4.7 Visual and Aesthetic Conditions

This section describes the existing landscape's character and quality and discusses the Project's potential visual effects. It discusses potential mitigation measures, including ways to avoid or minimize effects on visual quality and restore or enhance visual quality.

The Project's potential effects include removing trees, altering ʻEwa-Koko Head and mauka-makai views, and introducing project components that are out of scale or character with their setting. Potential effects consider viewer response to project changes, new light and shadow sources in sensitive areas, and effects on views designated in policy documents. The viewpoints and view direction are identified in Figure 4-16. For additional information and references, see the *Honolulu High-Capacity Transit Corridor Project Visual and Aesthetics Resources Technical Report* (RTD 2008e).

4.7.1 Background and Methodology

City policy documents and ordinances include provisions for protecting, enhancing, and developing resources related to the visual integrity and quality of communities and areas covered by these plans. The following plans include objectives related to the visual environment and identify key views within their plan areas:

- *City and County of Honolulu General Plan* (DPP 2002a)
- *ʻEwa Development Plan* (DPP 2000)
- *Central Oʻahu Sustainable Communities Plan* (DPP 2002b)
- *Primary Urban Center Development Plan* (DPP 2004a)
- *ʻAiea-Pearl City Livable Communities Plan* (DPP 2004b)
- *Waipahu Livable Communities Initiative* (DPP 1998a)
- *Waipahu Town Plan* (DPP 1998b)

Special District Regulations in Chapter 21 of the *Revised Ordinances of Honolulu* (ROH 1978a) include policies that safeguard special features and characteristics of particular districts to allow for their preservation and enhancement. Districts that may be affected by the Project include Hawaiʻi Capitol (Section 21-9.30), Diamond Head (Section 21-9.40), Punchbowl (Section 21-9.50), Chinatown (Section 21-9.60), and Waikīkī (Section 21-9.80).

Visual assessment for the Project follows USDOT guidance. Although this guidance was developed for highway projects, it was used because the Project is a linear transportation facility and the FTA has not issued guidance specific to transit projects. DPP and other interested groups (e.g., the Outdoor Circle, Scenic Hawaiʻi, Inc., and the Honolulu Chapter of the American Institute of Architects) also provided data or input. The major components of the visual assessment process included the following tasks:

- Establishing the affected environment—this includes identifying visually sensitive resources, such as landmarks, significant views and vistas, and view corridors
- Describing and assessing the affected environment's character and quality
- Determining major viewer groups that have views to and from the project alignment
- Evaluating views that would be interrupted by the facility and views from the facility, including viewer response
- Describing significant visible changes that would occur
- Developing measures to mitigate the Project's significant impacts

4.7.2 Affected Environment

The visual environment that would be affected by the Project includes areas that would have a view of the Project, areas visible from the corridor, and views that the Project could affect or create.

The Waiʻanae and Koʻolau Mountain Ranges and the coastline are visible from most of the project

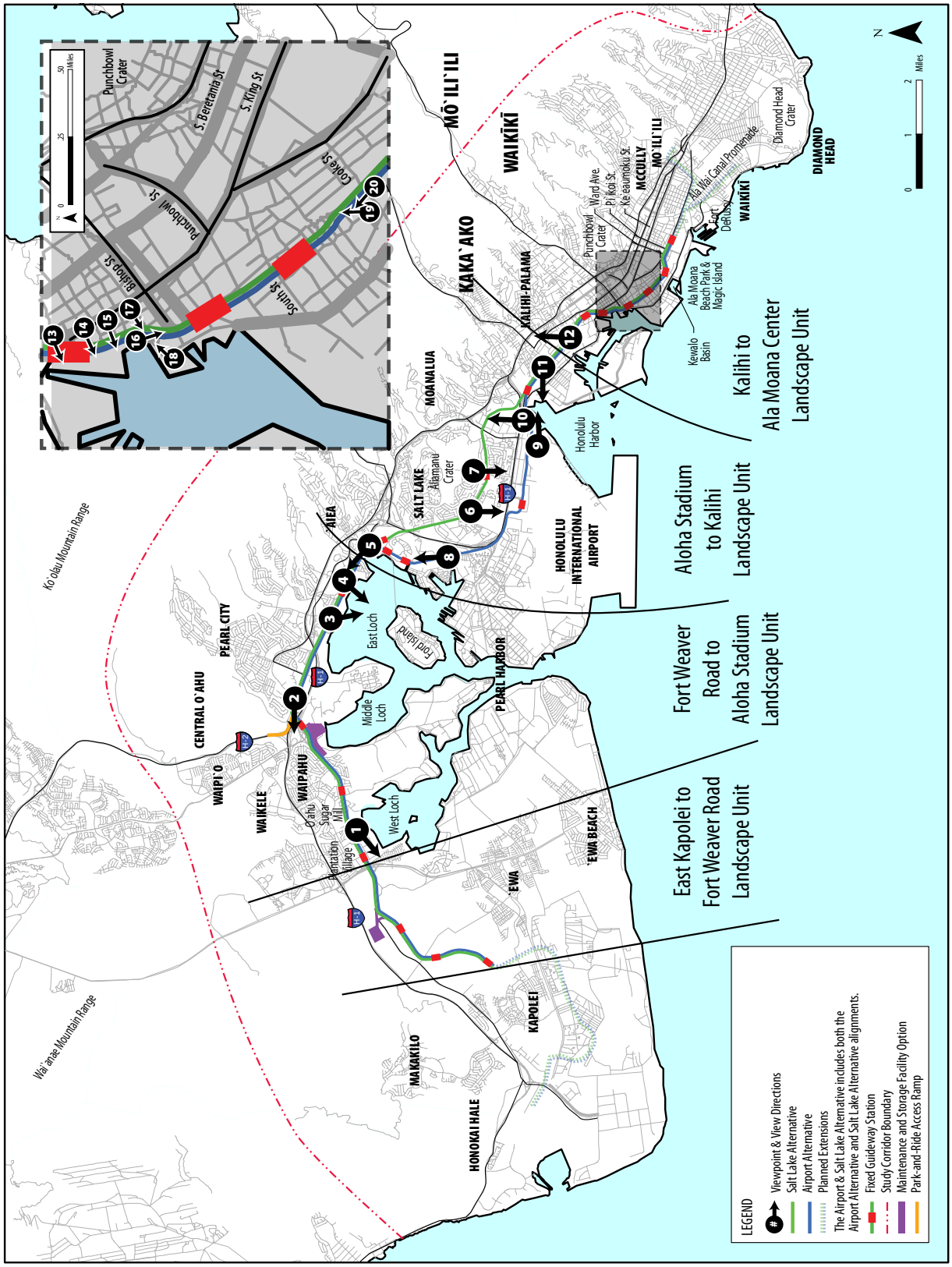

Figure 4-16 Visually Sensitive Resources and Representative Viewpoints within the Project Corridor

corridor along Farrington Highway, Kamehameha Highway, and Interstate Route H-1 (H-1 Freeway). The integrity of these landforms and the condition of public open spaces are important factors in determining visual character and quality.

Within coastal areas, the most scenic views are often captured when looking laterally along the coastline. These views capture the contrast between ocean and land form, usually in a distinctive visual pattern. Views at a strict 90-degree angle from the shoreline (e.g., along roadway corridors) are generally flat and uniform.

Viewer Groups

Major viewer groups within the project corridor include residents, commuters, business owners, recreationists, and visitors. *Residents* are people who observe the visual environment daily and for extended periods. *Commuters* are those who frequently travel through an area and, therefore, are familiar with the existing visual environment. However, this group does not have the same sense of ownership as residential viewer groups because they do not reside within that environment but only pass through it. *Business owners* have a vested interest in the visual environment surrounding their operations. Most business owners are familiar with their surrounding environment and may have a sense of ownership. *Recreationists* include people who frequent local parks, hiking trails, bikeways, and watercourses. They have definite expectations about the visual environment's condition. Visitors consist of both first-time and repeat visitors to the area. *Visitors* may consist of tourists, delivery or service personnel, or business employees and customers. This viewer group is less familiar with the existing visual environment's specific details, but they tend to have some sensitivity to and expectation of the surrounding environment.

Visually Sensitive Resources

Visually sensitive resources in the project corridor include landmarks, significant views and vistas, historic and cultural sites, and Exceptional Trees. These resources are important because of their scenic quality, scale, and prominence within the visual environment. Historic and cultural sites are discussed in Section 4.15, and Exceptional Trees are discussed in Section 4.14.

Landmarks, such as parks or open space, represent unique characteristics of a place or provide great value to local residents and visitors. Landmarks are also places or structures that have a unique style based on their architectural period, artistic merit, and the intrinsic qualities of Hawai'i. Landmarks represent the heart of a community and the people affected by events that occurred. Pearl Harbor is considered a historical landmark because of the part it played in the island's history.

Significant views and vistas are identified in policy documents that govern the project corridor and include protected mauka and makai views, as well as views of prominent landmarks.

The Project's visual environment changes from rural in the Wai'anae end of the corridor to dense high-rise development at the Koko Head end. The visual analysis considers the corridor in the following four landscape units, each of which is incrementally more urbanized (Figure 4-16).

Landscape Units are geographic areas where views of the Project would have a similar context or character.

East Kapolei to Fort Weaver Road Landscape Unit

This landscape unit extends from Kapolei to Fort Weaver Road and includes the communities of Kapolei and 'Ewa. Much of O'ahu's current and future population growth is expected to take place in this area, but it is still relatively rural and most of the area currently consists of agricultural cultivation and open space. Views across the 'Ewa Plain are still relatively open, allowing for mountain and

ocean vistas as well as distant views of Downtown high-rises. Significant protected views and vistas in this landscape unit are identified in the ʻEwa Development Plan and include the following:

- Views of na puʻu (Kapolei, Pālailai, and Makakilo) and makai
- Views of the Waiʻanae Mountain Range
- Distant vistas of the shoreline
- Views of Central Honolulu and Diamond Head

Fort Weaver Road to Aloha Stadium Landscape Unit

This landscape unit extends from Fort Weaver Road to Aloha Stadium. This area contains the wide fertile plateau that connects the Waiʻanae and Koʻolau Mountains and was previously in extensive agricultural use. It is now a growing suburban area, with access facilitated by the H-1 Freeway, Kamehameha Highway, and Moanalua Road. The demands of growth and development within the Central Oʻahu area have affected the natural environment, reducing some of its natural assets and replacing them with a built environment. This landscape unit is characterized by residential neighborhoods with one- and two-story residences. Clustered one- and two-story businesses are located along the Farrington Highway and Kamehameha Highway corridors. Most businesses are surrounded by parking lots that include large paved areas. Some of the paved areas include pockets of mature trees and shrubs that make the pavement appear less dominant. Utility poles and overhead utility lines are prevalent along both highway corridors. Significant protected views and vistas in this landscape unit are identified in the *Central Oʻahu Sustainable Communities Plan* (DPP 2002b) and the *PUC Development Plan* (DPP 2004a) and include the following:

- Views of Pearl Harbor and Lochs framed by the ocean
- Views of Central Oʻahu valleys and plains
- Views of the Waiʻanae and Koʻolau Mountain Ranges
- Views of West Loch
- Views of the Oʻahu Sugar Mill and Hawaiʻi's Plantation Village

Aloha Stadium to Kalihi Landscape Unit

The landscape unit from Aloha Stadium to Kalihi includes the Salt Lake portion of the PUC Development Plan Area, which comprises the communities of Salt Lake, Moanalua, and the Airport Area. These consist primarily of residential neighborhoods of one- and two-story residences and supporting commercial uses. The airport area encompasses industrial and commercial service-oriented buildings surrounded by large paved areas. Honolulu International Airport, Pearl Harbor Naval Base, and Hickam Air Force Base are located within this landscape unit. Views within this landscape unit are somewhat limited to the immediate surroundings because of dense development and the large scale of the many commercial and industrial buildings. The mountains can be viewed periodically from elevated locations and transportation corridors, such as Salt Lake Boulevard and Kamehameha Highway. Significant protected views and vistas in this landscape unit are identified in the *PUC Development Plan* (DPP 2004a) and include the following:

- Views of Pearl Harbor and Lochs framed by the Waiʻanae Mountain Range
- Views of Diamond Head and Honolulu valleys
- Views of Punchbowl Crater
- Views of Āliamanu Crater and Central Oʻahu valleys

Kalihi to Ala Moana Center Landscape Unit

The Kalihi to Ala Moana Center landscape unit comprises a continuous urban corridor and the highest densities of the PUC. Kalihi to Iwilei includes the neighborhood community of Kalihi-Palama, which contains waterfront properties that house extensive maritime operations. Business districts with major wholesale and distribution

facilities line King Street and Nimitz Highway. Farther Koko Head, this landscape unit encompasses Downtown, Kakaʻako, and Ala Moana. The mountains and shoreline that define the mauka and makai edges of this landscape unit are dominant elements of the landscape. Within the corridor, open space consists of volcanic craters, streams, and other water bodies, as well as larger parks and campuses. The mauka edge includes the Koʻolau Mountain Range and its undeveloped foothills and slopes. The makai edge includes the shorelines and waters of the Pacific Ocean and such landmarks as Pearl Harbor (East Loch), Honolulu Harbor, and Ala Wai Harbor. Direct views of the mountains and ocean are not common, but the Downtown skyline is visible from several areas. Significant protected views and vistas in this landscape unit are identified in the *PUC Development Plan* (DPP 2004a) and include the following:

Panoramic Views of Natural Features and Landmarks

- Koʻolau and Waiʻanae Mountain Ranges and foothills
- Pacific Ocean, Pearl Harbor's East Loch, Ford Island, Honolulu Harbor, Keʻehi Lagoon, and Kewalo Basin
- Volcanic craters of Lēʻahi (Diamond Head), Pūowaina (Punchbowl), and Āliamanu
- From Ala Wai Canal Promenade toward the Koʻolau Mountain Range
- From Ala Moana Beach Park toward the Koʻolau Mountain Range
- From Kewalo Basin toward Punchbowl and the Koʻolau Mountain Range
- From Punchbowl Lookout toward Diamond Head

Mauka/Makai View Corridors

- Bishop Street
- Cooke Street
- Ward Avenue
- Piʻikoi Street
- Keʻeaumoku Street
- ʻĀina Moana Park (Magic Island)

4.7.3 Environmental Consequences and Mitigation

Environmental Consequences

Visual and aesthetic consequences are changes to the visual landscape and viewer response to those changes. The Project's visual consequences have been categorized as low, moderate, or high as follows:

- **Low** visual effects generally occur when transportation elements (such as roadways) are already part of the view, when the view has few or no visually sensitive resources, and when the Project would introduce few (if any) noticeable changes. Viewer groups would not likely notice a visual change or expect a scenic viewpoint. Minor changes in light and glare may occur.
- **Moderate** visual effects occur when changes to the existing view would be noticeable but not substantial and/or when visually sensitive resources would undergo a noticeable change in view. Viewer groups would be somewhat aware and sensitive to visual change. Noticeable changes in light and glare may occur.
- **High** visual effects occur when substantial changes to existing views would be made and would result in a greatly changed view and/or when visually sensitive resources would undergo a substantial change in view. Viewer groups would be sensitive to visual change because they would expect attractive views or surroundings. Substantial changes in light or glare would occur.

The potential visual effects of the Project are summarized in Table 4-10.

No Build Alternative

Under the No Build Alternative, the Project would not be built and there would be no impact to the visual and aesthetic conditions. Although the

Table 4-10 Potential Visual Effects of the Build Alternatives (continued on next page)

Viewpoint (illustrated on Figure 4-16)	Location/View Direction	Existing Visual Quality	Visual Impact	Assessment
East Kapolei to Fort Weaver Road Landscape Unit				
n/a	Views assessed are in the general context of planned development	Moderate to High	Low to Moderate	The guideway and stations would noticeably contrast with the smaller scale buildings nearby, such as the U.S. Navy housing. They would also contrast with the open, undeveloped character that is predominant in this area. However, these areas are expected to be developed or re-developed and become more urban in character in a similar timeframe as the transit improvements. As a result, the contrast would become less noticeable.
Fort Weaver Road to Aloha Stadium Landscape Unit				
1	Farrington Highway near Waikele Road, looking `Ewa	Moderate	Moderate	The guideway would not substantially affect most panoramic and distant views of the mountains and would have a limited effect on the area's scenic quality. Farrington Highway is a major transportation corridor and project elements would be in character with the surrounding area.
2	Kamehameha Highway Near Acacia Street, looking `Ewa	Moderate	Moderate	The guideway would affect mauka views by partially blocking existing distant views of the sky and mountains. The scale and height of the guideway is in character with the adjacent buildings.
3	Kamehameha Highway at Ka`ahumanu Street, looking makai	Moderate	High	The bulk and scale of the guideway and columns would be dominant features, obstructing views of the tree canopies in Neal S. Blaisdell Park and substantially changing makai views toward the park.
4	Kamehameha Highway at Kaonohi Street, looking makai	Low	Moderate	Although changes to the existing view would be noticeable, the project elements would blend with the existing visual environment. The utility lines would be less prominent against the guideway in the background.
Aloha Stadium to Kalihi Landscape Unit				
5	Aloha Stadium, looking mauka	High	Moderate	The project element would change the composition of panoramic views with the high visibility of the guideway. However, these more distant views, which include the mountains and urban skyline, take in a wider view and would not be substantially affected.
6	Salt Lake Neighborhood at Wanaka Street, looking makai	Moderate	Moderate	The guideway and columns would serve as noticeable components of the larger landscape; however, the visual effect would not be substantial. Some makai views from residences near the guideway would be obstructed.
7	Ala Liliko`i Street/Salt Lake Boulevard Intersection near the Ala Liliko`i Station Area, looking makai	Moderate	High	The Ala Liliko`i Station and guideway would be dominant elements that would substantially change views and visual character. They would also be a distinct contrast with surrounding one- and two-story buildings.
8	Kamehameha Highway near Radford Road and the Pearl Harbor Naval Base Station Area, looking makai	Low	Moderate	The Pearl Harbor Naval Base Station and guideway would dominate the linear view corridor above the highway. However, the Kamehameha Highway is a major transportation corridor and visual effects would not be substantial.
9	Ke`ehi Lagoon Park, looking Koko Head	High	Low	The guideway would be slightly more visible than the highway in the background. However, it would not noticeably conflict with the views' character.

Table 4-10 Potential Visual Effects of the Build Alternatives (continued from previous page)

Viewpoint (illustrated on Figure 4-16)	Location/View Direction	Existing Visual Quality	Visual Impact	Assessment
10	Ke`ehi Lagoon Park, looking mauka	High	Low	The guideway and columns would be prominent elements in the background of mauka views from the park, where it would extend above Waiwai Loop Road. In addition, the guideway's bulk and scale would contrast with the open character of park facilities as it traverses the perimeter of tennis courts and a ball field. Further Koko Head it would run parallel with the H-1 Highway where it would be less noticeable.
Kalihi to Ala Moana Center Landscape Unit				
11	Dillingham Boulevard at Kalihi, looking `Ewa	Low	Moderate	The bulk of the guideway and columns would be out of scale with existing buildings. However, overhead utility lines are prevalent along Dillingham Boulevard, and the project elements would not contrast substantially with the setting's character.
12	Dillingham Boulevard near Honolulu Community College and Kapālama Station Area, looking makai	Moderate	Moderate	The Kapālama Station and guideway would be dominant features in views along Dillingham Boulevard. The existing trees would soften this effect.
13	King Street Bridge and Chinatown Station Area, looking makai	Moderate	High	The Chinatown Station and guideway would be dominant features in views along Nimitz Highway. Distant makai views over Nu`uanu Stream and Honolulu Harbor would be partially blocked. The project elements would contrast substantially with Chinatown's historic character.
14	Maunakea Street, looking makai	High	Moderate	The guideway and columns would be prominent features in makai views of Honolulu Harbor, partially blocking views of the sky.
15	O`ahu Market at King Street, looking makai	High	Moderate	The guideway and columns would be prominent features in views down Kekaulike Street in Chinatown's O`ahu Market. The bulk and scale of these project elements would be out of character with the pedestrian-oriented environment created by the O`ahu Market's architecture and streetscape.
16	Nimitz Highway/Fort Street Intersection `Ewa of Irwin Park and Aloha Tower Market Place, looking Koko Head	Moderate	Moderate	The Downtown Station and guideway would be dominant features in views along Nimitz Highway. These project elements would contrast substantially with Irwin Park street trees along the highway and the nearby smaller scale office buildings.
17	Fort Street Mall at Merchant Street, looking makai	High	Low	Just visible through the trees, the guideway structure would partially block a view of the Aloha Tower. Visual effects would be more noticeable for viewers closer to Nimitz Highway.
18	Nimitz Highway near Irwin Park and Aloha Tower Market Place, looking mauka	High	Moderate	The guideway and columns would only be slightly visible beyond the trees. However, the bulk and scale of the guideway would contrast with the more pedestrian scale character of the streetscape.
19	Mother Waldron Park near Halekauwila Street/Cooke Street Intersection, looking mauka	High	High	The bulk and scale of the straddle bent guideway and columns would contrast substantially with the scale and character of Mother Waldron Park and the adjacent five-story residential building. These elements would also block makai views from upper-story residences.
20	Halekauwila Street/Cooke Street Intersection, looking `Ewa past Mother Waldron Park	Moderate	High	The bulk and scale of the straddle bent guideway and columns would contrast substantially with the scale and character of Mother Waldron Park and the adjacent five-story residential building.

projects in the ORTP would be built, their environmental impacts would be studied in separate documents.

Common to All Build Alternatives

The Build Alternatives would be set in an urban context where visual change is expected and differences in scales of structures are typical. However, some viewer groups may perceive that visual changes associated with the Project are substantial, particularly when considered at a single location. Residents living in high-rise buildings adjacent to the project alignment would experience visual changes as a result of the Project.

Visual simulations of the Build Alternatives were developed for 20 representative viewpoints that would be affected by the Project to illustrate commonly experienced visual effects. The locations of these viewpoints are shown on Figure 4-16. The simulations (Figures 4-17 through 4-36) depict the guideway and other project elements to illustrate the facilities' sizes and positions but do not include detailed design features. For stations, they show a typical prototype without design detail because station configurations and finishes have yet to be developed, and input will be considered from communities surrounding each station through the Draft EIS and design processes.

The fixed guideway and stations would be elevated structures. They would result in noticeable changes to views where project elements would be near existing views or in the foreground of these views. This change would also occur for motorists traveling on the roadways along and under the guideway. The stations would be dominant visual elements in their settings and would noticeably change views. Stations are represented by the visual simulations in Figures 4-23, 4-24, 4-26, and 4-32. Support facilities, such as traction power substations, would also noticeably change existing views. However, most would be located adjacent to roadways where utilities are already part of the view, so the change would not be dramatic or substantial.

There would be additional lighting associated with park-and-ride facilities, stations, maintenance and storage facility, and trains, which include interior and safety lighting for the stations and interior lighting and headlights on the trains. For most of the alignment, light and glare associated with the guideway and trains are not anticipated to have an effect because the guideway would generally be located in existing roadway rights-of-way, which currently produce transportation-related light and glare. Furthermore, the light intensity from trains is expected to be comparable to or less than existing buildings and vehicles along the alignment.

The shadow pattern created by the elevated stations and guideway would change throughout the day and seasonally, depending on the alignment's direction, time of day, and time of year. Shadow impacts along the alignment would vary with orientation, height of the stations and guideway, and the height of surrounding trees and local development.

Viewpoints not located near the alignment would generally be less affected by changes in the visual environment because they would take in a longer, more expansive landscape. Project elements would be noticeable but not dominant features in these views, and visual effects to significant views and vistas would be low to moderate. Passengers on trains would have enhanced views of these areas compared to passengers in vehicles, whose views are often obstructed by buildings, vehicles, and commercial signage. Public views include views along streets and highways, mauka-makai view corridors, panoramic and significant landmark views from public places, views of natural features, heritage resources and other landmarks, and view corridors between significant landmarks (ROH 1978b). The City's General Urban Design Principles and controls state that "[s]uch public

Figure 4-17 Viewpoint 1—Farrington Highway near Waikele Road, looking `Ewa

The guideway would not substantially affect most panoramic and distant views of the mountains and would have a limited effect on the area's scenic quality. Farrington Highway is a major transportation corridor and project elements would be in character with the surrounding area

Figure 4-18 Viewpoint 2—Kamehameha Highway near Acacia Street, looking `Ewa

The guideway would affect mauka views by partially blocking existing distant views of the sky and mountains. The scale and height of the guideway are in character with the adjacent buildings.

Figure 4-19 Viewpoint 3—Kamehameha Highway at Ka`ahumanu Street, looking Makai

The bulk and scale of the guideway and columns would be dominant features, obstructing views of the tree canopies in Neal S. Blaisdell Park and substantially changing makai views toward the park.

Figure 4-20 Viewpoint 4—Kamehameha Highway at Kaonohi Street, looking Makai

Although changes to the existing view would be noticeable, the project elements would blend with the existing visual environment. The utility lines would be less prominent against the guideway in the background.

Figure 4-21 Viewpoint 5—Aloha Stadium, looking Mauka

The project element would change the composition of panoramic views with the high visibility of the guideway. However, these more distant views, which include the mountains and urban skyline, take in a wider view and would not be substantially affected.

Figure 4-22 Viewpoint 6—Salt Lake Neighborhood at Wanaka Street, looking Makai

The guideway and columns would serve as noticeable components of the larger landscape; however, the visual effect would not be substantial. Some makai views from residences near the guideway would be obstructed.

Figure 4-23 Viewpoint 7—Ala Liliko`i Street/Salt Lake Boulevard Intersection near the Ala Liliko`i Station Area, looking Makai

The Ala Liliko'i Station and guideway would be dominant elements that would substantially change views and visual character. They would also be a distinct contrast with surrounding one- and two-story buildings.

Figure 4-24 Viewpoint 8—Kamehameha Highway near Radford Road and the Pearl Harbor Naval Base Station Area, looking `Ewa

The Pearl Harbor Naval Base Station and guideway would dominate the linear view corridor above the highway. However, the Kamehameha Highway is a major transportation corridor and visual effects would not be substantial.

Figure 4-25 Viewpoint 9—Ke`ehi Lagoon Park, looking Koko Head

The guideway would be slightly more visible than the highway in the background. However, it would not noticeably conflict with the view's character.

Figure 4-26 Viewpoint 10—Ke`ehi Lagoon Park, looking Mauka

The guideway would be slightly more visible than the highway in the background. However, it would not noticeably conflict with the view's character.

Figure 4-27 Viewpoint 11— Dillingham Boulevard at Kalihi, looking Mauka

The bulk of the guideway and columns would be out of scale with existing buildings. However, overhead utility lines are prevalent along Dillingham Boulevard, and the project elements would not contrast substantially with the setting's character.

Figure 4-28 Viewpoint 12—Dillingham Boulevard near Honolulu Community College and Kapālama Station Area, looking `Ewa

The Kapālama Station and guideway would be dominant features in views along Dillingham Boulevard. The existing trees would soften this effect.

Figure 4-29 Viewpoint 13—King Street Bridge and Chinatown Station Area, looking Makai

The Chinatown Station and guideway would be dominant features in views along Nimitz Highway. Distant makai views over Nu'uanu Stream and Honolulu Harbor would be partially blocked. The project elements would contrast substantially with Chinatown's historic character.

Figure 4-30 Viewpoint 14—Maunakea Street, looking Makai

The guideway and columns would be prominent features in makai views of Honolulu Harbor, partially blocking views of the sky.

Figure 4-31 Viewpoint 15—O`ahu Market at King Street, looking Makai

The guideway and columns would be prominent features in views down Kekaulike Street in Chinatown's O'ahu Market. The bulk and scale of these project elements would be out of character with the pedestrian-oriented environment created by the O'ahu Market's architecture and streetscape.

Figure 4-32 Viewpoint 16—Nimitz Highway/Fort Street Intersection `Ewa of Irwin Park and Aloha Tower Market Place, looking Koko Head

The Downtown Station and guideway would be dominant features in views along Nimitz Highway. These project elements would contrast substantially with Irwin Park street trees along the highway and the nearby smaller scale office buildings.

Figure 4-33 Viewpoint 17—Fort Street Mall at Merchant Street, looking Makai

Just visible through the trees, the guideway structure would partially block a view of the Aloha Tower. Visual effects would be more noticeable for viewers closer to Nimitz Highway.

Figure 4-34 Viewpoint 18—Nimitz Highway near Irwin Park and Aloha Tower Market Place, looking Mauka

The guideway and columns would only be slightly visible beyond the trees. However, the bulk and scale of the guideway would contrast with the more pedestrian scale character of the streetscape.

Figure 4-35 Viewpoint 19—Halekauwila Street/Cooke Street Intersection, looking Mauka past Mother Waldron Park

The bulk and scale of the straddle bent guideway and columns would contrast substantially with the scale and character of Mother Waldron Park and the adjacent five-story residential building.

Figure 4-36 Viewpoint 20—Mother Waldron Park near Halekauwila Street/Cooke Street Intersection, looking `Ewa

The bulk and scale of the straddle bent guideway and columns would contrast substantially with the scale and character of Mother Waldron Park and the adjacent five-story residential building. These elements would also block makai views from upper-story residences.

views shall be protected by appropriate building heights, setbacks, design and siting controls" and that "[t]hese controls shall be determined by the particular needs of each view and applied to public streets and to both public and private structures." The guideway and some stations would partially block mauka-makai public views from streets that intersect with the alignment.

RTD will coordinate with the City to identify the particular needs of each view; however, the Build Alternatives would introduce a new linear visual element to the corridor, and changes to some views would be unavoidable. Depending on the degree of view obstruction or blockage, some view changes would be substantial. The viewer's response to this change would vary with exposure and sensitivity and depend on the alignment orientation, guideway and station height, and height of surrounding trees and/or buildings. View changes would be less notable in wider vista or panoramic views where the project elements serve as smaller components of the larger landscape. Generally, the project elements would not be dominant features in these views.

Effects on views within three of the four landscape units would be common to all Build Alternatives. Only effects on views within the Aloha Stadium to Kalihi landscape unit would differ between the Build Alternatives. Significant views and vistas and an assessment of expected changes in visual quality for viewpoints and views along the project alignment are presented below for each landscape unit.

The Project would provide users with expansive views from several portions of the corridor by elevating riders above highway traffic, street trees, and low structures adjacent to the alignment.

East Kapolei to Fort Weaver Road Landscape Unit

The surrounding visual environment consists mostly of scattered residential development and open agricultural land. The area is planned for future development, which would substantially alter the visual environment independent of the Project. The Build Alternatives would change the visual environment in this area, but these changes are expected to occur in a similar time frame as the planned development.

The potential for the guideway and stations to block mauka-makai views and vistas of features and landmarks would vary throughout this landscape unit. Viewpoints that are not close to the alignment would generally be less sensitive to changes in the visual environment because they take in a longer, more expansive landscape. Several mauka views of na puʻu are designated significant views under the ʻEwa Development Plan. Project elements would not likely be dominant features in these views or the following significant protected views and vistas, and visual effects would be low:

- Views of the Waiʻanae Mountain Range
- Distant vistas of the shoreline
- Views of Central Honolulu and Diamond Head

The guideway would introduce an elevated linear structure and urban elements (e.g., transit stations, park-and-ride lots, traction power substations, and a possible maintenance and storage facility) to what is currently an open, rural, and country-like setting. The guideway would range from 30 to 45 feet in height. The top of the stations with a mezzanine would be about 15 feet higher than the guideway where it enters the station. The guideway and stations would noticeably contrast with the smaller scale buildings nearby, such as the U.S. Navy housing. They would also contrast with the open, undeveloped character that is predominant in this area. However, these areas are expected to be developed or re-developed and become more urban in character in a similar time frame as the transit improvements. As a result, the contrast would become less noticeable.

Panoramas and distant views of the shoreline, Downtown, and Diamond Head would change to

include views of the guideway, support columns, and stations. However, panoramic views take in a wider, more expansive landscape and are usually less sensitive to change. Generally, the project elements would not be dominant features in these views. However, large open-paved surfaces would be noticeable at the proposed East Kapolei and UH West O'ahu park-and-ride lots. Views of the 'Ewa Plain from the elevated trains and stations would be enhanced. Overall visual effects, including the viewer response to change, would be moderate.

Fort Weaver Road to Aloha Stadium Landscape Unit

Farrington Highway is a major transportation corridor through this area. The West Loch Station and respective transit center would blend well with the bulk and scale of the Waipahu Town Center's densely developed commercial character. However, the guideway and columns along the alignment would be prominent visual features due in part to the long, straight view down the Farrington Highway and because the guideway's height of about 40 feet would be greater than many of the one- and two-story surrounding buildings.

Although the guideway at 30 to 45 feet in height would obstruct some makai and mauka views across the highway, panoramic views near the alignment and from the Waipahu Cultural Garden Park, Hawai'i's Plantation Village, and Waipahu District Park comprise a wider panoramic scene and, therefore, would not be substantially affected. Mature trees in the Farrington Highway median would be removed to accommodate the guideway, reducing the visual interest and memorability of views. Visual effects in this area would range from moderate to high.

The Waipahu Transit Center Station would be farther Koko Head along the alignment. Similar to the West Loch Station, it would blend well with the bulk and scale of the commercial setting that has developed around this section of the Farrington Highway corridor. As the guideway continues Koko Head toward Leeward Community College, it would be a more dominant feature and dramatically contrast with the suburban residential character makai and mauka of the highway. The mass and height of the guideway and columns would block some residents' views over Middle Loch to Pearl Harbor. However, many views in this area comprise a wider panoramic scene and, therefore, would not be substantially affected. Visual effects in this area would range from moderate to high.

The guideway would shift makai of Farrington Highway at Waipahu High School, which is near the site of a potential maintenance and storage facility. This area is a flat knoll makai of the H-1 Freeway/Farrington Highway Interchange. The Leeward Community College Station would be adjacent to a parking lot on the college campus and would be at ground level. The potential maintenance and storage facility would be makai of the interchange. These project elements would be highly visible from low-lying areas mauka of the interchange and from residences on the foothills above. However, most views in these areas comprise a wider panoramic scene and, therefore, would not be substantially affected. Visual effects in this area would range from low to moderate.

The guideway would cross over the H-1 Freeway Interchange and merge with Kamehameha Highway at Pearl City. The Pearl Highlands Station and park-and-ride structure would be 'Ewa of the Pearlridge Center and would blend well with the bulk and scale of its commercial character. However, these project elements would be highly visible and dominant features. The guideway would pass by Pacheco Neighborhood Park at Waimano Home Road, where nearby residents mauka and makai of the guideway would experience noticeable changes in their view. Makai views of East Loch and Pearl Harbor from the park and residences near the mauka side of the Waimano Home Road and Kamehameha Highway Intersection would include the guideway and columns,

and some views beyond the intersection would be blocked. Visual effects would range from low in the area around the H-1 Freeway Interchange to moderate in the rest of this area.

Koko Head of Puʻu Poni Street, the guideway would cross over the H-1 Freeway and continue above the Kamehameha Highway median to the vicinity of Aloha Stadium. The H-1 Freeway cross-over would be a dominant feature, visible at great distance. However, this change would be in context with the freeway setting and likely would not be perceived as substantial. Farther Koko Head, the guideway would continue above the Kamehameha Highway median through residential neighborhoods and mauka of Neal S. Blaisdell Park before crossing over Waimalu Stream. The bulk and scale of the guideway and columns would substantially change mauka and makai views from residences, such as panoramic views through the park toward Pearl Harbor and Downtown. Panoramic views would be less sensitive to change because they take in a wider, more expansive landscape. Visual effects would range from moderate to high in this area.

Continuing to the Pearlridge Station and Transit Center, three historic sites, including Sumida Farm, would be mauka of the guideway and station. The elevated station of about 40 feet above Kamehameha Highway would be a noticeable change, altering views and contrasting with the scale of these resources and the surrounding environment. Some ʻEwa and makai views of the skyline from the Sumida Farm would be blocked by the guideway. However, because it is at a much lower elevation than the highway, these views are already somewhat confined by the surrounding embankments. Overall visual effects near the station would be moderate because the project elements would blend with the surrounding commercial character, which is a heavily used transportation corridor with one- and two-story businesses and warehouses.

From residences on the hillside above Pearlridge, Kamehameha Highway is already a prominent feature in makai views toward the ʻEwa Plain, East Loch, and Downtown. However, the guideway would be a noticeable change. These project elements would also change panoramic views over the ʻAiea Bay State Recreation Area where the guideway would be about 30 feet above the Kamehameha Highway and Honomanu Street Intersection. Most scenic views from the recreation area are makai and would not be affected. Overall visual effects from Pearlridge to the Aloha Stadium area would range from moderate to high.

Throughout this landscape unit, the potential for the guideway and stations to block protected mauka-makai views and vistas of the following features and landmarks would vary:

- Views of Pearl Harbor and Lochs framed by the ocean
- Views of the Central Oʻahu valleys and plains
- Views of the Waiʻanae and Koʻolau Mountain Ranges
- Views of West Loch
- Views of the Oʻahu Sugar Mill and Hawaiʻi's Plantation Village

Viewpoints 1 through 4 illustrate views of the Project within this landscape unit (Figures 4-17 through 4-20). Viewpoints that are not close to the alignment would generally be less sensitive to changes in the visual environment because they would take in a longer, more expansive landscape. The project elements would be noticeable, but not dominant, features in these views, and visual effects to significant protected views and vistas would range from moderate to high, depending on the viewer's position and location.

Aloha Stadium to Kalihi Landscape Unit

The unique consequences of each Build Alternative on this landscape unit are discussed individually later in this section.

Kalihi to Ala Moana Center Landscape Unit

From Kalihi Koko Head, the guideway would follow Dillingham Boulevard to the vicinity of Kaʻaahi Street. The canopies of several mature trees along Dillingham Boulevard would be trimmed to accommodate the guideway and additional trees would be removed at the Kapālama and Iwilei station areas. The guideway and columns would be prominent visual features due in part to the long, straight view down the boulevard and because the guideway's height of about 40 feet above Dillingham Boulevard would be slightly greater than many of the one- and two-story surrounding buildings. Mauka and makai views would be obstructed from various points. Makai-view obstructions would be greatest from residences on the mauka side of Dillingham Boulevard. Overall visual effects in this area would be moderate.

The guideway could come within 10 feet of some facades along Dillingham Boulevard, depending on the setback, and would block views from the upper stories of mixed-use buildings Koko Head of Kalihi Street. The upper-story residences along Dillingham Boulevard would be affected by light and glare from trains traveling on the guideway and from station lighting. Due to the close proximity of the guideway and Kalihi and Kapālama Stations, the visual setting of several nearby historic sites would change and views of their facades would be partially obscured. The visual effects on these resources are expected to be high.

As the guideway turns farther Koko Head to connect to Nimitz Highway near Iwilei Road, it would blend with the bulk and scale of the surrounding one- and two-story commercial buildings, including light industrial warehouses and distribution centers. The Iwilei Station would be a noticeable visual change, and some views of building facades would be blocked. However, many viewers would not notice a blockage of views since the surrounding land is used mostly for light industry and offices or is under used. Visual effects in this area would be moderate.

The alignment would follow Nimitz Highway Koko Head to Halekauwila Street. This area of Downtown includes several historic districts and other sensitive visual resources, including view corridors. Although the Chinatown Station would generally be centered approximately 30 feet above Nimitz Highway, it would be a dominant visual element, contrasting in scale with the pedestrian environment and substantially changing makai views of Honolulu Harbor. However, the Downtown Station would not block views of Honolulu Harbor. The guideway and columns would reduce the open character of the streetscape, create shade and shadows, and block portions of makai views along the following perpendicular streets: Kekaulike, Maunakea, Nuʻuanu, Bethel, Fort, Bishop, and Richards. Views from the fourth- and fifth-story windows of adjacent offices and residences would also be blocked. In addition, trains traveling on the guideway would create light and glare, and the Chinatown and Downtown Stations would increase this effect. The addition of the guideway and columns would change the visual character of the streetscape and substantially affect the visual setting of the Dillingham Transportation Building and Irwin Park. Overall visual effects in this area would be high.

The alignment would leave Downtown Koko Head along Halekauwila Street where it would begin on the makai side of the street and transition to the center near Punchbowl Street. The canopies of several mature monkeypod trees along Halekauwila Street would be trimmed. The guideway and columns would also block views from the fourth- and fifth-story windows of adjacent offices and residences and create additional shade and shadows. Trains traveling on the guideway would increase light and glare at upper-story residences. Overall visual effects in this area would be high.

The Civic Center Station area is currently in transition from scattered one- and two-story businesses to higher-density taller structures. The guideway and columns would block views from the fourth- and fifth-story windows of adjacent offices and residences and create additional shade and shadows. Trains traveling on the guideway would increase light and glare. Mother Waldron Park is Koko Head at Cooke Street. The proposed station would substantially change views and contrast with the scale and character of the surrounding environment. Overall visual effects would be high.

Past Ward Avenue and the Kakaʻako Station, the alignment would transition to Queen Street. Property on the mauka side of Waimanu Street would be acquired to allow the alignment to cross over to Kona Street. No visually sensitive resources are in this area. Kakaʻako Station would be noticeable, but it would blend with the character of nearby big-box stores and smaller industrial use buildings. Visual effects would be moderate.

The guideway would run above Kona Street through Ala Moana Center. Mature trees would be removed from Piʻikoi Street through the Ala Moana Center Station area, substantially changing the character of the streetscape. With the exception of the mature trees near Piʻikoi Street, visually sensitive resources would not be affected, and most views of the mountains, Koko Head, and skyline would not be blocked. The Ala Moana Center Station would be at the end of the Project. The station and the guideway would be located between the Ala Moana Center and mid- to high-rise buildings and would not change the view from adjacent offices and residences.

Throughout this landscape unit, the potential would vary for the guideway and stations to block protected mauka-makai views of the following features and landmarks that are identified in policy documents:

- Koʻolau and Waiʻanae Mountain Ranges and foothills
- Pacific Ocean, Pearl Harbor's East Loch, Ford Island, Honolulu Harbor, Keʻehi Lagoon, and Kewalo Basin
- Volcanic craters of Lēʻahi (Diamond Head), Pūowaina (Punchbowl), and Āliamanu
- From Ala Moana Beach Park toward the Koʻolau Mountain Range
- From Kewalo Basin toward Punchbowl and the Koʻolau Mountain Range

Viewpoints that are not close to the alignment would generally be less sensitive to changes in the visual environment because they would take in a longer, more expansive landscape. The project elements would be noticeable, but not dominant, features in these views, and visual effects to significant protected views and vistas would range from moderate to high depending on the viewer's position and location.

The Project would cross, but not block, views along the following protected mauka-to-makai street view corridors:

- Bishop Street—the guideway and columns would be dominant elements in makai views between Nimitz Highway and Queen Street, and views of the horizon would be partially blocked. The bulk and scale of the guideway and columns would be compatible with Nimitz Highway, which functions as a major transportation corridor. Mauka of Queen Street, these elements would likely appear less dominant because the vista would take in a longer view and be more expansive.
- Cooke Street—the guideway and columns would be dominant elements in mauka-makai views, respectively, between Pohukaina Street and Queen Street. Views of the horizon would be partially blocked from viewpoints near the alignment, including mauka views from the park at Halekauwila Street and Cooke Street. The bulk and scale

of the guideway and columns would conflict with the pedestrian-oriented streetscape.

- Ward Avenue—the guideway and columns would be dominant elements in mauka-makai views, respectively, between Auahi Street and Queen Street. Views of the horizon would be partially blocked from viewpoints near the alignment. The bulk and scale of the guideway and columns would conflict with the pedestrian-oriented streetscape. For mauka views from Ala Moana Boulevard and makai views mauka of Queen Street, these elements would likely appear less dominant because the vista would take in a longer view and be more expansive.
- Piʻikoi Street—the guideway and columns would be dominant elements in mauka-makai views, respectively, between Waimanu Street and Kapiʻolani Boulevard. Views of the horizon would be partially blocked from viewpoints near the alignment. Although the bulk and scale of the guideway and columns would conflict with the pedestrian-oriented streetscape, the view includes rows of mature trees, which would reduce this effect.
- Keʻeaumoku Street—the guideway and columns would run along the mauka side of Ala Moana Center and blend with the bulk and scale of its three and four-story buildings. The Koko Head end of the station would also be visible. Mauka views from upper stories of the shopping center would be partially blocked by the guideway. The guideway and columns would be a noticeable change in makai views from Kapiʻolani Boulevard.
- Aina Moana Park (Magic Island)— the guideway would be noticeable behind Ala Moana Center in mauka views from Magic Island. However, the contrast in bulk and scale would be low because the overall view is dominated by tall buildings and the parking garage.

Viewpoints 12 through 20 illustrate views of the Project within this landscape unit (Figures 4-28 through 4-36).

Salt Lake Alternative

The Salt Lake Boulevard alignment would leave Kamehameha Highway just ʻEwa of Aloha Stadium, cross the Aloha Stadium parking lot, and continue Koko Head along Salt Lake Boulevard. Aloha Stadium is at a major freeway interchange and is surrounded by parking lots where transportation elements are already part of the view. The contrast in scale and character of the guideway and columns with the existing environment would be low. As the guideway continues Koko Head to the Aloha Stadium Station, the contrast with the makai residential neighborhood at Kalaloa Street would be more noticeable and some mauka views would be obstructed by the station, guideway, and columns. The proposed park-and ride lots nearby are not expected to result in a substantial change because large parking lots are already prevalent. Visual effects in this area are expected to be moderate.

As the guideway crosses over the H-1 Freeway and beyond Maluna Street, it would continue 30 to 40 feet above Salt Lake Boulevard. This area is a mix of one- and two-story residences mauka and taller buildings that comprise industrial parks and schools makai. The bulk and scale of the guideway, columns, and station would contrast with this character. In addition, the guideway, with a height of about 40 feet above the roadway, would be noticeable elements that would obstruct some views across Salt Lake Boulevard. Residents whose homes are adjacent to Salt Lake Boulevard would be the most sensitive to the visual change. However, many of the residences on the hillside above the boulevard have panoramic views where the project elements would serve as smaller components of the larger landscape in a wider vista. Visual effects in this area are expected to be moderate.

The guideway would shift to the makai side of Salt Lake Boulevard as it continues to the Ala Liliko'i Station. This area is comprised primarily of one- and two-story residences mauka with more open space, larger multi-story apartments, condominiums, and military housing makai. Mature trees would be removed at several locations to accommodate the guideway, which would vary from about 20 to 40 feet above the roadway. The guideway and columns would be a distinct contrast with single-story homes. View obstructions would be greatest from the residential neighborhood mauka of the boulevard where the guideway would block some views makai across the boulevard. However, as with other residential neighborhoods in this area, many of the residences on the hillside above the boulevard have panoramic views where the project elements would serve as smaller components of the larger landscape in a wider vista.

The Ala Liliko'i Station, at about 60 feet above the Salt Lake Boulevard and Ala Liliko'i intersection, would be a substantial change and a dominant element. It would also contrast with the two-story and taller residential character established by the surrounding apartments, military housing, and neighborhood shopping center. Views from upper-story windows of some multi-story residences would be obstructed by the station. These upper story residences would also be affected by light and glare from trains traveling on the guideway and from station lighting. Visual effects in this area are expected to range from moderate along the alignment to high in the station area Koko Head from the Ala Liliko'i Station to Pu'uloa Road, where the guideway would generally be above the median of Salt Lake Boulevard. Businesses and multi-story apartments and condominiums are mauka of the boulevard, with military family housing makai. Views from some fourth- and fifth-floor windows would be obstructed by the guideway and columns. View obstructions would be greatest mauka of Peltier Avenue. However, the guideway would be similar in scale to the surrounding multi-story buildings. Visual effects in this area are expected to be moderate to high.

The guideway would continue Koko Head through the Servco Māpunapuna Plaza and industrial park. Visual effects from the guideway and columns would be low in this area because it contains primarily automobile-oriented businesses and high volumes of traffic. However, the guideway and columns would be adjacent to Moanalua Stream where they would be dominant elements in views along the steam and from the park Koko Head. Mature trees along the stream would be trimmed or removed. The open, natural character of the stream bank and park would change substantially with the contrasting bulk and scale of the guideway, which would be on both sides of the stream. The most substantial changes would be along Moanalua Stream, and visual effects in this area are expected to range from moderate to high.

From Moanalua Stream, the guideway would cross over the H-1 Freeway interchange to the Middle Street Transit Center. The guideway over the H-1 Freeway and the Middle Street Transit Center would be dominant elements, visible at a great distance. However, they would fit with the large scale of the interchange and the surrounding developed urban character of the mostly industrial and commercial uses. Views of Honolulu Harbor from the park are already obstructed by the interchange and would not be substantially affected by the Project. Visual effects in this area are expected to be moderate.

The potential for the guideway and stations to block protected mauka-makai views and vistas of the following features and landmarks would vary throughout the Aloha Stadium to Kalihi landscape unit:

- Views of Pearl Harbor and Lochs framed by the Wai'anae Mountain Range
- Views of Diamond Head and Honolulu valleys

- Views of Punchbowl Crater
- Views of Āliamanu Crater and Central Oʻahu valleys

Viewpoints that are not close to the alignment would generally be less sensitive to changes in the visual environment because they would take in a longer, more expansive landscape. The project elements would be noticeable, but not dominant, features in these views, and visual effects to significant protected views and vistas would range from moderate to high depending on the viewer's position and location.

Viewpoints 5 through 8 illustrate views of the Project within this landscape unit (Figures 4-21 through 4-24).

Airport Alternative

The Airport alignment would continue Koko Head of the Kamehameha Highway makai past Aloha Stadium and over Hālawa Stream. Aloha Stadium is at a major freeway interchange and surrounded by parking lots. Views of East Loch and the Pearl Harbor historic sites from residences near Kohomua Street would be obstructed by the guideway and columns. Hālawa Bridge is a historic site, and its appearance would be substantially changed to accommodate the guideway and support columns. The contrast in the scale and character of the guideway, columns, station, and park-and-ride lot with the existing environment would be a noticeable change. Visual effects in this area are expected to range from moderate to high.

Between Hālawa Stream and the H-1 Freeway Intersection, the guideway would be above the Kamehameha Highway median. Six historic sites, including the Makalapa U.S. Navy housing and other U.S. Navy facilities, lie along this section of the alignment. The visual effects on these resources are expected to be moderate. Although ʻEwa views of Pearl Harbor from the U.S. Navy housing would change, the project elements would fit within the context of the highway as a transportation corridor, so overall visual effects would be moderate.

The Pearl Harbor Naval Base Station would fit with the scale and character of commercial development at the intersection of the Kamehameha Highway and Radford Drive. However, the guideway and columns would be noticeable changes in the visual environment makai of the H-1 Freeway as it intersects with Nimitz Highway. This area is a major interchange that includes wide paved areas and several elevated ramps. Visual effects would vary from low to moderate.

Project elements, including the Honolulu International Airport Station and Lagoon Drive Station, would fit with the bulk and scale of other structures in the vicinity of the airport, which is surrounded by other transportation elements and industrial buildings. Although the guideway and columns would reduce the open character of parking lots and the streetscape, and mature trees would be removed makai of the H-1 Freeway and ʻEwa of the Honolulu International Airport Station, the overall visual effect would be low.

The guideway would connect with Kamehameha Highway and the Middle Street Transit Center after passing over a portion of Keʻehi Lagoon Park and Nimitz Highway. The open spatial quality of the park would be altered by the guideway and columns. This change would be noticeable but not substantial to park users because the alignment would be along the periphery of the park and closely follow Nimitz Highway and the H-1 Freeway. Views of Honolulu Harbor and the park are already obstructed by the interchange and would not be substantially affected by the Project. Although the Middle Street Transit Center would be a dominant element, it would fit with the large scale of the interchange and the surrounding developed urban character of the mostly industrial

and commercial uses. The overall visual effects would be moderate.

The potential for the guideway and stations to block protected mauka-makai views and vistas of the following features and landmarks would vary throughout the Aloha Stadium to Kalihi landscape unit:

- Views of Pearl Harbor and Lochs framed by the Waiʻanae Mountain Range
- Views of Diamond Head and Honolulu valleys
- Views of Punchbowl Crater
- Views of Āliamanu Crater and Central Oʻahu valleys

Viewpoints 9 through 11 illustrate views of the Project within this landscape unit (Figures 4-25 through 4-27).

Viewpoints that are not close to the alignment would generally be less sensitive to changes in the visual environment because they would take in a longer, more expansive landscape. The project elements would be noticeable, but not dominant, features in these views, and visual effects to significant protected views and vistas would range from moderate to high depending on the viewer's position and location.

Airport & Salt Lake Alternative

Visual effects of the Airport & Salt Lake Alternative would include all the effects described previously for these individual alternatives. An exception would be the Arizona Memorial Station, which would only be included for this alternative. This station would create a moderate visual effect on views of East Loch and Pearl Harbor historic sites.

Mitigation

Mitigation measures will focus on preserving visual resources and enhancing the project design to comply with applicable policies. The following measures would be included with the Project to minimize negative visual effects and enhance the visual and aesthetic opportunities that it creates:

- Develop and apply design guidelines that would establish a consistent design framework for the Project with consideration of local context
- Retain existing trees where practical and provide new vegetation
- Shield exterior lighting
- Coordinate the project design with City TOD planning and DPP
- RTD will consult with the communities surrounding each station for input on station design elements.

4.8 Air Quality

This section evaluates the quantity of air pollutant emissions that would occur with each of the project alternatives. *Air pollution* is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. *Air quality* describes the amount of pollution in the air. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, or reducing human or animal health. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Air Quality and Energy Technical Report* (RTD 2008g).

4.8.1 Background and Methodology

Regulatory Requirements

The Clean Air Act Amendments of 1990 (40 CFR 51) and the Final Transportation Conformity Rule (40 CFR 93) direct the EPA to implement environmental policies and regulations that will ensure acceptable air quality levels.

As required by the Clean Air Act, National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants. Known as *criteria pollutants*, these are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2) and lead (Pb). The State of Hawai'i has also established ambient air quality standards that are either the same or more stringent than the corresponding Federal standards. State and Federal standards are summarized in Table 4-11.

In addition to the criteria pollutants addressed in the NAAQS, the EPA regulates air toxics. Toxic air pollutants are those known or suspected to cause cancer or other serious health effects. In 2001, the EPA identified 21 Mobile Source Air Toxics (MSAT) and highlighted 6 as priority MSATs.

In February 2007, the EPA finalized the *Control of Hazardous Air Pollutants from Mobile Sources* (EPA 2007) rule to reduce hazardous air pollutants from mobile sources. This rule limits gasoline's benzene content and reduces toxic emissions from passenger vehicles and gas cans.

Table 4-11 National and State Ambient Air Quality Standards

Pollutant	Standards	
	Hawai`i State Standard	Federal Primary Standard (Health)
Carbon Monoxide (CO)		
1 hour	9 ppm	35 ppm
8 hour	4.5 ppm	9 ppm
Nitrogen Dioxide (NO_2)		
Annual (arithmetic)	0.04 ppm	0.05 ppm
PM_{10}		
24 hour	150 µg/m^3	150 µg/m^3
Annual (arithmetic)	50 µg/m^3	Revoked
$PM_{2.5}$		
24 hour	No standard	35 µg/m^3
Annual (arithmetic)	No standard	15 µg/m^3
Ozone (O_3)		
8 hour	0.08 ppm	0.08 ppm
Sulfur Dioxide (SO_2)		
3 hour	0.5 ppm	No standard
24 hour	0.14 ppm	0.14 ppm
Annual (arithmetic)	0.03 ppm	0.03 ppm
Lead (Pb)		
3 months (arithmetic)	1.5 µg/m^3	1.5 µg/m^3

µg/m^3 = micrograms per cubic meter

ppm = parts per million

Sources: State of Hawai'i, Department of Health, Clean Air Branch—Hawai'i Administrative Rules, Chapter 59 Code of Federal Regulations, Title 40, Part 50, Accessed: December 10, 2007. EPA, National Ambient Air Quality Standards.

Methodology

Air quality effects predicted to result from the Project's operation are based on the anticipated vehicle miles traveled (VMT) and average network speed for each alternative. A regional mobile source pollutant burdens analysis was completed. It was based on link-by-link VMT and speed for each of the Build Alternatives and compared to the No

Build Alternative. VMT and the associated traffic simulation network speeds were used.

Emissions factors were obtained through the EPA's mobile source emission model, MOBILE6.2, in accordance with Hawai'i Department of Health Clean Air Branch's recommendation. This analysis compares regional pollutant burdens (the total quantity of each pollutant released in the region) for each alternative. Changes in regional emission levels were estimated to describe the potential effect the alternatives may have on regional air quality.

In 2006, the USDOT issued Interim Guidance regarding MSAT analysis in NEPA documentation. This guidance includes a three-tiered approach to determining potential project-induced MSAT impacts, depending on the nature of the project. A qualitative analysis of MSAT effects was completed.

4.8.2 Affected Environment

Relevant Pollutants

The Project would affect travel patterns within the study area, so pollutants that can be traced principally to motor vehicles are relevant in evaluating project consequences. These pollutants include CO, volatile organic compounds (VOC), nitrogen oxides (NO_x), PM_{10} and $PM_{2.5}$, and MSATs.

Air pollutant levels in Hawai'i are monitored by a network of sampling stations operated under the supervision of the State of Hawai'i Department of Health (HDOH) at various locations around O'ahu. The only NAAQS for which pollution levels have been measured greater than the standard since 2004 is $PM_{2.5}$. $PM_{2.5}$ concentrations exceeded the 24-hour standard on four occasions in Pearl City in 2004 as a result of fireworks.

Regional Compliance with the Standards

Section 107 of the 1977 Clean Air Act Amendments requires the EPA to publish a list of all geographic areas that are in compliance with the NAAQS and areas that do not attain the NAAQS. Areas not in compliance are called nonattainment areas. Areas for which insufficient data is available to make a determination are unclassified and treated as being in compliance (attainment areas) until proven otherwise. Designation of an area is made on a pollutant-by-pollutant basis.

The entire State of Hawai'i is designated as an attainment area for CO, O_3, PM_{10}, and $PM_{2.5}$. This means that the State is in compliance with the NAAQS for these pollutants.

Projects included in Hawai'i's regional transportation network are found in the Transportation Improvement Plan. The Honolulu High-Capacity Transit Corridor Project is listed in the area's Transportation Improvement Plan and complies with the goals set forth in the Statewide Transportation Plan.

4.8.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

The No Build Alternative provides a baseline to which the Build Alternatives are compared. Under this alternative, the Project would not be built. It is predicted that 6,854 kilograms (kg) of VOCs, 147,464 kg of CO, 4,842 kg of NO_x, 375 kg of PM_{10}, and 174 kg of $PM_{2.5}$ would be generated daily by transportation sources within the study area in 2030, including other projects in the ORTP.

Regional Analysis

It is anticipated that the Project would reduce regional pollutant emissions by between 3.2 to 4.0 percent (varying by Build Alternative) compared to the No Build Alternative (Table 4-12). Table 4-12 shows the results of the analysis of VOC, CO, NO_x, PM_{10}, and $PM_{2.5}$ for each of the Build Alternatives compared to the No Build Alternative. If the electricity used to operate any one of the Build Alternatives is generated by combustion, this

Table 4-12 2030 Regional Pollutant Burdens (kg/day)

Alternative	Emission Burden (kg/day)					Percent Change from No Build				
	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$
No Build	6,854	147,464	4,842	375	174	n/a	n/a	n/a	n/a	n/a
Salt Lake	6,585	142,616	4,678	361	168	-3.9%	-3.3%	-3.4%	-3.7%	-3.4%
Airport	6,580	142,500	4,674	361	167	-4.0%	-3.4%	-3.5%	-3.7%	-4.0%
Airport & Salt Lake	6,588	142,694	4,680	362	168	-3.9%	-3.2%	-3.3%	-3.5%	-3.4%

n/a = not applicable

may produce additional emissions. However, these emissions would be offset in whole or part by the reductions generated by reduced VMT. Furthermore, power plant emissions may be much more easily controlled than emissions from individual automobiles.

The Build Alternatives are expected to have a small positive effect on MSAT emissions in the study area, compared to the No Build Alternative because of the reduction of VMT. In comparing the Build Alternatives, MSAT levels could be higher in some locations than others, but current tools and science are not adequate to quantify these levels. However, for all the Build Alternatives, EPA's vehicle and fuel regulations coupled with fleet turnover will result in lower region-wide MSAT levels from current levels.

Salt Lake Alternative

With the Salt Lake Alternative, the Project is predicted to demonstrate a 4-percent reduction in VMT and no change in overall network speed compared to the No Build Alternative. This would result in predicted pollution reductions ranging from 3.3 to 3.9 percent compared to the No Build Alternative.

Airport Alternative

With the Airport Alternative, the Project is predicted to demonstrate a 4-percent reduction in VMT and no change in overall network speed compared to the No Build Alternative. This would result in predicted pollution reductions ranging from 3.4 to 4.0 percent compared to the No Build Alternative.

Airport & Salt Lake Alternative

With the Airport & Salt Lake Alternative, the Project is predicted to demonstrate a 4-percent reduction in VMT and no change in overall network speed compared to the No Build Alternative. This would result in predicted pollution reductions ranging from 3.2 to 3.9 percent compared to the No Build Alternative.

Local Effects

The study area is currently in attainment for CO, and monitored CO values are less than 20 percent of the applicable NAAQS. Therefore, no violations of the applicable NAAQS are likely to occur with the Project. As a result, microscale CO analysis was not conducted.

Mitigation

Because no substantial air quality impacts are anticipated to result from operation of any of the project alternatives, mitigation would not be required. Any measures to reduce automobile travel would reduce air pollutant emissions.

4.9 Noise and Vibration

This section describes the Project's effects on environmental noise and vibration levels in the study corridor. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Noise and Vibration Technical Report* (RTD 2008f).

4.9.1 Background and Methodology

Background

Environmental noise is composed of many frequencies, each occurring simultaneously at its own sound pressure level. The range of magnitude, from the faintest to the loudest sound the ear can hear, is so large that sound pressure is expressed on a logarithmic scale in units called decibels (dB). The commonly used frequency weighting for environmental noise is A-weighting (dBA), which simulates how an average person hears sound.

A common noise descriptor for environmental noise is the equivalent sound level (Leq). Leq is a measure of total noise—a summation of all sounds during a period of time. Leq measured over a one-hour period is the hourly Leq [Leq(h)]. The day/night noise level (Ldn) is a descriptor of the daily noise environment, which incorporates a penalty for high noise levels at night. Lmax is the maximum noise level from an event.

Typical sound levels experienced in urban environments are shown in Figure 4-37.

Noise from rail transit operations is generated from the interaction of wheels on track, motive power, and the operation of traction power substations. The interaction of steel wheels on rails generates the following three different types of noise, depending on track work: (1) noise generated by pass-by trains operating on tangent track sections, (2) noise generated from wheel squeal on tightly curved track, and (3) noise generated on special trackway sections, such as at crossovers or turnouts.

Noise Terminology

dBA is an A-weighted decibel, a measure that considers how people hear sound

Lmax is the maximum noise level during an event

Leq measures the average sound energy over time

Ldn is the day/night sound level, a 24-hour average with a penalty that makes sounds at night more important

Noise Criteria for the Project

Noise impacts from transit projects are evaluated using criteria established by the FTA, which are based on community reaction to environmental noise exposure (FTA 2006a). The FTA noise impact

Relative Sound Level	½ as loud			Baseline			Twice as loud		Four times as loud
Typical Sound Environment	Indoor Office			Urban Residential			Urban Commercial		
Lmax of Common Noise Sources		Washing Machine (3 ft)	Auto (50 mph at 50 ft)	Vacuum Cleaner (3 ft)		Garbage Disposal (3 ft)	Delivery Truck (50 mph at 50 ft)	Dump Truck (50 mph at 50 ft)	Blender (3 ft)
Sound Level dBA	60	65	70	75	80		85		90
Lmax at 50 ft of Transit Noise Source			Rail Transit with a Barrier (50 mph)		Rail Transit (50 mph)	City Bus (50 mph)			

Source: EPA 1971, EPA 1974, FTA 2006

Figure 4-37 Typical Sound Levels

Table 4-13 FTA Transit Noise Impact Criteria—Land Use Categories

Category	Metric	Land Use Description
1	Leq(h) (dBA)	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, land uses such as outdoor amphitheaters and concert pavilions, and National Historic Landmarks with substantial outdoor use.
2	Ldn (dBA)	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Leq(h) (dBA)	Institutional land uses with primary daytime and evening use. This category includes schools, libraries, and churches where it is important to consider interference with such activities as speech, meditation, and concentration on reading material. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios, and concert halls, fall into this category. It also includes places for meditation or study associated with cemeteries, monuments, and museums. Certain historical sites, parks, and recreational facilities are also included.

Source: FTA 2006a.

criteria group noise-sensitive land uses into the categories shown in Table 4-13.

The FTA criteria define moderate and severe impacts. The project-generated noise level (project noise exposure) at which an impact would occur depends on the existing noise environment and the category of land use. The noise impact criteria for transit operations are shown on Figure 4-38. Reading from the graph, if the existing noise level in a residential area is 60 dBA Ldn, then a project that generates less than 58 dBA Ldn would not have an effect. If it generates between 58 and 63 dBA Ldn, it would cause a moderate impact, and if it generates more than 63 dBA Ldn, it would cause a severe impact. Future noise exposure is the combination of existing noise exposure and the additional noise exposure caused by a project.

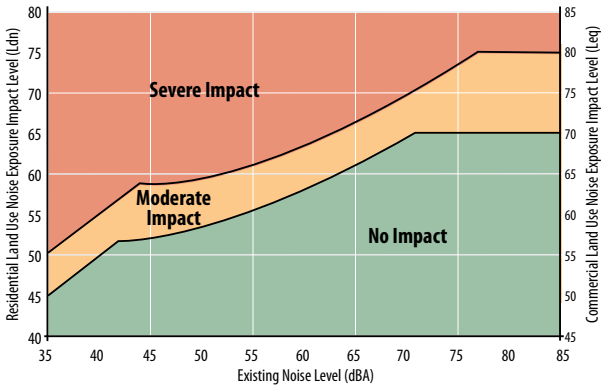

Figure 4-38 FTA Transit Project Noise Exposure Impact Criteria

Severe noise impacts are considered significant within the context of NEPA and HRS 343. Severe noise impacts require the evaluation of alternative locations/alignments to avoid severe impacts altogether. If it is not practical to avoid severe impacts by changing the location of the Project, mitigation measures must be considered and incorporated into the Project unless there are truly extenuating circumstances that prevent it. Moderate noise impacts also require consideration and adoption of mitigation measures when it is reasonable. The mitigation of moderate impacts should consider the predicted increase over existing noise levels, the type and number of noise-sensitive land uses affected, existing outdoor/indoor sound insulation, community views, special protection provided by law, and the cost-effectiveness of mitigating noise to more acceptable levels.

The State of Hawai‘i regulates community noise pollution through HAR 11-16. The regulations are applicable to stationary noise sources, such as traction power substations and the vehicle maintenance and storage facility.

Vibration Criteria for the Project

Vibration effects from transit operations are generated by motions/actions at the wheel/rail interface. The smoothness of these motions/actions

are influenced by wheel and rail roughness, transit vehicle suspension, train speed, track construction (including types of fixation and ballast), location of switches and crossovers, and the geologic strata (layers of rock and soil) underlying the track. Vibration from a passing train has the potential to move through the geologic strata, resulting in vibration transferred through the building foundation. The principal concern is annoyance to building occupants.

Ground-borne vibration is usually characterized in terms of vibration velocity. This is because—over the frequency range relevant to ground-borne vibration (about 1 to 200 hertz)—both human and building response tends to be more proportional to velocity than to displacement or acceleration. Vibration velocity is often reported as vibration decibels (VdB) relative to a reference velocity of 10^{-6} inches/second.

The FTA has developed criteria for acceptable levels of ground-borne vibration (FTA 2006a) as shown in Table 4-14.

Noise and Vibration Assessment Methodology

Project-related noise levels for the Build Alternatives were calculated using FTA reference sound levels for rail transit. Potentially noise-sensitive land uses and vibration-sensitive buildings were identified, as well as appropriate locations for noise monitoring.

Ground-level noise levels were measured at locations along the Build Alternative alignments and near proposed station locations to establish the most sensitive existing environment (i.e., existing baseline noise levels). This is done by performing a series of measurements at representative locations. All noise measurements were made in accordance with American National Standards Institute procedures for community noise measurements.

Noise measurements were taken at 53 noise-sensitive locations along the study corridor. Measurements for 24-hour periods were conducted at 29 sites that include residences and other buildings where people normally sleep (Category 2 sites). These measurement locations were supplemented with short-term 15-minute measurement sites to determine existing noise levels at typical recreational, institutional, and commercial land uses with primarily daytime and evening activity (Category 3 sites). Additional measurements were taken from upper floors of residential buildings with open lanais. Potential noise effects from transit park-and-ride lots and maintenance and storage facility operations were also identified.

Noise effects from the Project were determined by comparing the project-generated noise exposure

Table 4-14 FTA Ground-borne Vibration Impact Criteria

Land Use Category	Ground-borne Vibration Impact Levels (VdB)	
	Frequent Events[1]	Infrequent Events[2]
Category 1: Buildings where low ambient vibration is essential for interior operations	65 VdB[3]	65 VdB[3]
Category 2: Residences and buildings where people normally sleep	72 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use	75 VdB	83 VdB

Source: FTA 2006a.

[1] "Frequent Events" are defined as over 70 vibration events per day.
[2] "Infrequent Events" are defined as less than 70 vibration events per day. This includes most commuter rail systems.
[3] This criterion is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC system and stiffened floors.

level at each representative receptor in the corridor to the appropriate FTA criterion, given the land use and existing noise levels. If the project-generated noise would be below the level for moderate impact, no impact would occur. If the noise level would be between the level for moderate impact and severe impact, a moderate impact would occur. If the project noise level would be equal to or above the severe impact level, a severe impact would occur.

Vibration effects from the Build Alternatives were determined using the detailed vibration assessment information and procedures contained in the FTA's *Guidance Manual for Transit Noise and Vibration Impact Assessment* (FTA 2006b). FTA reference levels for a transit vehicle and FTA reference data on ground transmission of vibration energy were used to estimate vibration levels at distance from the fixed guideway.

4.9.2 Affected Environment

This section describes the noise survey used to establish baseline conditions. Ambient vibration levels were not measured as part of this study.

Ambient Noise Conditions in the Study Area

The measurement locations and existing sound levels are shown in Figures 4-39 through 4-42. These locations represent noise-sensitive land uses along the corridor.

Ambient Vibration Conditions in the Study Area

Ambient vibration levels were not measured as part of this study but are anticipated to be below perceptible levels.

4.9.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built and the only source of future noise levels would be traffic movements on local streets and highways. The Project would not generate any new noise impacts. Similarly, no new vibration sources would occur in the absence of the Project. Although the projects in the ORTP would be built, their environmental impacts would be studied in separate documents.

Common to All Build Alternatives

Noise

The Project would include an integrated noise-blocking parapet wall at the edge of the guideway structure that extends 3 feet above the top of rail and a system specification for vehicles with wheel skirts. The parapet wall would substantially reduce ground-level noise. Wheel skirts would increase the benefit of the parapet wall at locations above the elevation of the track. Figures 4-39 through 4-42 show the measured existing noise level and future project noise exposure at each site for each Build Alternative. The data table included in these figures for each site is labeled no impact or moderate impact for each site. Table 4-15 shows the total number of residential buildings that would experience adverse noise effects.

Table 4-15 Number of Residential Buildings, Parks, and Schools with Noise Impacts

Alternative (2030)	Moderate Impacts	Severe Impacts
Salt Lake	23	0
Airport	18	0
Airport & Salt Lake	18	0

The Project would cause no severe noise impacts. Moderate impacts would occur at between five and seven areas, depending on the alternative (Table 4-16). The lowest number of noise impacts experienced at sensitive receptors would occur under the Airport Alternative because the guideway would travel near fewer sensitive receptors. Noise levels in the Salt Lake neighborhood would be lower with the Airport & Salt Lake Alternative than with the Salt Lake Alternative because only

Table 4-16 Noise Impacts

Area	Receptor Description	Buildings Affected	Level of Impact
Common to All Build Alternatives			
West Loch to Waipahu Transit Center	94-340 Pupumomi Street	1 9-floor building	Moderate impact to 5th floor and above
Pearl Highlands	1060 Kamehameha Highway	1 46-floor building	Moderate impact to 2nd through 5th floors
Pearlridge to Aloha Stadium	Kamehameha Highway at Kauhale Street	14 single-family residences	Moderate impact at ground level
Civic Center to Kaka`ako	860 Halekauwila	1 30-floor building	Moderate impact to 6th floor and above
Kaka`ako to Ala Moana Center	1133 Waimanu	1 28-floor building	Moderate impact to 7th through 9th floors
Salt Lake Alternative			
Ala Liliko`i	3215 Ala `Ilima Boulevard	1 12-floor building	Moderate impact above 9th floor
Ala Liliko`i to Middle Street Transit Center	2889 Ala `Ilima Boulevard	4 10- to 20-floor buildings	Moderate impact above 9th floor

half as many trains would travel on the Salt Lake alignment under that alternative.

The greatest noise source from the traction power substations would be air-conditioning equipment, which would not generate substantial noise impacts. Project park-and-ride lots would be located in undeveloped or commercial areas. The nearest distance from a park-and-ride lot to a residential use would be more than 1,000 feet to the center of the park-and-ride site at the Pearl Highlands park-and-ride lot.

Noise sources at the maintenance and storage facility would include trains operating and switching within the facility and maintenance and cleaning activities. These activities would occur over a 24-hour period. There are no noise-sensitive uses near the Hoʻopili maintenance site option. Leeward Community College and Waipahu High School are both approximately 700 feet from the center of the Leeward Community College site. At this distance, the maintenance activities would not generate substantial noise impacts.

Vibration

Vibration levels at adjacent properties would not exceed 65 VdB for the elevated rail transit. This level is less than the FTA criterion of 72 VdB for residential buildings and other structures where people normally sleep (Category 2). No land use along the alignment is identified as having vibration-sensitive equipment that would require the use of lower vibration impact criteria; therefore, no vibration effects are anticipated.

Mitigation Common to All Build Alternatives

Noise

Between five and seven sites would experience moderate noise impacts. No feasible and reasonable mitigation is available to eliminate the moderate impact at Kauhale Street.

In areas with high-rise apartments and hotels that have lanais above the elevation of and facing the rail, the parapet wall would have a limited benefit (less than a 3-dBA noise reduction) at floors above the level of the guideway. Wheel skirts, which would be used on the vehicles, would reduce noise levels at floors above the guideway. The moderate noise impact that would occur at the high-rise buildings identified in Table 4-16 would only be experienced from units above track level. Measures to reduce noise levels above the track elevation, such as sound-absorptive materials in the track area, would be evaluated during preliminary engineer-

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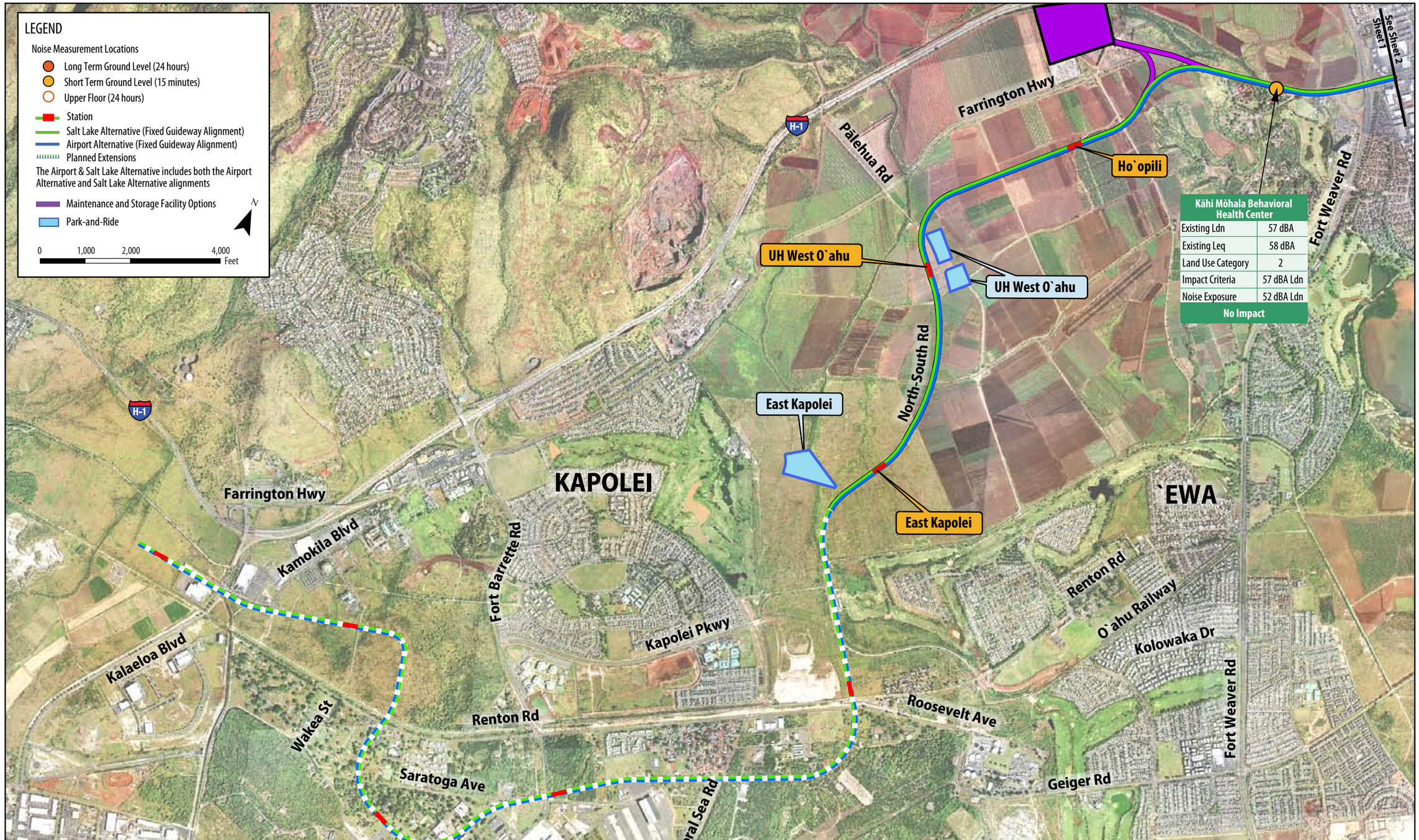
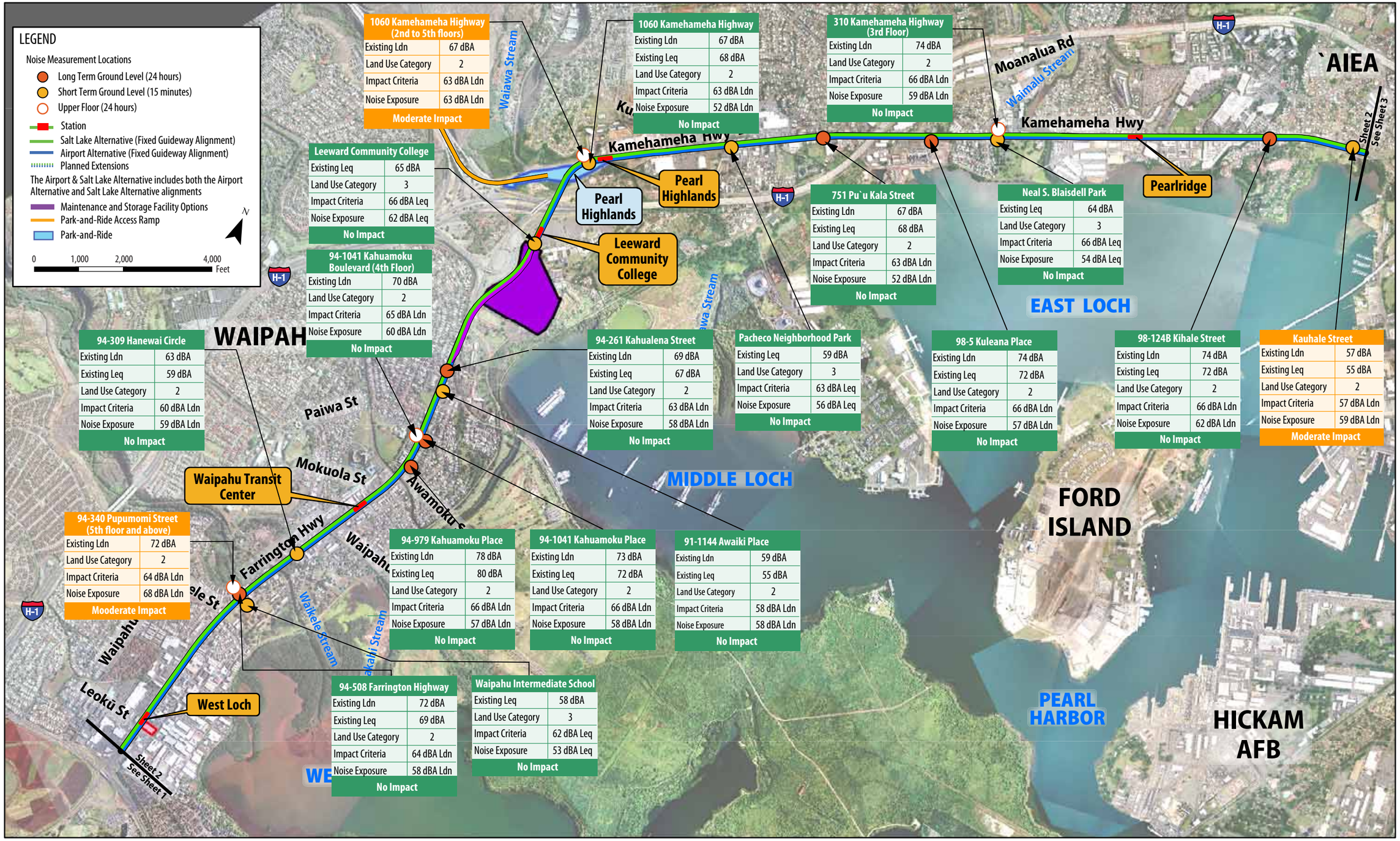


Figure 4-39 Noise Measurement Locations and Results (Kapolei to Fort Weaver Road)


LEGEND
Noise Measurement Locations
Long Term Ground Level (24 hours)
Short Term Ground Level (15 minutes)
Upper Floor (24 hours)
Station
Salt Lake Alternative (Fixed Guideway Alignment)
Airport Alternative (Fixed Guideway Alignment)
Planned Extensions
The Airport & Salt Lake Alternative includes both the Airport Alternative and Salt Lake Alternative alignments
Maintenance and Storage Facility Options
Park-and-Ride Access Ramp
Park-and-Ride
0 1,000 2,000 4,000 Feet
N
1060 Kamehameha Highway (2nd to 5th floors)
Existing Ldn 67 dBA
Land Use Category 2
Impact Criteria 63 dBA Ldn
Noise Exposure 63 dBA Ldn
Moderate Impact
1060 Kamehameha Highway
Existing Ldn 67 dBA
Existing Leq 68 dBA
Land Use Category 2
Impact Criteria 63 dBA Ldn
Noise Exposure 52 dBA Ldn
No Impact
310 Kamehameha Highway (3rd Floor)
Existing Ldn 74 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 59 dBA Ldn
No Impact
Leeward Community College
Existing Leq 65 dBA
Land Use Category 3
Impact Criteria 66 dBA Leq
Noise Exposure 62 dBA Leq
No Impact
94-1041 Kahuamoku Boulevard (4th Floor)
Existing Ldn 70 dBA
Land Use Category 2
Impact Criteria 65 dBA Ldn
Noise Exposure 60 dBA Ldn
No Impact
751 Pu`u Kala Street
Existing Ldn 67 dBA
Existing Leq 68 dBA
Land Use Category 2
Impact Criteria 63 dBA Ldn
Noise Exposure 52 dBA Ldn
No Impact
Neal S. Blaisdell Park
Existing Leq 64 dBA
Land Use Category 3
Impact Criteria 66 dBA Leq
Noise Exposure 54 dBA Leq
No Impact
94-309 Hanewai Circle
Existing Ldn 63 dBA
Existing Leq 59 dBA
Land Use Category 2
Impact Criteria 60 dBA Ldn
Noise Exposure 59 dBA Ldn
No Impact
94-261 Kahualena Street
Existing Ldn 69 dBA
Existing Leq 67 dBA
Land Use Category 2
Impact Criteria 63 dBA Ldn
Noise Exposure 58 dBA Ldn
No Impact
Pacheco Neighborhood Park
Existing Leq 59 dBA
Land Use Category 3
Impact Criteria 63 dBA Leq
Noise Exposure 56 dBA Leq
No Impact
98-5 Kuleana Place
Existing Ldn 74 dBA
Existing Leq 72 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 57 dBA Ldn
No Impact
98-124B Kihale Street
Existing Ldn 74 dBA
Existing Leq 72 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 62 dBA Ldn
No Impact
Kauhale Street
Existing Ldn 57 dBA
Existing Leq 55 dBA
Land Use Category 2
Impact Criteria 57 dBA Ldn
Noise Exposure 59 dBA Ldn
Moderate Impact
94-340 Pupumomi Street (5th floor and above)
Existing Ldn 72 dBA
Land Use Category 2
Impact Criteria 64 dBA Ldn
Noise Exposure 68 dBA Ldn
Mooderate Impact
94-979 Kahuamoku Place
Existing Ldn 78 dBA
Existing Leq 80 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 57 dBA Ldn
No Impact
94-1041 Kahuamoku Place
Existing Ldn 73 dBA
Existing Leq 72 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 58 dBA Ldn
No Impact
91-1144 Awaiki Place
Existing Ldn 59 dBA
Existing Leq 55 dBA
Land Use Category 2
Impact Criteria 58 dBA Ldn
Noise Exposure 58 dBA Ldn
No Impact
94-508 Farrington Highway
Existing Ldn 72 dBA
Existing Leq 69 dBA
Land Use Category 2
Impact Criteria 64 dBA Ldn
Noise Exposure 58 dBA Ldn
No Impact
Waipahu Intermediate School
Existing Leq 58 dBA
Land Use Category 3
Impact Criteria 62 dBA Leq
Noise Exposure 53 dBA Leq
No Impact
Pearl Highlands
Leeward Community College
Waipahu Transit Center
West Loch
Pearlridge
Kamehameha Hwy
Moanalua Rd
Waiawa Stream
Waimalu Stream
Paiwa St
Mokuola St
Farrington Hwy
Waikele Stream
Leokū St
H-1
`AIEA
WAIPAHU
EAST LOCH
MIDDLE LOCH
FORD ISLAND
PEARL HARBOR
HICKAM AFB
Sheet 2 See Sheet 3
Sheet 2 See Sheet 1

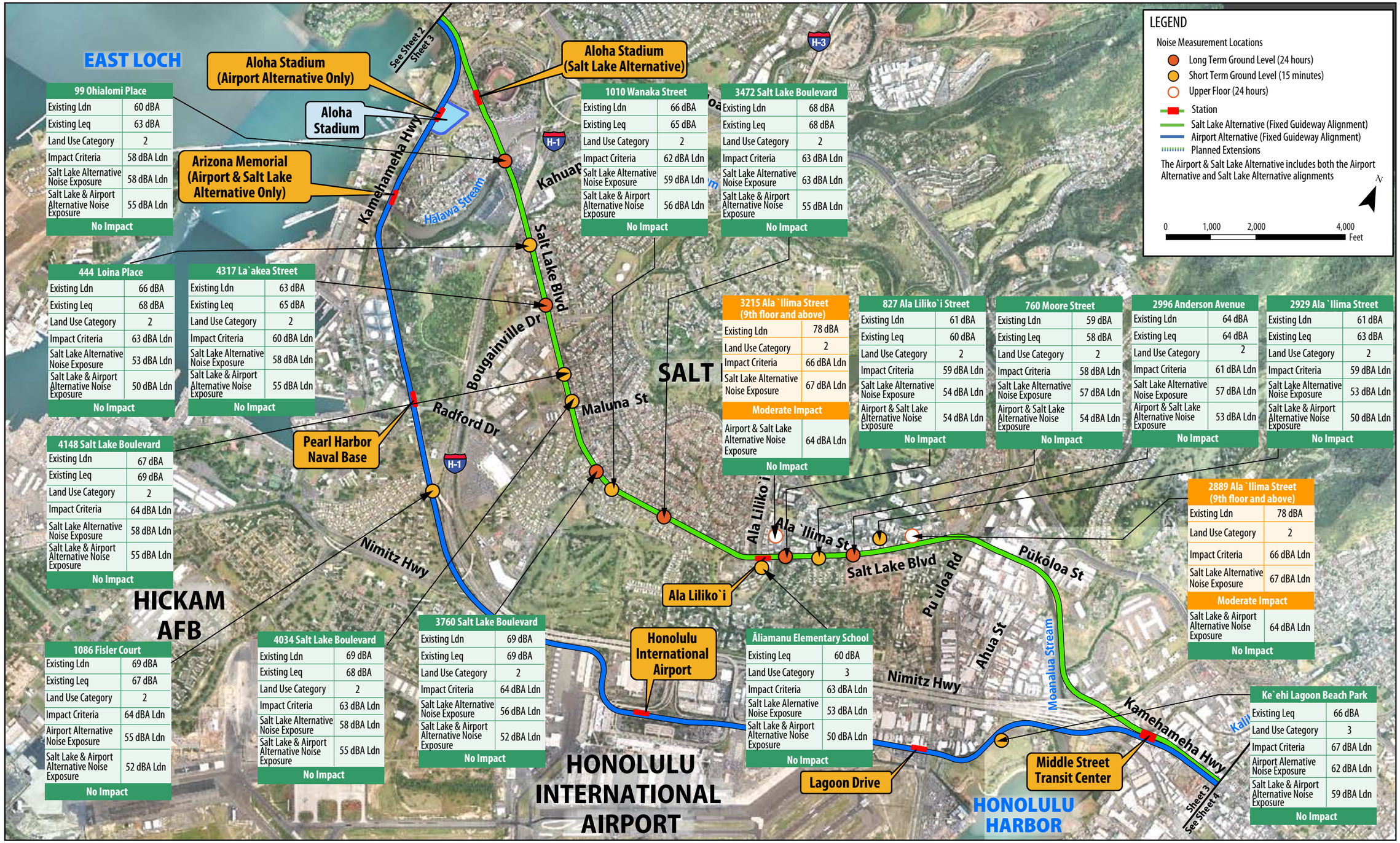


Figure 4-41 Noise Measurement Locations and Results (Aloha Stadium to Kalihi)

Honolulu Community College
Existing Leq 72 dBA
Land Use Category 3
Impact Criteria 71 dBA Leq
Noise Exposure 67 dBA Leq
No Impact
215 King Street
Existing Ldn 73 dBA
Existing Leq 72 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 63 dBA Ldn
No Impact
215 King Street (6th to 12th floors)
Existing Ldn 73 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 61 dBA Ldn
No Impact
Fort Street Mall
Existing Leq 67 dBA
Land Use Category 3
Impact Criteria 68 dBA Leq
Noise Exposure 63 dBA Leq
No Impact
Aloha Tower Marketplace
Existing Leq 63 dBA
Land Use Category 3
Impact Criteria 65 dBA Leq
Noise Exposure 62 dBA Leq
No Impact
700 Richards Street (7th floor)
Existing Ldn 76 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 67 dBA Ldn
No Impact
610 Cooke Street (5th floor)
Existing Ldn 75 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 62 dBA Ldn
No Impact
1746 Dillingham Boulevard
Existing Ldn 75 dBA
Existing Leq 73 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 58 dBA Ldn
No Impact
Harbor Village, 900 River Street
Existing Ldn 77 dBA
Existing Leq 74 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 54 dBA Ldn
No Impact
Harbor Square 700 Richards Street
Existing Ldn 76 dBA
Existing Leq 74 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 54 dBA Ldn
No Impact
Mother Waldron Park
Existing Leq 58 dBA
Land Use Category 3
Impact Criteria 62 dBA Leq
Noise Exposure 51 dBA Leq
No Impact
Na Lei Hulu Kupuna 610 Cooke Street
Existing Ldn 67 dBA
Existing Leq 65 dBA
Land Use Category 2
Impact Criteria 63 dBA Ldn
Noise Exposure 59 dBA Ldn
No Impact
860 Halekauwila Street (7th to 9th floors)
Existing Ldn 75 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 69 dBA Ldn
Moderate Impact
1133 Waimanu Street (7th to 9th floors)
Existing Ldn 75 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 66 dBA Ldn
Moderate Impact
1341 Kapiolani Boulevard (7th to 9th floors)
Existing Ldn 75 dBA
Land Use Category 2
Impact Criteria 66 dBA Ldn
Noise Exposure 61 dBA Ldn
No Impact
LEGEND
Noise Measurement Locations
Long Term Ground Level (24 hours)
Short Term Ground Level (15 minutes)
Upper Floor (24 hours)
Station
Salt Lake Alternative (Fixed Guideway Alignment)
Airport Alternative (Fixed Guideway Alignment)
Planned Extensions
The Airport & Salt Lake Alternative includes both the Airport Alternative and Salt Lake Alternative alignments
N
0 1,000 2,000 4,000 Feet
See Sheet 3
Sheet 4
Kalihi
Kapālama
Iwilei
Chinatown
Downtown
Civic Center
Kaka`ako
Ala Moana Center
HONOLULU HARBOR
ALA MOANA BEACHES
ALA WAI BOAT HARBOR
WAIKĪKĪ BEACHES
Sand Isl
Pu`uhale Rd
Mokauea St
Kalihi St
Waiakamilo Rd
Dillingham Blvd
Nimitz Hwy
N King St
Kōkea St
Kapālama Stream
Alakawa St
Līliha St
Nu`uanu Stream
Kuakini St
Pali Hwy
Kekaulike St
Beretania St
Hotel St
Punchbowl St
S King St
Ward Ave
Queen St
South St
Halekauwila St
Pensacola St
Pi`ikoi St
Kapi`olani Blvd
Kona St
Ala Moana Blvd
Punahou St
Dole St
S Beretania St
S King St
McCully St
University Ave
Kapi`olani Blvd
Date St
Kālaimoku St
Ala Wai Canal
Ala Wai Blvd
Kūhiō Ave
Kalākaua Ave
Lili`uokalani Ave
Kapahulu Ave
H-1

ing of the Project. Once the Project is operating, noise levels will be measured to determine the actual extent of project noise impacts.

Vibration

Because no vibration effects are projected for the Build Alternatives, no mitigation is proposed.

4.10 Energy and Electric and Magnetic Fields

This section describes the energy required for operating the Project and analyzes electric and magnetic fields (EMFs) as related to the Project's operation. Energy used during the Project's operation would include fuel consumed by buses, electricity used to power transit vehicles, and a negligible amount of energy for signals, lighting, and maintenance. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Electric and Magnetic Fields Technical Report* (RTD 2008h).

EMFs are a result of the voltage or electric potential of an object. For this Project, the high-capacity transit system would be powered by electricity from a third line located next to the rail tracks. Whenever an electrical current flows, it creates a magnetic field. An analysis of EMFs is included in this Draft EIS because of public concern about potential health effects and effects on equipment and machines adjacent to the corridor that may be sensitive to EMFs.

4.10.1 Background and Methodology

Energy

The analysis of operational energy consumption on Oʻahu was based on the transportation analysis prepared for the Project. Changes in overall transportation energy use for vehicles traveling on Oʻahu were assessed using daily VMT and speed values calculated from the transportation demand forecasting model.

The energy consumed by electrically powered transit operations for the high-capacity transit system was also considered. Fixed guideway high-capacity transit systems require energy for propulsion and to account for energy lost during transmission from the energy-generation site to the transit vehicles. The average energy consumption for a rail transit vehicle in the U.S. is 62,700 British thermal units (BTUs) per vehicle-mile of service (USDOE 2007).

Electric and Magnetic Fields

EMFs are produced wherever wires distribute electric power and wherever electrical equipment is used. EMFs decrease with the square of distance away from operating equipment or away from current-carrying electric lines. Sensitive equipment that may be affected by changes to the Earth's geomagnetic field caused by operation of the Project may be located at research, manufacturing, medical, and possibly military facilities. Available data on high-voltage power lines, medical and diagnostic facilities, institutional and research facilities, and military operations were assembled. This information was confirmed through field reconnaissance to verify site locations and identify equipment that may be sensitive to the influence of EMFs associated with the Project.

Research into the health effects of EMFs has not established a link between EMFs and any health effects. National Academy of Sciences National Research Center findings "do not support the contention that the use of electricity poses a major unrecognized public-health danger" (NRC 1999). The International Commission on Non-Ionizing Radiation Protection also concluded that data related to cancer do not provide a basis for assessing the health risks of human exposure to power frequency fields (ICNIRP 1998), but it did establish a protective guideline of 830 milligauss magnetic field density for exposure to the general public.

4.10.2 Affected Environment

Energy

In 2006, 291 million gallons of gasoline were consumed on the Island of Oʻahu. Gasoline represents the largest segment of transportation energy consumption, closely followed by aviation fuel, then by diesel.

Transportation modeling results for 2007 show approximately 11.5 million daily VMT on Oʻahu. This results in a daily consumption of approximately 666,000 gallons of fuel with an energy content of 85,600 million BTUs (MBTUs).

Electric and Magnetic Fields

Twenty locations were found during a field survey that are within 200 feet of the centerline of the Build Alternatives and which could have sensitive electronic equipment that could be affected by operation of the Project. The facility managers were contacted, and all but one facility was eliminated (Table 4-17). Honolulu Community College has an electron microscope that is between 200 and 250 feet from the alignment.

4.10.3 Environmental Consequences and Mitigation

Environmental Consequences

Energy

No Build Alternative

Transportation energy consumption for the No Build Alternative would include motor vehicle fuel consumption islandwide. This is estimated to be 94,610 MBTUs in 2030 (Table 4-18).

Common to All Build Alternatives

For all of the Build Alternatives, the total transportation energy demand for transit and highway vehicles would be lower than for the No Build Alternative. Table 4-18 summarizes the anticipated average daily transportation demand in 2030 for each of the alternatives. All Build Alternatives are anticipated to reduce daily transportation energy demand by approximately 2 percent compared to the No Build Alternative.

The Project would consume approximately 1 to 2 percent of the total projected electricity generated on Oʻahu in 2030. The planned electricity generation capacity on Oʻahu would be sufficient to support the transit system, but the electricity distribution system would require various upgrades to support the system (HECO 2008).

Integration of photo-voltaic cells into stations and other project features could reduce net project electricity demand.

Electric and Magnetic Fields

No Build Alternative

There would be no features generating EMFs.

Common to All Build Alternatives

The magnetic-field disturbance generated by operation of the Project would be low-frequency (0 to 10 hertz) and would occur at intervals determined by passing trains. EMFs produced by the Project would be of such low magnitude that the only potential effects would be to highly sensitive instruments that may be in use within facilities adjacent to the right-of-way. The electron microscope at Honolulu Community College is

Table 4-17 Location of Potential EMF Receptors within 200 Feet of Project Alternatives

Address	Building Name	Equipment
Institutional—University/Research		
874 Dillingham Boulevard	Honolulu Community College	Electron microscope

Table 4-18 2030 Summary of Average Daily Transportation Energy Demand by Alternative

Alternative	Roadway and Bus Energy Consumption (MBTUs)[1]	Fixed Guideway Vehicle Energy Consumption (MBTUs)[1]	Total Energy Consumption (MBTUs)[1]	Percent Change from No Build
No Build	94,610	0	94,610	n/a
Salt Lake	91,082	1,163	92,245	-2%
Airport	91,013	1,224	92,237	-2%
Airport & Salt Lake	91,132	1,194	92,326	-2%

[1] MBTUs = million British thermal units

unlikely to be affected by the Project; however, this will be confirmed during preliminary engineering. A review of the state of the science regarding health effects associated with EMFs found no new evidence linking these fields to biological issues. Project-generated magnetic fields would be less than the International Commission on Non-Ionizing Radiation Protection guideline limit in areas where the public may be regularly exposed. Because no negative health effects or effects on equipment related to EMFs are anticipated, mitigation would not be needed.

4.11 Hazardous Waste and Materials

This section analyzes potential contaminant sources that may be present in the study corridor. It also assesses the potential of encountering hazardous waste and chemically impacted soil and/or groundwater adjacent to the project alignment, as well as the Project's potential use of hazardous materials. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Hazardous Materials Technical Report* (RTD 2008i).

4.11.1 Background and Methodology

Regulatory Background

Many Federal and State laws regulate hazardous waste and materials. The primary Federal laws are the *Resource Conservation and Recovery Act of 1976* (USC 1976) and the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) (USC 1980). The National Priority List is a listing of the most polluted sites in the nation that are eligible for cleanup funding (Superfund) under CERCLA.

Hazardous waste in the City is primarily regulated by the Office of Hazard Evaluation and Emergency Response and the Solid and Hazardous Waste Branch, both within the HDOH. The Office of Hazard Evaluation and Emergency Response is responsible for implementing the *Hawai'i Environmental Response Law* (HRS 128D), the *State Contingency Plan* (HAR 11-451), and *the Hawai'i Emergency Planning and Community Right-to-Know Act* (HRS 128E). The Solid and Hazardous Waste Branch is responsible for overseeing the Office of Solid Waste Management, the Underground Storage Tank Program, and the Hazardous Waste Program.

Methodology

An Initial Site Assessment of the study corridor was conducted to identify potential hazardous waste areas. The following steps were performed during this assessment to establish existing conditions and to evaluate potential impacts and whether project-related activities have the potential to disturb, generate, use, and/or dispose of hazardous materials:

- Reviewed environmental database records to evaluate potential impacts to the Project. Environmental Database Resources, Inc., prepared a report for the Project on November 2,

2007 (EDR 2007). To generate this report, they conducted a search of all databases relevant to hazardous waste and materials operations in Hawai‘i.
- Reviewed previous Honolulu transit project hazardous materials surveys.
- Coordinated with HDOH.
- Reviewed historical land uses using maps and historic aerial photos to identify any past business uses in the immediate project vicinity that could have a negative impact on the Project in terms of hazardous materials and wastes.
- Conducted field reconnaissance to identify land uses that may indicate the presence of hazardous materials or waste. Field reconnaissance was conducted from public access areas and within the study corridor, as feasible.
- Contacted owners of oil and fuel pipelines to establish pipeline locations. Preliminary information was obtained, but coordination would be ongoing throughout design and construction.

Potential mitigation measures to be employed during further design, planning, and construction of the Project were developed based on the data collected and evaluations conducted.

4.11.2 Affected Environment

The study corridor is currently dominated by commercial and residential developments, with some areas of military activity and localized industrial activity. This assessment is based on field reconnaissance. Information from the database search and the review of historic maps and aerial photographs indicates a more industrial past for certain areas of the study corridor.

Past and present industrial activities along the study corridor are mostly agricultural, food processing, or warehousing. Contaminants associated with these uses are primarily petroleum hydrocarbons, such as gasoline, diesel, and oil. Other contaminants can include pesticides, herbicides, metals, and solvents, but solvents and metals are generally not used in bulk in agriculture, food processing, and warehousing.

Agricultural Uses

Specific areas of past industrial agricultural activity near the Project include the following:
- Former ‘Ewa Sugar Mill
- Former O‘ahu Sugar Mill
- Former ‘Aiea Sugar Mill
- Former Dole Pineapple Cannery

These industrial agricultural sites appear in the databases searched. However, these sites all ceased operations in the 1990s and were largely remediated and redeveloped in the late 1990s and early 2000s.

Industrial Uses

In some areas along the project alignment, current and historic land uses indicate a more industrial past than other areas, so they have a higher potential of harboring soil or groundwater contamination. These areas include the following:
- Waipahu (West Loch)—this neighborhood is dominated by gas stations and car dealerships along Farrington Highway, with warehouse and automobile repair businesses makai of Farrington Highway.
- Airport Industrial Area—this neighborhood is dominated by airport/airline support activities (tank farms and maintenance facilities), car dealerships, rental car agencies, warehouses, and light industrial activities.
- Māpunapuna—this area is dominated by warehouses, light industrial activities, and an automobile dealership.
- Kapālama-Iwilei—this area was dominated by the Dole Cannery and supporting businesses in the past but is increasingly becoming commercial. The former Kapālama Incinerator was located in the area along with a number of warehouse and light manufac-

turing businesses. Warehousing continues along Kapālama Canal.
- Kakaʻako—this neighborhood was once dominated by automobile dealerships and repair shops, warehouses, and light industry. However, it is becoming increasingly commercial and residential in character.

Military Uses

Military activities are also present within the study corridor and tend to have a broader array of associated pollutants. Pollutants included in the Pearl Harbor Naval Station Superfund Record of Decision include petroleum, solvents (perchloroethylene and others), polychlorinated biphenyls, metals (mercury and chromium), and pesticides. Military bases and activities near the Project include the following:

- Former Naval Air Station Barbers Point—now closed and under the Hawaiʻi Community Development Agency's jurisdiction
- Pearl Harbor Naval Station (former Navy Drum site)—an active Navy base on the National Priority List (Superfund)
- Hickam Air Force Base—an active Air Force base, but uses near the Project are primarily housing
- Fort Shafter Flats—an active military base, but the area near the Project is a relatively undeveloped floodplain

Petroleum Contaminants

Petroleum handling and transportation facilities are frequently associated with releases of oil or hazardous materials to the environment through leaks, spills, maintenance, and other activities. These facilities include gas stations, tank farms, large maintenance base yards, and pipelines and must be considered potential sites of contaminants wherever they appear along the project right-of-way. Petroleum contaminants (e.g., gasoline and diesel fuels) have been shown to migrate less than 300 feet from their source once released into a subsurface environment similar to that found in the study corridor. Therefore, only petroleum releases within this relatively short distance of the Project are considered a concern.

A recent utility survey identified a number of petroleum pipelines in the study corridor. These pipelines are owned by a variety of firms, including the military, the Hawaiian Electric Company, Chevron, and Tesoro. Pipeline locations include the following:

- Under Kapolei Parkway
- Along the Oʻahu Railway and Land right-of-way in Kapolei, Pearl City, Waimalu, and ʻAiea
- On the mauka side of Farrington Highway through Waipahu
- Under Kamehameha Highway from Pearl City to the airport
- Throughout the airport area, primarily on the makai side of Aolele Road
- Under Salt Lake Boulevard from Aloha Stadium to Puʻuloa Road
- Under Nimitz Highway to the Hawaiian Electric Company's downtown power plant

The fixed guideway would cross or run parallel to these pipelines in many areas of the study corridor. These pipelines have been in place for many years, and releases from them are possible.

Sites of Concern

Individual sites of concern have been identified during the environmental database review and field reconnaissance activities. Sites were first identified during database review, and their presence was verified and additional sites were identified during field reconnaissance. Sites of concern were ranked "1" or "2." A "1" ranking means there is a high probability that releases at the site have impacted soil or groundwater beneath the Project. A "2" ranking means there is a low probability that releases at the site have impacted soil or groundwater beneath the Project, but further evaluation is needed based on proximity to the Project. The

number of sites ranked "1" or "2" is summarized in Table 4-19. Sites that have been remediated or would not be of concern if the Project were built are identified in the Hazardous Materials Technical Report (RTD 2008i).

Examples of sites ranked "1" include the following:

- Pearl Harbor Naval Station (a Superfund site)
- Leaking underground storage tank sites that have not been remediated and are within 300 feet of the project alignment (e.g., Holiday Action Gas in Pearl City)

Examples of sites ranked "2" include the following:

- Sites adjacent to the Project that have been remediated (e.g., Pacific Machinery in Waipahu)
- Sites with large releases that are somewhat distant or downgradient from the Project (e.g., BHP Gas Company in Iwilei)
- Sites with institutional controls (e.g., where excavation is restricted due to the presence of contaminants) that are near the Project (e.g., Chuei Shokoh in Kakaʻako, a former dry cleaner)
- Sites observed to have limited hazardous materials issues (e.g., improper waste storage at Hi-Pace Racing in Kakaʻako)

The ground beneath any portion of the Project could be contaminated, most likely by petroleum products. Contamination is most likely to be present in the historically more industrial neighborhoods and near individual sites ranked "1" or "2." In addition, the geology and hydrogeology of the Airport Industrial Area, Māpunapuna, Kapālama-Iwilei, and Kakaʻako areas make them particularly likely to harbor residual pollutants. In these areas there would be a greater likelihood that spilled chemicals would remain in the area and not readily migrate or degrade. Therefore, soil and groundwater in these neighborhoods is frequently found to be degraded by petroleum and other contaminants. The potential for contamination has been confirmed by other projects in the industrial areas.

The Navy Drum site, inactive since the early 1970s, is a potential location for the fixed guideway maintenance and storage facility near Leeward Community College. In 1971, vandals started a fuel pump, which resulted in the release of motor gasoline to the ground surface. A remedial investigation was completed at the Navy Drum property by the Department of Navy in 2000 (Navy 2000). The investigation concluded that contaminants from the property have not and would not migrate to the deep freshwater aquifer or the artesian well water supply for the watercress ponds. There are no adverse human health or ecological effects that have, or will, result from the 1971 motor gasoline release. The U.S. Department of Health & Human Services and Hawaiʻi DOH reviewed the study and concur with the findings (DHHS 2005).

Table 4-19 Summary of Sites of Concern that Could Be Polluted near the Project

Alternative	Number of Sites Ranked 1 Based on Database Records	Number of Sites Ranked 2 Based on Database Records	Number of Additional Sites Ranked 1 Based on Field Reconnaissance	Number of Additional Sites Ranked 2 Based on Field Reconnaissance	Total Number of Sites Ranked 1	Total Number of Sites Ranked 2
Salt Lake	22	16	0	9	22	25
Airport	26	14	1	8	27	22
Airport & Salt Lake	22	16	0	9	22	25

4.11.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built, and there would be no impacts associated with hazardous materials. The projects defined in the ORTP would be built, and environmental impacts associated with those projects would be studied in separate documents.

Common to All Build Alternatives

In some locations, large or specialized hazardous wastes or materials sites may be affected by right-of-way acquisition. Large or specialized hazardous wastes and materials include underground and aboveground storage tanks (USTs and ASTs), fuel islands, and engineered storage facilities.

In a few cases, the Project may displace hazardous materials operations. This includes relocating gas station fuel islands and USTs and ASTs. Table 4-20 lists all sites from which right-of-way would be acquired where the Project would result in potential impacts to ongoing hazardous materials operations (Figure 4-43).

The operation and maintenance of a fixed guideway transit system would require using some hazardous materials and may generate hazardous waste. Likely hazardous materials include the following:

- Lubricants (both grease and oils) of various weights and viscosities
- Hydraulic fluid for transit vehicles and servicing equipment
- Cleaning products for maintaining equipment, cleaning electronic components and vehicles, and removing graffiti—cleaning solutions can range from acids to alkaline to petroleum-based solvents

Wastes (beyond standard office-type) that would require disposal or recycling could include the following:

- Used oil (not hazardous)
- Cleaning product waste (typically recycled through closed systems)
- Vehicle components that wear out or break, including fluorescent light tubes
- Sediment from vehicle washing

Most of these materials and wastes would be used or generated at the maintenance and storage facility. However, limited use of hazardous materials would be necessary to maintain the guideway, stations, and traction power substations.

Releases at sites ranked "1" or "2" (summarized in Table 4-19), petroleum pipelines, and in industrial areas may have resulted in contaminated soil and/or groundwater beneath the Project. The presence of contaminants would affect project construction. Effects during construction and related mitigation are discussed in Section 4.17.

Mitigation

Some properties that would be acquired to obtain required right-of-way for the Project received a rank of "1" or "2" during the Initial Site Assessment and, therefore, may be polluted. In some cases, it may be appropriate to do either a partial or complete Phase I Environmental Site Assessment (ESA) prior to acquiring portions of these properties to mitigate the chance that the City would acquire a degraded piece of real estate or that workers would be exposed to contaminants during construction. ESAs would be conducted per the American Society for Testing and Materials' *Standard Practice for Environmental Site Assessments—Phase I Environmental Site Assessments Process (E1527-05)* (ASTM 2005). Depending on the outcome of the Phase I ESAs, a Phase II assessment (including collecting and analyzing samples) may be appropriate. The City would decide whether a

Table 4-20 Hazardous Materials Sites from Which Right-of-Way Would Be Acquired

Site #	Site Name	Tax Map Key	Address	Type of Right-of-Way Acquisition	Potential Long-term Consequences
Common to All Build Alternatives					
1	7-11/Aloha Petroleum	97022006	897 Kamehameha Highway	Partial acquisition	Fuel island is very close to street and may need to be relocated
2	Fuji's Chevron Gas Station	98014012	98-121 Kamehameha Highway	Partial acquisition	One fuel island and USTs are close to street and may need to be relocated
3	7-11/Aloha Petroleum	12010068	1900 Dillingham Boulevard	Full acquisition	Fuel island and USTs affected
4	Arco AM/PM	12003101	1701 Dillingham Boulevard	Partial acquisition	Fuel islands are very close to street and may need to be relocated
5	Awa Wastewater Pump Station	15040003	190 North Nimitz Highway	Partial acquisition	Possible impact to existing UST
6	Motor Imports Service Center	21031030	607 South Street	Partial acquisition	Auto maintenance building and oil AST in acquisition area
7	Tio's Mexican Restaurant	21050062	404 Ward Avenue	Full acquisition	An unidentified AST is located on this property
8	Hi-Pace Racing	23007054	500 Pi`ikoi Place	Full acquisition	Full acquisition, including drum storage area
Salt Lake Alternative					
9	Ke`ehi Solid Waste Transfer Station	11006013	606 Middle Street	Partial acquisition	Relocation of truck wash and fuel AST may be necessary

partial or complete Phase I ESA is necessary for each property acquisition.

The use of hazardous materials for the fixed guideway system's operation and maintenance would be unavoidable. However, the volume of materials used and extent of worker exposure could be limited in the following ways:

- Using non-hazardous alternatives where possible
- Using closed systems designed to limit exposure
- Training employees in the safe use and management of hazardous materials
- Instituting waste minimization programs to limit the volume and type of materials used and resulting wastes
- Providing appropriate waste storage locations and receptacles
- Periodically evaluating wastes to establish whether they are hazardous
- Recycling wastes to the maximum extent practicable

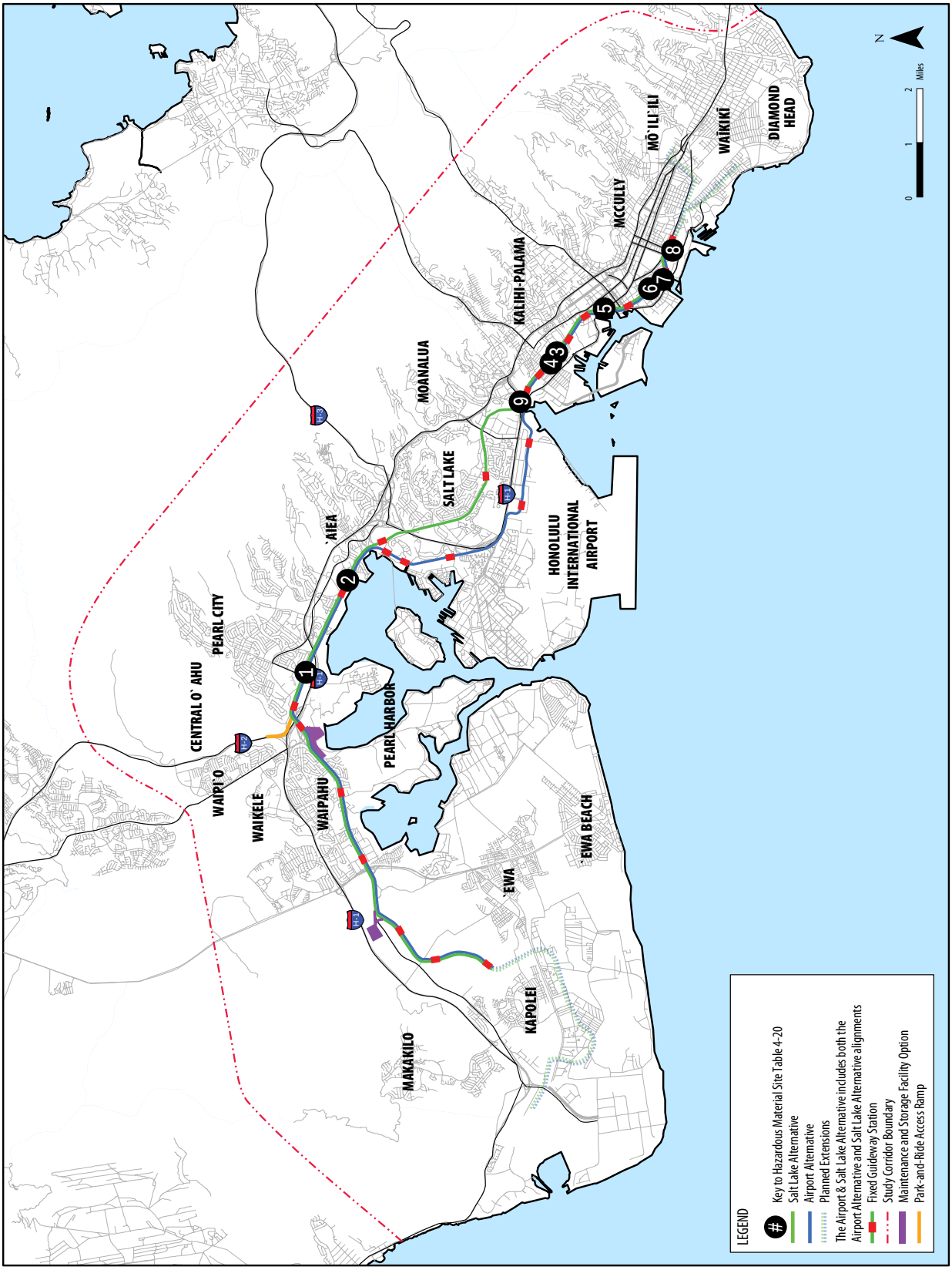


Figure 4-43 Locations of Potential Impacts to Ongoing Hazardous Materials Operations

4.12 Ecosystems

This section describes vegetation and wildlife within the study corridor. The assessment of vegetation and wildlife was made by reviewing existing studies, consulting with resource agencies, and conducting field surveys. Emphasis was placed on the potential presence of Federal- and/or State-protected species and sensitive habitats. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Ecosystems and Natural Resources Technical Report* (RTD 2008j).

4.12.1 Background and Methodology

Regulatory Context

Threatened and Endangered Species Regulations

Section 7 of the Endangered Species Act of 1973, as amended (7 USC 136; 16 USC 1531 et seq.), requires Federal agencies to consider impacts on endangered or threatened species and these species' critical habitat. It requires that Federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA/FS), depending on whether terrestrial or marine species may be affected. If effects on protected species are identified, a Biological Assessment would be required to address a project's effects on a listed or candidate species or on the destruction or adverse modification of designated critical habitat. Subsequently, the USFWS would issue a Biological Opinion (40 CFR 402).

The State of Hawai'i's counterpart law is HRS 195D, under which species are similarly protected from state actions. HRS 195D stipulates that where there may be an incidental take of a listed species, a Habitat Conservation Plan (HCP) must be "designed to result in an overall net gain in the recovery of Hawai'i's threatened and endangered species."

Migratory Bird Treaty Act

The Federal Migratory Bird Treaty Act (MBTA) (16 USC 703-711) protects migratory birds listed in the MBTA by prohibiting the taking of any listed bird, or any part, nest, or egg of any such bird. *Take* is defined as an attempt to "pursue, hunt, shoot, capture, collect, or kill." This act applies to all persons and organizations in the U.S., including Federal and State agencies. The USFWS administers the MBTA, and protection of listed migratory birds is delegated to USFWS staff handling Endangered Species Act Section 7. Regulation of unlisted migratory birds is delegated to the USFWS Migratory Bird Division.

Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 (16 USC 1361-1407) protects marine mammals listed in the act by prohibiting the taking of them in waters of the U.S. and by U.S. citizens on the high seas, as well as importing marine mammals and marine mammal products into the U.S. *Take,* as defined by Congress, is "to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal."

Correspondence with State and Federal Agencies

In March 2006, the following regulatory agencies were consulted to identify species that could be affected by the Project:

- U.S. Department of the Interior, USFWS
- U.S. Department of Commerce, NOAA/FS
- State of Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW)
- State of Hawai'i Department of Land and Natural Resources, Division of Aquatic Resources

This correspondence is included in the Ecosystems and Natural Resources Technical Report (RTD 2008j). Correspondence letters are also included in Appendix D of this Draft EIS.

Agencies indicated that no designated critical habitats exist on or within one-third mile of the project alignment. However, the agencies did mention that

the species listed in Table 4-21 may be present in the study corridor.

Methodology

Literature Review

Previous studies, pertinent literature, and USFWS Critical Habitat maps for Oʻahu within the study corridor were reviewed prior to undertaking the field surveys. Topographic maps and aerial photographs were examined to assess terrain and habitat characteristics, access, boundaries, and reference points. The Hawaiʻi Biodiversity and Mapping Program (HBMP) also provided a database of Federal- and State-protected species (plants and animals) previously observed within one-quarter mile of the project alignment.

The review reaffirmed that field surveys should focus on identifying or assessing the likely presence of the species listed by the agencies (Table 4-21) but also indicated that other species listed in Table 4-22 should be considered.

Field Surveys

Field surveys were performed for flora in the undeveloped ʻEwa Plain as well as for birds along the entire project alignment. A field survey was not performed for marine mammals and marine turtles because the Project would not approach or directly affect a marine habitat.

Flora Survey of Undeveloped ʻEwa Plain

Field surveys of the vegetation present in the undeveloped ʻEwa Plain portion of the project alignment were completed in September 2007 and January 2008. In areas along the corridor where rare or endangered species were previously reported, an intensive survey was conducted to attempt to establish whether these species and populations still remained. Encountered populations were photographed and mapped.

Wildlife Survey along the Alignment

Wildlife field surveys and observations along the project alignment were conducted in September 2007, and bird point counts were conducted from December 2007 to January 2008. The point-count method provides a species list and quantitative results for a given area in a short period of time. Point counts were performed at locations approximately 1 mile apart along the project alignment, except from Kalihi to UH Mānoa and Waikīkī, where point count locations were spaced every one-half mile to improve the possibility of detecting the State-listed threatened white tern. Counts were also performed at the following locations:

Table 4-21 Threatened, Endangered, and Protected Species Identified by Agencies

Common Name	Scientific Name	Mentioned by	Status
Endangered Flora			
Ko`oloa`ula or red `ilima	Abutilon menziesii	USFWS and DLNR-DOFAW	Endangered (S,F)
Maui chaff flower	Achyranthes splendens spp. rotundata	DLNR-DOFAW	Endangered (S,F)
Skottsberg's broomspurge	Chamaesyce skottsbergii	DLNR-DOFAW	Endangered (S,F)
Endangered Terrestrial Fauna			
`Ōpe`ap`a or Hawaiian hoary bat	Lasiurus cinereus semotus	USFWS	Endangered (S,F)
`Alae`ula or Hawaiian common moorhen	Gallinula chloropus sandvicensis	USFWS	Endangered (S,F)

F = Federal; S = State
DLNR-DOFAW = State of Hawai`i Department of Land and Natural Resources, Division of Forestry and Wildlife
USFWS = U.S. Fish and Wildlife Service

Table 4-22 Threatened, Endangered, and Protected Species Identified by Research

Common Name	Scientific Name	Status	Literature Source
Endangered Flora			
`Awīwī	Centaurium sebaeoides	Endangered (S,F)	HBMP, Bishop Museum website
`Ihi`ihi	Marsilea villosa	Endangered (S,F)	The *Recovery Plan for Marsilea Villosa* (USFWS 1996)
Endangered Terrestrial Fauna			
O`ahu `elepaio	Chasiempis sandwichensis ibidis	Endangered (S,F)	Vanderwerf 2001; and others
Hawaiian coot	Fulica americana alai	Endangered (S,F)	*Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision* (USFWS 2005b); and others
Hawaiian duck	Anas wyvilliana	Endangered (S,F)	*Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision* (USFWS 2005b); and others
Hawaiian stilt	Himantopus mexicanus	Endangered (S,F)	*Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision* (USFWS 2005b); and others
Protected Migratory Waterbirds			
Pacific golden-plover	Pluvialis fulva	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others
Black-crowned night heron	Nycticorax nycticorax hoactii	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others
Ruddy turnstone	Arenaria interpres	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others
Wandering tattler	Heteroscelus incanus	MBTA Protected	*Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a); and others
State Threatened and Endangered Terrestrial Fauna			
Pueo	Asio flammeus sandwichensis	Endangered (S)	Various
Newell's shearwater	Puffinus auricularis newelli	Threatened (S)	Various
White tern	Gygis alba	Threatened (S)	Miles 1986; Vanderwerf 2003

F = Federal; S = State
HBMP = Hawai`i Biodiversity and Mapping Program
MBTA = Migratory Bird Treaty Act
USFWS = U.S. Fish and Wildlife Service

- The makai perimeter of the proposed maintenance and storage facility adjacent to Leeward Community College—this bird point-count site was selected because of the proximity of the site to waterbird habitat in Pearl Harbor.
- A stand of ironwoods *(Causaurina equisetefolia)* along the southern edge of Kapiʻolani Park—this bird point-count site was selected because it historically has been an area of high concentrations of white terns in Waikīkī and could be used as a reference site to gauge the level of nesting activity in the population.

The point count involved identifying and recording the number of birds seen and heard at all distances from the point-count stations for a period of eight minutes. The Ecosystems and Natural Resources Technical Report (RTD 2008j) documents the results of this survey.

4.12.2 Affected Environment

A distinctive feature of Oʻahu's geomorphology is the broad plain that extends from ʻEwa and Kalaeloa across Pearl Harbor to Diamond Head. It is composed of raised coralline limestone and has natural harbors, a dry leeward climate, and abundant freshwater streams with headwaters in the Koʻolau and Waiʻanae Mountain Ranges. Upland perennial streams are sustained by groundwater from high-level aquifers and, on the coastal plain, perennial flow may originate from basal groundwater springs. Where groundwater is not accessible in a drainage basin, streams exhibit intermittent flow because they respond only to rainfall and runoff; this is particularly prevalent in the ʻEwa and Kapolei areas. Freshwater streams that enter the marine coastal waters create estuaries at stream mouths and embayments, such as Pearl Harbor, where freshwater nutrients stimulate productivity.

The past century of urbanization on Oʻahu, especially within the areas along much of the project alignment, has resulted in a highly altered environment, and this is reflected in the present state of the remaining communities of vegetation. No intact native vegetation species remain within the study area, and few native plant species are still extant near the alignment. The ʻEwa Plain is an area where relatively undeveloped land is present in the project study area, and vegetation in this area was found to consist of the following:

- Ruderal (weedy) patches in undeveloped areas or abandoned properties
- Plants in abandoned agricultural areas, such as the area makai of the H-1 Freeway near Kapolei
- Plantings in areas reserved for cultivation and diversified agriculture

Beyond the ʻEwa Plain, a few relatively undeveloped areas exist where the vegetation present is not restricted to maintained landscaping or weeds. Street trees, the most common ecological element of the maintained urban landscape, are discussed in Section 4.14. The undeveloped areas beyond the ʻEwa Plain are illustrated on Figures 4-44 and 4-45 and include the following:

- Pearl Harbor National Wildlife Refuge, Waiawa and Honoʻuliʻuli Units
- Waiawa Spring, which is occupied by taro patches
- Waiau Spring, which is currently wild but has been used for farming in the past
- Kalauao Spring, which is occupied by the Sumida Watercress Farm
- The Koko Head bank of Moanalua Stream

Table 4-23 lists all threatened, endangered, and protected species and indicates whether the species were observed during surveys performed for this Project.

Endangered Flora

Koʻoloaʻula *(Abutilon menziesii)* (Figure 4-46) was not observed during the field surveys; however, the Project is known to be in close proximity to extant plant clusters and within approximately 200 feet of the northern border of the established contingency reserve (Figure 4-44). Koʻoloaʻula is an endangered Hawaiian endemic hibiscus shrub that grows in dry forests. An HCP that addresses potential effects on the Koʻoloaʻula population near the corner of North-South Road and Kapolei Parkway is already in place (HDOT 2004). This HCP is being incrementally phased in over a 20-year period. The HCP describes impacts that assume the population would be incrementally taken as development in the vicinity of North-South Road is implemented.

Figure 4-46 Ko`oloa`ula

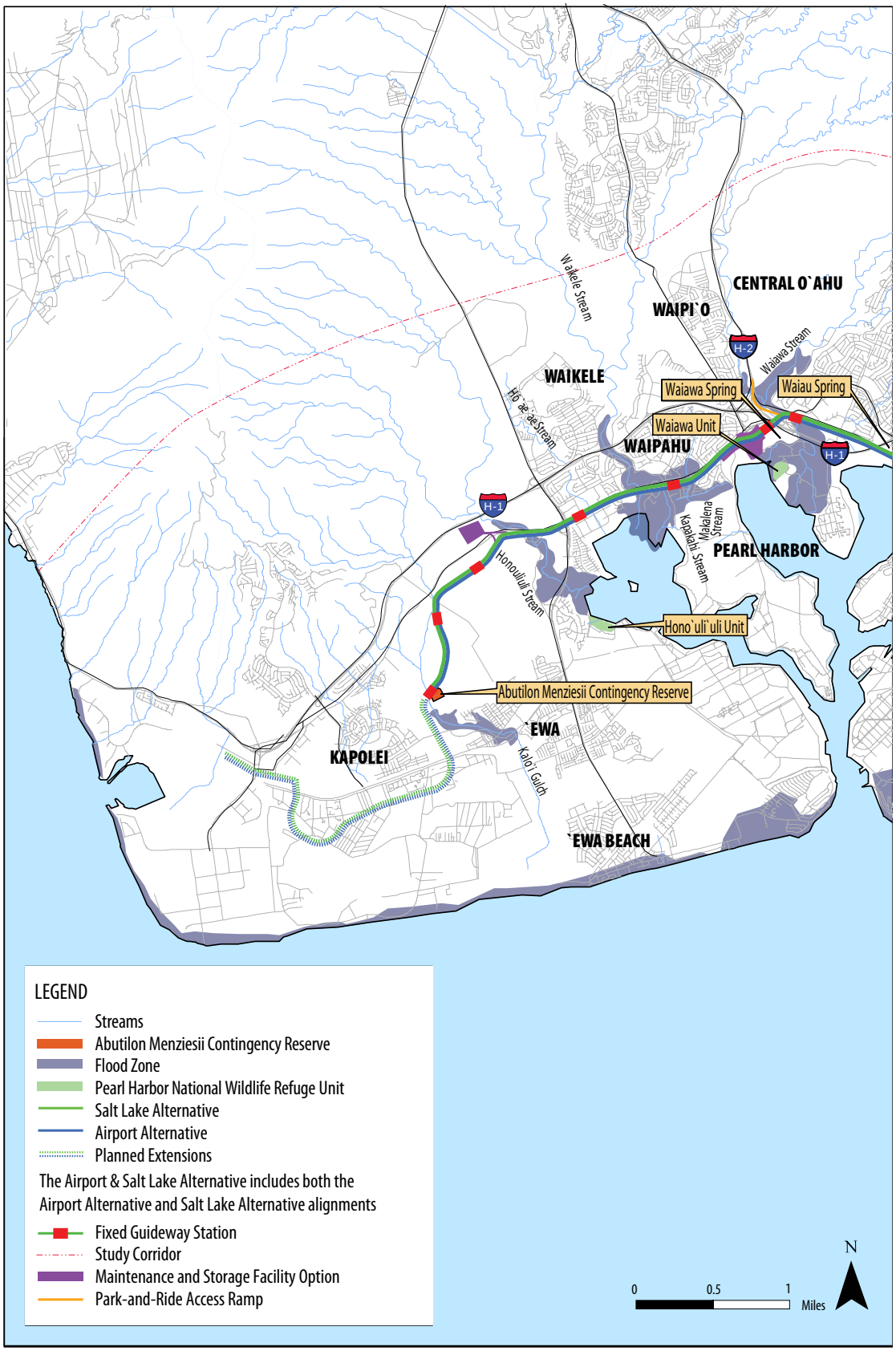


Figure 4-44 Natural Resources (Kapolei to Aloha Stadium)

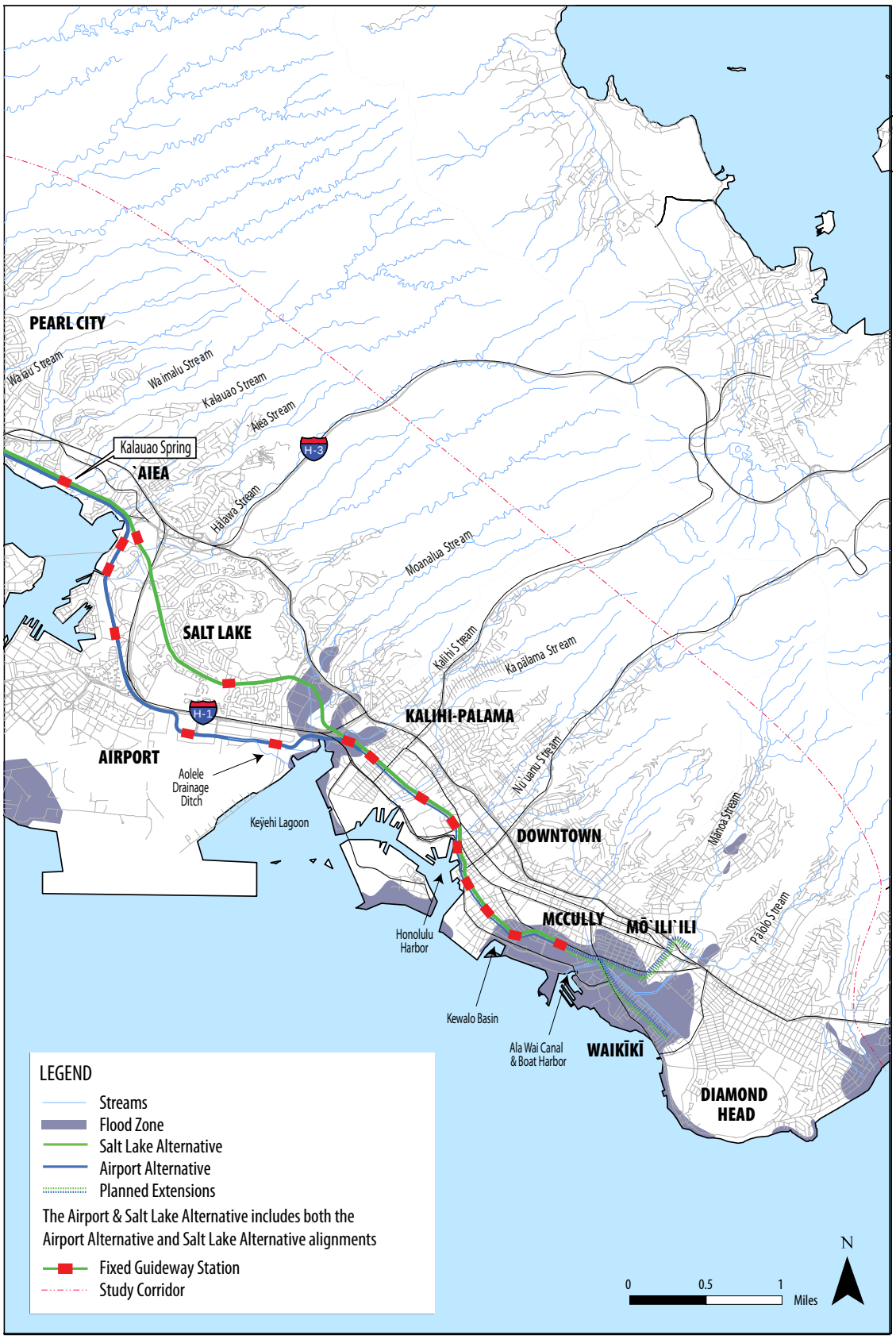


Figure 4-45 Natural Resources (Aloha Stadium to UH Mānoa and Waikīkī)

Table 4-23 Threatened, Endangered, and Protected Species Observed along the Study Corridor

Common Name	Scientific Name	Status	Observed During Survey
Endangered Flora			
Ko`oloa`ula or red `ilima	Abutilon menziesii	Endangered (S,F)	No
Maui chaff flower	Achyranthes splendens spp. rotundata	Endangered (S,F)	No
Skottsberg's broomspurge	Chamaesyce skottsbergii	Endangered (S,F)	No
`Awīwī	Centaurium sebaeoides	Endangered (S,F)	No
`Ihi`ihi	Marsilea villosa	Endangered (S,F)	No
Endangered Terrestrial Fauna			
`Ōpe`ape`a or Hawaiian hoary bat	Lasiurus cinereus semotus	Endangered (S,F)	No
O`ahu `elepaio	Chasiempis sandwichensis ibidis	Endangered (S,F)	No
Hawaiian common moorhen or `alae`ula	Gallinula chloropus sandvicensis	Endangered (S,F)	No
Hawaiian coot or `alae ke`oke`o	Fulica americana alai	Endangered (S,F)	No
Hawaiian duck or koloa maoli	Anas wyvilliana	Endangered (S,F)	No
Hawaiian stilt or ae`o	Himantopus mexicanus	Endangered (S,F)	Yes
Protected Migratory Waterbirds			
Pacific golden-plover	Pluvialis fulva	MBTA Protected	Yes
Black-crowned night heron	Nycticorax nycticorax hoactii	MBTA Protected	Yes
Ruddy turnstone	Arenaria interpres	MBTA Protected	Yes
Wandering tattler	Heteroscelus incanus	MBTA Protected	Yes
State Threatened and Endangered Terrestrial Fauna			
Pueo	Asio flammeus sandwichensis	Endangered (S)	No
Newell's shearwater	Puffinus auricularis newelli	Threatened (S)	No
White tern	Gygis alba	Threatened (S)	Yes

F = Federal; S = State
MBTA =Migratory Bird Treaty Act

The Maui chaff flower, Skottsberg's broomspurge, ʻawīwī, and ʻihiʻihi generally grow in dry forests and could be present on the ʻEwa Plain. They have reportedly been seen on the ʻEwa Plain in the past but were not observed near the project alignment.

There are no HCPs related to any of these species. Four of the reasons why these four endangered species are less likely to be present along the study corridor than koʻoloaʻula are as follows:

- The Maui chaff flower *(Achyranthes splendens spp. rotundata)*, a small shrub, is typically found on talus or rocky slopes and on coral-line plains with numerous sinkholes. The project alignment generally traverses farmed or relatively developed areas rather than talus or rocky slopes. The project alignment also avoids areas with sinkholes because of their structural instability.
- Skottsberg's broomspurge *(Chamaesyce skottsbergii)*, a small shrub, is generally found closer to the coast in drier and sandier areas than the project alignment.
- ʻAwīwī *(Centaurium sebaeoides)*, a small herb, is thought to be extinct on Oʻahu. It is generally found on rocky slopes near the coast.
- ʻIhiʻihi *(Marsilea villosa)*, a small fern resembling a four-leaf clover, requires periodic

flooding for spore release and fertilization, followed by a decrease in water levels for the young plants to establish. It typically occurs in shallow depressions in clay soil or lithified sand dunes overlaid with alluvial clay. This plant is known to occur in areas of Kalaeloa that meet these criteria; however, it does not occur in the more developed portion of Kalaeloa where the project alignment is planned.

Endangered Terrestrial Fauna

A number of endangered terrestrial fauna species are potentially present in the study corridor (birds and fresh/brackish water dwellers). The following is a discussion of these species:

- ʻŌpeʻapeʻa, or the Hawaiian hoary bat (*Lasiurus cinereus semotus),* was not observed during the project survey. Bats have been observed on Oʻahu according to the HBMP; however, the USFWS indicated that those reported sightings were "likely incidental occurrences of transient individuals." The *Recovery Plan for the Hawaiian Hoary Bat* (USFWS 1998) indicates that the species is a medium-sized, nocturnal, insectivorous bat most often observed in open areas and river mouths near wet forests on the Islands of Kauaʻi and Hawaiʻi. The plan further states that more research is needed prior to determining a recovery strategy for the bat.
- Oʻahu ʻelepaio *(Chasiempis sandwichensis ibidis)* is a monarch flycatcher endemic to the forests on Oʻahu and was not observed during the project survey. The Oʻahu ʻelepaio is provided for in the *Revised Recovery Plan for Hawaiian Forest Birds* (USFWS 2006), which indicates there are approximately 2,000 birds in the wild. The recovery area illustrated in the plan for the Oʻahu ʻelepaio is located well mauka of the project alignment.
- Four waterbirds are listed as endangered—the Hawaiian common moorhen, the Hawaiian coot, the Hawaiian duck, and the Hawaiian stilt. These four species inhabit similar habitats and are often found together; they are generally restricted to wetlands (freshwater and marine estuaries) but will visit temporarily flooded areas. Habitat in the study corridor where some or all of these species have been observed previously include Pearl Harbor National Wildlife Refuge, Waiawa Spring, Waiau Spring, and Kalauao Spring (the Sumida Watercress Farm). The *Draft Revised Recovery Plan for Hawaiian Waterbirds* (USFWS 2005a) provides for these four species and indicates that the only core habitat on the southern coast of Oʻahu is the Pearl Harbor National Wildlife Refuge, which is the only listed habitat in the study corridor. The plan lists no supporting habitat on the southern coast of Oʻahu. Observations of these endangered waterbirds during the project survey were limited to the following:
  - A pair of ducks was observed at a distance flying over agricultural fields along North-South Road. Field identification of mallard/koloa hybrids and true koloa is difficult, and positive identification requires closer inspection in the hand. Therefore, it is not known if the ducks observed were the endangered species *Anas wyvilliana*.
  - Five Hawaiian stilts *(Himantopus mexicanus)* were observed at Kalauao Spring (the Sumida Watercress Farm) during the project survey.

Protected Migratory Waterbirds

Four protected migratory waterbirds were observed during the project survey. The MBTA protects these species, but they are not considered threatened or endangered. The four species are as follows:

- The Pacific golden plover *(Pluvialis fulva)* breeds on the Arctic tundra in the summer and spends the winter primarily in South Asia and Australia with a few in California

and Hawai‘i. Twenty-seven Pacific golden plovers were observed in wetlands near count stations during the survey.

- Black-crowned night heron *(Nycticorax nycticorax hoactii)* is a migratory bird common throughout the world; some winter in Hawai‘i, but they can be present throughout the year. They nest in colonies and feed in both freshwater and saltwater wetlands. Individuals were observed during the project survey at the Kalauao Spring (the Sumida Watercress Farm), Moanalua Stream, and the drainage channel along Aolele Street. Local colonies are known to roost and nest in mangrove trees within Pearl Harbor and Ke‘ehi Lagoon; however, nests have not been observed in the mangroves along the Diamond Head bank of Moanalua Stream.
- Ruddy turnstone *(Arenaria interpres)* is a sandpiper that breeds in the northern parts of Eurasia and North America during the summer and winters on coastlines almost worldwide, including Hawai‘i. Six individuals were observed at Kalauao Spring (the Sumida Watercress Farm) during the project survey.
- Wandering tattler *(Heteroscelus incanus)* summer and breed in Alaska and northwestern Canada; in winter they are found on rocky islands in the Southwest Pacific, including Hawai‘i, and on rocky Pacific coasts from California to South America and as far as Australia. They feed on aquatic invertebrates. One wandering tattler was observed at Kalauao Spring (the Sumida Watercress Farm) during the project survey.

State Threatened and Endangered Terrestrial Fauna

Three species may be present in the study corridor that are designated as threatened or endangered by the State of Hawai‘i but not the USFWS. They are as follows:

- Pueo *(Asio flammeus sandwichensis)* are a subspecies of short-eared owl endemic to Hawai‘i that nests on the ground. Its habitat includes wet and dry forests on all the Hawaiian Islands. The Pueo has been observed on the ‘Ewa Plain, but it is in decline due to habitat loss and was not observed during the project survey. There are no recovery plans or designed critical habitat for the Pueo.
- Newell’s shearwater *(Puffinus auricularis newelli)* is endemic to the Hawaiian Islands and nests in burrows dug in forested uplands. No nesting colonies have been found on O‘ahu (Ainley 1997). Small numbers of fledgling Newell’s shearwater have been recovered on O‘ahu following downing incidents and were probably individuals that were attracted to shore from elsewhere by coastal lights (Ainley 1997). No Newell’s shearwater were observed during the project survey.
- White tern *(Gygis alba)* (Figure 4-47), also known as fairy tern, could only be observed with regularity in the Northwestern Hawaiian Islands prior to the 1960s. Their establishment on O‘ahu may be a result of crowded conditions elsewhere, which have forced the birds to search for other roosting and nesting locations (Miles 1986; Vanderwerf 2003). The white tern is Honolulu’s official bird and is currently found only along the southeastern coast of O‘ahu, where

Figure 4-47 White Tern

they breed and roost exclusively in large trees. White terns lay their eggs on bare branches in a small fork or depression, without a nest. The peak nesting period is from February through July. Nine white terns were observed during the project survey, all between Middle Street and UH Mānoa.

Threatened, Endangered, and Protected Marine Fauna

The nearest marine habitat is approximately one-quarter mile from the Project, which is beyond the area that would be affected by the Project.

4.12.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be constructed and would not have any impacts to the ecosystem. Although the projects in the ORTP would be built, their environmental impacts would be studied in separate environmental documents.

Common to All Build Alternatives

As explained in Section 4.13, the Project would result in fewer VMT; therefore, the overall pollutant load in stormwater would be lower than it would be under the No Build Alternative and there would be less threat of surface and marine water contamination. The Project would rely on electric propulsion, which would generate minimal pollutants on the guideway compared to pollutants generated by roadway traffic. This improvement in water quality could provide some relative benefit to downstream habitats, including nearby wetlands, streams, and the Pacific Ocean.

As summarized in Table 4-24, the Project would have no effect on any threatened, endangered, or protected species as described in the following sections.

Endangered Flora

The Project would have no effect on endangered flora. The only endangered flora in the study corridor is koʻoloaʻula *(Abutilon menziesii)*. The presence of this species has previously been well documented, and the HDOT addressed potential effects on the koʻoloaʻula in the study corridor in an HCP prepared for the North-South Road Project in 2004. Mitigation measures are specified in the HCP related to the construction of a variety of developments in the area. Therefore, the Project would not have an effect on the koʻoloaʻula.

Endangered Terrestrial Fauna

The Project would have no effects on endangered terrestrial fauna. The Project would not affect the hoary bat or the Oʻahu ʻelepaio because none of these species are expected to occur in the study corridor.

The Project would not impact any designated critical, core, or supporting habitat for any of the endangered terrestrial fauna species. The nearest such habitat is the Pearl Harbor National Wildlife Refuge Waiawa Unit (Figure 4-44), which is designated as core habitat for the four endangered waterbirds. The Waiawa Unit is more than 1,000 feet southeast of one of the possible

Table 4-24 Summary of the Project's Effects on Threatened, Endangered, and Protected Species Common to All Build Alternatives

Endangered Flora	Endangered Terrestrial Fauna	Protected Migratory Waterbirds	State Threatened and Endangered Terrestrial Fauna	Threatened, Endangered, and Protected Marine Fauna
No effect, with mitigation for ko`oloa`ula	No effect	No effect	No effect	No effect

maintenance and storage facility locations. As stated in Section 4.13, the Project would not affect other wetlands where the endangered waterbirds have been observed, such as Waiawa Spring, Waiau Spring, and Kalauao Spring (the Sumida Watercress Farm).

"No effect" is the project determination even though some of the endangered waterbirds have been observed adjacent to the study corridor. Over time, the waterbirds would adjust to new structures built for the Project since the wetlands would remain intact. This is expected because the waterbirds have continued to occupy the wetlands after the construction of nearby buildings and overhead utilities and the construction or widening of adjacent roads and highways.

Protected Migratory Waterbirds

The Project would not result in the taking of any protected migratory waterbirds. The only protected waterbird that nests in Hawai'i is the black-crowned night heron. The heron is known to nest in mangrove stands in Pearl Harbor and Ke'ehi Lagoon, which are remote from the study corridor. Over time, the waterbirds would adjust to new structures built for the Project and be able to avoid the structures and vehicles. This is expected because the waterbirds have continued to occupy the wetlands, streams, and drainage features after the construction of nearby buildings and utilities and the construction or widening of adjacent roads and highways, including viaducts.

State Threatened and Endangered Terrestrial Fauna

The Project would have no effect on state threatened and endangered terrestrial fauna. The only state threatened or endangered species that is present in the study corridor is the white tern, and none of the species have critical habitat in the area. As explained in Section 4.14, some large street trees along the project alignment would require pruning or removal. White terns select the largest high canopy trees for roosting and nesting. The pruning and removal of these trees are not expected to affect the white tern population because there are numerous other large canopy trees in the urban area of Honolulu that would not be affected by the Project and that could be used by the white terns.

Mitigation

Although the Project would have no effect on threatened, endangered, and protected species, some mitigation would be implemented to ensure this determination in the case of ko'oloa'ula.

A State Incidental Take License for ko'oloa'ula was issued on March 18, 2005, to the HDOT. The DLNR-DOFAW would require that the Project secure a Certificate of Inclusion from the State for the Project. Mitigation measures have already been specified in an HCP for this population of ko'oloa'ula related to construction of a variety of developments, and the Project would comply with those measures. One of the measures has established the 18-acre contingency reserve that contains the largest number of individual plants. The reserve would need to remain *in-situ* until other success criteria of the HCP are met. Success will depend on qualitative and quantitative measures, and the reserve duration is unspecified. The Project would also consider ko'oloa'ula during construction activities, as discussed in Section 4.17.7

4.13 Water

This section identifies surface and marine waters, groundwater, navigable waters, coastal zone management areas, floodplains, and wetland resources in the study corridor. It addresses the potential effects of implementing the Project on these resources and presents mitigation measures that would be incorporated into the Project for each alternative. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Water Resources Technical Report* (RTD 2008k).

4.13.1 Background and Methodology

Numerous water bodies are located in the study corridor and regulated by a variety of Federal and State programs under several different laws.

Regulatory Context

Surface and Marine Waters

The State of Hawai‘i's general policy is to maintain or improve existing water quality in all State waters. Streams that are not expected to meet State water quality standards, even after application of technology-based effluent limitations, are included in the 303(d) List of Impaired Waters (HDOH 2008).

Coastal areas and embayments can be listed by the Hawai‘i Department of Health as "Water Quality-Limited Segments," as required by the Clean Water Act (CWA) Section 305(b) and defined by 40 CFR 130.8. These segments are water bodies with pollutants in excess of established water quality standards, such that they cannot reasonably be expected to attain or maintain State water quality standards without additional action to control sources of pollution.

Alterations to stream channels are regulated by the State of Hawai‘i Commission on Water Resource Management (Water Commission) through a Stream Channel Alteration Permit.
Surface water resources in the study corridor were identified from existing maps, and their use and quality as described in this section are in relationship to State standards. The potential surface water permits required for the Project have been identified and would be obtained when appropriate (see Section 4.20).

Navigable Waters

The U.S. Army Corps of Engineers (USACE) is also authorized to regulate activities in the Nation's waters pursuant to Section 10 of the Rivers and Harbors Act of 1899 (USC 1899) and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (USC 1972). Section 10 of the Rivers and Harbors Act of 1899 requires authorization for the construction of any structure in or over a navigable water of the U.S. Structures or work that occurs outside the defined limits for navigable waters of the U.S. require a Section 10 permit if the structure or work affects the water body's course, location, or condition.

Waters subject to tidal influence and non-tidal streams that carry commercial traffic are generally defined as navigable by the U.S. Coast Guard. The Coast Guard's authority comes from Section 9 of the Rivers and Harbors Act of 1899 (USC 1899), the Act of March 23, 1906 (USC 1906), and the General Bridge Act of 1946 (USC 1946). New bridges or causeways, and the reconstruction or modification of existing bridges and causeways, require a Coast Guard bridge permit to protect the right of navigation. Project structures that would cross navigable waterways have been identified, and consultation with the Coast Guard is underway to determine permit requirements.

Coastal Zone Management Area Program

The Hawai‘i Coastal Zone Management Program has the following goals:

- Protecting valuable resources
- Preserving management options
- Ensuring public access to beaches, recreation areas, and natural reserves

Groundwater

The EPA has designated the Southern O‘ahu Basal Aquifer as the sole or principal source of drinking water for southern O‘ahu. The 1984 Sole Source Aquifer Memorandum of Understanding between the EPA and the USDOT requires projects potentially impacting a sole-source aquifer to coordinate with the EPA to evaluate potential impacts.

Floodplains

Protection of floodplains is required by Presidential Executive Order 11988 (USEO 1977); USDOT

Order 5650.2 (USDOT 1979); the Federal Aid Highway Program Manual (FHWA 1992b); and 23 CFR 650 (CFR 1999). These regulations place special importance on floodplains and require Federal agencies to avoid conducting, allowing, or supporting actions on a floodplain. If a project is located within a floodplain, a sufficient analysis must be included in the project's Final EIS, as specified in USDOT Order 5650.2.

Existing floodways and floodplain limits within the study corridor have been identified using Federal Emergency Management Agency Flood Insurance Rate Maps and other existing data. The State National Flood Insurance Program staff has also been consulted.

As piers for the Project are located and designed, the proposed structures' potential effects on floodplains would be evaluated by conducting hydraulic studies at these specific locations.

Wetlands

Several Federal and State agencies are authorized to regulate wetlands through the CWA and Section 10 of the Rivers and Harbors Act of 1899 (USC 1899), as well as associated State rules for water quality standards. The Army Corps of Engineers makes a Jurisdictional Determination for wetlands in the study corridor. Under Section 404 of the CWA, the discharge of dredge or fill material into "waters of the U.S." and adjacent wetlands, as defined by 33 CFR 328, automatically triggers the need for a permit from the Corps of Engineers. This is called a "Department of the Army permit." Under Section 401 of the CWA, the need for a Department of the Army permit triggers the need for a Section 401 Water Quality Certification from the Clean Water Branch of the Hawai'i Department of Health.

The criteria used in evaluating Section 404 filling activities have been promulgated by the EPA in 40 CFR 230, also known as the "404(b)(1) Guidelines." To demonstrate compliance with these guidelines, applicants for Section 404 permits must conduct an alternatives analysis to determine that there are no practicable alternatives to placing fill in wetlands.

If mitigation is required for fill placed in wetlands, the Project must comply with *Compensatory Mitigation for Losses of Aquatic Resources Final Rule.*

Methodology

Field investigations for wetlands were conducted along the project alignment in December 2007 and January 2008 to identify areas with wetland characteristics, including the presence of water (hydrology), hydrophytic vegetation, and hydric soils. Functions and values (e.g., waterbird habitat, stormwater storage, and riverine watercourses) were qualitatively assessed for any wetlands that the Project could affect.

4.13.2 Affected Environment

Surface and Marine Waters

Streams

Streams within the study corridor are listed in Table 4-25 and illustrated in Figures 4-44 and 4-45. Most of these stream channels have been altered in their lower reaches and are not of high ecological quality. The overall water quality in these urban streams is poor, and many are included on Hawai'i Department of Health's 303(d) List of Impaired Waters (HDOH 2008). Complete navigability determinations for each affected waterway are pending with the Coast Guard. Tentatively, the Coast Guard may classify these channels as Advanced Approval Waterways because they are only navigated by rowboats, canoes, and small motorboats.

Recreational use of many of the navigable streams in the study corridor is minimal because they are located in urban areas and lined with concrete, which is unsuitable for kayaking, fishing, or other recreational opportunities.

Table 4-25 Streams in the Study Corridor

Stream	Navigable Water[1]	Associated Floodplain[2]	Stream Channel within the Study Corridor	303(d) Impaired[3]
Kalo`i Gulch	No	Yes	Natural	No
Honouliuli Stream	No	Yes	Natural	No
Hō`ae`ae Stream	No	No	Concrete	No
Waikele Stream	No	Yes	Concrete	Yes
Kapakahi Stream	No	Yes	Natural	Yes
Makalena Stream	No	Yes	Concrete	No
Waiawa Stream	No	Yes	Natural	No
Pearl City Stream	No	No	Concrete	No
Waiau Stream	No	No	Natural	No
Waimalu Stream	No	No	Natural	Yes
Kalauao Stream	No	Yes	Natural	No
`Aiea Stream	Yes	No	Natural	Yes
Hālawa Stream	Yes	No	Concrete	Yes
Moanalua Stream	Yes	Yes	Natural	Yes
Kalihi Stream	Yes	Yes	Natural	Yes
Kapālama Canal	Yes	No	Concrete	Yes
Nu`uanu Stream	Yes	No	Natural	Yes

[1] Navigability as defined by the U.S. Coast Guard.
[2] Floodplains as defined by the Federal Emergency Management Agency.
[3] 303(d) Impaired Waterway as defined by State of Hawai`i Department of Health.

Marine Waters

The large coastal surface water bodies within or adjacent to the study corridor are listed in Table 4-26 and illustrated in Figures 4-44 and 4-45. These water bodies are all highly urbanized and/or altered from their natural state.

Coastal Zone Management Areas

Recreational uses of surface and marine waters within or adjacent to the study corridor are limited primarily to the ocean. The ʻEwa portion of the corridor falls within a non-designated ocean recreation segment from Pearl Harbor to Kalaeloa. The remainder of the corridor falls within the South Shore Oʻahu Ocean Recreation Management segment, which includes all ocean waters and navigable streams from Makapuʻu Point to the western boundary of the Reef Runway of Honolulu International Airport. Activities in this area include swimming, sunbathing, surfing, snorkeling, paddling, canoeing, sailing, cruising, riding jet skis, whale watching, water skiing, and fishing.

Offshore of Ala Moana Regional Park is the Ala Moana Commercial Thrill Craft Zone, which is restricted to commercial operators. ʻEwa of this zone and Koko Head of the airport is the Keʻehi Lagoon/Kahakaʻaulana Islet Commercial Zone, which is the site of commercial thrill craft and other commercial ocean activities. Recreational thrill craft are accommodated in the Reef Runway Zone that parallels the airport's Reef Runway.

For all Build Alternatives, project construction would occur within the South Shore Oʻahu Ocean Recreation Management area.

Table 4-26 Marine Waters in the Study Corridor

Water Body	Class	Associated Aquifer	Associated Inlets	303(d) Impaired[1]
Pearl Harbor	2—Inland water/estuary	Pearl Harbor	Point-source discharges; streams	Yes
Ke`ehi Lagoon	A—Marine embayment	Honolulu	Storm drains; streams	Yes
Honolulu Harbor	A—Marine embayment	Honolulu	Storm drains; streams	Yes
Kewalo Basin	A—Marine embayment	Honolulu	Storm drains	Yes

[1] 303(d) Impaired Waterway as defined by State of Hawai`i Department of Health.

Table 4-27 Floodplains

Associated Water Body	Developed	Functions	Flood Zone(s) Traversed by Fixed Guideway
Kalo`i Gulch	Yes	Groundwater recharge; stormwater conveyance	AE
Honouliuli Stream	No	Groundwater recharge; stormwater conveyance	A
Waikele Stream	Yes	Stormwater conveyance	AEF, AE
Kapakahi Stream	Yes	Stormwater conveyance	AEF, AE
Makalena Stream	Yes	Stormwater conveyance	AEF, AE
Waiawa Stream	Yes	Stormwater conveyance	AEF, AE
Kalauao Stream	Yes	Stormwater conveyance	AEF
Moanalua Stream	Yes	Stormwater conveyance	AEF, AE, AO
Kalihi Stream	Yes	Stormwater conveyance	AEF, AE, AO

Zone A = the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE = the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AEF = the area within Zone "AE" reserved to pass the base flood.

Zone AO = the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. The depth should be averaged along the cross-section and then along the direction of flow to determine the extent of the zone. Average flood depths derived from the detailed hydraulic analyses are shown within this zone. In addition, alluvial fan flood hazards are shown as Zone AO on the Flood Insurance Rate Map.

Groundwater

The entire Project overlies the Southern Oʻahu Basal Aquifer and includes two aquifer sectors. The Pearl Harbor Aquifer Sector contains the ʻEwa, Waipahu, Waiawa, and Waimalu Aquifer Systems, and the Honolulu Aquifer Sector contains the Moanalua, Kalihi, and Nuʻuanu Aquifer Systems.

Floodplains

Flood Insurance Rate Maps show that the project alignment would cross several floodplains associated with streams, estuaries, and canals (Figures 4-44 and 4-45). Floodplains along the project alignment mostly recharge groundwater levels, convey stormwater toward the ocean, and help moderate floods when they occur. These areas also support plants and wildlife within urbanized areas, while maintaining areas for outdoor recreation and enjoyment and preserving the land's natural beauty. The floodplains and their associated waters, functions, and zones are listed in Table 4-27.

Wetlands

Wetlands near the project alignment are associated with riverine, tidal, and spring water systems. Wetland areas are listed in Table 4-28 and illustrated in Figures 4-44 and 4-45. Land development has

altered or destroyed most of these wetlands, leaving only a few remnants today.

4.13.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built and would not have any impacts to water resources. The projects in the ORTP would be built and the consequences of those projects would be studied in separate environmental documents.

Common to All Build Alternatives

The Project would not adversely affect water resources. The following sections discuss possible effects to surface water, groundwater, floodplains, and wetlands and presents coordination activities and mitigation that would occur to address possible effects. Effects during construction are discussed in Section 4.17.

Surface and Marine Waters

The number of vehicle miles traveled in the corridor is expected to be lower if the Project is constructed when compared to the No Build Alternative. With fewer VMT, the overall pollutant

Table 4-28 Water Resource Systems

Associated Water Resource	Channel	Potential Wetlands Classification	Functions/Values
Honouliuli Stream at Fort Weaver Road	Concrete culvert	Riverine	Drainage
Hō`ae`ae Stream at Farrington Highway	Concrete channel	Riverine	Drainage
Waikele Stream at Farrington Highway	Concrete channel	Riverine	Drainage
Kapakahi Stream at Farrington Highway	Natural drainage	Riverine	Drainage
Makalena Stream at Farrington Highway	Concrete channel	Riverine	Drainage
Waiawa Stream at Farrington Highway	Natural drainage	Riverine	Drainage
Waiau Stream at Kamehameha Highway	Natural drainage	Riverine	Drainage
Waiau Spring at Kamehameha Highway (mauka of HECO power plant)[1]	Natural drainage	Palustrine	Agricultural, water storage, water purification, wildlife habitat/aesthetic, cultural
Waimalu Stream at Kamehameha Highway	Natural/concrete drainage	Riverine	Drainage
Sumida Watercress Farm (Kalauao Spring) at Kamehameha Highway[2]		Wet agricultural field	Agricultural, water storage, water purification, wildlife habitat/waterbird watching, cultural
Kalauao Stream at Kamehameha Highway	Natural drainage	Riverine	Drainage
`Aiea Stream at Kamehameha Highway	Natural drainage	Riverine	Drainage
Hālawa Stream at Salt Lake Boulevard	Concrete channel	Riverine	Drainage
Hālawa Stream at Kamehameha Highway	Concrete channel	Riverine	Drainage
Drainage Ditch parallel to Aolele Street	Concrete drainage	Man-made channel	Localized drainage sump
Moanalua Stream at Nimitz Highway	Natural drainage	Riverine	Drainage/fishing, recreation
Kalihi Stream at Dillingham Boulevard	Natural drainage	Riverine	Drainage
Kapālama Canal at Dillingham Boulevard	Concrete channel	Riverine	Drainage

[1] The proposed guideway will be adjacent to Waiau Spring for a distance of approximately 300 feet. There is an approximately 15- to 20-foot upland buffer from the mauka edge of the highway. The adjacent area surrounding the wetland is developed with residential housing.

[2] The Sumida Watercress Farm is hydrologically linked to the Kalauao Spring approximately 900 feet to the north of the highway. The Project will be adjacent to this watercress farm for a distance of approximately 530 feet.

load in stormwater would be lower and there would be less threat of surface and marine water contamination. The Project would rely on electric propulsion, which would generate minimal pollutants on the guideway compared to pollutants generated by roadway traffic.

Some stream crossings would be required along the alignment. In some instances, the discharge of stormwater from the guideway may increase stormwater inflow to some of these waters. However, because stormwater quality is not expected to be adversely affected, no streams or downstream marine waters are expected to experience negative effects.

Permanent best management practices (BMPs) would be installed as part of the Project to address stormwater quality before the water is discharged to streams or existing storm drain systems. The BMPs would promote a natural, low-maintenance, sustainable approach to managing and increasing stormwater quality. An integral part of the permanent BMPs will be an inspection and maintenance plan to ensure that the BMPs operate as designed. Examples of likely permanent BMPs include grit removal, in-line physical structures, vegetated swales, and retention ponds. The selection of BMPs would depend on developments and the availability of land in the area.

The design of the vehicle maintenance and storage facility will include an increased level of BMPs because it would be the system's most industrial facility. BMPs would likely include vegetated swales, berms, and infiltration trenches to route on-site stormwater to an infiltration basin and prevent off-site stormwater from entering the site. Oil-water separators may be used in specific areas where maintenance is routinely performed or where fueling and washing activities occur.

In some instances, piers may need to be built in streams. Areas where elevated structures would cross navigable waterways have been identified, and consultation with the Coast Guard is underway to address effects. Bridges will be designed to maintain the current navigability of streams. Any piers in streams would be placed to line up with existing bridge structures where feasible.

In conclusion, surface and marine waters within the study corridor are not expected to be adversely affected by the Project.

Coastal Zone Management Area

The objectives and policies of the Hawai'i Coastal Zone Management (CZM) Program are designed to protect and manage Hawaii's valuable coastal areas and resources. The Project is located within the State's CZM area, which covers the entire State. Pursuant to 15 CFR 930.32, federally permitted, licensed, or assisted activities undertaken in or affecting Hawaii's coastal zone must be consistent with the CZM objectives and policies.

The following discussion describes the Project's consistency with the objectives and policies of the State's CZM Program. This assessment will be reviewed by the DBEDT Office of Planning, the agency administering the State's CZM Program.

Recreation Resources

The Project would improve access to existing and future park and recreational facilities along the alignment.

Historic Resources

Consultation with the State Historic Preservation Division (SHPD) would result in commitments or conditions to reduce impacts on historic resources, so that agreement can be reached on findings of effect. No historic resources that are completely coastal in origin (lighthouses, shipyards, etc.) would be affected by the Project. For a full discussion of historic resources, see Section 4.15.

Scenic and Open Space Resources

Scenic impacts associated with the Build Alternatives include potential removal or relocation of Exceptional Trees, a change in the setting of a historic or cultural site or Section 4(f) resource, alteration of ʻEwa-Koko Head and mauka-makai views, and the introduction of project components that are out of scale or character with their setting. The guideway would be visible from some coastal areas and affect views. However, areas where one can clearly see the guideway from the shoreline are already urbanized. Section 4.7 describes visual impacts.

Coastal Ecosystems

The study corridor does not appear to be located within the Shoreline Setback Area or the Special Management Area. None of the Build Alternatives would affect coastal ecosystems. Construction impacts that could affect coastal water quality would be mitigated, as described in Section 4.17.

Economic Uses

To accomplish the economic development objectives for Oʻahu's urban corridor, suitable infrastructure must be developed. The Project would result in improved infrastructure and long-term benefits to residents, businesses, commuters, and developers. None of the alternatives would adversely affect coastal-dependent economic activities.

Coastal Hazards

The Project is not located in a tsunami evacuation zone and would not affect coastal hazards.

Managing Development

The Project would require State and City permits and approvals that include provisions for public participation and ensure protection of coastal resources. The Project would also provide necessary infrastructure to accommodate existing and planned future travel demand.

Public Participation

Agencies, non-governmental groups, and the public have been engaged throughout the Project's planning process, as required by Federal and State law. For more details on public participation opportunities, see Chapter 8, Comments and Coordination.

Beach Protection

The Project is not adjacent to or abutting a beach. None of the alternatives would affect coastal erosion or Oʻahu's beaches.

Marine Resources

The Project is not adjacent to or abutting a shoreline and would not affect marine resources.

Groundwater

The Project would meet the coordination requirements of Section 1424(e) of the Safe Drinking Water Act, in accordance with the 1984 Sole Source Aquifer Memorandum of Understanding between the EPA and the FHWA. A Water Quality Impact Assessment for EPA is underway. It is anticipated that contamination of the Southern Oʻahu Basal Aquifer would not occur, based on the construction methods that would be employed and the presence of an upward hydraulic gradient in the study corridor. Therefore, there would be no adverse effect to groundwater quality.

The Build Alternatives would increase impermeable surfaces and redirect runoff. By installing permanent BMPs, runoff would be directed back into the ground to recharge the groundwater system, resulting in no change in the amount of infiltration. In this way, although runoff from surrounding surfaces may enter the groundwater system along a different path than previous, the groundwater recharge needed to sustain the aquifer system would continue. Therefore, the Project would not result in any long-term changes to groundwater levels, including artesian conditions. Runoff from the guideway itself is expected to be

relatively free of pollutants and would not threaten groundwater quality.

Floodplains

As a linear feature, the guideway would cross several floodplains. However, the Build Alternatives would not cause significant floodplain encroachment as defined by USDOT Order 5650.2. The guideway and stations would be elevated above the floodplain by piers, but some facilities, such as stairs, elevators, and traction power substations, would have to be built at ground level. These features could be affected by flooding if and where they are placed within a floodplain.

The fixed guideway would provide a safe alternative to surface transportation during storms. No likely future damage associated with floodplain encroachment is anticipated that could be substantial in cost or extent. The guideway would be elevated and could continue to run even if flooding occurred on the ground below.

There would be no notable adverse impacts on natural and beneficial floodplain values. In general, the only beneficial functions for the floodplains analyzed in the study corridor are the recharge of groundwater and drainage conveyance. None of the Build Alternatives would affect these functions.

Wetlands

Most of the guideway, stations, and transit facilities are planned within existing roadway corridors and in non-wetland areas. Therefore, no direct impacts to wetlands are expected for any of the Build Alternatives.

One major spring-fed wetland system in Kalauao is adjacent to a segment of the Project and is currently used by the Sumida Watercress Farm. Placement of the guideway structure within the median of Kamehameha Highway would not directly impact these wetlands, but shadows cast by the elevated structure may slightly affect water temperatures and affect watercress growth. These consequences are anticipated to be very slight to non-existent, based on the proposed guideway's distance from open water and watercress farming areas. Shade would only reach open water and watercress in the late afternoon. No direct impact to either of the springs and associated wetlands is anticipated.

A letter has been sent to the Army Corps of Engineers asking for their Jurisdictional Determination concurring that the Project will not have a direct impact on wetlands.

Mitigation

Surface and Marine Waters

Since no adverse impacts to surface and marine waters are expected, no mitigation is required.

Groundwater

Because no impacts to groundwater or the Southern Oʻahu Basal Aquifer are expected, no mitigation other than the BMPs discussed above would be required.

Floodplains

Facilities in floodplains at ground level, such as stairs and elevators, would be designed to function and remain safe during flooding.

Hydraulic studies for specific locations where the Project crosses floodplains would be performed during project design. If hydraulic studies reveal that piers in the floodway would raise base flood elevations, such increases may be avoided by the design. In particular, the Pearl Highlands parking structure would require a design that allows floodwaters to pass unimpeded. Since the Project will be designed to meet these requirements when constructed in the floodplain, no mitigation would be required.

Wetlands

Because no impacts to wetlands are expected, no mitigation is expected to be required.

4.14 Street Trees

This section describes street trees within the study corridor. A street tree is considered any planting in a street or highway right-of-way that exceeds a height of approximately 8 feet. Street trees are prevalent along many of the corridor's roadways, starting in Waipahu and extending to UH Mānoa and Waikīkī. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Street Trees Technology Report* (RTD 2008l).

4.14.1 Background and Methodology

City and County of Honolulu Street Tree Regulations

Exceptional street trees are regulated by Revised Ordinances of Honolulu (ROH), Chapter 41, Article 13. Coordination with the City Department of Parks and Recreation, Division of Urban Forestry, and community groups, such as the Outdoor Circle and Sierra Club, with regard to street trees was initiated at the start of the Draft EIS process. This coordination has resulted in the identification of "Exceptional Trees" along the project alignment. Coordination will be ongoing as the Project progresses.

Street Tree Survey

A comprehensive survey of street trees was conducted in the project corridor to identify species, size, maturity, condition, and the Project's probable effect on each tree. Trees were also listed as "Notable" or "Excellent," if applicable.

4.14.2 Affected Environment

Nearly 50 different tree species were identified during the survey (Figure 4-48). Along most of the alignment, street trees belong to the following species: rainbow shower, be-still, monkeypod, tall fan palm, and coconut palm. Many of the other species present are relatively common in Hawai'i, but some uncommon plantings are present, such as autograph trees *(Clusia rosea)* in Ke'ehi Lagoon Beach Park.

Notable Trees are those deemed to be important to the urban landscape character.

Excellent Trees are mature trees, without any other plantings nearby, that have been allowed to expand to their fullest possible canopy and have not been pruned or affected in such a manner to take away from their appearance.

Exceptional Trees are a single tree or grove of trees with historic or cultural value or which, by reason of their age, rarity, location, size, aesthetic quality, or endemic status, have been designated by the City Council as worthy of preservation (ROH 1990).

Notable Trees along the entire route include the following clusters:

- 43 true kamani trees in rows along both sides of Dillingham Boulevard between Kōkea and Ka'aahi Streets (Figure 4-49)
- 10 privately owned monkeypod trees in the median along Kona Street within Ala Moana Center

The following trees were not identified as Exceptional or Notable, but are important to consider:

- Plantings in the median of Farrington Highway between Fort Weaver Road and Waipahu High School helped beautify this roadway approximately five years ago and were nominated for a landscaping/beautification award. These currently juvenile or semi-mature plantings of rainbow shower trees, tall fan palms, and kou trees are important to the community and the Waipahu streetscape.
- Several streets, including Dillingham Boulevard, Kapi'olani Boulevard, Kona Street, Kalākaua Avenue, and portions of

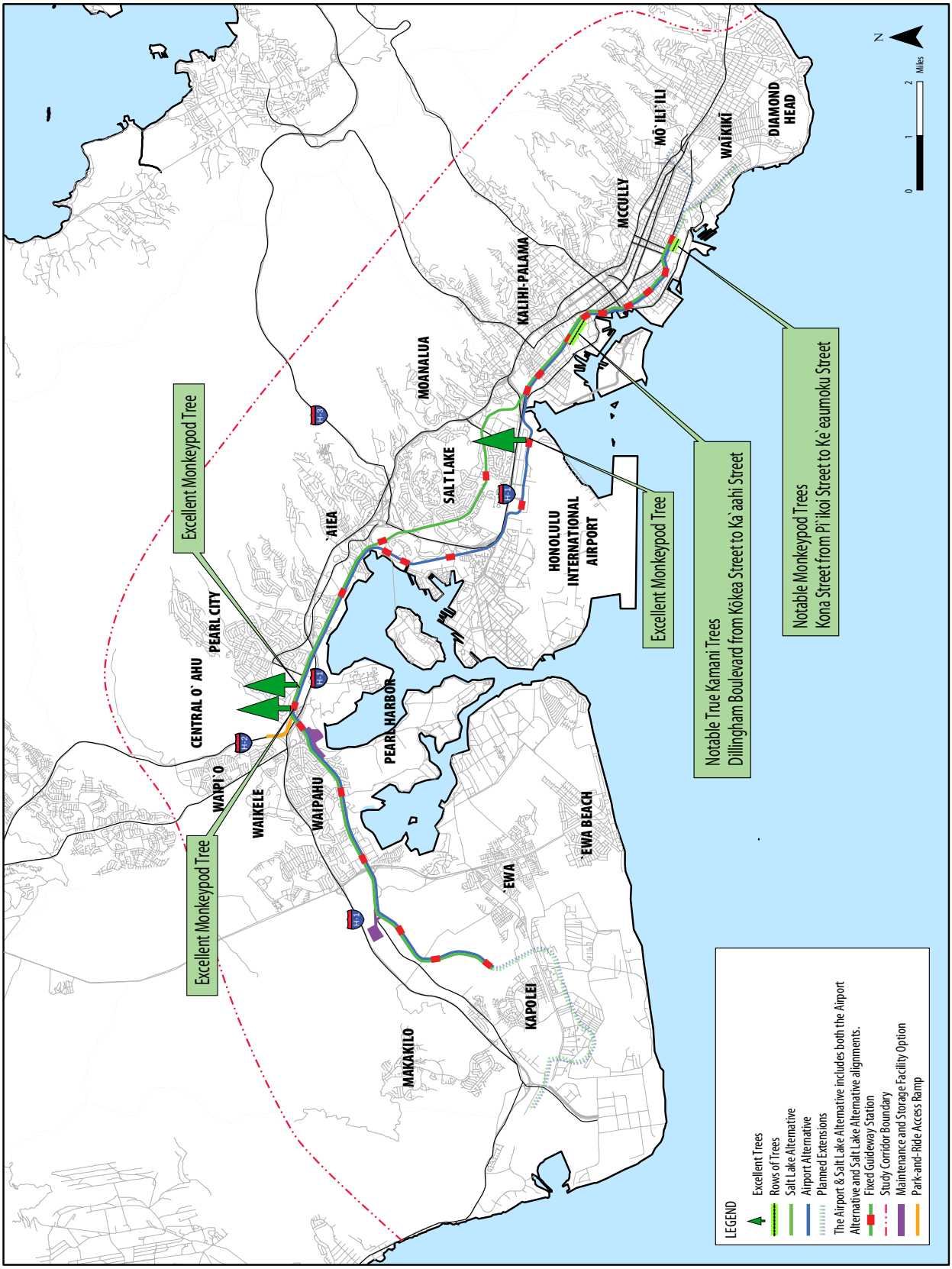


Figure 4-48 Identified Street Trees

Figure 4-49 True Kamani Trees on Dillingham Boulevard

Halekauwila Street, contain mature vegetation within the medians and streetscapes.

- At Honolulu International Airport, near the old interisland terminal, there are many relatively newly planted rainbow shower trees.

4.14.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built and would not impact street trees. Although the projects in the ORTP would be built, their environmental impacts would be studied in separate environmental documents.

Common to All Build Alternatives

Table 4-29 shows the approximate number of street trees that would be pruned, removed, or transplanted as a result of the Build Alternatives.

The Build Alternatives would require tree pruning and removal. Tree removal would be minimized to the greatest extent possible, but if a street tree is close to the guideway, it would likely require periodic pruning, if not removal.

The following effects would result from the Project. The fixed guideway would primarily affect street trees in Waipahu and Downtown. Notable effects would include the following:

- Two monkeypods identified as Excellent trees along Kamehameha Highway near Pearlridge Center have very large canopies that are approximately 50 feet from the center of the planned guideway. They may require minimal pruning.
- Along Dillingham Boulevard, 28 Notable true kamani trees would be removed. . Trees on the makai side of the street are already periodically pruned because of the presence of utilities.
- Most of the relatively newly planted trees along Farrington Highway in Waipahu would be removed.
- Monkeypod Trees on Kona Street between Pi‘ikoi Street and Ke‘eaumoku Street would be removed.

The consequences of the Build Alternatives would be fairly similar because the Notable and Excep-

Table 4-29 Summary of Street Tree Effects/Transplanting Mitigation

Alternative	Trees to Be Pruned	Trees to Be Removed	Trees that Could Be Transplanted
Salt Lake	100	350	250 (71 percent)
Airport	100	550	300 (55 percent)
Airport & Salt Lake	150	650	350 (53 percent)

Note: (71 percent) = approximate percent of trees that would be removed that are transplantable.

tional trees that would be affected are in areas common to all alternatives.

Salt Lake Alternative

The Salt Lake Alternative would prune and remove the fewest number of street trees of all the Build Alternatives.

Airport Alternative

The Airport Alternative would remove approximately 200 more trees than the Salt Lake Alternative. Although the number of trees affected is higher than that for the Salt Lake Alternative, the overall affect is not much greater. Many of the trees that would be affected along the Airport Alternative are relatively small and easily replaceable be-still trees, which explains why a lower percentage of the affected trees along this alternative are considered transplantable. However, the Airport Alternative would require the removal and possible transplant of 14 newly planted rainbow shower trees near the old interisland terminal. In addition, one Excellent monkeypod in Keʻehi Lagoon Beach Park may require slight pruning. Specific quantities of trees to be pruned, removed, and transplanted are included in the totals in Table 4-29.

Airport & Salt Lake Alternative

The Airport & Salt Lake Alternative would result in the combined effects of both the Salt Lake Alternative and the Airport Alternative.

Mitigation

Effects to street trees would be mitigated by transplanting existing trees or planting new ones. Among the trees that require removal but could be transplanted are most of the trees along Farrington Highway. The location where street trees would be transplanted would be selected based on project-specific criteria that could include the following:

- Areas where existing landscaping would be lost along the study corridor
- Areas where opportunities exist for enhancing existing streetscapes near the study corridor
- Areas where stations and parking lots would be constructed
- Areas where shared benefits would be accomplished, such as areas adjacent to parks or historic sites

Street tree pruning, removal, and planting would comply with City ordinances and would require that a certified arborist manage the pruning of any Exceptional trees.

In addition to transplanting existing trees, plans for new plantings would be prepared by a landscape architect during final design to further mitigate effects to street trees. To mitigate any substantial effects in areas that require tree removal, special attention would be given to developing landscaping plans so that new plantings would provide similar advantages to the community. If new plantings would not offer equitable mitigation (e.g., older mature trees that are removed), additional younger trees could be planted that would, in time, develop similar benefits.

4.15 Archaeological, Cultural, and Historic Resources

This section provides the regulatory context that governs archaeological and cultural resources, as well as historic structures. It also discusses how the Project would affect resources and structures within the Area of Potential Effect (APE) and proposed mitigation to address those effects. For more information and references, see the *Honolulu High-Capacity Transit Corridor Project Archaeological Resources Technical Report* (RTD 2008n), the *Honolulu High-Capacity Transit Corridor Project Cultural Resources Technical Report* (RTD 2008p), and the *Honolulu High-Capacity Transit Corridor Project Historic Resources Technical Report* (RTD 2008o).

The Area of Potential Effect (APE) is the geographical area or areas within which an undertaking may directly or indirectly change the character or use of historic properties .

4.15.1 Background and Methodology

Regulations

The Project must comply with Federal and State archaeological, cultural, and historic preservation laws and regulations.

Federal

The Project is subject to compliance with the National Historic Preservation Act (NHPA) of 1966, as amended (16 USC 470 et seq.). According to Section 106 of the NHPA, the responsible Federal agency is required to consider the effect of a project on cultural resources (consisting of archaeological, historic, and architectural properties) included or eligible for inclusion on the National Register of Historic Places (NRHP). The lead Federal agency, in consultation with the State Historic Preservation Division (SHPD), is responsible for the determination of eligibility for listing on the NRHP and for the finding of effect. The Federal Advisory Council on Historic Preservation (ACHP) is given the opportunity to comment on the Project and its effects on cultural resources and participate in development of the Memorandum of Agreement (MOA).

Cultural resources include prehistoric and historic districts, sites, buildings, structures, and objects that represent past human activities. This term includes artifacts, features, and remains that are related to and located within such properties, as well as properties of traditional religious and cultural importance that meet the significance criteria described in this section. This section defines archeological, cultural, and historic resources separately, although each of them are called "historic properties" when they are determined eligible for the NRHP.

Section 4(f) of the U.S. Department of Transportation Act of 1966 also applies to historic properties and is addressed separately in Chapter 5.

State

HRS 343 also includes a cultural component: House Bill No. 2895 H.D.1, passed by the 20th Legislature and approved by the Governor on April 26, 2000, as Act 50. This act amends the EIS law and expands the definition of "significant effect" to include adverse effects on cultural practices.

HRS 6E promotes the preservation of significant historical resources of value to the people of Hawai'i. HRS 6E-43 and HAR 13-300 establish provisions pertaining to the discovery of historic burial sites outside of established, maintained cemeteries on non-Federal lands within the State.

Process for Applying Regulations

Under NHPA, Section 106 requires Federal agencies to consider the effects of their actions on historic properties. This includes traditional cultural properties, which are beliefs, customs, and practices of a living community of people that have been passed down through the generations. Hawai'i's historic preservation review legislation [HAR 13-275(b)] includes similar requirements. The following steps describe the consultation process:

- Initiate consultation and public involvement
- Identify the APE
- Identify and evaluate the NRHP eligibility of resources within the APE
- Assess effects on historic properties currently listed or eligible for listing on the NRHP
- Involve SHPD and other consulting parties in discussions regarding adverse effects on historic properties resulting in an MOA

- Submit the MOA to the Advisory Council on Historic Preservation
- Implement provisions of the MOA

Area of Potential Effect

After coordination with SHPD, the FTA defined the APE for aboveground cultural and historic resources to be generally one parcel deep from the project alignment but larger around stations and in a few other locations. The APE also includes parcels immediately adjacent to all facilities associated with the fixed guideway system, such as park-and-ride lots, traction power substations, and the maintenance and storage facility. The APE around transit stations has been defined to include entire blocks (or to extend 500 feet where blocks are not discernible) around the facilities. A copy of correspondence from SHPD dated February 4, 2008, concurring with the APE is located in Appendix D of this Draft EIS.

The Project's APE for below-ground archaeological resources is defined as all areas of direct ground disturbance. Confining the archaeological resources' APE to the limits of ground disturbance is warranted because the surrounding built environment is largely developed and becomes progressively more urban as the Project progresses Koko Head.

Methodology

NRHP criteria defined in 36 CFR 60.4 were applied to evaluate pre-1969 properties in the APE, which would be 50 years or older at completion of the Project. These regulations state that "the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association." These properties must also meet one or more of the following broad cultural/historic Significance Criteria (NPS 1991; 36 CFR 60.4):

- Criterion A—resource is associated with events that have made a significant contribution to the broad patterns of our history.
- Criterion B—resource is associated with the lives of persons significant in our past.
- Criterion C—resource embodies the distinctive characteristics of a type, period, or method of construction; represents the work of a master; possesses high artistic values; or represents a significant and distinguishable entity whose components may lack individual distinction.
- Criterion D—resource has yielded or may be likely to yield information important in prehistory or history.

In its review of technical reports prepared for the Project, SHPD did not have any questions or comments regarding the methodology used to determine National Register Eligibility. Appendix D of this Draft EIS includes a letter from SHPD dated September 26, 2008, that includes its review comments on the Historic Resources Technical Report (RTD 2008o).

Archaeological Resources

The vast majority of archaeological resources within the APE have been previously identified, investigated, and recorded as a result of cultural resource management work conducted since the 1970s. This work has supported the historic preservation and/or environmental compliance efforts of various private-, Municipal-, State-, and Federal-funded projects and undertakings.

To evaluate below-ground effects on archaeological resources within the study corridor, the corridor was divided into 10 different sub-areas. A qualitative rating system describing potential archaeological impacts was developed and applied to each sub-area. This rating system considered existing archaeological documentation, geological and depositional characteristics, and some field inspec-

tion within the study corridor. The 10 sub-areas are rated Low, Moderate, or High as defined below:

- A *Low* rating indicates potential effects are possible but not considered likely, or that there is a reasonable expectation of potential effects in no more than 10 percent of a given sub-area.
- A *Moderate* rating indicates a reasonable potential for effects on between 10 and 50 percent of a given sub-area.
- A *High* rating indicates a reasonable expectation of potential effects on more than 50 percent of a given sub-area.

A High rating does not mean that at least 50 percent of a sub-area is expected to encounter archaeological deposits. Rather, this rating only means that there is a reasonable potential to encounter archaeological deposits within at least 50 percent of the sub-area. The actual percentage of the sub-area where archaeological resources are encountered would undoubtedly be smaller.

Similarly, the rating system says nothing regarding the NRHP eligibility of potential archaeological resources. That evaluation and consultation will be deferred until an alignment is selected and design is further along. The Archaeological Resources Technical Report (RTD 2008n) describes the methodology and consultation process in detail.

The primary goal of the Project's archaeological effort would be to provide additional background research and limited field investigation results for those areas that would be disturbed by the Project, as well as cultural consultation to support development of the archaeological portions of the Project's Programmatic Agreement (PA). The PA would describe the archaeological historic property and resource identification and evaluation effort, as well as the mitigation procedures for identified archaeological resources. Mitigation would be conducted in advance of, and in some cases during, the construction phases in the Project's different geographic areas. See Section 4.15.3, Environmental Consequences and Mitigation, for additional information on the PA.

Cultural Resources

Cultural resources are sites or places associated with significant events and/or people important to the native Hawaiian patterns of prehistory in the study corridor. These resources also include sites or places that embody distinctive characteristics or that are likely to yield information important for research on the prehistory of Hawai'i. Sites that yield resources important for past and present native Hawaiian cultural practices and items that are part of a cultural place-based context are also included.

The analysis of cultural resources was based on compliance requirements for NEPA (USC 1969), HRS 343 (HRS 2008); Section 106 (USC 1966a), and Act 50 (HHB 2000). The purpose of an Act 50 Cultural Impact Assessment is to: (1) gather information about traditional cultural practices, ethnic cultural practices, urban cultural practices, and pre-historic and historic cultural resources and practices that may be affected by implementation of a development project; (2) analyze the data; (3) produce an impact assessment; and (4) provide mitigation measures and suggestions.

The Act 50 information-gathering process included: (1) identifying individuals and groups with expertise about cultural resources, practices, and beliefs within the transit and station corridor; (2) conducting field surveys (e.g., canvassing or conducting ethnographic pedestrian surveys) in selected areas of the corridor; (3) conducting semi-focused interviews of cultural experts or other individuals familiar with details of cultural practices that would be adversely affected; (4) making site visits; and (5) reviewing pertinent archival documents. In addition to the NRHP criteria A-D, Act 50 adds criteria that have traditional cultural significance

to an ethnic group, including religious structures and/or burials.

Historic Resources

Known and potential historic resources were identified and evaluated, and the Project's effects on them were determined. GIS data were compiled and used to initially identify resources to survey. Properties within the APE were identified as those with construction dates before 1969. In addition, several buildings were surveyed at the request of SHPD, despite being past the 1969 cut-off date or slightly outside the APE. Field observations were made and photographs were taken of more than 1,000 surveyed properties. Research was conducted on resources evaluated as eligible at the Tax Office and other research centers. Summary forms were prepared for all surveyed properties. These were reviewed by SHPD.

Section 106 Consultation

Extensive effort was made to contact, identify, and consult with various cultural and ethnic groups to identify traditional cultural properties and practices during the Alternatives Analysis process. The information gathered at that time provided a starting-point for work to support this Draft EIS.

The purpose of consultation was to identify cultural resources and other issues relating to the Project's potential effects on such resources. Information was obtained from individuals and organizations likely to have knowledge of potential resources in the project study area. A reasonable and good faith effort must be made to identify Native Hawaiian organizations that might attach religious and cultural significance to historic properties in the APE, and they must be given an adequate opportunity to express their views.

In addition to consultation with SHPD, Section 106 consultation letters were sent to Native Hawaiian historic and cultural preservation organizations to request the identification of any cultural concerns that may require attention. The letters initiated an ongoing consultation process with the following groups (Section 106 consulting parties) to identify resources, consider project effects, and develop mitigation to limit the adverse effects of the Project.

- National Trust for Historic Preservation
- Historic Hawaiʻi Foundation
- University of Hawaiʻi Historic Preservation Certificate Program
- American Institute of Architects
- Hawaiʻi Community Development Authority (for Kakaʻako)
- U.S. Navy, Naval Facilities Engineering Command, Hawaiʻi
- Office of Hawaiian Affairs
- Oʻahu Island Burial Council
- Hui Malama I Na Kupuna O Hawaiʻi Nei (Group Caring for the Ancestors of Hawaiʻi)
- Royal Order of Kamehameha
- The Ahahui Kaʻahumanu (civic club formed in 1864 to celebrate the life of Queen Kaʻahumanu)
- The Hale O Na Aliʻi O Hawaiʻi
- The Daughters and Sons of the Hawaiian Warriors
- Association of Hawaiian Civic Clubs—and 15 individual clubs

For a copy of the letters, see Appendix D. FTA will consult directly with the Advisory Council on Historic Preservation.

4.15.2 Affected Environment

Archaeological Resources in the APE

Archaeological resources already documented within the APE include remnants of fishponds, human burials, subsurface cultural layers related to traditional Native Hawaiian occupation, historic building and structure foundations, and historic trash pits and privies.

Three general categories of archaeological resources that could be affected are identified:

burials, pre-contact archaeology, and post-contact archaeology. They are shown by area and rated by probability of occurrence in Figure 4-50 (see Archaeological Resources under Methodology in Section 4.15.1, Background and Methodology).

Cultural Resources in the APE

Because of the level of existing development along the study corridor, many cultural resources have been destroyed or altered beyond repair. The Cultural Resources Technical Report (RTD 2008p) lists cultural resources identified within the Project's APE.

Historic Resources in the APE

The APE contains 84 historic resources (individual or districts). The Historic Resources Technical Report (RTD 2008o) lists all historic resources identified within the Project's APE. SHPD completed determinations of eligibility for historic structures on October 3, 2008. A copy of the determination letter is included in Appendix D of this Draft EIS.

4.15.3 Environmental Consequences and Mitigation

Environmental Consequences

No Build Alternative

Under the No Build Alternative, the Project would not be built, and there would be no impacts associated with archaeological, cultural, or historic resources. The projects defined in the ORTP would be built, and environmental impacts associated with those projects would be studied in separate documents.

Archaeological Resources

Subsurface features and deposits that have not been previously identified may be affected by the Project. Native Hawaiian testimonies in Land Commission Award claims indicate that there are documented burials within the study corridor. These effects would occur during construction (see Section 4.17 for more information). After completion of construction, no additional project-related effects on archaeological resources are expected.

The Project will use a phased approach to identify archaeological resources, including burials. Toward that end, a PA is being drafted by the joint leads. When final, the PA will stipulate the full extent of RTD's and FTA's Section 106 responsibilities prior to each construction phase, identify invited and concurring signatories, and provide direction on mitigation of adverse effects.

Cultural Resources

Potential long-term effects on cultural resources include permanent modification, such as displacement, damage, or destruction. Table 4-30 summarizes the number of resources possibly affected by each Build Alternative. Any cultural resources that are uncovered would be assessed through collaborative consultation with appropriate cultural practitioners and/or community groups. Table 4-31 lists resources within the APE that would be affected.

The phased approach PA discussed above will also include Traditional Cultural Properties (TCPs) in its scope. TCPs are not necessarily the same properties as those identified in the Cultural Resources Technical Report (RTD 2008p), so further evaluation has been initiated to identify TCPs.

Historic Resources

Eighty-four listed or eligible historic resources are identified within the APE. Full or partial acquisitions would occur from some of these historic properties. In addition, possible "diminishment of integrity of setting, feeling and/or association" could result from any Build Alternative. All Build Alternatives would cross the Chinatown Historic District, but none of them would directly affect any contributing elements. These properties, and potential impacts, are shown on Figure 4-51 and listed in Table 4-32.

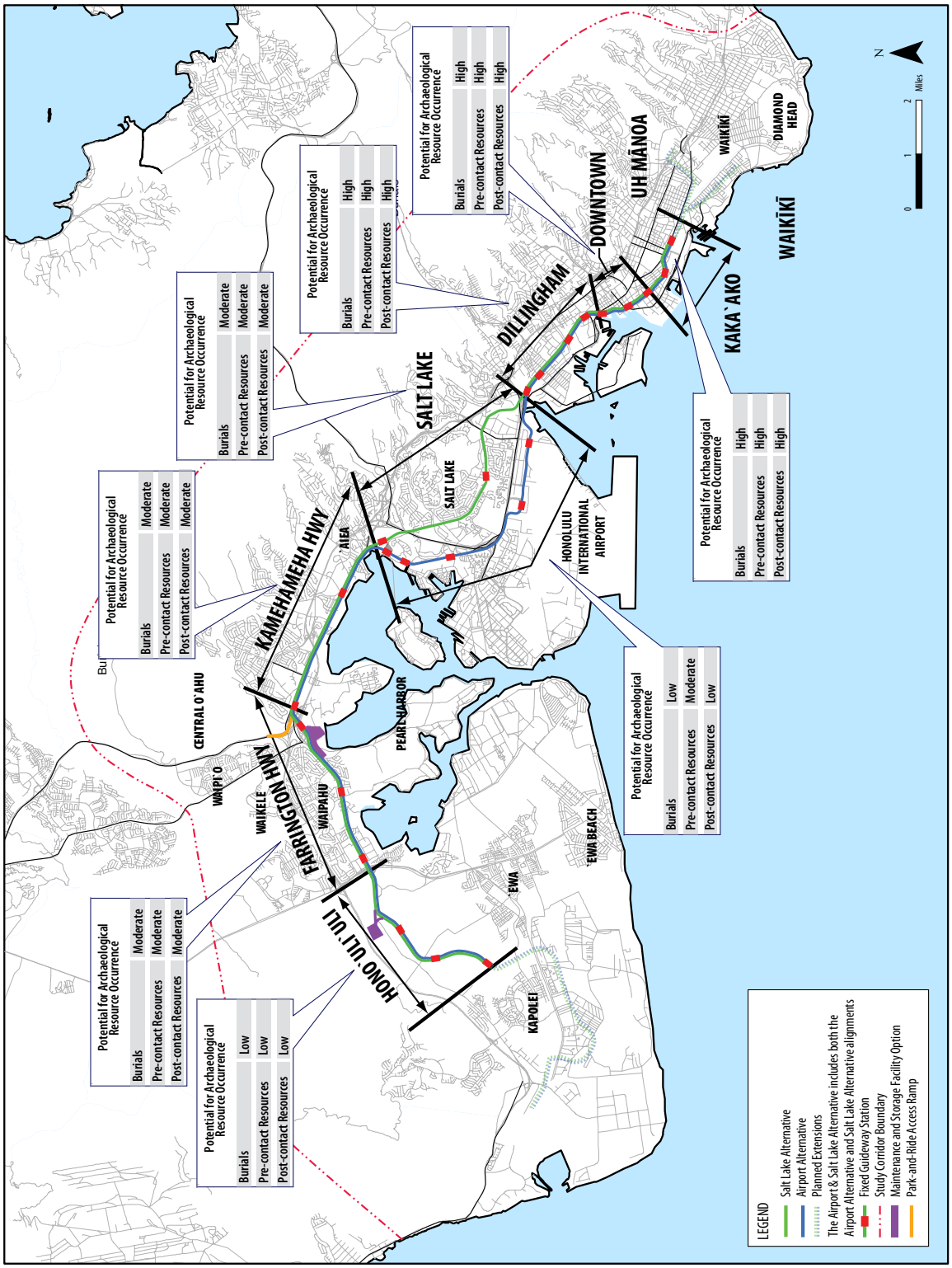


Figure 4-50 Potential to Affect Archaeological Resources

Table 4-30 Summary of Effects on Cultural Resources

Alternative	Cultural Resources Affected
Salt Lake	7
Airport	7
Airport & Salt Lake	7

Of the seven resources that would be adversely affected by all Build Alternatives, one is a grouping of street trees that would require removal and the remainder are historic structures where right-of-way needs would demolish buildings, create a parcel acquisition, or where there would be an adverse visual effect. For the Airport Alternative and the Airport & Salt Lake Alternative, a small amount of right-of-way would also be required from the Pearl Harbor Naval Base National Historic Landmark, but none of its contributing resources would be directly affected.

SHPD has reviewed the preliminary determination of effect presented in this Draft EIS. The division has not yet completed concurrence on determinations of adverse effects and has inquired about indirect effects to several resources and the magnitude of effect to the Chinatown Historic District. Figures 4-29 through 4-31 show views of the Project within the Chinatown Historic District. Consultation is ongoing related to the effects of the Project and commitment of mitigation to reduce those effects to historic resources.

An adverse effect is found when an undertaking may alter any of the characteristics that qualify an historic property for inclusion on the National Register (36 CFR 800.5(a)(1)).

Mitigation

To comply with NHPA Section 106, consultation with SHPD regarding NRHP eligibility and effects resulting from a proposed undertaking is required through preparation of a Determination of Eligibility/Finding of Effect. Because this Project would result in adverse effects and avoidance is not possible, an MOA will be prepared to outline responsibilities and measures to mitigate or reduce project effects. The ACHP and other Section 106 consulting parties will be notified of the potential adverse effects and will be invited to participate in development of the MOA. The MOA will be prepared concurrently with the effects determination to ensure that any project commitments considered in the effects determination are addressed in the MOA.

Because archaeological resources are only expected to be affected during construction, mitigation

Table 4-31 Potential Long-term Adverse Effects on Cultural Resources Related to Act 50

Resource	Type	Effect
Waiawa Stream	Resource (water)	Route crosses in two places. May adversely affect access to stream and resources within stream.
Dee Lite Bakery	Practice	Displacement
Aku Bone Lounge & Grill	Practice	Displacement
Hawai`i International Child	Practice	Displacement
Makana Esthetics Wellness Academy	Practice	Displacement
Tio Restaurant	Practice	Displacement
Rock-n-Roll Sushi	Practice	Displacement

These resources are identified as having potentially adverse long-term impacts. Under Act 50, these types of impacts are called "significant effects" (HHB 2000).

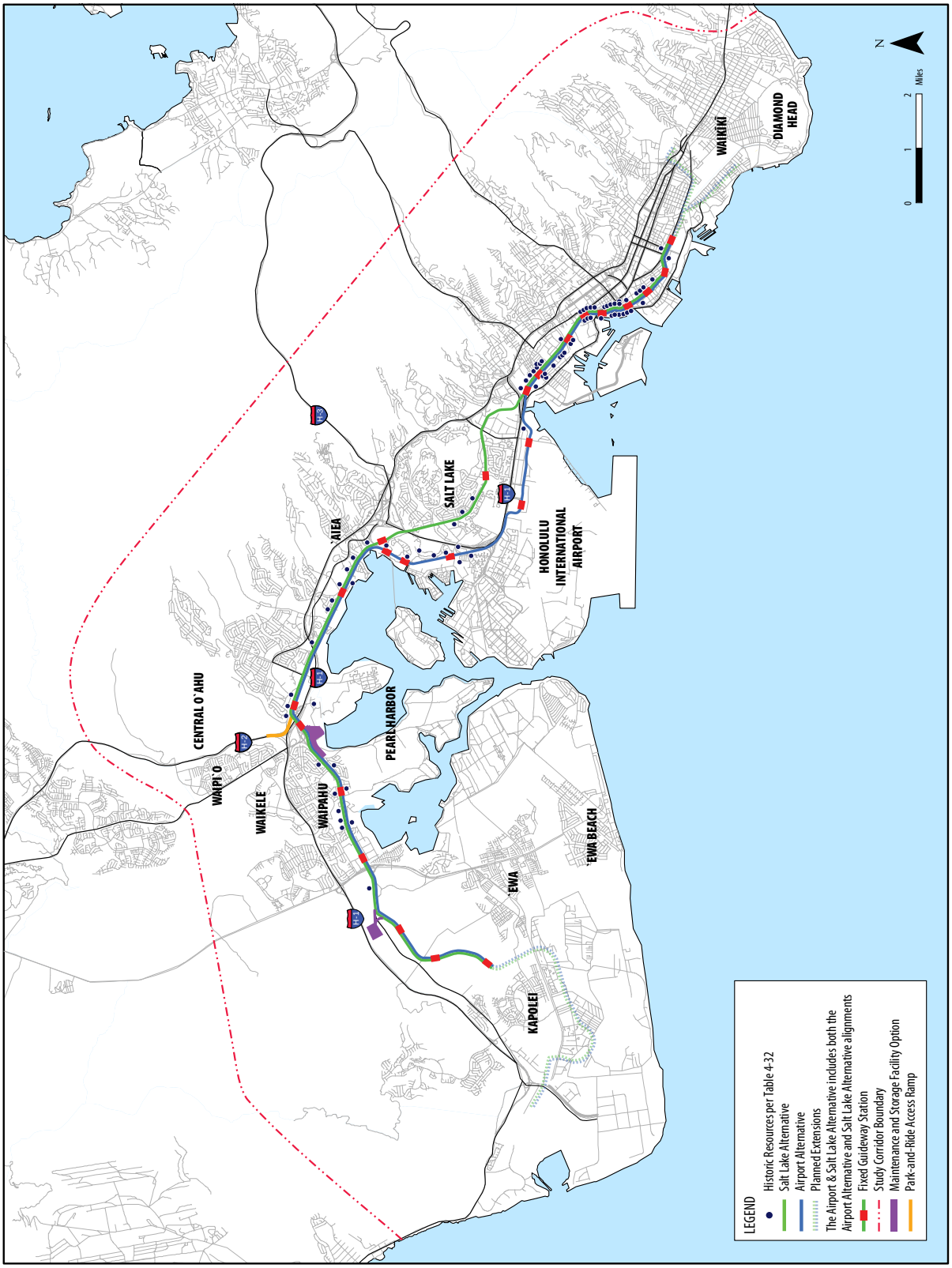


Figure 4-51 Historic Resources

Table 4-32 Historic Properties within Project's Area of Potential Effect (continued on next page)

Tax Map Key	Resource Name	Description of Effect	Preliminary Section 106 Determination
Common to All Build Alternatives			
None	Hono`uli`uli Stream Bridge (Farrington Highway)	No property acquisition	No Effect
94025008	Ishihara House	No property acquisition	No Adverse Effect
94027127	West O`ahu Christian Church/former American Security Bank (round plan)	No property acquisition	No Adverse Effect
94036071	Waipahu Hawai`i Stake, Church of Jesus Christ of Latter-Day Saints	No property acquisition	No Adverse Effect
94039082	Tehahira Apartments	No property acquisition	No Adverse Effect
None	Waikele Stream Bridge, eastbound span and bridge over OR&L spur	No property acquisition	No Effect
94017043	Cavalho Apartments	No property acquisition	No Adverse Effect
94019020	Ohara Apartments	No property acquisition	No Adverse Effect
94038050	Sandobal House	No property acquisition	No Adverse Effect
96003026	Watercress of Hawaii	No property acquisition	No Effect
96003018	***Solmirin House***	***Full acquisition, including building***	***Adverse Effect***
None	Waiawa Booster Pump Station	No property acquisition	No Effect
None	Waiawa Stream 1932 Bridge (westbound lanes)	No property acquisition	No Effect
None	Waiawa Stream 1952 Bridge (eastbound lanes)	No property acquisition	No Effect
None	Waiawa Separation Bridge	No property acquisition	No Effect
98003010	Hawaiian Electric Company Waiau Plant	No property acquisition	No Adverse Effect
98006024	Nishi Service	No property acquisition	No Adverse Effect
98016047	Sumida Watercress Farm	No property acquisition	No Adverse Effect
98018041	Akiona House (Quonset)	No property acquisition	No Adverse Effect
98018042	Forty-Niner Saimin Restaurant	No property acquisition	No Adverse Effect
98022081	Waimalu Shopping Center	No property acquisition	No Adverse Effect
None	Waimalu Stream Bridge	No property acquisition	No Effect
None	Kalauao Springs Bridge	No property acquisition	No Effect
None	Kalauao Stream Bridge	No property acquisition	No Effect
99012006 & 99012001	`Aiea (Honolulu Plantation) Cemetery	No property acquisition	No Adverse Effect
12013006	Foremost Dairy	No property acquisition	No Adverse Effect
12013007	GasPro Store	No property acquisition	No Adverse Effect
None	Lava Rock Curbs (Laumaka Street to South Street, except not along Nimitz Highway)	No property acquisition	No Effect
12002108	Duarte House	No property acquisition	No Adverse Effect
12002113	Ten Courtyard Houses	No property acquisition	No Adverse Effect
12009017	***Afuso House***	***Acquisition, including building***	***Adverse Effect***
12009017	***Higa Fourplex***	***Acquisition, including building***	***Adverse Effect***

Table 4-32 Historic Properties within Project's Area of Potential Effect (continued on next page)

Tax Map Key	Resource Name	Description of Effect	Preliminary Section 106 Determination
12009018	***Teixeira House***	***Full acquisition, including building***	***Adverse Effect***
12009060	Pang Craftsman-style House	No property acquisition	No Effect
12012014	Pu`uhale Market	No property acquisition	No Adverse Effect
15029060	***Boulevard Saimin Restaurant***	***Minor parcel acquisition (0.01 acre), close to building***	***Adverse Effect***
15015008	Six Quonset Huts	Minor strip acquisition (0.1 acres) along Dillingham Boulevard	No Adverse Effect
15022004	Two-story (Tsumoto) Shop House	No property acquisition	No Adverse Effect
15022005	AC Electric	No property acquisition	No Adverse Effect
None	Kapālama Stream Bridge	No property acquisition	No Effect
None	***True Kamani Trees on Dillingham Boulevard***	***Removal of approximately 28 trees along Dillingham Boulevard***	***Adverse Effect***
15007001 & 15007002	OR&L Office/Document Storage Building and Terminal Building	No impact to historic resources	No Adverse Effect
15007001 & 15007002	OR&L basalt street paving	No impact to historic resources	No Adverse Effect
15007001	Former filling station on OR&L Property	No impact to historic resources	No Adverse Effect
15007003	Tong Fat Co.	No property acquisition	No Adverse Effect
15007003	Wood Tenement Buildings	No property acquisition	No Adverse Effect
15007033	Tamura Building	No property acquisition	No Adverse Effect
17002, 17003, & 17004 plats	Chinatown Historic District	Minor parcel acquisition near Chinatown Marketplace (0.3 acre), no impact to building	No Adverse Effect
None	Nu'uanu Stream Bridge	No property acquisition	No Effect
21001056	Harbor retaining wall of coral blocks from Honolulu Fort	No property acquisition	No Effect
Tax Map Keys in plats 17002 & 21002	Merchant Street Historic District	No property acquisition	No Adverse Effect
21001001	Pier 10/11 Building	No property acquisition	No Adverse Effect
21001005	Department of Transportation Harbors Division Offices	No property acquisition	No Adverse Effect
21001013	Aloha Tower	No property acquisition	No Effect
21013007	Irwin Park	No property acquisition	No Adverse Effect
21014003	***Dillingham Transportation Building***	***Minor parcel acquisition (0.06 acre), close to building***	***Adverse Effect***
21014006	Hawaiian Electric Company Downtown Plant	Minor parcel acquisition (0.14 acre), no impact to building	No Adverse Effect
various	Hawai`i Capital Historic District	No property acquisition	No Adverse Effect

Table 4-32 Historic Properties within Project's Area of Potential Effect (continued on next page)

Tax Map Key	Resource Name	Description of Effect	Preliminary Section 106 Determination
None	Walker Park	No property acquisition	No Adverse Effect
21030014	Kamaka Ukulele	No property acquisition	No Effect
21031012	Department of Transportation Building	No property acquisition	No effect
21031018	[Old] Kaka`ako Fire Station	No property acquisition	No Effect
21031021	Royal Brewery/The Honolulu Brewing & Malting Co.	No property acquisition	No Effect
21051006 & 21051005	Mother Waldron Playground	No property acquisition	No Adverse Effect
21050049	Ching Market & House	No property acquisition	No Effect
21050052	American Savings Bank/Liberty Bank—Queen-Ward Branch	No property acquisition	No Effect
21052008	Fuji Sake Brewing Co.	No property acquisition	No Adverse Effect
23007029	Pacific Development Office Building	No property acquisition	No Adverse Effect
23039023	Hawaiian Life Building	No property acquisition	No Adverse Effect
23039001	Ala Moana Building	No property acquisition	No Adverse Effect
Salt Lake Alternative			
11010011	Facility X-24/Quonset Hut (Navy Public Works Center)	No impact to historic resources	No Adverse Effect
99002023	Radford High School	Minor parcel acquisition (0.01 acres)	No Adverse Effect
11021018	Āliamanu Pumping Station (Board of Water Supply)	No property acquisition	No Adverse Effect
11007036	First Hawaiian Bank—Māpunapuna Branch	No property acquisition	No Adverse Effect
11017006–11018014	Potential Salt Lake Duplexes Historic District	No property acquisition	No Adverse Effect
Airport Alternative			
99003029	Pearl Harbor Naval Base National Historic Landmark	Minor parcel acquisition (0.6 acre)	No Adverse Effect
99003066 (partial)	Kamehameha Highway Bridge over Hālawa Stream (mauka span)	No property acquisition	No Effect
99002004	CINCPACFLT Admin Building/CINCPAC Headquarters—Facility 250	No property acquisition	No Adverse Effect
99001008	Ossipoff's Aloha Chapel, SMART Clinic, and Navy-Marine Corps Relief Society—Facility 1514	No impact to historic resources	No Adverse Effect
99001008	Navy WWII splinterproof shelter —Facility S-51	No property acquisition	No Adverse Effect
99001008	Navy Rehab Center/former Fire Station—Facility 199	No property acquisition	No Adverse Effect
99002004	Potential Makalapa Housing Historic District	No impact to historic resources	No Adverse Effect
99002004	Potential Little Makalapa Housing Historic District	No impact to historic resources	No Adverse Effect
11016004	Hawai`i Employers Council	No property acquisition	No Adverse Effect
Airport & Salt Lake Alternative			
11010011	Facility X-24/Quonset Hut (Navy Public Works Center)	No impact to historic resources	No Adverse Effect

Table 4-32 Historic Properties within Project's Area of Potential Effect (continued from previous page)

Tax Map Key	Resource Name	Description of Effect	Preliminary Section 106 Determination
99002023	Radford High School	Minor parcel acquisition (0.01 acres)	No Adverse Effect
11021018	Āliamanu Pumping Station (Board of Water Supply)	No property acquisition	No Adverse Effect
11007036	First Hawaiian Bank—Māpunapuna Branch	No property acquisition	No Adverse Effect
11017006–11018014	Potential Salt Lake Duplexes Historic District	No property acquisition	No Adverse Effect
99003029	Pearl Harbor Naval Base National Historic Landmark	Minor parcel acquisition (0.5 acre)	No Adverse Effect
99003066 (partial)	Kamehameha Highway Bridge over Hālawa Stream (mauka span)	No property acquisition	No Effect
99002004	CINCPACFLT Admin Building/CINCPAC Headquarters—Facility 250	No property acquisition	No Adverse Effect
99001008	Ossipoff's Aloha Chapel, SMART Clinic, and Navy-Marine Corps Relief Society—Facility 1514	No impact to historic resources	No Adverse Effect
99001008	Navy WWII splinterproof shelter —Facility S-51	No property acquisition	No Adverse Effect
99001001	Fuel Oil Pump House—Facility S-386	No impact to historic resources	No Adverse Effect
99002004	Potential Makalapa Housing Historic District	No impact to historic resources	No Adverse Effect
99002004	Potential Little Makalapa Housing Historic District	No property acquisition	No Adverse Effect
11016004	Hawai`i Employers Council	No property acquisition	No Adverse Effect

measures for these resources are discussed in Section 4.17. Where archaeological, cultural, or historic resources remain or are discovered, all efforts would be made to avoid destruction.

Mitigation measures for historic resources affected by the Project are being developed in consultation with SHPD and other Section 106 consulting parties. In addition, Section 106 regulations direct the Federal (or designated) agency to consult with the State Historic Preservation Officer, Chairperson of the Hawai'i Department of Land and Natural Resources, to develop "modifications to the undertaking that could avoid, minimize, or mitigate adverse effects on historic properties" (36 CFR 800.6). Discussions with SHPD regarding mitigation have included preparation of cultural landscape reports and NRHP forms for eligible resources, and historic significance signing and design review with SHPD and other appropriate stakeholders. The NRHP nominations would be updated for already listed affected resources. These will be developed in coordination with SHPD and appropriate stakeholders.

Decisions to avoid adverse effects were made during the Project's Alternatives Analysis phase, including selecting an alignment that would affect the fewest historic resources. Modifications to the Project that could minimize adverse effects involved making engineering refinements (e.g., alignment variations and changes in station designs) and shifting station locations. Further design refinement, such as exact column placement to avoid archaeological resources, will continue during the ongoing design of the Project. Discussions with SHPD will continue to determine engineering choices to minimize adverse effects on areas with the highest-density and highest-quality historic resources.

State of Hawai`i Act 50 Findings

Act 50 findings are detailed in the Cultural Resources Technical Report (RTD 2008p).

Archival and ethnographic research shows that most traditional cultural resources within the study corridor have been heavily damaged or destroyed through previous development, with the exception of a few sink holes in the ʻEwa-Kapolei section and streams in the Pearl City-Moanalua sections. A few of the identified cultural resources would be adversely affected. The greatest effect would be displacement of current traditional/ethnic/urban resources. These would be mitigated with the same measures identified in Section 4.3. Effects on traditional cultural practices associated with streams will be mitigated by minimizing the effects on streams, as discussed in Section 4.13.

4.16 Maintenance and Storage Facility

This section describes the effects of the maintenance and storage facility options on the natural and built environments. Two locations are being considered for the maintenance and storage facility: a 41-acre site in the proposed Hoʻopili development in ʻEwa and a 43-acre vacant site in Waipahu near Leeward Community College. Only one site would be selected, and either location would be compatible with any of the Build Alternatives. The maintenance and storage facility is described in Chapter 2, and the site options are illustrated on Figures 2-41 and 2-42. Effects of the maintenance and storage facility on transportation are described in Chapter 3, Transportation, of this Draft EIS.

The selected site would contain several buildings for administration, a system control center, and parking for maintenance and employees. It would also include areas for operation and maintenance of the trains, including storage for approximately 100 vehicles, a vehicle-wash area, and storage track. The facility would operate 24 hours a day. Each option would require special track work for trains to access the site from the guideway.

4.16.1 No Build Alternative

Under the No Build Alternative, the maintenance and storage facility would not be built and would not affect the natural or built environments.

4.16.2 Common to All Build Alternatives

Land Use

Ho`opili Option

The Hoʻopili maintenance and storage facility option would be mauka of Farrington Highway, makai of the H-1 Freeway between Palehua and Fort Weaver Roads. This site is adjacent to a Hawaiian Electric Company (HECO) substation. The site is used for agricultural purposes by Aloun Farms and includes orchards, fields, storage facilities, operations buildings, and plant nursery shade areas. However, the site is owned by D.R. Horton-Schuler Homes and is in the area of the future Hoʻopili Master Planned Community. The site would be converted from current agricultural use and planned industrial/commercial use to a transportation facility. This option would be consistent with planned land use in the area.

Option near Leeward Community College

This site is near Middle Loch, between Waipahu and Pearl City. The site is makai of Farrington Highway and the H-1 and H-2 Freeways. This site is near Waipahu High School and Leeward Community College. The site is vacant but was used by the Navy as a fuel storage and delivery facility during World War II; the site is no longer used for fuel storage but remains under caretaker status with the Navy. The site would be converted from vacant land to a transportation facility. If not developed as a maintenance and storage facility, the potential exists that the Department of Hawaiian Home Lands could develop the site for housing or light industrial uses. Use of the site for a vehicle maintenance and storage facility is consistent with the past industrial land use of the site.

Noise

Noise would be produced at the maintenance and storage facility. Noise generated would be similar at both sites.

Ho`opili Option

This site is makai of the H-1 Freeway, which is a substantial noise generator. A HECO transmission station is makai of the site. The HECO site does not generate much noise, nor would it be affected by noise from the maintenance and storage facility. There are no existing noise-sensitive land uses near the site. Planned development adjacent to the site is anticipated to be light industrial and commercial. The Master Planned community would also include residential development that would be susceptible to noise and vibration impacts, but these uses are planned to be makai of Farrington Highway.

Option near Leeward Community College

This site lies between Waipahu High School in the ʻEwa direction and Leeward Community College Koko Head. Pearl Harbor is makai of the site, and a bike path runs between the site and Pearl Harbor. The two schools and the bike path are susceptible to noise and vibration effects. However, the school properties are approximately 700 feet from the center of the site. The nearest use at Waipahu High School is a sports field. The schools and the bike path would not experience noise impacts.

Visual

Ho`opili Option

This site is currently an open flat agricultural area adjacent to an electrical substation. The maintenance and storage facility would contrast with the open, rural setting. In addition, the facility buildings would be visible from mauka foothill residences. Planned future development near the proposed Hoʻopili site includes light industrial and commercial uses that are expected to occur in a similar timeframe as the Project. Development of these uses on surrounding properties would reduce the visual contrast of the maintenance and storage facility. A maintenance and storage facility at this site would result in moderate visual effects. Light from the site is not anticipated to affect wildlife.

Option near Leeward Community College

This site is vacant and undeveloped. It is on a flat knoll makai of the H-1 Freeway/Farrington Highway interchange. The maintenance and storage facility buildings would be highly visible from low-lying areas makai of the interchange and from residences on the foothills above. However, the facility would not contrast substantially with elements of the surrounding visual character, which include the highway interchange, community college buildings, and adjacent parking lots. A maintenance and storage facility at this site would result in moderate visual effects. Light from the site is not anticipated to affect wildlife.

Other Environmental Effects

Effects on air quality, energy use, and natural resources are not anticipated to result from either site option. Cultural and historic resources are not anticipated to be affected; the Hoʻopili site has been disturbed by farming activities, and the site near Leeward Community College was formerly used by the military. Both sites are near or include some flood zones; however, the area that would be developed for the maintenance and storage facility is outside of the flood zone area. Stormwater treatment measures would be installed at either site to prevent the runoff of pollution or polluted stormwater.

Hazardous materials, waste, and contamination are not anticipated to be encountered at either site. The Hoʻopili site has been used for agricultural purposes. The site near Leeward Community College was formerly occupied by the military, but a remedial investigation and environmental analysis completed by the Department of the Navy revealed that no adverse human health or ecological effects have resulted, or will result, from the previous

petroleum spill on the site. The U.S. Department of Health & Human Services and HDOH concur with this assessment.

Mitigation

Operation of the maintenance and storage facility would meet local regulations related to noise, air quality, and stormwater management typical of light industrial operations.

4.17 Construction Phase Effects

Construction effects would be temporary and limited in area as construction proceeds along the length of the project alignment. Construction work details will be developed during preliminary and final design. Effects could include dust, noise, and traffic disruption congestion, and diversion, as well as limited or temporarily lost access and parking to residences and businesses. This section of the Draft EIS discusses construction effects related to the natural and built environment with regard to the entire Project. Section 3.5, Construction-Related Effects on Transportation, of this Draft EIS discusses transportation-related construction impacts.

Construction-related effects would result primarily during construction of the main structural components, foundations and columns, superstructure (the elevated guideway structure), and stations. Construction of other system components, such as traction power substations, the maintenance and storage facility, and park-and-ride lots, would also have associated effects but to a lesser degree.

The maintenance and storage facility, park-and-ride lots, and stations could be used for construction staging areas. Additional areas would be identified by the contractor as needed. The contractor would be responsible for obtaining any necessary permits and approvals. The effects of activities in the staging areas known at this time are included in the discussion of construction effects on the natural and built environments.

The proposed construction methods, as described in Appendix C, Construction Approach, would minimize potential adverse construction effects. Construction is expected to begin in late 2009, and the Project is anticipated to be complete in 2018. Because construction would generally be completed sequentially from the UH West Oʻahu to Ala Moana termini, the duration of disruption in any single location would be substantially less than the nine-year total construction period.

Project construction would not have a substantial effect on some resources discussed in earlier sections of Chapter 4, including electric and magnetic fields, natural hazards, and farmlands. Effects on other resources are discussed in the following sections.

As described in Chapter 2, the Project would open in phases, including potentially a connection to the airport as a phase construction of the Airport & Salt Lake Alternative. Stations at the ends of each phase would operate temporarily as terminal stations until the next phase is completed. This operation would temporarily affect access and travel patterns around the stations.

4.17.1 Land Use and Economic Activity

Developed areas Koko Head of Waipahu would experience more land use and community effects than currently undeveloped sections in West Oʻahu. Temporary construction activities, such as temporary detours, may be required in parcels near the project right-of-way. Effects on land use from these activities would be temporary.

Business Access

Access to businesses near construction activities could be temporarily affected. In several locations left-turn lanes would be closed during construction, requiring drivers to change their approach and make a right-hand turn to the businesses. Such closures are expected on Farrington Highway in Waipahu, Kamehameha Highway in Pearl City,

Salt Lake Boulevard, and Dillingham Boulevard. Segments of Halekauwila and Queen Streets may be made temporarily one-way or have parking eliminated during construction. The MOT Plan would be developed by the contractor prior to construction and would address temporary effects on access to businesses during construction. Proposed mitigation to reduce adverse economic hardships for existing businesses along the project alignment during construction activities may include the following:

- Access to businesses would be maintained during construction.
- A public involvement plan would be developed prior to construction to inform business owners of the construction schedule and activities
- Initiating public information campaigns to reassure people that businesses are open during construction and to encourage their continued patronage
- Minimizing the extent and number of businesses, jobs, and access affected during construction
- To the extent practicable, coordinating the timing of temporary facility closures to minimize impacts to business activities—especially those related to seasonal or high sales periods
- Minimizing, as practical, the duration of modified or lost access to businesses
- Providing signage, lighting, or other information to indicate that businesses are open
- Providing public information (e.g., press releases or newsletters) regarding construction activities and ongoing business activities, including advertisements in print and on television and radio
- Phasing construction in each area so as to maintain access to individual businesses for pedestrians, bicyclists, passenger vehicles, and trucks during business hours and important business seasons
- Providing advance notice if utilities would be disrupted and scheduling major utility shut-offs during non-business hours

Employment

Based on construction cost estimates and state-specific employment multipliers, construction-related employment was estimated for direct, indirect, and induced employment. *Direct employment* refers to all new jobs created within the heavy civil engineering and construction sector. *Indirect employment* is created when jobs are created in other sectors as a result of construction (i.e., increases in the food service sector to support increases in construction employment). *Induced employment* results from an overall expansion of the regional economy (and thus new jobs) as a result of the proposed construction.

This analysis estimates the total direct, indirect, and induced jobs to be as high as 11,700 jobs per year over the nine-year construction period (Table 4-33).

4.17.2 Communities and Neighborhoods

During construction, automobile, pedestrian, and transit access to communities and neighborhoods surrounding the project alignment would be affected. These effects are discussed further in the following sections.

The site-specific Construction Safety and Security Plans would be developed and implemented by the construction contractors to mitigate effects on community services, such as fire prevention and emergency preparedness and response, as well as to protect the general public, private property, and workers from construction risks. The FTA requires that such plans be prepared to address these potential construction effects.

The following emergency services departments would be consulted in preparing the Construction Safety and Security Plans and would have some

Table 4-33 Employment Effects

Alternative	Construction Cost 2007 $ (millions)	Average Number of Jobs per Year (9 years of Construction)[1]			
		Direct	Indirect	Induced	Total
No Build	$0	0	0	0	0
Salt Lake	$3,921	4,000	1,700	3,900	9,600
Airport	$4,125	4,200	1,800	4,100	10,100
Airport & Salt Lake	$4,803	4,900	2,100	4,700	11,700

[1] Multipliers of 9.25 for direct, 4.03 for indirect, and 8.90 for induced jobs are based on the 2008 State of Hawai`i Input-Output factor for heavy civil construction (jobs per million $)

responsibility for the Project's safety hazards and security risks:

- The Honolulu Police Department
- The Honolulu Fire Department
- The Department of Emergency Management
- The Honolulu Emergency Services Department

During development of the Construction Safety and Security Plans, measures would be identified to minimize effects on communities and their resources that address specific consequences anticipated at each location within the various communities, as well as ensure the safety of the public and the environment.

In cases where traffic rerouting or delays are expected to affect access to public facilities or the functioning of public and emergency services, alternate access routes would be maintained during construction. Construction in high-volume traffic and pedestrian areas could employ police support to direct and control traffic and pedestrian movements to lessen effects on mobility. To maintain the functionality of public facilities, social resources, and transportation routes during construction, mitigation would include relocating and rearranging certain facilities, noise mitigation, and other efforts deemed necessary to maintain full functionality. In cases where project placement would restrict existing vehicular or pedestrian access routes to public service buildings, alternate access points would be included in mitigation efforts.

Schools, Parklands, and Recreational Resources

Schools adjacent to the project alignment may be affected by a variety of construction issues, such as noise, vibration, air quality, and visual intrusion, depending on a school's distance from the Project. The various parks and recreational resources directly along the project alignment are expected to be affected by temporary nuisances associated with construction, such as noise, dust, and visual intrusion.

The Salt Lake Alternative would have a greater effect than the Airport Alternative to schools, parklands, and recreational resources during construction because of the greater number of such facilities along Salt Lake Boulevard.

In instances where any school, parkland, or recreational resource would experience a disruption in access, the effects would be mitigated as necessary and appropriate using applicable practices similar to those outlined in Business Access in Section 4.17.1, Land Use and Economics Activity. Temporary barrier walls or fences would be placed around any school, parkland, or recreational resource near a construction area.

Utilities

Utilities comprise facilities owned by public utility agencies and private utility companies and include service lines to adjoining properties. Utilities include sanitary sewers; storm drains; water, gas, electric power, telephone, and oil pipelines; street

lights; and traffic signals. Communication and coordination have been initiated with the affected utility agencies and companies and would continue throughout design and construction. HDOT would be involved with utility coordination for utility work in the state roadways and roadway rights-of-way.

Design criteria would govern all new utility construction outside of buildings, as well as the support, maintenance, relocation, and restoration of utilities encountered or affected by construction of the fixed guideway. Utility service to abutting properties would not be interrupted. If facilities were temporarily relocated, the area would be restored as close as possible to its original condition. Replacements for existing utilities would provide service or capacity equal to that currently offered.

Utility rearrangements would ensure that construction of transit facilities may proceed without affecting utility service. Utilities that penetrate through or cross over transit structures would be designed so as to prevent damage. The vertical and lateral clearances of overhead and underground utility lines shall comply with the rules and regulations of the appropriate utility agency and Hawai‘i Administrative Rules during final design and approved by the utility agencies. Coordination would occur with emergency services and utility companies to ensure that utility relocations meet their needs and that sufficient clearance is provided.

Environmental Justice

Construction activities would occur along the entire project alignment and would affect all population groups equally.

4.17.3 Visual and Aesthetic Conditions

During construction, visual quality may be altered for all viewer groups. Construction-related signage and heavy equipment would be visible at and near construction sites. The removal or pruning of mature vegetation, including trees, to accommodate construction of the guideway, stations, and park-and-ride lots, would degrade or partially obstruct views or vistas. Short-term changes to the visual character of areas adjacent to the alignment could result from introducing the following construction elements:

- Construction vehicles and equipment
- Clearing and grading activities that result in exposed soils until replanting or repaving occurs
- Erosion-control devices such as silt fences, plastic ground cover, and straw bales
- Dust, exhaust, and airborne debris in areas of active construction
- Stockpiling of excavated material
- Staging areas for equipment storage and construction materials

These short-term changes would be greatest at station locations, park-and-ride lots, elevated guideway, and maintenance and storage facility sites.

Temporary lighting may be necessary for nighttime construction of certain project elements or in existing highway rights-of-way to minimize disruption to daytime traffic. Temporary lighting could affect residential areas by exposing residents to glare from unshielded light sources or increasing ambient nighttime light levels.

The following mitigation measures are proposed to minimize visual impacts during construction:

- Removing visibly obtrusive erosion-control devices, such as silt fences, plastic ground cover, and straw bales, as soon as an area is stabilized
- Locating stockpile areas in less visibly sensitive areas whenever possible so they are not visible from the road or to residents and businesses
- Shielding temporary lighting and directing it downward to the extent possible

- Limiting the times construction lighting could be used in residential areas
- Replacing removed street trees and other vegetation with appropriately sized vegetation after construction is completed; this would be achieved by implementing a Landscape Architecture Plan for the Project

4.17.4 Air Quality

Air pollution from construction activities would be limited to short-term increased fugitive dust or airborne particulate matter (generally of a relatively large particulate size) and mobile-source emissions. Fugitive dust primarily results from particulate matter being "kicked up" by vehicle movement around a construction site and material being blown from uncovered haul trucks. The State of Hawai'i regulates fugitive air pollutant emissions (HAR 11-60.1). The Project would comply with these regulations. Mobile-source pollution is generated from the operation of construction equipment near construction sites and from traffic disruption and congestion during construction.

The following control measures can substantially reduce fugitive dust:

- Minimize land disturbance
- Use watering trucks to minimize dust
- Use low emission equipment when feasible
- Cover loads when hauling dirt
- Cover soil stock piles if exposed for long periods of time
- Use windbreaks to prevent accidental dust pollution
- Limit the number of vehicular paths and stabilize temporary roads
- Maintain stabilized construction area ingress/egress areas
- Wash or clean trucks prior to leaving construction sites
- Minimize unnecessary vehicular activities

Mobile-source pollution can be reduced by minimizing unnecessary vehicular and machinery activities and limiting traffic disruptions, particularly during peak travel hours (see Section 3.5, Construction-Related Effects on Transportation, for more detail). All State and Local regulations for dust control and other air quality emission reduction controls would be followed.

4.17.5 Noise and Vibration

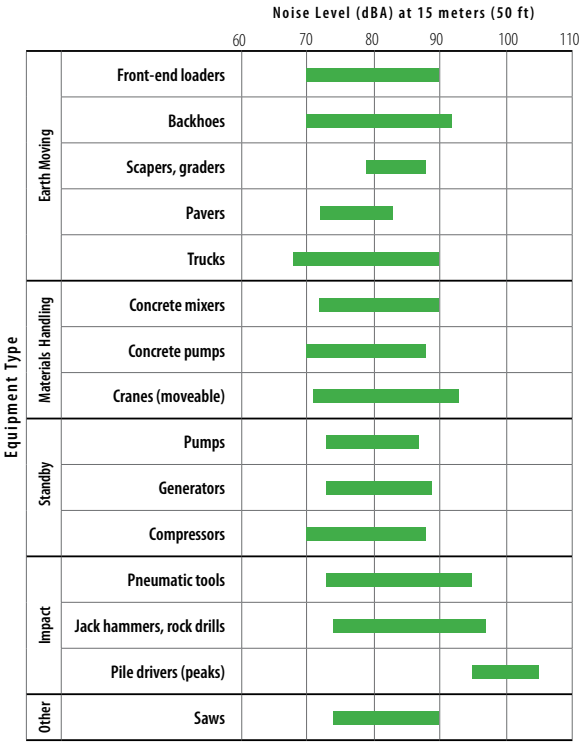
Noise

Noise during construction would be bothersome and annoying to nearby residents, visitors, tourists, and businesses. All of the alternatives would generate similar types of noise, which would occur sporadically in different locations throughout the nine-year construction period.

The most common noise source in construction areas would be engine-powered machinery, such as earth-moving equipment (bulldozers), materials handling equipment (cranes), and stationary equipment (generators). Mobile equipment (e.g., trucks and excavators) operates in a cyclic manner, and stationary equipment (generators and compressors) generates noise at fairly constant levels. The loudest and most disruptive construction activities would be impact pile-driving followed by demolition, jackhammers, and hoe rams. Impact pile-driving, if used as a method for pile placement, would result in the loudest and most disruptive construction work. Impact pile-driving would only be used where less disruptive foundation placement methods cannot be used. Vibration or hydraulic insertion could be used where appropriate to replace impact pile-driving to reduce noise.

Figure 4-52 shows the range of noise levels that can be expected from different types of construction equipment. Construction noise at locations more than 50 feet away decreases at a rate of 6 to 8 dBA per doubling of the distance from the source. For example, if the noise level is 90 dBA at 50 feet from a jackhammer, it would be reduced to approximately 83 dBA at 100 feet and 76 dBA at 200 feet. Doubling the number of noise sources would

increase the noise level by 3 dBA. In the above example, two jackhammers operating together would generate a noise level of 93 dBA at 50 feet from the activity.



Source: EPA, 1971, and WSDOT, 1991.

Figure 4-52 Typical Construction Equipment Noise Levels

The mitigation discussed in this section is meant to be a guideline for developing project-specific measures to reduce construction noise. Prior to construction, the contractor would be required to obtain an approved Community Noise Variance from HDOH. The permit would regulate construction times and activities and include mitigation commitments. The following measures are examples of what could be incorporated. They would be re-evaluated in more detail during preliminary design because impacts to residences cannot be accurately determined without detailed construction plans and schedules.

- Develop a monitoring plan with noise limits
- Construct temporary noise barriers or curtains
- Equip construction equipment engines with adequate mufflers and intake silencers
- Strategically place stationary equipment, such as compressors and generators

These measures can be incorporated into site-specific construction noise mitigation plans to minimize noise impacts to sensitive receivers along the project alignment. Noise emission limits could also be developed. Construction hours could be set, and noise-level criteria could be decided upon and adhered to during construction. Construction noise monitors could be required. Community meetings could be held to explain the construction work, the time involved, and control measures to be taken to reduce the effects of construction noise.

The contractor would comply with standard specifications and all applicable local sound control and noise level rules, as well as regulations set by HDOH. For all alternatives, construction noise from some activities (e.g., pile-driving in certain sections of the alignment) could exceed levels set in the State noise regulations for work between 6 p.m. and 7 a.m. A variance would be required for such nighttime work, which would likely be necessary at certain locations and during certain phases of the Project. Variance permits would specify mitigation measures to minimize effects by limiting the time of day that certain activities could occur.

Vibration

Common sources of vibration during construction activities include jackhammers, pavement breakers, hoe rams, bulldozers, and backhoes. Pavement breaking and soil compaction would likely produce the highest levels of vibration. Depending on soil conditions in an area, activities such as pile-driving can generate enough vibration to result in substantial short-term noise impacts.

Pile-driving would cause the highest vibration levels of the proposed construction activities. Pile-driving activities more than 75 feet from newer, non-historic buildings would not exceed

risk criteria for those buildings. For buildings closer than 75 feet to pile-driving activities, the contractor would be required to provide mitigation for vibration levels during these activities. Contractors could be required to perform a video survey of the immediate area prior to the start of any construction activity where vibration levels may be high enough to affect surrounding structures. The most appropriate method for reducing vibration would be to use drilled shafts or auger-cast piles, which are cast in-place rather than driven into the ground, in areas where vibration-sensitive buildings or utilities are located. By using these types of foundations, impact driving would be eliminated and drilling would generate lower vibration levels.

Construction vibration would have less of an effect on underground and buried utilities than on buildings. Pile-driving is the only proposed construction activity that would generate vibration levels that could damage utilities. Utilities less than 25 feet from pile-driving locations may need to be further evaluated during final design to determine whether mitigation is needed.

4.17.6 Construction Energy Consumption

Construction of at-grade high-capacity transit systems generally requires 20,000 MBTUs of energy per track mile (Caltrans 1983), including track and power systems. Because the Build Alternatives are all elevated, an additional 150,000 MBTUs of energy per track mile would be required to construct the elevated structure. Table 4-34 summarizes the energy that would be required to construct the Build Alternatives.

Measures that maintain roadway speeds and construction practices that reduce energy consumption could reduce energy demand during construction. Any transportation-control measures that reduce traffic volumes and congestion would also decrease energy consumption. Mitigation of traffic impacts during construction are discussed in Chapter 3.

Table 4-34 Total Construction Energy Required

Alternative	Project Construction Energy (MBTUs)
Salt Lake	7,140,000
Airport	7,480,000
Airport & Salt Lake	9,020,000

MBTUs = million British thermal units

4.17.7 Natural Resources

Construction activities could affect wildlife, vegetation, wetlands, and streams near the Project.

Vegetation

During construction, impacts to vegetation would result from the following:

- Footprints cleared for cranes and other equipment
- General clearing and grubbing activities
- Accidental fires resulting from the operation of construction equipment
- Dust generated from construction equipment and from moving and grading earth

Accidental fires and excessive dust could directly and adversely impact the endangered koʻoloaʻula (*A. menziesii,* red ʻilima), a native Hawaiian dryland shrub that is present in an 18-acre contingency reserve located within 200 feet of the East Kapolei Terminal Station and associated guideway. No other endangered or threatened species or critical habitat would be affected by project construction.

To mitigate impacts to vegetation, cranes and other equipment would be sited on previously disturbed areas to the extent possible, and clearing and grubbing would be kept to a minimum. Construction impacts to the endangered koʻoloaʻula would be mitigated by following a Habitat Conservation Plan, using high-visibility construction barriers, implementing fire-prevention measures, and establishing appropriate buffers. Additionally,

prior to clearing and grubbing near the koʻoloaʻula contingency reserve, the area would be surveyed. DLNR permitting requirements will be met. If any koʻoloaʻula are found, a horticulturist from the DLNR would be given an opportunity to remove the plants and transplant them to the contingency reserve.

Street Trees

Street trees that require pruning for construction activities would be pruned more extensively than they would later for system operation. For street trees that would not be affected by system operation, a tree protection zone would be established during construction. The protection zone would be delineated by protective fencing.

Streams and Wetlands

The alteration of stream channels may be necessary as part of the construction process. Stream crossings that exceed 130 feet would likely require placing a 6- to 10-foot-diameter supporting column in the stream. This would affect water quality and require a permit from the USACE.

BMPs would be developed to mitigate potential impacts to streams and wetlands. Migration of the native fish ʻoʻopu also would be considered in BMP design and permit applications. Agency reviews conducted as part of the permit process would ensure that the permits identify proper control techniques to be implemented during construction.

To mitigate the potential impacts of construction on streams and wetlands where no in-water work is required, a construction buffer from the top of the stream bank (or the ordinary high water line for non-tidal streams and the mean high tide for tidal streams) would be established during work in the area.

Wildlife

Construction activities near wetlands and other wildlife habitat that do not permanently alter the habitat are likely to only temporarily disturb wildlife in these areas, including endangered waterbirds. It is anticipated that, over time, wildlife in nearby habitats would adjust to the new structures. The white tern uses large canopy trees for roosting and nesting. The pruning of large canopy trees prior to construction could affect the nests of this species.

Mitigation of construction impacts on wildlife would include avoiding spring-fed wetlands and minimizing construction activities near endangered Hawaiian waterbirds' habitat. A wildlife biologist would survey all large canopy trees to be pruned prior to construction to ensure that no trees have chicks that have not yet fledged, including white terns. If any are found, pruning could be delayed until chicks fledge.

4.17.8 Contaminated Media, Stormwater Quality, and Solid Waste

Contaminated Media

Subsurface conditions are highly variable throughout the construction area where earthwork would occur. Excavation would primarily occur during installation of guideway foundations and relocation of utilities. Other ground disturbance and grading would occur at the maintenance and storage yard, park-and-ride lots, and construction baseyards.

Earthwork could uncover contaminated soil. The Initial Site Assessment prepared for this Draft EIS identified a number of sites and neighborhoods of concern where contaminated soil and groundwater may be present (Section 4.11). The presence of unanticipated contamination could threaten worker health and safety and affect the Project's schedule and cost. Contaminated media can also negatively impact water quality as a result of stormwater runoff and drainage.

To identify soil and groundwater conditions along the project alignment, in-depth assessments of the

sites and neighborhoods identified as concerns in the Initial Site Assessment would be performed during the Project's design phase. It is appropriate to perform additional studies during the design or construction phase because subsurface conditions can change dramatically between the time a project is planned and constructed. Additional studies could include a complete Phase I Environmental Site Assessment, or portions of an Environmental Site Assessment, as well as soil and groundwater sampling. The nature of any future study would vary by area or site and would depend on the level of concern in each area.

Stormwater Quality

Over the anticipated nine-year construction period (2009–2018), stormwater runoff from the construction sites may enter streams, bays, and harbors along the south shore of O'ahu and could affect the quality of nearby surface waters. Sediment loading of stormwater could occur when unstabilized, exposed soil at excavations and stockpiles are exposed to heavy rain, resulting in stormwater runoff. Excavated soil may contain oil, grease, and other contaminants that could be carried away by stormwater into streams, bays, and harbors. Sediment-laden stormwater could create unacceptable levels of turbidity and high sedimentation rates, and contaminated stormwater could contaminate surrounding waters.

Other water sources could flow into natural streams or stormwater collection systems if not properly controlled. Other water sources of concern include water used to wash concrete trucks and control dust, as well as drilling fluids.

In some areas, drilled shafts may extend close to or into the aquifer, and artesian heads may be considerably above the existing ground. To control the flow of groundwater in these cases, dewatering may be necessary to lower groundwater levels to workable levels. Localized grouting may be necessary to stem the inflow.

Dewatering, ground amendment, a combination thereof, or other ground stabilization techniques would likely be required where excavations extend more than several feet below static groundwater levels. Although a dewatering method would be determined during the design stage, it would likely consist of pumping from a sump. To achieve satisfactory drawdown, a more sophisticated technique (e.g., a well point system) may be required if a sump cannot keep up with the recharge. Pile caps, utility trenches, and partially or fully embedded structures are possible dewatering scenarios, depending on groundwater conditions at particular sites.

Dewatering disturbs groundwater's natural level and flow characteristics. Depression of the natural groundwater table can induce consolidation of subsoils and subsequent ground settlement, called *subsidence*. Subsidence can cause cracking and other damage to buildings and facilities.

Dewatering would be required where groundwater is above the base of the pile caps or footings. Dewatering requirements would be greatest in floodplains, including near streams and Pearl and Honolulu Harbors. Dewatering effluent would be discharged to streams, bays, and harbors along the project alignment. As with excavated soil, groundwater could contain petroleum and other contaminants that could be discharged to streams, bays, and harbors. The process of removing groundwater from an excavation may also disturb natural characteristics of the groundwater and result in subsidence, which could damage structures in the area.

Prior to the start of construction, a National Pollution Discharge Elimination System (NPDES) permit for construction would be obtained. The information gathered during a future Phase I Environmental Site Assessment and sampling activities would be considered in the permit preparation. Project and site-specific BMPs would

be prepared and submitted with the NPDES permit. BMPs would include methods to mitigate possible pollution, soil erosion, and turbidity caused by stormwater runoff from all sources. Agency reviews conducted as part of the NPDES permit process would ensure that proper control techniques are identified in the permit and implemented during construction. Stormwater BMPs overlap with air quality mitigation measures to a degree and could include the following:

- Minimize land disturbance
- Stabilize or cover the surface of soil piles
- Maintain stabilized construction area ingress/egress areas
- Wash or clean trucks prior to leaving the construction site
- Install silt fences and stormwater intake filters
- Prevent off-site stormwater from entering the construction site
- Implement other stormwater management techniques

The NPDES permit would also address other sources of water and their proper management, including water used to wash concrete trucks and control dust, as well as drilling fluids.

An NPDES permit would also be obtained for the discharge of groundwater from dewatering activities. All water discharged into the stormwater drainage system or surface-water bodies as a result of the dewatering processes would be required to meet prevailing water quality standards. Site-specific dewatering BMPs would be identified and designed so that the effluent would meet applicable standards. BMPs that could be employed include using settlement tanks or basins, oil-water separators, and sediment filtration, among other dewatering management techniques. The method of dewatering and BMPs employed would vary at each location based on site-specific needs and would also depend on which method is least invasive for each site.

Where settlement due to dewatering is a concern, ground-stabilization methods would be conducted to protect existing conditions. Performance criteria would be established to limit the extent of any adverse influences beyond the work zone to acceptable and time-proven limits. Induced settlement or movement of nearby facilities would not be permitted. Where this possibility may exist, pre- and post-construction monitoring would be required to monitor for unexpected movements or displacements.

Solid Waste

Large volumes of solid waste are often generated at construction sites. Solid waste, ranging from unused construction materials to soda containers, can blow around, causing a general nuisance in addition to degrading the quality of stormwater runoff.

In addition to and/or in support of NPDES permits, the contractor would prepare the following plans to mitigate construction impacts related to wastes:

- **A Construction Safety and Security Plan—** this plan would meet the FTA requirement in 49 CFR 633 and address fire prevention, emergency preparedness and response, and protection of the general public and private property from construction activities, including exposure to toxic materials.
- **A Construction Health and Safety Plan—** this plan would meet the requirements of 29 CFR 1910 and 1926 and all other applicable Federal, State, and Local regulations and requirements. It would also include provisions for identifying asbestos and lead-based paint that would be disturbed by the Project.
- **A Construction Contaminant Management Plan—**this plan would identify procedures for contaminant monitoring and identification and the temporary storage, handling, treatment, and disposal of waste and materials in accordance with applicable

Federal, State, and Local regulations and requirements.

- **A Construction Contingency Plan—**this plan would identify provisions for responding to events, such as discovery of unidentified underground storage tanks, hazardous materials, petroleum hydrocarbons, or hazardous or solid wastes, during construction.
- **A Solid Waste Management Plan—**this plan would identify procedures for recycling green waste during clearing and grubbing activities; maximizing the recycling of construction and demolition wastes, if appropriate; and properly containing solid waste generated during construction and disposing of it at solid waste disposal or recycling facilities permitted by the HDOH. Every effort will be made to recycle all appropriate demolished material.

4.17.9 Archaeological, Cultural, and Historic Resources

Archaeological Resources

Three general categories of archaeological resources (burials, pre-contact archaeology, and post-contact archaeology) could be affected during construction of the Project. With few exceptions, the resources that could be affected are subsurface features and deposits that have not been previously identified. Prior to construction, additional archaeological work would be completed to investigate the potential for sub-surface deposits. This additional work would focus on locations of columns, once they are known.

An MOA pertaining to archaeological resources would be developed in consultation with SHPD, the Advisory Council on Historic Preservation, Native Hawaiian organizations, and other stakeholders to address management of inadvertent finds during construction. The following sections describe potential MOA components that would be employed during construction to mitigate potential impacts to archaeological resources.

Archaeological Monitoring

Consultation with SHPD would assess the need for archaeological monitoring during construction. The archaeological monitoring program would follow the MOA. A monitoring report would be prepared to document all results at the completion of construction.

Preserving Archaeological Resources

In advance of construction, archaeological resources deemed worthy of preservation in place may be identified. If this occurs and the Project is modified to avoid such resources, construction activities would also avoid those resources. Protection zones would be established around these resources to avoid disturbance during construction.

Burial Treatment

During the inventory survey, burials would be identified and managed in compliance with applicable laws. This would include consulting with project proponents, the Oʻahu Island Burial Council, SHPD, and recognized lineal and/or cultural descendants to develop burial treatment plans. Although the goal would be to identify all burials and treat them appropriately prior to the start of construction in a particular area, the chance exists that additional previously undiscovered burials would be encountered during construction.

In each geographic area, the parties consulted regarding burials during the Project's inventory survey phase would be consulted if a find is made during construction. The MOA would outline the treatment of burials discovered during construction.

Cultural Resources

Adverse impacts related to cultural resources resulting from construction of the Project would likely be short-term and consist of affecting access to areas where cultural resources exist or cultural

activities are practiced. The impact to cultural resources or areas would be mitigated using the same maintenance of access policies outlined for businesses.

Historic Resources

Historic resources could be inadvertently affected during construction. Any potential construction impacts would be mitigated using measures outlined in previous construction sections related to noise, vibration, air quality, and water quality. In addition, to avoid collision with or damage to historic resources during construction, protection zones would be established around such resources to avoid disturbance during construction activities.

4.17.10 Relationship between Short-term Uses of the Environment and Long-term Productivity

Construction of the Project would have short-term effects on the environment during construction, as described in this section. These effects would end with the completion of construction. The Project would provide the following improvements in productivity, which are identified as the Purpose of the Project in Chapter 1 of this Draft EIS:

- Provide faster, more reliable public transportation service
- Provide reliable mobility in areas of the corridor with limited income and aging populations
- Serve rapidly developing areas
- Provide an alternative to the private automobile
- Moderate anticipated growth in traffic congestion

The long-term benefit that would be provided by the Project would be greater than the short-term adverse effects to the human environment.

4.18 Indirect and Cumulative Effects

The CEQ regulations at 40 CFR 1500 et seq. and HRS 343 (HAR 11-200) require an assessment of indirect and cumulative impacts. This section summarizes the assessment of these impacts. For more information on land use impacts associated with TOD, see the *Honolulu High-Capacity Transit Corridor Project Land Use Technical Report* (RTD 2008b). For more information on study corridor and regional economics, see the *Honolulu High-Capacity Transit Corridor Project Economics Technical Report* (RTD 2008c).

The cumulative effects analysis includes evaluation of the planned extensions. Additional details about the anticipated effects of the planned extensions may be found by topic in the 16 Honolulu High-Capacity Transit Corridor Project Technical Reports (RTD 2008a through 2008p); however, because the planned extensions are not being constructed at this time and would require further planning and design, information about the extensions is less definitive than information about the Project.

4.18.1 Background and Methodology

Regulatory Requirements

Indirect impacts are defined by CEQ as "effects which are caused by the [proposed] action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to changes in the pattern of land use, population density, or growth rate…"

Cumulative impacts are defined by CEQ as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time." Cumulative impacts

include the direct and indirect impacts of a project together with the reasonably foreseeable future actions of others.

Methodology

A qualitative assessment of indirect effects was based on land use and economic analyses, information gained from planning officials in the area regarding future development, and from land developers active in the study area.

Federal guidance was used in evaluating the Project's cumulative effects, specifically CEQ's *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997a).

Timeframe for the Analysis

The timeframe for the cumulative impacts analysis included both past actions and reasonably foreseeable future actions. The time period of the past analysis was determined by the information available for the resources studied but essentially considered the time since the start of O'ahu's rapid population growth in 1920. Generally, the time for future effect analysis extends from the present day to 2030. This is the timeframe for which the City has plans and projections and anything beyond that is speculation and not reasonably foreseeable.

Geographic Areas of the Analysis

Indirect effects of the Project are likely to occur within the station areas. The station areas are where the greatest changes in access to the transit system would occur; these also are likely to be the areas where development and change in development densities can be reasonably expected in response to the Project.

The cumulative effects analysis considers both the region and study corridor, including the planned extensions.

4.18.2 Indirect Effects

Future development will be greatly influenced by factors outside the control of the project sponsor or any of the other planned projects. U.S. and Asian economic trends can affect the economy of Hawai'i as well as how, when, and to what degree land is developed on O'ahu. The growth projections in the City and State plans are predicated on current information. Actual growth may be more or less than projected.

Regardless of whether the Project is built, City plans direct future development to occur within the study corridor. City policies and plans for areas outside the study corridor allow for limited growth and development.

According to the 2000 census, 63 percent of O'ahu's population of 876,200 was located within the study corridor. By 2030, the total island population will increase by 28 percent, with 91 percent of that increase residing within the study corridor. This level and concentration of growth within the study corridor are consistent with public policy and plans.

Common to All Build Alternatives

After completion of construction, the Project would not decrease or increase regional population or the number of jobs; however, it would influence the distribution of development.

Within station areas, the Project combined with supportive public policies and favorable real estate market conditions could attract transit-supportive development (TSD) and TOD. TSD includes land uses such as office space and multi-story residential buildings near transit stations. Office uses generate more transit riders per square foot of space than any other land use. TOD is more intensive and deliberately planned to integrate with transit and generally includes pedestrian-oriented moderate- to high-density mixed uses.

If one of the Build Alternatives is constructed, it is likely that the City would adopt zoning rules that would allow more dense development near transit stations relative to existing conditions and surrounding areas. The City Council has already taken steps in this direction. The ʻEwa Development Plan, in particular, stresses development in concert with a transit system. Although the addition of transit does not directly cause development to occur, plans and policies would encourage new development to be located near transit stations to take advantage of the transportation infrastructure and increased accessibility if a new transit line is built. These policies and the presence of a transit system can also have an indirect effect on property values in station areas (increases have been demonstrated in other cities with transit systems).

At the study-corridor level, the Project would support the development programmed in the *ʻEwa Development Plan* (DPP 2000), *Central Oʻahu Sustainable Communities Plan* (DPP 2002b), and *Primary Urban Center Development Plan* (DPP 2004a). It would provide greater choice in mode of travel.

At a regional level, the greater attractiveness of the ʻEwa Plain could lessen the pressure on development outside the study corridor. Therefore, relative to the No Build Alternative, a greater percentage of the future population and jobs would be located in the study corridor.

Station Area Development

The City is developing a TOD ordinance, which is expected to be enacted in 2008. Development in the study corridor, whether highway-oriented or TOD, would be based on market demands.

Pursuant to the policy, if adopted, TOD would be expected to occur in project station areas as an indirect effect of the Project. The increased mobility and accessibility that the Project may provide would also increase the desirability and value of land near the stations, thereby attracting new real estate investment nearby. Therefore, the Project's primary indirect effect would be to alter development near the stations, bringing higher densities than presently planned or could otherwise be developed near transit stations. These land use effects could take the form of TOD or TSD. If development occurs around stations, it is anticipated that City infrastructure would be improved in these areas.

It is not expected that the Project would lead to an increase in the overall level of growth allowed or expected in the study corridor. Rather, it would focus the growth into patterns that would increase the number of viable travel options available to corridor residents and employees, including transit, walking, and bicycling. As an additional benefit, compact TOD development would reduce the cost of providing utilities, facilities, and services to new residential and commercial developments.

The potential for TOD differs at each station site. Factors that could spur TOD development, beyond the addition of a transit station, include available and undeveloped land, adoption of TOD zoning and policies, other real estate investment in the area, and market demand for new and additional floor space. The following sections discuss TOD potential at stations.

`Ewa Plain: East Kapolei, UH West O`ahu, and Ho`opili

The undeveloped ʻEwa Plain area has the greatest potential for TOD because of the availability of vacant parcels (Figure 4-3). The undeveloped nature of this area and the fact that fixed guideway construction would occur during or prior to many of the surrounding developments make this area ideal for TOD. The specific stations and planned developments in the station areas that could incorporate TOD elements are presented below:

- East Kapolei—developments by the Department of Hawaiian Home Lands (DHHL), Hunt Development Group (developer of

UH West Oʻahu), and the Salvation Army (Kroc Center) are planned in this area. In addition, a regional shopping center is being planned by the DHHL.

- UH West Oʻahu—developments are planned for the campus as well as the surrounding area by Hunt Development Group on the ʻEwa side of North-South Road and Hoʻopili by DR Horton on the Diamond Head side of North-South Road.
- Hoʻopili—the proposed Hoʻopili development by DR Horton surrounds this station.

Waipahu: West Loch and Waipahu Transit Center

TOD in Waipahu and the remainder of the stations would primarily involve redevelopment of existing uses rather than greenfields development due to a lack of undeveloped land. The same factors that spur TOD in undeveloped areas would apply in these areas but, instead of the availability of undeveloped land, the presence of outdated buildings and uses could spur redevelopment and, hence, TOD.

TOD visioning for these two station areas is being conducted by DPP. This process started in late 2007 and will continue for some time. This process is scheduled to be replicated for all other project station areas.

Leeward Community College and Aloha Stadium

These two stations differ from the other project stations. Both are fairly remote from other developments and not likely to have any indirect TOD effects. The Leeward Community College Station area is difficult to access by vehicle, and the little available land in the area would most likely be used as a project maintenance and storage facility. The maintenance and storage facility is not expected to have any indirect land use effects.

The primary land use near the Aloha Stadium Station is the stadium and Pearl Harbor Navy facilities, neither of which is likely to be redeveloped before 2030.

Pearl City and `Aiea: Pearl Highlands and Pearlridge

The commercial uses near the stations are well established and draw regional customers. These include big-box retail stores near the Pearl Highlands Station and Pearlridge Center near the Pearlridge Station. The volume of traffic through the area and recent investments indicate that development will continue; however, the lack of open space and the relative newness of surrounding development suggest TOD would likely be limited in the near term. One of the few exceptions related to large under-used space is the former drive-in theater adjacent to Pearlridge Center.

Kalihi-Iwilei: Middle Street Transit Center, Kalihi, Kapālama, and Iwilei

These stations would be in relatively urban areas where uses differ parcel to parcel, generally becoming more commercial approaching Downtown (Figures 4-5 and 4-6). Parcel size may limit TOD in some areas; parcels near the Kalihi Station tend to be small, but some parcels near the other three stations are of sufficient size to support TOD. Parcel ownership may also affect redevelopment potential; the smaller parcels are owned by individuals unlikely to substantially change land use, but Kamehameha Schools has substantial holdings in the area and has suggested it is planning redevelopment. Public housing in the area could also be redeveloped to take advantage of the transit system.

Considerable investments have been made in the area Koko Head of Kapālama Stream in the last 10 years. These investments suggest redevelopment in the area is possible and could be further spurred by the Project.

Chinatown and Downtown

Chinatown and Downtown already have TOD or TOD-like developments. Redevelopment in the

area has taken place with recent condominium towers being built Downtown. Further redevelopment could occur, particularly around the port, and incorporate more TOD elements in the future. The historic districts restrict redevelopment to a degree. The Project is unlikely to substantially alter development plans in the Chinatown and Downtown areas.

Kaka`ako: Civic Center, Kaka`ako, and Ala Moana Center

Land use in much of this area is overseen by the Hawai'i Community Development Authority, and new developments already include some TOD features. Considerable investments in both condominium high-rises and commercial developments have been made in this area recently. Continued redevelopment is planned and is expected to continue. Similar to Kalihi, parcel size and ownership is likely to play a role; the smaller parcels in the mauka area are less likely to undergo TOD, while the larger underutilized parcels owned by Kamehameha Schools and General Growth Partners, among others, would be more likely to redevelop and incorporate TOD elements.

Property Values

Changes in property values that would result from construction of the transit system would be indirect effects. Research based on New York and other cities has shown that residential property values can increase close to a transit station (Table 4-35). While most studies of transit's impact on real estate values show increases, they cannot explicitly isolate transit benefits from other market forces.

Value increases near a transit station are realized in sales prices or rents. For residential properties, these increases probably reflect better access to the transit system and associated reductions in vehicle costs. For commercial properties, transit proximity potentially broadens the customer base, increases foot traffic near the business, and contributes to employee accessibility.

In some cases, transit may have a negative effect on real estate values due to what are often called "nuisance" effects—noise, increased foot traffic, visible infrastructure, transit-associated parking lots, and increased bus traffic. These factors can reduce the desirability of properties in the immediate vicinity of the fixed guideway. Such nuisance effects would most likely occur in areas where value is attributable to the remoteness of the location.

Because the Project is forecast to result in travel-time savings and would be placed on already busy roadways, the likelihood of negative effects on real estate value is minimal.

Salt Lake Alternative

Any additional indirect effects specific to this alternative would be minimal. The Ala Liliko'i Station area is dominated by residential and military uses (Figure 4-5) and considerable redevelopment is unlikely.

Airport Alternative

The three stations along the airport alignment, Pearl Harbor Naval Base, Honolulu International Airport, and Lagoon Drive, are largely industrial, airport operations, or military in character (Figure 4-5). TOD is not considered likely in these areas given their industrial nature; however, the proximity of Ke'ehi Lagoon Park and airport jobs suggests that TOD could be attractive in the airport and Lagoon Drive area. The height, and therefore density, of any development in this area would be limited by the proximity of the airport. Development restrictions around the airport decrease the likelihood of TOD in the area.

Airport & Salt Lake Alternative

The indirect impacts of the Airport & Salt Lake Alternative would be the same as for the other alternatives combined. The one exception is that development may occur near the Arizona Memorial Station, which is included only in this alternative. However, this is unlikely since most

Table 4-35 Rail System Benefits on Real Estate Values

Rail System	Rail Technology	Increase in Home Sales Price	Source
BART—San Francisco	Rapid rail	$1,578 increase for every 100 feet closer to a station	Lewis-Workman and Brod 1997
MTA—New York City	Rapid rail	$2,300 increase for every 100 feet closer to a station	Lewis-Workman and Brod 1997
San Diego	Light rail transit	$82.90 increase for every 100 feet closer to a station	Landis, et al., 1995
San Jose	Light rail transit	$60 increase for every 100 feet closer to a station	Landis, et al., 1995
MAX—Portland	Light rail transit	$202 increase for every 100 feet closer to a station	Al-Mosaind, et al., 1993
Metro—Washington, D.C.	Rapid rail	$0.23 increase in per square foot rent for every 100 feet closer to a station	FTA 2000

of the land is under the control of the military (Figure 4-5).

4.18.3 Cumulative Effects

This section describes the cumulative effects of the Project with other past, present, and reasonably foreseeable actions.

Past Actions

Oʻahu experienced major population growth (between 42 and 64 percent per decade) between 1920 and 1950. Much of this growth can be attributed to a military buildup before, during, and after World War II, as well as rapid increases in the tourism industry as air travel became more available. Growth rates decreased steadily in subsequent decades and fell to only 5 percent during the 1990s.

The most notable past action was the urban and suburban development of Oʻahu beginning in the 1940s. This development pressure has continued as Waipahu, the Pearl Harbor area, Salt Lake, Kalihi, and Downtown Honolulu became built-out and in-filled in the post-World War II years. By 1960, the study corridor was virtually built out between Downtown and Waipahu. Since then, ʻEwa and Kapolei have been developing. The latter is the only section of the study corridor with vast amounts of land available for new development.

Construction of the H-1 and H-2 Freeways supported this western push into Central and West Oʻahu. The construction of other highways, such as Farrington, Kamehameha, and Nimitz, helped improve accessibility between West Oʻahu and Downtown and reinforced growth and development.

Present and Reasonably Foreseeable Actions

Depending on which alternative is constructed, the 2030 population within one-half mile from a project station would range from 229,000 to 252,000, which would be approximately a 10-percent increase from 2007. Employment in 2030 within the same area would range from 299,000 to 317,000, an approximate 6-percent increase from 2007.

In addition to the Project, other transportation improvements are anticipated to be completed on Oʻahu by 2030. Table 2-3 (in Chapter 2) lists major roadway projects that are anticipated to be completed. The planned extensions to West Kapolei, UH Mānoa, and Waikīkī also are included in the ORTP and anticipated to be completed by 2030.

Table 4-36 summarizes planned and foreseeable development within the Central Oʻahu Sustainable Community Plan area and the ʻEwa and PUC Development Plan areas in the study corridor. The

development areas within the study corridor are illustrated in Figure 4-2.

Land Use

At a regional level, land use changes associated with past projects have included transformation of the land from undeveloped to urban, suburban, and rural farm uses. The bulk of future regional land use changes are expected in the study corridor. Most undeveloped land within the study corridor is likely to become urban or suburban. Many already developed lands within the study corridor also are likely to be redeveloped to higher-density uses. Expansion of public services and facilities would be associated with future growth. Such growth would be consistent with community plans.

The planned Kapolei extension would result in conversion of approximately 20 additional acres of farmland to transportation use, none of which is actively cultivated (Figure 4-7). The UH Mānoa and Waikīkī extensions would not have substantial effects on land use because those areas are already highly urbanized.

Economy

Economic changes have come with transitions to and from agricultural, military, and tourism economies. Continued focus on tourism is anticipated. The economic forecast is for continued steady growth. Planned projects are intended to continue to encourage and enable economic growth in the region. Completion of the planned extensions would include additional land conversion to public transportation use, decreasing the taxable land and associated property tax revenues.

It also would require hiring of additional workers to support the expanded system.

Displacements

Past projects, such as the H-1 Freeway construction project, have resulted in a number of relocations. Planned projects, including transportation projects listed in the ORTP, will result in some level of displacement of a variety of land uses. Projects likely to result in displacements include widening of the H-1 Freeway in Kalihi and Pearl City. The planned extensions to the fixed guideway system are anticipated to require approximately 15 full and 50 partial acquisitions. These acquisitions would result in the displacement of approximately 20 residential units and 60 businesses.

Community Facilities and Public Services

As growth proceeds, community facilities and public services would need to expand to meet increasing demand. Public policy requires that large developments provide land and develop such facilities, including schools. As development proceeds, the tax base also would grow to fund the expansion of such facilities.

The network of utilities would grow and be upgraded as a result of continued development. Water, sewer, and electrical upgrades would be a benefit to the community as they would improve availability and reliability of services.

The planned extensions would affect existing parks and recreational resources in Kalaeloa and would cross the Ala Wai Promenade. They also would affect, but not displace, fewer than 10 existing community resources through partial acquisition of properties where they operate. Effects to utilities would be similar to the effects of the Project, but located in the areas of the extensions.

Neighborhoods

Past projects, such as construction of the H-1 Freeway, have affected neighborhoods by cutting through and separating communities in the urban area and changing the character of communities. Continued development and increased density in the study corridor will affect the character of neighborhoods; however, effects as extensive as those caused by the construction of a new freeway

Table 4-36 Planned and Foreseeable Actions in the Study Corridor

Corridor Area	Present and Known Planned Developments	Foreseeable Actions
`Ewa Development Plan Area	• Ka Makana Ali`i, a 1.1-million-square-foot mixed-use development with commercial, office, and hotel space on 67 acres developed by DeBartolo on behalf of DHHL • Salvation Army-sponsored Kroc Center in Kapolei • Disney hotel and timeshare with 800 units at Ko `Olina Resort • Kapolei Commons, a 610,000-square-foot shopping center on 50 acres • University of Hawai`i West O`ahu campus—a 76-acre planned campus near the proposed UH West O`ahu station; 4,000 homes and commercial areas would be developed around the campus as part of the plan • Ho`opili, a mixed-use community planned by DR Horton on land it already owns, which would include 11,700 homes • Ocean Pointe residential, harbor, and golf course development by Haseko Homes on 1,100 acres • Makaiwa Hills, a planned community of 4,100 homes plus business areas • Mehana at Kapolei, a single- and multi-family residential development by DR Horton with 1,000 homes • New electric power plant for peak demand in Campbell Industrial Park • Transportation projects in the 2030 ORTP • Kalaeloa Harbor 2020 Master Plan improvements • Kalaeloa Airport improvements • Redevelopment of Kalaeloa (former Barbers Point Naval Air Station) • Near complete buildout of residential, commercial, and public facilities as planned in the `Ewa Development Plan by 2030 • Planned fixed guideway extension to West Kapolei	• Development of a Downtown Kapolei • Redevelopment of Kalaeloa (former Barbers Point Naval Air Station) • Near complete buildout of residential, commercial, and public facilities as planned in the `Ewa Development Plan by 2030
Central O`ahu Sustainable Communities Plan Area	• A TOD plan in two station site areas initiated by DPP • Koa Ridge, a master planned development with 3,500 homes by Castle and Cooke • Transportation projects in the 2030 ORTP	• Near complete buildout of residential, commercial, and public facilities as planned in the Central O`ahu Sustainable Communities Plan
Primary Urban Center Development Plan Area	• Plans by Kamehameha Schools to redevelop land it owns in Kalihi into mixed-use developments, including residential and retail • Potential redevelopment in Kaka`ako on land owned by Kamehameha Schools, General Growth Properties, and others • Transportation projects in the 2030 ORTP • Honolulu International Airport Master Plan improvements • Honolulu Harbor 2020 Master Plan improvements • Planned fixed guideway extension to UH Mānoa • Planned fixed guideway extension to Waikīkī	• Possible development of the downtown HECO power-plant site • Redevelopment of aging and underutilized land to higher-density uses

would not occur. Future projects would likely have less severe effects than previous H-1 Freeway construction. Those effects would be gradual as individual projects are implemented.

Redevelopment, and specifically TOD, could occur in certain neighborhoods. In areas such as Chinatown, Downtown, and Waikīkī, TOD would not change neighborhood character. In other areas, TOD could have an effect. The principles of TOD, such as pedestrian-orientation and mixed uses, are generally credited with reviving neighborhoods or making them more vibrant.

The planned extensions would serve additional neighborhoods with transit stations, such as Makakilo-Kapolei-Honokai Hale, McCully-Mōʻiliʻili, and Waikīkī. No substantial effects to those neighborhoods are expected. This is primarily because the extensions would follow already busy thoroughfares or pass through undeveloped areas. The increase in mobility resulting from the extensions would generally improve the quality of life for neighborhood residents, especially for those with limited financial resources and those who may be transit-dependent.

Environmental Justice

EJ communities are expected to benefit from the Project, planned extensions, and related development. The planned extensions would expand the extent of the fixed guideway transit system, which would improve travel options for transit-dependent groups. An affordable and reliable means of transportation throughout the study corridor would provide more opportunity for low-income groups to live and work throughout the study corridor. The planned extensions would not be located within any areas of EJ populations (Figure 4-14).

Visual

The visual environment has been affected by past changes in land use and by the increasing height of buildings in the Downtown, Kakaʻako, and Waikīkī areas. Similar effects are expected to gradually continue throughout the study corridor. In the ʻEwa area, visual resources would be affected more rapidly than other areas in the study corridor by the replacement of undeveloped land and farmland with housing, commercial, and public facility developments in accordance with development plans.

Modification of height limit and/or setback distances near transit stations could change the aesthetic character and design in transit station areas. More views and open areas outside the study corridor may be preserved as a result of concentrating development around station areas and away from more rural portions of Oʻahu.

Views of the planned extensions would be similar to those of the Project shown in Section 4.7. Figures 4-53 and 4-54 show simulated views of the planned UH Mānoa and Waikīkī extensions.

Noise

Noise has been steadily increasing in the region as it has become more urban and suburban and as air and road traffic have increased. As the study corridor becomes more densely developed, ambient noise levels will continue to increase. The planned extensions would create additional noise impacts in the vicinity of the alignment, which are similar to those discussed for the Project in Section 4.9. With existing land uses, no noise impacts would occur at ground level, but users of outdoor lanais located above the height of the guideway and facing the extensions would experience moderate noise impacts at some locations between the Ala Moana Center Station and the end of the Waikīkī extension.

Hazardous Materials

Industrial and military land uses in the past have resulted in the release of hazardous materials, such as fuels and solvents, into the environment. Several brownfield sites are located in the study

Figure 4-53 Visual Simulation of UH Mānoa Extension at Convention Center, looking Mauka

Figure 4-54 Visual Simulation Waikīkī Extension at Kālaimoku, looking Mauka

corridor. As a result of laws enacted since the 1970s, new developments and industrial activities are not expected to result in the release of hazardous materials.

The planned extensions to the fixed guideway system are anticipated to affect approximately 10 additional sites of concern for hazardous material contamination.

Ecosystems

Past development of suburban areas and farms has replaced undeveloped lands throughout the region. Even in the 1920s, there was almost no undeveloped land in the study corridor due primarily to sugar cane plantations. The few wetland areas that were not used for sugar cane production were mostly developed for post-war housing, such as in the Salt Lake area. The former sugar cane lands do not provide significant habitat; however, continued development could have a lasting effect on bird species that adapt well to urbanization. The Project could indirectly result in the preservation of a larger volume of vacant and undeveloped land outside the study corridor by supporting development within the corridor. This would have a commensurate benefit to ecosystems.

There would be no additional cumulative effect to ecosystems as a result of the planned extensions.

Threatened and Endangered Flora

An 18-acre koʻoloaʻula *(Abutilon menziesii)* contingency reserve lies within the ʻEwa Development Plan area. Proposed development in the Kapolei area could affect endangered plants in the vicinity. The transplantation of plants and special protective measures during construction may be needed in this area as outlined in the approved Habitat Conservation Plan.

Impacts to other threatened and endangered flora is unlikely because few species are present within the area and, if any are encountered, they would receive protection and mitigation similar to the Habitat Conservation Plan for koʻoloaʻula.

Threatened and Endangered Wildlife

More threatened and endangered wildlife species were observed in the developed portion of the study corridor than in the undeveloped area. This is because there is no habitat for threatened and endangered wildlife species in the ʻEwa area even though it is relatively undeveloped. Because no cumulative impacts to habitat are likely, no cumulative impacts to these species are likely.

Water Resources

Water resources have been degraded by past residential and farm development. The most substantial effects of past actions include the following:

- The channelization of most streams in urban and suburban areas
- The draining and filling of wetlands in Waikīkī, Salt Lake, and Pearl Harbor
- The pollution of surface water and groundwater with agricultural (herbicide and insecticide) and other chemicals

Past development has resulted in degraded water quality within the PUC. In the Central Oʻahu and ʻEwa areas, continued development will likely cause additional degradation of water resources in those areas. However, most streams in the ʻEwa area are ephemeral, responding only to storm events, and golf courses in the area have been designed to collect stormwater to manage water quality and mitigate flooding. In addition, future projects in the ʻEwa Plain would not affect wetlands because the developable upland area is dry and has permeable soil that does not contain any wetlands.

There would be no additional cumulative effect to water resources as a result of the planned extensions.

Street Trees

The planned extensions to Waikīkī and UH Mānoa would affect street trees along those alignments, including monkeypod trees on Kapiʻolani Boulevard and mahogany trees along Kalākaua Avenue. Some of the monkeypod trees would require removal, while the mahogany trees could be preserved with pruning.

Archaeological, Cultural, and Historic Resources

Archaeological, cultural, and historic resources have been impacted during development within the study corridor.

Future development will occur near pre-contact and post-contact archaeological and burial sites. Future development also could affect historic resources, churches, cemeteries, schools, parks, recreational facilities, and other urban cultural entities. Such resources are located throughout the corridor.

In the Kalaeloa development area (formerly the Barbers Point Naval Air Station), the redevelopment outlined in the Master Plan would affect the World War II vintage military housing and support facilities.

The planned extensions could affect additional archaeological, cultural, and historic resources. The likelihood of encountering burials would be high for the Waikīkī extension. Any future development would be required to comply with appropriate Federal and State laws, such as Section 106, Section 4(f). and Act 50, as described here and in Section 4.15.

4.19 Irreversible and Irretrievable Commitments of Resources

As described in Chapter 4 of this Draft EIS, the Project would convert land to transportation use and consume energy, construction materials, and labor. These resources would not be available for other projects.

4.20 Anticipated Permits and Approvals

Table 4-37 summarizes permits, certificates, and/or approvals anticipated to be required for implementation of the Project.

Table 4-37 List of Anticipated Permits

Permit or Approval	Coordinating Agencies
Federal	
Archaeological Resource Protection Permit	NPS
Clean Water Act Section 404	USACE/EPA
Farmland Conversion Impact Rating	NRCS
Floodplain Management and Protection Approval	FTA
Jurisdictional Determination	USACE
Section 10	USACE/USCG
Sole Source Aquifer	EPA
State	
Archaeological Inventory Survey Plan	SHPD
Certificate of Inclusion	HDLNR (Division of Forestry and Wildlife), HDOT/USFWS
Clean Water Act Section 401	HDOH
Coastal Zone Management	DBEDT
Drainage Injection Well	HDOH (Safe Drinking Water Branch)
Memorandum of Agreement	SHPD
National Pollutant Discharge Elimination System (Dewatering)	HDOH (Clean Water Branch), City and County Environmental Services Department, HDOT (Highways Division), HDOT (Airports Division), UH Mānoa, U.S. Navy (Pearl Harbor)
National Pollutant Discharge Elimination System (General)	HDOH (Clean Water Branch)
Noise Variance	HDOH
Road Closure	HDOT
Stream Channel Alteration	HDLNR
City and County	
Pruning of Exceptional Trees	HDPR (Division of Urban Forestry)

DBEDT = State of Hawai`i Department of Business, Economic Development and Tourism
EPA = Environmental Protection Agency
FTA = Federal Transit Administration
HDLNR = State of Hawai`i Department of Land and Natural Resources
HDOH = State of Hawai`i Department of Health
HDOT = State of Hawai`i Department of Transportation
HDPR = Honolulu Department of Parks and Recreation
NPS = National Park Service
NRCS = Natural Resources Conservation Service
SHPD = State Historic Preservation Division
UH = University of Hawai`i
USACE = U.S. Army Corps of Engineers
USCG = U.S. Coast Guard
USFWS = U.S. Fish and Wildlife Service