Chapter 2 Alternatives Considered

Screening and Selection Process

During the fall of 2005 and winter of 2006, the City and County of Honolulu conducted an alternatives screening that is documented in the *Honolulu High-Capacity Transit Corridor Project Alternatives Screening Memorandum* (DTS, 2006b). The alternatives screening was approached through a top-down analysis completed in five major steps. The first step was to gather input needed for the analysis. The input included the purpose and need for the project, past studies and their recommendations, requirements of the FTA process, adopted community and area plans, and a visual assessment of the entire corridor as it currently exists. The second step used the information gathered to identify a comprehensive list of potential alternatives. The third step included developing screening criteria and undertaking the initial screening of all potential alternatives to identify those that address the needs of the corridor and do not have any "fatal flaws." Those surviving alternatives were then presented to the public and interested public agencies and officials for comment through a scoping process in the fourth step. Finally, input from the scoping process was collected and analyzed, and refinements were made to the alternatives. Once the evaluations were completed, the modal, technology, and alignment options were matched to create the alternatives that are carried forward into this AA.

Alternatives Considered

Multiple sources were accessed for input to determine the initial options screened. The goal was to screen as broad a range of feasible alternatives as possible to ensure that the best solutions for the corridor would be considered. A long list of alternatives was developed based on these previous studies, a field review of the study corridor, an analysis of current population and employment data for the corridor, and a literature review of modal technologies.

The alternatives considered during screening included a No Build Alternative, a Transportation System Management Alternative, and a number of "build" alternatives. Transit technologies that were examined included conventional bus, guided bus, light rail transit, personal rapid transit, people mover, monorail, magnetic levitation, rapid rail, commuter rail, and waterborne ferry service. Several highway improvements considered during OMPO's 2030 ORTP planning process also were reviewed for their ability to improve transit capacity and reliability, including a bridge or tunnel crossing of Pearl Harbor to connect 'Ewa with the PUC and the construction of a two-lane elevated structure from the Waiawa Interchange to Iwilei, which would be used by transit vehicles and potentially carpools and single-occupant vehicles willing to pay a congestion-based toll. In addition, 75 Fixed Guideway alignment options were screened.

Alternatives Considered but Rejected

All of the alternatives considered are detailed in the *Honolulu High-Capacity Transit Corridor Project Alternatives Screening Memorandum* (DTS, 2006b). The following alternatives were eliminated before undertaking this AA.

The tunnel crossing of Pearl Harbor was rejected because it would not provide an alternative to private automobile use or improve linkages within the study corridor, as it would bypass much of the corridor and not provide any new connections within the remainder of the corridor.

Waterborne ferry service was eliminated as a primary transit system because its capacity and travel times were not competitive with other alternatives. This alternative is being studied as an augmentation to the existing transit system in a separate effort from this project.

Several transit technologies were eliminated for various reasons. Diesel multiple unit was eliminated based on technical maturity, supplier competition, and environmental performance. Personal rapid transit was eliminated based on lack of technical maturity and line capacity. Commuter rail was eliminated because it is not suited for short station spacing and is not competitive without existing freight tracks being available. Also, emerging rail concepts were eliminated because of their lack of technical maturity and the rapid implementation schedule for the project.

For the Fixed Guideway Alternative screening analysis, the corridor was divided into eight sections. (Following the screening analysis, the eight sections were combined into a set of five sections.) Within each of the sections, the alignments that demonstrated the best performance related to mobility and accessibility, supporting smart growth and economic development, constructability and cost, community and environmental quality, and planning consistency were retained for evaluation in the AA.

Alternatives Evaluated in this Alternatives Analysis

Four alternatives are evaluated in this AA report. They were developed through a screening process that considered alternatives identified through previous transit studies, a field review of the study corridor, an analysis of current population and employment data for the corridor, a literature review of technology modes, work completed by the O‘ahu Metropolitan Planning Organization (OMPO) for its *2030 O‘ahu Regional Transportation Plan* (OMPO, 2006a), and public and agency comments received during a formal project scoping process held that would satisfy the requirements of the National Environmental Policy Act (NEPA) and the Hawai‘i EIS Law (Chapter 343). The four alternatives are described in detail in the *Honolulu High-Capacity Transit Corridor Project Alternatives Analysis Detailed Definition of Alternatives* (DTS, 2006a). The alternatives evaluated are as follows:

- No Build Alternative
- Transportation System Management Alternative
- Managed Lane Alternative
- Fixed Guideway Alternative.

Alternative 1: No Build

The No Build Alternative includes existing transit and highway facilities and committed transportation projects anticipated to be operational by 2030. Committed transportation

projects are those programmed in the *2030 O'ahu Regional Transportation Plan* prepared by OMPO. The committed highway elements of the No Build Alternative are also included in the build alternatives.

The No Build Alternative's transit component would include an increase in fleet size to accommodate the anticipated growth in population, while allowing service frequencies to remain the same as today. Bus fleet requirements are listed in Table 2-1.

Table 2-1. Transit Vehicle Requirements

Alternative	Bus		Fixed Guideway	
	Peak	Fleet	Peak	Fleet
2005 Existing Conditions				
Existing Conditions	409	525	0	0
Alternative 1: 2030 No Build				
No Build Alternative	511	614	0	0
Alternative 2: 2030 Transportation System Management				
TSM Alternative	638	765	0	0
Alternative 3: 2030 Managed Lane				
Two-Direction Option	705	846	0	0
Reversible Option	755	906	0	0
Alternative 4: 2030 Fixed Guideway				
Kalaeloa - Salt Lake - North King - Hotel	441	529	72	90
Kamokila - Airport - Dillingham - King with a Waikīkī Branch	435	525	68	90
Kalaeloa - Airport - Dillingham - Halekauwila	448	540	74	90
20-mile Alignment East Kapolei to Ala Moana Center	497	596	54	70

Alternative 2: Transportation System Management

The Transportation System Management (TSM) Alternative would provide an enhanced bus system based on a hub-and-spoke route network, conversion of the present a.m. peak-hour-only zipper-lane to both a morning and afternoon peak-hour zipper-lane operation, and relatively low-cost capital improvements on selected roadway facilities to give priority to buses. Bus fleet requirements are listed in Table 2-1. The TSM Alternative includes the same committed highway projects as assumed for the No Build Alternative.

Alternative 3: Managed Lane

The Managed Lane Alternative would include construction of a two-lane, grade-separated facility between Waipahu and Downtown Honolulu (Figure 2-1 and Figure 2-2) for use by buses, paratransit vehicles, and vanpool vehicles. The managed lane facility would integrate with HDOT's proposed Nimitz Flyover project that is included in the *2030 O'ahu Regional Transportation Plan* (OMPO, 2006a). HOV and toll-paying, single-occupant vehicles also would be allowed to use the facility provided that sufficient capacity would be available to maintain free-flow speeds for buses and the above-noted paratransit and vanpool vehicles. Variable pricing strategies for single-occupant vehicles would be implemented to maintain free-flow speeds for transit and HOVs. Two design

and operational variations of the Managed Lane Alternative are evaluated: a Two-direction Option (one lane in each direction) and a two-lane Reversible Option. For both options, access to the facility in West O'ahu would be via ramps from the H-1 and H-2 Freeways just prior to the Waiawa Interchange. Both options would require modification to the Nimitz Flyover project's design and would terminate with ramps tying into Nimitz Highway at Pacific Street. The H-1 zipper lane would be maintained in the Two-direction Option but discontinued in the Reversible Option.

An intermediate bus access point would be provided in the vicinity of Aloha Stadium. Bus service using the managed lane facility would be restructured and enhanced, providing additional service between Kapolei and other points 'Ewa of the Primary Urban Center, and Downtown Honolulu and UH Mānoa.

Characteristics of the Managed Lane Alternative

The Two-direction Option would serve express buses operating in both directions during the entire day. The Reversible Option would serve peak-direction bus service, while reverse-direction service would use H-1. Twenty-nine bus routes, with approximately 93 buses per hour, would use the managed lane facility during peak hours for either option. One limited-stop route and one local route would continually operate in the managed lane. A total of 27 peak-period express routes would operate in the peak direction using the managed lane facility. Of these, three are new express routes serving developing areas and nine are new routes developed for exclusive use of the managed lane. The nine new managed lane express bus system routes originate from Kalaeloa, Kapolei, or Central O'ahu and terminate at the Alapa'i Transit Center, Waikīkī, or UH Mānoa. Other peak-period, local and limited-stop routes follow a route similar to the current structure but will use the managed lane for the line-haul portion of the route.

A toll structure has been developed that ensures that the managed lane facility would operate to maintain free-flow speeds for buses. To maintain free-flow speeds in the Two-direction Option, it may be necessary to charge tolls to manage the number of HOVs using the facility. For the Reversible Option, three-person HOVs would be allowed to use the facility for free, while single-occupant and two-person HOVs would have to pay a toll.

Optimum Managed Lane Option

The two Managed Lane options discussed above are evaluated in the following chapters of this report in relation to transportation benefits, environmental and social consequences, and costs. The findings within each of these topics are synthesized at the beginning of Chapter 6 (Comparison of Alternatives) where it is determined that the Reversible Option is optimal.

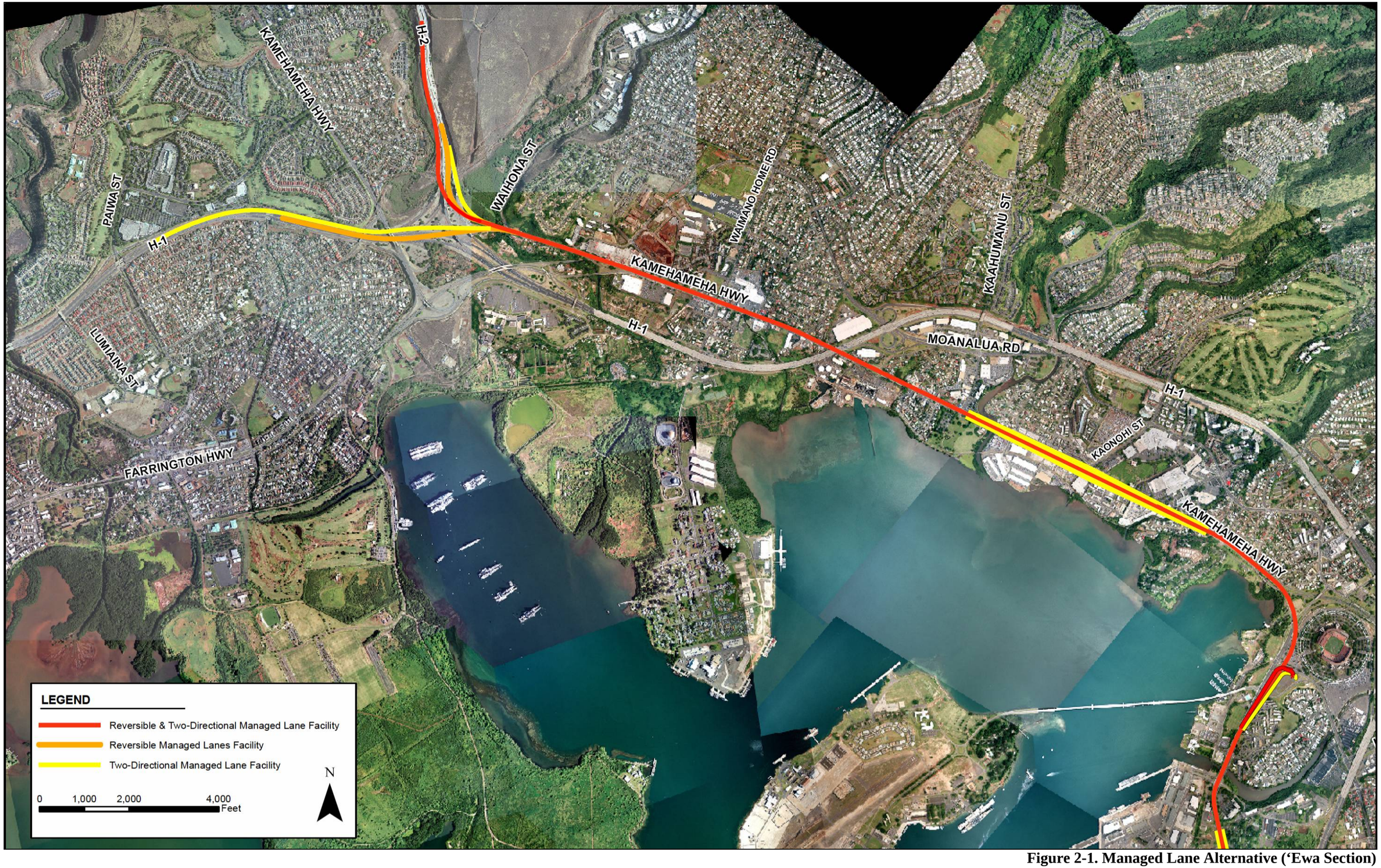

Figure 2-1. Managed Lane Alternative (‘Ewa Section)

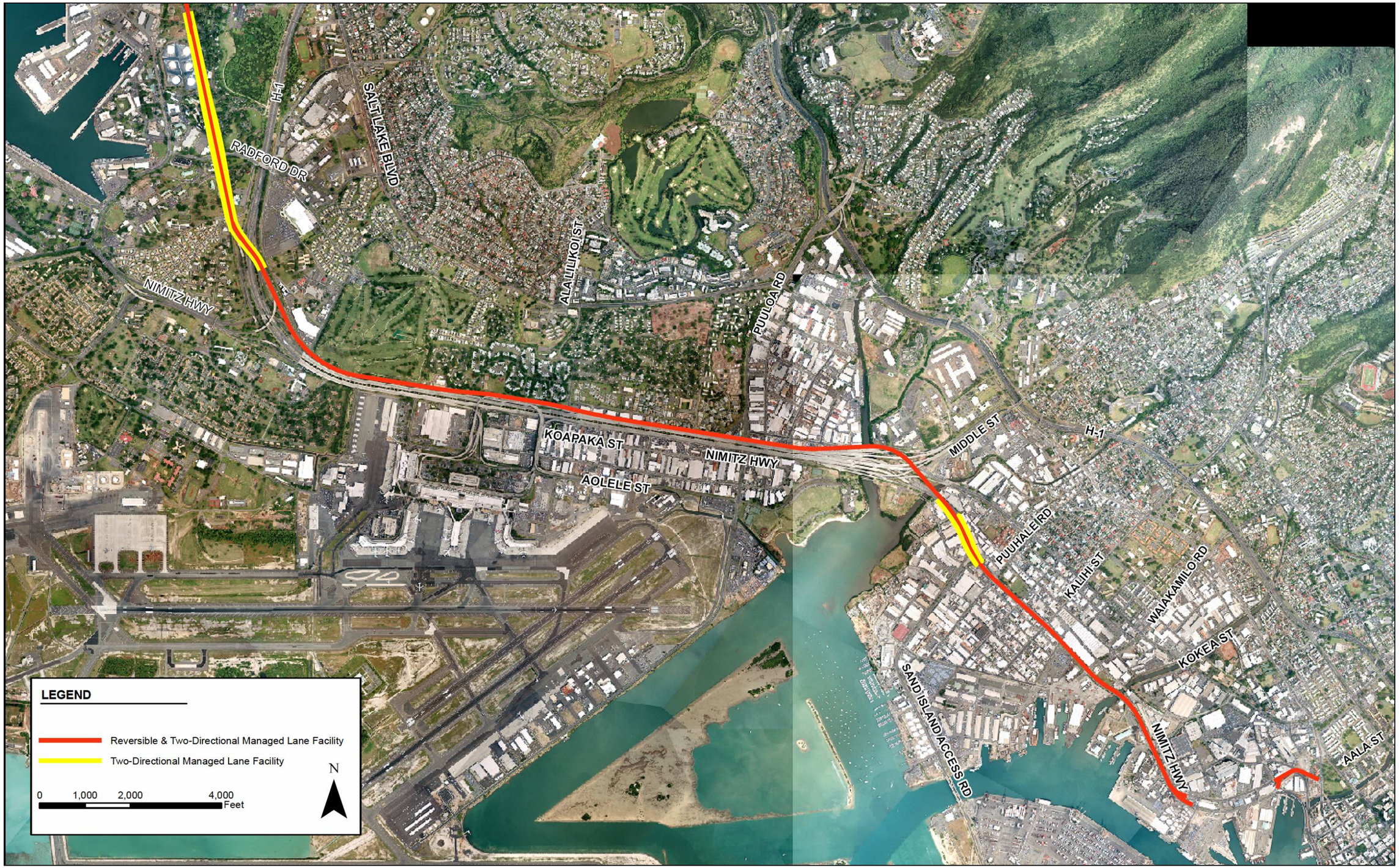

Figure 2-2. Managed Lane Alternative (Koko Head Section)

Alternative 4: Fixed Guideway Alternative

The Fixed Guideway Alternative would include the construction and operation of a fixed-guideway transit system between Kapolei and UH Mānoa. The system could use any of a range of fixed-guideway transit technologies that meet performance requirements and could be either automated or employ drivers.

The study corridor for the Fixed Guideway Alternative is evaluated in five sections to simplify the analysis and facilitate evaluation in this report (Figure 2-3 through Figure 2-7). Detailed alignment drawings are available in the *Honolulu High-Capacity Transit Corridor Project Alignment Plans and Profiles* (DTS, 2006e). Each alignment has distinctive characteristics and environmental impacts, as well as providing different service options. Therefore, each alignment is evaluated individually and compared to the other alignments in that section. The sections, the alignments within each section, and the number of stations considered for each alignment are listed in Table 2-2.

Station and supporting facility locations also are considered. Supporting facilities include a vehicle maintenance facility and park-and-ride lots. Some bus service would be reconfigured to bring riders on local buses to nearby fixed-guideway transit stations. To support this system, the bus fleet would increase or remain as today, as shown in Table 2-1.

Although this alternative would be designed to be within existing street or highway rights-of-way as much as possible, property acquisition at various locations would be required. Future extensions of the system to Central O‘ahu, East Honolulu, or within the corridor are possible, but are not being addressed in detail in this AA.

Combination of Fixed Guideway Alternative Alignment Options

For ease of comparison to Alternatives 1 through 3, three alignment combinations are presented in this report. The combinations were selected considering initial information about performance of the various alignment options in each of the corridor sections. While the presented combinations include the alignments with the best performance characteristics in each section, they do not preclude a different combination of alignments from being selected. The three combinations presented are as follows:

- Kalaeloa - Salt Lake - North King - Hotel. This combination would link the following series of alignments through the study corridor: Saratoga Avenue/North-South Road to Farrington Highway/Kamehameha Highway to Salt Lake Boulevard to North King Street to Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard.
- Kamokila -- Airport - Dillingham - King with a Waikīkī Branch. This combination would link the following series of alignments through the study corridor: Kamokila Boulevard/Farrington Highway to Farrington Highway/Kamehameha Highway to Aolele Street to Dillingham Boulevard to King Street/Waimanu Street/Kapi‘olani Boulevard with a Waikīkī Branch.
- Kalaeloa - Airport - Dillingham - Halekauwila. This combination would link the following series of alignments through the study corridor: Saratoga Avenue/North-South

Road to Farrington Highway/Kamehameha Highway to Aolele Street to Dillingham Boulevard to Nimitz Highway/Halekauwila Street/Kapi‘olani Boulevard.

Table 2-2. Fixed Guideway Alternative Analysis Sections and Alignments

Section	Alignments Being Considered	Number of Stations
I. Kapolei to Fort Weaver Road	Kamokila Boulevard/Farrington Highway	5
	Kapolei Parkway/North-South Road	6
	Saratoga Avenue/North-South Road	9
	Geiger Road/Fort Weaver Road	7
II. Fort Weaver Road to Aloha Stadium	Farrington Highway/Kamehameha Highway	5
III. Aloha Stadium to Middle Street	Salt Lake Boulevard	2
	Mauka of the Airport Viaduct	3
	Makai of the Airport Viaduct	4
	Aolele Street	4
IV. Middle Street to Iwilei	North King Street	3
	Dillingham Boulevard	4
V. Iwilei to UH Mānoa	Beretania Street/South King Street	7
	Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard	11
	King Street/Waimanu Street/Kapi‘olani Boulevard	7
	Nimitz Highway/Queen Street/Kapi‘olani Boulevard	9
	Nimitz Highway/Halekauwila Street/ Kapi‘olani Boulevard	9
	Waikīkī Branch	3

Characteristics of the Fixed Guideway Alternative

The fixed guideway system is planned to operate between 4 a.m. and midnight, with a train arriving in each direction at each station between every three and six minutes (Table 2-3). The system is planned to operate with a unified fare structure with TheBus, with transfers and passes usable on both systems. A possible fare-collection system would include one that operates on an honor basis. No gates or fare inspection points would be used in the stations. Fare machines would be available at all stations and standard fare boxes would be used on buses. Fare inspectors would ride the system and check that passengers have valid tickets or transfers. Violators would be cited and fined.

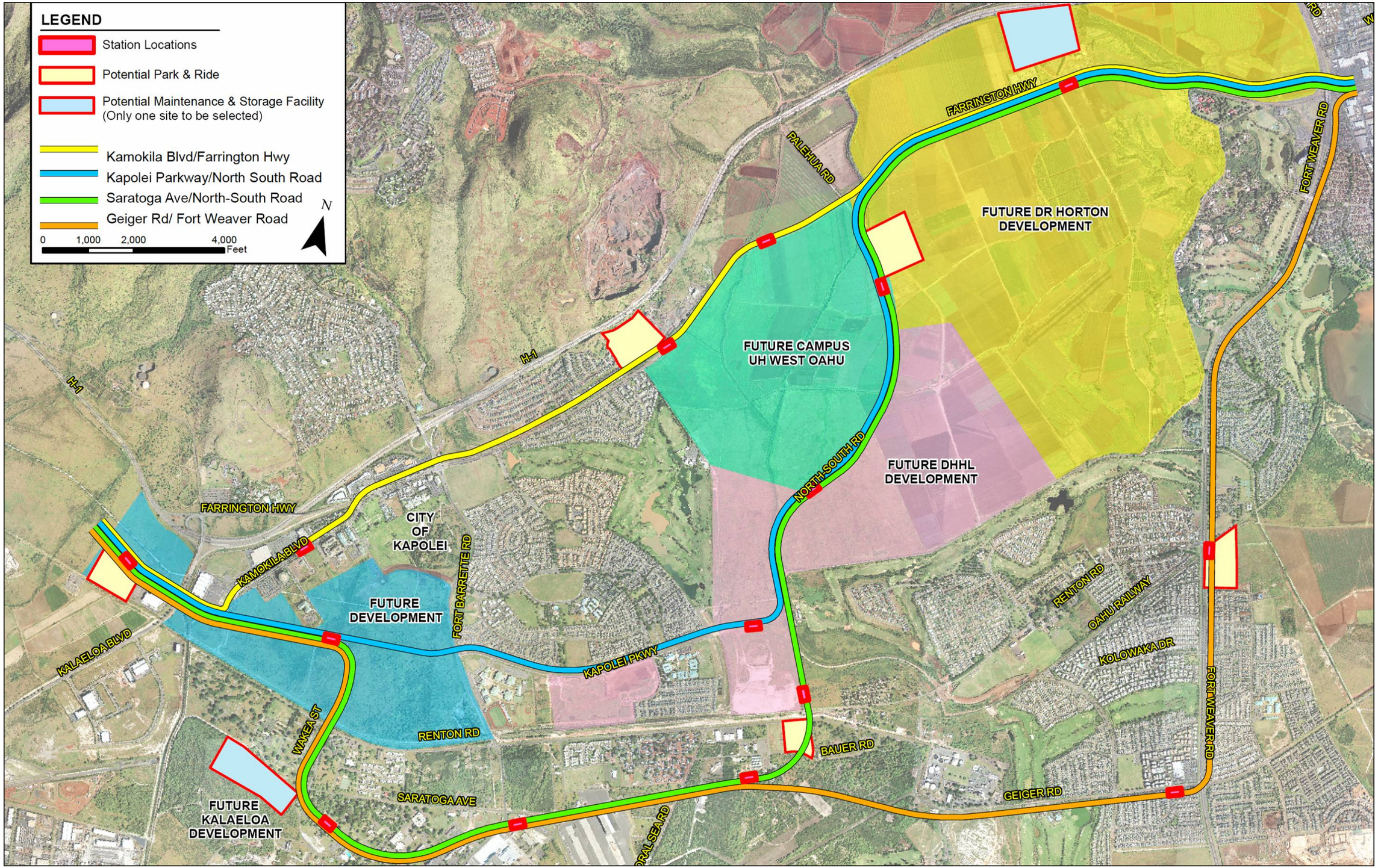

Figure 2-3. Fixed Guideway Alternative Section I

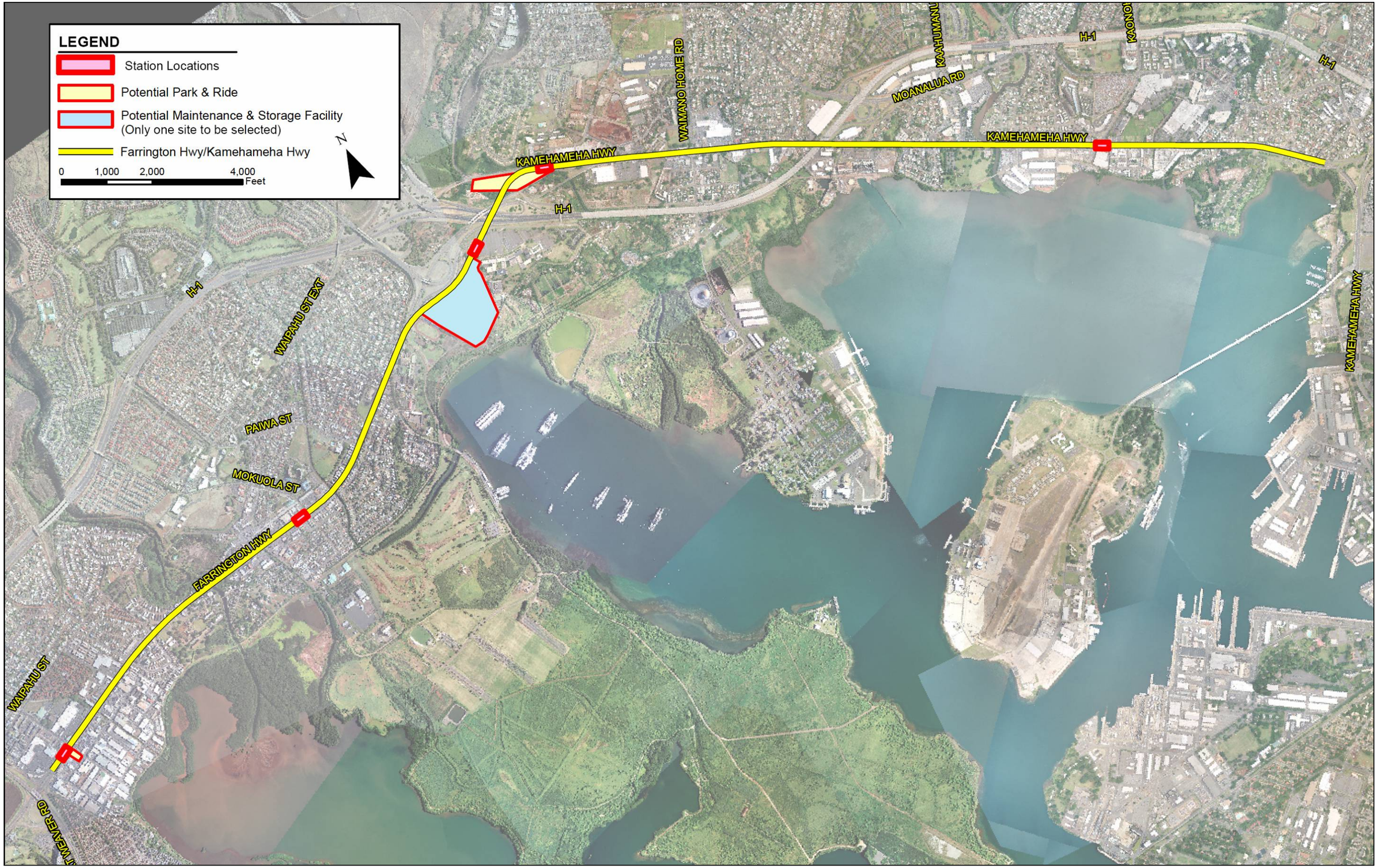

Figure 2-4. Fixed Guideway Alternative Section II

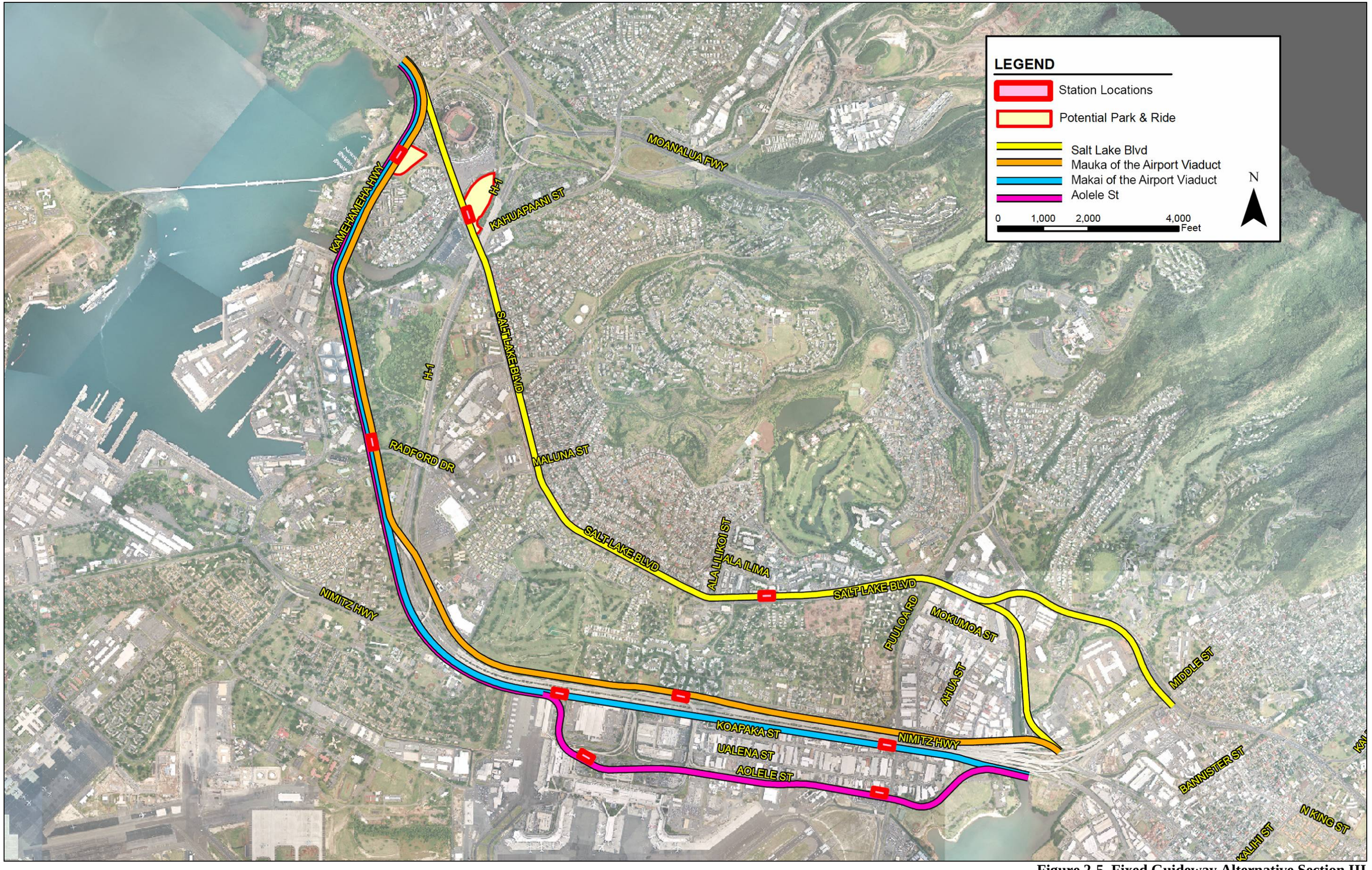

Figure 2-5. Fixed Guideway Alternative Section III

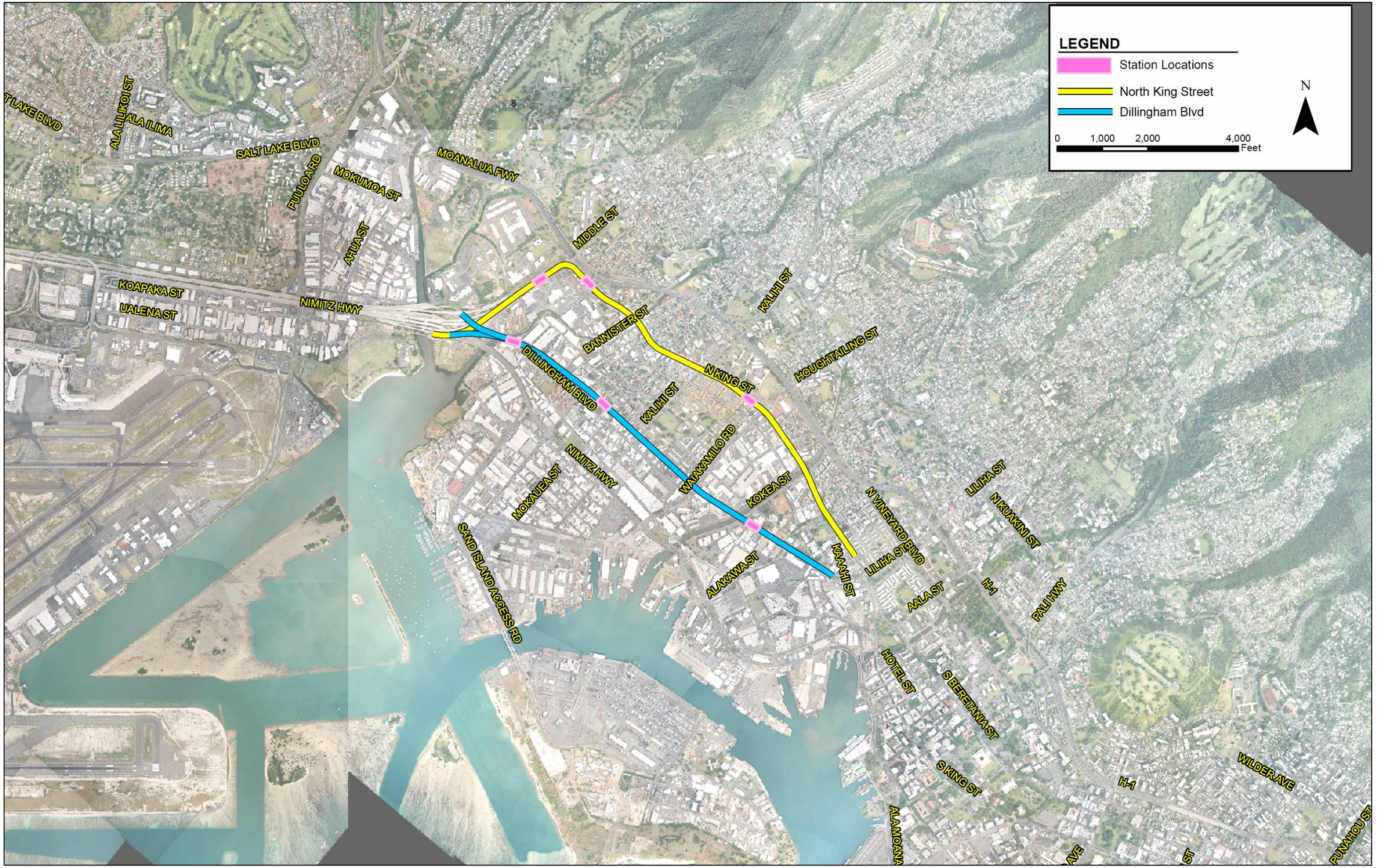

Figure 2-6. Fixed Guideway Alternative Section IV

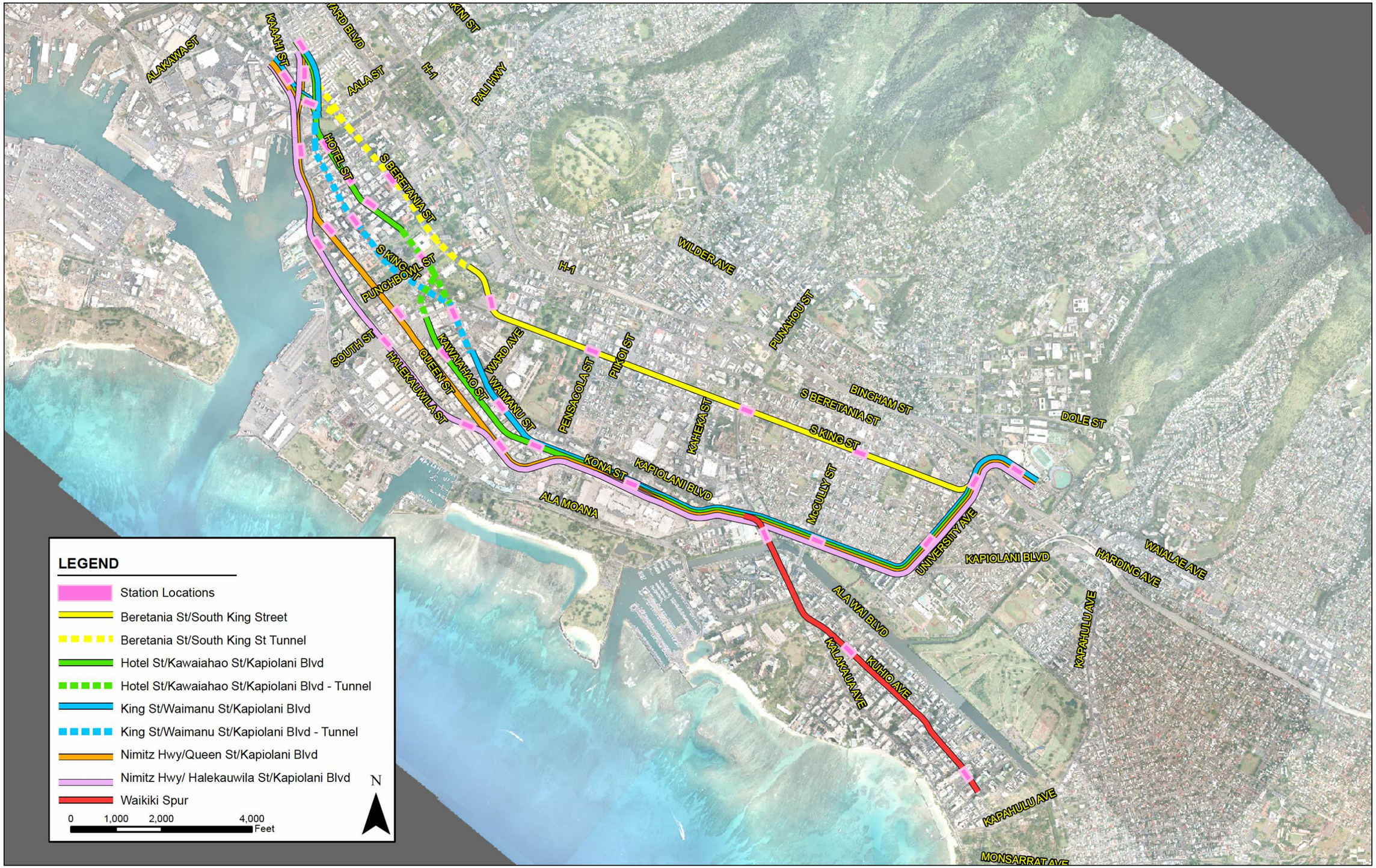

Figure 2-7. Fixed Guideway Alternative Section V

Table 2-3. Fixed Guideway Alternative Operating Assumptions

Time of Day[1]	System Headway[2]
4 a.m. to 6 a.m.	6 minutes
6 a.m. to 9 a.m.	3 minutes
9 a.m. to 3 p.m.	6 minutes
3 p.m. to 6 p.m.	3 minutes
6 p.m. to 8 p.m.	6 minutes
8 p.m. to 12 a.m.	10 minutes

[1]System is closed from 12 a.m. to 4 a.m.
[2]With Waikīkī Branch, branch-line headway to Waikīkī and UH Mānoa would be twice that of the main line.

A vehicle loading standard of one standee per 2.7 square feet of floor space has been used. The system is planned to operate with multicar or articulated trains approximately 175 to 200 feet in length, with each train able to carry a minimum of 300 passengers. This would provide a peak capacity of at least 6,000 passengers per hour per direction. The number of vehicles required to provide this service is listed in Table 2-1, assuming two vehicles per train. With the exception of the Hotel Street alignment, the system would be expandable to longer trains of up to 300 feet in the future to increase capacity by 50 percent. Also, the system could be operated with shorter headways to increase peak capacity.

Optimum Fixed Guideway Alignment

Each of the Fixed Guideway alignment options discussed above is evaluated in the following chapters of this report in relation to transportation benefits, environmental and social consequences, and costs. The findings within each of these topics are synthesized at the beginning of Chapter 6 (Comparison of Alternatives) to determine the optimal combination of alignments. The comparison results in an optimal alignment of Saratoga Avenue/North-South Road to Farrington Highway/Kamehameha Highway to Aolele Street to Dillingham Boulevard to Nimitz Highway/Halekauwila Street/Kapi‘olani Boulevard, which is the Kalaeloa - Airport - Dillingham - Halekauwila combination Figure 2-8.

Twenty-mile Alignment

To provide an alternative with lower cost than the Full-corridor Alignments, a 20-mile Alignment was identified for evaluation. The 20-mile Alignment provides a substantial benefit to users with a lower capital cost.

Several portions of the corridor could be selected within the range of sections and alignments considered for the Fixed Guideway Alternative; however, the optimum shortened alignment should be able to provide substantial benefit to transit users independent of the remainder of the system under long-range consideration. As indicated by the financial analysis presented in Chapter 5, there is a substantial level of uncertainty in development of a fixed guideway system for the entire length of the study corridor (Kapolei to UH Mānoa) with known available funds from tax sources, combined with a

reasonable projection of Federal funds. With this in mind, the following items were considered in defining possible shortened alignments from the alignments considered for the entire length of the study corridor.

- The alignment must, at minimum, reach Downtown Honolulu
- The alignment should serve as much of the study corridor as practical
- The alignment selected in each section should provide the greatest user benefit while considering the cost of the alignment.

The 20-mile Alignment evaluated in Chapter 6 (Comparison of Alternatives) could be constructed and operated within the funding assumptions that are established in Chapter 5. When the additional future funding sources become more certain over the course of project development, the 20-mile Alignment could be modified to accommodate the changed condition. The 20-mile Alignment includes the portion of the Optimum Fixed Guideway Alignment discussed above that would begin makai of UH West O‘ahu and continue to Ala Moana Center. In its entirety, the 20-mile Alignment would begin at one station Wai‘anae of UH West O‘ahu near Kapolei Parkway and North-South Road. The alignment would include a design variation to serve UH West O‘ahu and cross D.R. Horton land to Farrington Highway then continue Koko Head following Kamehameha Highway to Aolele Street and Dillingham Boulevard, and then continue elevated following Nimitz Highway and Halekauwila Street to Ala Moana Center (Figure 2-9).

Costs of the Alternatives

The costs for each alternative are detailed in Chapter 5. They are summarized in this section to provide a comparison among the alternatives.

Capital Costs

Capital costs for the No Build and TSM Alternatives would be $660 and $856 million, respectively, which accounts for bus replacement and system expansion. Total capital costs for the Managed Lane Alternative would range between $3.6 and $4.7 billion, of which $2.6 to $3.8 billion would be for construction of the managed lanes. Capital costs for the Fixed Guideway Alternative, including bus system costs, would range between $5.2 and $6.1 billion for the Full-corridor Alignments, of which $4.6 to $5.5 billion would be for the fixed guideway system. The costs would be $4.2 billion for the 20-mile Alignment, of which $3.6 billion would be for the fixed guideway system.

Operating and Maintenance Costs

Operating costs in 2030 for the No Build Alternative, in 2006 dollars, would be approximately $192 million. Operating costs for the TSM Alternative would be approximately $42 million greater than for the No Build Alternative. Transit operating costs for the Managed Lane Alternative would range between approximately $251 and $261 million as a result of additional buses that would be put in service under that alternative. These costs do not include the cost of maintaining the managed lane facility. The total operating costs for the Fixed Guideway Alternative, including the bus and fixed guideway, would range between approximately $248 and $256 million.

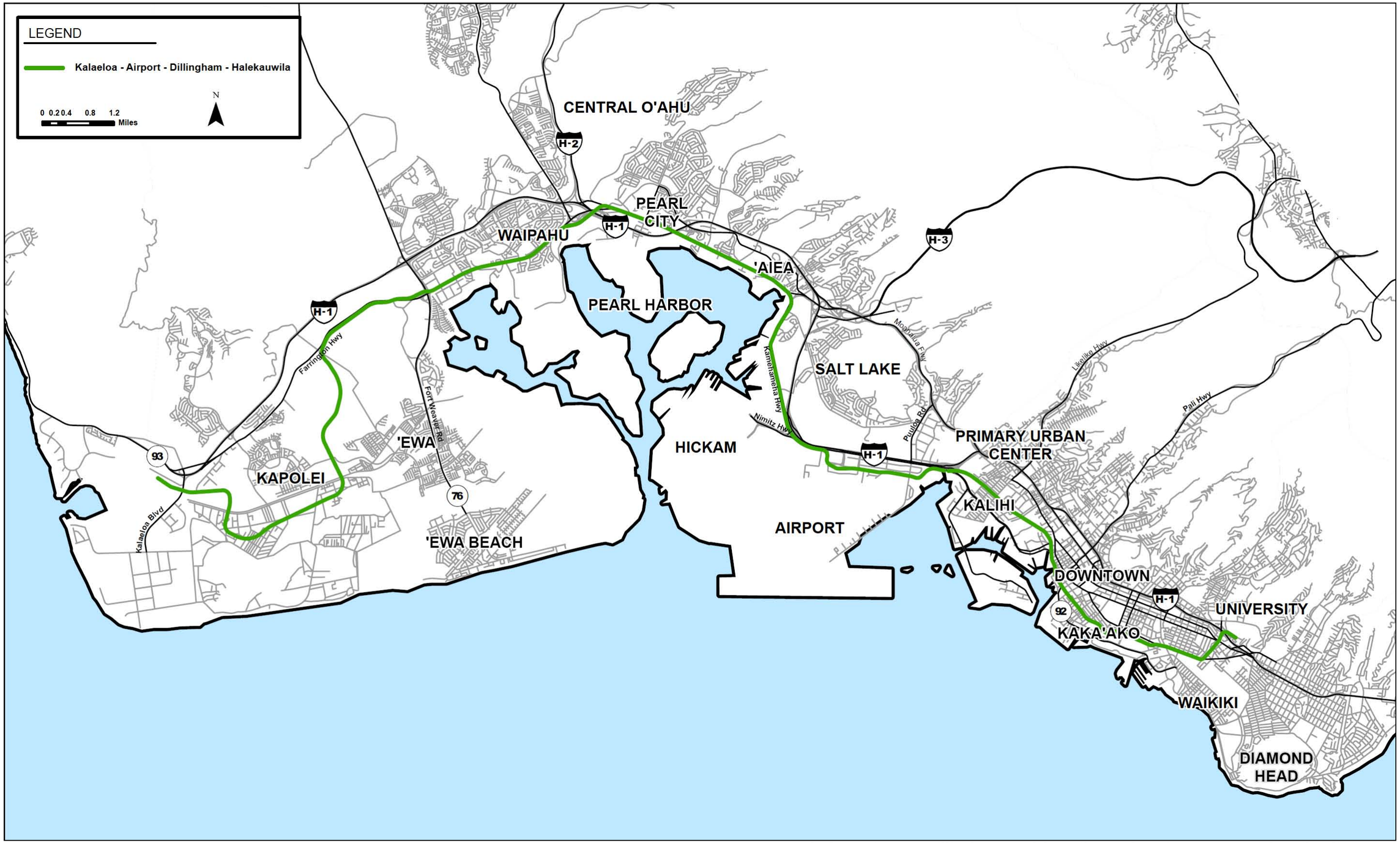

Figure 2-8. Kalaeloa - Airport - Dillingham - Halekauwila Combination (Twenty-eight-mile Alignment)

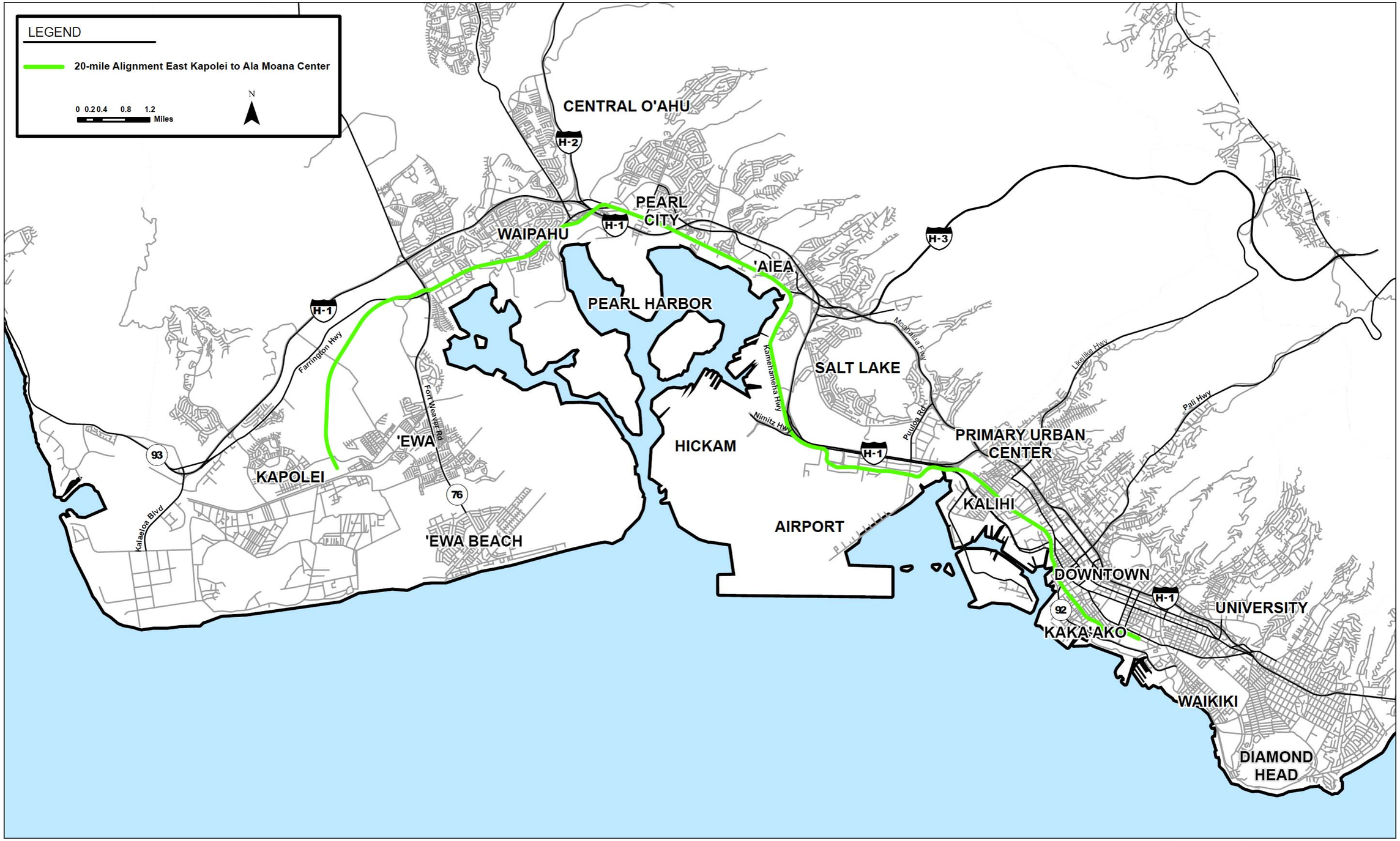

Figure 2-9. Twenty-mile Alignment

Schedule

Projects developed through the FTA New Starts process progress through many stages from system planning to operation of the project. The Honolulu High-Capacity Transit Corridor Project is currently in the Alternatives Analysis phase, which includes defining and evaluating specific alternatives to address the purpose of and needs for the project discussed in Chapter 1. The anticipated project development schedule for completion of the 20-mile Alignment is shown in Figure 2-10.

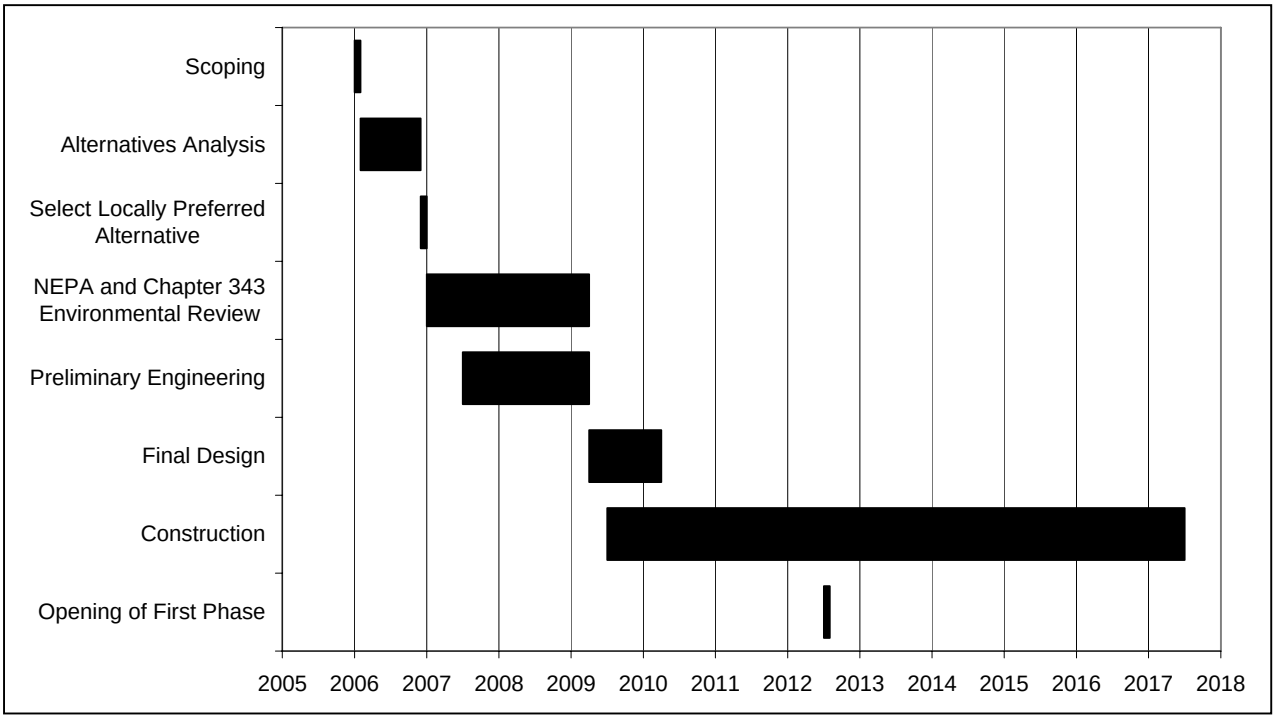

Figure 2-10. Project Schedule