APPENDIX 3.7-E: SUPPLEMENTAL NOISE ANALYSIS ON TERRESTRIAL WILDLIFE SPECIES

1 INTRODUCTION

Noise is defined as undesirable sound. Thus, the analysis of noise effects relies upon the theory and methods of acoustics, as applied to sensitive resources. Those resources include terrestrial wildlife in the study area: amphibians, reptiles, birds, and mammals. Acoustic concepts relevant to this analysis are presented in the *Wildlife Corridor Assessment Report* (WCA) (Authority 2020, Appendix C, Section 4.5.3.1).

All native wildlife potentially present in the project area were considered as potentially vulnerable to noise effects; however, this analysis is focused on mammals for the following reasons:

- An analysis of noise effects on birds has been presented in the WCA (Authority 2020, Appendix C, Sections 4.5 and 6.2.1.2).
- Reptiles and amphibians have very limited sensitivity to sound but appreciable sensitivity to vibration; thus, high-speed rail (HSR) impacts via that mechanism are more substantial. The Final environmental impact report (EIR)/environmental impact statement (EIS) will present an analysis of reptile and amphibian susceptibility to vibration.
- No evidence suggests invertebrate sensitivity to noise.
- The WCA (Section 6.2.1.1) analyzed noise effects on mammals in an analysis that relied mainly upon guidance propagated for evaluating noise effects on livestock. In response to public comment, this analysis more closely examines mammalian responses to HSR noise sources.

Analysis of mammalian wildlife response to noise generated by HSR traffic relies upon considerations of exposure and response. Exposure describes the noise itself, and response describes how the noise affects the animal. Existing studies of HSR noise and existing baseline noise sources, along with acoustic models, permit a quantitative estimation of noise exposure. Response, however, generally cannot be described in quantitative terms and must be inferred from published studies that consider different noise sources, different animals, and different locations compared to those that occur in the study area.

In this analysis, impacts of noise on mammalian wildlife are described as significant if either of the following California Environmental Quality Act (CEQA) significance thresholds would be exceeded:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife (CDFW) or U.S. Fish and Wildlife Service (USFWS)
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

The Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project impacts (as described in Section 3.1.6.4, Methods for Evaluating Impacts, of the Draft EIR/EIS). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- **Context—**For the analysis of impacts on biological and aquatic resources, the context would be the existing resources within the resource study area (RSA): the status of sensitive communities and species that occur or that could occur along the project corridor and the regulatory setting pertaining to biological and aquatic resources.
- **Intensity—**For the analysis of impacts on biological and aquatic resources, the intensity or severity of an impact would reflect the magnitude of the change between the existing and

projected conditions—specifically, the degree to which the construction and operations of the project could affect these resources.

2 NOISE EXPOSURE IN THE STUDY AREA

Exposure has many components, such as:

- The timing and duration of the noise
- The distribution of noise energy at different frequencies
- How loud the noise is at different distances from the rail line
- How loud it is relative to background noise levels from other sources such as highways and airports

Existing studies of HSR noise and background noise, as well as acoustic models, permit a quantitative estimation of noise exposure. Much of this information is summarized in WCA Section 4.5.3.1 (Authority 2020, Appendix C), which describes how loud the train would be, how much acoustic energy would be generated at different frequencies, how noise is generated by a passing train, and the methods used to model noise generation. That analysis is focused on trains moving through rural areas associated with the Pajaro River Important Bird Area (IBA) and the Grasslands Ecological Area IBA, areas in which trains would achieve speeds of 220 miles per hour (mph). Terrestrial wildlife would also be exposed to train noise in areas between San Jose and the Pajaro River IBA, where trains would generally be moving more slowly and producing less noise, although taking longer to pass any stationary receptor. This analysis conservatively assumes that such trains would produce the same noise as the trains moving at a higher speed but would take twice as long to pass any affected animals.[1] The WCA also presents maps (Authority 2020, Appendix C, Figures 6-1, 6-2, and 6-3) showing the results of noise modeling for trains passing through the Upper Pajaro River IBA and the Grasslands Ecological Area IBA. Outside of those two areas, this analysis assumes peak noise levels consistent with that model. Although this introduces uncertainty to the analysis, it is a conservative assumption that the train is producing the same amount of noise as if it were traveling at 220 mph. The noise levels generated by such a train are shown in Table 1.

Table 1 Modeled Unshielded Distance to L_{max} Noise Contour for a Train Moving at 220 mph

L_{max}	Rail Alignment Type	
	Aerial (feet)	Embankment (feet)
93 dBA	93	138
87 dBA	278	320
81 dBA	555	760
75 dBA	1,100	1,580
69 dBA	2,200	3,180
63 dBA	4,400	6,350
57 dBA	8,800	12,700
51 dBA	17,600	25,400
45 dBA	35,200	50,800
39 dBA	70,400	101,600

dBA = A-weighted decibel

[1] Projected train speeds in this area vary between the alternatives but fall within the range of 110 to 220 mph.

L_{max} = maximum sound level
All distance estimates are subject to acoustic model assumptions of flat terrain, agricultural vegetation, and no wind. Actual distances would be expected to vary depending on local conditions of train speed, wind speed and direction, air temperature, humidity, topography, buildings, and vegetation cover.

It is assumed that a typical train would be 660 feet long and that approximately 176 trains would pass any given point in any given 24-hour period, with up to 148 trains between 7 a.m. and 10 p.m. and up to 28 trains between 10 p.m. and 7 a.m. A train moving past a given point would take 2.05 seconds to pass at a speed of 220 mph or 4.10 seconds at 110 mph; thus, maximum noise levels would be experienced for 5.8 minutes per day along parts of the alignment where trains were moving 220 mph or 11.6 minutes per day where trains were moving 110 mph. Train noise is also propagated forward and backward along the track, so lower noise levels would be experienced for longer durations.

Trains would sound horns when approaching stations and also at certain crossings. Horns would not be sounded for grade crossings under Alternatives 1, 2, or 3 but would be sounded under Alternative 4. All proposed locations for sounding of horns coincide with locations where horns are currently sounded by Caltrain or freight trains. Federal Railroad Administration (FRA) requirements for locomotive horns are summarized in Section 3.1.3.3 of the *Noise and Vibration Technical Report* (Volume 2, Appendix 3.4-A). The minimum permissible sound level for a horn is 96 dBA at a distance of 100 feet, and this is the proposed level under the project. Although the horns point forward, field measurements indicate that horns are approximately omnidirectional. Due to the rapid onset rate of horn noise, it has a high potential to cause a startle or stress response in affected wildlife. L_{max} values for horn noise would be perceived at distances approximately 50% greater than the values shown in Table 1. Nearly all horn-sounding locations are in urban areas that provide little value for wildlife, but four locations are within the rural area between the San Jose and Morgan Hill urban areas, and two are within the first mile south from the Gilroy urban area.

Existing background noise levels in the study area are presented in Appendix B of the *Noise and Vibration Technical Report* (Volume 2, Appendix 3.4-A). As shown there, L_{90} noise levels (i.e., the noise level that is exceeded 90% of the time, roughly an indication of the most quiet time of the day) from San Jose through Gilroy range from approximately 35 to 70 dBA. One station, N132, was located in the biologically sensitive upper Pacheco Creek area, and this station recorded an L_{90} noise level of 33 to 72 dBA. In the Upper Pajaro River IBA, measurement site N130 found an L_{90} noise level of 30 to 49 dBA. In the Grasslands Ecological Area IBA, L_{90} noise levels of 30 to 70 dBA were found at measurement sites N134, N135, and N136. Most stations show minimum levels between midnight and 5 a.m., and two periods with maximum levels at about 7 a.m. and 6 p.m.

Along much of the alignment, noise exposures would be reduced due to masking effects or due to mitigation in the form of noise barriers. Masking is defined as reduced perception of one sound due to the introduction of another sound. In this case, noise produced by an HSR train may be masked by the presence of another, louder noise source such as a highway or non-HSR railway. These factors are difficult to quantify. Masking effects would occur in areas where a competing noise source (vehicular traffic, usually associated with a major highway or an urban core area) would mask the noise of the HSR trains. Masking effects would be variable due to variation in the noise level produced by the masking source, as well as variation in the HSR noise levels. In general, though, the times of day with heavy HSR traffic coincide with the times of day having heavy vehicular traffic, and light HSR traffic tends to coincide with light vehicular traffic. Thus, masking would reduce the effects of HSR noise during the hours of peak activity, while having relatively little effect on HSR noise during the late night and early morning hours of minimum traffic.

The principal masking noise sources are highways and urban areas. The entire alignment north of Station B665+00 is located in the San Jose urban area. In this area, there are numerous arterial roads that support traffic much of the day, and the alignment is also collocated with Caltrain and freight rail traffic. Thus, noise impacts from the project would be masked on both sides of the alignment through much of the day. Southwards, to approximately Station B1025+00, the project is still collocated with Caltrain and freight rail. Immediately to the east is arterial traffic on Monterey Road, and approximately 1 mile farther east is U.S. Highway 101, a major freeway. Thus, noise impacts are partially masked between the alignment and Coyote Creek and are substantially masked east of U.S. Highway 101; however, there are few and minor masking features west of the alignment, except that some topographic masking would occur in areas west of the valley floor. Continuing south, urban area masking would occur through the cities of Morgan Hill and Gilroy, down to Station B1730+00 where the rail alignment intersects U.S. Highway 101. South of there, however, the line turns east and transits open agricultural lands across the valley floor to about Station B2250+00; throughout this area, there are no major sources of masking noise on the landscape. Eastward to Station B2350+00, the alignment crosses State Route (SR) 152, then passes through a tunnel, and then crosses SR 152 again. The busy highway would provide some masking effect to reduce noise effects in the hills north of SR 152, while the tunnel would mask all train noise. From Station B2350+00 to B3330+00, the alignment would follow the valley of Pacheco Creek. Throughout this area, SR 152 is never more than 0.5 mile north of the alignment, and it would provide substantial masking in that direction. To the south, however, there are no sources of masking noise, except that some topographic masking would occur in areas on the slopes west of Pacheco Peak. From Station B3330+00 to Station B4030+00, the alignment is in a tunnel, and noise effects on wildlife would not be a concern. East from there to Volta, Station B4630+00, the alignment traverses rural and agricultural lands, with little masking except locally where the alignment crosses Interstate (I-)5 at nearly a perpendicular angle. From Volta to the project's eastern limit at Station B5330+00, however, the alignment traverses agricultural and wildlife lands on the south side of Henry Miller Road, a moderately busy arterial, which provides some masking for lands north of the alignment but no masking for lands south of the alignment. These masking features are summarized in Table 2, and the areas identified in Table 2 are shown in Figure 1.

The Draft EIR/EIS proposed mitigation features to reduce noise impacts on humans and birds. These features in most locations consist of noise barriers, approximately 14 to 17 feet high, erected on both sides of the alignment. These noise barriers would attenuate noise by an average of 10 dBA for an observer located 100 feet from the alignment, with greater effect at lesser distances and reduced effect at greater distances. At greater distances, the attenuation effect is reduced due to reflection and refraction effects on sound waves emerging from between the barrier walls. Noise barriers are proposed in areas having sensitive human receptors (in accordance with the analysis in Section 3.4, Noise and Vibration, of the Draft EIR/EIS) and within the Pajaro River and Grasslands Ecological Area IBAs (as specified in Section 3.7, BIO-MM#80, Minimize Permanent Intermittent Noise, Visual, and Train Strike Impacts on Wildlife Movement, of the Draft EIR/EIS). Noise barriers protecting sensitive human receptors are predominantly located in urban areas, where they offer little benefit for wildlife. The locations of noise barriers proposed to protect wildlife, however, are listed in Table 2. In these areas, the noise exposure distances shown in Table 1 would be reduced by approximately two-thirds, with a smaller reduction (approximately one-third) for distances greater than about 5,000 feet.

Table 2 Masking and Mitigation Features along the Rail Alignment from San Jose to Merced

Alignment	Station Start[1]	Station End[1]	Masking on East/North	Masking on West/South	Label on Figure 1	Masking Source on East/North	Masking Source on West/South	Distance to Masking Source on East/North (feet)	Distance to Masking Source on West/South (feet)
San Jose Diridon Station Approach, Monterey Corridor, Morgan Hill and Gilroy	B0000	B0665	Partial	Partial	Urban San Jose	San Jose urban area	San Jose urban area	0	0
Morgan Hill and Gilroy	B0665	B1025	Partial	Partial	Rural	Monterey Road, U.S. Highway 101	Topography in Santa Cruz Mountains	0–200, 1,700–4,800	4,100–8,800
Morgan Hill and Gilroy	B1025	B1730	Partial	Partial	Urban Morgan Hill	Morgan Hill/Gilroy urban area	Morgan Hill/Gilroy urban area	0	0
Morgan Hill and Gilroy	B1730	B1932	None	None	Rural	–	–	–	–
Morgan Hill and Gilroy	B1932	B2164	Partial	Partial	Bird Noise Barrier	Noise barrier[1]	Noise barrier[1]	0	0
Morgan Hill and Gilroy	B2164	B2250	None	None	Rural	–	–	–	–
Morgan Hill and Gilroy	B2200	B2255	Partial	None	Highway	State Route 152	None	0–2,900	–
Morgan Hill and Gilroy	B2255	B2350	Complete	Complete	Tunnel	Tunnel	Tunnel	0	0
Pacheco Pass	B2350	B3330	Partial	Partial	Rural	State Route 152	Topography on W slopes Pacheco Peak	100–2,000	1,000–6,000
Pacheco Pass	B3330	B4030	Complete	Complete	Tunnel	Tunnel	Tunnel	0	0
Pacheco Pass, San Joaquin Valley	B4030	B4550	None	None	Rural	None[2]	None[2]	–	–

Alignment	Station Start[1]	Station End[1]	Masking on East/North	Masking on West/South	Label on Figure 1	Masking Source on East/North	Masking Source on West/South	Distance to Masking Source on East/North (feet)	Distance to Masking Source on West/South (feet)
San Joaquin Valley	B4550	B4630	Partial	Partial	Bird Noise Barrier	Noise barrier	Noise barrier	0	0
San Joaquin Valley	B4630	B4914	Partial	None	Rural	Henry Miller Road	–	0–150	–
San Joaquin Valley	B4914	B5095	Partial	Partial	Bird Noise Barrier	Noise barrier	Noise barrier	0	0
San Joaquin Valley	B5095	B5330	Partial	None	Rural	Henry Miller Road	–	100–150	–

[1] Stationing shown is for Alternatives 1, 2, and 4. Under Alternative 3, the noise barrier would extend from Stations B1870 to B2097. Also, Alternative 3 would avoid the Gilroy urban area but instead would experience masking from U.S. Highway 101 from there to the maintenance-of-way facility (MOWF).
[2] There would be some local masking where the rail alignment crosses Interstate 5. The extent of masking would vary with conditions but would likely be within 1,000 feet of the highway more than 90% of the time.

3 MAMMALIAN WILDLIFE RESPONSES TO NOISE

Mammalian wildlife use sound mainly to forage, to evade predators, and for intraspecific communication. Among wildlife, hearing is arguably the most important sense; secondary loss of vision is more common than loss of hearing (Fong et al. 1995), suggesting that an animal with impaired hearing is at greater risk than one with impaired vision. Hearing enables herbivores to continue foraging while they listen for evidence of an approaching predator. Hearing enables predators to be effective in situations where vision has limited usefulness, such as dense vegetation or darkness. Many species of mammalian wildlife can hear sounds inaudible to humans. Whereas humans can hear sounds at frequencies of approximately 64 to 23,000 Hertz (Hz), most wild mammals can hear higher frequencies, with some bats hearing frequencies of 110,000 Hz, and some mammals hearing lower frequencies, e.g., 16 Hz in ferrets (Strain 2020). Hearing sensitivity in mammalian wildlife is generally comparable to that of humans, with a peak sensitivity of approximately 0 decibels (dB) recorded in such diverse mammals as ungulates, rodents, and bats (Heffner and Heffner 2010; Dent et al. 2018). However, predators often have considerably more sensitive hearing. The most sensitive species studied, the red fox, can hear sounds at -15 dB at 4 kilohertz (kHz), and the raccoon can hear to -12 dB at 1 kHz (Malkemper et al. 2014). That corresponds to sounds one-quarter to one-fifth as loud as the softest sound audible to a human. Reptiles, in comparison, have very poor hearing, with thresholds of 40 dB or greater and almost no ability to hear outside of a frequency range from ca. 50 to 1,000 Hz (Bowles 1995; Young and Aguilar 2002).

Francis and Barber (2013) describe noise effects on wildlife as ranging along a continuum from infrequent, abrupt, and unpredictable noise to chronic noise. The former noise may constitute a disturbance that elicits an antipredator response (Frid and Dill 2002; Francis and Barber 2013). Such a response is often called “startle” but can include a variety of antipredation responses such as vigilance and flight. Antipredation responses can affect mammalian wildlife by masking acoustic information (Francis and Barber 2013).

Masking is defined as reduced perception of one sound due to the introduction of another sound. In this case, wildlife perception of important sounds such as the activity of predators or prey may be masked by the sound of a passing HSR train. There have been extensive studies of masking effects in wildlife; a thorough review by Barber et al. (2010) provides the following examples, which give evidence of the diversity of mammalian wildlife reliance on sound:

- Proximity to noise sources increases vigilance behavior by California ground squirrels, at a cost to foraging efficiency.
- Pronghorn spend more time being vigilant and less time foraging within 300 meters of a road.
- For bats, frequencies between approximately 3 and 8 kHz are crucial for accurate sound localization.

There is evidence that noise of the magnitudes and durations that would occur under the project can elicit an antipredation response in mammalian wildlife. Train noise is not expected to exceed 93 dBA (L_{max}) at 138 feet (Table 1),[2] and, as discussed earlier, exposure to noise of this intensity would last no more than a few seconds at a time. However, due to the high speed of the train, onset levels would be rapid and thus could elicit an antipredation response. One study has found that sound levels above about 90 dB are likely to be adverse to mammalian wildlife and are associated with behavioral responses such as retreat from the sound source, freezing, or a strong startle response, but sound levels below about 90 dB usually do not cause such responses (Manci et al. 1988). However, more recent studies addressing a variety of wildlife species have not set quantitative thresholds of effect and have emphasized that a noise does not necessarily have to be at high intensity to elicit an antipredation response. In particular, temporal and spatial

[2] Alternatively, 96 dBA L_{max} at 100 feet when a train horn is being sounded. This is approximately the same noise level as 93 dBA at 138 feet, but few horn-sounding locations occur in modeled wildlife habitat. 96 dBA at 100 feet is also the peak noise level experienced under current conditions in portions of the proposed alignment colocated with Caltrain or freight train tracks.

context and similarity to relevant biological sounds are also important (Shannon et al. 2016). A study of desert bighorn and mule deer response to simulated military aircraft noise found that for exposures of one to seven simulated flybys per day, broadcast through loudspeakers at noise levels of 92 to 112 dB (i.e., levels comparable to or up to 10 times louder than the proposed HSR train), animal responses included elevated heart rates for up to 3 minutes and sometimes looking toward the sound. Flight or evasion was not observed, and habituation to repeated exposures was observed. At the lowest noise levels, i.e., 92 dB, these responses were minimal (Weisenberger et al. 1996). Conversely, a study of pronghorn near highways in Alberta found that busy roadways (defined as more than 300 vehicles per day) were associated with elevated levels of vigilance and reduced foraging activity levels for pronghorn near the roadway (Gavin and Komers 2006). Accordingly, there is a substantial potential for train passage to produce an antipredation response in wildlife near the tracks, but data are insufficient to state the area within which such a response may occur in any given wildlife species. Antipredation response, whether triggered by noise or other stimuli, has been associated with a wide variety of responses in mammalian wildlife, including reduced foraging efficiency, altered mating behavior, reduced care for young, flight, stress physiology, and increased bioenergetic costs, with potential consequences both for individual fitness and for wildlife populations (Frid and Dill 2002; Francis and Barber 2013).

It is also possible that noise may affect wildlife movement corridors by deterring mammalian wildlife from crossing the rail alignment. A variety of studies have been performed to evaluate wildlife tendencies to cross barriers, usually major highways. In the Coyote Valley area, the *Coyote Valley Linkage Assessment Study* (Pathways for Wildlife et al. 2016) found that “Wildlife, including bobcat, grey fox, coyote, deer and other small and medium-sized mammals have been documented traveling from Coyote Ridge and Coyote Creek County Park on the east side of Coyote Valley by using the Coyote Creek Golf Course Drive Underpass to safely cross underneath Highway 101.” It also notes that roadkill provides evidence of mountain lion and badger attempts to cross U.S. Highway 101. Further camera trapping efforts documented by *Safe Passage for Coyote Valley* (Phillips et al. 2012) show crossing below U.S. Highway 101 in Coyote Valley by a mountain lion and a dusky woodrat. In the western Pacheco Pass area, recent camera trapping efforts at bridges along SR 152 by Pathways for Wildlife (2020) found that “within the twelve month monitoring period, multiple species including deer (*Odocoileus hemionus*), American badger (*Taxidea taxus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and opossum (*Didelphis virginiana*) were recorded consistently traveling under each of the three bridges.” Based on this evidence, it is clear that despite the presence of existing noise sources in the form of major highways, both common and sensitive wildlife do successfully use existing passage routes in the study area.

4 IMPACT ASSESSMENT

A substantial impact would occur if the project would have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS. Eleven special-status mammal species are potentially affected: San Joaquin kit fox, Fresno kangaroo rat, mountain lion, Tule elk, badger, dusky-footed woodrat, ringtail, Townsend’s big-eared bat, western mastiff bat, pallid bat, and western red bat.

Noise has been identified as potentially affecting any of these species through behavioral changes such as masking prey sounds, masking predator sounds, masking intraspecific communication, or deterring an animal from crossing the rail alignment. In addition, a substantial impact would occur if the project would interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. These impacts are evaluated here on a species-by-species basis, concluding with an evaluation of potential impacts on non-special-status terrestrial mammals.

4.1 San Joaquin Kit Fox

San Joaquin kit fox habitat is evaluated in Appendix F of the WCA. Kit fox observations in the study area have been made in the area east of the east portal of the Pacheco Pass tunnel and particularly along a least-cost north-south movement corridor that, in the project vicinity, generally follows the California Aqueduct. The kit fox likely has extremely good hearing; the related red fox can hear sounds at -15 dB at 4 kHz (Malkemper et al. 2014). The kit fox would be subject to noise effects from HSR train passage. There is a high potential that this noise would affect kit fox foraging effectiveness. There is also some potential that it would increase predation risk and, by causing the fox to avoid the rail alignment, deter the fox from crossing the alignment. However, there is considerable evidence that kit foxes will use crossings at major highways. Bremner-Harrison et al. (2007) confirmed that San Joaquin kit foxes visited crossing structures at I-5, SR 58, and SR 14 but did not pass through the structures, presumably due to low openness factors; instead they crossed the highway, and two roadkills were found. Similarly, Clevenger et al. (2010) showed that swift foxes use crossing structures on 4-lane divided highways in Colorado and South Dakota, and McCollister and van Manen (2010) showed that red and gray foxes use undercrossings on divided highways in North Carolina. Potential noise impacts on kit foxes were assessed by USFWS (2009) in its biological opinion for the Merced to Fresno Project Section of the HSR system. It determined that “noise disturbance from operation of the HST will not occur during nocturnal activities of San Joaquin kit fox in areas adjacent to the alignment from 12:00 a.m. through 6:00 a.m.” and that “it is likely that San Joaquin kit fox will become quickly adapted to the increased noise disturbance generated by operation of the HST[3].” In summary, there would be a considerable potential for operational noise to affect foraging and alignment crossing by San Joaquin kit fox, and measures to minimize those effects are discussed below (Section 5.1, San Joaquin Kit Fox).

4.2 Fresno Kangaroo Rat, Badger, Dusky-Footed Woodrat, and Ringtail

Habitat for the Fresno kangaroo rat and badger is evaluated in Appendix F of the WCA. That analysis finds optimum habitat permeability for the Fresno kangaroo rat east of the Pacheco Pass tunnel (approximately from Stations B4310 to B5100). For the badger, optimum permeability exists in Coyote Valley (approximately from Stations B0665 to B1025) and throughout the Pacheco Pass area (approximately from Stations B2250 to B4310). The dusky-footed woodrat and the ringtail were not modeled, but they belong to the same “moderate mobility small fauna” movement guild as the badger; dusky-footed woodrat has been observed in Coyote Valley in camera traps documenting wildlife passage across U.S. Highway 101 (Phillips et al. 2012).

The Fresno kangaroo rat is primarily nocturnal, but its daily peak activity occurs about 20 minutes after sunset (Lockard and Owings 1974), at which time train activity would be frequent (comparable to daylight hours). There is high potential that kangaroo rats in close proximity to passing trains would display a predation avoidance response when trains pass, disrupting foraging and other behaviors at those times. Kangaroo rat passage across the alignment might be delayed until later, when train activity diminishes.

The badger, dusky-footed woodrat, and ringtail are primarily nocturnal and thus most active during the times when there is little activity on the rail alignment. Thus, these animals are at relatively low risk of predation, impaired foraging, or passage impediments due to HSR noise.

In summary, there would be a considerable potential for operational noise to affect foraging and passage by Fresno kangaroo rat. Such impacts would be unlikely for badger, dusky-footed woodrat, and ringtail.

4.3 Mountain Lion

Habitat permeability for the mountain lion is evaluated in Appendix F of the WCA. That analysis finds optimum habitat permeability in Coyote Valley (approximately from Stations B0665 to

[3] HST or “high speed train” was the term USFWS used in 2009 to refer to the HSR project.

B1025) and throughout the Pacheco Pass area (approximately from Stations B2250 to B4310). Evidence from both roadkills and camera traps indicates mountain lion passage through both areas, and both areas may provide mountain lion foraging habitat. The west Pacheco Pass area is particularly important for mountain lion habitat connectivity, as it provides a nexus for movement between the Santa Cruz Mountains, Diablo Range, Gabilan Range, and inner Coast Range. The mountain lion likely has good hearing ability and uses it for prey detection, especially at night.

In Coyote Valley, train noise would be masked by Monterey Road and U.S. Highway 101 along the alignment north of Morgan Hill, but there are no important sources of masking noise to the west of this alignment. HSR noise would affect nearly the whole valley floor in that direction, extending up into the hills. There is a high potential that this noise would affect mountain lion foraging effectiveness and that it would add to other existing barriers, such as the existing rail line and U.S. Highway 101, in deterring mountain lions from crossing the valley through this area.

In the Pacheco Pass area, train noise would be substantial along upper Pacheco Creek (Stations B2350 to B3330). This area includes possibly the best mountain lion foraging habitat in the San Jose–Merced segment, i.e., the perennial reach of Pacheco Creek upstream of Casa de Fruta. There is a high potential that train noise would affect mountain lion foraging effectiveness and that it would add to the existing barriers represented by SR 152 in deterring mountain lions from crossing the valley through this area. In summary, there would be a considerable potential for operational noise to affect foraging and alignment crossing by mountain lions, and measures to minimize those effects are discussed below (Section 5.2, Mountain Lion).

4.4 Tule Elk

Tracking collar data for Tule elk in the study area (Hobbs 2017) indicate that their activity is mainly in the vicinity of San Luis Reservoir and that SR 152 constitutes a barrier to further movement northwards. However, were the elk to have access to lands in the vicinity of the rail alignment between the east portal of the Pacheco Pass tunnel and the west edge of the San Joaquin Valley (approximately from Stations B4035 to B4290), they would then be subject to the effects of train noise. Such noise could impair elk foraging and might deter them from crossing the rail alignment, which is on viaduct for several extended sections in this area. However, as the elk will not foreseeably have access to this habitat, those impacts are not expected to occur. In summary, there would not be a considerable potential for operational noise to affect Tule elk.

4.5 Townsend's Big-Eared Bat, Western Mastiff Bat, Pallid Bat, and Western Red Bat

Bats in general are vulnerable to human-caused noise. Although their ability to hunt by echolocation is well known, many bats also hunt via "passive listening," i.e., hearing their prey. Many bats use a combination of echolocation and passive listening to hunt, e.g., by using echolocation to orient themselves but passive listening to home in on prey items (Jones et al. 2016). Bat audiograms typically reveal that their hearing is most sensitive at frequencies higher than 10 kHz (Heffner et al. 2013, Figure 4), which is well above the predominant sound frequencies of HSR trains (Deng et al. 2014). Experimental exposure of bats to traffic noise, as well as to noise from other sources including synthesized white noise, has shown that bats will forage by passive listening even in a high noise environment, with foraging most limited by continuous white noise (Schaub et al. 2008). These findings suggest that HSR noise can be expected to cause some reduction in bat foraging success but that there is a low likelihood of bats avoiding areas with HSR noise. Moreover, since bats are primarily nocturnal predators, most of their foraging would occur at times when trains were infrequent and exposure brief. In summary, there would not be a considerable potential for operational noise to affect Townsend's big-eared bat, western mastiff bat, pallid bat, or western red bat.

4.6 Non-Special-Status Mammals

A wide variety of non-special-status mammalian wildlife occur in the study area, representing a wide variety of mammals—bats, insectivores, rodents, rabbits, carnivores, and ungulates (mostly deer). Apart from rabbits and insectivores, these are the same groups represented by the special-status mammals. For all these animals, an impact would be significant if it interfered substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites.

Bats and burrowing animals (most rodents and rabbits, and some carnivores) are at low risk of impacts. Bats are nocturnal and primarily function at acoustic frequencies higher than those produced by HSR trains. Burrowing animals are shielded from noise by the earth, but they are at elevated risk of impacts through the mechanism of vibration (separately analyzed). Insectivores are small animals with very limited home ranges that do not undertake migrations or other seasonal movements at a scale that would conflict with the HSR alignment; moreover, most of them are also burrowing animals. Potential impacts would be greatest with larger carnivores and ungulates, which sometimes perform long-distance movements that could be impeded by the rail alignment and commonly use sound to find prey or evade predation. However, all of the common carnivores and ungulates are distinguished by their tolerance for human activity. As detailed above in Section 3, Mammalian Wildlife Responses to Noise, existing studies of mammal use of crossings in Coyote Valley and upper Pacheco Creek have all documented frequent use of crossings at U.S. Highway 101 and SR 152 by common wildlife (Phillips et al. 2012; Pathways for Wildlife et al. 2016; Pathways for Wildlife 2020). These mammals are common because they are able to forage, evade predators, breed, and move about on the landscape despite the presence of human disturbances in the form of light, noise, and activity. Their primary vulnerability to humans is related to possible loss of habitat through conversion to other cover types, an impact that is not relevant to this analysis of noise effects. In summary, there would not be a considerable potential for operational noise to affect non-special-status mammals.

5 MEASURES TO REDUCE EFFECTS

The measures described in this section could be implemented to address operational noise impacts on relevant special-status species mammals. The measures described in this section involve construction of noise barriers similar to those proposed in Draft EIR/EIS measure BIO-MM#80 to address impacts on birds.

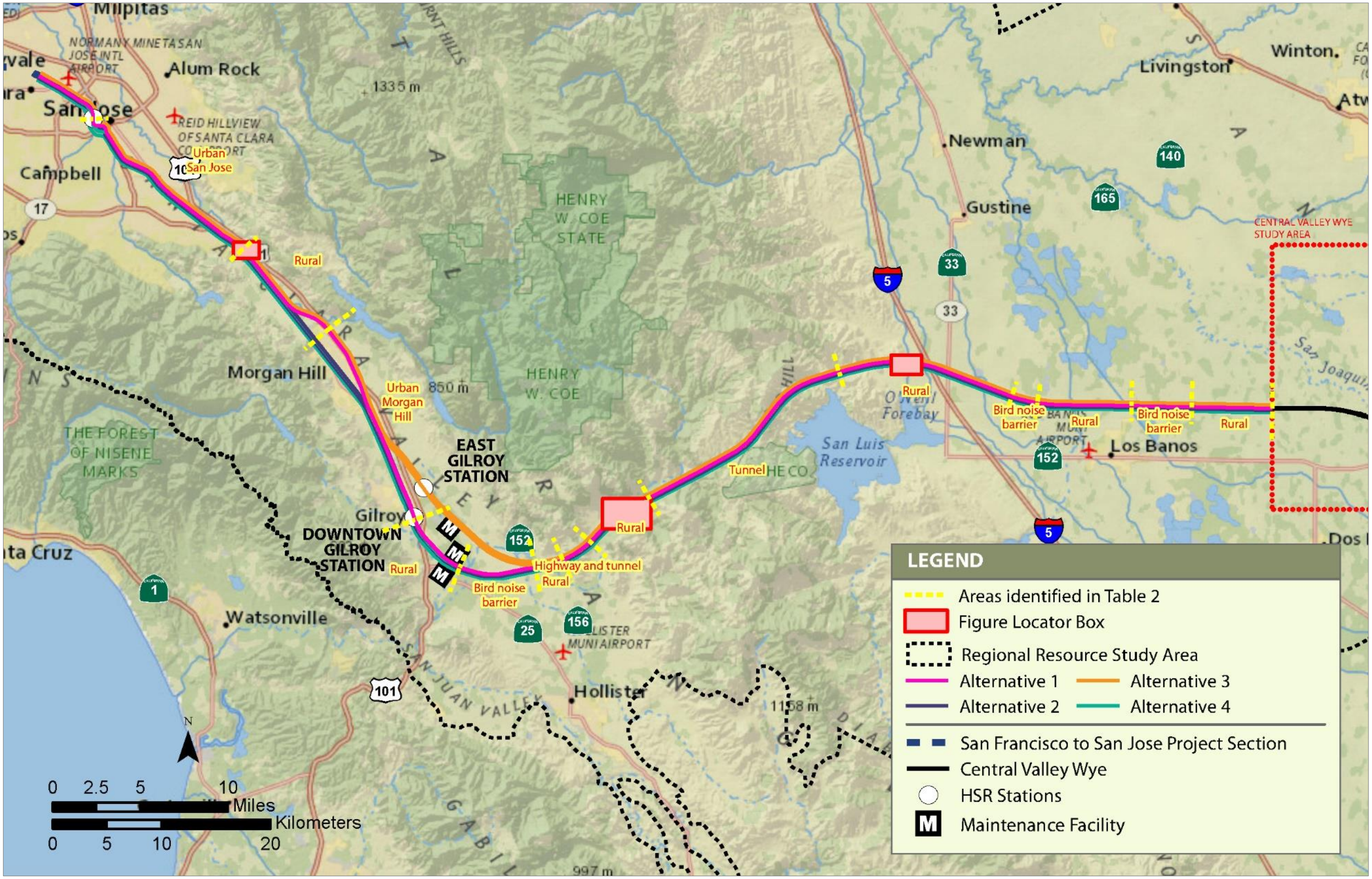
5.1 San Joaquin Kit Fox

Installation of noise barriers adjacent to crossing structures and in locations where San Joaquin kit fox are expected to cross under viaducts would reduce impacts by facilitating San Joaquin kit fox movements across the rail alignment and by reducing the extent and severity of impacts on kit fox foraging behavior. This measure would be most effective in the area where least-cost paths for north-south migratory movements have been identified (WCA, Appendix F1, pages F-15 to F17). The highest-value location is north of the connection of San Luis Reservoir and the O'Neill Forebay, which has been identified as a regionally critical connection for north-south movements by this species. This is the viaduct section that crosses the California Aqueduct between Stations B4245 and B4255. Secondary high-value movement corridors in the area include the viaduct sections between Stations B4156 and B4171 and between Stations B4184 and B4197, as well as the kit fox crossing structures located at Stations B4204+75, B4224+50, B4238+33, and B4262+00. Noise barriers at crossing structures would be most beneficial if located on both sides of the track and extending at least 550 feet in each direction from the crossing if the crossing is beneath a viaduct or 720 feet in each direction if the crossing is beneath an embankment. This should be sufficient to produce a large zone of reduced noise that may be attractive to the fox. Noise barriers in these locations are designed to achieve a 10 dB noise reduction at 100 feet from the track, with greater effect at lesser distances and reduced effect at greater distances, as discussed earlier (page 3.7-E-4). The barrier would reduce L_{max} levels near the rail alignment to approximately one-quarter the level that would occur in the absence of the measure. With this measure, impacts on San Joaquin kit fox habitat use and passage across the HSR alignment would be reduced but not eliminated.

5.2 Mountain Lion

The addition of noise barriers would reduce impacts on mountain lion by facilitating movements across the rail alignment and by reducing the extent and severity of impacts on mountain lion foraging behavior. Due to the severity of existing barriers to passage through Coyote Valley, there is limited confidence that such a measure would produce observable effects. However, noise barriers could facilitate mountain lion movement across Coyote Valley and upper Pacheco Creek. Barriers would be most effective if collocated with wildlife undercrossings providing passage from across U.S. Highway 101 in Coyote Valley and across SR 152 in upper Pacheco Creek.

In Coyote Valley, noise barriers to protect wildlife crossings would be beneficial if located between Stations B0648+80 and B0754+80, depending on the alternative (Figures 2a, 2b, 2c, and 2d). In the Pacheco Creek area, the highest value site for noise barriers is between Stations B3254+70 and B3303+00 (Figure 3). This includes the highest value corridor for north-south mountain lion movement in the area and is also located directly south of two Pacheco Creek bridges and one tributary culvert on SR 152 that have all been documented by camera traps to have high use by mammalian wildlife (Pathways for Wildlife 2020). The adjacent valley of Pacheco Creek contains high-value foraging habitat for a wide variety of mammals, including mountain lions, and the barrier would reduce noise impacts on that habitat. Due to the importance of this habitat, further benefits would accrue to mountain lion habitat if the barrier were extended southwest as far as Station B3175. As discussed above for the kit fox, it would also be beneficial to place noise barriers at the crossing of the California Aqueduct at Stations B4248+00 to B4249+00 (all alternatives; Figure 4). Barriers at that location would also facilitate mountain lion movements in that area. With these measures, impacts on mountain lion habitat use and passage across the HSR alignment would be reduced but not eliminated.



Source: Basemap, National Geographic ESRI 2017

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Figure 1 Project Alignment, Showing Locations of Noise Masking Features

Source: Basemap, National Geographic ESRI 2017

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Figure 2a Proposed Noise Barrier in Coyote Valley, Alternative 1

Source: Basemap, National Geographic ESRI 2017

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Figure 2b Proposed Noise Barrier in Coyote Valley, Alternative 2

Source: Basemap, National Geographic ESRI 2017

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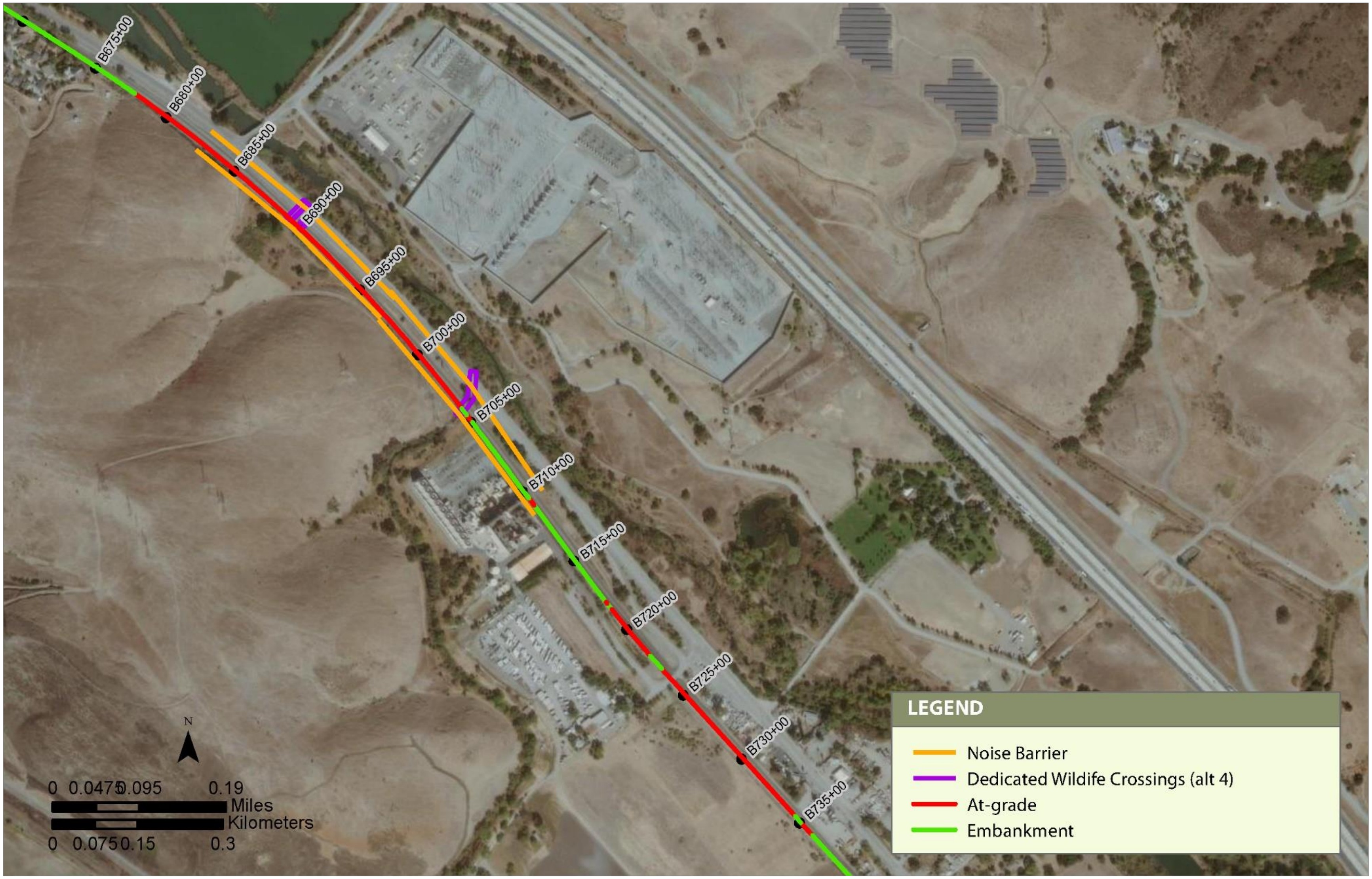
Figure 2c Proposed Noise Barrier in Coyote Valley, Alternative 3



Source: Basemap, National Geographic ESRI 2017

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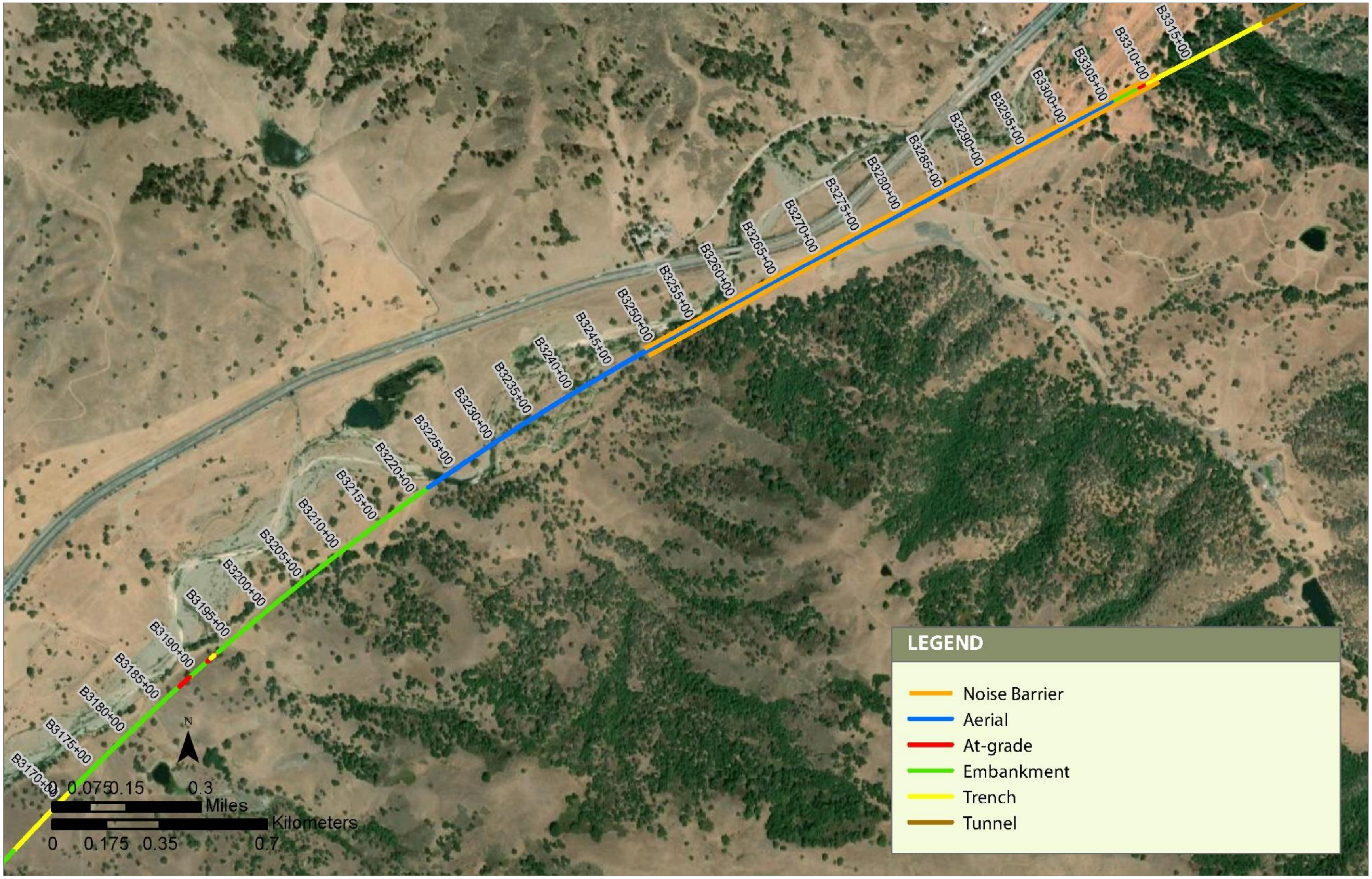
Figure 2d Proposed Noise Barrier in Coyote Valley, Alternative 4



Source: Basemap, National Geographic ESRI 2017

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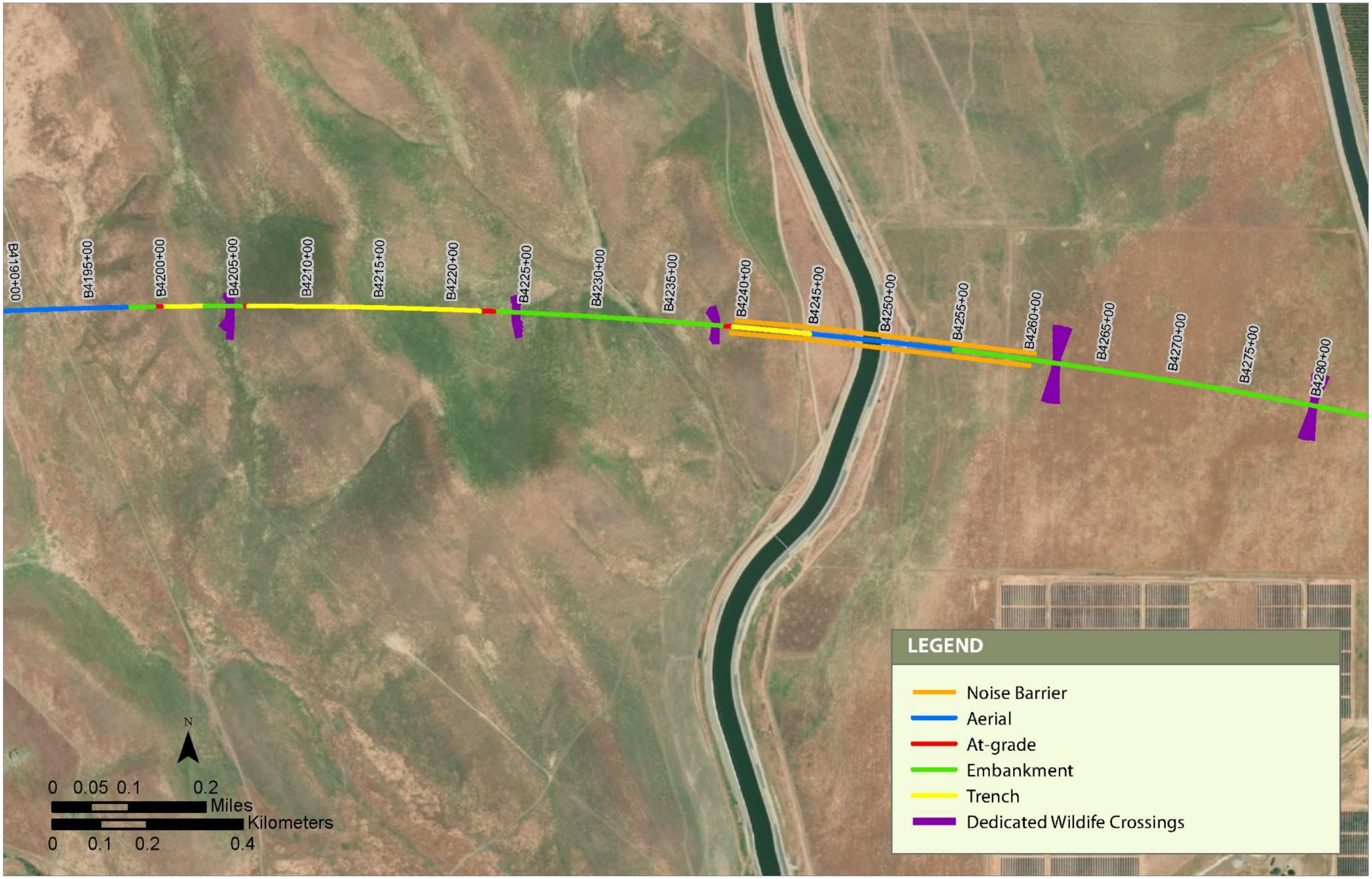
Figure 3 Proposed Noise Barrier near Upper Pacheco Creek



Source: Basemap, National Geographic ESRI 2017

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Figure 4 Proposed Noise Barrier near California Aqueduct

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