

Draft
Honolulu High-Capacity Transit Corridor Project
Environmental Consequences:
Supporting Information

October 26, 2006

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Table of Contents

Introduction	1
Land Use and Economic Activity	1
Background, Studies, and Coordination	1
Impacts	2
Mitigation.....	6
Neighborhoods and Communities.....	7
Affected Environment.....	7
Impacts.....	9
Mitigation.....	17
Environmental Justice	17
Farmlands.....	21
Impacts	21
Visual and Aesthetic Resources.....	22
Methodology	22
Affected Environment.....	23
Impacts	24
Mitigation.....	28
Air Quality and Energy.....	29
Noise and Vibration.....	30
Background, Studies, and Coordination	30
Affected Environment.....	31
Impacts	41
Mitigation.....	46
Water Resources	47
Affected Environment.....	47
Impacts.....	48
Mitigation.....	50
Natural Resources.....	50
Affected Environment.....	50
Impacts	50
Mitigation.....	56
Hazardous Materials	58
Cultural, Historic, and Archaeological Resources.....	59
Background, Studies, and Coordination	59
Cultural Resource Impacts	60
Cultural Resource Mitigation.....	63
Historic Resource Impacts	63
Historic Resource Mitigation	69
Archaeological Resource Impacts.....	69
Archaeological Resource Mitigation	72
Conclusions Regarding Environmental Consequences	73
Alternative 3: Managed Lane Alternative.....	73
Alternative 4: Fixed Guideway Alternative	73

List of Tables

Table 1. Project Access, Connectivity, Land Use, and Development Potential	3
Table 2. Person-Years of Employment Generated by Project Construction	4
Table 3. Numbers of Parcels Affected (Full and Partial Acquisitions)	11
Table 4. Numbers of Community and Utility Facilities Affected	12
Table 5. Affected Public Parklands, Recreation Areas, and Refuges	13
Table 6. Numbers of Parcels Directly Affected by Each Alternative within Communities of Concern.....	19
Table 7. Identified Resources	24
Table 8. Summary of Visual Impacts and Benefits	26
Table 9. Daily Air Pollution Emissions and Energy Consumption	29
Table 10. Existing 24-Hour Noise Measurements.....	41
Table 11. Existing Short-Term Noise Measurements.....	43
Table 12. Summary of Noise Impacts for the Managed Lane Alternative	43
Table 13. Summary of Noise Impacts for the Fixed Guideway Alternative	44
Table 14. Water Resources Affected by the Project Alternatives	49
Table 15. Natural Resources Affected by the Project Alternatives	52
Table 16. Known Hazardous Materials Sites Near Each Alternative.....	59
Table 17. Cultural Practices and Resources in the Study Area	61
Table 18. Historic Resources in the Study Area.....	65
Table 19. Historic Resources Affected by the Fixed Guideway Alternative.....	67
Table 20. Summary of Potential Impacts to Archaeological Resources.....	71

List of Figures

Figure 1. Noise Monitoring and Assessment Locations for the Managed Lane Alternative (‘Ewa Section)	33
Figure 2. Noise Monitoring and Assessment Locations for the Managed Lane Alternative (Koko Head Section)	34
Figure 3. Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section I).....	35
Figure 4. Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section II)	36
Figure 5. Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section III).....	37
Figure 6. Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section IV).....	38
Figure 7. Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section V)	39

Introduction

This document discusses the current natural and social environment in the Honolulu High-Capacity Transit Corridor Project's study area, and addresses the effects that the proposed alternatives would have on the environment. This analysis focuses on environmental elements that provide the greatest differentiation between these alternatives. It does not provide a comprehensive listing of all environmental changes anticipated in the study corridor area.

Land Use and Economic Activity

The project corridor's existing land use pattern on the southern shore of O'ahu is well established. Most of the project corridor lies between the foot of the Wai'anae and Ko'olau Mountains and the Pacific Ocean, and is virtually built out from Waipahu to Waikiki. This narrow, geographically constrained corridor is where most O'ahu's residents live and work, and it is served by the island's major transportation facilities. The highest density development (e.g., office, retail, government, residential, and hotel towers) is located between Downtown Honolulu and Waikiki. This area is experiencing major redevelopment and construction for even higher densities.

The lowest-density development in the project corridor (e.g., single-family detached housing, low-rise office parks, free-standing shopping centers, and big-box retail stores) is farther Wai'anae in 'Ewa and Kapolei. These West O'ahu areas are rapidly developing, but still include areas of open space, agricultural use, and Kalaeloa (formerly known as Barbers Point Naval Air Station). The moderately dense built-up area between Waipahu and Downtown Honolulu is relatively stable, with little major new construction evident.

Background, Studies, and Coordination

The State of Hawai'i Land Use Law (Chapter 205, Hawai'i Revised Statutes, 1961, amended 1985) establishes an overall framework for land use management, where all state land is classified into one of four districts: Urban, Rural, Agricultural, and Conservation. The City and County of Honolulu has planning and zoning authority over all of the Island of O'ahu. The General Plan for the City and County of Honolulu was first adopted in 1987 and has been updated through 1991 in the Revised 1992 Edition. This General Plan, required by City Charter, is a statement of long-range social, economic, environmental, and design objectives for the people of O'ahu's general welfare and prosperity. It is also a statement of broad policies that facilitate the Plan's objectives. Future development in the project corridor is guided by community comprehensive plans prepared and adopted by the City and County of Honolulu. The following community plans are applicable to the project corridor: 'Ewa Development Plan, Central O'ahu Sustainable Communities Plan, and Primary Urban Center (PUC) Development Plan: West, Central, and East.

Economic activity may be affected by the project in many ways; however, long-term employment on O‘ahu has been assumed to remain consistent with projections in the 2030 O‘ahu Regional Transportation Plan (ORTP). Given this assumption, the greatest direct economic affect of the project would be on employment during construction. Construction generates employment in three ways:

1. Direct employment (on-site construction job growth attributable to new projects)
2. Indirect employment (off-site employment, including manufacturing and preparing supplies and equipment)
3. Induced employment (employment generated to fulfill newly employed households' demands for goods and services)

The number of jobs generated is proportional to a project's size. For Hawaii, the Department of Business, Economic Development, and Tourism (DBEDT) has calculated that 23.73 person-years of employment are generated for each million dollars of heavy construction undertaken (DBEDT, 2002).

Impacts

The general future land use pattern of the project corridor is shown in the City and County of Honolulu's community-level comprehensive plans. Most of the project corridor between Waipahu and Waikīkī contains no undeveloped land. Redevelopment in this area will be the key to future land use, and is highly dependent on market demand and the availability of suitable vacant and underdeveloped land near the proposed project alternatives. The greatest potential for continued high-density development (e.g., office, retail, and possibly government, residential, and hotel uses) is between Downtown Honolulu and Waikīkī (Table 1). The greatest potential for lower- to medium-density new development in the project corridor (e.g., single-family detached housing, low-rise office parks, free-standing shopping centers, and big-box retail stores) is farther 'Ewa. These more suburban and rural areas are planned for development, including Kalaeloa. The moderately dense, built-up areas between Waipahu and Downtown Honolulu and along South King Street and University Avenue to the University of Hawai'i (UH) at Mānoa are relatively stable, with few vacant parcels. In the future as transit and market demand develops, redevelopment of key underused parcels is likely.

The project alternatives' land use impacts are consistent with the regional plan's broad policies. For example, the General Plan for the City and County of Honolulu establishes a policy to redistribute O‘ahu's future population by 2025 so 17 percent is in 'Ewa, 13 percent is in Central O‘ahu, and 46 percent is in the PUC. To accomplish this, new planned developments in Kapolei and Kalaeloa in the 'Ewa Development Area are consistent with this policy.

Table 1. Project Access, Connectivity, Land Use, and Development Potential

Alternative	Connections to major activity centers	2030 employment within ½ mile of stations	2030 population within ½ mile of stations	Potential for Transit-Oriented Development	Compatible with land use regulations (zoning)	Potential for increased development in station area
No Build Alternative	N/A	N/A	N/A	N/A	N/A	N/A
TSM Alternative	N/A	N/A	N/A	N/A	N/A	N/A
Alternative 3: Managed Lane (by section)						
3a. Two-Direction Option						
Waiawa IC to Hālawā Stream	1	7,640	5,780	Low	N/A	N/A
Hālawā Stream to Pacific Street	1	5,150	1,110	Low	N/A	N/A
3b. Reversible Option						
Waiawa IC to Hālawā Stream	1	0	0	Low	N/A	N/A
Hālawā Stream to Pacific Street	1	0	0	Low	N/A	N/A
Alternative 4: Fixed Guideway (by section)						
I. Kapolei to Fort Weaver Road						
Kamokila Boulevard/Farrington Highway	1	18,900	30,600	High	No	Yes
Kapolei Parkway/North-South Road	1	21,100	42,700	High	No	Yes
Saratoga Avenue/North-South Road	1	23,000	44,300	High	Yes	No
Geiger Road/Fort Weaver Road	1	17,400	35,300	High	Yes	No
II. Fort Weaver Road to Aloha Stadium						
Farrington Highway/Kamehameha Highway	1	20,000	28,600	Low	Yes	No
III. Aloha Stadium to Middle Street						
Salt Lake Boulevard	1	4,900	19,500	Low	Yes	No
Mauka of the Airport Viaduct	2	16,500	8,100	High	No	Yes
Makai of the Airport Viaduct	1	20,700	9,400	Low	Yes	No
Aolele Street	2	22,900	7,500	High	No	Yes
IV. Middle Street to Iwilei						
North King Street	1	23,000	33,600	Low	Yes	No
Dillingham Boulevard	1	40,300	28,200	Low	Yes	No
V. Iwilei to UH Mānoa						
Beretania Street/South King Street	2	223,600	193,300	Low	No	No
Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard	6	432,400	283,700	High	Yes	Yes
King Street/Waimanu Street/Kapi'olani Boulevard	6	276,600	211,900	High	Yes	Yes
Nimitz Highway/Queen Street/Kapi'olani Boulevard	6	322,100	234,000	Medium	Yes	Yes
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	4	337,600	255,800	Medium	Yes	Yes
Waikīkī Branch	8	80,100	56,300	High	Yes	Yes

This development policy may conflict with policy established in the State of Hawai‘i Land Use Law to maintain the viability of agriculture on O‘ahu, specifically in ‘Ewa and Central O‘ahu. The community plans are somewhat in conflict with this policy, because some agricultural lands in these areas are planned for urban uses. The Central O‘ahu and ‘Ewa Plans are more supportive of the land use impacts of the project alternatives than they are of continued agricultural use. These community-level policies are consistent with the regional policy to reduce speculation in land and housing, because these plans clearly indicate where development is encouraged and discouraged.

Alternative 1: No Build Alternative

Substantial changes in land use impacts are not expected with the No Build Alternative.

Alternative 2: TSM Alternative

Substantial changes in land use impacts would not be expected with the Transportation System Management (TSM) Alternative.

Construction associated with the minor capital improvements that would be completed for the TSM Alternative would generate approximately 950 person-years of direct, indirect, and induced employment over the course of project completion (Table 2).

Table 2. Person-Years of Employment Generated by Project Construction

Alternative	Project Construction Cost (millions 2006 \$)	Person-Years of Employment Generated
Alternative 1: No Build		
No Build Alternative	\$0	none
Alternative 2: Transportation System Management		
TSM Alternative	\$40	950
Alternative 3: Managed Lane		
3a: Two-Direction	\$3,780	89,700
3b: Reversible	\$2,570	61,000
Alternative 4: Fixed Guideway		
Kalaeloa – Salt Lake – North King – Hotel	\$4,880	115,800
Kamokila – Airport – Dillingham – King with a Waikiki Branch	\$6,140	145,700
Kalaeloa – Airport – Dillingham – Halekauwila	\$4,630	109,900
20-mile Alignment	\$3,550	84,200

Alternative 3: Managed Lane Alternative

The most likely impact of the Managed Lane Alternative would be induced or indirect development farther mauka and ‘Ewa than its termini on Interstate Route H-1 (H-1) and H-2. Shorter travel times from Central O‘ahu and Kapolei to Honolulu, for example, would enable commuters to live in less expensive and larger housing farther from employment centers. Little or no land use impacts would be expected within the Koko Head section of the Managed Lane corridor, because virtually no access to adjacent parcels exists.

Construction associated with the Managed Lane Alternative would generate between approximately 61,000 and 89,700 person-years of direct, indirect, and induced employment over the course of project completion (Table 2).

Alternative 4: Fixed Guideway Alternative

Construction of the Fixed Guideway Alternative for the full length of the corridor would generate between approximately 109,900 and 145,700 person-years of direct, indirect, and induced employment over the course of project completion (Table 2). Construction of the 20-mile Alignment would generate approximately 84,200 person-years of employment.

Land use impacts could be substantial within one-half mile of certain station locations along the four alignment options being considered for the Fixed Guideway Alternative. This radius is within walking distance to a station, and the new transit service would increase mobility and accessibility. These changes would affect land values and increase the potential for real estate development investments. The potential for transit-supportive development (TSD) and transit-oriented development (TOD) are described in this section. TSD would include land uses such as office space and multi-story residential buildings near transit stations. Office uses generate more transit riders than any other land use. TOD includes the following elements:

- Moderate- to higher-density uses
- Within easy walking distance to and from the station
- A mix of uses
- Pedestrian-oriented
- New construction or redevelopment
- Generates transit ridership.

For successful TOD to occur, the following has to be present: an excellent transit system, strong market demand, available parcels close to the station, and a consistent TOD land use planning policy. The following sections describe the probable land use impacts of the Fixed Guideway Alternative in the five project sections described in Chapter 2 of the *Alternatives Analysis Report*.

Section I. Kapolei to Fort Weaver Road

The Kamokila Boulevard/Farrington Highway alignment option would have the best potential for TOD of the four optional alignments in this section, because of the planned locations of Downtown Kapolei and UH West O‘ahu. The station sites along Kamokila Boulevard and Farrington Highway would serve large concentrations of employees, shoppers, students, faculty, and staff. This alignment would also be the shortest of the four. The Kapolei Parkway/North-South Road alignment has the second-best potential for TOD and TSD for the same reasons, and would be more central to planned residential areas. However, this alignment is a bit longer. The future orientation of the densest uses in Downtown Kapolei and UH West O‘ahu could shift toward stations along Kapolei Parkway and North-South Road. The Saratoga Avenue/North-South Road and the Geiger Road/Fort Weaver Road alignments would have the least potential for TSD or

TOD, because they are located in planned and existing residential areas with little commercial and no apartment zoning. These two alignment options are also the longest of the four being considered.

Section II. Fort Weaver Road to Aloha Stadium

Although there is only one alignment option in this section and so no comparison of alignments can be made, all four stations offer some potential for TSD or TOD. All TSD areas adjacent to these four stations could generate ridership, but strong pedestrian connections would be needed between these areas and the stations. The potential for TOD would be limited over the short-term, but more probable with long-range redevelopment.

Section III. Aloha Stadium to Middle Street

The Salt Lake Boulevard alignment has limited TOD potential because of built-up land around station areas. In addition, this alignment would not serve Honolulu International Airport (HNL), a major generator of potential riders. The Mauka Side of the Airport Viaduct has no TOD potential and would not serve the airport well with a pedestrian connection. The Makai Side of the Airport Viaduct has little TOD potential but would serve the airport. The Aolele Street alignment would have the greatest TOD potential.

Section IV. Middle Street to Iwilei

Neither alignment is a strong candidate for TOD and TSD in this area, because of its built-up industrial and commercial nature. With redevelopment, the North King Street alignment may be a slightly stronger candidate because it contains more residential uses likely to be occupied by a highly transit-dependent population.

Section V. Iwilei to UH Mānoa

The more makai alignments along Hotel Street and Nimitz Highway have stronger TOD potential than the alignment along South King Street, because the former two are located in developing areas and closer to activity centers. Of the two, the Hotel Street-Kapi'olani alignment is the most central to the major shopping, business, and governmental districts of Downtown Honolulu. South King Street is farthest from the major activity centers and in a low-density residential and commercial area in this section of the project corridor. The Waikīkī Branch has a high potential to attract even more redevelopment in this densely built-up area.

Mitigation

The City and County of Honolulu has traditionally addressed development issues through the administration of land use regulations (zoning, site plan, and subdivision regulations) that are usually based on local master plans. The responsibility for mitigating the effects of ongoing growth, regardless of the project, rests with local governments that have jurisdiction over land use and with developers who carry out development projects. For example, the City and County of Honolulu could work with affected communities to help implement the regional vision described in the General Plan. Potential measures to mitigate the effects of growth on the environment include:

- Revising local community master plans to accommodate even higher densities than planned and to use less land
- Updating zoning districts to increase densities near the project and add the planned community zone
- Encouraging TOD where feasible
- Acquiring open space and protecting farmland
- Engaging in more aggressive regional planning efforts.

Neighborhoods and Communities

Affected Environment

Communities along the project corridor include Kapolei, the ‘Ewa area, Waipahu, Pearl City, Salt Lake, Kalihi, Downtown Honolulu, Kaka‘ako, McCully, the University District, and Waikīkī. Kapolei is located in a plain of former sugar cane fields. The agricultural land is rapidly developing, and the area has been designated as O‘ahu’s “second city.” As the corridor extends Koko Head, land uses become more urbanized. The corridor traverses through sugar plantation worker communities that date from the late 19th century; single-family bedroom communities; suburban cities with low-rise mixed residential and commercial/industrial uses; and ultimately, the dense high-rise residential apartment, condominium, commercial, and office developments of Downtown Honolulu. Major institutions include several military bases and associated enlisted-persons housing, Aloha Stadium, several regional retail and commercial shopping centers, Honolulu International Airport, and major industrial and port businesses. The corridor includes Waikīkī, one of the densest tourist areas in the world and the University of Hawai‘i Mānoa, with an enrollment of over 20,000 students.

The Island of O‘ahu’s population was over 876,000 in 2000 according to the U.S. Census Bureau – an increase of 4.8 percent over the previous decade. The fastest growing areas were suburban communities where residents could find more affordable housing. Between 2000 and 2030, the Island’s population is expected to increase 28 percent to over 1.1 million. Based on local land use planning policies, this future population growth will be focused in the ‘Ewa and PUC areas.

Like many of Hawaii’s largest metropolitan areas, O‘ahu’s demographic characteristics are increasingly more diverse, particularly as a result of the Native Hawaiians and Polynesians originally inhabiting the island. In 2000, 79 percent of the population was non-White, with 46 percent Asian. Key racial groups included Native Hawaiians, Filipinos, Samoans, Japanese, and Chinese. Large concentrations of White and Black persons were in close proximity to the military bases, which is typical of temporarily stationed military personnel.

The median income in 1999 was \$52,280, but this number represents limited purchasing power because of Hawaii’s high cost of living. Ten percent of the population had an income below the poverty level. Neighborhoods with concentrations of residents below the poverty level included Downtown Honolulu, Kalihi-Pālama, and Kalihi Valley, which contain low-income housing, a disproportionate number of elderly, and many new

immigrants. Seven percent of the households received public assistance and 22 percent and 27 percent receive income from retirement and social security, respectively. Only 49 percent of dwellings are owner-occupied, but 55 percent are single-family residences.

Honolulu, the state capitol, is the center of commerce for all of Hawai‘i and Polynesia and a world-renowned tourist destination that contributes considerably to the local economy. The metropolitan area provides regional medical services, shopping, and education. This area has several military bases, substantial industrialized maritime business activity, and an international airport. The project corridor encompasses many outlying communities where old sugar refineries have been converted to shopping centers and industrial parks in the past 10 to 15 years. These suburban communities have smaller commercial areas and neighborhood shopping districts that meet the everyday needs of both residents and visitors.

Major employment centers along the project corridor include the following:

- Pearl Harbor and the nearby industrial area
- Pearlridge Center
- Honolulu International Airport and supporting businesses
- Industrial districts in Hālawā Valley, Māpunapuna, Kalihi, Iwilei, and Kaka‘ako
- Downtown Honolulu and the Capital District
- Ala Moana Center and the surrounding area
- Waikīkī
- University of Hawai‘i (UH) at Mānoa.

Many public services and community facilities are located in the project corridor, including fire, police, and emergency medical services. Public health clinics, hospitals, senior centers, schools, colleges, universities, libraries, religious institutions, and cemeteries are also present. Together, they support the community’s social fabric.

Despite the urban character of much of the project corridor, natural areas, parks, and other types of recreational amenities are numerous. These include regional recreation areas for picnicking and hiking, ocean beaches, developed facilities such as recreation centers and golf courses, neighborhood parks for local residents and children’s organized sports programs, and small urban parks. Meandering pedestrian and bicycle trails are also present. Major facilities include the Hawai‘i Raceway Park, Hawaiian Waters Adventure Park, Ke‘ehi Lagoon Beach Park, Ala Moana Regional Park, Stadium Park, and the UH Stan Sheriff Sports Center. These amenities provide a variety of recreational opportunities.

A substantial portion of the proposed project corridor encompasses urban areas served by a number of different utilities, including electric, water, sewer, stormwater, telephone, cable, and fiber optics. No underground natural gas lines exist, but there are fuel lines to the military bases and airport. Most of these facilities include buried cables, conduits, or pipelines, either in the public right-of-way or on separate rights-of-ways or easements. Facilities with buried or above-ground structures such as electric substations or telephone

switching stations also exist. A number of major high-voltage power lines are also located in the project corridor.

Cohesion is provided by many social settings and activities in the project corridor. In the 'Ewa end of the corridor, sugar plantation history is an important part of the community's cultural history and present social fabric. This area includes historic Hawaiian and Filipino enclaves and communities of recent immigrants from throughout the Pacific, the Philippines, and Southeast Asia. Downtown Honolulu contains the long-established Chinatown District. At the State Capitol, a special Hawaiian lei draping ceremony takes place for Father Damien's Birthday and Lili'uokalani's birthday. The 'Iolani Palace hosts commemorative gatherings for the Native Hawaiian community. Certain neighborhoods and communities celebrate special cultural events such as the Prince Lot Hula Festival. Large cultural institutions provide a community focus, such as the Bishop Museum of Hawaiian artifacts and royal family heirlooms and the annual "Salute the Troops" celebration for Hawaii's armed services. Other social activities include ethnic rituals, including the Japanese and Okinawan ritual Bon dances to commemorate the dead and special community holiday events, such as the annual Kalihi Christmas parade. Multi-cultural celebrations for Mardi Gras, the Chinese New Year, and St. Patrick's Day also take place. Community gathering places include low-key neighborhood farmers' markets and movie nights at local beaches. Community identity is strengthened by the many cultural practices, such as special ethnic food preparation, dance studios, traditional arts, languages, and family-oriented ceremonies provided by local neighborhood businesses. All of these attributes contribute to neighborhood and community cohesion along the project corridor.

Impacts

Alternative 1: No Build Alternative

The No Build Alternative would not include construction of a new transit system, so neighborhoods and communities would not be affected. It would not cause displacements, provide new access, or affect parklands, utilities and services in the corridor. Long-term impacts would include increased congestion on surface streets, which would impact the operating environment for fire, police, and emergency medical service vehicles and access to some community facilities. General public service vehicles such as school buses and solid waste collection trucks would also experience delays caused by increased congestion.

Alternative 2: TSM Alternative

Community Cohesion

Communities would be served by the enhanced bus system. No impacts on population or demographics would be expected.

Displacements and Relocations

With this alternative, the existing bus system would be enhanced. These enhancements would involve changing existing operations and frequencies of service, and would not require additional right-of-way. Additional right-of-way requirements for new transit

centers, Park-and-Ride lots and bus maintenance facilities have not yet been identified, but would be less than the requirements for Alternatives 3 and 4.

Services, Utilities and Public Safety

Compared to the No Action Alternative, the limited transportation improvements and enhanced bus system associated with Alternative 2 would improve transit service. These improvements would have a small effect on community facilities by increasing accessibility. Impacts on utilities and community cohesion would be expected to be minor.

Parklands

No impacts to parklands have been identified.

Alternative 3: Managed Lane Alternative

Community Cohesion

The Managed Lane Alternative would provide additional vehicular through-capacity in an existing transportation corridor. It is not expected to have a substantial additional impact on the overall population or demographic characteristics in adjacent census tract areas, because these areas are already separated by a four-lane or wider highway. The facility would largely be constructed within an existing highway right-of-way. The effects of the Two-Direction and Reversible options would be the same.

Displacements and Relocations

Up to 49 adjacent parcels could be affected by parcel acquisition under this option (Table 3). Of this total, two parcels have been identified as residential, and up to 47 parcels with commercial/office and other uses would be affected. Where buildings are located on the affected parcels, displacements could occur.

Two parcels where residential uses occur would be affected by right-of-way acquisition for both of the options for this alternative. Parcels affected by right-of-way acquisition may include condominium or apartment buildings where multiple dwelling units could be affected, as well as single-family homes. Therefore, this alternative may result in a slight reduction in housing in the project area.

Table 3. Numbers of Parcels Affected (Full and Partial Acquisitions)

Alternative	Parcels of All Types ¹	Residential Parcels	Commercial/Office Parcels
Alternative 1: No Build			
No Build Alternative	0	0	0
Alternative 2: Transportation System Management			
TSM Alternative	None identified		
Alternative 3: Managed Lane (by section)			
3a. Two-Direction Option			
Waiawa IC to Hālawā Stream	11	2	4
Hālawā Stream to Pacific St.	38	0	26
3b. Reversible Option			
Waiawa IC to Hālawā Stream	9	2	3
Hālawā Stream to Pacific St.	35	0	26
Alternative 4: Fixed Guideway (full-length system by section)			
I. Kapolei to Fort Weaver Road			
Kamokila Blvd./Farrington Hwy.	22	0	3
Kapolei Pwy./North-South Rd.	19	0	0
Saratoga Ave./North-South Rd.	35	0	0
Geiger Rd./Fort Weaver Rd.	28	0	4
II. Fort Weaver Road to Aloha Stadium			
Farrington Hwy./Kamehameha Hwy.	14	2	4
III. Aloha Stadium to Middle Street			
Salt Lake Blvd.	24	1	12
Mauka of the Airport Viaduct	33	0	20
Makai of the Airport Viaduct	49	0	37
Aolele St.	15	0	1
IV. Middle Street to Iwilei			
North King St.	37	2	6
Dillingham Blvd.	39	1	22
V. Iwilei to UH Mānoa			
Beretania St./South King St.	36	3	22
Hotel St./Kawaiaha'o St./Kapi'olani Blvd.	83	11	58
King St./Waimanu St./Kapi'olani Blvd.	36	9	62
Nimitz Hwy./Queen St./Kapi'olani Blvd.	63	8	47
Nimitz Hwy./Halekauwila St./Kapi'olani Blvd.	77	9	51
Waikīkī Branch	16	1	10
Total for 20-mile Alignment	139	7	72

¹Parcels of all types is greater than the sum of the other columns because it also includes parcels with governmental or utility company ownership that are not currently transportation right-of-way.

Services and Public Safety

Table 4 shows the parcels that support community and utility facilities that would be directly affected. Overall, introduction of a two-lane grade-separated facility between Waipahu and Downtown Honolulu would have effects similar to the Fixed Guideway Alternative. However, the scale and intensity of impacts would be less.

Table 4. Numbers of Community and Utility Facilities Affected

Alternative	Number and Type of Community Facilities	Number and Type of Utility Facilities	Total Number of Community and Utility Parcels
Alternative 1: No Build			
No Build Alternative	0	0	0
Alternative 2: Transportation System Management			
TSM Alternative	None identified		
Alternative 3: Managed Lane			
Managed Lane Alternative	0	1-Refuse 1-Electrical	2
Alternative 4: Fixed Guideway (full-length system by section)			
I. Kapolei to Fort Weaver Road			
Kamokila Boulevard/Farrington Highway	1-Health Service	2-Water	3
Kapolei Parkway/North-South Road	1-Health Service	2-Water	3
Saratoga Avenue/North-South Road	1-Health Service	2-Water	3
Geiger Road/Fort Weaver Road	None	1-Sewer	1
II. Fort Weaver Road to Aloha Stadium			
Farrington Highway/Kamehameha Highway	2-Educational Services 1-Religious Institution	None	3
III. Aloha Stadium to Middle Street			
Salt Lake Boulevard	None	1-Refuse 1-Water 1-Sewer	3
Mauka of the Airport Viaduct	None	1-Refuse	1
Makai of the Airport Viaduct	1-Social/Charitable	None	1
Aolele Street	1-Social/Charitable	None	1
IV. Middle Street to Iwilei			
North King Street	1-Educational Service 2-Religious Institutions	None	3
Dillingham Boulevard	1-Health Services 1-Educational Service	1-Electric	3
V. Iwilei to UH Mānoa			
Beretania Street/South King Street	1-Police Station 2-Educational Services	1-Electric	4
Hotel Street/Kawaiaha'o Street/ Kapi'olani Boulevard	1-Cultural Activity 1-Health Service 1-Educational Service	2-Electric	5
King Street/Waimanu Street/ Kapi'olani Boulevard	1-Cultural Activity 1-Health Service 1-Educational Service	2-Electric	5
Nimitz Hwy./Queen St./Kapi'olani Blvd.	1-Educational Service	1-Electric	2
Nimitz Hwy./Halekauwila St./Kapi'olani Blvd.	1-Educational Service	1-Electric 1-Sewer	3
Waikīkī Spur	1-Social/Charitable	None	1
Total for 20-mile Alignment	1-Health Services 2-Educational Service 2-Religious Institutions	2-Electric 1-Sewer	8

Parklands

The Managed Lane Alternative is anticipated to affect one public park, Waiawa District Park, and one recreational facility, Aloha Stadium (Table 5). It is anticipated that the proposed project improvements would require additional right-of-way at the Waiawa District Park and Aloha Stadium. However, it is not anticipated that these resources would be required to be relocated. Access to the facilities would be maintained. Parking may be permanently acquired at the Aloha Stadium. The Navy-Marine Golf Course would also be impacted through partial acquisition by the proposed project, but this facility is not considered a public resource.

Table 5. Affected Public Parklands, Recreation Areas, and Refuges

Alternative	Parklands	Sports and Recreation Areas	Wildlife and Waterfowl Refuges	Total
Alternative 1: No Build				
No Build Alternative	0	0	0	0
Alternative 2: Transportation System Management				
TSM Alternative	None identified			
Alternative 3: Managed Lane				
3a. Two-Direction Option	1	1	0	2
3b. Reversible Option	1	1	0	2
Alternative 4: Fixed Guideway (full-length system by section)				
I. Kapolei to Fort Weaver Road				
Kamokila Boulevard/Farrington Highway	1	0	0	1
Kapolei Parkway/North-South Road	1	0	0	1
Saratoga Avenue/North-South Road	1	0	0	1
Geiger Road/Fort Weaver Road	0	0	0	0
II. Fort Weaver Road to Aloha Stadium				
Farrington Highway/Kamehameha Highway	0	0	0	0
III. Aloha Stadium to Middle Street				
Salt Lake Boulevard	0	1	0	1
Mauka of the Airport Viaduct	0	1	0	1
Makai of the Airport Viaduct	1	1	0	2
Aolele Street	1	1	0	2
IV. Middle Street to Iwilei				
North King Street	0	0	0	0
Dillingham Boulevard	0	0	0	0
V. Iwilei to UH Mānoa				
Beretania Street/South King Street	0	0	0	0
Hotel Street/Kawaiaha'o Street/ Kapi'olani Boulevard	2	0	0	2
King Street/Waimanu Street/Kapi'olani Boulevard	0	0	0	0
Nimitz Highway/Queen Street/Kapi'olani Boulevard	0	0	0	0
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	1	0	0	1
Waikīkī Branch	1	0	0	1
Total for 20-mile Alignment	2	1	0	3

Alternative 4: Fixed Guideway Alternative

Community Cohesion

Long-Term Impacts

The introduction of a fixed guideway transit system could both increase and decrease access through neighborhoods. Access to community services and businesses could be enhanced around stations. Overall adverse effects on community cohesion and social interaction would be low, because most of the proposed improvements would occur in existing major transportation corridors that already act as physical barriers between neighborhoods.

Experience in other cities with fixed guideway transit systems has shown that under appropriate market and regulatory conditions, a fixed guideway system can stimulate greater incentive for investment by property owners, especially in station areas. Transit-oriented development (TOD) is pedestrian-friendly, and concentrations of pedestrian-oriented businesses and services can increase social interaction within communities. Faster, more reliable, more frequent transit service can also increase access to community facilities and employment opportunities, benefiting all communities along the route.

Construction Impacts

Temporary physical barriers to isolate construction sites from traffic lanes would likely restrict access across roadways. Some streets would also be partially or fully closed during certain phases of construction, hindering access and temporarily reducing community cohesion within neighborhoods.

Displacements and Relocations

The parcels that would be affected by Alternative 4 would vary according to the alignment selected within each section (Table 3). Displacement and relocation issues for the five corridor sections are discussed in the following sections.

Section I. Kapolei to Fort Weaver Road

This portion of the route would affect up to 35 adjacent parcels. None of these parcels would require full acquisition. The Saratoga Avenue/North-South Road alignment would affect the most parcels, but many of the parcels that would be affected are currently vacant and planned for redevelopment as part of the Hawai'i Community Development Authority's Kalaeloa Master Plan. The Kapolei Parkway/North-South Road alignment would affect the fewest number of parcels. .

Section II. Fort Weaver Road to Aloha Stadium

Fourteen parcels would be affected along this portion of the corridor. Five of these parcels would be acquired in full and could include building displacements.

Section III. Aloha Stadium to Middle Street

Up to 49 parcels would be affected along this portion of the corridor. The greatest number of affected parcels would occur along the Makai of the Airport Viaduct

alignment, and the fewest along the Aolele Street alignment. One of these parcels would likely be acquired in full and could include building displacements.

Section IV. Ke'ehi Interchange to Iwilei

Thirty-nine parcels could be affected by one alignment or another along this portion of the corridor. The Dillingham Boulevard alignment would affect the most adjacent parcels, as a result of widening to accommodate the fixed guideway structure. As many as 25 of these parcels would be acquired in full and could include building displacements.

Section V. Iwilei to UH Mānoa

Up to 83 parcels could be affected by one alignment or another along this portion of the corridor. The greatest number of parcels affected within this section would occur along the King Street/ Kawaiha'ō Street/Kapi'olani Boulevard alignment. The fewest affected parcels would occur along the Beretania Street/South King Street alignment. As many as 39 of the affected parcels would be acquired in full and could include building displacements.

The Waikīkī Branch would affect up to 17 parcels. No full acquisitions would occur.

20-mile Alignment

Up to 139 parcels could be affected along this alignment. As many as 25 of the affected parcels would be acquired in full and could include building displacements. The 20-mile Alignment would affect seven residential parcels.

Services and Public Safety

Long-Term Impacts

Long-term impacts could involve either the physical placement of the project on or adjacent to a public service or community facility, or a change in a public service or community facility's operating environment. The number of parcels supporting community facilities that would be directly affected by physical placement is shown in Table 4, which is organized by section with the number of affected parcels listed for each alignment option.

Overall, Alternative 4 would increase mobility and accessibility within the project corridor. It could limit or impede local access to specific public services (e.g., police, fire, or emergency medical services) in areas where access would be limited by installation of raised medians. Community facilities could be adversely affected if access to these facilities is viewed as restricted and less desirable or travel times are extended. These effects would be minor and would vary little between the alignments. To the extent that community facilities function as places of social interaction, the displacement of a substantial number of these facilities could change the way that some residents gather socially. However, as shown in Table 4, few community facilities would be directly affected by the Fixed Guideway Alternative.

Construction Impacts

For public services, some traffic rerouting or delays could affect fire, police, and emergency medical service vehicles during construction, and some cross streets could be temporarily closed to complete construction work. In some cases, construction requiring temporary road closures would be conducted at night or during off-peak hours to minimize traffic impacts. Construction of at-grade and elevated guideway sections in high-volume traffic and pedestrian areas could require additional police support services to direct and control traffic and pedestrian movements. Traffic rerouting or delays could also affect school bus routes and solid waste collection.

Access to community facilities near construction sites may be impeded by traffic restrictions and detours, displacement of parking or loading areas, and road closures for project construction and utility relocation. Permanent relocation of some facilities may be necessary, although the magnitude of this impact would vary between alignment options.

Utilities

Long-Term Impacts

Long-term impacts on utility services and systems are expected to be minimal. Indirectly, the increased densities that may occur around station locations could decrease siting costs for new utilities, because a compact growth pattern would be easier to serve than a more dispersed development pattern. The number of parcels supporting utility facilities that would be directly affected is shown in Table 4.

Construction Impacts

Multiple physical utilities are located within, adjacent to, or traverse the project corridor roadways, including electric, water, sewer, stormwater, telephone, cable, and fiber optics. These utilities may or may not be affected during construction, depending on their depth below grade, soil conditions, the excavation limits, the exact location of the guideway, and other factors.

Underground utilities would be relocated or otherwise protected to allow for excavation and minimize potential load impacts on existing utilities. Numerous utility poles that support overhead lines may also require relocation. Some of these impacts may be significant to some utility service providers in terms of relocation costs incurred, staff time and resources, and temporary loss of existing access to utilities.

Cut-and-cover construction (which is being considered for the Hotel Street/Kawaiaha'o Street/ Kapi'olani Boulevard Alignment) followed by at-grade construction would generally have the greatest impact on utility infrastructure. This is because these methods would require more relocation of underground piles and above-ground utility poles for guideways, stations, and right-of-way acquisitions. Construction of elevated sections could also require relocation of utilities. However, elevated supports can often be placed to avoid conflicts with major underground utilities and could straddle crossing roadways. This would help avoid having utilities run beneath them. Bored tunnel sections would generally pass beneath most underground utilities and would not require

relocation. Protection of these utilities in some cases (typically deeper sewer pipes) may be required. Disruptions to utility service during utility relocations would likely be minimal, because temporary connections to customers would typically be established before relocating utility conveyances.

Parklands

Long-term impacts could involve either the physical placement of the project on or adjacent to a public park or recreational use, or a change in a public service or community facility's operating environment. The number of parcels supporting park or recreation uses that would be directly affected by physical placement of the project is shown in Table 5, organized by section with the number of affected parcels listed for each alignment option. It is anticipated that the proposed transit project would require additional right-of-way at the parks and recreational resources. However, it is not anticipated that any of these resources would require permanent relocation.

Mitigation

Where relocations would occur, compensation would be provided to affected businesses or residents. Compensation for parcel acquisitions, including buildings and structures, would be provided at fair market value and comply with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. These regulations provide for relocation services for businesses and residences and include measures for providing assistance in locating suitable replacement housing and business sites. If residences are displaced, housing relocation assistance would be provided to displaced persons.

Federal laws require that no person be required to move from a residence unless comparable replacement property is available within that person's financial means. In addition, no displaced person, business, or organization would be required to move from any dwelling or business facility without being given a written notice at least 90 days prior to the earliest date that they could be required to move. Relocation services would be provided to all affected property owners and tenants without discrimination.

Environmental Justice

Executive Order 12898 requires that federal agencies identify and not disproportionately affect minority and low-income populations. For this project, environmental justice communities have been expanded to include areas with high proportions of linguistically isolated households, in order to more broadly define communities of concern to fit O'ahu's diverse ethnic make-up. This section identifies environmental justice populations, discusses outreach made to these populations, and analyzes effects on these populations. Effects evaluated include land acquisitions, distribution of transportation benefits, and construction impacts.

Alternative 1: No Build Alternative

With the No Build Alternative, the proposed project would have no disproportionately high or adverse impacts on low-income and/or minority communities. This is because

there would be no new construction other than what has already been planned and approved. Projects included under the No Build Alternative would undergo planning and environmental review as part of their individual project development process.

Alternative 2: TSM Alternative

Long-Term Impacts

The TSM Alternative would provide an enhanced bus system based on a hub-and-spoke route network, conversion of the present morning peak-hour-only zipper-lane to a morning and afternoon peak-hour zipper-lane operation, and other relatively low-cost bus priority capital improvements on selected roadway facilities. It would also include completion of projects defined in the O‘ahu Regional Transportation Plan, which are also included in the No Build Alternative. The limited transportation improvements and enhanced bus system associated with Alternative 2 would improve traffic operations on corridor roadways. These improvements would benefit low-income and/or minority communities by increasing accessibility to these communities.

Construction Impacts

Construction of bus enhancement facilities could affect low-income and/or minority communities if such facilities are located in or adjacent to those communities. However, impacts such as noise or dust from construction activities would be temporary and would be minimized and monitored by using Best Management Practices (BMPs) such as construction scheduling or dust control measures, if necessary. Traffic impacts during construction would be managed through implementation of Traffic Management Plans.

Alternative 3: Managed Lane Alternative

Long-Term Impacts

The acquisition of commercial and residential uses may have a disruptive influence on a community. According to Table 6, within potential low-income or minority communities, approximately 21 parcels (including one parcel where a residential use occurs) may be potentially affected by right-of-way acquisition for the Two-Direction Option for the Managed Lanes Alternative. Approximately 17 parcels, including one residential use, may be affected by right-of-way acquisition for the Reversible Option. This impact would result in a slight reduction in commercial and residential uses for these communities. The Two-Direction Option provides more opportunity to connect communities, because two stations are associated with this option. The Reversible Option would only connect communities near the ends of the facility (Ewa of Waiawa Interchange or Koko Head of Pacific Street) and near the Salt Lake neighborhood (from the Salt Lake Boulevard ramps).

Table 6. Numbers of Parcels Directly Affected by Each Alternative within Communities of Concern

Alternative	Parcels Directly Affected in Communities of Concern (EJ)	
	Total*	Residential
Alternative 1: No Build		
No Build Alternative	N/A	N/A
Alternative 2: Transportation System Management		
TSM Alternative	N/A	N/A
Alternative 3: Managed Lane		
3a. Two-Direction Option	21	1
3b. Reversible Option	17	1
Alternative 4: Fixed Guideway (by section)		
I. Kapolei to Fort Weaver Road		
Kamokila Boulevard/Farrington Highway	3	0
Kapolei Parkway/North-South Road	2	0
Saratoga Avenue/North-South Road	2	0
Geiger Road/Fort Weaver Road	5	0
II. Fort Weaver Road to Aloha Stadium		
Farrington Highway/Kamehameha Highway	2	0
III. Aloha Stadium to Middle Street		
Salt Lake Boulevard	5	1
Mauka of the Airport Viaduct	15	0
Makai of the Airport Viaduct	8	0
Aolele Street	8	0
IV. Middle Street to Iwilei		
North King Street	29	2
Dillingham Boulevard	23	0
V. Iwilei to UH Manoa		
Beretania Street/South King Street	21	3
Hotel Street/Kawaiaha'o Street/ Kapi'olani Boulevard	10	1
King Street/Waimanu Street/Kapi'olani Boulevard	39	1
Nimitz Highway/Queen Street/Kapi'olani Boulevard	22	0
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	25	1
Waikiki Branch	14	1
Total for 20-mile Alignment	54	1

*Includes City-owned, negotiated, or donated parcels

Construction Impacts

Short-term construction impacts would potentially include increased congestion on surface streets, noise, and dust during construction activities. Temporary construction easements may be required for properties adjacent to the proposed alignment. Short-term noise and dust from construction activities would be minimized and monitored through the use of BMPs such as construction scheduling or dust control measures, if necessary. Traffic impacts during construction would be managed through the implementation of Traffic Management Plans.

Alternative 4: Fixed Guideway Alternative

Long-Term Impacts

The relocation or acquisition of commercial and residential uses may have a disruptive influence on a community (Table 6). Impacts to services such as schools, community and social facilities, and public services can have a disruptive affect on communities. In Section I, no residential uses would be acquired. Kapolei Parkway/North-South Road alignment and Saratoga Avenue/North-South Road alignment would have the least acquisitions (two parcels). Geiger would potentially have the greatest disruption with approximately five parcels to be fully or partially acquired. In Section II, Farrington Highway/Kamehameha would potentially impact two parcels within low-income or minority communities. In Section III, the Salt Lake Boulevard alignment would have the least impact, with five parcels fully or partially acquired, but one residential use would be impacted. The Mauka of Airport Viaduct alignment would potentially acquire 15 parcels within low-income or minority communities, with no impact to residential uses. In Section IV, North King Street alignment would have the greatest impact, with a potential impact to 29 parcels where two residential uses occur. In Section V, the Hotel Street/Kawaihahao Street/Kapiolani Boulevard would have the least impact to parcels that occur within low-income or minority communities (ten parcels including one residential). The King Street/Waimanu Street/Kapiolani Boulevard alignment would have the greatest impact, with approximately 39 full or partial acquisitions, including one residential use. Residential-use parcels may include condominium and/or apartment units as well as single-family residences.

Construction Impacts

Short-term construction impacts could potentially include increased congestion on surface streets, noise, and dust during construction activities. Temporary construction easements may be required for properties adjacent to the proposed alignment. Short-term noise and dust from construction activities would be minimized and monitored through the use of BMPs such as construction scheduling or dust control measures, if necessary. Traffic impacts during construction would be managed through implementation of Traffic Management Plans.

Mitigation

Where relocations would occur, compensation would be provided to affected businesses or residents. Compensation for parcel acquisitions, including buildings and structures, would be provided at fair market value and comply with the Federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. These regulations provide for relocation services for businesses and residences and include measures for providing assistance in locating suitable replacement housing and business sites. If residences are displaced, housing relocation assistance would be provided to displaced businesses, persons, and organizations.

Federal laws require that no person be required to move from a residence unless comparable replacement property is available within that person's financial means. In addition, no displaced person, business or organization would be required to move from

any dwelling or business facility without being given a written assurance at least 90 days prior to the earliest date that they could be required to move. Relocation services would be provided to all affected property owners and tenants without discrimination.

Public outreach to affected communities would occur during the project's planning and construction phases. Where identified, multilingual publications would be produced for communities with language barriers. Interpreters would be also be available and provided upon request.

Farmlands

The 'Ewa Plain was once a major agricultural area primarily used to cultivate sugarcane. However, sugarcane has not been cultivated in 'Ewa since 1995. Despite recent rapid urbanization, much of the 'Ewa Plain is still classified and/or zoned for agricultural use by the State of Hawai'i and City and County of Honolulu. In particular, the State of Hawai'i still designates much of 'Ewa that is not urbanized to be "prime" and "unique" farmlands, under the "Agricultural Lands of Importance to the State of Hawai'i" (ALISH) land classification system. The remainder of the project corridor does not contain known agricultural uses or lands designated as "prime" or "unique."

Although currently designated as "prime" or "unique" farmland according to ALISH, some areas in 'Ewa have existing or planned land uses for development. For example, East Kapolei is designated "prime" land and is still actively farmed, but long-term plans for East Kapolei do not include agricultural use. All of East Kapolei is slated (zoned or planned) for development, along with the rest of the 'Ewa/Kapolei region, in accordance with the City's General Plan and the 'Ewa Development Plan. The University of Hawai'i (UH) has already begun planning its UH West O'ahu campus on a site along the west side of North-South Road (see Chapter 1 of the *Alternatives Analysis Report*). Tenant farms in East Kapolei are on short-term leases with the Estate of James Campbell or the Department of Land and Natural Resources (DLNR), with the understanding that these lands are not intended for indefinite agricultural use.

In the more urbanized corridor along Farrington Highway and Kamehameha Highway in Waipahu and Pearl City, some limited areas are still designated as "prime" or "unique." Part of the City's Waipahu Cultural Garden Park, located slightly mauka of Farrington Highway in the heart of Waipahu, is designated "unique" land. Makai of Kamehameha Highway in Pearl City, active cultivation of taro and potentially other crops is occurring on coastal property along Pearl Harbor, directly 'Ewa of the Hawaiian Electric Company (HECO)'s Waiau Power Plant.

Impacts

Alternatives 1 and 2

No direct impacts to farmlands would result from the No Build Alternative (Alternative 1) or the TSM Alternative (Alternative 2).

Alternative 3: Managed Lane Alternative

The Managed Lane Alternative would have no direct footprint impacts on farmlands. Although some “prime” and “unique” agricultural lands lie adjacent to or near H-1, H-2, and Kamehameha Highway through the Waiawa/Pearl City area, the elevated structure would have no appreciable impact on any farmland operations because this alternative stays largely within existing rights-of-way.

Alternative 4: Fixed Guideway Alternative

Three of the four alignments in Section I of the Fixed Guideway Alternative would affect lands in the ‘Ewa area that are currently leased and used by active farms. These areas, which are currently under crop production, may be developed by the time this project would be ready for implementation. Therefore, lands are expected to be lost to agricultural production by 2030 with or without the project. Only the Geiger Road/Fort Weaver Road alignment option would not impact existing agricultural operations. If agricultural activities in the ‘Ewa Plain remain stable, only a very limited amount of farmland would be lost as a result of the project, which would be largely within existing roadway right-of-way.

The Fixed Guideway Alternative would not cause any other direct impacts to farmlands. Other lands in the Kapolei/‘Ewa and Waipahu/Pearl City areas are categorized as “prime” or “unique” lands under ALISH, but these areas are either already developed, plans exist for their development, and/or they would become part of roadway right-of-way under future development plans, such as in the City of Kapolei. Moreover, most of the remainder of the Fixed Guideway Alternative alignments would be within existing roadway right-of-way, such as on Kamehameha Highway through Pearl City.

Visual and Aesthetic Resources

This section concentrates on viewshed impacts, shading, and any impacts to light and glare that the project would create.

Methodology

The study of visual and aesthetic resources included a review of related studies previously conducted within the study corridor, consultation with agencies and special interest groups, and field surveys to verify literature review findings. The City and County of Honolulu Department of Planning and Permitting (DPP) and the Outdoor Circle were also consulted to obtain additional data, refine the focus for the visual analysis, and elicit the most pertinent concerns that stakeholders had regarding safeguarding the aesthetic environment. Comments received during public scoping meetings for this project were reviewed, to gain perspective on the concerns and ideas that communities, organizations, and businesses have regarding the proposed project’s aesthetic impact.

Field surveys were conducted to develop a baseline condition and document existing conditions for view corridors protected by policy. The field and view corridor surveys

helped define the Area of Visual Affect (AVE) and identify representative viewpoints. The surveys also helped identify viewer groups that would be exposed to project changes on a regular basis. Visual impacts are a combination of effects on the AVE and important resources, as well as response of persons viewing the impacts. Viewer response involves viewer sensitivity and viewer exposure.

An assessment of visual impacts was conducted using criteria based on state and federal preservation requirements and simulations for the representative viewpoints. Impacts were evaluated for the short-term, the construction period, and the long-term operational period.

Affected Environment

The island has maintained most of its natural open space and scenic resources through preservation and enhancement policies. These policies generally reflect the community's desire to preserve the island's historic character, design projects that fit the local setting's character, maintain proper scale and balance between the built environment and its surrounding setting, and limit impacts to scenic resources. The following policy documents govern the study area and identify scenic resources:

- O'ahu General Plan (Revised 2002)
- 'Ewa Sustainable Communities Plan (August 1997)
- Central O'ahu Sustainable Communities Plan (December 2002)
- Primary Urban Center Development Plan (Draft June 2004)
- Aiea-Pearl City Livable Communities Plan (May 2004)
- Waipahu Livable Communities Initiative (May 1998)
- Waipahu Town Plan (December 1995)
- Revised Ordinance of Honolulu 1990

'Ewa, which has a generally open and rural agricultural nature, is slowly transitioning to a more urbanized context with new growth and development, supporting the City and County of Honolulu's vision for this area as a second urban center. Similarly, Central O'ahu, previously in extensive agricultural use, is growing into a more suburban area. The Primary Urban Center (PUC) encompasses a wide range of land uses and neighborhoods as it extends from Pearl City at the Ewa end to Waialae and Kahala at the Koko Head end. Pearl Harbor, Honolulu International Airport, Downtown, and Waikiki are located within the PUC. Although densely developed, the PUC still supports several parks, beaches, and streams that offer recreational and open space opportunities for its community members.

Scenic resources within the study area include landmarks, significant views and vistas, and view corridors. Table 7 is a list of the National Historic Landmarks and views located within the study corridor. They are protected by policy and considered to be significant scenic resources based on their scale and prominence within the visual environment.

Table 7. Identified Resources

Class of Resource	Resources
National Historic Landmarks	Pearl Harbor
	Pearl Harbor Naval Base
	Diamond Head
	Puowaina Crater (Punchbowl)
Significant Views and Vistas	Waianae and Koolau Mountains
	Pacific Shoreline
	Downtown Skyline
	Pearl Harbor
	Diamond Head

View Corridors

View corridors were reviewed, and either considered to be unaffected by the proposed project alignments or located within the study area and possibly affected. Photographs were taken to document existing conditions at each view corridor that could be affected.

Viewpoints

The visual quality of 23 representative viewpoints within the study corridor was rated as high, moderate or low depending on how well an image, as seen from the viewpoint, met visual excellence and visual quality criteria as defined by U.S. Department of Transportation (DOT). Visual excellence was measured based on *vividness* (the memorability of the view), *intactness* (freedom from encroaching elements), and *unity* (the cohesiveness of an image) as evaluative criteria. If all three criteria were met, an image was rated high for visual quality. If two criteria were met, the viewpoint was rated as moderate for visual quality. If none or only one of the criteria were met, the viewpoint was rated low for visual quality.

Impacts

Impacts were evaluated based on the following parameters:

- Physical changes to the visual environment;
- Removal, alteration, or obstruction of scenic, cultural, or historic resources;
- Changes in visual quality from existing conditions to modified conditions;
- Viewer response to modified conditions;
- Changes in the light environment, which consists of sources of light, glare, shade, and shadow patterns; and
- Inconsistency with aesthetic goals outlined in policy documents governing the study area.

Construction impacts that would be similar for all build alternatives affecting the visual environment include the following:

- removal of vegetation during clearing and grubbing operations;
- placement of barriers, signage, and screening materials during construction for traffic control;
- safety, privacy, and noise abatement; and
- storage of large equipment and construction materials.

These elements are a component of construction operations and would temporarily affect the existing landscape by changing visual aesthetics within and surrounding the construction site.

Alternative 1: No Build

No construction would occur under the No Build Alternative; so no impacts to visual resources or the existing visual environment would occur. Since no visual impacts would occur, Alternative 1 would be consistent with policies protecting the aesthetic environment.

Alternative 2: Transportation System Management

Alternative 2 consists primarily of operational improvements to the existing bus system, such as bus network and zipper-lane improvements. It would also include some capitol improvements that give priority to buses. These improvements would not permanently affect visual resources. The TSM Alternative also includes construction of new transit centers and bus maintenance facilities. Visual effects would be minor and limited to the area surrounding the new facilities.

Alternative 3: Managed Lane Alternative

Long-Term Impacts

Physical Change to Visual Environment

The Managed Lane Alternative would add an elevated roadway structure into the visual environment between the Waiawa Interchange and Iwilei.

Change in Visual Quality

Changes in visual quality for the Two-Direction and Reversible options were based on the following criteria:

- Potential for impacts to exceptional trees, historic sites, or cultural resources as a result of property acquisition
- Introduction of project elements that would be out of scale or character with the existing visual environment
- Introduction of new sources of light, glare, shade, or shadow patterns
- Viewer response to physical changes, and
- Whether proposed changes or affects on scenic resources would be consistent with policy documents.

Both options have the potential for impacts under all of the above criteria. The Two-Direction Option would result in greater impacts than the Reversible Option because of the proposed structure's increased width. Operational effects for this option would be moderate to high (Table 8). The Reversible Option would result in moderate effects.

Construction Impacts

The Managed Lane Alternative would have a fairly large construction footprint and construction is anticipated to last several years. During that time, the elements and

conditions of construction would cause a change in the existing landscape’s character that would be visible to the public.

Construction of a grade-separated structure would require additional equipment that would be much larger and more visible from a distance. The Managed Lane Alternative would also require additional staging and storage areas. Construction activities could occur 24 hours a day, 7 days a week to minimize overall project costs and shorten the build-out period. Continuous construction operations would require night-time lighting equipment that would introduce new sources of light and glare in rural areas that have limited light sources and in residential areas with low lighting.

Table 8. Summary of Visual Impacts and Benefits

Alternative	Operational Effects
Alternative 1: No Build	
No Build Alternative	None
Alternative 2: Transportation System Management	
TSM Alternative	Low
Alternative 3: Managed Lane (by section)	
3a. Two-Direction Option	
Waiawa IC to Halawa Stream	Moderate
Halawa Stream to Pacific Street	Moderate - High
3b. Reversible Option	
Waiawa IC to Halawa Stream	Moderate
Halawa Stream to Pacific Street	Moderate
Alternative 4: Fixed Guideway (by section)	
I. Kapolei to Fort Weaver Road	
Kamokila Boulevard/Farrington Highway	Moderate - High
Kapolei Parkway/North-South Road	Moderate - High
Saratoga Avenue/North-South Road	Moderate - High
Geiger Road/Fort Weaver Road	Moderate - High
II. Fort Weaver Road to Aloha Stadium	
Farrington Highway/Kamehameha Highway	Moderate - High
III. Aloha Stadium to Middle Street	
Salt Lake Boulevard	Moderate
Mauka of the Airport Viaduct	Low - Moderate
Makai of the Airport Viaduct	Low - Moderate
Aolele Street	Low - Moderate
IV. Middle Street to Iwilei	
North King Street	Moderate - High
Dillingham Boulevard	Low - Moderate
V. Iwilei to UH Manoa	
Beretania Street/South King Street	Moderate - High
Hotel Street/Waimanu Street/Kapi’olani Boulevard	Low - Moderate
Hotel Street/Kawaiaha’o Street/Kapi’olani Boulevard	Low - Moderate
King Street/Waimanu Street/Kapi’olani Boulevard	Low - Moderate
Nimitz Highway/Queen Street/Kapi’olani Boulevard	Low - Moderate
Nimitz Highway/Halekauwila Street/Kapi’olani Boulevard	Low - Moderate
Waikī Branch	Low - Moderate

Alternative 4: Fixed Guideway

Long-Term Impacts

Physical Change to Visual Environment

The Fixed Guideway Alternative would add a mostly elevated fixed guideway into the visual environment between Kapolei and UH Manoa. The structure would be narrower than the roadway structure for the Managed Lane Alternative, but would extend a greater distance.

Change in Visual Quality

All of the alignments proposed under the Fixed Guideway Alternative would have the potential for impacts to exceptional trees, historic and cultural resources, the existing aesthetic environment's character, the existing light environment, viewer groups, and aesthetic policies.

Operational effects for each alignment are shown in Table 8. Operational effects were based on what level of effect (high, moderate, low) an alignment would have on visual quality, what the viewer groups' level of sensitivity, and the level of impact an alignment would have on light, glare, shade, shadow, and aesthetic policies. A percentage scale was used to determine the level of impact (high, moderate, low) for change in light, glare, shade, shadow and policy consistency. This was based on the number of elements introduced (light, glare, shade, shadow) and the number of policy documents with which the alignment would be inconsistent. Introduction of 0 to 1 new light conditions was considered low, 2 new conditions was considered moderate, and 3 to 4 new conditions was considered high. Inconsistency with 0 to 2 policy documents was considered low, 3 to 5 policy documents was moderate, and 6 to 8 policy documents was high.

The elevated guideway structure has the potential to be out of scale or character in settings that are more historic, pedestrian-oriented, and low-profile or open. Among the five sections, Section I would have higher operational effects because of the low-profile, open character of the Ewa-Kapolei area. On the other hand, impacts within Section V would be lower because of the existing density and number of high-rise structures in the Downtown and Waikiki areas.

Construction Impacts

The Fixed Guideway Alternative would have a fairly large construction footprint, with construction anticipated to last several years. During that time, the elements and conditions of construction would cause a change in the character of the existing landscape that would be visible to the public.

Construction of a grade-separated structure would require additional equipment that would be much larger and more visible from a distance. The Fixed Guideway Alternative would also require additional staging and storage areas. Construction activities could occur 24 hours a day, 7 days a week to minimize overall project costs and shorten the build-out period. Continuous construction operations would require night-

time lighting equipment that introduce new sources of light and glare in rural areas that have limited light sources and residential areas with low lighting.

Mitigation

Alternative 1: No Build

No construction would occur under the No Build Alternative, so no impacts to the visual environment would occur. No mitigation would be required.

Alternative 2: Transportation System Management

Construction would be localized to a small area, and the use of context-sensitive design would integrate the transit facilities into the existing environment. Consideration of basic design principles would mitigate impacts to less than substantial.

Alternative 3: Managed Lane

Impacts associated with the Managed Lane Alternative would include:

- Potential removal or relocation of exceptional trees
- Changes in the setting of an historic or cultural site or Section 4(f) resource
- Alteration of mauka-makai views
- Introduction of project components that are out of scale or character with their setting
- Moderate to high viewer response to project changes
- Introduction of new light sources in sensitive areas, and
- Inconsistency with policy documents.

The following design principles should be considered to help minimize, reduce, or mitigate these impacts:

- Integrate landscaping and artwork to improve the project's visual quality.
- Project design should consider a contextual approach, so project elements are functional as well as aesthetically appropriate to their setting.
- Consider alignments that better support the construction of large-scale, elevated components.
- Consult with a multi-disciplinary advisory committee regarding an appropriate design theme.
- Use project components to define spaces and create a "sense of place" that is appropriate in scale and character to its setting.
- Consider design components that help create a human-scale and pedestrian-friendly environment.
- Create opportunities for appropriate and sensitive "showcasing" of project components that are too large-scale to apply minimizing techniques.
- In highly sensitive settings, use design features with materials and shapes that fit the topography and visual setting.
- Look for opportunities to use materials that reflect the Hawai'ian culture and minimize the potential for vandalism.
- Incorporate appropriate consultation, monitoring, preservation, and documentation measures to minimize impacts to Section 4(f), historic, cultural, and vegetative resources.

- Pursue cooperative agreements with adjacent property owners to finance and maintain landscaping, artwork, or other design features that would improve the project’s visual quality.

Alternative 4: Fixed Guideway

Mitigation for impacts related to Alternative 4 would be similar to those discussed for Alternative 3.

Air Quality and Energy

The island of O’ahu is in attainment with all national ambient air quality standards. Air pollutants related to motor vehicles are relevant to the evaluation of project impacts. These pollutants include carbon monoxide (CO), volatile organic compounds (VOC), nitrogen oxides (NO_x), particulate matter (PM₁₀ and PM_{2.5}), and Mobile Source Air Toxics. Emissions of Mobile Source Air Toxics are not calculated, because initial transportation data indicate that the project alternatives would not substantially increase their emission. They would vary among the alternatives, similar to the other air pollutants.

Air pollutant emissions from transportation sources are related to vehicle miles traveled (VMT) and the average network speed for each alternative. Regional air pollutant emissions would be between 0 and 4 percent less (depending on the pollutant of interest) for the TSM and Fixed Guideway Alternatives compared to the No Build Alternative. Pollutant emissions with the Managed Lane Alternative would be between 0 and 4 percent greater compared to the No Build Alternative (Table 9). The total transportation energy demand for roadway and fixed guideway transit vehicles would be lowest for the Fixed Guideway and TSM Alternatives and highest for the Managed Lane Alternative.

Table 9. Daily Air Pollution Emissions and Energy Consumption

Alternative	Air Pollutant Emissions (kg/day) ¹					Energy Consumption (MBTUs) ²
	VOC	CO	NO _x	PM ₁₀	PM _{2.5}	
Alternative 1: No Build						
2030 No Build	8,040	143,000	4,780	424	203	92,310
Alternative 2: Transportation System Management						
2030 TSM	7,980	142,000	4,750	420	201	91,600
Alternative 3: Managed Lane						
2030 Two-Direction Option	8,030	143,500	4,800	424	203	94,860
2030 Reversible Option	8,340	147,000	4,930	438	210	95,360
Alternative 4: Fixed Guideway						
2030 Fixed Guideway – Minimum	7,760	139,000	4,640	410	196	91,200
2030 Fixed Guideway – Maximum	7,800	139,700	4,670	412	197	92,100

¹Kilograms per day

²Million British Thermal Units

Energy is consumed during construction and operation of transportation projects. It is used during construction to manufacture materials, transport materials, and operate construction machinery. Energy used during project operation includes fuel consumed

by vehicles on O‘ahu, electricity used to power transit vehicles, and a negligible amount of energy for signals, lighting, and maintenance. Total transportation energy consumption with the Managed Lane Alternative would be approximately 3 percent greater than with the No Build Alternative. Total transportation energy consumption would be less for the Fixed Guideway Alternative than for the No Build Alternative.

The project’s construction-related air quality effects would be limited to short-term increased fugitive dust and mobile-source emissions. Construction of the Managed Lane Alternative would require between 2,990,000 and 4,160,000 million BTUs of energy. Construction of the Fixed Guideway Alternative would require between 3,700,000 and 4,900,000 million BTUs of energy.

Noise and Vibration

Noise and vibration effects were evaluated using Federal Transit Administration (FTA) noise and vibration impact criteria. The impact criteria include transit-specific criteria that vary depending on the existing sound environment, and an adoption of Federal Highway Administration (FHWA) highway noise criteria for roadway noise sources. The State of Hawai‘i Highway Department of Transportation (HDOT) Noise Analysis and Abatement Policy, which is the local adaptation of the FHWA criteria, was used to evaluate potential noise impacts for the Managed Lane Alternative. The transit-specific criteria were used to evaluate the Fixed Guideway Alternative.

Background, Studies, and Coordination

A general discussion of the science and policy of transportation noise and vibration is provided in the *Honolulu High-Capacity Transit Corridor Project Noise and Vibration Technical Report*. The impact criteria considered are described in this section.

FTA Noise Criteria

The amount that a transit project is allowed to change the overall noise environment is reduced with increasing levels of existing noise. The FTA noise impact criteria group noise-sensitive land uses into the following three categories:

Category 1: Buildings or parks where quiet is an essential element of their purpose.

Category 2: Residences and buildings where people normally sleep. This includes residences, hospitals, and hotels where nighttime sensitivity is assumed to be of utmost importance.

Category 3: Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, churches, office buildings, and other commercial and industrial land use.

L_{dn} is a measure of the average noise level over a 24-hour day. It is used to characterize noise exposure for residential areas (Category 2). The maximum 1-hour L_{eq} is used for other noise-sensitive land uses such as school buildings (Categories 1 and 3). Two levels

of impact are included in the FTA criteria. The interpretations of these two levels of impact are summarized below:

Severe Impact: Severe noise impacts are considered "significant". This term is used in the National Environmental Policy Act (NEPA) and implementing regulations. Noise mitigation will normally be specified for severe impact areas unless there is no practical method of mitigating the noise.

Moderate Impact: In this range, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These other factors can include the predicted increase over existing noise levels, the types and number of noise-sensitive land uses affected, existing outdoor-indoor sound insulation, and the cost effectiveness of mitigating noise to more acceptable levels.

FTA Vibration Criteria

The FTA has developed impact criteria for acceptable levels of vibration. Ground-borne vibration from transit vehicles is characterized in terms of the RMS vibration velocity amplitude. The threshold of vibration perception for most people is around 65 "vibration" decibels (VdB). Levels in the 70 to 75 VdB range are often noticeable but acceptable, and levels over 80 VdB are often considered unacceptable. For urban transit systems with 10 to 20 buses per hour throughout the day, limits for acceptable levels of residential ground-borne vibration are usually between 70 and 75 VdB.

FHWA/HDOT Noise Criteria

HDOT's Noise Analysis and Abatement Policy implements the requirements of the FHWA regulations on noise impacts (23 CFR 772). The policy requires that a noise analysis be performed whenever potentially affected receptors exist in the study area, either as developed lands or lands that are planned, designed, or programmed for future use.

Under HDOT policy, a noise impact occurs when predicted traffic noise levels approach or exceed FHWA's Noise Abatement Criteria (NAC), or when predicted traffic noise levels substantially exceed existing noise levels. FHWA's NAC for residential and other noise-sensitive land uses is 67 A-weighted decibels (dBA) $L_{eq}(h)$. This criterion applies to most land uses considered Category 1 or 2 under the FTA noise impact criteria.

Affected Environment

To establish the existing baseline noise levels, a series of noise measurements were taken at representative locations along the proposed alignment corridor. This section provides details on the existing noise levels used to establish baseline conditions.

Noise measurements were taken at 43 noise-sensitive locations along the study corridor. These locations provide a good representation of all noise-sensitive land uses along the corridor. Thirty long-term (24-hour) noise measurements and 13 short-term (15-minute) measurements were taken at the locations shown in Figure 1 and Figure 2 for Alternative 3 and in Figure 3 through Figure 7 for Alternative 4. The measurement data are

summarized in Table 10 and Table 11. L_{dn} (24-hour) noise measurements are used to assess transit noise in locations where people sleep, and peak-hour L_{eq} noise levels are used to assess roadway noise in all locations and transit noise in locations with daytime use only. To determine the peak noise hour L_{eq} , each short-term measurement was compared to the closest 24-hour data at the same hour of the day. The short-term measured levels in Table 11 were adjusted relative to the 24-hour samples to develop a peak L_{eq} for each of the short-term measurement locations.

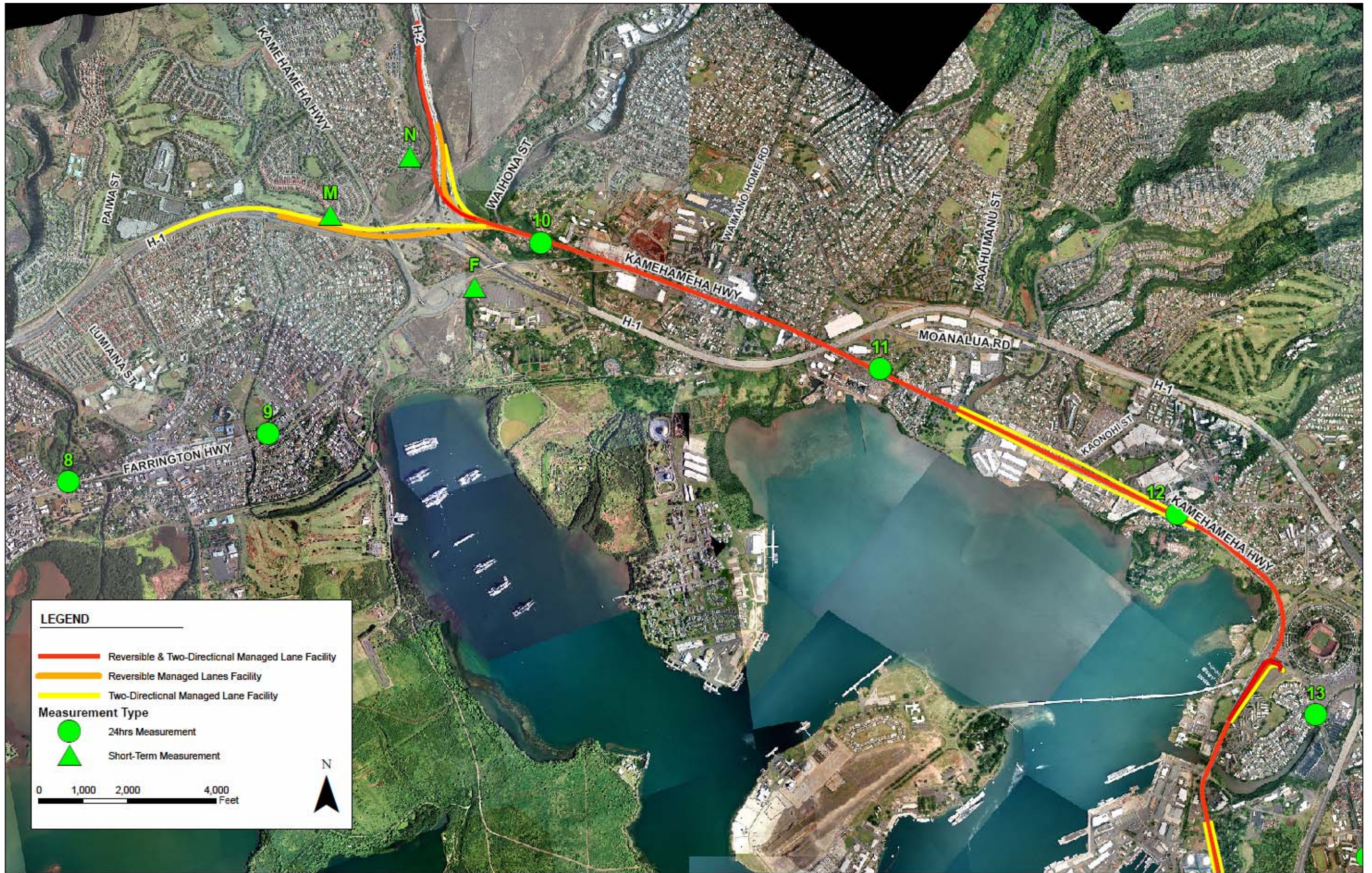


Figure 1: Noise Monitoring and Assessment Locations for the Managed Lane Alternative ('Ewa Section)

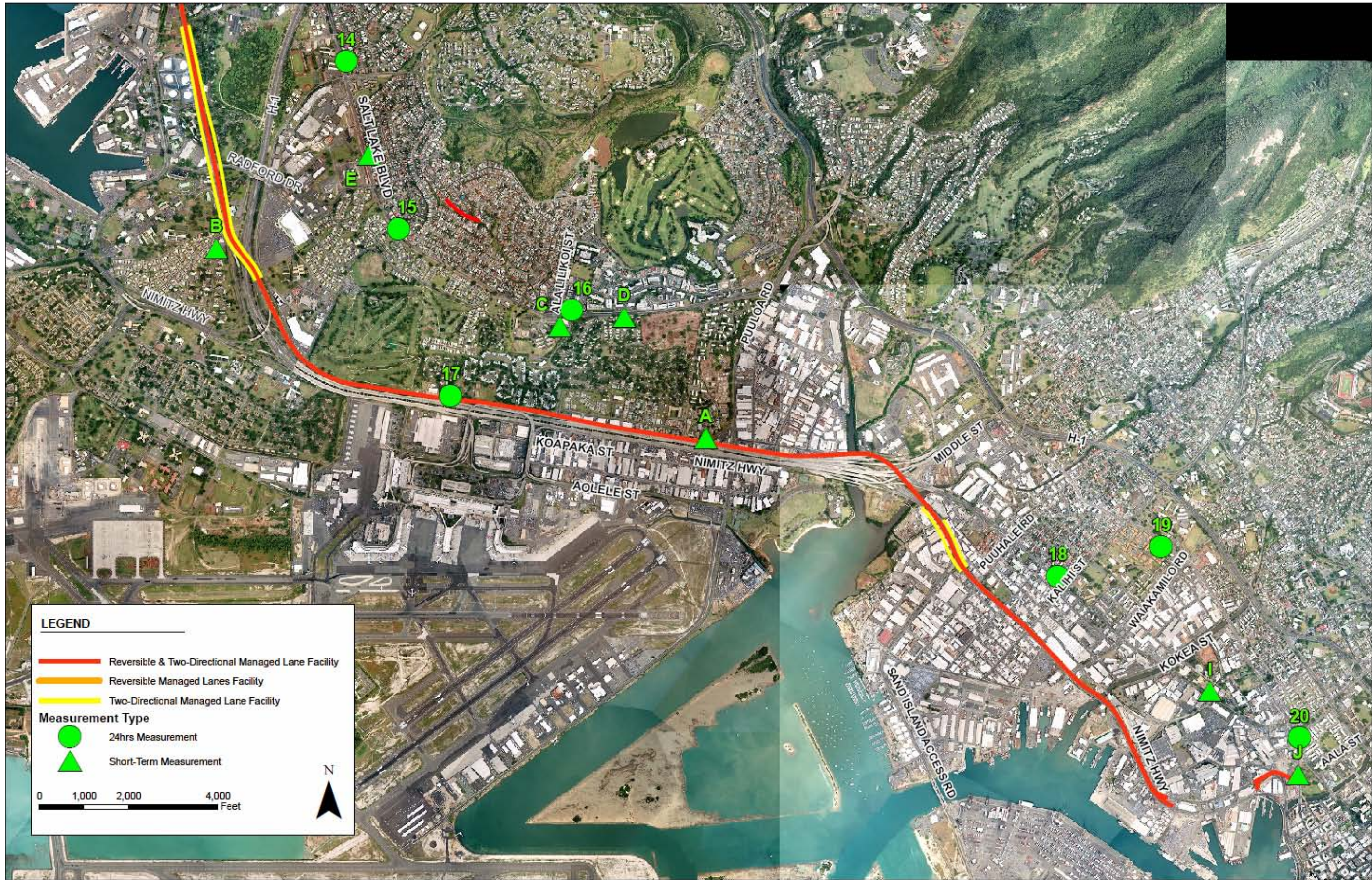


Figure 2: Noise Monitoring and Assessment Locations for the Managed Lane Alternative (Koko Head Section)

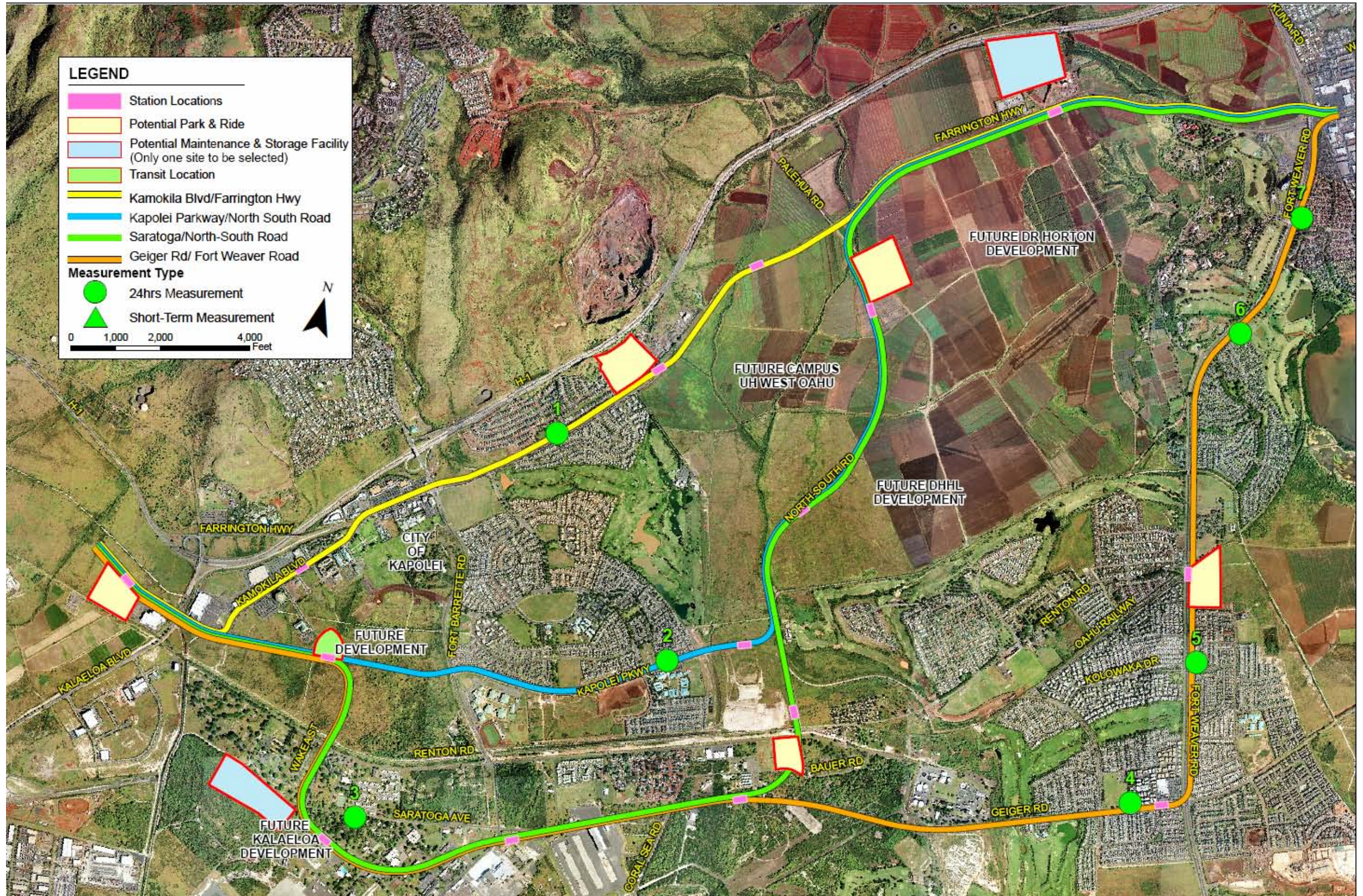


Figure 3. Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section I)

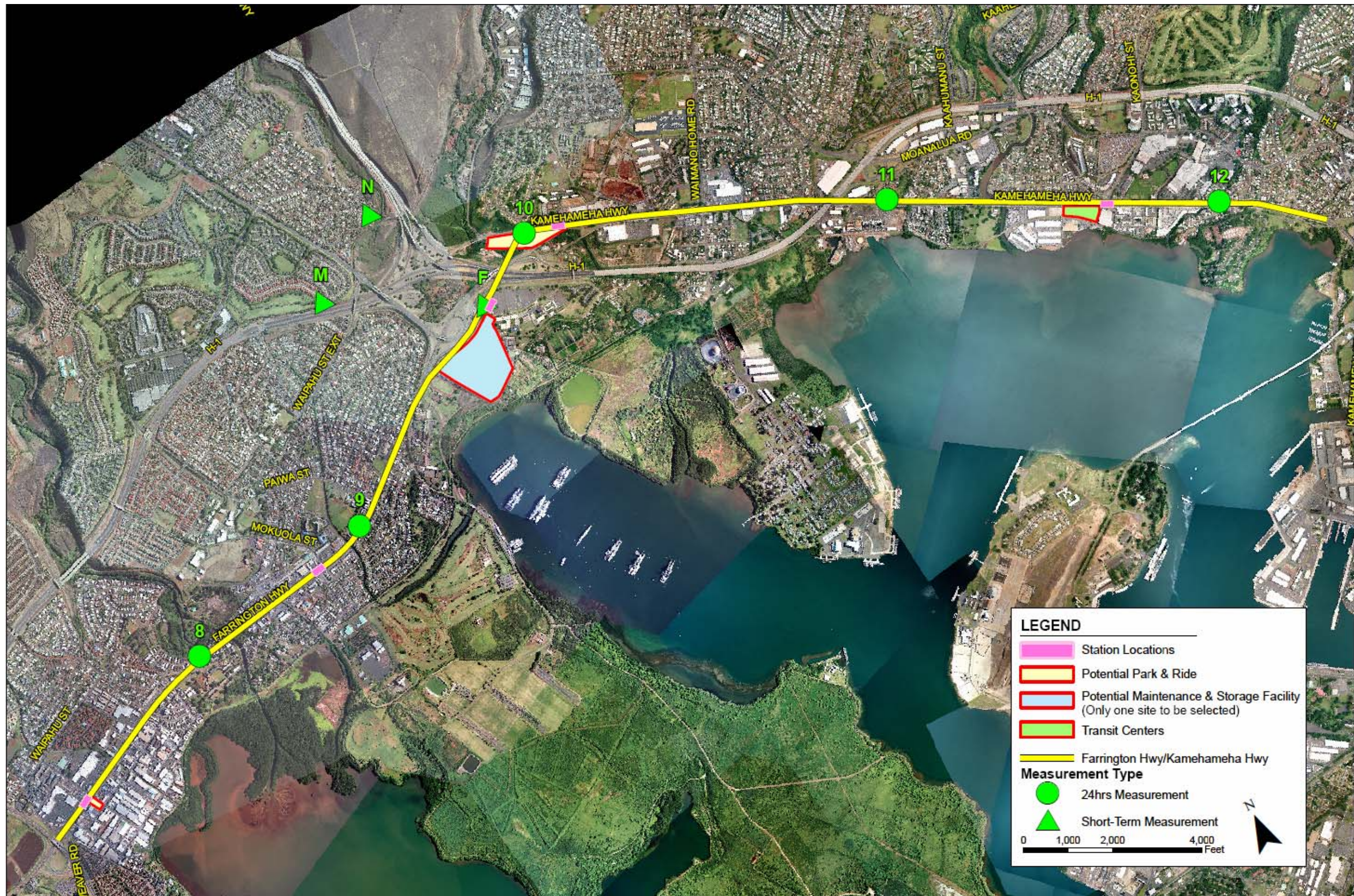


Figure 4: Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section II)

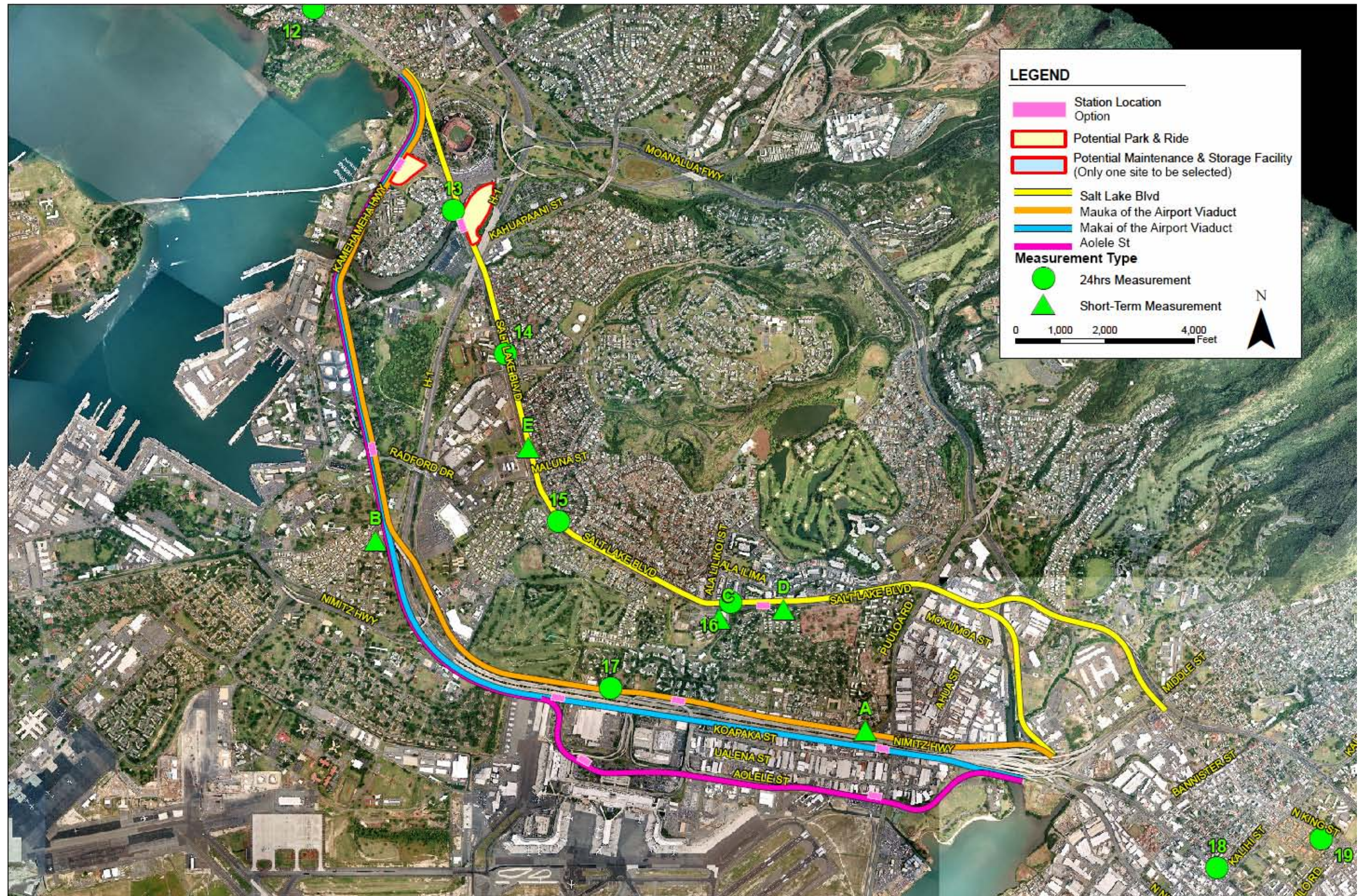


Figure 5: Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section III)

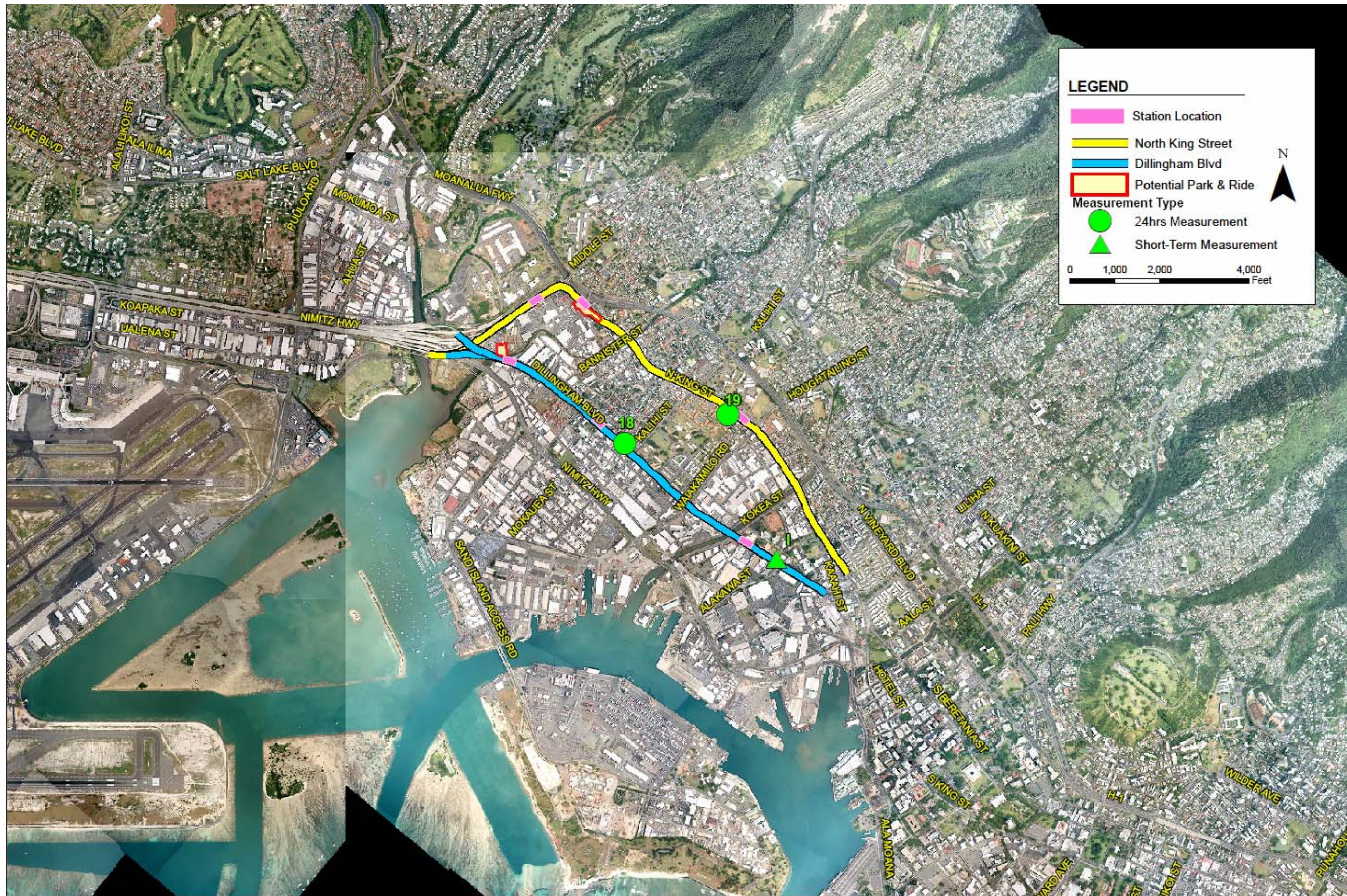


Figure 6: Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section IV)

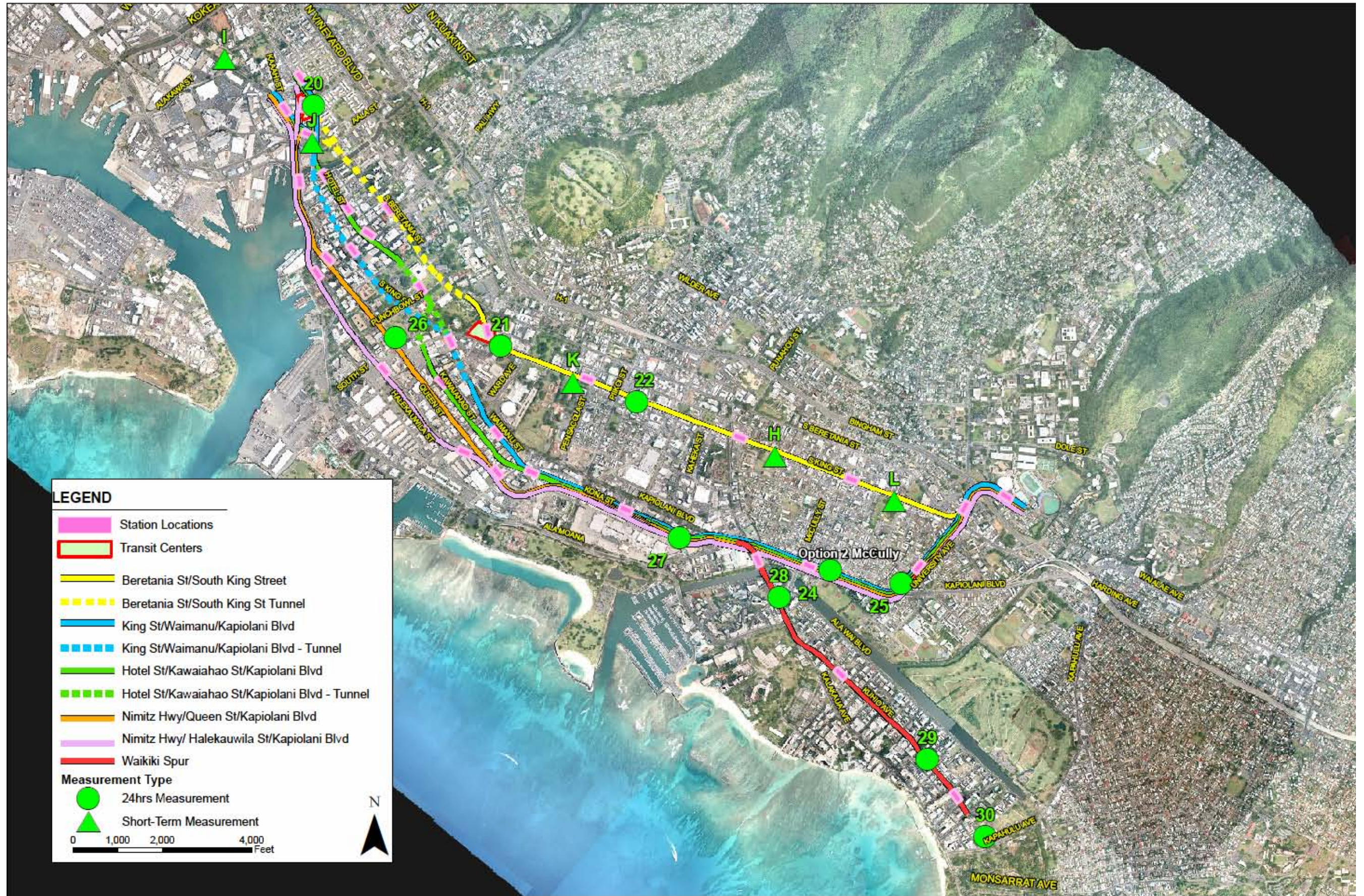


Figure 7: Noise Monitoring and Assessment Locations for the Fixed Guideway Alternative (Section V)

Where the short-term measurements were taken at hotels/motels or residential land uses (Sites A, B, D, E, and J), the 15-minute noise measurement was used to estimate an L_{dn} level by comparison to the nearest 24-hour measurement location at the same hour of the day. Traffic on local streets is the primary cause of existing noise levels. The 24-hour L_{dn} noise levels range from 59 dBA to 77 dBA, and peak one-hour noise levels range from 58 dBA to 72 dBA (Table 10 and Table 11).

Ambient vibration levels were not measured as part of this study. The FTA vibration impact criteria were used to identify locations where potential impacts may occur based on existing land use activities. If needed, these locations would be surveyed for ambient vibration levels at a later time as part of the final engineering design. No buildings with special ground-borne vibration concern were identified.

Impacts

Alternative 1: No Build Alternative

No traffic noise impacts are predicted to result from the No Build Alternative.

Alternative 2: TSM Alternative

No traffic noise impacts are predicted to result from the TSM Alternative.

Alternative 3: Managed Lane Alternative

Long-Term Impacts

Traffic noise levels, including the effects of the Managed Lane Alternative, would exceed the FHWA/HDOT noise abatement criteria at approximately 250 first-row residences along the corridor, as shown in Table 12.

The existing peak-hour L_{eq} at location M of 66 dBA is already above the NAC. Therefore, an increase of 1 dBA would cause traffic noise impacts at the 77 first-row residences (Table 12). Sites 10, 11, and 12 represent 67 sensitive receivers. An increase of 3 dBA would increase the peak-hour noise levels to above 75 dBA at these sites, which would be a severe impact under FHWA/HDOT criteria. The 35 first-row residential units along Kamehameha Highway from Salt Lake Boulevard to the Airport Viaduct are represented by Site B. The existing peak-hour noise level, at 67 dBA, is above the NAC, so a 3 dBA noise increase would cause a noise impact to 35 residential units (Table 12). Since the existing peak-hour L_{eq} at locations 17 and A, 70 and 71 dBA (respectively) are already above the NAC, an increase of 1 dBA would result in traffic noise impacts at 82 first-row residences (Table 12).

Construction Impacts

Noise impacts from project construction would be generated by heavy equipment used during major construction periods as close as 50 feet from existing structures along the alignment. Common vibration-producing equipment used during at-grade construction activities includes jackhammers, pavement breakers, hoe rams, auger drills, bulldozers, and backhoes. Pavement breaking and soil compaction would probably produce the

highest levels of vibration. These noise levels would be bothersome to nearby residents, but would be temporary and would not create long-term adverse effects.

Table 10. Existing 24-Hour Noise Measurements

Noise Measurement Site	Activity or Land Use Category ¹	Measured L _{dn} ² (dBA)	Peak-Hour L _{eq} (dBA)	Noise Source
1 91-1001 Pa'aoloulu Way	2	69	67	Farrington Highway
2 91-1027 C Wa'a'ula Street	2	62	63	Kapolei Parkway
3 Saratoga Avenue at Franklin Street	2	59	60	Saratoga Avenue
4 91-275 Hanapouli Circle	2	70	68	Geiger Road
5 91-1005 Niolo Street	2	67	71	Fort Weaver Road
6 91-1042 Hamoula Street	2	63	66	Fort Weaver Road
7 91-102 Aha Way	2	71	69	Fort Weaver Road
8 94-508 Farrington Highway	2	72	69	Farrington Highway
9 94-979 Kahuamoku Place	2	78	79	Farrington Highway
10 96-165 Kamehameha Highway	2(B)	75	73	Kamehameha Highway
11 98-5 Kuleana Place	2(B)	74	72	Kamehameha Highway
12 98-124B Kihale Street	2(B)	74	72	Kamehameha Highway
13 99-259 Ohialomi Place	2	60	63	Salt Lake Boulevard
14 4335 La'akea Street	2	59	57	Salt Lake Boulevard
15 3760 Salt Lake Boulevard	2	69	69	Salt Lake Boulevard
16 827 Ala Liliko'i Street	2	61	65	Salt Lake Boulevard
17 2200-B Hupua Loop	2(B)	72	70	Kamehameha Highway and H-1 on Viaduct
18 1746 Dillingham Boulevard	2	75	74	Dillingham Boulevard
19 1507 Haka Drive	2	68	70	North King Street
20 404 North King Street	2	77	76	North King Street and Beretania Street
21 818 South King Street	2	70	75	South King Street
22 1239 South King Street	2	71	70	South King Street
24 2148 Kapi'olani Boulevard	2	74	72	Kapi'olani Boulevard
25 630 University Avenue	2	68	67	University Avenue
26 550 Queen Street	2	73	73	Queen Street
27 410 Atkinson Drive	2	72	71	Kona Street
28 1880 Kalākaua Avenue	2	73	73	Kalākaua Avenue
29 2406 Kūhiō Avenue	2	77	76	Kūhiō Avenue
30 2588 Kūhiō Avenue	2	73	72	Kūhiō Avenue

Notes: ¹ Land use or activity category descriptors: B = FHWA land use category B. 1, 2, or 3 = FTA land use category.

² L_{dn} is used for land uses with nighttime sensitivity to noise and for residential areas where FTA rather than FHWA noise procedures are applicable.

Table 11. Existing Short-Term Noise Measurements

Noise Measurement Site	Activity or Land Use Category ¹	Measured L _{eq} ² (dBA)	Estimated L _{dn} ³ (dBA)	Peak-Hour L _{eq} (dBA)	Noise Source
A 1653 Plumpago Court	2(B)	65	73	71	Kamehameha Highway and H-1 Viaduct
B 1086 Fisler Court	2(B)	69	69	67	Kamehameha Highway
C Āliamanu Elementary School	3	60	NA	60	Salt Lake Boulevard
D 760 Moore Street	2	58	59	58	Salt Lake Boulevard
E 4034 Salt Lake Boulevard	2	68	69	68	Salt Lake Boulevard
F Leeward Community College	3	65	NA	65	Farrington Highway Kamehameha Highway
H Washington Middle School	3	66	NA	66	South King Street
I Honolulu Community College	3	72	NA	72	Dillingham Boulevard
J 215 N. King Street	2	72	73	72	North King Street
K McKinley High School	3	61	NA	61	South King Street
L Old Stadium Park	3	64	NA	64	South King Street
M 94-1121 Lelehu Street	B	66	NA	66	H-1
N 94-1033 Lumipolu Street	B	59	NA	60	H-2

Notes: ¹ Land use activity or category descriptors: B = FHWA land use category B. 1, 2, or 3 = FTA land use category.

² Each 15-minute noise measurement is compared to the closest 24-hour measurement site at the same hour of the day. The 15-minute noise levels are then adjusted relative to the 24-hour levels to develop a peak Leq and Ldn for each of the 15-minute measurement locations.

³ L_{dn} is used for land uses with nighttime sensitivity to noise and for residential areas where FTA rather than FHWA noise procedures are applicable.

NA= Not Applicable. These sites do not have sleep activity or would only be affected by the Managed Lane Alternative. Ldn existing noise levels are not applicable at these sites.

Table 12. Summary of Noise Impacts for the Managed Lane Alternative

Location	Representative Noise Site(s)	Noise Impacts
H-1	M	Impacts at 77 receivers
H-2	N	None
H-1 to Waimano Home Road	10	Impacts at 8 receivers
Waimano Home Road to Ka'ahumanu Street	11	Impacts at 27 receivers
Ka'ahumanu Street to Kalauao Bridge	12	Impacts at 32 receivers
Kalauao Bridge to Salt Lake Boulevard	None	None
Salt Lake Boulevard to Radford Drive	B	Impacts at 35 receivers
Radford Drive to Kalihi Street	17, A	Impacts at 82 receivers

Alternative 4: Fixed Guideway Alternative

Long-Term Impacts

The potential noise impacts associated with the Fixed Guideway Alternative are shown by section, alignment, and transit technology in Table 13. These values do not consider

the effects of mitigation that could be used to reduce transit noise levels. The LRT and Rapid Rail technologies would have the largest number of potential noise impacts, with up to 440 moderate and 140 severe noise impacts (Table 13).

Table 13. Summary of Noise Impacts for the Fixed Guideway Alternative

Section and Alignment	Representative Noise Site(s)	Technology		
		LRT and Rapid Rail	Monorail	Maglev
I. Kapolei to Fort Weaver Road				
Kamokila Boulevard/ Farrington Highway	1	Moderate impact at 77 receivers	No Impact	No Impact
Kapolei Parkway/ North-South Road	2	Severe impact at 78 receivers	Moderate impact at 78 receivers	No Impact
Saratoga Avenue/ North-South Road	3	Moderate impact at 20 receivers	Moderate impact at 20 receivers	No Impact
Geiger Road/Fort Weaver Road	4, 5, 6, 7	Moderate impact at 138 receivers	No Impact	No Impact
II. Fort Weaver Road to Aloha Stadium				
Farrington Highway/ Kamehameha Highway	8, 9 ,F, 10, 11, 12	Moderate impact at 153 receivers	No Impact	No Impact
III. Aloha Stadium to Middle Street				
Salt Lake Boulevard	13, 14, E, 15, C, 16, D	Severe impact at 55 receivers and moderate impact at 207 receivers	Moderate impact at 262 receivers	No Impact
Mauka of the Airport Viaduct	B, 17, A	No Impact	No Impact	No Impact
Makai of the Airport Viaduct	B, 17, A	No Impact	No Impact	No Impact
Aolele Street	None	No Impact	No Impact	No Impact
IV. Middle Street to Iwilei				
North King Street	19, 20, J	Moderate impact at 52 (45*) receivers	Moderate impact at 7 receivers	No Impact
Dillingham Boulevard	18, I, 20, J	Moderate impact at 17 receivers	No Impact	No Impact
V. Iwilei to UH Mānoa				
Beretania Street/ South King Street	21,K,22,H,L	Moderate impact at 10 receivers	No Impact	No Impact
Hotel Street/Kawaiaha'o Street/ Kapi'olani Boulevard	27,24,25	No Impact	No Impact	No Impact
King Street/Waimanu Street/Kapi'olani Boulevard	27,24,25	No Impact	No Impact	No Impact
Nimitz Highway/Queen Street/ Kapi'olani Boulevard	26,27,24,25	Moderate impact at 3 receivers	No Impact	No Impact
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	27,24,25	No Impact	No Impact	No Impact
Waikīkī Branch	28,29	Moderate impact at 23 receivers	No Impact	No Impact

*Noise impacts for the North King Street Alignment would be reduced to 45 receivers if connecting to Nimitz Highway.

The greatest number of noise impacts would occur on the Salt Lake Boulevard Alignment. The alignments ranked highest to lowest by noise impacts for the LRT and Rapid Rail technologies follow (alignments not listed would not cause noise impacts):

- Salt Lake Boulevard – 55 severe noise impacts, 207 moderate noise impacts
- Kapolei Parkway/North South Road – 78 severe noise impacts
- Farrington Highway/Kamehameha Highway – 153 moderate noise impacts
- Geiger Road/Fort Weaver Road – 138 moderate noise impacts
- Kamokila Boulevard/Farrington Highway – 77 moderate noise impacts
- North King Street – 52 moderate noise impacts (45 if connecting to Nimitz Highway in Section V)
- Waikīkī Branch – 23 moderate noise impacts
- Saratoga Avenue/North South Road – 20 moderate noise impacts
- Dillingham Boulevard – 17 moderate noise impacts
- Beretania Street/South King Street – 10 moderate noise impacts
- Nimitz Highway/Queen Street/Kapi‘olani Boulevard – 3 moderate noise impacts

Monorail technology would cause up to 333 moderate noise impacts. The alignments ranked highest to lowest by noise impacts for the monorail technology are listed below. Alignments not listed would not cause any noise impacts.

- Salt Lake Boulevard – 262 moderate noise impacts
- Kapolei Parkway/North South Road – 78 moderate noise impacts
- Saratoga Avenue/North South Road – 20 moderate noise impacts
- North King Street to Beretania Street/South King Street tunnel – 7 moderate noise impacts

Maglev technology would cause no noise impacts.

Ground vibration levels from the LRT and Rapid Rail cars would be the highest among the technologies. The highest vibration level for the LRT and Rapid Rail of 62 VdB would occur at Site 20. This level would not exceed the FTA criteria of 72 VdB for residential buildings and other structures where people normally sleep (Category 2). Because no land use along the alignment has vibration-sensitive equipment that would be subject to lower vibration impact criteria, no vibration impacts are projected.

Construction Impacts

Noise impacts from project construction would be generated by heavy equipment used during major construction periods as close as 50 feet from existing structures along the alignment. Common vibration-producing equipment used during at-grade construction activities includes jackhammers, pavement breakers, hoe rams, auger drills, bulldozers, and backhoes. Pavement breaking and soil compaction would probably produce the highest levels of vibration. These noise levels would be bothersome to nearby residents, but would be temporary and would not create long-term adverse effects.

Mitigation

Alternative 3: Managed Lane Alternative

Mitigation of Long-Term Impacts

Noise barriers at the right-of way or at the top of the slope of H-1 'Ewa of the Waiawa Interchange could reduce noise levels by at least 5 dBA and eliminate traffic noise impacts in this area.

Noise barriers would not be feasible to provide noise abatement for receivers along Kamehameha Highway for two reasons. First, noise barriers placed on the elevated managed lane structure would only reduce traffic noise by 1 to 3 dBA (a 5 dBA noise reduction is needed for a noise barrier to be feasible). Second, the managed lane structure's height would make ground-level walls ineffective, because they would not break the line of sight. The Managed Lane Alternative would add 3 dBA to the current noise level. Noise barriers at ground level would need to provide at least 8 dBA noise reduction from the noise level of the at-grade section of Kamehameha Highway.

Other forms of noise mitigation along Kamehameha Highway would need to be analyzed during the preliminary engineering and environmental review phase if this alternative is selected as the preferred alternative.

Noise barriers placed on the edges of the elevated viaduct along Nimitz Highway Koko Head-bound between Radford Drive and Kalihi Street could reduce noise levels at Sites 17 and A by at least 5 dBA. However, traffic under the viaduct is the major noise source in the area, so overall noise levels would only be reduced by 1 to 2 dBA. To be effective, noise barriers must block the direct view of the noise source and must be solid with minimal openings. A ground-level noise barrier would not block the line of sight to or from the elevated section of the viaduct, and the length of noise barrier needed to provide at least a 5-dBA noise reduction would cause the barriers to block local cross-street traffic.

Mitigation of Construction Impacts

Noise control measures would be required during construction to minimize impacts on existing noise-sensitive land uses. All construction activities must comply with State of Hawai'i Department of Health noise regulations.

Alternative 4: Fixed Guideway Alternative

Mitigation of Long-Term Impacts

Placement of a solid 3- to 5-foot barrier on the guideway structure at locations with noise impacts could reduce noise levels by at least 5 dBA. The placement of the barriers as noise mitigation would eliminate all moderate noise impacts from the LRT and Rapid Rail technologies and reduce severe noise impacts. This would moderate impacts for the Salt Lake Boulevard and Kapolei Parkway alignments.

Noise barriers for monorail technology are not feasible, but monorail vehicles with skirts that wrap around the guideway beam would be quieter than the modeled levels. Further study would be conducted if this technology is selected.

Because no noise impacts are predicted for the maglev technology, no noise mitigation is proposed.

Mitigation of Construction Impacts

Noise control measures would be required during construction to minimize impacts on existing noise-sensitive land uses. All construction activities must comply with the State of Hawai‘i Department of Health noise regulations.

Water Resources

Several federal and state agencies are authorized to regulate inland surface waters, tidal waters and wetlands (collectively, “waters of the United States”). This authority derives primarily through the Clean Water Act, the Rivers and Harbors Act, and associated state rules for water quality standards.

Affected Environment

Many streams, including navigable waters, are located within the study corridor. Most of these stream channels have been altered in the lower reaches and are not of high ecological quality. The overall water quality in these urban streams is poor and many are included on the 303(d) List of Impaired Waters by the Hawai‘i Department of Health (HDOH). Many streams in the state are not listed because data collection is ongoing. Tributaries to water bodies that appear on the 303(d) list may also be considered impaired for regulatory purposes and permits.

Wetland complexes within the study area from Kapolei to Waikīkī are associated with riverine, tidal, and spring systems in three areas: Pearl Harbor, Salt Lake, and Waikīkī. Over time, land development has altered or destroyed most of these wetlands, leaving only a few remnants. All streams within low-lying areas, and especially at road crossings, have been altered through channelization, lining, dredging, or other alteration (Hawai‘i Cooperative Park Service Unit, 1990).

The following large coastal (marine) surface water bodies are located within or adjacent to the transit corridor:

- Pearl Harbor
- Ke‘ehi Lagoon
- Honolulu Harbor
- Kewalo Basin
- Ala Wai Canal and Boat Harbor

These five water bodies are all highly urbanized and/or altered from their natural state. They are all listed by HDOH as “Water Quality-Limited Segments.”

Within the proposed project corridor, coral reefs and eroded volcanic material have formed a wedge of sedimentary rock and sediments referred to as *caprock*, which rests on the underlying volcanic rock. Caprock is composed predominantly of coral-algal limestone, interlaid with terrigenous clay and mud. Volcanic ash from the Honolulu volcanic series is often found in caprock. The caprock ranges between approximately zero and 1,000 feet thick in the project corridor (Wentworth, 1951).

The Southern O‘ahu Basal Aquifer (SOBA) occurs as a basal freshwater lens floating on saline groundwater. It is recharged by rainfall that falls on the Leeward Coast and the mauka area of Honolulu. The caprock overlies the SOBA and impedes the escape of groundwater from this basaltic aquifer. Water in the caprock is brackish and not potable. The caprock is less permeable than water-bearing lava flows near the Ko‘olau Range and constitutes a barrier that retards the seaward flow of groundwater.

Impacts

The Managed Lane and Fixed Guideway Alternatives would have similar impacts on water resources. Both would include construction of an elevated structure. The Managed Lane viaduct would not be as long as the structure proposed for the Fixed Guideway, so impacts would be less widespread. To simplify the comparison of the alternatives including the various alignments for the Fixed Guideway Alternative, Table 14 lists the types of stream and river crossings for each alignment. The Managed Lane Alternative would cross 20 water resources. The Fixed Guideway Alternative would cross between 30 and 37 water resources. At each crossing, there would be a need for a Coast Guard permit if the water body is considered navigable. If building the bridge would require dredging or soil or other fill material in the river/stream or associated wetland, an Army Corps of Engineers permit would be required in addition to permits from other state agencies. If the water body has been listed as impaired by HDOH, additional permits may be required.

The viaduct structure for both the Managed Lane and Fixed Guideway Alternatives would be supported on piers or columns drilled or driven into the subsurface. Because the underlying aquifer is a prime source of drinking water for O‘ahu (referred to as a *Sole Source Aquifer*), construction that could pollute the aquifer (i.e., when piers penetrate into the caprock) will be evaluated in a Groundwater Impact Assessment as required by Section 1424(e) of the Clean Water Act.

Building the elevated structure would also likely require dewatering in order to pour concrete. Although disposal of the water can be permitted through the Clean Water Act, some water may be contaminated with petroleum and other hazardous chemicals. Treatment of the contaminated water would need to occur before its discharge into nearby storm sewers, streams, or marine waters. Similarly, soil removed to build the piers may be contaminated. When exposed to rain, contaminated soil may run off into surface water bodies.

Dewatering can also cause subsidence as water is removed from the ground and soils compact in the area requiring dewatering. Walls, buildings, roads, and other

infrastructure may be damaged. Subsidence, water disposal, and drinking water protection are all issues common to the Managed Lane and Fixed Guideway Alternatives for construction of the required viaducts. These issues would also be of high importance in evaluating the impacts of the tunnels proposed as part of the Fixed Guideway Alternative.

Table 14. Water Resources Affected by the Project Alternatives

Alternative	Crossings of Navigable Water	Crossings of Riverine Wetlands	Crossings of Impaired Water Bodies
Alternative 1: No Build			
No Build Alternative	0	0	0
Alternative 2: Transportation System Management			
TSM Alternative	0	0	0
Alternative 3: Managed Lane			
Managed Lane Alternative	6	8	6
Alternative 4: Fixed Guideway (by section)			
I. Kapolei to Fort Weaver Road			
Kamokila Boulevard/Farrington Highway	0	1	0
Kapolei Parkway/North-South Road	0	0	0
Saratoga Avenue/North-South Road	0	0	0
Geiger Road/Fort Weaver Road	0	1	0
II. Fort Weaver Road to Aloha Stadium			
Farrington Highway/ Kamehameha Highway	1	10	4
III. Aloha Stadium to Middle Street			
Salt Lake Boulevard	2	2	3
Mauka/Makai of the Airport Viaduct	2	2	2
Aolele Street	2	2	2
IV. Middle Street to Iwilei			
North King Street	1	3	2
Dillingham Boulevard	2	2	2
V. Iwilei to UH Mānoa			
Beretania Street/South King Street	1	1	1
Hotel Street/Kawaiaha'o Street/ Kapi'olani Boulevard	1	1	3
King Street/Waimanu Street/ Kapi'olani Boulevard	1	1	3
Nimitz Highway/Queen Street/ Kapi'olani Boulevard	1	1	3
Nimitz Highway/Halekauwila Street/ Kapi'olani Boulevard	1	1	3
Waikīkī Branch	1	1	1

When the new transit system is operational, stormwater runoff would increase as a result of the additional pavement associated with the transit system. The Fixed Guideway Alternative would include a longer structure than the other alternatives, and additional transit stations and parking lots. As a result, it would cause a greater increase in

stormwater runoff. Impacts to water quality would be greater under the Managed Lane Alternative because the number of vehicle miles traveled on O‘ahu would be greater than with the other alternatives.

Mitigation

Sedimentation and turbidity caused by sediment suspended in stormwater runoff would be mitigated by a site-specific Best Management Practices (BMP) Plan. Current design standards would be followed in handling stormwater runoff from structures and parking lots after operation of the transit system begins.

Natural Resources

Impacts to natural resources, including vegetation, wildlife, threatened and endangered species, and wetlands are discussed in this section.

Affected Environment

Except for portions of the ‘Ewa Plain, the study area consists of heavily urbanized environments. Birds are the most prominent wildlife in the project area, so the primary focus of field investigations was to document the species of birds and their population at count stations along the alignments being considered for the Managed Lane and Fixed Guideway alternatives.

Coordination with governmental agencies and a literature review indicated that no designated critical habitats are located within the proposed project area. Several protected species were reported as being present or potentially present in or near the proposed project area.

Impacts

Alternative 1: No Build Alternative

The No Build Alternative includes no new construction related to this project, but other projects defined in the 2030 ORTP would proceed as planned. Although the No Build Alternative would have no impacts on the project area, by 2030 the project corridor would be more urbanized than it is currently, especially in the ‘Ewa and Kapolei areas. This would reduce the amount of farming, open space, and habitat for wildlife and plants.

Alternative 2: TSM Alternative

No major construction projects would be undertaken under the TSM Alternative. Because of the limited nature of actions proposed under this alternative, no major impacts on natural resources would be expected in the long or short term. Similar to the No Build Alternative, the project corridor would become more urbanized than it is currently, especially in the ‘Ewa and Kapolei areas, reducing the amount of farming, open space, and habitat for wildlife and plants.

Alternative 3: Managed Lane Alternative

From a natural resources perspective, the primary difference between the two options of the Managed Lane Alternative is that the Two-Direction Option would require an approximately 50-foot-wide structure and the Reversible Lanes Option would require an approximately 40-foot-wide structure. In both cases, the bottom of the structure would average between 17 and 30 feet above ground level. Under both alternatives, an approximately 13-mile-long elevated structure would be constructed, extending from Waipahu to Downtown Honolulu, primarily above the median of existing roadways in heavily developed areas.

Impacts on natural resources caused by the Managed Lane Alternative would be minor and primarily affect vegetation, particularly street trees (Table 15). No direct impacts on natural resources, farmlands, or wildlife are anticipated. A possible indirect impact on farmland, street trees, and vegetation is the shade that would be produced by the managed-lane structure. Shadow impacts could occur at the Waiiau Stream taro patch and the Sumida Watercress Farm on Kamehameha Highway. Possible direct impacts on street trees would likely include:

- Removal of the five notable monkeypod trees at the intersection of Nimitz Highway and Sand Island Access Road
- Removal, transplanting, or trimming of some trees on the Aloha Stadium property and inside the Pu‘uwai Momi Apartments (low-income housing) property
- Transplanting fan palms and shower trees on Kamehameha Highway in the vicinity of the Arizona Memorial
- Effects on all 83 trees on the mauka side of Nimitz Highway between Kamehameha Highway and Middle Street
- Effects on some scrambled egg trees, coconut and Manila palms, shower trees, and kou trees in the median of Nimitz Highway east of Middle Street.

Impacts on street trees could result in secondary impacts on wildlife. Street trees with large canopies provide ideal roosting and nesting sites for white terns, a state threatened species. Although no white terns were observed along the Alternative 3 alignment during this study, the habitat is available and could be used in the future.

Alternative 4: Fixed Guideway Alternative

Because of its length and associated Park-and-Ride lots, maintenance facilities, and transit centers, the Fixed Guideway Alternative would result in a greater impact on natural resources than the other three alternatives. However, similar to the other alternatives, the Fixed Guideway Alternative is not expected to impact natural hazards.

The Fixed Guideway Alternative would impact farmlands and wildlife in the ‘Ewa area, but all areas currently under cultivation or occupied by kiawe woodlands in the ‘Ewa Plain may be developed in the near future whether or not this project proceeds. Also, as discussed previously for the Managed Lane Alternative, shadow impacts could occur at the Waiiau Stream taro patch and the Sumida Watercress Farm.

Table 15. Natural Resources Affected by the Project Alternatives

Alternative	Geology and Natural Hazards	Wildlife	Botanical Resources Including Street Trees
Alternative 1: No Build			
No Build Alternative	None	Habitat for introduced birds would be lost to urbanization independent of the project	Loss of some vegetated open spaces to urbanization independent of the project
Alternative 2: Transportation System Management			
TSM Alternative	None	Same as No Build	Same as No Build
Alternative 3: Managed Lane			
3a. Two-Direction Option			
Waiawa IC to Hālawā Stream	None	No impact on common introduced birds; no sensitive species present	May impact Waiawa Stream vegetation; possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments. On Kamehameha Highway near Arizona Memorial, transplant fan palms and shower trees; transplant 10 queen palms on Nimitz Highway; remove five notable monkeypods on Nimitz Highway at Sand Island Access Road
Hālawā Stream to Pacific Street	None	White tern	
3b. Reversible Option			
Waiawa IC to Hālawā Stream	None	Same as Alternative 3a	Same as Alternative 3a
Hālawā Stream to Pacific Street	None	Same as Alternative 3a	
Alternative 4: Fixed Guideway (by section)			
Section I. Kapolei to Fort Weaver Road			
Kamokila Boulevard/ Farrington Highway	None	Same as No Build	Disturbance and loss of native and weedy species; Indian coral trees on Kapolei Parkway; transplant 76 kamani trees
Kapolei Parkway/ North-South Road	None	Same as No Build	Loss of weedy plant species; incidental take license needed for possible disturbance to <i>Abutilon menziesii</i> population; Indian coral trees on Kapolei Parkway; transplant 7 monkeypod trees
Saratoga Avenue/ North-South Road	None	Same as No Build	Loss of weedy and possible native species; incidental take license needed for possible disturbance to <i>Abutilon menziesii</i> population; other impacts undetermined; additional fieldwork necessary; possible impacts on canopy trees
Geiger Road/ Fort Weaver Road	None	Same as No Build	Loss and disturbance of weedy and possible native species; transplant all street trees in Fort Weaver Road median; remove one notable monkeypod; impacts undetermined in Kalaeloa; additional fieldwork necessary

Alternative	Geology and Natural Hazards	Wildlife	Botanical Resources Including Street Trees
Section II. Fort Weaver Road to Aloha Stadium			
Farrington Highway/ Kamehameha Highway	None	No effect on common introduced species; no sensitive species present	Transplant all median landscaping on Farrington Highway in Waipahu
Section III. Aloha Stadium to Middle Street			
Salt Lake Boulevard	None	Same as Section II	Possible impact on trees at Aloha Stadium; remove a few Indian coral trees on Salt Lake Boulevard; pruning or other impact on two monkeypods on Kikowaena Street
Makai of the Airport Viaduct	None	Same as Section II	Possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments; on Kamehameha Highway near Arizona Memorial transplant fan palms and shower trees; pruning of shower trees on Nimitz Highway
Mauka of the Airport Viaduct	None	Same as Section II	Possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments; on Kamehameha Highway near Arizona Memorial transplant fan palms and shower trees; transplant 10 queen palms on Nimitz Highway
Aolele Street	None	Same as Section II	Possible impact on trees at Aloha Stadium and Pu'uwai Momi Apartments; transplant various trees on Aolele Street; possible impact on damaged Indian coral trees in Ke'ehi Lagoon Park
Section IV. Middle Street to Iwilei			
North King Street	None	Same as Section II	Transplant fiddlewoods on mauka side of North King Street; possibly transplant fiddlewoods on Middle Street
Dillingham Boulevard	None	Same as Section II	Several notable trees affected by widening Dillingham Boulevard – one monkeypod and 26 kamani trees; additional kamani tree impacts at Honolulu Community College transit stop; possibly transplant fiddlewoods on Middle Street

Alternative	Geology and Natural Hazards	Wildlife	Botanical Resources Including Street Trees
Section V. Iwilei to UH Mānoa			
Hotel Street/ Kawaiaha'o Street/ Kapi'olani Boulevard	None	Alteration or removal of mature trees may impact roosting/nesting of white terns	Transplant minor fiddlewoods on Hotel Street; removal of notable monkeypods on Kona Street possible; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue
King Street/Waimanu Street/ Kapi'olani Boulevard	None	Same as above	Possible impact on notable monkeypod at Waimanu Street and Ward Avenue; removal of notable monkeypods on Kona Street possible; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue
Nimitz Highway/ Queen Street/ Kapi'olani Boulevard	None	Same as above	Right-of-way needed may affect notable monkeypod on Queen Street; removal of notable monkeypods on Kona Street possible; removal of some notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue
Nimitz Highway/ Halekauwila Street/ Kapi'olani Boulevard	None	Same as above	Remove/replace four notable monkeypods on makai side of Halekauwila Street; removal of notable monkeypods on Kona Street possible; removal of notable monkeypods on Kapi'olani Boulevard between Kalākaua Avenue and McCully Street; transplant 27 new shower tree plantings on University Avenue
Beretania Street/ South King Street	None	Same as above	Impacts depend on method of tunnel construction; tree impacts may occur at transit stations; pruning of shower, earpod, and banyan trees likely on King Street, but tree removal possible at transit stations
Waikīkī Branch	None	Same as above	Tree protection zones needed for exceptional mahogany trees on Kalākaua Avenue; pruning or removal/ replacement of several new plantings along Kūhiō Avenue

The Fixed Guideway Alternative would have limited impact on vegetation in open areas of the 'Ewa Plain. Most of the area has been heavily disturbed by farming in the past, but a few native species are present, including 'ilima, Uhaloa, Kooloaula (*Abutilon menziesii*), and Kauna'oa pehu. *Abutilon menziesii* is an endangered species and known to be present at the southern end of North-South Road. A Habitat Conservation Plan for *A. menziesii* at Kapolei already exists.

Street trees would also be affected by the Fixed Guideway Alternative. Because this alternative would extend farther into the city of Honolulu, it would have more impacts on street trees than the Managed Lane Alternative. Street tree impacts would depend largely on the alignment selected.

Possible impacts on natural resources are discussed in the following sections, arranged according to the section of the project where they would occur.

Section I. Kapolei to Fort Weaver Road

The four alignments are similar in their potential impacts on natural resources, with the exception of the following alignment-specific impacts:

- The Kamokila Boulevard/Farrington Highway alignment would not impact the *A. menziesii* population but would impact some of the 294 street trees on Kamokila Boulevard.
- The Kapolei Parkway/North-South Road and the Saratoga Avenue/North-South Road alignments could impact the *A. menziesii* population.
- The Geiger Road/Fort Weaver Road alignment would not impact the *A. menziesii* population and is the only alignment that would not impact any active farmlands. However, some of the 286 street trees on Fort Weaver Road would be impacted, including the one notable banyan tree in the median near Old Fort Weaver Road.

Section II. Fort Weaver Road to Aloha Stadium

Possible impacts along the one alignment in this section include shading of farms, as discussed for the Managed Lane Alternative. Some impacts on street trees along the alignment would also likely occur. Many new plantings in the median of Farrington Highway in Waipahu would likely be affected, but few street trees exist along Kamehameha Highway and none are located in the median.

Section III. Aloha Stadium to Middle Street

The four alignments are similar in their potential impacts on natural resources, with the exception of the following alignment-specific impacts:

- The Salt Lake Boulevard alignment would result in the fewest number of impacts on street trees.
- The alignment makai of the airport viaduct could impact some street trees, but fewer trees than the mauka alignment. A few street trees along the makai alignment are potential nesting and roosting sites for white terns.

- The alignment mauka of the airport viaduct would impact more street trees than the makai alignment. A few street trees along this alignment are potential nesting and roosting sites for white terns.
- The Aolele Street alignment contains more street trees, but few are located in the median and some are Indian coral trees, which are already in poor condition as a result of gall wasp infestation. Some street trees along this alignment are potential nesting and roosting sites for white terns.

Section IV. Middle Street to Iwilei

The two alignments in this section would have similar potential impacts on natural resources. The North King Street alignment has more street trees, but only two are considered notable. The Dillingham Boulevard alignment has fewer trees, but most are considered notable. No street trees along either alignment are located in the median, but shoulder trees would be affected by road widening.

Section V. Iwilei to UH Mānoa

The five alignment options and the Waikīkī branch in this section of the Fixed Guideway Alternative would have similar impacts. All alignments would impact some street trees, and some street trees along all of the alignments are potential white tern roosting and nesting habitat. Specifics for each alignment are discussed below.

- The four alignments that include Kona Street (Ala Moana Center) would all have similar impacts. Ten notable monkeypod trees in the median of Kona Street, seven notable monkeypod trees in the median along Kapi‘olani Boulevard, and several relatively new shower trees in the median of University Avenue would be affected. Some large trees planted on the shoulder along each alignment would also be affected, but probably to a lesser degree than trees planted in the medians.
- The Beretania Street/South King Street alignment contains more total trees and more notable trees than the other four alignments, but none are located in the median so impacts could be less.
- The Waikīkī Branch alignment contains more street trees than the other alignments in Section V, including 10 exceptional mahogany trees in the median of Kalākaua Avenue and many relatively new plantings in the median of Kūhiō Avenue.

Mitigation

No mitigation would be necessary for Alternatives 1 and 2. The following sections summarize general mitigation measures related to impacts that could result from Alternatives 3 and 4.

Wildlife

Suitable trees for white tern nesting and roosting are present throughout Downtown Honolulu. The relatively small number of trees that would be removed or trimmed as a result of the proposed project should not have a substantial impact on the terns, so no immediate or direct mitigation is needed. Street trees and plantings are discussed below.

Tree removal and trimming during construction and maintenance along the routes of the Managed Lane and Fixed Guideway alternatives would need to take into account the potential presence of roosting or nesting white terns. In areas of urban Honolulu east of Hickam Air Force Base to Waikīkī, mature street trees provide ideal nesting habitat for white terns. To prevent possible impacts on this state-listed threatened species, it is recommended that tree removal or trimming be conducted: (a) during fall and early winter when fewer white terns are nesting, (b) after the trees have been inspected for the presence of terns and none were found, and (c) after any white tern chicks present have fledged.

Vegetation

The only known threatened or endangered vegetation that could be affected by any of the alternatives is the population of kooloaula (*A. menziesii*) at the southern end of the North-South Road. This population would only be affected by the Kapolei Parkway/North-South Road and Saratoga Avenue/North-South Road alignments of the Fixed Guideway Alternative. If one of these alignments is selected, a Habitat Conservation Plan would be developed and followed.

As part of the environmental planning for North-South Road and a portion of Kapolei Parkway, a Habitat Conservation Plan for *Abutilon menziesii* at Kapolei was finalized in March 2004. Mitigation measures have already been specified for populations of *A. menziesii* related to construction of North-South Road. Two proposed alignments include North-South Road as an easement. Future construction on North-South Road for the proposed fixed guideway system should consider the impact it may have on the *A. menziesii* population, including possible shading of the population and secondary disturbance due to dust and debris from construction.

A landscaping plan would be prepared during final design to replace common weedy species with more aesthetically pleasing or native vegetation. The new vegetation would be designed to serve a number of purposes, including habitat restoration, erosion control, and beautification.

Street Trees

A Tree Preservation Plan would be developed to minimize and mitigate impacts on street trees. In general, healthy mature trees that are notable or otherwise distinctive would be kept in place where possible. Other trees may need to be removed (or transplanted, if viable) and replaced with new landscaping appropriate to the area and the elevated structure. Tree project zones would also be established during construction.

The landscaping plan for the project, discussed previously, would include planting new street trees in areas where existing trees would require removal and could not be transplanted.

Hazardous Materials

A hazardous material is any substance that may be hazardous to humans, animals, or plants and may include pesticides, herbicides, toxic metals and chemicals, volatile chemicals, explosives, and nuclear fuels or low-level radioactive wastes. O‘ahu has a wide variety of industries and land uses that generate, use, store, or handle hazardous materials. Most of these sites are associated with industrial and commercial uses located throughout the island. For this assessment, potential contaminant sources were defined as facilities that treat, store, or dispose of hazardous waste; use hazardous substances; store petroleum products on site; or otherwise present a source of contamination to the project. Construction of the project may also be affected by potential contaminant sources located within the project footprint, or contaminants that may have migrated from an off-site source to an area involved in one or more of the project alternatives.

The hazardous waste/materials assessment was performed along the proposed alignments for the Build Alternatives and is summarized in Table 16. The Fixed Guideway Alternative has a larger number of potential hazardous waste/materials than the Managed Lane Alternative. This results from the longer length of the alignments and other footprint impacts. The potential for encountering contaminated materials is greater for the alternatives and alignments that are near a greater number of potentially or known contaminated sites.

For the Managed Lane Alternative, the Reversible Option would encounter fewer hazardous waste/materials sites (10 sites) than the Two-Direction Option (17 sites). For Section I of the Fixed Guideway Alternative, the Kapolei Parkway/North-South Road and Saratoga Avenue/North-South Road alignments would encounter no known hazardous waste/materials sites. The Kamokila Boulevard/Farrington Highway alignment would encounter 1 site and the Geiger Road/Fort Weaver Road would encounter 2 sites. For Section II of the Fixed Guideway Alternative, the Farrington Highway/Kamehameha Highway alignment would encounter 1 hazardous waste/materials site. For Section III of the Fixed Guideway Alternative, the Aolele Street alignment would encounter the fewest hazardous waste/materials sites (12 sites). For Section IV of the Fixed Guideway Alternative, the North King Street alignment would encounter the fewest hazardous waste/materials sites (5 sites). For Section V of the Fixed Guideway Alternative, the Beretania Street/South King Street alignment would encounter the fewest hazardous waste/materials sites (3 sites). The Waikīkī Branch would not encounter any known sites.

Table 16. Known Hazardous Materials Sites Near Each Alternative

Alternative	Number of Known Hazardous Waste/ Materials Sites that could be Affected
Alternative 1: No Build	
No Build Alternative	0
Alternative 2: Transportation System Management	
TSM Alternative	0
Alternative 3: Managed Lane (by section)	
3a. Two-Direction Option	
Waiawa IC to Hālawā Stream	4
Hālawā Stream to Pacific Street	13
3b. Reversible Option	
Waiawa IC to Hālawā Stream	4
Hālawā Stream to Pacific Street	6
Alternative 4: Fixed Guideway (by section)	
I. Kapolei to Fort Weaver Road	
Kamokila Boulevard/Farrington Highway	1
Kapolei Parkway/North-South Road	0
Saratoga Avenue/North-South Road	0
Geiger Road/Fort Weaver Road	2
II. Fort Weaver Road to Aloha Stadium	
Farrington Highway/Kamehameha Highway	1
III. Aloha Stadium to Middle Street	
Salt Lake Boulevard	14
Mauka of the Airport Viaduct	28
Makai of the Airport Viaduct	15
Aolele Street	12
IV. Middle Street to Iwilei	
North King Street	5
Dillingham Boulevard	13
V. Iwilei to UH Mānoa	
Beretania Street/South King Street	3
Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard	11
King Street/Waimanu Street/Kapi'olani Boulevard	15
Nimitz Highway/Queen Street/Kapi'olani Boulevard	10
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	11
Waikīkī Branch	0

Cultural, Historic, and Archaeological Resources

Background, Studies, and Coordination

Cultural practices, as defined by the Hawai'i State Legislature in Act 50, Hawai'i Session Laws of 2002, were evaluated for the various alternatives. These practices were broadly defined as: (1) a traditional cultural practice that is being conducted in an urban setting, and (2) traditions, beliefs, practices, life ways, and societal history of a community and its traditions, arts, crafts, music, and related institutions. Cultural practices include such

broad categories as food, dance, physical practices and health arts, museums, flora, religious practices and gathering places, cultural settings, and festivals and ceremonies. To gather information about the identification and impact of cultural resources within the study area, more than 400 letters were mailed to community members and organizations requesting comments related to cultural and ethnic practices and beliefs within the study area.

In regard to historic resources, this project must comply with Section 106 of the National Historic Preservation Act of 1966 (NHPA) and Section 4(f) of the Department of Transportation Act of 1966 because of federal participation in the project. The environmental analysis completed for this proposed project addresses the first steps in meeting the requirements of these two acts. A review of resources along the proposed alignments was conducted to determine if they are eligible for the National Register of Historic Places. Consultation and confirmation of resource eligibility have not been completed.

For archaeological resources, three general categories of resources were identified: burials, pre-contact archaeology, and historic archaeology. With few exceptions, the archaeological resources that could be affected by the project are subsurface features and deposits that have not been previously identified. Such impacts would occur during construction. Once negative impacts from construction (e.g., archaeological resource destruction) and positive impacts from construction (e.g., an increase in archaeological knowledge about O‘ahu’s south shore) have occurred, no long-term project-related impacts on archaeological resources are expected.

Cultural Resource Impacts

Approximately 1,120 cultural practices and resources were identified in the study area. The cultural practices varied from one-time annual events (e.g., the Aloha Week festival) to churches or community organizations where cultural activities are regularly held. Each cultural resource or practice was analyzed to assess the following:

- A finding of potential impact on the cultural practice
- Impacts on access to the practice during construction
- Potential impact to the cultural practice during operation or implementation of the project; or
- A finding of no impact.

Potential impacts identified may not be substantial, and may be avoided or minimized with mitigation. Table 17 summarizes cultural practices and resources that may be affected by each alternative. Generally, impacts to resources during construction would include temporary limits on access to resources, or the need to temporarily relocate or reroute resources or events such as parades. Impacts to major events could be avoided by coordinating construction activities around events such as the Kamehameha Day Parade.

The No Build Alternative includes existing transit and highway facilities and committed transportation projects expected to be operational by 2030. An independent cultural

impact analysis would need to be conducted for each of these other projects. Accordingly, it was determined that there would be no long-term or construction-related impacts from the No Build Alternative on the identified cultural resources or practices.

Table 17. Cultural Practices and Resources in the Study Area

Alternative	Total Resources	Resources that May be Affected during Construction	Resources that May be Affected during Operation
Alternative 1: No Build			
No Build Alternative	1,120	Not identified	Not identified
Alternative 2: Transportation System Management			
TSM Alternative	1,120	Not identified	Not identified
Alternative 3: Managed Lane			
3a. Two-Direction Option	178	125	0
3b. Reversible Option	178	125	0
Alternative 4: Fixed Guideway (by section)			
I. Kapolei to Fort Weaver Road			
Kamokila Boulevard/Farrington Highway	48	43	0
Kapolei Parkway/North-South Road	15	12	0
Saratoga Avenue/North-South Road	3	3	2
Geiger Road/Fort Weaver Road	47	8	2
II. Fort Weaver Road to Aloha Stadium			
Farrington Highway/Kamehameha Highway	151	112	0
III. Aloha Stadium to Middle Street			
Salt Lake Boulevard	23	6	0
Mauka of the Airport Viaduct	23	11	0
Makai of the Airport Viaduct	23	11	0
Aolele Street	23	11	0
IV. Middle Street to Iwilei			
North King Street	88	43	2
Dillingham Boulevard	34	23	0
V. Iwilei to UH Mānoa			
Beretania Street/South King Street	159	128	0
Hotel Street/Kawaiaha'o Street/ Kapi'olani Boulevard	142	134	7
King Street/Waimanu Street/Kapi'olani Boulevard	148	42	2
Nimitz Highway/Queen Street/Kapi'olani Boulevard	49	45	0
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	35	25	0
Waikīkī Branch	109	99	1

Similarly, Alternative 2, Transportation System Management, would include the same committed highway projects assumed for the No Build Alternative. Therefore, the determination was made that there would be no long-term or construction-related impacts from this alternative on the identified cultural resources or practices.

Alternative 3, Managed Lane, would include construction of a two-lane, grade-separated facility for use by buses, paratransit vehicles, and vanpools between Waipahu and Downtown Honolulu. Impacts on cultural resources would be the same for both options

under this alternative (Two-Direction and Reversible). In general, no long-term impacts on cultural activities are expected under the Managed Lane Alternative. Along this route, 178 cultural resources were identified and one cultural resource would be directly affected, but not over the long term. Access to 125 of these resources (including the directly affected cultural resource) could be affected during construction (Table 17). Access to small ethnic food shops and cultural activities between Aloha Stadium and Ke‘ehi Lagoon Beach Park, including fishing and canoe paddling events, could occur. Access to prominent features, such as the Arizona Memorial and USS Missouri, may be affected. However, there would be no long-term impacts on cultural resources under the Managed Lane Alternative.

In general, Alternative 4, Fixed Guideway, would have few long-term impacts on cultural resources or practices, except in the historic and culturally sensitive areas of Downtown – in particular Kawaiaha‘o Church, the Mission Houses, and ‘Iolani Palace. The greatest impact on cultural resources would occur during construction when access to resources (including ethnic food shops and religious sites where various ethnic and cultural groups gather) could be affected. The alignments that included a bored tunnel and those that avoid Chinatown and Downtown would cause fewer disruptions. However, some cultural resources and practices may be affected during construction and operation if the project displaces or eliminates a particular cultural practice or resource.

In Section I of Alternative 4, the Kapolei to Fort Weaver Road alignment, the Kamokila Boulevard/Farrington Highway alignment could impact the largest number of cultural resources and practices. Access to 43 cultural resources could be temporarily affected by construction, but no long-term impacts would occur. The Saratoga Avenue/North/South Road alignment would have the fewest impacts: a direct impact to one cultural practice would occur and access to three cultural resources could be affected by construction. Two resources could be impacted during operation.

For Section II of Alternative 4, Fort Weaver Road to Aloha Stadium, construction of the Farrington Highway/Kamehameha Highway alignment could temporarily impair access to 112 cultural resources, but no long-term impacts would occur.

Along Section III of Alternative 4, Aloha Stadium to Middle Street, construction of all four alignments could temporarily affect access to cultural resources, but there would be no long-term impacts during operation.

In Section IV of Alternative 4, Middle Street to Iwilei, the North King Street Alignment would have the greatest impact on cultural resources and practices. A direct impact to one cultural practice would occur and access to 43 cultural resources could be temporarily affected by construction. Two resources could be affected long-term.

For Section V of Alternative 4, Iwilei to UH Mānoa, the Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard Alignment would have the greatest impacts on cultural resources and practices. Direct impacts could affect 17 practices, and access to 134 cultural resources could be temporarily affected by construction. Seven resources could be affected long-term. The Nimitz Highway/Halekauwila Street/Kapi‘olani Boulevard

Alignment would have the least impact on cultural resources and practices. Access to 25 cultural resources could be affected by construction, but no long-term impacts on cultural resources would occur during operation. The number of resources that would be affected by the Beretania Street/South King Street and King Street/Waimanu Street/Kapi‘olani Boulevard tunnel alignments would be reduced because they would be constructed using a tunnel boring machine, which would leave the surface undisturbed.

Cultural Resource Mitigation

Transit stations can enhance cultural practices and resources through appropriate interpretive signage in different ethnic languages. In the Kapolei area, transit centers could also provide a venue for traditional cultural stories about the area, including legends and Hawaiian place names. Coordination of construction activities would avoid impacts on traditional ceremonies and festivals, including the Kamehameha Day Parade.

Historic Resource Impacts

The City and County property record search identified approximately 1,000 pre-1965 tax map lots within the study corridor. These properties are not evenly distributed among the proposed transit corridor’s various sections. The preliminary list was used to determine resources that were reviewed in previous studies and/or are already included in the State Historic Preservation Division (SHPD)’s State and National Register lists. Resources that had not been previously assessed were reviewed in a field survey. This survey identified buildings and structures that appear to possess distinctive characteristics of a type, period, or method of construction. The fewest pre-1965 resources are located in the Kapolei area, and the most in the Honolulu area (Table 18).

Alternative 1: No Build

No impacts to historic resources would occur as a result of project activities under the No Build Alternative. Transportation projects included in the 2030 O‘ahu Regional Transportation Plan would be evaluated individually as each project is developed.

Alternative 2: TSM

Similar to the No Build Alternative, no impacts to historic resources would occur as a result of project activities. Transportation projects included in the 2030 O‘ahu Regional Transportation Plan, and any other transit capital improvements, would be evaluated individually as each project is developed.

Alternative 3: Managed Lane

Both the Two-Direction and Reversible options under this alternative could impact the physical environment of 26 historic resources identified along this route. The impacts to historic resources, discussed below, would be the same for either option selected for implementation.

The various historic resources (districts, cemeteries, parks, buildings, bridges, stone paving, curbing, and other such objects) considered potentially eligible, potentially

eligible pending further study, or already on the Register(s) along this alternative's alignment could face a loss of integrity of setting, feeling, and association. The loss of these aspects of integrity could result during project construction and operation (long-term impacts).

Long-Term Impacts

Impacts during project operation could include direct changes to physical features of a property's setting that contribute to its historic significance. Specific changes would include infrastructure that is visually incompatible and blocks the view of a historic resource (e.g., the scale of the infrastructure could overwhelm the resource's historic appearance).

Construction Impacts

Impacts during construction could include the following:

- Demolition or damage to historic objects
- Alterations (e.g., stabilization efforts/reinforcement, particularly to historic bridges) where such alterations would change the historic appearance
- Inadvertent collision of equipment and/or material into the resource
- Collision from overhead debris
- Construction vibration causing direct movement or resulting in ground displacement (which could cause settling and movement, resulting in structural damage to the resource)
- Dewatering from adjacent foundation excavations, creating settling and movement beneath historic resources
- Dewatering resulting in the rapid dry rot of any previously submerged timber piles when exposed to air
- High concentrations of dust that directly soils the exterior or infiltrates the interior and damages interior architectural features
- Construction noise altering the feeling of historic areas (particularly residential neighborhoods)

Alternative 4: Fixed Guideway

Long-Term Impacts

The Fixed Guideway Alternative could impact the physical environment of 209 historic resources identified along its various alignments (Table 18). As a means of comparing the relative degree of impact that the various alignments in each section would entail, each has been given a ranking from low to high in the far right column of Table 19.

Table 18. Historic Resources in the Study Area

Section and Alignment ¹	Pre-1965 Properties	Resources Determined Eligible	Potentially Eligible Resources ²	Historic Districts (HD) Affected
Alternative 3: Managed Lane (by section)				
Waiawa IC to Hālawā Stream	78	0	9	1 (PH NHL ³)
Hālawā Stream to Pacific Street	63	2	19	1 (PH NHL ³)
Alternative 4: Fixed Guideway (by section)				
I. Kapolei to Fort Weaver Road (5)				
Kamokila Boulevard/Farrington Highway	0	0	2	0
Kapolei Parkway/North-South Road	1	0	1	0
Saratoga Avenue/North-South Road	1	0	3	0
Geiger Road/Fort Weaver Road	3	0	3	0
II. Fort Weaver Road to Aloha Stadium (9)				
Farrington Highway/Kamehameha Highway	173	0	9	0
III. Aloha Stadium to Middle Street (10)				
Salt Lake Boulevard	110	0	3	1 (Palm Circle NHL)
Mauka of the Airport Viaduct	9	0	8	1 (PH NHL ³)
Makai of the Airport Viaduct	21	0	8	1 (PH NHL ³)
Aolele Street	18	0	8	0
IV. Middle Street to Iwilei (44)				
North King Street	94	3	33	0
Dillingham Boulevard	49	2	12	0
V. Iwilei to UH Mānoa (141)				
Beretania Street/South King Street	126	16	56	2 (Chinatown HD, Hawai'i Capital HD)
Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard	228	33	52	2 (Chinatown HD, Hawai'i Capital HD)
King Street/Waimanu Street/Kapi'olani Boulevard	205	37	50	2 (Chinatown HD, Hawai'i Capital HD)
Nimitz Highway/Queen Street / Kapi'olani Boulevard	218	21	45	3 (Chinatown HD, Merchant St. HD, Hawai'i Capital HD)
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	186	15	33	2 (Chinatown HD, Merchant St. HD)
Waikīkī Branch	33	0	8	0
Total historic or potentially historic resources that may be affected by Alternative 4: 209				

Notes on table:

¹The numbers in parentheses are the total number of resources that meet the 1965 cut-off date for each section. Because some resources are affected by multiple alignments, the numbers in parentheses are typically less than the total of the resources for each section in column two.

²Includes pre-1965 properties from the City and County database, plus other properties identified during field surveys.

³PH NHL = Pearl Harbor National Historic Landmark

In addition to the number of historic or potentially historic resources identified along each alignment, the rankings take into account several other weighting factors. These factors include the level of impact that would result from where the system is built in a particular area (above-grade, at-grade, and below-grade). For example, at-grade alignments were evaluated as posing less impact than elevated alignments, and tunneled

alignments would pose less impact than at-grade alignments. The tunneled alignments were projected to cause the least amount of impact among these three types of alignments, because it is assumed that construction damage would be avoided or minimized and no historic resources adjacent to the tunneled alignments would be affected. The ranking also reflects how many of the resources are already on the National and/or State registers, and the path an alignment takes through a historic district. For example, a lower ranking is given when an alignment is adjacent to the outer boundary of a district, compared to an alignment that goes directly through it.

Of the four alignments within Section I, the Kapolei Parkway/North-South Road alignment has the least potential for impact to historic resources because it is adjacent to only one potentially historic resource. The other three alignments are adjacent to either two or three potentially historic resources. This section contains no properties already listed on the State or National registers and does not contain any historic districts. The system would also be elevated in this section. Therefore the various weighting factors do not affect the ranking of these alignments. The relative rankings for this section directly reflect the number of potentially historic resources identified in the survey.

Section II contains only one alignment, Farrington Highway/Kamehameha Highway, which is adjacent to nine potentially historic resources. Because no other alignments exist for comparison purposes, it was not given a ranking.

Four alignments exist in Section III, all of which are proposed to be elevated. The Salt Lake Boulevard alignment has the least potential for impact to historic resources because it is adjacent to only three historic or potentially historic resources. It passes adjacent to the outer boundary of the Palm Circle National Historic Landmark, but none of the landmark's resources are located near this boundary so its direct impact to historic resources in this area is insignificant. The three other alignments in Section III affect eight resources each. They also follow the Kamehameha Highway boundary of the Pearl Harbor National Historic Landmark, passing directly in front of some of its historic resources. These three alignments would result in more impacts to historic resources.

Of the two alignments in Section IV, the Dillingham Boulevard alignment has a lower potential for impacts to historic resources than the North King Street alignment. This is because the Dillingham Boulevard alignment is adjacent to 12 potentially historic resources (of which only one is on one of the registers), and the North King Street alignment is adjacent to 33 historic resources (of which 5 are on either the Hawai'i Register or Eligible for the National Register). Because neither of these alignments passes through or near any historic districts and both use elevated systems, the rankings are primarily based on the historic or potentially historic resources located along the alignments.

Table 19. Historic Resources Affected by the Fixed Guideway Alternative

Section and Alignment ¹	Number of Resources Eligible or Potentially Eligible along Alignment ²	Historic Districts along Alignment	Relative Potential for Impact ³
I. Kapolei to Fort Weaver Road (5)			
Kamokila Boulevard/Farrington Highway	2	0	●
Kapolei Parkway/North-South Road	1	0	○
Saratoga Avenue/North-South Road	3	0	●
Geiger Road/Fort Weaver Road	3	0	●
II. Fort Weaver Road to Aloha Stadium (9)			
Farrington Highway/Kamehameha Highway	9	0	Not ranked; only one alignment
III. Aloha Stadium to Middle Street (10)			
Salt Lake Boulevard	3	1 (Palm Circle NHL)	○
Mauka of the Airport Viaduct	8	1 (PH NHL)	●
Makai of the Airport Viaduct	8	1 (PH NHL)	●
Aolele Street	8	1 (PH NHL)	●
IV. Middle Street to Iwilei (44)			
North King Street	33	0	●
Dillingham Boulevard	12	0	○
V. Iwilei to UH Mānoa (141)			
Beretania Street/South King Street	56	2 (Chinatown HD, Hawai'i Capitol HD)	●
Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard	52	2 (Chinatown HD, Hawai'i Capitol HD)	●
King Street/Waimanu Street/Kapi'olani Boulevard	50	2 (Chinatown HD, Hawai'i Capitol HD)	●
Nimitz Highway/Queen Street/ Kapi'olani Boulevard	45	3 (Chinatown HD, Merchant St. HD, Hawai'i Capitol HD)	●
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	33	2 (Chinatown HD, Merchant St. HD)	○
Waikīkī Branch	8	0	Not ranked
TOTAL: 209			

¹Numbers in parentheses following segment titles are the total number of resources on the NR and/or HR, determined eligible, or evaluated as potentially eligible, that could be affected within each section. Because some resources are affected by multiple alignments, the numbers in parentheses are typically less than the total of the resources for each section in column two.

²Includes pre-1965 properties from the City and County database, plus other properties identified during field surveys.

³○ = Lowest Potential, ● = Highest Potential.

Of the five alignments in Section V, the Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard alignment has the least potential for impacts to historic resources. This alignment avoids many areas with concentrated groups of resources (central Chinatown, South King Street), and also avoids the Hawai'i Capital Historic District, which has a number of high-profile resources. However, this alignment does not entirely avoid historic resources. Its elevated route goes through the makai side of the Chinatown Historic District where it is adjacent to 10 resources, and would further isolate that

district from its historic connection with the waterfront. It also runs along the border of the Merchant Street Historic District.

The Nimitz Highway/Queen Street/Kapi‘olani Boulevard alignment would have the same impacts as the Nimitz Highway/Halekauwila Street/Kapi‘olani Boulevard alignment, but would also affect properties within the Hawai‘i Capital Historic District (Post Office, Ali‘iōlani Hale building, and Attorney General’s building). It would also affect three National Register properties along Queen Street (C. Brewer, Alexander and Baldwin, and Royal Brewery buildings). This alignment is fully elevated – there are no tunnels proposed that would reduce the number of historic resources affected.

The Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard alignment would operate at grade on Hotel Street. This is in context with this street’s history, because a streetcar historically ran along it (this precedence notably minimizes but does not eliminate the alignment’s impact). This alignment would tunnel under the Hawai‘i Capital Historic District, which reduces the number of resources affected to approximately the same number as found along the Nimitz Highway/Queen Street/Kapi‘olani Boulevard alignment. Important resources along the Hotel Street alignment are 18 buildings in the Chinatown Historic District; the National Register-eligible Campbell, McCorrison, and Portland buildings; and five other National Register-listed resources (one Capitol District building, the Kawaiaha‘o Church, the Mission Houses, Ala Wai Park Clubhouse, and Church of the Crossroads).

In Section V, the King Street/Waimanu Street/Kapi‘olani Boulevard alignment would tunnel under the Chinatown Historic District and Hawai‘i Capital Historic District and the National Register-eligible Honolulu Advertiser Building. Koko Head of Ward Avenue, the alignment is similar to the other alignments that would be elevated near the Ala Wai Park Clubhouse and Church of the Crossroads.

The Beretania Street/South King Street alignment within Section V has the highest number of historic resources, but because of the tunneling proposed along the Beretania Street portion of the alignment, fewer resources would actually be affected. Many potentially historic resources identified along South King Street are not listed on either the Hawai‘i or National registers. Important resources along the South King Street alignment listed on the National Register are Thomas Square, McKinley High School, the Board of Agriculture and Forestry building, and Church of the Crossroads.

Construction Impacts

Impacts during construction could include:

- Ground displacement and movement of historic properties from tunneling, resulting in structural damage
- Inadvertent collision of equipment and/or material into the resource
- Collision from overhead debris
- Construction vibration, causing direct movement or ground displacement (resulting in settling and movement and possible structural damage to the resource)

- Dewatering from adjacent foundation excavations, creating settling and movement beneath historic resources
- Dewatering, resulting in the rapid dry rot of any previously submerged timber piles when exposed to air
- High concentrations of dust, soiling the exterior or infiltrating the interior and damaging interior architectural features
- Construction noise altering the feeling of historic areas (particularly residential neighborhoods)

Historic Resource Mitigation

Mitigation of Long-Term Impacts

Impacts to historic resources should be avoided and minimized where possible. Other mitigation methods, specifically documentation, should take place if avoiding and minimizing impacts are not practicable. Where the grade-separated roadway or selected fixed guideway alignment would pose a considerable negative impact on historic resources (in particular where the alignment is above grade and would block the primary façade or view), documentation of the resources prior to construction would be an appropriate method of mitigation. The format of this documentation could be either Historic American Buildings Survey or Historic American Engineering Record reports, as appropriate. If station locations cannot be located away from historic resources, interpretive signs could be installed in the stations located near the affected historic resources. These signs could provide historical and architectural information to transit users.

Mitigation of Construction Impacts

During construction, historic properties located near work areas would be protected from damage. This would include erecting barriers to prevent collision from machinery, equipment, and construction materials, and erecting overhead protection if construction is needed above the resource. Vibration from nearby construction should be monitored at historic resources to avoid damage either directly (e.g., from pile driving) or from ground displacement. Dewatering of the ground under historic resources should be prevented by using watertight excavation support systems (e.g., slurry walls) to ensure that water pumped from a construction site does not come from adjacent properties. Dust suppression measures should be used at construction sites. A monitoring program should be implemented during construction to evaluate the efficacy of protective measures and recommend new measures as needed.

Archaeological Resource Impacts

Alternative 1 (No Build) and Alternative 2 (Transportation System Management) may involve construction that could impact archaeological resources. However, these impacts are not considered in this analysis, because these alternatives would undergo a separate environmental review as part of their planning and implementation. Most areas affected by Alternative 3, Managed Lane, would also be within the area affected by Alternative 4,

Fixed Guideway. Depending on the alignment and construction methods chosen for the Fixed Guideway Alternative, the Managed Lane Alternative could result in fewer impacts on archaeological resources than the Fixed Guideway Alternative, because the Managed Lane Alternative would involve disturbance of a shorter corridor (Table 20).

The potential for encountering archaeological resources is dependent on the construction methods used. Construction of elevated structures requires soil disturbance at periodic intervals where columns are placed, but would not disturb areas between these columns. With tunnel construction, boring machines create deep tunnels below the layer where archeological resources are commonly found, so are not likely to disturb resources except near the ends of the tunnel. Cut-and-cover tunnel construction removes material from the surface, so any resources in the alignment are likely to be disturbed.

Alternative 3: Managed Lane

In relation to archaeological impacts, no differences exist between Managed Lane Alternative 3a (Two-Direction Option) and 3b (Reversible Option). For the section of the Managed Lane Alternative from the Waiawa Interchange to Hālawa Stream, the potential to impact burials is rated as low, and the potential to impact archaeological resources and historic resources is rated as medium. The section of the Managed Lane Alternative from Hālawa Stream to Pacific Street has a medium rating for impacts to all archaeological resource types.

Alternative 4: Fixed Guideway

For Section I of the Fixed Guideway Alternative, the potential for impacts to all three types of archaeological resources decreases in direct correlation with an alignment's distance from the coast. The most mauka alignment, Kamokila Boulevard/Farrington Highway, has the least potential to impact archaeological resources. All three mauka alignments (Kamokila Boulevard/Farrington Highway, Kapolei Parkway/North-South Road, and Saratoga Avenue/North-South Road) have a low impact potential for all archaeological resource types. The makai alignment, Geiger Road/Fort Weaver Road, has a medium impact potential for pre-contact archaeological resources and a low impact potential for burials and historic resources.

Table 20. Summary of Potential Impacts to Archaeological Resources

Alternative	Burials	Pre-Contact Archaeology	Historic Archaeology
Alternative 1: No Build			
No Build Alternative	N/A	N/A	N/A
Alternative 2: Transportation System Management			
TSM Alternative	N/A	N/A	N/A
Alternative 3: Managed Lane (by section)			
3a. Two-Direction Option			
Waiawa IC to Hālawā Stream	○	◐	◐
Hālawā Stream to Pacific Street	◐	◐	◐
3b. Reversible Option			
Waiawa IC to Hālawā Stream	○	◐	◐
Hālawā Stream to Pacific Street	◐	◐	◐
Alternative 4: Fixed Guideway (by section)			
I. Kapolei to Fort Weaver Road			
Kamokila Boulevard/Farrington Highway	○	○	○
Kapolei Parkway/North-South Road	○	○	○
Saratoga Avenue/North-South Road	○	○	○
Geiger Road/Fort Weaver Road	○	◐	○
II. Fort Weaver Road to Aloha Stadium			
Farrington Highway/Kamehameha Highway	○	◐	◐
III. Aloha Stadium to Middle Street			
Salt Lake Boulevard	○	○	○
Mauka of the Airport Viaduct	○	◐	◐
Makai of the Airport Viaduct	○	◐	◐
Aolele Street	○	◐	◐
IV. Middle Street to Iwilei			
North King Street	◐	◐	◐
Dillingham Boulevard	◐	◐	◐
V. Iwilei to UH Mānoa			
Beretania Street/South King Street	◐	◐	◐
Hotel Street/Kawaiāha'o Street/ Kapi'olani Boulevard	●●	●	●
King Street/Waimanu Street/ Kapi'olani Boulevard	●	●	●
Nimitz Highway/Queen Street/ Kapi'olani Boulevard	●	●	●
Nimitz Highway/Halekauwila Street/ Kapi'olani Boulevard	●	●	●
Waikīkī Branch	●	●	●

Notes:

○ = Low Potential, ● = High Potential

The highest potential for encountering burials would occur during cut-and-cover tunnel construction, which would be used on the Hotel Street/Kawaiāha'o Street alignment.

Only one alignment is being considered for Section II: Farrington Highway/Kamehameha Highway. This alignment has a low impact potential for burials and a medium impact potential for pre-contact archaeological and historic resources.

For Section III, the potential impact to burials is rated low for all four alignments. The potential to impact archaeological and historical resources along the mauka side of the Airport Viaduct, makai of the Airport Viaduct, and Aolele Street alignments is rated medium. For the Salt Lake Boulevard alignment, the potential impact rating for archaeological and historical resources is low, primarily because of the extensive land modification that has occurred in this area.

Both of the alignments for Section IV have medium impact potential for all archaeological resource types.

The alignments along Section V have the greatest potential to impact archaeological resources because of the area's intensive land use history through pre-contact and historic times. Of the six alignments, the most mauka alignment, Beretania Street/South King Street, has a medium impact rating for all archaeological resource types. All other alignments are rated as having a high impact potential for all archaeological resources. The cut-and-cover tunnel excavation for the Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard alignment would have the highest potential for encountering burials because of the large area excavated. The other tunnel alignments, Beretania Street/South King Street and King Street/Waimanu Street/Kapi'olani Boulevard, would be excavated using a tunnel boring machine, which would not disturb the surface and would dig at a depth generally below where burials are located.

Archaeological Resource Mitigation

Archaeological mitigation would include burial treatment, archaeological data recovery, and archaeological monitoring. If some flexibility in the construction design exists, it may be possible to preserve the archaeological resources in place.

Because a reasonable potential exists for Alternatives 3 and 4 to affect burials, particularly Native Hawaiian burials, the project's program for the treatment of burials should be proactive and conscientious. As a unique class of archaeological resource, burial treatment must be carried out in accordance with the specific guidelines of Hawai'i State and federal burial law. If federal lands are involved, Native American Grave Protection and Repatriation Act guidelines would need to be followed. Early consultation with the O'ahu Island Burial Council is appropriate. A project burial plan should be developed to outline the treatment for all previously identified and inadvertent burial finds encountered by the project.

Archaeological data recovery is a method of extracting important information from archaeological sites to mitigate a project's effect on the site's destruction. In consultation with State Historic Preservation Division, a detailed data recovery plan would be written that describes the data recovery investigation's research questions, data requirements, and methods for acquiring the needed information to answer research questions. Once the archaeological investigation is complete, a data recovery report would be written to document all results.

Archaeological monitoring can minimize the impact of a development on as-yet-identified or incompletely documented archaeological resources. The goal is to document exposed archaeological resources and, for the most important archaeological resources, potentially save them from destruction. Typically, archaeological monitoring programs follow a plan that outlines the construction methods and impacts of the proposed project, the types of archaeological resources expected, and the methods to be used to document the archaeological resources encountered. A monitoring report is prepared to document all results.

Archaeological preservation involves avoiding impacts to archaeological resources and protecting and safeguarding these resources in place. Archaeological preservation can include active interpretation of the resource, for example with signage and other forms of public interpretation. It can also involve conserving the resource through evasion. Preservation strategies and methods differ depending on the type of archaeological resource encountered. Typically, a preservation plan is written to describe the archaeological resource and the preservation measures to be enacted. Once approved by the State Historic Preservation Division (SHPD), the plan is implemented.

Conclusions Regarding Environmental Consequences

The proposed project alternatives present a range of trade-offs when considering their effects on various elements of the environment. The No Build and TSM Alternatives have the fewest physical impacts, but would require more operating energy and generate more air and water pollution than the Fixed Guideway Alternative. Within the Managed Lane and Fixed Guideway Alternatives, the environmental effects would vary by the option or alignment selected.

Alternative 3: Managed Lane Alternative

The Reversible Option would be narrower than the Two-Direction Option, creating less visual impact. However, it would have greater energy consumption, air pollution, and water pollution emissions. Overall, the differences in environmental effects between the two options are not sufficient to select one over the other.

Alternative 4: Fixed Guideway Alternative

The Fixed Guideway Alternative would generate the greatest environmental benefit for several elements of the environment. The impacts would vary substantially between alignments. The long-term environmental effects that differentiate each alignment are discussed in the following sections. Overall, trade-offs exist between the various alignments, but two alignment options would have substantially greater environmental impacts than the other alignments within their section. In Section III, the Salt Lake Boulevard alignment would cause a substantially greater number of noise impacts than any other alignment within the study corridor. In Section IV, the Hotel Street/Kawaihae Street/Kapi'olani Boulevard alignment would require more residential property acquisitions and would have a greater potential to disturb cultural practices and burials than any other alignment.

Section I. Kapolei to Fort Weaver Road

Overall, fewer social and environmental impacts would occur in Section I than in other portions of the corridor. The Kapolei Parkway/North-South Road and Saratoga Avenue/North-South Road alignments would better support planned land use, because they would serve a greater portion of the future population (Table 1). The Saratoga Avenue/North-South Road alignment would have the fewest noise impacts (Table 13). These alignments are not greatly differentiated by other elements of the environment.

Section III. Aloha Stadium to Middle Street

The Salt Lake Boulevard alignment would serve more residents than the other three alignments, but would serve fewer jobs (Table 1). The Salt Lake Boulevard and Aolele Street alignments would affect fewer land parcels than the other alignments (Table 3). The makai of the Airport Viaduct and Aolele Street alignments would each cross a portion of Keehe Lagoon Park near H-1 (Table 5). The greatest number of noise impacts within the entire study corridor would occur along the Salt Lake Boulevard alignment (Table 13). More potential contaminated sites would be crossed mauka of the Airport viaduct than with any of the other alignments (Table 16).

Section IV. Middle Street to Iwilei

The North King Street alignment would serve more residents than the Dillingham alignment, but would serve fewer jobs (Table 1). The Dillingham alignment would require more parcel acquisitions, but fewer residential parcels would be acquired (Table 3). More noise impacts would occur with the North King Street alignment (Table 13). A greater number of potentially historic properties are located along the North King Street alignment (Table 18) than along the other alignments.

Section V. Iwilei to UH Mānoa

The Beretania Street/South King Street alignment would serve the fewest residents and jobs (Table 1). The Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard alignment would require acquisition of the greatest number of residential parcels of any alignment within the study corridor (Table 3). Noise impacts would be greater with a Waikīkī Branch than at any other location in Section V, but would be fewer than with the Salt Lake Boulevard or North King Street alignments (Table 13). The Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard alignment could affect a greater number of cultural practices (Table 17) and disturb the greatest number of burials (Table 20) compared to any alignment within the study corridor.