before salamanders and frogs have been able to metamorphose 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. ▪ **Post-construction monitoring**—After construction, the Authority would monitor water levels and aquatic resource conditions of affected features twice annually (spring and summer) and affected protected trees for at least 5 years or as determined through consultation with USFWS and CDFW. As long as groundwater levels are demonstrated to be recovering, monitoring would continue until baseline conditions return or 5 years, whichever is longer. In the event that supplementary water is not successful at restoring aquatic resources and/or protected trees to baseline conditions in the post-construction period and off-site compensation is triggered, then monitoring may be waived for certain features if it is determined that there is no further utility for monitoring the specific feature. Once the Authority determines that conditions have returned to baseline conditions, monitoring would no longer be required. ▪ **Post-construction riparian or wetland restoration**—The Authority would 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. The Authority would implement restoration of riparian or wetland restoration, as applicable, as defined in Mitigation Measures BIO-MM#71 and BIO-MM#73.

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	▪ **Post-construction compensation**—If the Authority determines through direct monitoring or data interpretation that substantial disruption (i.e., loss of 0.5 acre or greater) to habitat supporting special-status species has likely occurred during or after construction and that habitat restoration efforts did not achieve success criteria or that restoration was determined unfeasible, the Authority would compensate for this loss of habitat. In addition, if affected protected trees demonstrate substantial impairment to health or mortality after 5 years of monitoring, the Authority would compensate for affected protected trees with replacement on at least a 1:1 basis. The Authority would implement the compensation of suitable habitat, as applicable, as defined in Mitigation Measures BIO-MM#10, BIO-MM#12, BIO-MM#28, BIO-MM#31, BIO-MM#33, BIO-MM#35, BIO-MM#57, BIO-MM#72, BIO-MM#74 and BIO-MM#75.
BIO-MM#10: Prepare and Implement a Compensatory Mitigation Plan for Species and Species Habitat	The Authority would prepare a compensatory mitigation plan (CMP) that sets out the compensatory mitigation that would be provided to offset permanent and temporary impacts on federal and state-listed species and their habitat, fish and wildlife resources regulated under Section 1600 et seq. of the Cal. Fish and Game Code, and special-status species. The CMP would include the following: ▪ A description of the species and habitat types for which compensatory mitigation is being provided. ▪ A description of the methods used to identify and evaluate mitigation options. Mitigation options would include one or more of the following: – Purchase of mitigation credits from an agency-approved mitigation bank. – Protection of habitat through acquisition of fee-title or conservation easement and funding for long-term management of the habitat. Title to lands acquired in fee would be transferred to CDFW and conservation easements would be held by an entity approved in writing by the applicable regulatory agency. In circumstances where the Authority protects habitat through a conservation easement, the terms of the conservation easement would be subject to approval of the applicable regulatory agencies, and the conservation easement would identify applicable regulatory agencies as third party beneficiaries with a right of access to the easement areas. – Payment to an existing in-lieu fee program. ▪ A summary of the estimated direct permanent and temporary impacts on species and species habitat. ▪ A description of the process that would be used to confirm impacts. Actual impacts on species and habitat could differ from estimates. Should this occur, adjustments would be made to the compensatory mitigation that would be provided. Adjustments to impact estimates and compensatory mitigation would occur in the following circumstances: – Impacts on species (typically measured as habitat loss) are reduced or increased as a result of changes in project design – Pre-construction site assessments indicate that habitat features are absent (e.g., because of errors in land cover mapping or land cover conversion) – The habitat is determined to be unoccupied based on negative species surveys – Impacts initially categorized as permanent qualify as temporary impacts

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	▪ An overview of the strategy for mitigating effects on species. The overview would include the ratios set forth in the species and habitat specific compensatory mitigation measures to be applied to determine mitigation levels and the resulting mitigation totals. ▪ A description of habitat restoration or enhancement projects, if any as provided by the habitat restoration mitigation measure, that would contribute to compensatory mitigation commitments. ▪ A description of the success criteria that would be used to evaluate the performance of habitat restoration or enhancement projects, and a description of the types of monitoring that would be used to verify that such criteria have been met. ▪ A description of the management actions that would be used to maintain the habitat on the mitigation sites, and the funding mechanisms for long-term management. ▪ A description of adaptive management approaches, if applicable, that would be used in the management of species habitat. ▪ A description of financial assurances that would be provided to demonstrate that the funding to implement mitigation is assured.
BIO-MM#11: Implement Measures to Minimize Impacts during Off-Site Habitat Restoration, or Enhancement, or Creation on Mitigation Sites	Prior to ground-disturbing activities associated with habitat restoration, enhancement, and/or creation actions at a mitigation site, the Authority would conduct a site assessment of the work area to identify biological and aquatic resources, including plant communities, land cover types, and the distribution of special-status plants and wildlife. Based on the results of the site assessment, the Authority would obtain any necessary regulatory authorizations prior to conducting habitat restoration, enhancement and/or creation activities, including authorization under the FESA or CESA, Cal. Fish and Game Code Section 1600 et seq., the CWA, and the Porter-Cologne Act. Restoration, enhancement, and/or creation of aquatic resources may result in the permanent conversion of grassland to wetland or riparian habitat. While such activities would be beneficial for vernal pool, riparian, and aquatic-breeding species, they would result in a small but measurable loss of upland habitat for other species (e.g., foraging habitat for tricolored blackbird, non-breeding habitat for California tiger salamander and California red-legged frog). Permanent impacts on grassland habitat from aquatic resource restoration, enhancement, and creation would be mitigated at a minimum ratio of 1:1 (acres preserved, enhanced, or restored: acres affected).
BIO-MM#12: Provide Compensatory Mitigation for Impacts on Listed Plant Species	The Authority would provide compensatory mitigation for direct impacts on federally and state-listed plant species based on the number of acres of occupied plant habitat directly affected. Such mitigation would include the following measures: ▪ Compensatory mitigation would be provided at a 1:1 ratio to offset direct impacts on occupied federally listed plant species habitat, unless a higher ratio is required pursuant to regulatory authorizations issued under FESA. ▪ Compensatory mitigation would be provided at a 1:1 ratio to offset direct impacts on occupied state-listed plant species habitat, unless a higher ratio is required pursuant to regulatory authorizations issued under CESA. Compensatory mitigation would be provided using one or more of the methods described in BIO-MM#10.

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BIO-MM#13: Implement Work Stoppage	In the event that any special-status wildlife species is found in a work area, the Project Biologist would have the authority to halt work to prevent the death or injury to the species. Any such work stoppage would be limited to the area necessary to protect the species and work may be resumed once the Project Biologist determines that the individuals of the species have moved out of harm's way or the Project Biologist has relocated them out of the work area in accordance with authorizations issued under FESA and CESA. Any such work stoppages and the measures taken to facilitate the removal of the species, if any, would be documented in a memorandum prepared by the Project Biologist and submitted to the Authority within 2 business days of the work stoppage.
BIO-MM#14: Avoid Direct Impacts on Bay Checkerspot Butterfly Host Plants	Prior to construction, the Project Biologist would survey for Bay checkerspot larval host plants—dwarf plantain and purple owl's-clover—within suitable habitat. If host plants are found, the Project Biologist would conduct surveys for adult butterflies during the peak of the flight period to determine presence/absence. Where adult butterflies are present, construction personnel would avoid host plants outside permanent impact areas.
BIO-MM#15: Prepare and Implement Bay Checkerspot Butterfly Protection Plan	Prior to final design, the Authority would incorporate features to minimize impacts on Bay checkerspot butterfly dispersal consistent with regulatory authorizations issued under the FESA. Actions may include: ▪ Plant shrubs or trees along the east side of the viaduct, the predominant direction from which dispersing butterflies are likely to originate. Trees and shrubs would provide a more natural transition over the viaduct. ▪ Place lighting under the viaduct in strategic locations to minimize shadows. ▪ Create vegetated "stepping stones" to attract butterflies under the viaduct and along a path that is the shortest distance between the Coyote Ridge core population and the Tulare Hill sub-population. If monitoring indicates that dispersal is affected by viaduct shadows, the Authority would develop a translocation project to facilitate Bay checkerspot butterfly dispersal between the core and sub-population. The project may include: ▪ Conservation of land near the alignment to improve survival conditions for dispersing butterflies. ▪ A monitoring and adaptive management process that would detail how the performance criteria of "no net change in dispersal" would be defined and maintained.
BIO-MM#16: Provide Compensatory Mitigation for Impacts on Bay Checkerspot Butterfly Habitat	The Authority, in accordance with authorizations issued under the FESA, would determine the compensatory mitigation required to offset impacts on habitat, including critical habitat, for Bay checkerspot butterfly. Compensatory mitigation could include one or more of the following: ▪ Purchase of credits from an agency-approved conservation bank ▪ Acquisition in fee title of USFWS-approved property ▪ Purchase or establishment of a conservation easement with an endowment for long-term management of the property-specific conservation values ▪ An in-lieu fee contribution determined through negotiation and consultation with the USFWS ▪ Contribution to SCVHA habitat protection, restoration, or management efforts

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	Mitigation for Bay checkerspot butterfly would first prioritize measures within the San Martin critical habitat unit and, to the extent feasible, that contribute to regional conservation efforts (i.e., habitat protection efforts underway by the SCVHA). The second priority would be to implement measures in another critical habitat unit. If mitigation within designated critical habitat is not feasible, the Authority would implement mitigation outside critical habitat that provides an equivalent contribution to Bay checkerspot butterfly recovery. The compensatory mitigation areas and methods selected would include appropriate measures to guide management of habitats (e.g., grazing, weed control), monitor populations, and identify methods to establish or reestablish populations, if necessary. ▪ Habitat restoration and management would be needed on many Bay checkerspot habitat areas. Appropriate grazing management should verify that habitats are neither overgrazed nor overgrown. Weeding, biological control, mowing, herbicides, and fire should also be considered as possible tools to control nonnative plant species. ▪ Monitoring of populations would serve to identify, on an ongoing basis, populations that are in trouble and in need of recovery efforts, as well as populations that are healthy and suitable as sources of individuals for reintroduction efforts. Several factors are important in deciding which habitat areas to protect: (1) habitat size and quality, including habitat diversity; (2) location in relation to other habitat patches and to core populations; (3) presence, current or historic, of Bay checkerspots; and (4) ease and cost of protection. Habitat protection should include buffer zones as necessary. Bay checkerspot habitat areas considered for mitigation can be ranked in approximate order of priority as follows: ▪ Core habitat areas a) Kirby (3,900 acres) b) Metcalf (1,100 acres) c) San Felipe (780 acres) d) Silver Creek Hills (1,000 acres) ▪ Potential core areas—Santa Teresa Hills (1,100 acres) ▪ Larger, good-quality habitat areas near core populations a) Tulare Hill (300 acres) b) North of Llagas Avenue (420 acres), c) West hills of Santa Clara Valley (74 acres) ▪ Stepping stones—Tulare Hill, Santa Teresa Hills, Redwood City ▪ Other current or historic localities or suitable habitat areas, generally larger than 1 hectare (2.5 acres), within the historic range of the butterfly, identified for their habitat value, function as dispersal corridors, proximity to other habitat, or other biological value. The Authority would submit a memorandum to the USFWS to document compliance with this measure.
BIO-MM#23: Conduct Surveys and Implement Avoidance Measures for Crotch Bumble Bee	In accordance with survey protocols for another rare North American bee species (rusty patched bumble bee [*Bombus affinis*]) (USFWS 2019), surveys of Crotch bumble bee habitat (as identified by species modeling) in the project footprint would be conducted by qualified biologists within 1 year prior to the

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	start of construction. Surveys would be conducted during four evenly spaced sampling periods during the flight season (March through September) (Thorp et al. 1983). For each sampling event, the biologist(s) would survey suitable habitat using nonlethal netting methods for 1 person-hour per 3 acres of the highest quality habitat or until 150 bumble bees are sighted, whichever comes first. If initial sampling of a given habitat area indicates that the habitat is of low quality or nonexistent, no further sampling of that area would be required. General guidelines and best practices for bumble bee surveys would follow USFWS' *Survey Protocols for the Rusty Patched Bumble Bee (*Bombus affinis*)* (USFWS 2019), which are consistent with other bumble bee survey protocols used by The Xerces Society for Invertebrate Conservation in the Pacific Northwest (Hatfield et al. 2017; Washington Department of Fish and Wildlife et al. 2019). If sampling identifies occupied Crotch bumble bee habitat within the project footprint, the project biologist would conduct pre-construction surveys of such habitat for active bee nest colonies and associated floral resources (i.e., flowering vegetation on which bees from the colony are observed foraging) no more than 30 days prior to any ground disturbance between March and September. The purpose of this pre-construction survey would be to identify active nest colonies and associated floral resources outside of permanent impact areas that could be avoided by construction personnel. The project biologist would establish, monitor, and maintain no-work buffers around nest colonies and floral resources identified during surveys. The size and configuration of the no-work buffer would be based on best professional judgment of the project biologist. At a minimum, the buffer would provide at least 20 feet of clearance around nest entrances and maintain disturbance-free airspace between the nest and nearby floral resources so bees can forage. Construction activities would not occur within the no-work buffers until the colony is no longer active (i.e., no bees are seen flying in or out of the nest for three consecutive days).
BIO-MM#24: Provide Compensatory Mitigation for Impacts on Crotch Bumble Bee	The Authority would provide compensatory mitigation for impacts on habitat for Crotch bumble bee. Impacts on occupied habitat (confirmed through presence/absence surveys as described in BIO-MM#23) would be compensated for at a ratio of 3:1, unless a higher ratio is required pursuant to an authorization issued under CESA, through the purchase of CDFW-approved bank credits or through preservation of habitat in perpetuity.
BIO-MM#25: Prepare Plan for Dewatering and Water Diversions	Prior to initiating any construction activity that occurs within open or flowing water, or streamside activities, the Authority would prepare a dewatering plan, which would be subject to the review and approval by the applicable regulatory agencies. The plan would incorporate measures to minimize turbidity and siltation. The Project Biologist would monitor the dewatering and/or water diversion sites, including collection of water quality data, as applicable. Prior to the dewatering or diverting of water from a site, the Project Biologist would conduct pre-activity surveys to determine the presence or absence of special-status species within the affected waterbody. In the event that special-status species are detected during pre-activity surveys, the Project Biologist would relocate the species (unless the species is fully protected under state law), consistent with any regulatory authorizations applicable to the species.
BIO-MM#26: Prepare and Implement a Cofferdam Fish Rescue Plan	If cofferdam construction or stream dewatering is required, the Authority or a contractor on behalf of the Authority would develop a fish rescue plan. The fish rescue plan would outline the methods for removing and relocating fish to adjacent waterways and would be implemented by a qualified fisheries biologist

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	with a CDFW Scientific Collecting Permit. The plan would also include methods for minimizing the risk of stress and mortality from capture and handling and adverse impacts on listed fish species (if present) associated with fish stranding. The USFWS, NMFS, and CDFW would be notified at least 48 hours prior to the start of fish rescue efforts, and a report of the species, number, and size of fish collected would be submitted to the CDFW, USFWS, and NMFS within 30 days of the fish rescue. The area to be dewatered would first be seined and then electrofished to remove remaining fish. The agency-approved biologist must have appropriate training and experience in electrofishing techniques and all electrofishing must be conducted according to the NMFS's *Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act* (NMFS 2000). A fisheries biologist would be on-site during initial dewatering to confirm compliance with the fish rescue plan. In streams bearing anadromous fish, in-water construction would avoid migration periods, and dewatering (installation of cofferdams) would begin no earlier than June 1 and would be completed (i.e., cofferdams removed) by October 15. If a cofferdam is required, the Authority would implement the following measures, unless other methods are approved by NMFS: ▪ Construct cofferdams 30–50 feet upstream and downstream of the construction location ▪ Minimize the cofferdam footprint to the minimum extent possible ▪ Pump water from the upstream location to the downstream location through a flexible corrugated pipe ▪ Match pumping volumes and velocities to upstream flows and maintain pumping volumes and velocities to match changes in upstream flows ▪ Install a T-pipe and riprap apron at the discharge location to disperse outflow and minimize erosion ▪ Construct cofferdams and riprap aprons over visqueen or similar material to facilitate cleanup and removal of materials ▪ Remove all construction materials, including sandbags and rock, and restore the area to pre-construction contours The agency-approved biologist would continuously monitor the placement of cofferdams and dewatering of isolated areas for the purpose of removing and relocating any listed species that were not detected or could not be removed and relocated prior to construction. The agency-approved biologist would be present at the work site until all listed species have been removed and relocated.
BIO-MM#27: Prepare and Implement an Underwater Sound Control Plan	The Authority or a contractor on behalf of the Authority would develop an underwater sound control plan to avoid and minimize potential adverse impacts from in-water pile-driving activities on federally listed salmonid species. The underwater sound control plan would include the following: ▪ Measures to minimize underwater sound pressure levels to below the following thresholds for peak pressure and accumulated sound exposure levels: – Peak pressure = 206 decibels – Accumulated sound exposure levels = 183 decibels ▪ Underwater sound monitoring during pile-driving activities

Impact Avoidance and Minimization Feature	Description
	▪ Oversight of all monitoring and construction activities by an agency-approved biological monitor to enforce full compliance with the underwater sound control plan ▪ Use of vibratory or non-impact methods (i.e., hydraulic) to drive sheet piling that results in sound pressures below threshold levels to the extent feasible ▪ Restrictions on pile driving to daytime hours Initial drives would be low energy with reduced impact frequency, gradually increasing in energy and frequency until necessary full force and frequency are achieved
BIO-MM#28: Provide Compensatory Mitigation for Permanent Impacts on Steelhead and Chinook Salmon Habitat	The Authority would provide compensatory mitigation for permanent impacts on habitat for CCC and SCCC steelhead and Central Valley fall-run Chinook salmon that is commensurate with the type (spawning, rearing, migratory, or critical habitat) and amount of habitat lost as follows: ▪ Spawning aquatic and riparian habitat within critical habitat would be protected and restored or protected and enhanced at a minimum of 3:1 (protected:affected) unless different ratios are specified in authorizations issued under the FESA ▪ All rearing and migratory aquatic and riparian habitat within critical habitat would be protected and restored or protected and enhanced at a minimum of 2:1 (protected:affected) or as specified in authorizations issued under the FESA ▪ All other rearing and migratory aquatic and riparian habitat outside of critical habitat would be protected and restored or protected and enhanced at a minimum of 1:1 (protected:affected) or as specified in authorizations issued under the FESA The Authority or a contractor on behalf of the Authority would purchase riparian and aquatic habitat credits at an NMFS-approved anadromous fish conservation bank, or another NMFS-approved conservation option, for the areal extent of riparian and suitable aquatic habitat affected by the action.
BIO-MM#29: Conduct Pre-Construction Surveys for California Tiger Salamander	Prior to any ground-disturbing activity scheduled to occur during the dry season (June 1–October 15), the Project Biologist would conduct a pre-construction survey of suitable upland habitat within the work area and extending out 100 feet from the boundary of the work area, where access is available, to determine whether California tiger salamanders are present. Such surveys would be conducted no earlier than 30 days prior to ground-disturbing activities in the work area. The Project Biologist may employ the use of conservation dogs (scent dogs) to augment focused species surveys using methods described in Wasser et al. (2004), Smith et al. (2006), and/ or Filazzola et al. (2017). The Project Biologist would coordinate with USFWS and CDFW before using conservation dogs. In the event that ground-disturbing activities are scheduled to occur during the rainy season (October 15–June 1), in addition to upland surveys, the Project Biologist would survey potential breeding habitat in the work area for the presence of California tiger salamanders using methods from the *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander* (CDFG and USFWS 2003) or other more recent guidelines, if available.
BIO-MM#30: Implement Avoidance and Minimization	Prior to any ground-disturbing activity, the contractor, under the direction of the Project Biologist would install WEF along the boundary of the work area containing California tiger salamander suitable habitat or would implement similar measures as otherwise required pursuant to regulatory authorizations

Impact Avoidance and Minimization Feature	Description
Measures for California Tiger Salamander	issued under the FESA or CESA. WEF must be trenched into the soil at least 4 inches in depth, with the soil compacted against both sides of the fence for its entire length to prevent tiger salamanders from passing under the fence, and must have must have intermittent exit points. During the dry season (June 1–October 15), the Project Biologist would inspect the WEF at least twice weekly on nonconsecutive days and on a daily basis between October 15 and June 1 or following any rain event. WEF would be installed with turn-arounds at access points to direct California tiger salamander away from gaps in the fencing. To the extent feasible, construction activities would not be conducted within 250 feet of areas identified as occupied California tiger salamander breeding habitat during the rainy season (October 15–June 1). However, construction activities may begin within such areas after April 15 if the breeding habitat is no longer inundated.
BIO-MM#31: Provide Compensatory Mitigation for Impacts on California Tiger Salamander Habitat	The Authority would provide compensatory mitigation to offset the loss of modeled California tiger salamander habitat. Compensatory mitigation would be provided for impacts on habitat occupied or presumed occupied by California tiger salamander at a ratio of 3:1, unless higher ratios are required through regulatory authorizations issued under the FESA or CESA. Compensatory mitigation would be provided using one or more of the methods described in BIO-MM#10.
BIO-MM#32: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for California Red-Legged Frog	Prior to any ground-disturbing activity scheduled to occur during the dry season (June 1–October 15), the Project Biologist would conduct a pre-construction survey of modeled suitable potential breeding habitat within the work area and extending out 100 feet from the boundary of the work area, where access is available, to determine whether California red-legged frogs are present using methods from the *Revised Guidance on Site Assessments and Field Surveys for The California Red-legged Frog* (USFWS 2005), or other more recent guidelines, if available. Such surveys would be conducted no earlier than 30 days prior to ground-disturbing activities in the work area. Appropriate avoidance and minimization measures, including moving individuals to nearby ponds, or other appropriate measures, would be implemented based on authorizations issued under the FESA.
BIO-MM#33: Provide Compensatory Mitigation for Impacts on California Red-Legged Frog Habitat	The Authority, in accordance with authorizations issued under the FESA, would compensate for impacts on habitat, including critical habitat, for California red-legged frog. Compensatory mitigation could include one or more of the following: ▪ Purchase of credits from an agency-approved conservation bank ▪ Acquisition in fee title of USFWS-approved property ▪ Purchase or establishment of a conservation easement with an endowment for long-term management of the property-specific conservation values ▪ An in-lieu fee contribution determined through negotiation and consultation with the USFWS Compensatory mitigation for red-legged frog would prioritize lands that would contribute to the recovery of the species and, to the extent feasible, to regional conservation efforts. The recovery plan for the California red-legged frog (USFWS 2002) describes tasks that would contribute to the recovery of the California red-legged frog. To the extent feasible, the compensatory mitigation for California red-legged frog would incorporate one or more of the following conservation needs identified by the recovery plan for the core recovery areas: ▪ East San Francisco Bay Core Recovery Area: protect existing populations; control nonnative predators; study effects of grazing in riparian corridors,

Impact Avoidance and Minimization Feature	Description
	ponds, and uplands (e.g., on East Bay Regional Park District lands); reduce impacts associated with livestock grazing; protect habitat connectivity; minimize impacts of recreation and off-road vehicle use (e.g., Corral Hollow watershed); avoid and reduce impacts of urbanization; protect habitat buffers from nearby urbanization (Recovery Task 1.16) ▪ Santa Clara Valley Core Recovery Area: protect existing populations and control nonnative predators (Recovery Task 1.17) The first priority would be to implement compensatory mitigation within the Wilson Peak Critical Habitat Unit. The second priority would be to implement compensatory mitigation in another designated critical habitat unit. If mitigation within designated critical habitat is not feasible, the Authority would implement compensatory mitigation outside critical habitat that provides an equivalent contribution to California red-legged frog recovery. Compensatory mitigation would be provided for impacts on California red-legged frog breeding and refugia/foraging habitat at a ratio of 3:1 and 2:1, respectively.
BIO-MM#34: Conduct Pre-Construction Surveys and Implement Avoidance and Minimization Measures for Foothill Yellow-Legged Frog	Prior to any ground-disturbing activity scheduled to occur during the dry season (June 1–October 15), the Project Biologist would survey potential breeding habitat (as identified by species modeling) in the project footprint for the presence of foothill yellow-legged frogs using methods from the *Draft Visual Encounter Survey Protocol for Rana boylii in Lotic Environments* (Peek et al. 2017), or other more recent guidelines, if available. Surveys would be conducted no more than 30 days before the start of ground-disturbing activities and would be spatially phased to precede construction activities. Appropriate avoidance and minimization measures, including moving individuals to nearby ponds or other appropriate measures, would be implemented with authorizations issued under the CESA.
BIO-MM#35: Provide Compensatory Mitigation for Impacts on Foothill Yellow-Legged Frog Habitat	The Authority, in keeping with the state incidental take permit, would provide compensatory mitigation for impacts on habitat for foothill yellow-legged frog. Impacts on occupied or presumed occupied aquatic habitat would be compensated for at a ratio of 3:1 for primary breeding and foraging habitat through the purchase of CDFW-approved bank credits or through preservation of occupied habitat in perpetuity.
BIO-MM#36: Conduct Pre-Construction Surveys for Special-Status Reptiles and Amphibians	Prior to any ground-disturbing activities, the Project Biologist would conduct pre-construction surveys in suitable habitat to determine the presence or absence of special-status reptile and amphibian species within the work area. Surveys would be conducted no more than 30 days before the start of ground-disturbing activities in a work area. The results of the pre-construction survey would be used to guide the placement of ESAs or conduct species relocation.
BIO-MM#37: Implement Avoidance and Minimization Measures for Special-Status Reptiles and Amphibians	The Project Biologist would monitor all initial ground-disturbing activities that occur within suitable habitat for special-status reptiles and amphibians, and would conduct clearance surveys of suitable habitat in the work area on a daily basis. If a special-status reptile or amphibian is observed, the Project Biologist would identify actions, to the extent feasible, sufficient to avoid impacts on the species and to allow it to leave the area of its own volition. Such actions may include establishing a temporary ESA in the area where a special-status reptile or amphibian has been observed and delineating a 50-foot no-work buffer around the ESA. In circumstances where a no-work buffer is not feasible the Project Biologist would relocate any of the species observed from the work area. For federally or state-listed species, relocations would be undertaken in accordance with regulatory authorizations issued under the FESA or CESA.

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BIO-MM#43: Conduct Pre-Construction Surveys and Delineate Active Nest Buffers for Breeding Birds	Prior to any ground-disturbing activity, including vegetation removal, scheduled to occur during the bird breeding season (February 1 to September 1), the Project Biologist would conduct visual pre-construction surveys within the work area for nesting birds and active nests (nests with eggs or young) of non-raptor species protected under the MBTA and/or the Cal. Fish and Game Code. In the event that active bird nests are observed during the pre-construction survey, the Project Biologist would delineate no-work buffers. No-work buffers would be set at a distance of 75 feet, unless a larger buffer is required pursuant to regulatory authorizations issued under the FESA or CESA. No-work buffers would be maintained until nestlings have fledged and are no longer reliant on the nest or parental care for survival or the Project Biologist determines that the nest has been abandoned. In circumstances where it is not feasible to maintain the standard no-work buffer, the no-work buffer may be reduced, provided that the Project Biologist monitors the active nest during the construction activity to ensure that the nesting birds do not become agitated. Additional measures that may be used when no-work buffers are reduced include visual screens and noise barriers
BIO-MM#45: Conduct Surveys for Burrowing Owls	No more than 30 days but no less than 14 days prior to any ground-disturbing activity in burrowing owl habitat, the Project Biologist would conduct pre-construction surveys for burrowing owl within suitable habitat located in the work area and/or extending 250 feet from the boundary of the work area, where access is available. Surveys would be conducted in accordance with the SCVHP's condition of approval for covered activities in burrowing owl habitat (ICF International 2012: page 6-62). This methodology is consistent with the CDFW *Staff Report on Burrowing Owl Mitigation* (CDFG 2012), but it may be updated based on future changes by the SCVHA.
BIO-MM#46: Implement Avoidance Measures for Burrowing Owl	Occupied burrowing owl burrows found during pre-construction surveys would be avoided in accordance with the SCVHP's condition of approval for covered activities in burrowing owl habitat (ICF International 2012: page 6-62). To the extent feasible, the Project Biologist would establish 250-foot no-work buffers around occupied burrowing owl burrows in the work area. An occupied burrow is defined as any burrow at which (1) an adult owl is observed on two or more pre-construction surveys, or (2) a pair of adult owls is observed on one or more pre-construction survey. Construction may proceed outside the 250-foot nondisturbance zone. Construction may proceed inside the 250-foot nondisturbance no-work buffer zone during the breeding season if the season-specific criteria (nesting season: February 1–August 31; non-nesting season: September 1–January 31) described in the SCVHP are met.
BIO-MM#47: Provide Compensatory Mitigation for Loss of Active Burrowing Owl Burrows and Habitat	To compensate for permanent impacts on occupied burrowing owl breeding habitat, the Authority would provide compensatory mitigation at a minimum 1:1 ratio for occupied breeding and foraging habitat. Lands proposed as compensatory mitigation would meet one of the following criteria: ▪ Support at least two breeding adult owls for every breeding adult owl displaced by construction of the project ▪ Support at least 1 acre of burrowing owl breeding habitat for every acre of habitat affected (i.e., 1:1 mitigation ratio). For the purposes of this measure, burrowing owl breeding habitat is defined as any land cover type with all of the following attributes: – Open terrain with well-drained soils – Short, sparse vegetation with few shrubs and no trees

Impact Avoidance and Minimization Feature	Description
	– Underground burrows or burrow surrogates (e.g., debris piles, culverts, pipes) for nesting and shelter from predators or weather. Burrows in earthen levees, berms, or canal banks within or along the margins of agricultural fields can be counted as compensatory breeding habitat as long as adjacent fields or pastures are suitable for foraging. – Abundant and accessible prey (arthropods, small rodents, amphibians, lizards)
BIO-MM#48: Conduct Pre-Construction Surveys for Eagles	At least 1 year prior to the start of any ground-disturbing activities and construction, the Project Biologists would conduct nesting season surveys for eagles. Surveys for bald and golden eagle nests would be conducted within 4 miles of any construction areas supporting suitable nesting habitat and important eagle roost sites and foraging areas. Surveys would be conducted in accordance with the USFWS *Interim Golden Eagle Inventory and Monitoring Protocols* (Pagel et al. 2010), CDFW's *Bald Eagle Breeding Survey Instructions* (CDFW 2017), or current guidance. A nesting territory or inventoried habitat would be considered unoccupied by golden eagles only after completing at least two full surveys in a single breeding season. Prior to initial construction activities, the Project Biologist would conduct a pre-construction sweep of the project site for golden eagle use.
BIO-MM#49: Implement Avoidance Measures for Active Eagle Nests	Prior to the start of any ground-disturbing activity, if an occupied nest (as defined by Pagel et al. 2010) is detected within 4 miles of the work areas, the Authority would implement a 1-mile line-of-sight and 0.5-mile no-line-of-sight no-work buffer during the breeding season (January 1 through August 31) so that construction activities do not result in injury or disturbance to eagles. The no-work buffer would be maintained throughout the breeding season or until the young have fledged and are no longer dependent on the nest or parental care that includes nest use for survival. Buffers around occupied nests may be reduced if the Project Biologist determines that smaller buffers would be sufficient to avoid impacts on nesting eagles. Factors to be considered for determining buffer size would include the presence of natural buffers provided by vegetation or topography, nest height, locations of foraging territory, and baseline levels of noise and human activity. Buffers would be maintained and nests monitored until the Project Biologist has determined that young have fledged and are no longer reliant on the nest or parental care that includes nest use for survival. Eagle nest exclusion zones may be removed if monitoring reveals the nest not to be in use as determined by the Project Biologist. An in-use eagle nest is one that is "a bald or golden eagle nest characterized by the presence of one or more eggs, dependent young, or adult eagles on the nest in the past ten days during the breeding season" (USFWS 2016c). Monitoring to demonstrate whether or not eagle nests are in use would follow observational procedures described by Pagel et al. (2010). In bald and golden eagle nesting territories, the Project Biologist would examine debris piles and determine if there is a potential to attract prey species. If the Project Biologist determines debris piles may attract prey species and pose a danger to eagles, the debris piles would be removed or moved.
BIO-MM#50: Provide Compensatory Mitigation for Loss of Eagle Nests	If pre-construction surveys identify in-use or alternate eagle nests in the permanent impact area, the Authority, in consultation with the USFWS, would develop a nest relocation or replacement plan for the affected nest(s). The plan would describe why there is no practicable alternative to nest removal while enabling project construction. Any relocation or replacement of eagle nests

Impact Avoidance and Minimization Feature	Description
	would be in accordance with the BGEPA and subject to the following minimum requirements: ▪ The nest would be relocated, or a suitable nest would be provided, within the same nesting territory to provide a viable nesting option for the affected eagle pair. ▪ Post-construction monitoring to confirm continued nesting within the affected nesting territory would be conducted for a minimum of 3 years using observation procedures described by Pagel et al. (2010).
BIO-MM#52: Conduct Pre-Construction Surveys and Monitoring for Raptors	If construction or other vegetation removal activities are scheduled to occur during the breeding season for raptors (January 1–September 1), no more than 14 days before the start of the activities, the Project Biologist would conduct pre-construction surveys for nesting raptors in areas where suitable habitat is present. Specifically, such surveys would be conducted in habitat areas within the work area and, where access is available, within 500 feet of the work area boundary where breeding raptors with active nests are found, the Project Biologist would delineate a 500-foot buffer (or as modified by regulatory authorizations for species listed under the FESA or CESA) around the nest to be maintained until the young have fledged from the nest and are no longer reliant on the nest or parental care for survival or until such time as the Project Biologist determines that the nest has been abandoned.
BIO-MM#53: Conduct Surveys for Swainson's Hawk Nests	Surveys must be performed no more than 1 year prior to the commencement of construction activities. The Project Biologist would conduct surveys for Swainson's hawk during the nesting season (March 1–August 31) within both the work area and a 0.5-mile buffer surrounding the work area, provided access to such areas is available. No sooner than 30 days prior to any ground-disturbing activity, the Project Biologist would conduct pre-construction surveys of nests identified during the earlier surveys to determine if any are occupied. The initial nesting season surveys and subsequent pre-construction nest surveys would follow the protocols set out in the Recommended Timing and Methodology for *Swainson's Hawk Nesting Surveys in California's Central Valley* (SHTAC 2000).
BIO-MM#54: Implement Avoidance and Minimization Measures for Swainson's Hawk Nests	Any active Swainson's hawk nests (defined as a nest used one or more times in the last 5 years) found within 0.5-mile of the boundary of the work area during the nesting season (March 1–August 31) would be monitored daily by the Project Biologist to assess whether the nest is occupied. If the nest is occupied, the Project Biologist would establish no-work buffers following CDFW's *Staff Report Regarding Mitigation for Impacts to Swainson's Hawks (*Buteo swainsoni*) in the Central Valley of California* (CDFG 1994), and the status of the nest would be monitored until the young fledge or for the length of construction activities, whichever occurs first. If ground-disturbing activities or other construction activities may cause nest abandonment or forced fledging within the specified buffer area, the biological monitor would monitor the nest site to determine if the nest is abandoned. If an occupied Swainson's hawk nest tree is to be removed as a result of construction, or nest abandonment is observed during construction, an incidental take permit under CESA would be obtained and impacts would be minimized and fully mitigated.
BIO-MM#55: Provide Compensatory Mitigation for Loss of Swainson's Hawk Nesting Trees and Habitat	To compensate for permanent impacts on active Swainson's hawk nest trees (i.e., trees in which Swainson's hawks were observed building nests during protocol-level surveys described in BIO-MM#53) and foraging habitat, the Authority would provide compensatory mitigation that replaces affected nest

Impact Avoidance and Minimization Feature	Description
	trees and provides foraging habitat. Lands proposed as compensatory mitigation for Swainson's hawk would meet the following minimum criteria: ▪ Support at least three mature native riparian trees suitable for Swainson's hawk nesting (i.e., valley oak, Fremont cottonwood, or willow) for each Swainson's hawk nest tree removed by construction of the project extent ▪ Support at least one Swainson's hawk nesting territory in the last 5 years To compensate for impacts on Swainson's hawk foraging habitat, the Authority would contribute to the project's mitigation commitment for Swainson's hawk foraging habitat, which would be calculated based on the following ratios: ▪ 1:1 for impacts on Primary Active Foraging Habitat ▪ 0.75:1 for impacts on Secondary Active Foraging Habitat ▪ 0.5:1 for impacts on Tertiary Active Foraging Habitat
BIO-MM#56: Conduct Surveys and Implement Avoidance Measures for Active Tricolored Blackbird Nest Colonies	Prior to initiation of construction at any location within 300 feet of suitable nesting habitat, the Project Biologist with experience surveying for and observing tricolored blackbird would conduct pre-construction surveys to establish use of nesting habitat by tricolored blackbird colonies. Surveys would be conducted in suitable habitat within 300 feet of proposed construction areas, where access allows, during the nesting season (generally March 15–July 31). If construction is initiated near suitable habitat during the nesting season, three surveys would be conducted within 15 days prior to construction, with one of the surveys within 5 days prior to the start of construction. If active tricolored blackbird nesting colonies are identified, construction activities must avoid the nesting colonies and associated habitat during the breeding season (generally March 15–July 31) to the extent practicable within 300 feet of the colony, consistent with the CDFW's *Staff Guidance Regarding Avoidance of Impacts to Tricolored Blackbird Breeding Colonies on Agricultural Fields in 2015* (CDFW 2015). This minimum buffer may be reduced in areas with dense forest, buildings, or other habitat features between the construction activities and the active nest colony, or where there is sufficient topographic relief to protect the colony from excessive noise or visual disturbance as determined by a Project Biologist experienced with tricolored blackbird. If tricolored blackbirds colonize habitat adjacent to construction after construction has been initiated, the Authority would reduce disturbance through establishment of buffers or sound curtains, as determined by the Project Biologist.
BIO-MM#57: Provide Compensatory Mitigation for Impacts on Tricolored Blackbird Habitat	The Authority would provide compensatory mitigation required to offset impacts on tricolored blackbird. Compensatory mitigation would replace permanent loss of habitat with habitat that is commensurate with the type (nesting, roosting, and foraging) and amount of habitat lost. Suitable tricolored blackbird nesting habitat would be permanently protected or restored and managed at a ratio of 3:1 (protected or restored:affected) at a location subject to CDFW approval, and in proximity to the nearest breeding colony observed within the past 15 years, if possible. Suitable breeding season foraging habitat would be protected and managed at a ratio of 1:1 (protected:affected) at a location subject to CDFW approval. Suitable nonbreeding season foraging habitat would be protected or restored at a ratio of 1:1 (protected:affected). Compensatory mitigation would be provided using one or more of the methods described in the CMP.
BIO-MM#58: Provide Compensatory Mitigation for Impacts on Waterfowl,	The Authority would provide compensatory mitigation required to offset impacts on waterfowl and shorebirds in the UPR and GEA IBAs. Compensatory mitigation would replace permanent loss of habitat with habitat that is

Impact Avoidance and Minimization Feature	Description
Shorebird, and Sandhill Crane Habitat	commensurate with the type (nesting, roosting, or foraging) and amount of habitat lost as follows: ▪ Suitable waterfowl and shorebird nesting and foraging habitat would be permanently protected and enhanced at a suitable location at a ratio of 1:1 (protected:affected) for permanent habitat loss; 1:1 (protected:affected) for habitat where hearing damage could result during operations (residual noise of 93 dBA or greater, as measured outside the HSR right-of-way); and 0.5:1 for habitat where arousal, visual disturbance, or masking effects result from operations (residual noise of 77 dBA or greater, as measured outside of the HSR right-of-way). Protection and enhancement of habitat would be implemented within the GEA and UPR IBAs or a suitable alternative location. ▪ Enhancement activities could include improved water management (to increase food supplies); improvement or replacement of water management infrastructure; vegetation control and management; contouring to increase topographic heterogeneity (to increase habitat diversity); or levee repair, maintenance, and replacement.
BIO-MM#59: Conduct Pre-Construction Surveys for San Joaquin Kit Fox	Within 30 days prior to the start of any ground-disturbing activity, the Project Biologist would conduct pre-construction surveys in suitable kit fox habitat in the work area. The Project Biologist would conduct the surveys in accordance with USFWS' *San Joaquin Kit Fox Survey Protocol for the Northern Range* (USFWS 1999) between May 1 and September 30 for the purpose of identifying potential San Joaquin kit fox dens. All dens would be mapped and their type and status determined. Den types would be identified as defined in Exhibit A (Definitions) of the USFWS' *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox prior to or during Ground Disturbance* (USFWS 2011). If any occupied or potential dens are found during pre-construction surveys, they would be flagged and a 50-foot no-work buffer would be established around the den until the den type is identified cleared, in accordance with regulations under the FESA and CESA, if necessary to allow construction activities to proceed. The Project Biologist may employ the use of conservation dogs (scent dogs) to augment focused species surveys using methods described in Smith et al. (2006). The Project Biologist would coordinate with USFWS and CDFW before using conservation dogs.
BIO-MM#60: Implement San Joaquin Kit Fox Avoidance and Minimization Measures	The Authority would implement USFWS' *Standardized Recommendations for Protection of the San Joaquin Kit Fox* Prior to or During Ground Disturbance (USFWS 2011) to minimize impacts on this species, including: ▪ Disturbance of all kit fox dens would be avoided to the extent feasible. ▪ Construction activities that occur within 200 feet of any occupied dens would cease within one-half hour after sunset and would not begin earlier than one-half hour before sunrise, to the extent feasible. ▪ All construction pipes, culverts, or similar structures with a diameter of 4 inches or greater that are stored within the construction footprint for one or more overnight period would be thoroughly inspected for kit foxes before the pipe is subsequently buried, capped, or otherwise used or moved. ▪ If a San Joaquin kit fox is detected within a work area during construction, the Project Biologist would request approval from the USFWS and CDFW to capture and relocate the kit fox if it does not safely leave the area by its own volition. ▪ To minimize the temporary impacts of WEF and construction exclusion fencing on kit fox and their movement/migration corridors during construction, artificial dens would be installed along the outer perimeter of WEF and

Impact Avoidance and Minimization Feature	Description
	construction exclusion fencing. Artificial dens or similar escape structures would also be installed at dedicated wildlife crossing structures to provide escape cover and protection against predation. The artificial dens would be located on parcels owned by the Authority or at locations where access is available.
BIO-MM#61: Provide Compensatory Mitigation for Impacts on San Joaquin Kit Fox Habitat	The Authority would provide compensatory mitigation for impacts on San Joaquin kit fox habitat through the acquisition of suitable habitat that is acceptable to USFWS and CDFW. Habitat would be replaced at a minimum ratio of 1:1 for high- or moderate-value suitable habitat (natural lands) and at a ratio of 0.5:1 for low-value suitable habitat (urban or agricultural lands), unless a higher ratio is required by regulatory authorizations issued under the FESA and CESA. Compensatory mitigation would be provided using one or more of the methods described in BIO-MM#10.
BIO-MM#64: Conduct Pre-Construction Surveys for American Badger Den Sites and Implement Avoidance and Minimization Measures	Prior to any ground-disturbing activity, the Project Biologist would conduct pre-construction surveys for American Badger den sites within suitable habitat located within the work area. These surveys would be conducted no less than 14 days and no more than 30 days prior to the start of ground-disturbing activities in a work area. The Project Biologist would establish a 100-foot no-work buffer around occupied maternity dens throughout the pup-rearing season (February 15–July 1) and a 50-foot no-work buffer around occupied dens during other times of the year. If nonmaternity dens are found and cannot be avoided during construction activities, they would be monitored for badger activity. If the Project Biologist determines that dens may be occupied, passive den exclusion measures would be implemented for 3–5 days to discourage the use of these dens prior to project disturbance activities.
BIO-MM#65: Conduct Pre-Construction Surveys for Ringtail and Ringtail Den Sites and Implement Avoidance Measures	Prior to any ground-disturbing activity, the Project Biologist would conduct pre-construction surveys for ringtail and ringtail den sites in suitable habitat within the work area. These surveys would be conducted no more than 30 days before the start of ground-disturbing activities in a work area. The Project Biologist would establish 100-foot no-work buffers around occupied maternity dens throughout the pup-rearing season (May 1–June 15) and a 50-foot no-work buffer around occupied dens during other times of the year.
BIO-MM#66: Conduct Pre-Construction Surveys for Dusky-Footed Woodrat and Implement Avoidance Measures	Prior to any ground-disturbing activity, the Project Biologist would conduct pre-construction surveys for woodrat stick houses within suitable habitat located within the work area. These surveys would be conducted no more than 14 days before the start of ground-disturbing activities in a work area. The Project Biologist would establish a 10-foot no-work buffers around each stick house using ESA fencing. If stick houses are found within temporary or permanent impact areas and cannot be avoided, the following condition would be implemented: ▪ Removal of woodrat stick houses would not occur between March and May when nesting is most likely. Outside this period, the contractor, under supervision of the Project Biologist, may dismantle stick houses by hand or using small construction machinery (e.g., Bobcat or similar) and move nesting material to suitable habitat outside the project footprint so that woodrats may rebuild new houses.
BIO-MM#67: Conduct Pre-Construction Surveys for Special-Status Bat Species	No more than 1 year before the replacement or modification of any bridges or removal of other structures modeled as bat habitat and where access is available, the Project Biologist would conduct a survey of the bridge looking for evidence of roosting bats. If bat sign is detected, biologists would conduct an evening visual emergence survey of the bridge or structure, from a half hour

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	before sunset to 1–2 hours after sunset for a minimum of 2 nights within the season that construction would be taking place. If a potentially active bat roost is in the bridge or structure, passive monitoring with full-spectrum bat detectors would be used to assist in determining species present. To the extent possible, all monitoring would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists would analyze the bat call data using appropriate software and would prepare a report that would be submitted to the Authority, including an assessment of the significance of the roost for local bat populations.
BIO-MM#68: Implement Bat Avoidance and Relocation Measures	If active hibernacula or maternity roosts are identified in the work area or 500 feet extending from the work area during pre-construction surveys, they would be avoided to the extent feasible. If avoidance of a hibernacula is not feasible, the Project Biologist would prepare a relocation plan to remove the hibernacula and provide for construction of an alternative bat roost outside of the work area. The Project Biologist would implement the relocation plan before the commencement of any ground-disturbing activities that would occur within 500 feet of the hibernacula. Removal of roosts would be guided by accepted exclusion and deterrent techniques.
BIO-MM#69: Implement Bat Exclusion and Deterrence Measures	If nonbreeding or nonhibernating individuals or groups of bats are found roosting within the work area, the Project Biologist would facilitate the eviction of the bats by either opening the roosting area to change the lighting and airflow conditions, or installing one-way doors or other appropriate methods. To the extent feasible, the Authority would leave the roost undisturbed by project activities for a minimum of 1 week after implementing exclusion and/or eviction activities. Steps would not be taken to evict bats from active maternity or hibernacula; instead such features may be relocated pursuant to a relocation plan.
BIO-MM#70: Prepare and Implement an Annual Vegetation Control Plan	Prior to O&M of the HSR, the Authority would prepare an annual vegetation control plan (VCP) to address vegetation removal for the purpose of maintaining clear areas around facilities, reducing the risk of fire, and controlling invasive weeds during the operational phase. The Authority would generally follow the procedures established in Chapter C2 of the California Department of Transportation (Caltrans) Maintenance Manual to manage vegetation on Authority property (Caltrans 2010). Vegetation would be controlled by chemical, thermal, biological, cultural, mechanical, structural, and manual methods. The VCP would be updated each winter and completed in time to be implemented no later than April 1 of each year. The annual update to the VCP would include a section addressing issues encountered during the prior year and changes to be incorporated into the VCP. The plan would describe site-specific vegetation control methods, as outlined below: ▪ Chemical vegetation control methods ▪ Mowing program consistent with Section 1415 of the FAST Act ▪ Other nonchemical vegetation control ▪ Other chemical pest control methods (e.g., insects, snail, rodent) Only Caltrans-approved herbicides may be used in the vegetation control program. Pesticide application would be conducted by certified pesticide applicators in accordance with all requirements of the California Department of Pesticide Regulation and County Agricultural Commissioners. Noxious/invasive weeds would be treated where requested by County Agricultural Commissioners. The Authority would cooperate in area-wide efforts to control noxious/invasive weeds if such programs have been established by local agencies.

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BIO-MM#71: Restore Temporary Riparian Impacts	Within 90 days of completing construction in a work area, the Project Biologist would direct the revegetation of any riparian areas temporarily disturbed as a result of the construction activities, using appropriate native plants and seed mixes. Native plants and seed mixes would be obtained from stock originating from local sources, to the extent feasible. The Project Biologist would monitor restoration activities consistent with provisions in the RRP (BIO-MM#1).
BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat	The Authority would compensate for permanent impacts on riparian habitats at a ratio of 2:1 (mixed riparian and palustrine forested wetland) or 4:1 (California sycamore woodland), unless a higher ratio is required by agencies with regulatory jurisdiction over the resource. Compensatory mitigation may occur through habitat restoration, the acquisition of credits from an approved mitigation bank, participation in an in-lieu fee program or habitat preservation or enhancement at a permittee responsible mitigation site.
BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts	Within 90 days of the completion of construction activities in a work area, the Authority would begin to restore aquatic resources that were temporarily affected by the construction. As set out in the RRP (BIO-MM#1), such areas would be, to the extent feasible, restored to their natural topography. In areas where gravel or geotextile fabrics have been installed to protect substrate and to otherwise minimize impacts, the material would be removed and the affected features would be restored. The Authority would revegetate affected aquatic resources using appropriate native plants and seed mixes (from local sources where available). The Authority would conduct maintenance monitoring consistent with the provisions of the RRP.
BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources	The Authority would prepare and implement a CMP that identifies mitigation to address temporary and permanent loss, including functions and values, of aquatic resources as defined as waters of the U.S. under the federal CWA and/or waters of the state under the Porter-Cologne Act. The compensatory mitigation for state- and federally protected wetlands would meet the federal and state policy for no net loss of functions and values. Compensatory mitigation may involve the restoration, establishment, enhancement, and/or preservation of aquatic resources through one or more of the following methods: ▪ Purchase of credits from an agency-approved mitigation bank ▪ Preservation of aquatic resources through acquisition of property ▪ Establishment, restoration, or enhancement of aquatic resources ▪ In-lieu fee contribution determined through consultation with the applicable regulatory agencies The following ratios would be used for compensatory mitigation unless a higher ratio is required pursuant to regulatory authorizations issued under Section 404 of the CWA and the Porter-Cologne Act: ▪ Vernal pools: 2:1 ▪ Seasonal wetlands: between 1.1:1 and 1.5:1 based on impact type, function and values lost – 1:1 off-site for permanent impacts – 1:1 on-site and 0.1:1 to 0.5:1 off-site for temporary impacts For mitigation involving establishment, restoration, enhancement, or preservation of aquatic resources by the Authority, the CMP would contain the following information: ▪ Objectives—A description of the resource types and amounts that would be provided, the type of compensation (i.e., restoration, establishment,

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	enhancement, and/or preservation), and the manner in which the resource functions of the compensatory mitigation project would address the needs of the watershed or ecoregion ▪ Site selection—A description of the factors considered during the term sustainability of the resource ▪ Adaptive management plan—A management strategy to address changes in site conditions or other components of the compensatory mitigation project ▪ Financial assurances—A description of financial assurances that would be provided to support success of the compensatory mitigation In circumstances where the Authority intends to fulfill compensatory mitigation obligations by securing credits from approved mitigation banks or in-lieu fee programs, the CMP need only include the name of the specific mitigation bank or in-lieu fee program to be used and the method for calculating credits.
BIO-MM#76: Minimize Impacts on Wildlife Movement during Construction	During construction, all known wildlife crossing structures, such as underpasses and culverts, would be maintained unobstructed to the extent possible; no equipment storage, staging, or unnecessary operations would be conducted in such areas. Where an existing underpass or culvert must be closed or obstructed, a temporary crossing structure or an alternative movement corridor would be created where feasible. Construction would be timed to minimize impacts on movement by providing at least one crossing feature in a region. For example, to minimize impacts on wildlife using the Fisher Creek culvert, construction at Fisher Creek would not commence until the construction of the Tulare Swale undercrossing is complete. Fencing would be placed to funnel individuals to temporary or alternative crossing structures or movement corridors. To the extent feasible, the Authority would avoid placing fencing, either temporarily or permanently, within known movement routes for wildlife (e.g., the Fisher Creek underpass) in those portions of the alignment where the tracks are elevated (e.g., viaducts or bridges). The Authority would avoid conducting ground-disturbing activities within known wildlife movement routes during nighttime hours, to the extent feasible, and would shield nighttime lighting to avoid illuminating wildlife movement corridors in circumstances where feasible. To avoid impeding movement of aquatic species, the Authority would employ the use of vibratory (rather than impact) pile driving for work in or within 200 feet of waterbodies that provide habitat for steelhead or giant garter snake, where feasible. To allow for movement of steelhead and other fish species around dewatered sites, the capture and translocation of fish around the job site to a downstream location would be undertaken on consultation with the NMFS and CDFW. Additionally, to the extent feasible, the Authority would establish wildlife-friendly fencing at soil stabilization areas and tunnel portals where a large right-of-way would be required. While access restriction fencing directly adjacent to the rail, tunnel portals, and HSR facilities would still be necessary for human safety and security, it would not be necessary around the larger construction footprints necessary for soil stabilization areas and tunnel portal work areas. Within these areas, a wildlife-friendly fence would be used with the following attributes (Paige 2012): ▪ Three- or four-strand wire design ▪ No more than 40 inches tall (to allow adult mammals to jump over)

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	▪ Bottom 18 inches off the ground (to allow animals to crawl under) (changes in topography such as gullies or dips can be used to provide this clearance distance) ▪ At least 12 inches between the top two wires ▪ Smooth top and bottom wires ▪ No vertical stays between posts; if stays are necessary, consider stiff plastic or composite stays ▪ Wood or steel posts at 16.5-foot intervals ▪ Gates, drop-downs, or other passage where wildlife can concentrate and cross ▪ Flagging or other measure to increase fence visibility (especially important for low-flying birds)
BIO-MM#77: Design Wildlife Crossings to Facilitate Wildlife Movement	To the extent feasible, the Authority would design all wildlife crossings created specifically for terrestrial species consistent with the guidelines and recommendations in the WCA (Authority and FRA 2019a: Appendix C). The guidelines and recommendations include the following features: ▪ Native earthen bottom ▪ Avoid metal walls ▪ Unobstructed entrances (e.g., no riprap, energy dissipaters, grates), although vegetative cover, adjacent to and near the entrances of crossings, is permissible ▪ Openness and a clear line of sight from end to end ▪ Design entrances to minimize light reflection from train lights ▪ Cover materials within the crossing such as rock or brush piles where smaller animals can take cover ▪ Year-round absence of water for a portion of the width of the crossing (i.e., no flowing water) ▪ Where water is likely to be present within a crossing as a result of a high groundwater table or proximity to an existing floodplain, wildlife crossing design would include features to minimize water entry into the crossing (e.g., impermeable groundwater barriers, berms) and to maximize drainage and drying time (e.g., slopes, sump pumps or permeable soils) ▪ Where hydrologic flow balancing features (culverts) provide wildlife connectivity, "shelves" would be constructed, where feasible, to allow small and medium animals to pass through the structure when it is flooded ▪ Slight grade at approaches to prevent flooding ▪ Hydrologic designs (ledges, cross slopes, water detention features, infiltration features, water proofing, or other features) to maintain crossing functionality (a dry crossing path) up to and including 100-year storm events for 95 percent of the year (347 days) ▪ Limited open space distance between crossing and cover/habitat ▪ Separation from human use areas (e.g., trails, multiuse undercrossings) ▪ Avoidance of artificial light at approaches to wildlife crossings ▪ To mitigate impenetrable barriers caused by construction of concrete vehicle barriers beneath viaducts in the Monterey Corridor and Morgan Hill and Gilroy Subsections (Alternatives 1 and 3), install Type L Concrete Barrier Wildlife Passageways at stations 718, 735, 755, 846, and 875

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BIO-MM#78: Establish Wildlife Crossings at Embankment in West Slope of Pacheco Pass	The Authority would create dedicated wildlife crossings to accommodate wildlife movement across permanently fenced infrastructure in the western portion of the Pacheco Pass Subsection near Casa de Fruta, where wildlife movement would be significantly reduced. Wildlife crossings would be placed approximately every 0.3 mile, as feasible, where the alignment is at grade, on embankment, or trenched at the following locations: ▪ Crossing A: B3161+34: 130 feet long by 40 feet wide by 23 feet high. ▪ Crossing B: B3174+00: 144 feet long by 40 feet wide by 38 feet high ▪ Crossing C: B3197+00: 165 feet long by 40 feet wide by 38 feet high ▪ Crossing D: B3209+98: 185 feet long by 40 feet wide by 38 feet high Crossings would conform to the minimum spacing and dimensions set forth in the WCA (Authority and FRA 2019a: Appendix C), unless different dimensions or frequencies are specified in authorizations issued under the FESA or CESA. Additionally, to the extent feasible, specific designs would incorporate the features outlined under BIO-MM#77 to facilitate wildlife movement through dedicated crossings.
BIO-MM#79: Provide Wildlife Movement between the Santa Cruz Mountains and Diablo Range	The Authority would address effects of permeability reduction caused by construction of the MOWF. Within 2 years of the start of construction at the MOWF, the Authority would conserve or improve wildlife movement between the Santa Cruz Mountain and the Diablo Range wildlife linkage (Penrod et al. 2013) by conserving natural or agricultural lands that provide for wildlife movement, enhancing wildlife movement between the Santa Cruz Mountains and the Diablo Range, or both. The extent of preservation or enhancement would provide for one of the following: ▪ An increase in permeability of the Santa Cruz Mountains to Diablo Range Wildlife Linkage (as mapped by Penrod et al. 2013) and the Soap Lake 100-year floodplain equivalent to the decrease in permeability at the MOWF in its combination of magnitude and affected area ▪ Protection of 238 acres (Alternatives 1, 2, and 4) or 239 acres (Alternative 3) of lands prioritized for their importance to wildlife movement in the Santa Cruz Mountains to Diablo Range Wildlife Linkage and the Soap Lake 100-year floodplain, which corresponds to a 1-to-1 ratio of protected land to project footprint at the MOWF ▪ A combination of enhancement and protection where the implemented percentages of the above enhancement and preservation combine to 100 percent Acquisition and enhancement efforts would prioritize lands in either the Santa Cruz Mountains to Diablo Range Wildlife Linkage or the Soap Lake 100-year floodplain, particularly along known wildlife movement routes or corridors, especially those adjacent to or near wildlife crossing structures under UPRR, Monterey Road, and the HSR. The prioritization of lands for protection would be developed in coordination with local stakeholders, such as the SCVHA, the SCVOSA, The Nature Conservancy, the Peninsula Open Space Authority, and with wildlife agency staff. Preservation of natural or agricultural lands would be in perpetuity through either fee title acquisition or conservation easement. Enhancement efforts may include enhancement of movement on lands protected by the Authority, or it may entail funding projects that would enhance

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	movement on other protected lands, reduce or eliminate existing barriers to movement, or construct structures to improve wildlife movement.
BIO-MM#80: Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement	To address the permanent intermittent impact of noise, visual disturbance, and train strike on wildlife movement in the UPR and GEA IBAs, the Authority would build additional structures in these areas to minimize or avoid such impacts. Structures would be designed with the goal of reducing or eliminating the visual presence of the moving train and exceedance of the established quantitative noise thresholds (as measured at the outer edges of the HSR right-of-way), as described in the WCA: ▪ Permanent hearing damage: 140 dBA or greater ▪ Temporary hearing damage: 93 dBA or greater but less than 140 dBA ▪ Masking: 84 dBA or greater but less than 93 dBA ▪ Arousal: 77 dBA or greater but less than 84 dBA The Authority would build opaque noise barriers to cover or obscure some or all of the train, including the OCS, if feasible, and the following locations: ▪ In the GEA IBA near Volta, between Stations B4550+00 and B4630+00 (all alternatives) ▪ In the UPR IBA (corresponding to the 10-year Pajaro River floodplain), between Stations B1932+00 and B2164+00 (Alternatives 1, 2, and 4) ▪ In the UPR IBA between Stations B1870+00 and B2097+00 (Alternative 3) The noise barriers would be a minimum height of 17 feet and would be designed to provide a minimum of 10 dBA attenuation of sound generated by HSR operations, as measured immediately outside the noise barrier. The noise barriers would be built in conjunction with the installation of track and OCS and would be completed before HSR train operations begin. Under all alternatives, for approximately 3.4 miles In the GEA IBA, centered approximately at Mud Slough between Stations B4914+00 and B5095+00, the rail design would be modified to enclose the train's operating envelope and OCS. The enclosure would be constructed using opaque, nonglare materials that provide a minimum of 10 dBA attenuation of sound generated by HSR operations, as measured immediately outside the enclosure. The enclosure would also be designed to minimize sound generated by HSR train exit and entry. The Authority would design the guideway enclosure in compliance with all HSR design, operations, and maintenance requirements, including but not limited to: ▪ Train performance ▪ Passenger comfort ▪ Fire-life-safety readiness and response ▪ Loading to viaduct girder structure and embankment foundation ▪ 100-year service life under suitable, acceptable maintenance practices and costs The guideway enclosure would be built in conjunction with the installation of track and OCS and would be completed before HSR train operations begin. If structure designs in the UPR and GEA IBAs can be demonstrated through quantitative modeling to reduce sound levels outside the HSR right-of-way to less than 77 dBA, no additional measures would be necessary. If residual noise of 77 dBA or more (as measured outside the HSR right-of-way) is still demonstrated, and therefore would exceed one or more of the quantitative noise

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	thresholds, HSR would implement the compensatory mitigation approach described in BIO-MM#58, which requires compensatory mitigation for lost habitat for waterbirds. The amount of compensatory mitigation required under BIO-MM#58, if implemented in concert with this mitigation measure, would depend on the extent of noise reduction that can be demonstrated using noise barriers or enclosures. The Authority would consult with CDFW, USFWS, Grasslands Water District, the owner(s) of private properties affected by the 3.4-mile HSR project footprint, and other stakeholders as part of final design of the guideway enclosure.
BIO-MM#81: Minimize Permanent Intermittent Impacts on Terrestrial Species Wildlife Movement	To address the permanent intermittent impact of operations on wildlife movement from train strike and entrapment, the Authority would implement an array of exclusion features for terrestrial species. These features include the following, which are specified in detail in the WCA (Authority and FRA 2019a: Appendix C): ▪ Permanent chain-link fencing along all at-grade portions ▪ Fencing buried 3.5 feet at a 45-degree angle on the outside of the fence beneath the existing grade in the following locations: Alternative 2 between Stations B725 and B1075 (Coyote Valley) and Stations B1810 and B4310; Alternatives 1, 2 and 4 between Stations B2160 to B2350 (eastern Soap Lake and western Pacheco Pass); Alternative 3 between Stations B2040 and B2280 (eastern Soap Lake); and all alternatives between Station B31545 and B4310 (Pacheco Pass) ▪ Angled barbed wire at the top of chain-link fencing to prevent large animals from jumping over the fence and into the right-of-way in the following locations: Alternative 2 between Stations B725 and B1075 (Coyote Valley) and Stations B1810 and B4310; Alternatives 1, 2 and 4 between Stations B2160 to B2350 (eastern Soap Lake and western Pacheco Pass); Alternative 3 between Stations B2040 and B2280 (eastern Soap Lake); and all alternatives between Station B31545 and B5337 (Pacheco Pass and San Joaquin Valley) ▪ Fine-mesh (0.25- to 0.5-inch mesh size) fencing or other barrier designed to exclude small animals (e.g., California tiger salamander, Fresno kangaroo rat, blunt-nosed leopard lizard, and giant garter snake) and extending at least 2 feet aboveground and at least 6 to 10 inches below-ground with an overhanging 90-degree lip (minimum 6 inches) to prevent climbing in the following locations: Alternative 2 between Stations B840 and B960; Alternative 4 between Stations B800 and B900; all alternatives between Stations B3148 and B3223; and all alternatives between Station B4050 and Station B5337 ▪ All gates designed to prevent animal access ▪ Jump out exit features that allow large mammals such as deer to exit the fenced right-of-way would be placed near at-grade road crossings in Coyote Valley at the following station numbers: B688, B691, B703, B730, B759, B761, B822, B823, B862, B863, B902, B935, B971, and B972 ▪ Small, one-way exit flaps would be provided on each of the four fenced sections at each fence opening in Coyote Valley ▪ Prevent wildlife entry into the rail alignment at unfenced, at-grade rail sections using Rosehill anti-trespass panels or another method that has been shown to be effective for targeted focal species

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	▪ WEF, exit features, and exclusion devices would be inspected at least monthly to enforce proper function as described in the WCA (Authority and FRA 2019a: Appendix C).
BIO-MM#82: Minimize Permanent Intermittent Impacts on Aerial Species Wildlife Movement	To address the permanent intermittent impact of operations on aerial wildlife movement from train strike and entrapment, the Authority would implement an array of deterrent and diversion features for avian species. These features include the following, which are specified in detail in the WCA (Authority and FRA 2019a: Appendix C): ▪ Install pigeon wire or other features to discourage birds from perching on OCS throughout the project ▪ In selected areas, place flight barriers such as fencing, pole barriers or a tubular screen (Life Impacto Cero 2015) to the height of OCS to avoid birds flying into the rail alignment and being struck by the train in the following locations: Alternatives 1–3 between Stations B2270 and 2390 (near the San Jose International Airport); Alternative 4 between Stations B2872 and 2930 (near the San Jose International Airport); Alternatives 1, 2, and 4 between Stations B2164 and B2255 (eastern Soap Lake); Alternative 3 between Stations B2097 and B2185 (eastern Soap Lake); Alternatives 1, 2, and 4 between Stations B2340 and B3325 (western Pacheco Pass); Alternative 3 between Stations B2270+B3325 (western Pacheco Pass) and all alternatives between Stations B4035 and B4310 (eastern Pacheco Pass). ▪ Modify OCS poles to preclude bird entrapment in hollow poles (e.g., avoid the use of tubular poles or cap openings in all poles) ▪ Design aerial structures and tunnel portals to discourage bats from roosting in expansion joints or other crevices; light tunnel entrances
BIO-MM#83: Implement Removal of Carrion that May Attract Condors and Eagles	During operations in California condor and eagle foraging areas, automated security monitoring and track inspections would be used to detect fence failures or the presence of a carcass (carrion) within the right-of-way that could be an attractant to condors and eagles. Dead and injured wildlife found in the right-of-way would be removed when the train is not in operation. This measure would apply to Alternatives 1, 2, and 4 between Stations B2164 and B2255 (eastern Soap Lake); Alternative 3 between Stations B2097 and B2185 (eastern Soap Lake); Alternatives 1, 2, and 4 between Stations B2340 and B3325 (western Pacheco Pass); Alternative 3 between Stations B2270 and B3325 (western Pacheco Pass), and all alternatives between Stations B4035 and B4310 (eastern Pacheco Pass).
CULTURAL RESOURCES	
CUL-IAMF#6: Pre-Construction Conditions Assessment, Plan for Protection of Historic Built Resources, Repair of Inadvertent Damage	Prior to Construction (any ground disturbing activities that are within 1,000 feet of a historic built property) the Contractor may be required to assess the condition of construction-adjacent historic properties, and prepare a Plan for the Protection of Historic Built Resources and Repair of Inadvertent Damage. The MOA and Built Environment Treatment Plan (BETP) would stipulate for which properties the plan is to be prepared. MOA signatories and consulting parties may comment on the adequacy of the assessments. Protection measures would be developed in consultation with the landowner or land-owning agencies as well as the SHPO and the MOA signatories and consulting parties, as required by the Programmatic Agreement. As the design progresses, additional properties may be identified by the Authority as requiring this plan. The plan shall record existing conditions in order to (1) establish a baseline against which to compare the property's post-project condition, (2) to identify structural

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	deficiencies that make the property vulnerable to project construction related damage, such as vibration, and (3) to identify stabilization or other measures required to avoid or minimize inadvertent adverse effects. The plan would be further described in the BETP and be prepared by an interdisciplinary team, including (but not limited to) as appropriate, an architectural historian, architect, photographer, structural engineer, and acoustical engineer. Ambient conditions would be used to identify buildings that are sensitive receptors to construction-related vibration and require vibration monitoring during construction activities. Additional protective measures may be required if the property is vacant during construction. The plan content shall be outlined in the BETP and is to be completed and approved by the Authority, with protective measures implemented before construction begins within 1,000 feet of the subject building. The plan shall describe the protocols for documenting inadvertent damage (should it occur), as well as notification, coordination, and reporting to the SHPO, MOA signatories, and the owner of the historic property. The plan shall direct that inadvertent damage to historic properties shall be repaired in accordance with the Secretary of the Interior's (SOI) Standards for the Treatment of Historic Properties (U.S. Department of the Interior, 1995). The plan shall be developed in coordination with the Authority and FRA, and shall be submitted to the SHPO for review and approval. Protective plans would be required for buildings that would be moved as part of the project mitigation, including stabilization before, during, and after relocation; protection during temporary storage; and relocation to a new site, followed by rehabilitation.
CUL-IAMF#7: Built Environment Monitoring Plan	Prior to Construction (any ground disturbing activities within 1,000 feet of a historic property or resource) the Contractor shall prepare a Built Environment Monitoring Plan (BEMP). Draft and final BEMP's would be prepared describing the properties that would require monitoring, the type of activities or resources that would require full-time monitoring or spot checks, the required number of monitors for each construction activity, and the parameters that would influence the level of effort for monitoring. Maximum vibration level thresholds may be established in the Plan for Protection of Historic Resources and Repair of Inadvertent Damage the monitoring of which would be included in this monitoring plan. The BETP would outline the process for corrective action should the protection measures prove ineffective. Consultation procedures would also be defined in the BETP. The Contractor shall develop both the draft and final plans in coordination with the Authority and FRA, and shall be submitted to the SHPO for review and approval. The plan would be implemented prior to any ground-disturbing activities within 1,000 feet of properties identified as requiring monitoring, as specified in the BETP.
CUL-IAMF#8: Implement Protection and/or Stabilization Measures	Implement the plan described in the Plan for Protection of Historic Resources and Repair of Inadvertent Damage and in the Built Environment Treatment Plan. Such protection measures would include, but would not be limited to, vibration monitoring of construction in the vicinity of historic properties; cordoning off of resources from construction activities (e.g., traffic, equipment storage, personnel); shielding of resources from dust or debris; and stabilization of buildings adjacent to construction. Temporary stabilization and protection measures would be removed after construction is complete, and the historic properties would be restored to their pre-construction condition. For buildings that would be moved, treatment would include stabilization before, during, and after relocation; protection during temporary storage; and relocation to a new site, followed by rehabilitation.

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CUL-MM#1: Mitigate Adverse Effects on Archaeological and Built Environment Resources Identified during Phased Identification and Comply with the Stipulations Regarding the Treatment of Archaeological and Historic Built Resources in the PA and MOA	Once parcels are accessible and surveys have been completed, including consultation as stipulated in the MOA, additional archaeological and built environment resources may be identified. For newly identified eligible properties that would be adversely affected, the following process would be followed, which are presented in detail in the BETP and ATP: ▪ The Authority would consult with the MOA signatories and concurring parties to determine the preferred treatment of the properties/resources and appropriate mitigation measures. ▪ For CRHR-eligible archaeological resources, the Authority would determine if these resources could feasibly be preserved in place, or if data recovery is necessary. The methods of preservation in place would be considered in the order of priority provided in CEQA Guidelines Section 15126.4(b)(3). If data recovery is the only feasible treatment the Authority would adopt a data recovery plan as required under CEQA Guidelines Section 15126.4(b)(3)(C). ▪ Should data recovery be necessary, the principal investigator (PI), in consultation with the MOA signatories and consulting parties, would prepare a data recovery plan for approval from the Authority/FRA and in consultation with the MOA signatories. Upon approval, the PI would implement the plan. ▪ For archaeological resources the Authority would also determine if the resource is a unique archaeological site under CEQA. If the resource is not a historical resource but is an archaeological site, the resource would be treated as required in Cal. Public Res. Code Section 21083.2 by following protection, data recovery, and other appropriate steps outlined in the ATP. The ATP outlines the review and approval requirements for these documents. ▪ For historic built resources, the PI would amend the BETP to include the treatment and mitigation measures identified by the Authority and FRA in consultation with the MOA signatories and concurring parties. The PI would implement the treatment and mitigation measures accordingly.
CUL-MM#2: Halt Work in the Event of an Archaeological Discovery, and Comply with the PA, MOA, ATP, and all State and Federal Laws, as Applicable	During construction (any ground-disturbing activities, including cleaning and grubbing) should there be an unanticipated discovery, the contractor would follow the procedures for unanticipated discoveries as stipulated in the PA, MOA, and associated ATP. The procedures must also be consistent with the following: the SOI's Standards and Guidelines for Archaeology and Historic Preservation (48 Fed. Reg. 44716–42), as amended; and Guidelines for the Implementation of CEQA, as amended (14 Cal. Code Regs. Chapter 3, Article 9, §§ 15120–15132). Should the discovery include human remains, the contractor, the Authority, and the FRA would comply with federal and state regulations and guidelines regarding the treatment of human remains, including relevant sections of NAGPRA (§ 3(c)(d)); Cal. Health and Safety Code, Section 8010 et seq.; and Cal. Public Res. Code Section 5097.98; and consult with the NAHC, tribal groups, and the SHPO. In the event of an unanticipated archaeological discovery, the contractor would cease work in the immediate vicinity of the find, based on the direction of the archaeological monitor or the apparent location of cultural resources if no monitor is present. If no qualified archaeologist is present, no work can commence until it is approved by the qualified archaeologist in accordance with the MOA, ATP, and monitoring plan. The contractor's qualified archaeologist would assess the potential significance of the find and make recommendations for further evaluation and treatment as necessary. These steps may include evaluation for the CRHR and NRHP, and necessary treatment to resolve significant effects if the resource is a historical resource or historic property. If,

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	after documentation is reviewed by the Authority and FRA, and they determine it is a historic property and the SHPO concurs that the resource is eligible for the NRHP, or the Authority determines it is eligible for the CRHR, the Authority would consider preservation in place in the order of priority provided in CEQA Guidelines Section 15126.4(b)(3) and in consultation with the signatories and consulting parties to the MOA. If data recovery is the only feasible mitigation, then the PI would prepare a data recovery plan as required under CEQA Guidelines Section 15126.4(b)(3)(C), the MOA, and ATP, for the Authority's approval. The contractor would notify the Authority, who would notify the CSLC, if the find is a cultural resource on or in the submerged lands of California and consequently under the jurisdiction of the CSLC. The Authority would comply with all applicable rules and regulations promulgated by CSLC with respect to cultural resources in submerged lands. If human remains were discovered on state-owned or private lands the contractor would contact the relevant County Coroner to allow the Coroner to determine if an investigation regarding the cause of death is required. If no investigation is required and the remains are of Native American origin the Authority would contact the NAHC to identify the most likely descendant (MLD). The MLD would be empowered to reinter the remains with appropriate dignity. If the MLD fails to make a recommendation the remains would be reinterred in a location not subject to further disturbance and the location would be recorded with the NAHC and relevant Information Center of the CHRIS. If human remains are part of an archaeological site, the Authority and contractor would, in consultation with the MLD and other consulting parties, consider preservation in place as the first option, in the order of priority called for in CEQA Guidelines Section 15126.4(b)(3). In consultation with the relevant Native American tribes, the Authority may conduct scientific analysis on the human remains if called for under a data recovery plan and amenable to all consulting parties. The Authority would work with the MLD to satisfy the requirements of Cal. Public Res. Code Section 5097.98. Performance tracking of this mitigation measure would be based on successful implementation and acceptance of the documentation by the SHPO and appropriate consulting parties.
CUL-MM#3: Other Mitigation for Effects on Pre-Contact Archaeological Sites	As a result of limited access to private properties during the environmental review phase of this project, the FRA's and Authority's ability to fully identify and evaluate archaeological resources within the APE has also been limited. Thus, the majority of the project APE has not been subject to archaeological field inventories. Because pedestrian field surveys are a necessary component of the archaeological resource identification and evaluation effort, the commitment to complete the field surveys prior to ground-disturbing activities associated with the project, is codified in the MOA that has been executed as a condition of the Final EIR/EIS. Access to previously inaccessible properties to complete the archaeological resource identification effort is expected to be available after the ROD, during the design-build phase of the project. However, because of the design constraints associated with constructing an HSR system, the ability to shift the alignment to avoid any newly identified archaeological resources at this late phase of the project delivery process is substantially limited or unlikely, because the alignment is already established. As such, impacts on as-yet-unidentified significant archaeological resources as a result of this project are anticipated;

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	however, the nature and quantity of such impacts remains unknown until completion of the archaeological field identification and evaluation effort. The MOA and ATP include protocols for the identification, evaluation, treatment, and data-recovery mitigation of as-yet-unidentified archaeological resources. Efforts to develop meaningful mitigation measures for effects on as-yet-unidentified Native American archaeological resources that cannot be avoided would be negotiated with the tribal consulting parties. Measures negotiated among the MOA signatories and tribal consulting parties would be the Authority's responsibility to implement.
CUL-MM#4: Minimize Adverse Effects through Relocation of Historic Buildings and Structures	The Authority-prepared MOA and BETP may identify historic properties/historical resources for relocation to avoid their destruction and minimize direct adverse effects resulting from physical damage or alteration. The development of plans for relocation and the implementation of relocation would take place before construction within 1,000 feet of the properties. The relocation of the historic properties/historical resources would be specified in the BETP by the Authority or the PI, depending on when the location is identified, and take into account the historic site and layout (i.e., the orientation of the buildings to the cardinal directions), and their potential reuse. The contractor's qualified architectural historian, along with an interdisciplinary team of professionals as appropriate, would prepare a relocation plan that would provide for protection and stabilization of the buildings or structures before, during, and after the move, as well as measures to address inadvertent damage. The plan would be subject to review and approval by the Authority and FRA, in consultation with the MOA signatories and concurring parties. The relocation would be implemented according to the plan. As the design progresses, the Authority may determine that additional properties require this mitigation.
CUL-MM#6: Prepare and Submit Additional Recordation and Documentation	The Authority-prepared MOA and BETP would identify specific historical resources that the project would physically alter, damage, relocate, or destroy and that would require documentation. This documentation may consist of preparation of updated recordation forms (DPR 523), or may be consistent with the Historic American Buildings Survey (HABS), the Historic American Engineering Record (HAER), or the Historic American Landscape Survey (HALS) programs; a Historic Structure Report; or other recordation methods stipulated in the MOA and described in the BETP. The specific mitigation for each property would be determined in consultation with the MOA signatories and concurring parties. The BETP would detail the appropriate type and level of recordation for each property. The recordation undertaken by this treatment would focus on the aspect of integrity the project would affect for each historic property subject to this treatment. For example, historic properties in an urban setting that would experience an adverse visual effect would be photographed to capture exterior and contextual views; interior spaces would not be subject to recordation if they would not be affected. The BETP would specify the appropriate method of documentation for each property, resulting from consultation with the SHPO, MOA signatories and concurring parties. Such documentation would follow the appropriate guidance for the recordation format and program selected. Copies of the documentation would be provided to the consulting parties and offered to the appropriate local governments, historical societies and agencies, or other public repositories, such as libraries, as specified in the BETP. The documentation would also be offered in printed and electronic form to any repository or organization to which the SHPO, the Authority, and the local agency with jurisdiction over the property, through consultation, may agree. The

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	electronic copy of the documentation may also be placed on an agency or organization's website. As the design progresses, additional properties may be determined by the Authority as requiring documentation. In general, photography should capture views of the historic property from multiple views, and could include reproduction of historic images, and architectural or engineering drawings as well. The contractor would complete all fieldwork necessary for photodocumentation, architectural or engineering drawings, and digital recordation through GIS or GPS and the Authority and SHPO would approve it before project construction begins. The written data would include a narrative for the historic property that would utilize existing inventory, evaluation, and nomination documents to the extent possible. This kind of documentation would require the contractor to engage an interdisciplinary team to adequately complete this mitigation. The team would likely be required to include, at a minimum, an architectural historian, a historian, and a photographer. Other team members may include a landscape architect or computer-aided design and drafting technician. The BETP would detail the required personnel and qualification standards for these preparers. The Authority would submit the documentation to the SHPO for review and comment. If the documentation is to follow the HABS/HAER/HALS program, consultation by the Authority with the National Park Service (NPS) would be required. The contractor's qualified team would prepare the final documentation, NPS would approve it, and the Authority would submit it to the Library of Congress. The BETP would identify the distribution of printed and electronic copies of the photodocumentation, as well as permanent archival disposition of the record, if applicable.
CUL-MM#7: Prepare Interpretive or Educational Materials	The Authority-prepared MOA and BETP would identify historic properties and historical resources that would be subject to historic interpretation or preparation of educational materials. Interpretive and educational materials would address the significance of the properties that would be affected by the project. Interpretive or educational materials could include, but are not limited to brochures, videos, websites, study guides, teaching guides, articles or reports for general publication, commemorative plaques, or exhibits. The BETP would specify the agreed-upon method of interpretation for each property, resulting from consultation with the SHPO, MOA signatories, and concurring parties. The contractor would be responsible for assembling the appropriate interdisciplinary team to fulfill this mitigation. The BETP would specify the required professionals and their qualifications. In the preparation of the interpretive or educational materials, the contractor's team would utilize previous research included in the environmental technical documents, images, narrative history, drawings, or other material produced for other mitigation measures. The interpretive or educational materials would be made available to the public in physical or digital formats, at local libraries, historical societies, or public buildings, as specified in the BETP.
CUL-MM#10: Station Design Consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties	Prior to HSR station construction adjacent to or on an NRHP or CRHR site, the contractor would prepare a historic properties compatibility report for Authority review and approval. Several HSR stations would be constructed adjacent to or on the site of NRHP/CRHR-listed or NRHP/CRHR-eligible railroad stations, within historic districts, or in close proximity to other historic properties. At the time of the RODs for each project section, the station locations would be identified; station design would be prepared post-ROD. The Authority would issue requests for qualifications (RFQ) to receive statements of qualifications

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	(SOQ) from qualified firms (contractor) for station designs and related services. Such firms would be contracted to provide professional consultant and design services for all design stages through final design. Selected firms would be responsible for making their designs context sensitive and meeting the SOI's standards for the treatment of historic properties. The Section 106 MOA and BETP would identify stations that require this mitigation measure, as appropriate. The MOA and BETP would also specify consultation roles of MOA signatories and interested parties in the design of the stations. At a minimum, the Authority's professionally qualified architectural historians and the SHPO would receive the opportunity to review and comment on the designs. If the proposed location is on the site of or adjacent to historic properties, the contractor at a minimum would include on their team a professionally qualified architectural historian, and may also be required to include a historical architect, a landscape architect with experience related to historic properties, an archaeologist, or other historic preservation professionals. The Authority's professionally qualified staff would review and approve selected professionals' qualifications. The Authority would require the contractor to provide three schemes for Authority review, including an evaluation of each scheme. The deliverables would also include drawings, such as plans, elevations, and renderings. The contractor must include in each evaluation a historic property design compatibility report prepared by a qualified architectural historian describing how the scheme is consistent with the SOI's Standards for Rehabilitation for infill designs or additions, and if any restoration or rehabilitation would be required of the historic buildings and structures and how such restoration is consistent with the SOI's Standards for Restoration. The report would reference applicable NPS Preservation Briefs, such as #14 New Exterior Additions to Historic Buildings, and discuss size, scale, and massing of the proposed project and how it would be differentiated from the historic property. It would also include application of the criteria of adverse effect (36 C.F.R. § 800.5) to each proposed scheme, considering both direct and indirect effects on historic properties, to ascertain that the selected design would not adversely affect historic properties. For the purposes of evaluating effects on historic properties, the contractor may be required to produce renderings that include adjacent properties. The Authority's professionally qualified staff would review and comment on the report and they may require revision prior to transmitting it to the SHPO and other MOA signatories and consulting parties, as specified in the MOA and BETP.
CUL-MM#11: Relocate Automatic Train Control Site to Avoid Demolition of 415 Illinois Avenue	Under Alternatives 1, 2, and 3, an ATC site would be built within the parcel containing 415 Illinois Avenue in San Jose. This residence is a one-story worker's cottage that is eligible for listing in the NRHP and is listed in the CRHR. Construction of the ATC site within this parcel could be accommodated only through the demolition of the historic property at 415 Illinois Avenue. Following the completion of the project design of Alternatives 1, 2, and 3, a suitable alternate location for the ATC site was identified at 365 Bird Avenue, which is near 415 Illinois Avenue and lies within the footprint of Alternatives 1, 2, and 3. In some instances the relocation of project elements to avoid the demolition of historic properties would be deemed infeasible. In contrast, the alternate site for the ATC site at 365 Bird Avenue is large enough to contain all necessary components of this project feature; the alternate site would also provide direct mid-block access to Bird Avenue. Furthermore, placement of the ATC site within the parcel containing 365 Bird Avenue would not require the demolition of an

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	historic property. As a result, the project design could feasibly be adjusted to move the ATC site and avoid the demolition of 415 Illinois Avenue. With implementation of this mitigation measure, 415 Illinois Avenue would remain intact in its original location during the construction of the HSR right-of-way on viaduct, which would occur approximately 35 feet south of 415 Illinois Avenue. At this distance, the construction of the HSR viaduct would be near enough to the property that the project could result in vibration-related damage to the characteristics that qualify 415 Illinois Street for listing in the NRHP and CRHR. In order to protect the physical characteristics of 415 Illinois Avenue during HSR construction, this mitigation measure would also require the incorporation of the following project features: preparation of a pre-construction conditions assessment, plan for protection of historic built resources, and repair of inadvertent damage (CUL-IAMF#6), preparation of a BEMP (CUL-IAMF#7), and implementation of protection and/or stabilization measures (CUL-IAMF#8).
HAZARDOUS MATERIALS AND WASTE	
HMW-IAMF#3: Work Barriers	Prior to Construction (any ground disturbing activities), the Contractor shall verify to the Authority through preparation of a technical memorandum the use of work barriers. Nominal design variances, such as the addition of a plastic barrier beneath the ballast material to limit the potential release of volatile subsurface contaminants, may be implemented in conjunction with site investigation and remediation.
HMW-IAMF#6: Spill Prevention	Prior to Construction (any ground disturbing activities), the Contractor shall prepare a Construction Management Plan addressing spill prevention. A Spill Prevention, Control, and Countermeasure (SPCC) plan (or Soil Prevention and Response Plan if the total above-ground oil storage capacity is less than 1,320 gallons in storage containers greater than or equal to 55-gallons) shall prescribe BMPs to follow to prevent hazardous material releases and clean-up of any hazardous material releases that may occur. The plans would be prepared and submitted to the PCM on behalf of the Authority and shall be implemented during Construction.
HYDROLOGY AND WATER RESOURCES	
HYD-IAMF#1: Storm Water Management	Prior to Construction, the Contractor shall prepare a storm water management and treatment plan for review and approval by the Authority. During the detailed design phase, each receiving stormwater system's capacity to accommodate project runoff would be evaluated. As necessary, on-site stormwater management measures, such as detention or selected upgrades to the receiving system, would be designed to provide adequate capacity and to comply with the design standards in the latest version of Authority Technical Memorandum *2.6.5 Hydraulics and Hydrology Guidelines*. On-site stormwater management facilities would be designed and constructed to capture runoff and provide treatment prior to discharge of pollutant-generating surfaces, including station parking areas, access roads, new road over- and underpasses, reconstructed interchanges, and new or relocated roads and highways. Low-impact development techniques would be used to detain runoff on site and to reduce off site runoff such as constructed wetland systems, biofiltration and bioretention systems, wet ponds, organic mulch layers, planting soil beds, and vegetated systems (biofilters), such as vegetated swales and grass filter strips, would be used where appropriate.
HYD-IAMF#3: Prepare and Implement a Construction	Prior to Construction (any ground disturbing activities), the Contractor shall comply with the State Water Resources Control Board (SWRCB) Construction General Permit requiring preparation and implementation of a SWPPP. The

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Stormwater Pollution Prevention Plan	Construction SWPPP would propose BMPs to minimize potential short-term increases in sediment transport caused by construction, including erosion control requirements, stormwater management, and channel dewatering for affected stream crossings. These BMPs would include measures to incorporate permeable surfaces into facility design plans where feasible, and how treated stormwater would be retained or detained on site. Other BMPs shall include strategies to manage the amount and quality of overall stormwater runoff. The Construction SWPPP would include measures to address, but are not limited to, the following: ▪ Hydromodification management to verify maintenance of pre-project hydrology by emphasizing on site retention of stormwater runoff using measures such as flow dispersion, infiltration, and evaporation (supplemented by detention where required). Additional flow control measures would be implemented where local regulations or drainage requirements dictate. ▪ Implementing practices to minimize the contact of construction materials, equipment, and maintenance supplies with stormwater. ▪ Limiting fueling and other activities using hazardous materials to areas distant from surface water, providing drip pans under equipment, and daily checks for vehicle condition. ▪ Implementing practices to reduce erosion of exposed soil, including soil stabilization, regular watering for dust control, perimeter siltation fences, and sediment catchment basins. ▪ Implementing practices to maintain current water quality, including: siltation fencing, wattle barriers, stabilized construction entrances, grass buffer strips, ponding areas, organic mulch layers, inlet protection, storage tanks and sediment traps to arrest and settle sediment. ▪ Where feasible, avoiding areas that may have substantial erosion risk, including areas with erosive soils and steep slopes. ▪ Using diversion ditches to intercept surface runoff from off site. ▪ Where feasible, limiting construction to dry periods when flows in water bodies are low or absent. ▪ Implementing practices to capture and provide proper off-site disposal of concrete wash water, including isolation of runoff from fresh concrete during curing to prevent it from reaching the local drainage system, and possible treatments (e.g., dry ice). ▪ Developing and implementing a spill prevention and emergency response plan to handle potential fuel and/or hazardous material spills. Implementation of a SWPPP would be performed by the construction contractor's as directed by the contractor's Qualified SWPPP Practitioner or designee. As part of that responsibility, the effectiveness of construction BMPs must be monitored before, during and after storm events. Records of these inspections and monitoring results are submitted to the local regional water quality control board (RWQCB) as part of the annual report required by the Statewide Construction General Permit. The reports are available to the public online. The SWRCB and RWQCB would have the opportunity to review these documents.
HYD-IAMF#5	The Contractor shall implement the following tunnel design features and construction methods to avoid and/or minimize the potential for groundwater depletion during tunnel construction and operation, and consequential potential

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	for hydrologic changes that may affect groundwater and/or surface water resources in areas overlying the tunnel alignment. Two types of potential effects must be considered, (1) temporary effects that occur due to construction; and (2) permanent effects that could occur over the lifetime of the project. Hydraulic conductivity of the subsurface strata is expected to be low along many parts of the Pacheco Pass tunnel alignments based on evaluation of the construction of previous tunnels nearby and of the geological strata along the proposed tunnel alignment (Authority 2017b). However, certain sections of the tunneled alignment (e.g. fault zones, zones of highly fractured or sheared rock, or other pervious deposits) could exhibit higher hydraulic conductivity, higher rates of groundwater inflow into excavated opening(s) and higher water pressure(s) on permanent tunnel structures (final liner). Subsurface conditions for the HSR tunnels could include groundwater pressures up to 435 psi (Authority 2017b). The amount of groundwater depletion will depend upon the geotechnical and hydrogeological conditions along the tunnel alignment, and the design features incorporated and tunnel construction methods utilized to minimize such inflows. Temporary inflows into the tunnel and groundwater flow around the outside of the tunnel (annular flow) during construction are likely unavoidable. Thus, temporary effects to surface and groundwater conditions may potentially occur even with implementation of this IAMF. Methods implemented to control potential effects will depend on the circumstances and the availability of engineering and design approaches. Tunnel excavation would likely be conducted using a combination of tunnel boring machines (TBM) and conventional tunneling methods. The type of machine used would be determined by the Authority's design-build contractor, based on the tunnel length, the geology of the project, the amount of groundwater present and its condition, and other factors. A detailed discussion of tunnel construction methods is available in the *San Jose to Merced Project Section Conceptual Tunnel Design and Constructability Considerations—Pacheco Pass* (Authority 2017b) and is summarized below: ▪ Tunnel boring machines: TBMs are shielded or open-type machines consisting of a rotating cutting wheel, called a cutterhead, followed by a main bearing, a thrust system and other trailing equipment. Such equipment may include conveyors or other systems for muck removal, control rooms, electrical systems, dust removal, ventilation and mechanisms for transport of pre-cast segments. These machines excavate rock with disc cutters mounted in the cutterhead, and then transfer the excavated rock through openings in the cutterhead to a belt conveyor for removal from the tunnel. Following TBM excavation, a tunnel lining is erected to support the ground and control groundwater inflows. The shield is then pushed forward with hydraulic jacks that thrust against the lining erected within the tunnel shield. ▪ Conventional tunneling methods: The primary conventional tunneling method anticipated to be used is a roadheader, consisting of a boom-mounted cutting head, a loading device usually involving a conveyor, and a crawler traveling track to move the machine forward into the rock face. Drill-and-blast techniques and the use of hydraulic excavators could also be required. Conventional tunneling methods require access to the open face of the tunnel and are limited to ground which can remain stable during excavation. In very hard rock, drill and blast methods are required. In medium to soft rock, a road header can be employed and in stiff clay and soil an excavator can be used.

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Conventional tunneling is a very flexible method and can adapt to varying ground conditions and changing geometry.

The table below summarizes the potential for temporary and permanent groundwater effects for the two primary tunneling methods. It should be recognized that potential for groundwater effects also depends on geologic and groundwater conditions as well.

Tunneling Method	Potential for Temporary Groundwater Depletion	Potential for Permanent Groundwater Depletion	Comments
TBM Methods	Typically, lower inflows than conventional mining, but may be high in areas of high groundwater pressures. Inflows are controlled by utilizing TBM designs that include special measures (discussed below) and a watertight tunnel lining or by ground treatment from the surface to lower potential for groundwater inflows into the tunnel.	Very low especially with the provision of a watertight lining. Also, grouting around precast segmental liner would lower potential for directional groundwater depletion due to annular flows along the tunnel alignment.	Generally, TBM tunnels will have a one-pass precast concrete segmental lining designed to be watertight.
Conventional Mining or SEM Methods	Typically, can be higher than with TBM methods; inflows along the entire tunnel alignment can be controlled by special measures (discussed below) until final lining is installed.	Very low since a watertight lining will be provided.	Initial lining installed using this approach is usually not a watertight lining. Special measures (grouting) can control higher inflows during sequential excavation and initial liner construction. Drainage system may be

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			provided to reduce hydrostatic pressures on final lining; however, such system is usually not practical in long tunnels due to requirement for continuous maintenance measures of the drainage system components (e.g., cleanouts, piping).

Tunnel Design to Avoid Permanent Groundwater Depletion

Tunnels shall be designed to be watertight, smooth, durable, and low maintenance to maintain existing groundwater levels over the tunnel structures throughout the tunnel design service life. Tunnel lining shall consist of one- or two-pass lining systems to meet HSR design criteria requirements. The specific tunnel lining type will be determined during final design, informed by Phase 2 geotechnical investigations proximate to the tunnel alignment. The Contractor shall utilize tunnel design and construction methods to avoid or minimize groundwater depletion to the maximum extent practicable.

TBM Methods - One-pass tunnel lining construction entails the installation of a precast concrete segmental lining with gaskets at each segment joint to construct an essentially watertight tunnel lining. The segmental lining is installed from within the shield at the rear of a TBM. A dual system of gaskets can be utilized to increase safety factors for resisting water pressures and arrest groundwater intrusion into the final tunnel structure. The feasibility for one-pass watertight linings is generally limited to magnitudes of water pressure less than 40 bars (580 psi)[1].

A two-pass tunnel lining system involves two stages of construction and would be used in tunnels where groundwater pressures exceed the capacity of one-pass linings available at the time of project construction. During the first stage of construction, an initial ground support system (e.g. precast segmental lining for a TBM tunnel) would be erected during the excavation cycle to maintain stability of the excavated opening, minimize water inflows and protect workers. During the second stage, a watertight membrane together with a cast-in-place concrete liner would be installed as the final component and permanent support of a two-pass lining system. This two-pass lining approach has been used in long, high-speed rail tunnel projects with high ground water pressures, such as in tunnels in the Lyon-Turin line, the Gotthard Base Tunnel (Switzerland), and the Vienna-St. Pölten Railway Line (Austria).

Conventional Tunneling Methods – Conventional tunneling methods using drill and blast or mechanical excavation would also be designed to be undrained and

[1] See discussion of Hallandsas Tunnel and Arrowhead Tunnels in Authority (2017a).

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	watertight to arrest or minimize potential groundwater depletion effects. The initial concrete linings used for temporary excavation support would likely consist of sprayed shotcrete, reinforced or unreinforced, and may be preceded by implementation of grouting measures that may control groundwater inflows during excavation. Following application of initial shotcrete support and prior to installation of permanent (final) lining, a waterproofing membrane would be installed. 'Compartmentalization' of the waterproofing membrane can be implemented, including grouting hoses, to allow local repairs to be made later in case groundwater leakage is identified in course of the liner service life. The shape and size of the tunnel cross section of a conventionally mined tunnel would be designed and adjusted to accommodate ground conditions, including potentially high groundwater pressures. **Construction Methods to Minimize Temporary Groundwater Depletion** Depending on the tunneling method, the following construction methods would be required to be employed to avoid and minimize temporary groundwater depletion due to tunnel construction. TBM Methods - TBM requirements include: ▪ Capability to control potential water inflows by using a closed-face, shielded TBM including special shield provisions (multiple brush tail seal system) to control groundwater inflows prior to segmental liner erection; ▪ Capability of systematic probe drilling, monitoring of water inflows, and pre-excavation grouting and backfilling with two-component grout. Grouting requirements include providing adequate backfill grouting, monitoring grout volumes, and using appropriate grout mixes to prevent grout washout; these measures would improve watertight performance of tunnel linings; and ▪ Check-grouting through dedicated grout couplings in precast segmental liner to completely fill the annular opening due to TBM over-excavation, between the segments and the ground. Pre-excavation grouting can be performed from the TBM, provided the TBM is delivered with built-in capability, including grout ports through the TBM cutter-head and through the shield, and set-up for concurrent drilling and grouting of multiple holes. For predominantly non-cohesive soils, or cohesive soils, Slurry TBMs or Earth Pressure Balance (EPB) TBMs, respectively, as well as variable density TBMs, use pressurized tunnel face and pressurized tunnel perimeter around the tunnel shield to counterbalance external earth and groundwater pressures to minimize groundwater inflow during tunnel construction and work in concert with special layered shield brush-system with inflatable seals, to assure shield water-tightness during the tunnel excavation. Conventional Tunneling Methods –. Support type and excavation methods can be adapted to meet the ground conditions including the ability to vary the support types, size of opening, ring closure time and the excavation technique as well as other factors. Tunneling can be done full face or in several drifts and benches. Typically, the cyclic steps of excavation included loosening and removing material in short sets of 3 feet to 10 feet before placing support measures. The freshly exposed ground must remain stable long enough to allow workers time to put initial support measures such as dowels, mesh, shotcrete, and lattice girders in place. The face and sides of the tunnel are exposed during the time between excavation and placement of support. For this reason, conventional tunneling methods are limited to stable soil or rock conditions, unless ground improvement measures are implemented. Construction below the water table in fractured rock or highly permeable ground such as sand, requires

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	ground modification measures such as grouting or ground freezing in advance of excavation. Such measures are usually employed for short stretches of tunnel or adits but generally are cost prohibitive for long tunnels where use of a TBM is much more economical. In conventional mined tunnel segments and cross passages, the Contractor shall use pre-excavating grouting techniques as the preliminary primary method of groundwater control to lower ground permeability and minimize or reduce ground water inflow into the excavated openings, prior to excavation of cross passages and other underground structures. Pre-excavation grouting would be adjusted as necessary to control ground water inflows. Pre-excavation grouting for conventionally mined tunnels would be carried out within the tunnel by face grouting or radial grouting. Ground improvement measures such as jet grouting and ground freezing, as applicable to specific ground conditions, are other methods which may be used to stabilize the excavation and seal off water during construction. Should unanticipated groundwater inflows be such that excavation by conventional tunneling methods is only possible with dewatering, design of dewatering measures shall specify horizontal and vertical limits on lowering of the groundwater table. Controlled dewatering, if necessary, could be accomplished by vertical or horizontal wells or vacuum drains and could be done from the ground surface or from within the tunnel. If monitoring and modeling indicate that water levels outside of the immediate vicinity of the tunnel could be affected, a simultaneous pumping and injection system could be used to maintain existing water levels away from the immediate vicinity of the tunnel. **Monitoring and Adjustments in Tunnel Design and Construction Methods** Hydrogeologic information from pre-construction subsurface investigations will be used to model existing hydrogeologic features and evaluate potential effects of tunneling on the local groundwater regime. Based on assessment of existing conditions and anticipated effects of construction to groundwater regime, the contractor will identify the specific methods (based on the methods described above) to minimize construction effects to the existing groundwater regime and tunnel excavation methods and/or design to minimize or eliminate the risk and likelihood of impacts to groundwater. Following initial construction of the tunnel, if groundwater inflow and/or annular flow around the completed tunnel indicates unacceptable groundwater depletion, then additional actions, primarily consisting of additional grouting around the tunnel exterior and/or other appropriate mitigating actions shall be employed.
LAND USE AND DEVELOPMENT, STATION PLANNING	
LU-IAMF#3: Restoration of Land Used Temporarily During Construction	Prior to any ground disturbing activities at the site of land to be used temporarily during construction, the Contractor shall prepare a restoration plan addressing specific actions, sequence of implementation, parties responsible for implementation and successful achievement of restoration for temporary impacts. Before beginning construction use of land, the Contractor shall submit the restoration plan to the Authority for review and obtain Authority approval. The restoration plan shall include time-stamped photo documentation of the pre-construction conditions of all temporary staging areas. All construction access, mobilization, material laydown, and staging areas would be returned to a condition equal to the pre-construction staging condition. This requirement is included in the design-build construction contract requirements.

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NOISE AND VIBRATION	
NV-IAMF#1: Noise and Vibration	Prior to Construction, the Contractor shall prepare and submit to the Authority a noise and vibration technical memorandum documenting how the FTA and FRA guidelines for minimizing construction noise and vibration impacts would be employed when work is being conducted within 1,000 feet of sensitive receptors. Typical construction practices contained in the FTA and FRA guidelines for minimizing construction noise and vibration impacts include the following: ▪ Construct noise barriers, such as temporary walls or piles on excavated material, between noisy activities and noise sensitive resources. ▪ Route truck traffic away from residential streets, when possible. ▪ Construct walled enclosures around especially noisy activities or around clusters or noise equipment. ▪ Combine noisy operations so that they occur in the same period. ▪ Phase demolition, earthmoving, and ground impacting operations so as not to occur in the same time period. ▪ Avoid impact pile driving where possible in vibration sensitive areas.
NV-MM#1: Construction Noise Mitigation Measures	Prior to construction (any ground-disturbing activities), the contractor would prepare a noise-monitoring program for Authority approval. The noise-monitoring program would describe how during construction the contractor would monitor construction noise to reduce noise levels to the noise limits (an 8-hour L_{eq} of 80 dBA during the day and 70 dBA at night for residential land use, 85 dBA for both day and night for commercial land use, and 90 dBA for both day and night for industrial land use) where a noise-sensitive receptor is present and wherever feasible. The contractor would be given the flexibility to reduce noise in the most efficient and cost-effective manner. This can be done by prohibiting certain noise-generating activities during nighttime hours or providing additional noise control measures to meet required noise limits. In addition, the noise-monitoring program would describe the actions required of the contractor to meet required noise limits. These actions would include the following nighttime and daytime noise control mitigation measures, as necessary: ▪ Install a temporary construction site noise barrier near a noise source. ▪ Avoid nighttime construction in residential neighborhoods. ▪ Locate stationary construction equipment as far as possible from noise-sensitive sites. ▪ Reroute construction truck traffic along roadways that would cause the least disturbance to residents. ▪ During nighttime work, use smart backup alarms, which automatically adjust the alarm level based on the background noise level, or switch off back-up alarms and replace with spotters. ▪ Use low-noise-emission equipment. ▪ Implement noise-deadening measures for truck loading and operations. ▪ Monitor and maintain equipment to meet noise limits. ▪ Line or cover storage bins, conveyors, and chutes with sound-deadening material. ▪ Use acoustic enclosures, shields, or shrouds for equipment and facilities. ▪ Use high-grade engine exhaust silencers and engine-casing sound insulation.

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	▪ Prohibit aboveground jackhammering and impact pile driving during nighttime hours. ▪ Minimize the use of generators to power equipment. ▪ Limit use of public address systems. ▪ Grade surface irregularities on construction sites. ▪ Use movable noise barriers at the source of the construction activity. ▪ Limit or avoid certain noisy activities during nighttime hours. ▪ To mitigate noise related to pile driving, use an auger to install the piles instead of a pile driver to reduce noise levels substantially. If pile driving is necessary, limit the time of day that the activity can occur. The Authority would establish and maintain in operation until completion of construction a toll-free "hotline" regarding the project construction activities. The Authority would arrange for all incoming messages to be logged (with summaries of the contents of each message) and for a designated representative of the Authority to respond to hotline messages within 24 hours (excluding weekends and holidays). The Authority would make a reasonable good-faith effort to address all concerns and answer all questions, and would include on the log its responses to all callers. The Authority would make a log of the incoming messages and the Authority's responsive actions publicly available via its website. The contractor would provide the Authority with an annual report by January 31 of the following year documenting how it implemented the noise monitoring program.
NV-MM#2: Construction Vibration Mitigation Measures	Prior to construction involving impact pile driving within 50 feet of any building, the contractor would provide the Authority with a vibration technical memorandum documenting how project pile driving criteria would be met. Upon approval of the technical memorandum by the Authority, and where a noise-sensitive receptor is present, the contractor would comply with the vibration reduction methods described in that memorandum. Potential construction vibration building damage is only anticipated from impact pile driving at very close distances to buildings. If pile driving occurs more than 50 feet from buildings, or if alternative methods such as push piling or auger piling are used, damage from construction vibration is not expected to occur. When a construction scenario has been established, the contractor would conduct pre-construction surveys at locations within 50 feet of pile driving to document the existing condition of buildings in case damage is reported during or after construction. The contractor would arrange for the repair of damaged buildings or would pay compensation to the property owner.
NV-MM#3: Implement Proposed California High-Speed Rail Project Noise Mitigation Guidelines	Various options exist to address the potentially severe noise effects from HSR operations. The Authority has developed Noise and Vibration Mitigation Guidelines for the statewide HSR system that sets forth three categories of mitigation measures to reduce or offset severe noise impacts from HSR operations: noise barriers, sound insulation, and noise easements. The guidelines also set forth an implementation approach that considers multiple factors for determining the reasonableness of noise barriers as mitigation for severe noise impacts, including structural and seismic safety, cost, number of affected receptors, and effectiveness. Noise barrier mitigation would be designed to reduce the exterior noise level from HSR operations from severe to moderate, according to the provisions of the FRA guidance manual (FRA 2012) and Figure 3.4 12.

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	The Noise and Vibration Mitigation Guidelines, included as Volume 2, Appendix 3.4-B, describe the following mitigation measures and approach: ▪ **Noise Barriers**—Prior to operation of the HSR, the Authority would install noise barriers where they can achieve between 5 and 15 dB of exterior noise reduction, depending on their height and location relative to the tracks. The primary requirements for an effective noise barrier are that the barrier must (1) be high enough and long enough to break the line-of-sight between the sound source and the receiver, (2) be of an impervious material with a minimum surface density of four pounds per square foot, and (3) not have any gaps or holes between the panels or at the bottom. Because many materials meet these requirements, aesthetics, durability, cost, and maintenance considerations usually determine the selection of materials for noise barriers. Depending on the situation, noise barriers can become visually intrusive. Typically, the noise barrier style is selected with input from the local jurisdiction to reduce the visual effect of barriers on adjacent lands uses (Authority 2014). For example, noise barriers could be solid or transparent, and made of various colors, materials, and surface treatments. Pursuant to the Noise and Vibration Mitigation Guidelines, recommended noise barriers must meet the following criteria to be considered a reasonable and feasible mitigation measure: – Achieve a minimum of 5 dB of noise reduction, which is then defined as a benefited receptor. – The minimum number of receptors should be at least 10. – The length should be at least 800 feet. – Must be cost-effective, defined as mitigation not exceeding $95,000 per benefited receptor. The maximum noise barrier height would be 14 feet for at-grade sections. Berm and berm/wall combinations are the preferred types of noise barriers where space and other environmental constraints permit. On aerial structures, the maximum noise barrier height would also be 14 feet, but barrier material would be limited by engineering weight restrictions for barriers on the structure. All noise barriers would be designed to be as low as possible to achieve a substantial noise reduction. Noise barriers on both aerial structures and at-grade structures would consist of solid, semitransparent, or transparent materials, as defined in Aesthetic Options for Non-Station Structures (Authority 2014). Figure 3.4 32 shows an example of a noise barrier that meets the Authority's typical requirements. Volume 2, Appendix 3.4-B, Noise and Mitigation Guidelines, provides additional details.

Impact Avoidance and Minimization Feature	Description
	 Source: Arch21 2019 DRAFT MAY 2019 **Figure 3.4-32 Example of a Typical Noise Barrier** ▪ **Install Building Sound Insulation**—If sound walls are not proposed for receptors with severe impacts, or if proposed sound walls do not reduce exterior sound levels to below a severe impact level, the Authority would consider providing sound insulation as a potential additional mitigation measure on a case-by-case basis. Sound insulation of residences and institutional buildings to improve outdoor-to-indoor noise reduction is a mitigation measure that can be considered when the use of noise barriers is not feasible in providing a reasonable level (5 to 7 dBA) of noise reduction. Although this approach has no effect on noise in exterior areas, it may be the best choice for sites where noise barriers are not feasible or desirable and for buildings where indoor sensitivity is of most concern. Substantial improvements in building sound insulation (on the order of 5 to 10 dBA) can often be achieved by adding an extra layer of glazing to windows, by sealing holes in exterior surfaces that act as sound leaks, and by providing forced ventilation and air conditioning so that windows do not need to be opened. ▪ **Noise Easements**—If a substantial noise reduction cannot be completed through installation of noise barriers or installing sound insulation, the Authority would consider acquiring a noise easement on properties with a severe impact on a case-by-case basis. An agreement between the Authority and the property owner can be established wherein the property owner releases the right to petition the Authority regarding the noise level and subsequent disruptions. This would take the form of an easement that would encompass the property boundaries to the right-of-way of the rail line. The Authority would consider this mitigation measure only in isolated cases where other mitigation is ineffective or infeasible.
NV-MM#4: Support Potential Implementation of Quiet Zones by Local Jurisdictions	Trains sound warning horns when approaching at-grade crossings because it is required by the FRA as a safety precaution (49 C.F.R. Parts 222 and 229). FRA does allow for the possibility of establishing horn-free Quiet Zones, which would eliminate the requirement for all trains to routinely sound their warning horns when approaching at-grade highway/rail crossings. Establishing Quiet Zones can only be legally undertaken by local jurisdictions; HSR cannot legally establish or require a Quiet Zone. However, HSR would assist local communities with this process through the installation of four-quad gates and channelization at all at-grade crossings that presently lack them, which would help cities to implement Quiet Zones, should they choose to do so. Establishing Quiet Zones would eliminate train warning horns for all trains approaching at-grade highway and rail crossings under normal, nonemergency situations.

<table>
<tr><th>Impact Avoidance and Minimization Feature</th><th>Description</th></tr>
<tr><td>NV-MM#8: Project Vibration Mitigation Measures</td><td>Mitigation for operations vibration impacts can take place at the source, at the sensitive receptor, or along the propagation path from the source to the sensitive receptor. Table 3.4-22 lists the mitigation procedures and their locations.

Table 3.4-22 Vibration Mitigation Procedures and Descriptions
<table><tr><th>Mitigation Procedure</th><th>Location of Mitigation</th><th>Description</th></tr><tr><td>Location and design of special trackwork</td><td>Source</td><td>Review crossover, turnout, and insulated joint locations during the preliminary engineering stage. When feasible, relocate special trackwork to a less vibration-sensitive area. Install spring frogs and other non-gap trackwork to eliminate gaps and help reduce vibration levels.</td></tr><tr><td>Vehicle suspension</td><td>Source</td><td>Employ rail vehicle with low unsprung weight, soft primary suspension, minimum metal-on-metal contact between moving parts of the truck, and smooth wheels that are perfectly round.</td></tr><tr><td>Special track support systems</td><td>Source</td><td>Use floating slabs, resiliently supported ties, high-resilience fasteners, and ballast mats to help reduce vibration levels from track support system.</td></tr><tr><td>Building modifications</td><td>Receptor</td><td>For existing buildings, if vibration-sensitive equipment is affected by train vibration, stiffen the floor upon which the vibration-sensitive equipment is located, isolate it from the remainder of the building, or both. For new buildings, support and effectively isolate the building foundation with vibration-isolating components such as springs and elastomer pads.</td></tr><tr><td>Buffer zones</td><td>Receptor</td><td>Negotiate a vibration easement from the affected property owners or expand rail right-of-way.</td></tr></table>Source: Authority 2017</td></tr>
<tr><td colspan="2">PARKS, RECREATION, AND OPEN SPACE</td></tr>
<tr><td>PK-IAMF#1: Parks, Recreation, and Open Space</td><td>Prior to Construction, the Contractor shall prepare and submit to the Authority a technical memorandum that identifies project design features to be implemented</td></tr>
</table>

Impact Avoidance and Minimization Feature	Description
	to minimize impacts on parks, recreation and open space. Typical design measures to avoid or minimize impacts to parks and recreation may include: ▪ Provide safe and attractive access for present travel modes (e.g., motorists, bicyclists, pedestrians-as applicable) to existing park and recreation facilities. ▪ Design guideway, system, and station features in such a way as to enhance the surrounding local communities. Provide easy crossings of the guideway which allows for community use under the guideway or at station areas.
PR-MM#1: Provide Access to Trails during Construction	Prior to construction-related ground-disturbing activities affecting trails, the contractor will prepare a technical memorandum documenting how connections to the unaffected trail portions and nearby roadways will be maintained during construction. The contractor will provide alternative access via a temporary detour or permanent realignment of the trail using existing roadways or other public rights-of-way. This will include a detour during construction while portions of the Highway 87 Bikeway North are closed. This will also include a realignment of Coyote Creek trail under Alternatives 1, 2, and 3. The Coyote Creek Trail would be realigned under Alternatives 1 and 3 prior to construction along some sections between Forsum Road and Metcalf Road; the trail would be replaced under Alternative 2 with a multiuse shared path between Forsum Road and Metcalf Road. The contractor will provide detour signage and lighting and alternative routes that meet public safety requirements. The technical memorandum will be submitted to the Authority for review and approval. Upon approval by the Authority, the contractor will implement the activities identified in the technical memorandum. The activities will be incorporated into the design specifications and will be a pre-condition requirement.
PR-MM#2: Provide Temporary Park Access	Prior to construction-related ground-disturbing activities affecting park access, the contractor will prepare a technical memorandum documenting how connections to the unaffected park portions or nearby roadways will be maintained during construction. The technical memorandum will be submitted to the Authority for review and approval. Upon approval by the Authority, the contractor will implement the activities identified in the technical memorandum. The activities will be incorporated into the design specifications and will be a pre-condition requirement.
PR-MM#3: Provide Permanent Park Access	During the design phase, the contractor will prepare a technical memorandum documenting how access to parks and trails will be maintained or established following completion of construction activities. The technical memorandum will be submitted to the Authority for review and approval. Upon approval by the Authority, the contractor will implement the activities identified in the technical memorandum. The activities will be incorporated into the design specifications and will be a pre-condition requirement.
PR-MM#4: Implement Project Design Features	Upon approval by the Authority, the contractor will implement project design features identified in the technical memorandum prepared as part of PK-IAMF#1. The project design features will be incorporated into the design specifications and will be a pre-condition requirement.
PR-MM#5: Implement Measures to Reduce Impacts Associated with the Relocation of Important Facilities	Prior to construction, the Authority would minimize impacts resulting from the acquisition, displacement, and/or relocation of key community facilities. The Authority would consult with the appropriate parties before land acquisition to assess potential opportunities to reconfigure land use and buildings or to relocate affected facilities, as necessary, to minimize the disruption of facility activities and services, and also to provide for relocation that allows the community currently being served to continue to use these services.

Impact Avoidance and Minimization Feature	Description
	The Authority would continue to implement a comprehensive non–English speaking language outreach program as land acquisition begins. This program would facilitate the identification of approaches that would maintain continuity of operation and allow space and access for the types of services currently provided and planned for these facilities. To avoid disruption to these community amenities, the Authority would provide for reconfiguring land uses or buildings, or relocating of community facilities is completed before the demolishing existing structures. The Authority would document compliance with this measure through annual reporting.
SOCIOECONOMICS AND COMMUNITIES	
SOCIO-IAMF#1: Construction Management Plan	Prior to Construction, the Contractor shall prepare a CMP providing measures that minimize impacts on low-income households and minority populations. The plan shall be submitted to the Authority for review and approval. The plan would include actions pertaining to communications, visual protection, air quality, safety controls, noise controls, and traffic controls to minimize impacts on low-income households and minority populations. The plan would verify that property access is maintained for local businesses, residences, and emergency services. This plan would include maintaining customer and vendor access to local businesses throughout construction by using signs to instruct customers about access to businesses during construction. In addition, the plan would include efforts to consult with local transit providers to minimize impacts on local and regional bus routes in affected communities.
SAFETY AND SECURITY	
SS-MM#2: Construct Temporary Access Roads and Driveways for Morgan Hill Charter School	Prior to commencing construction of the rail alignment, the contractor would construct temporary access roads and driveways to provide and maintain emergency vehicle access to the Morgan Hill Charter School (9530 Monterey Road, Morgan Hill) at all times during the construction period. The contractor would complete construction of temporary access roads and driveways to provide vehicle access prior to closing or relocating existing roads and driveways for rail alignment construction and would reconfigure temporary roads and driveways as required throughout the construction period to maintain emergency vehicle access to the school property at all times during the construction period. These temporary access roadways and driveways would provide equivalent emergency vehicle access to Monterey Road during all construction phases, including the provision of signalized left turn in and left turn out movements.
SS-MM#3: Install Emergency Vehicle Detection	Prior to construction, the contractor would install emergency vehicle detection equipment at the following intersections on Monterey Road: Bernal Road northbound ramps, Flintwell Way, Ford Road, Monterey Plaza Driveway, Blossom Hill Road eastbound ramps, Chynoweth Avenue, Edenview Drive, Branham Lane, Skyway Drive, Senter Road, Capitol Expressway eastbound ramps and Capitol Expressway westbound ramps. The contractor would prepare all materials necessary for and seek the approval of the City of San Jose for the implementation of this improvement.
TRANSPORTATION	
TR-IAMF#2: Construction Transportation Plan	The design-build contractor shall prepare a detailed Construction Transportation Plan (CTP) for the purpose of minimizing the impact of construction and construction traffic on adjoining and nearby roadways in close consultation with the local jurisdiction having authority over the site. The Authority must review

Impact Avoidance and Minimization Feature	Description
	and approve the CTP before the Contractor commences any construction activities. This plan would address, in detail, the activities to be carried out in each construction phase, with the requirement of maintaining traffic flow during peak travel periods. Such activities include, but are not limited to, the routing and scheduling of materials deliveries, materials staging and storage areas, construction employee arrival and departure schedules, employee parking locations, and temporary road closures, if any. The CTP would provide traffic controls pursuant to the California Manual on Uniform Traffic Control Devices sections on temporary traffic controls (Caltrans 2012) and would include a traffic control plan that includes, at a minimum, the following elements: ▪ Temporary signage to alert drivers and pedestrians to the construction zone. ▪ Flag persons or other methods of traffic control. ▪ Traffic speed limitations in the construction zone. ▪ Temporary road closures and provisions for alternative access during the closure. ▪ Detour provisions for temporary road closures-alternating one-way traffic would be considered as an alternative to temporary closures where practicable and where it would result in better traffic flow than would a detour. ▪ Identified routes for construction traffic. ▪ Provisions for safe pedestrian and bicycle passage or convenient detour. ▪ Provisions to minimize access disruption to residents, businesses, customers, delivery vehicles, and buses to the extent practicable-where road closures are required during construction, limit to the hours that are least disruptive to access for the adjacent land uses. ▪ Provisions for farm equipment access. ▪ Provisions for 24-hour access by emergency vehicles. ▪ Safe vehicular and pedestrian access to local businesses and residences during construction. The plan would provide for scheduled transit access where construction would otherwise impede such access. Where an existing bus stop is within the work zone, the design-builder would provide a temporary bus stop at a safe and convenient location away from where construction is occurring in close coordination with the transit operator. Adequate measures would be taken to separate students and parents walking to and from the temporary bus stop from the construction zone. ▪ Advance notification to the local school district of construction activities and rigorously maintained traffic control at all school bus loading zones, to provide for the safety of schoolchildren. Review existing or planned Safe Routes to Schools with school districts and emergency responders to incorporate roadway modifications that maintain existing traffic patterns and fulfill response route and access needs during project construction and HSR operations. ▪ Identification and assessment of the potential safety risks of project construction to children, especially in areas where the project is located near homes, schools, day care centers, and parks. ▪ Promotion of child safety within and near the project area. For example, crossing guards could be provided in areas where construction activities are located near schools, day care centers, and parks. CTPs would consider and account for the potential for overlapping construction projects.

Impact Avoidance and Minimization Feature	Description
TR-IAMF#4: Maintenance of Pedestrian Access	The Contractor shall prepare specific construction management plans to address maintenance of pedestrian access during the construction period. Actions that limit pedestrian access would include, but not be limited to, sidewalk closures, bridge closures, crosswalk closures or pedestrian rerouting at intersections, placement of construction-related material within pedestrian pathways or sidewalks, and other actions that may affect the mobility or safety of pedestrians during the construction period. If sidewalks are maintained along the construction site frontage, provide covered walkways and fencing. The plan objective shall be to maintain pedestrian access where feasible (i.e., meeting design, safety, Americans with Disabilities Act (ADA) requirements). This measure shall be addressed in the CTP.
TR-IAMF#5: Maintenance of Bicycle Access	The Contractor shall prepare specific construction management plans to address maintenance of bicycle access during the construction period. Actions that limit bicycle access would include, but not be limited to, bike lane closures or narrowing, closure or narrowing of streets that are designated bike routes, bridge closures, placement of construction-related materials within designated bike lanes or along bike routes, and other actions that may affect the mobility or safety of bicyclists during the construction period. Maintain bicycle access where feasible (i.e., meeting design, safety, ADA requirements). This measure shall be addressed in the CTP.
TR-IAMF#7: Construction Truck Routes	The Contractor shall deliver all construction-related equipment and materials on the appropriate truck routes and shall prohibit heavy-construction vehicles from using alternative routes to get to the site. Truck routes would be established away from schools, day care centers, and residences, or along routes with the least impact if the Authority determines those areas are unavoidable. This measure shall be addressed in the CTP.