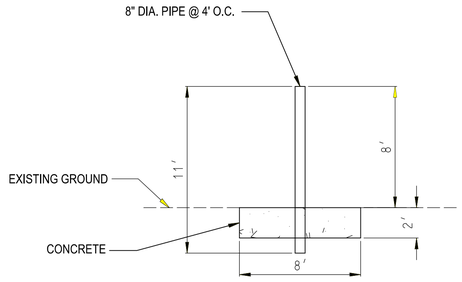
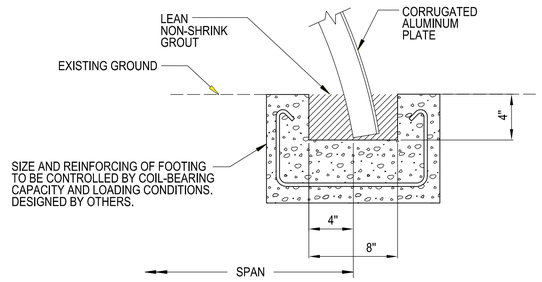


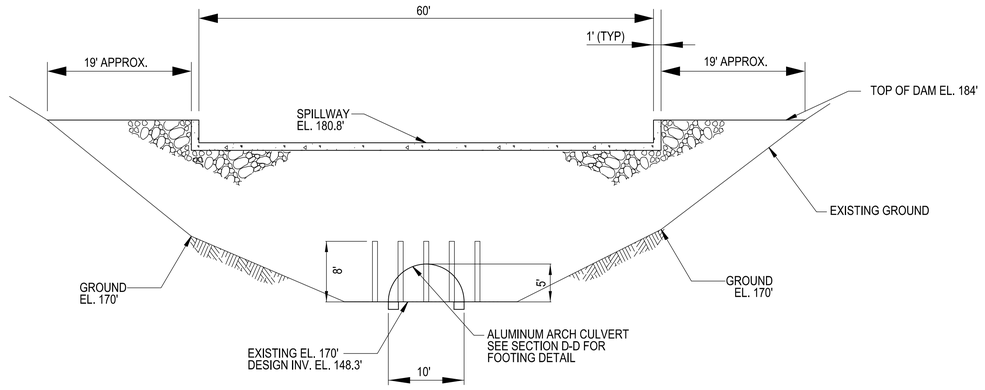
MAKIKI DEBRIS AND DETENTION BASIN SECTION A-A

SCALE: 1"=5'



SLOTTED CONCRETE FOOTING MAKIKI DEBRIS AND DETENTION SECTION D-D

SCALE: NTS

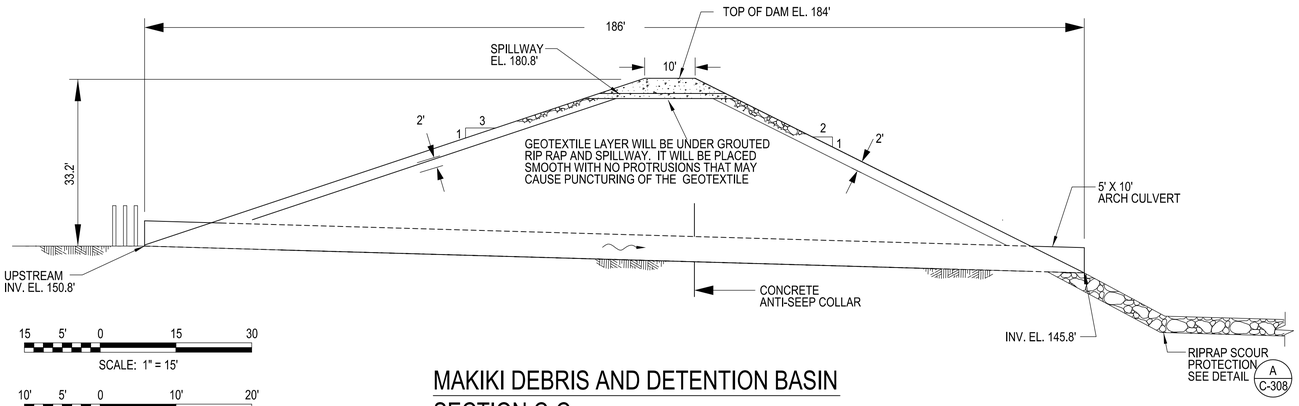


MAKIKI DEBRIS AND DETENTION BASIN SECTION B-B

SCALE: 1"=10'

NOTES:

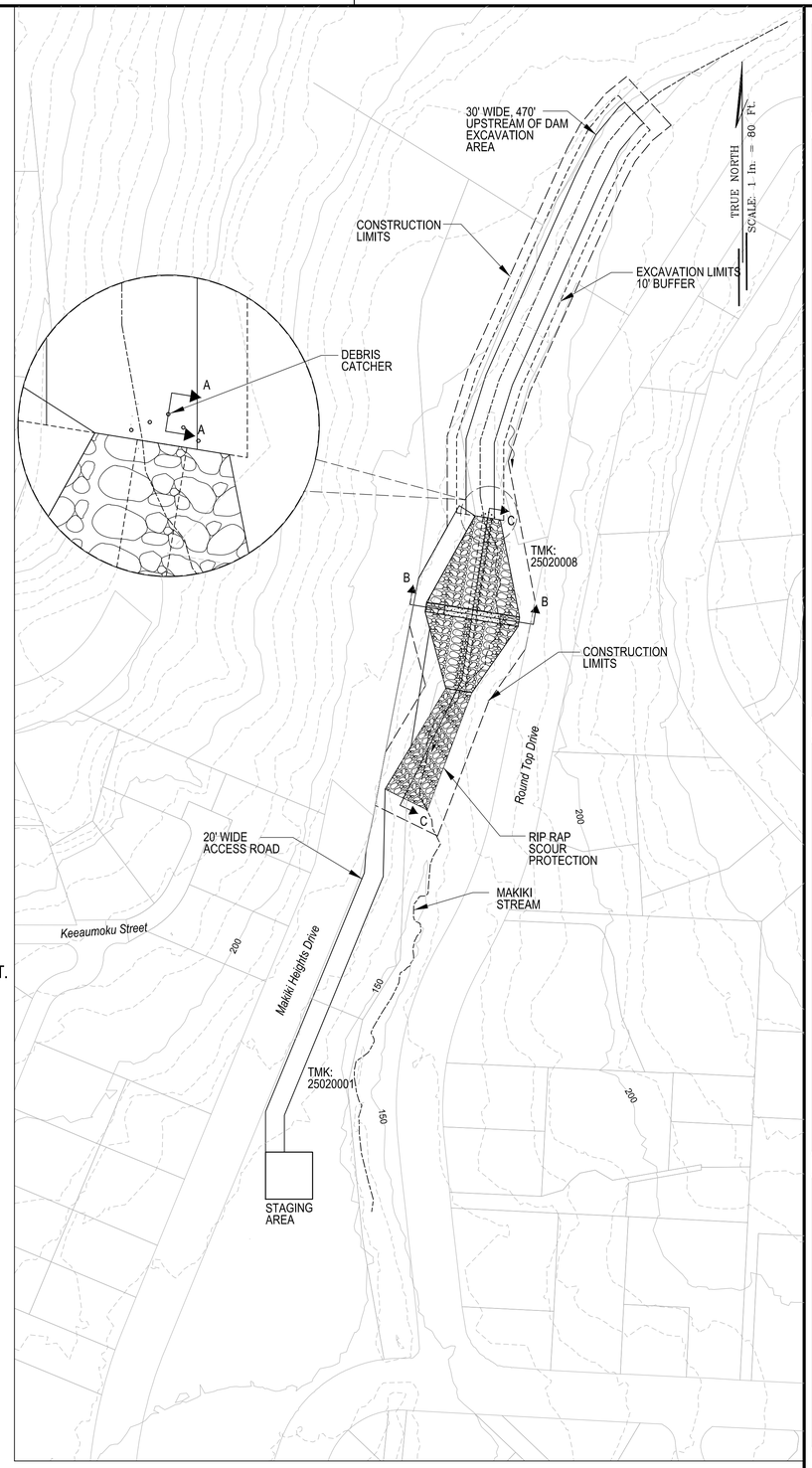
1. ALUMINUM ARCH CULVERT METAL THICHNESS IS 1.50". WITH A NATURAL BOTTOM.
2. THE APPROXIMATE AREA UNDER THE ARCH CULVERT IS 35.3 SQ FT.
3. THE ACCESS ROAD WILL ALSO BE USED FOR MAINTENANCE.



Note: All elevations are feet MSL

MAKIKI DEBRIS AND DETENTION BASIN SECTION C-C

SCALE: 1"=15'



PLAN

SCALE: 1"=80'

SOLID LINE = 50' CONTOURS
DOTTED LINE = 10' CONTOURS

US Army Corps of Engineers
Honolulu District

35% DESIGN

MARK	DESCRIPTION	DATE	APPR.	MARK	DESCRIPTION	DATE	APPR.

DESIGNED BY: JHH
DRAWN BY: CP
SUBMITTED BY:
PLOT SCALE:
PLOT DATE:
SIZE: ANSI D
DATE:
CHECKED BY:
REVISION:
SOLICIT. / CONTRACT NO.:
LOCATION CODE
DRAWING NUMBER:
FILE NAME: Ala_Wai_C-315xxx

US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII

ALA WAI CANAL PROJECT

MAKIKI DEBRIS AND DETENTION BASIN
PLAN AND SECTIONS

SHEET IDENTIFICATION
C-315
SHEET 0 OF 31

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Appendix E3
Clean Water Act Section 404(b)(1) Evaluation

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Clean Water Act, Section 404(b)(1) Evaluation
Ala Wai Canal Project
Honolulu, Hawaii

I. PROJECT DESCRIPTION

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR), the U.S. Army Corps of Engineers, Honolulu District (USACE) is conducting a feasibility study for the Ala Wai Canal Project[1] (hereafter referred to as "the project").

The Ala Wai watershed is located on the southeastern side of the island of Oahu, Hawaii. The watershed encompasses 19 square miles (mi^2) (12,064 acres) and extends from the ridge of the Koolau Mountains to the nearshore waters of Mamala Bay. It includes Maikiki, Manoa, and Palolo streams, which drain to the Ala Wai Canal, a 2-mile-long, man-made waterway constructed during the 1920s to drain extensive coastal wetlands. This construction and subsequent draining allowed the development of the Waikiki district. A map of the Ala Wai watershed is provided in the Draft Feasibility Study Report with Integrated Environmental Impact Statement (EIS).

A. Authority

The project is authorized under Section 209 of the Flood Control Act of 1962. Section 209 is a general authority that authorizes surveys in harbors and rivers in Hawaii "with a view to determining the advisability of improvements in the interest of navigation, flood control, hydroelectric power development, water supply, and other beneficial water uses, and related land resources."

B. Project Purpose and Need

The purpose of the project is to reduce the risk of flood hazards within the Ala Wai watershed. A high risk of flooding exists within the watershed due to aging and undersized flood conveyance infrastructure. Based on the peak flows computed for this study, it is estimated that the Ala Wai Canal has the capacity to contain about a 20- to 10-percent annual chance exceedance (ACE) flood[2] before overtopping the banks. The risk of flooding is exacerbated by the flashy nature of the streams in the watershed, with heavy rains flowing downstream extremely quickly due to steep topography and relatively short stream systems.

Overtopping of the Canal has previously flooded Waikiki multiple times, including during the November 1965 and December 1967 storms and during the passage of Hurricane Iniki in 1992. Upstream areas are also at risk of flooding, as demonstrated by several recent events, including the October 2004 storm that flooded Manoa Valley and the March 2006 storm that flooded Makiki. The October 2004 event was estimated to have a 4-percent chance of occurring in any single year, and caused more than $85 million in damages (USACE, 2006a). Multiple other past flood events have been documented within the watershed over the course of the past century. In addition to recorded property damages, these events have contributed to health and safety risks, including two known deaths (associated with flooding in December 1918 and December 1950) (USACE, 2006).

Analyses conducted in support of this project show that the 1-percent ACE floodplain extends over approximately 1,358 acres of the watershed. Within this area, the affected population is comprised of approximately 54,000 residents plus an additional estimated 79,000 visitors in Waikiki on any given day. In addition to threatening the safety of both residents and visitors, a major flood event could result in

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[1] The project has also previously been referred to as the "Ala Wai Watershed Project"; for consistency with the congressional documentation, the project will continue to be referred to as the "Ala Wai Canal Project."

[2] The 1-percent ACE floodplain is the area that is inundated by a flood with a 1-percent chance (1 in 100) of occurring in any single year. These are also commonly referred to as the 100-year floodplain and 100-year flood (but do not mean that this degree of flooding occurs every 100 years). This definition also applies to floods of other magnitudes (for example, a 20-year flood is a flood that has a 5-percent chance of occurring and a 10-year flood has a 10-percent chance of occurring in any single year, respectively).

catastrophic damages to structures and property throughout the watershed, with impacts to Waikiki crippling the local economy. Modeling results indicate the 1-percent ACE flood would result in damages to more than 3,000 structures, with approximately $318 million in structural damages alone (2013 price levels).

C. Background and History

In response to a request from DLNR, the reconnaissance phase of the Ala Wai Canal Project was initiated in April 1999. At that time, Federal, State, and local agencies sought a comprehensive management and restoration plan to restore aquatic habitat and biological diversity in the Canal and upstream tributaries. The reconnaissance report was submitted in August 1999 and recommended that the USACE assist the State with restoration of the Canal. Approval by USACE for continuation into the feasibility phase was granted in September 1999.

Independently, the Ala Wai Flood Study was initiated in September 1998 under the Planning Assistance to States (PAS) Program (Section 22 of the Water Resources Development Act of 1974) to determine the potential flood risk to the Waikiki area, in response to a request by the Land Division of DLNR. The study was completed in October 2001 and documented a high flood hazard associated with potential overtopping of the Ala Wai Canal. This study identified several mitigative measures and conceptual alternatives that could potentially minimize flood damages to Waikiki and surrounding area. The results of this technical study were used to establish that the USACE could be involved in the investigation of flood damage reduction in the Canal. As a result, a flood risk management objective was added to the Ala Wai Canal Project, thus expanding the project focus to both ecosystem restoration and flood risk management in the Canal area.

The FCSA was executed between USACE and the non-Federal sponsor, DLNR Engineering Division, in 2001. The feasibility phase of the project was initiated in July 2002, and a scoping meeting was held in June 2004. Subsequently, in October 2004, heavy rains caused Manoa Stream to overtop its banks, resulting in significant damages. In response, the USACE temporarily ceased work on the feasibility study, such that the project could be expanded to include the upstream portions of the Ala Wai watershed. While the cost-share agreement was being amended to address a more comprehensive scope, the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) received federal funds to identify specific actions to address flooding in Manoa Valley. The Manoa Watershed Project was initiated in 2006 and resulted in detailed topographic mapping, hydrologic and hydraulic modeling, and identification of potential measures to address specific flood problems.[3] However, because of insufficient federal funding to complete the project, the Manoa Watershed Project was terminated before implementation.

Information developed through the Manoa Watershed Project was subsequently incorporated into the Ala Wai Canal Project, which was re-started in 2007. A second scoping meeting was held in October 2008. Project-related efforts were primarily focused on bringing the technical information for the entire watershed up to the same level of detail as produced for Manoa under the Manoa Watershed Project.

In October 2012, a charette was held to re-scope the project as part of the USACE Civil Works Planning Modernization process.[4] The purpose of the charrette was to bring together the USACE project delivery team (PDT), Pacific Ocean Division and Headquarters staff, with the non-federal sponsor and other cooperating agencies, in order to determine the path forward for completing the feasibility study in compliance with current USACE planning requirements. Key outcomes of the charrette included consensus on the problems and opportunities, objectives and constraints, screening and decision criteria, the array of alternatives, and a framework for identification of the tentatively selected plan (TSP). Based on the project review at the charette, ecosystem restoration was eliminated as a study objective, as it was determined that the biological resources within the watershed do not have enough national significance to adequately justify

[3] This work was conducted by the USACE on behalf of NRCS via a Support Agreement in compliance with a Memorandum of Agreement between USACE and USDA, pursuant to the Economy in Government Act (31 USC S. 1535.).

[4] The charrette was held on October 16-19, 2012 with the purpose of reaching consensus on the actions needed to complete the project on budget and schedule, including a clear path for identification of the TSP (USACE, 2012). Participants included the project delivery team, non-federal sponsors, USACE Division and Headquarters staff, and cooperating agency representatives.

ecosystem restoration as an objective. However, the ecosystem-related information previously identified as part of the study is being incorporated as part of environmentally sustainable design considerations, particularly as related to maintaining in-stream habitat and migratory pathways for native aquatic species.

D. Planning Process

General investigations, such as those carried out under Section 209 of the Flood Control Act of 1962, are funded by specific appropriations and are conducted through a feasibility planning process. The USACE feasibility planning process is comprised of six steps, as specified by USACE planning regulations and guidance, including Engineer Regulation (ER) 1105-2-100 "Planning Guidance Notebook" (USACE, 2000). These steps include: (1) specification of water and related land resources problems and opportunities; (2) inventory, forecast, and analysis of water and related land resources conditions within the study area; (3) formulation of alternative plans; (4) evaluation of the effects of the alternative plans; (5) comparison of the alternative plans; and (6) identification of a TSP based upon the comparison of the alternative plans.

Recognizing the need to modernize their planning process with an emphasis on delivering high-quality feasibility studies within shorter timeframes and at lower costs, the USACE has recently applied a SMART [Specific, Measurable, Attainable, Risk Informed, Timely] planning approach to the six-step process (USACE, 2012). The SMART planning approach emphasizes risk-based decision making and focuses on three primary requirements for feasibility studies (referred to as the "3x3x3 Rule"): completion within 3 years, at a cost of no more than $3 million, and with 3 levels of vertical team alignment (including USACE District, Major Subordinate Command (MSC), and Headquarters staff). Other key components include (1) focusing the detailed analysis and design on the tentatively selected plan, and (2) identification of the appropriate level of detail, data collection, and modeling based only on what is necessary to complete the feasibility study.

E. Project Description

Over the course of the planning process, a variety of structural and non-structural flood risk management measures were identified, with a focus on the following approaches to flood risk management: (1) peak flow reduction, (2) increased channel capacity, (3) debris management, and (4) minimization of flood damages. The measures are generally based on the concepts originally developed in support of the Ala Wai Flood Study (USACE, 2006) and the Manoa Watershed Project (Oceanit, 2008). The conceptual measures were sited and screened using a set of project-specific criteria, including technical feasibility, availability of land, implementation costs, O&M requirements, legal and public acceptability, flood risk reduction, and life safety risks. Through the screening process, some measures were eliminated while others were further refined and combined into an array of alternatives; this process incorporated the range of agency and public input obtained through scoping efforts and other stakeholder engagement activities conducted to date. This effort resulted in the tentative selection of an alternative plan for implementation (also referred to as the Tentatively Selected Plan [TSP]); this alternative plan constitutes the proposed action. The measures included in the TSP are based on the following concepts:

- **Detention basin**: Detention basins involve construction of an earthen structure that would allow high-frequency stream flows to pass, but would capture and delay larger volume stream flows, helping to reduce flood peaks. Detention basins may be located either within a stream channel or in an open space area directly adjacent to a stream/canal.
    - The in-stream detention basins would be comprised of an earthen berm that extends perpendicularly across a stream channel that would, in combination with the natural topography, provide temporary containment of storm flows. The basins would not be designed to permanently contain water; they would include a natural-bottom arch culvert or concrete box culvert that would maintain passage of low flows and also allow the basin to completely drain into the stream as flood conditions subside. An emergency spillway would allow water to overflow the berm in the event the capacity of the detention basin is exceeded. Rip-rap energy dissipation and scour protection features downstream of the culverts would protect the stream channels from erosion during high flows. Debris

catchment structures would be incorporated as part of each measure, and would function to capture large in-stream debris. To facilitate safe operation and maintenance of each basin, the area surrounding the berm would be kept clear of woody vegetation.

- The off-stream detention basins would function similarly to the in-stream detention basins, but would be formed by construction of a berm around the perimeter of a nearby open space; stream flows would be directed into the detention basin via a spillway along the stream bank, then would flow back into the stream as flood conditions subside.

- **Debris catchment**: As described above, the in-stream detention basins would include a debris catchment feature. In addition, debris catchment structures were also considered as stand-alone measures; these structures would generally consist of a narrow concrete pad that would span the stream, with evenly-spaced steel posts. They would allow stream flows to pass, while functioning to block large debris as it flows downstream. Similar to the in-stream detention basins, the area surrounding the catchment structure would be kept clear of woody vegetation.
- **Floodwalls**: The floodwalls would be comprised of concrete walls that would function to increase existing channel capacity. The floodwalls would range in height (with an average height of 4 feet), and would be constructed with a minimal set back distance from the existing stream or canal walls. Local drainage patterns would be maintained to the extent possible, with flap gates and/or slide gates and pumps incorporated where necessary.
- **Non-structural measures**: Non-structural measures generally involve the use of knowledge, practices or agreements to change a condition, such as through policies and laws. These may also include efforts such as improved flood warning, greater communication of flood risks, and tools or incentives to property owners to help protect their property (such as flood insurance). The only non-structural measure that was found to be feasible for this project is improvement of the existing flood warning system.

Consistent with USACE regulations (Engineering Regulation [ER] 1105-2-100), compensatory mitigation measures were incorporated into the TSP to compensate for unavoidable impacts to aquatic habitat. As further described in the Mitigation and Monitoring Plan for this project, the Hawaii Stream Habitat Evaluation Procedure (HSHEP) was used to quantify the potential impacts to aquatic habitat, thus establishing the basis for mitigation. Based on the known problems relating to the existing aquatic habitat quality, a suite of potential mitigation measures were developed and evaluated. This process resulted in the selection of a mitigation alternative comprised of two measures, each of which involves removal of a passage barrier to improve access to high quality upstream habitat for native aquatic species.

Each of the flood risk management measures and associated compensatory mitigation measures included in the TSP is summarized in Table 1. Locational maps and engineering drawings of each measure are included as part of the Draft Feasibility Report/EIS.

TABLE 1
Flood Risk Management Measures and Associated Compensatory Mitigation Measures in the ~~TSP~~Recommended Plan

Flood Risk Management Measure	Description ~~of Measure~~
Waihi debris and detention basin	Earthen dam, approximately ~~24~~37~~3~~42 feet high and ~~225~~477 feet across; ~~arch~~box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approx~~.~~imately 150 feet of riprap for energy dissipation and scour protection downstream of culvert.. New access road to be constructed for construction and O&M.
Waiakeakua debris and detention basin	Earthen dam, approximately ~~203~~437 feet high and ~~185~~401 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; ~~energy dissipation structure to be located on~~ approx~~.~~imately 150 feet of riprap for energy dissipation and scour protection downstream ~~end~~ of culvert.

TABLE 1
Flood Risk Management Measures and Associated Compensatory Mitigation Measures in the ~~TSP~~Recommended Plan

Flood Risk Management Measure	**Description ~~of Measure~~**
Woodlawn Ditch detention basin	Three-sided berm, approximately 15 feet high and 840 feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side.
~~Manoa~~Mānoa in-stream debris catchment	Concrete pad, approximately 8 feet wide and 60 feet across; steel posts (up to approximately 7 feet high) evenly spaced 4 feet apart along concrete pad.
Kanewai Field multi-purpose detention basin	Earthen berm, approximately~~ 7~~9 feet high, around 3 sides of the field; grouted rip-rap inflow spillway along bank of Mānoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.
~~Waiomao~~ Wai'ōma'o debris and detention basin	Earthen ~~dam~~structure, approximately ~~24~~33.534 feet high and ~~120~~275 feet across; ~~arch~~box culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approx~~.~~imately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approx~~.~~imately ~~2,000~~3,060 yd^3 to provide required detention volume upstream of berm; ~~low-flow channel with existing substrate to be restored following excavation.~~ New access road to be constructed for construction and O&M.
~~Pukele~~ Pūkele debris and detention basin	Earthen ~~dam~~structure, approximately ~~24~~3035 feet high and ~~120~~82 feet across; ~~arch~~box culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approx~~.~~imately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of approximately 14,330 yd^3 to provide required detention volume upstream of berm. New access road to be constructed for construction and O&M.
Makiki debris and detention basin	Earthen ~~berm~~structure, approximately ~~24'30~~36 feet high and 100~~'~~ feet across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip-rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; approx~~.~~imately 150 feet of riprap for energy dissipation and scour protection downstream of culvert. Excavation of 3,035 yd^3 to provide required detention volume upstream of berm. ~~20-foot-wide perimeter to be maintained as cleared around perimeter of berm.~~ New access road to be constructed for construction and O&M.
Ala Wai Canal floodwalls	Concrete floodwalls ranging up to approximately 4 feet high, offset from existing Canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. ~~Three~~Two pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.
Hausten Ditch detention basin	Concrete floodwalls and an earthen berm (approximately 4.3 feet high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent a backflow from the Ala Wai Canal during a flood event.
Ala Wai Golf Course multi-purpose detention basin	Earthen berm, ~~up to approximately 7~~ on average 2.7 feet high, around the north and east perimeter of the golf course; grouted rip-rap inflow spillway along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal.
Flood warning system	Installation of 3 real-time rain gages (Mānoa, Makiki, and Pālolo streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai Watershed.
Compensatory mitigation measures (Falls 7 and 8)	Removal of passage barrier at two separate in-stream structures. Each of the structures currently has an overhanging lip, such that the stream flow over these structures is free-falling and does not maintain contact with the surface of the structure, creating a barrier to upstream passage for native species. The proposed mitigation involves installation of grouted stones as part of the existing in-stream structure to provide a suitable surface for migration of the native species to upstream habitat.

Following construction, each of the measures will be operated and maintained by the non-federal sponsor. The operations and maintenance (O&M) requirements for each measure type are summarized in Table 2.

TABLE 2
Proposed Operations and Maintenance (O&M) Activities

Measure Type	Summary of O&M Activities
Debris and Detention Basin	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year; Clear accumulated debris following flood event or annually (whichever is greater)
Multi-Purpose Detention Basin	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year; Assumes minimal sediment or debris removal would be required
Debris Catchment	Clear accumulated debris twice per year
Floodwalls	Inspect and maintain gates (e.g., greased) annually; Inspect, test, and maintain pump system annually; Inspect floodwalls and repair as needed (e.g., patching)
Flood Warning System	Inspect and test annually (includes annual operating cost)
Mitigation Measures	Inspect for erosion annually

NOTES:
[1] Debris and sediment cleared from the flood risk management measure locations would be disposed at an existing authorized location.

E. General Description of Dredged or Fill Material

1. General Characteristics of Material

The materials to be used would vary by measure; these are generally described in Table 3. The exact specifications of the materials have not yet been determined. In general, the materials would be obtained from existing sources. Stone for the rip-rap would be durable material free from cracks, seams and other defects that would tend to increase deterioration from natural causes. Rip-rap stone used for scour protection would have a mean diameter of 2.2 feet. Fill material would consist of soil and stones less than 3-inches in diameter; concrete would be a 4000 psi standard mix. Base course material would consist of clean gravel. The arch culverts would consist of corrugated aluminum, the box culverts would be 12-foot by 6-foot concrete, and the debris catchment posts would be 8-inch-diameter steel poles. Slide gates would be comprised of cast iron, and flap gates would be comprised of cast iron and steel.

2. Quantity of Material

For the purpose of this analysis, quantities were calculated based on the conservative assumption that the ordinary high water mark (OHWM) is approximately at the level of the 50-percent ACE event.[5] Based on this assumption, the quantity of material to be placed below the OHWM includes approximately 202 cubic yards of concrete, approximately 853 cubic yards of compacted fill, approximately 109 cubic yards of grouted rip-rap or stone, and approximately 70 cubic yards of base course material (gravel). Table 3 lists the type and quantity of fill material specific to each measure location. These quantities are based on the 35% level of design, and will be revisited and modified as needed during the detailed design phase.

Specific to O&M, no placement of fill material is anticipated. O&M activities would require work within the OHWM; however, these activities would generally be limited to trimming/clearing vegetation around the perimeter of the in-stream detention berms. Accumulated sediment and debris would also be removed from the debris catchment features and in-stream detention basins, as listed in Table 4.

3. Source of Material

The exact source of the material has yet to be determined. However, all fill material would be obtained from a certified pit/quarry or other approved source, and will be free of contaminants. All stone and rock would be clean and reasonably free from soil, quarry fines, and would contain no refuse.

[5] The exact location of OHWM will be verified as part of a formal jurisdictional delineation to be conducted during the detailed design phase; this analysis will be updated based on the delineation, as well as any refinements to the project design.

TABLE 3
General Description of Construction-Related Excavation and Placement of Fill Within Waters of the U.S.

Measure	Component of Measure	Excavated Material			Fill Material		
		Description	Quantity	Unit	Description	Quantity	Unit
Waihi debris and detention basin	Culvert				Concrete ~~footing~~box, 12'x6'	~~9~~160	~~yds^3~~Lin. ft
	Detention berm				Compacted fill Grouted rip-rap	140 3	yds^3 yds^3
	Scour Protection				Stone rip-rap	500	yds^3
	Debris catchment feature				Concrete footing	19	yds^3
					Steel posts (8" dia.)	7	posts
	Access road				Base course (gravel)	2	yds^3
Waiakeakua debris and detention basin	Culvert				Concrete footing	7	yds^3
	Detention berm				Compacted fill Grouted rip-rap	290 12	yds^3 yds^3
	Debris catchment feature				Concrete footing	19	yds^3
					Steel posts (8" dia.)	7	posts
	~~Energy dissipator~~Scour Protection				~~Concrete blocks (3' wide)~~ Stone rip-rap	~~8~~500	yds^3
Woodlawn Ditch detention basin	Culvert				Concrete footing	6	yds^3
	Detention berm				Compacted fill Grouted rip-rap	3 1	yds^3 yds^3
Manoa in-stream debris catchment	Debris catchment feature				Concrete footing	36	yds^3
					Steel posts (8" dia.)	14	posts
Kanewai Field multi-purpose detention basin	Spillway				Grouted rip-rap	41	yds^3
Waiomao debris and detention basin	Culvert				Concrete ~~footing~~ box, 12'x6'	~~9~~170	~~yds^3~~Lin. ft
	Detention berm				Compacted fill Grouted rip-rap	140 3	yds^3 yds^3
	Scour Protection				Stone rip-rap	500	yds^3
	Debris catchment feature				Concrete footing	15	yds^3
					Steel posts (8" dia.)	5	posts
	Access road				Base course (gravel)	60	yds^3

Measure	Component of Measure	Excavated Material			Fill Material		
		Description	Quantity	Unit	Description	Quantity	Unit
	Detention Basin	Excavation	~~2,000~~ 3,060	yds^3	none	-	-

Measure	Component of Measure	Excavated Material			Fill Material		
		Description	Quantity	Unit	Description	Quantity	Unit
Pukele debris and detention basin	Culvert				Concrete ~~footing~~ box, 12'x6'	~~9~~160	~~yds^3~~Lin. ft
	Detention berm				Compacted fill Grouted rip-rap	140 6	yds^3 yds^3
	Scour Protection				Stone rip-rap	500	yds^3
	Debris catchment feature				Concrete footing	15	yds^3
					Steel posts (8" dia.)	5	posts
	Access road				Base course (gravel)	4	yds^3
	Detention Basin	Excavation	14,330	yds^3	none	-	-
Makiki debris and detention basin	Culvert				Concrete footing	9	yds^3
	Detention berm				Compacted fill Grouted rip-rap	140 6	yds^3- yds^3
	Scour Protection				Stone rip-rap	500	yds^3
	Debris catchment feature				Concrete footing	15	yds^3
					Steel posts (8" dia.)	5	posts
	Access road				Base course (gravel)	4	yds^3
	Detention Basin	Excavation	3,035	yds^3	none	-	-
Ala Wai Canal floodwalls	Floodwalls				None	-	-
	Access stairs				None	-	-
	Slide/flap gates				Metal slide/flap gates	47	gates
Hausten Ditch detention basin	Concrete wall				Concrete	26	yds^3
	Slide gates				Metal slide gates	4	gates
Ala Wai Golf Course multi-purpose detention basin	Spillway				Grouted rip-rap	30	yds^3
Flood warning system	Sensors				Prefabricated hoses	1	hoses
Mitigation– Falls 7	Species passage				Grouted stone	4	yds^3
Mitigation– Falls 8	Species passage				Grouted stone	3	yds^3
TOTAL		**Total Excavation**	**~~2,000~~20,425**	**yds^3**	**Concrete**	**~~202~~167**	**yds^3**
					Compacted fill	**853**	**yds^3**

Measure	Component of Measure	Excavated Material			Fill Material		
		Description	Quantity	Unit	Description	Quantity	Unit
					Grouted rip-rap ~~/ stone~~	109	yds^3
					Base course (gravel)	70	yds^3
					Stone rip-rap	2,500	yds^3
					Posts	35	yds^3
					Total Fill	3734	yds^3

NOTES:

1. The quantities reflect excavation and placement of fill material as part of construction (assumes no discharge associated with general clearing and grubbing). Quantities were calculated based on the conservative assumption that the ordinary high water mark (OHWM) is approximately at the level of the 50-percent ACE event. The exact location of OHWM will be verified as part of a formal jurisdictional determination to be conducted during the next phase of the project; this analysis will be updated based on the delineation, as well as any refinements to the project design.

TABLE 4
General Description of Excavation and Placement of Fill Within Waters of the U.S. for Operations and Maintenance

Measure	Description	Excavated Material		Fill Material	
		Quantity[1]	Unit	Quantity	Unit
Waihi debris and detention basin	Sediment/debris removal	300	yds^3	-	-
Waiakeakua debris and detention basin	Sediment/debris removal	400	yds^3	-	-
Woodlawn Ditch detention basin	None	-	-	-	-
Manoa in-stream debris catchment	Sediment/debris removal	25	yds^3	-	-
Kanewai Field multi-purpose detention basin	None	-	-	-	-
Waiomao debris and detention basin	Sediment removal	300	yds^3	-	-
Pukele debris and detention basin	Sediment removal	100	yds^3	-	-
Makiki debris and detention basin	Sediment removal	250	yds^3	-	-
Ala Wai Canal floodwalls	None	-	-	-	-
Hausten Ditch detention	None	-	-	-	-
Ala Wai Golf Course multi-purpose detention basin	Sediment removal	200	yds^3	-	-
Flood warning system	None	-	-	-	-
Mitigation measures (Falls 7 and 8)	None	-	-	-	-

NOTES:
[1] Quantities are an estimate of the amount of sediment and debris to be removed annually; assumes no discharge of dredged or fill material associated with other O&M activities (e.g., trimming/clearing vegetation around the perimeter of the in-stream detention berms and clearing debris within the debris catchment features and in-stream detention basins).

F. Description of Proposed Discharge Sites

1. Location

The proposed measures would be located within and along the various waterways within the Ala Wai watershed; these include Makiki, Manoa and Palolo Streams and the Ala Wai Canal. Each measure is briefly described in Table 1; maps showing their location are contained in the Draft Feasibility Report/EIS.

2. Size

The amount of area within which fill material would be discharged varies by measure. The length of channel that would be within the footprint of each permanent structure (i.e. the areas that would be subject to placement of fill), as well as the length of channel within the overall construction limits for each measure is summarized in Table 5.

3. Type of Habitat

Streams in the Ala Wai watershed arise on the southern slopes of the Koʻolau range. Manoa and Palolo valleys contain the two major streams draining to the Ala Wai Canal, with Manoa Stream consisting of a complex radial set of six tributaries in its upper reaches. Makiki Stream also flows to the Ala Wai Canal, but drains a much smaller area, with at least one of its four tributaries (Kanaha Stream) flowing only intermittently (Englund and Arakaki, 2004). A formal jurisdictional determination of Waters of the U.S. has not yet been completed for the project area; however, all of the streams and Canals in the watershed are assumed to be Waters of the U.S. (AECOS, 2014).[6] Jurisdictional wetlands are not expected to be present outside the defined channel limits. This information will be verified during the next phase of the project

[6] The Ala Wai Canal is a navigable Waters of the U.S., and therefore also subject to Section 10 of the Rivers and Harbors Act.

through a formal jurisdictional determination in accordance with the new Clean Water Rule: Definition of "Waters of the United States" (33 CFR Part 328).

Each stream generally consists of an upper, middle, and lower reach that flow to an estuarine reach and then to the Ala Wai Canal, before discharging to the ocean. In this context, upper reaches are the tributary streams with youthful profiles (steep, relatively straight courses in down-cutting channels). Middle reaches have more mature profiles, slightly meandering and eroding mostly laterally. Lower reaches flow across the coastal plain and are typified by sediment accumulation. The estuarine reaches are those in which sea water and freshwater mix, typically along a gradient of increasing salinity seaward.

Riparian vegetation is present along all of the upper stream reaches, and is generally dominated by non-native species (many of which are considered invasive), including large trees such as Chinese banyan, *kukui* (*Aleurites moluccana*), mango, octopus tree, *hau* (*Hibiscus tiliaceus*), fiddlewood (*Citharexylum spinosum*), mountain apple (*Syzygium malaccense*), gunpowder tree (*Trema orientalis*), and gum (*Eucalyptus* sp.), as well as smaller herbaceous species such as exotic ginger (*Hedychium* sp.) and Job's tears (*Coix lachryma-jobi*) (Kido, 2006; Kido, 2007; Kido, 2008; Oceanit, 2004).

Within the urbanized portion of the watershed, riparian vegetation is generally limited to unchannelized stream reaches, such as along portions of Manoa Stream (for example, near the Dole Street Bridge). A majority of Palolo and Makiki streams are channelized and lack a riparian zone (Oceanit, 2004; Englund and Arakaki, 2004; Kido, 2008). Mangrove trees (*Rhizophora mangle*) are present in some areas in the lower estuarine reaches of the Manoa–Palolo Drainage Canal and the Ala Wai Canal, although concrete and concrete masonry (CRM) walls constructed as banks have eliminated much of the riparian vegetation.

A description of the habitat at each measure location is provided in Table 5.

4. Timing and Duration of Discharge

Subject to approvals and appropriation of funds, construction would begin in the year 2021. In total, construction is expected to last approximately 3 years; it is expected that construction of individual measures will require on the order of 6 to 12 months each.

G. Description of Disposal Method

In general, all material would be moved and placed mechanically.[7] Cranes, backhoes, scrapers, dump trucks and other appropriate heavy machinery would be used to deliver and place fill materials during construction. Materials would be placed in a manner that minimizes disturbance of the aquatic environment. Rip-rap would generally be placed in a systematic manner to ensure a continuous uniform layer of well-graded stone. Concrete for footings would be placed using pumps into wooden formwork. Concrete for rip-rap may be placed using pumps or by hand.

[7] Due to access limitations, it is anticipated that the mitigation measures would be constructed by hand.

TABLE 5
Description of Proposed Discharge Sites

Measure[1]	Location	Description of Habitat	Length of Stream Within Construction Limits (linear feet)	Length of Stream Subject to Placement of Fill (linear feet)	Length of Stream Within O&M Area (linear feet)
Waihi debris and detention basin	Waihi Stream, ~1,200 feet above the upper extent of development in Manoa Valley (~380' in elevation).	Site is characterized by forested habitat, with dominant species including monkeypod (*Albizia saman*), Chinese banyan, gunpowder, *kukui*, swamp mahogany (*Eucalyptus robusta*), mango, Java plum, and Christmas berry; pothos vine (*Epipremnum pinnatum*) is prominent climbing the trees. Site is located on the lower edge of a prominent belt of albizia trees.	~~160~~355	~~130~~355	40
Waiakeakua debris and detention basin	Waiakeakua Stream, ~200 feet above the upper extent of development in Manoa Valley (~300' in elevation).	Site (including the staging area) is characterized by forested habitat, with species including guarumo (*Cecropia obtusifolia*), macaranga (*Macaranga tanarius*), hau (*Hibiscus tiliaceus*), bamboo, and the shrub *Odontonema strictum*. Other species include red ginger (*Alpinia purpurata*), shoebutton ardesia (*Ardisia elliptica*), and white shrimp plant (*Justicia betonica*); pothos vine is prominent climbing the trees; site is located on the lower edge of a prominent belt of albizia trees.	~~190~~390	~~110~~350	40
Woodlawn Ditch detention basin	Woodlawn Ditch (manmade tributary to Manoa Stream), adjacent to E. Manoa Road (~200' in elevation)	Site is characterized by mixed secondary forest and tended farm/garden areas; forest is nearly monotypic stand of macaranga (*Macaranga tanarius*), with a limited number of tropical almond (*Terminalia catappa*), shoebutton ardisia, Chinese hibiscus (*Hibiscus rosa-sinensis*), coconut (*Cocos nucifera*), African tulip (*Spathodea campanulata*), and small albizia.	120	60	40
Manoa in-stream debris catchment	Middle reach of Manoa Stream, directly adjacent to lower edge of Manoa District Park (~160' in elevation)	Site is characterized as open stream channel, with minimal riparian vegetation (some shade is provided by trees in the adjacent residential properties); the staging areas within Manoa District Park is dominated by lawn, with some planted trees including Formosan *koa* (*Acacia confusa*), *kukui*, coconut, and royal palms (*Roystonia regia*).	48	8	40
Kanewai Field multi-purpose detention basin	Lower reach of Manoa Stream, just below Dole Street	Site is comprised of maintained field for park; predominantly a mowed lawn with two large mango trees near the west corner site; adjacent stream includes a riparian corridor with various mature trees of Java plum, *hau*, mango, macaranga, and monkeypod.	70	70	0
Waiomao debris and detention basin	Pukele Stream, adjacent to residences on Waiomao Rd. (~380' in elevation)	Site is comprised of a heavily forested riparian zone adjacent to residential properties; dominated by non-native species including octopus tree, gunpowder, monkeypod, macaranga (Macaranga tanarius), mango, and fiddlewood; pothos vine is prominent climbing the trees.	~~455~~720	~~130~~320	40

TABLE 5
Description of Proposed Discharge Sites

Measure[1]	Location	Description of Habitat	Length of Stream Within Construction Limits (linear feet)	Length of Stream Subject to Placement of Fill (linear feet)	Length of Stream Within O&M Area (linear feet)
Pukele debris and detention basin	Pukele Stream, adjacent to residences on Ipulei Place (~400' in elevation)	Site includes the maintained lawns of two residential homes; right bank of the stream is dominated by weedy species including Guinea grass (*Panicum maximum*) and castor bean (*Ricinus communis*); left bank is forested with non-native species including Chinese banyan, swamp mahogany, and Java plum	~~170~~810	~~130~~310	40
Makiki debris and detention basin	Makiki Stream, directly adjacent to Makiki Heights Drive (~160' in elevation).	Site is characterized by dense riparian forest; dominant species include Chinese banyan, African tulip (*Spathodea campanulata*), gunpowder tree, she oak (*Grevillea robusta*), and mango. The understory is as well dominated by a variety of nonnative shrubs and vines, notably pothos (*Epipremnum pinnatum*), shrimp plant (Justicia betonica), and Madeira vine (*Anredera cordifolia*). Staging area includes open *kukui* copse, with open floor.	~~175~~780	~~130~~310	40
Ala Wai Canal floodwalls	Perimeter of Ala Wai Canal	Vegetation along the Canal is generally limited to landscaping, with a single row of trees lining most of both sides of Canal, including *niu* (*Cocos nucifera*), with some milo (*Thespesia populnea*) and monkeypod.	0	0	0
Hausten Ditch detention basin	Hausten Ditch (drainage input to Ala Wai Canal)	Hausten Ditch is dominated by non-native species, including mangroves; native species that occur along ditch (including '*akulikuli* [*Sesuvium portulacastrum*]; *kou* [*Cordia subcordata*], and *kīpūkai* [*Heliotropium Curassavicum*]) are common species. The remainder of the site is a maintained lawn, with scattered *niu*, milo and monkeypod trees.	70	35	35
Ala Wai Golf Course multi-purpose detention basin	Ala Wai Canal	Landscaped vegetation for golf course greens and fairways; site also includes two shallow basins and a ditch that are identified as seasonally flooded wetland features on the National Wetlands Inventory (USFWS, 2006a)	70	70	0
Flood warning system	Specific locations to be determined	Assumed to be located in upper reaches of the watershed	0	0	0
Mitigation - Falls 7	Manoa Stream, approximately 400 feet downstream of Pawaina St. Bridge	Site is characterized as open stream channel, with minimal riparian vegetation (some shade is provided by trees in the adjacent residential properties)	50	5	0
Mitigation - Falls 8	Manoa Stream, immediately downstream of Pawaina St. Bridge	Site is characterized as open stream channel, with minimal riparian vegetation (some shade is provided by trees in the adjacent residential properties)	60	5	0

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations

1. Substrate Elevation and Slope

In general, the proposed measures are designed to conform to the existing elevation and slope of the stream channel, as further described below.

- **In-stream detention basins:** Overall, the elevation and slope of the existing channel bottom would be maintained throughout the various in-stream detention basins. Specifically, the designs incorporate a natural-bottom arch culvert that would maintain the natural channel for the length of the detention berm. Energy dissipation structures and other features have been incorporated as needed to maintain channel stability.

  Although the detention berms would not substantially affect the channel form, these features would function to temporarily detain stream flows that exceed the approximately 20-percent ACE level. ~~One~~Three of the basins (Waiomao, Pukele, and Makiki debris and detention basins) would require excavation in the area behind the detention berm (including the stream) to provide adequate storage capacity. This work would result in localized changes in the elevation and slope of the area adjacent the stream, but the general channel form would be maintained and the excavation would be designed to blend with the existing topography to the extent possible. Inundation associated with each of the in-stream detention basins is expected to be infrequent and of short duration (e.g., less than 12 hours for the 1% ACE event), such that significant loss of environmental characteristics and values is not anticipated.

- **Multi-purpose detention basins:** These measures would primarily be located in upland areas adjacent to a stream channel, and would not involve modification of the stream bottom. To create an inflow spillway for each basin, a minimal amount of grading may be required along approximately 70 feet of the stream bank, prior to placement of rip-rap. No significant changes in the elevation or slope is expected.

- **Debris catchment features:** The debris catchment features involve installation of a small concrete pad with inset steel poles across the stream bottom. The concrete pad would be installed at existing grade, such that no changes in elevation or slope of the stream channel are anticipated. The steel poles would function to capture debris, which will be removed as part of routine O&M activities.

- **Flood warning systems:** This measure would not affect the elevation or slope of channel.

- **Mitigation measures:** The mitigation measures involve the installation of grouted stone to eliminate an overhanging lip associated with erosion at two existing in-stream structures. The measures would not affect the elevation of the stream bed.

Based on the minimal degree of change in channel substrate elevation and slope, there are not expected to be significant changes in water circulation, depth or temperature during periods of normal flow.

2. Sediment Type

The existing substrate in stream channel within the Ala Wai watershed includes a gradation of materials, with a mixed size of rock and varying levels of sediment. The substrate in the upper reaches of the watershed is typically comprised of large boulders and cobbles, and the middle reaches incorporate a mixed substrate, with a larger percentage of medium-sized substrate. The lower reaches of the watershed, including the Ala Wai Canal and Hausten Ditch include a large component of sediment and other fine particulates.

Construction of the flood management measures would modify the existing substrate within portions of the measure footprint, as described below.

- **In-stream detention basins:** These measures would involve placement of compacted fill and grouted rip-rap for construction of the detention berm. To minimize the loss of natural substrate, an arch culvert would be incorporated into the detention berm to allow for maintenance of a natural-bottom channel at Waiakeakua, Woodlawn, and Makiki, while concrete box culverts would be used at Waihi, Waiomao, and Pukele. Approximately 150 feet of stream channel downstream of the Waihi, Waiakeakua, Waiomao, Pukele, and Makiki basins would be lined with rip-rap (mean stone diameter of 2.2 feet) to dissipate energy and prevent scour during high flows. The substrate within the channel would likely be affected during construction, with an increased amount of sediment and fine particulates. Following construction, the natural substrate is expected to return to pre-construction conditions, except within the box culverts and rip-rapped scour protection. However, some amount of sediment and debris is expected to accumulate in the area behind the detention berm, and would be routinely removed as part of O&M.
- **Multi-purpose detention basins:** The multi-purpose detention basins would involve placement of rip-rap along a short section of channel bank, which would function as the inflow spillway for the detention basin. The rip-rap would replace the existing earthen stream bank.
- **Debris catchment features:** The debris catchment features would involve installation of a concrete pad, which would displace the existing substrate. However, these features would be at existing grade, and given their relatively small size, are not expected to result in a substantial loss of environmental characteristics and values.
- **Flood warning system:** The flood warning system would not displace or otherwise affect the natural substrate.
- **Mitigation measures:** The mitigation measures would involve placement of grouted stone to address erosion and undercutting associated with existing in-stream structures. The grouted stone would be sized and installed in a manner that mimics the natural channel substrate.

3. Dredged/Fill Material Movement

Fill material would be placed directly into the stream channels, which would be diverted/dewatered to accommodate construction activities. In addition, best management practices (BMPs) would also be implemented to reduce the potential for erosion and sedimentation during construction. The proposed fill material would be sufficiently sized and/or protected (e.g., with rip-rap, vegetative covering or other stabilization measures) so as to preclude downstream movement of the fill materials following construction. The stabilization methods that would be applied to specific areas will be determined during final design. With proper diversion/dewatering and implementation of BMPs, the proposed discharge is expected to be stable, such that the substrate surrounding the discharge site is not expected to be affected by erosion, slumping or lateral displacement of materials.

4. Physical Effects on Benthos

Placement of fill material would smother and/or displace benthic organisms located within the footprint of the flood risk management structures. Excavation activities (i.e. for Waiomao, Pukele, and Makiki debris and detention basins) could also result in mortality of benthic organisms within these areas. However, it is expected that the newly placed substrate would be rapidly colonized, with little to no long-term effects on benthic communities.

5. Actions Taken to Minimize Impacts

Efforts to minimize stream-related impacts on the physical substrate include the use of approved construction procedures, in compliance with Federal and State requirements, as well as implementation of BMPs. These include:

- Work within the stream channels would be limited to periods of low flow, with proper diversion/ dewatering techniques, as appropriate.
- Construction activities would be sequenced to limit the extent of exposed soil at any given time.
- Erosion prevention and sedimentation control measures would be implemented and maintained for the duration of construction.
- Dirt stockpile areas containing more than 100 cubic yards of material would be covered or kept wet.
- All fill materials would be acquired from approved sources and will be free of contaminants.
- Appropriate vehicles and equipment would be utilized for all stages of construction, and construction crews would be adequately trained to avoid and minimize impacts to the aquatic environment.

B. Water Circulation, Fluctuation, and Salinity Determinations

1. Water Chemistry

The use of clean fill material would preclude any significant impacts on water chemistry as a result of the proposed fill activities. Minor, short-term decreases in water clarity would likely occur during construction, but are not expected to occur long-term. No significant impacts on water color, odor, taste, dissolved oxygen levels, temperature or nutrient levels are anticipated.

2. Current Patterns and Circulation

None of the measures involve placement of fill materials that would substantially modify the existing flow patterns under normal flow conditions. Some aspects of the proposed measures could affect water circulation and/or temporarily alter flow patterns during high flow events, as further described below.

- **In-stream detention basins:** The in-stream detention basins include a natural-bottom arch culvert, which is sized to maintain passage of stream flows up to the 20-percent ACE level. During periods when flows exceed this level, water would be temporarily detained in the detention basins. This would result in areas with reduced flow velocity and circulation behind the detention berm (which could increase deposition of suspended particulates), and a concentration of flows with increased velocity within the culvert (which could result in increased erosion). However, d~~esign features (such as~~ energy ~~dissipators)~~dissipation and scour protection consisting of rip-rap and stilling pools would be incorporated to regulate flow velocities and reduce the potential for erosion. In addition, these flow conditions are only expected to occur on an infrequent basis and for a short duration (less than 12 hours for the 1-percent ACE event), such that significant impacts are not anticipated.
- **Multi-purpose detention basins:** As previously described, the multi-purpose detention basins would be located in an upland area adjacent to a stream, and would include an inflow spillway on the stream bank, as needed to divert stream flows during flood conditions. The spillway would not

affect flow patterns or circulation during normal stream flows. During flood flows, the detention basin would temporarily fill with stream flows, which would then be returned to the stream. As these features are located off-channel, and would serve to reduce peak flow volumes on an infrequent basis, they are not expected to affect flow patterns or circulations in a manner that would substantially affect stream characteristics or values.

- **Debris catchment features:** The debris catchment features would function to capture debris that would otherwise flow downstream and increase the potential for stream blockages. If excessive amounts of debris accumulate in the debris catchment features, stream flow circulation could be affected. However, the debris that is caught by these features would be removed as part of routine O&M, such that substantial changes in flow and circulation are not anticipated.
- **Flood warning system:** The flood warning system would not affect flow patterns or water circulation.
- **Mitigation measures:** The mitigation measures are intended to eliminate an overhanging lip associated with undercutting and erosion of in-stream structures. Grouted stone would be installed in a manner that restores water contact with the surface of the structure. This work is not expected to result in a substantial change to flow or circulation.

3. Normal Water Level Fluctuations

In general, the proposed measures are designed to maintain the normal flow regime, such that typical water level fluctuations would not be affected. However, during flood flows, both the in-stream and multi-purpose detention basins are intended to detain water, resulting in areas of inundation behind (or within) the detention berms. However, these conditions would only occur on an infrequent basis and for a short duration (e.g., less than 12 hours for a 1-percent ACE event), such that no substantial changes are anticipated relative to the stream characteristics and values.

4. Salinity Gradients

The vast majority of the proposed measures would be located in areas that are not tidally influenced. The only measures that would be located in areas subject to salinity gradients are the Hausten Ditch Detention Basin and the Ala Wai Golf Course Detention Basin. However, implementation of these measures would not divert or restrict flows in a manner that would substantially affect the salinity gradients. The Ala Wai Golf Course Detention Basin would only divert flood flows that exceed the 20-percent ACE level, and flows would return to the Ala Wai Canal as the flood waters subside (estimated to occur within less than 10 hours). Similarly, the Hausten Ditch Detention Basin would also be used only during flood flows, in which case slide gates would be activated until the flood waters subside. In both cases, modification of the flows would occur infrequently and for a short duration, such that the salinity gradient in the Ala Wai Canal is not expected to be significantly affected.

5. Actions Taken to Minimize Impact

As previously described, design features (such as energy dissipators) would be incorporated into the in-stream debris and detention basins to regulate flow velocities and reduce the potential for erosion. In addition, standard BMPs would be implemented, including those listed above (Section II(A)(5)).

C. Suspended Particulate/Turbidity Determination

1. Suspended Particulates and Turbidity Levels

As previously described, the fill materials to be placed include a combination of earthen fill, rip-rap, concrete and base course, all of which would be adequately stabilized during construction. In general, the size and characteristics of these materials would not substantially contribute to increased turbidity or suspended particulate levels over the long term. However, some degree of increased turbidity and increased concentration of suspended solids is likely to occur during construction of project features. Proper

diversion/dewatering techniques and other BMPs would be implemented to avoid and minimize the potential for erosion and sedimentation to the extent possible. As such, these are expected to be temporary impacts, and would be relatively minor and restricted to a localized area. No long-term adverse effects on water quality are expected.

2. Effects on Chemical and Physical Properties of the Water Column

Temporary increases in suspended particulates and turbidity could result in minor impacts on the physical properties of the water column, including reduced light penetration and habitat quality for aquatic species. However, these changes would be short-term and localized, and it is expected that the potential effects would rapidly dissipate upon completion of construction. All discharge material would be clean and free of contaminants, such that no effects relative to toxic metal concentrations, pathogens, or viruses are anticipated.

3. Actions Taken to Minimize Impact

As previously described in Section II(A)(5), BMPs would be implemented during construction, and would help to avoid and minimize impacts associated with suspended particulates and turbidity to the extent possible.

D. Contaminant Determinations

As previously specified, all materials used for construction would be from approved sources, and would be clean and free of contaminants. Previous studies have investigated the extent of pollution in the water column and sediments within the Ala Wai Canal, with a few studies also sampling the main streams in the watershed. In general, these studies have identified the presence of contaminants including bacteria, trace metals, nutrients, pesticides, and toxic organics (Edward K. Noda and Associates, 1992a, 1992b, and 1992d; Laws et al., 1993; DOH, 1997a; DOH, 2002; Anthony et al., 2004; De Carlo et al., 2004). As previously described, the detention basins would function to temporarily hold stream flows, slowly releasing them within the streams and Canal. To the extent that contaminants are present in the detention areas (particularly within the multi-purpose detention areas, which may be subject to herbicide applications), detained water could flush contaminants into the streams, thus contributing to degraded water quality conditions. However, the multi-purpose detention features are located within areas that are already subject to flooding, such that the project is not expected to substantially increase delivery of contaminants to the streams beyond that which already occurs. Similarly, in-stream detention in the upper reaches of the watershed is not expected to substantially increase mobilization of any contaminants beyond the existing condition. As such, the proposed work is not expected to introduce or increase the presence of contaminants into the streams.

E. Aquatic Ecosystem and Organism Determinations

1. Effects on Plankton

During construction, an increase in turbidity and suspended solids in the areas associated with the proposed fill activities might have a short-term localized effect on phytoplankton productivity. It is expected that any potential impacts would be temporary, such that the plankton populations would recover quickly following construction.

2. Effects on Benthos

Placement of fill material would cover and smother benthic communities located within the footprint of each measure. In-stream excavation activities (e.g., at Waiomao, Pukele, and Makiki debris and detention basins) also could result in mortality of macroinvertebrates. However, it is expected that the affected areas would be rapidly colonized, with little to no long-term effects on benthic organisms. Where the stream channel is lined with rip-rap for scour protection, the large diameter stone may alter the character of the

stream sediments, especially where fine sediments prevailed prior to construction, and lead to colonization by a different community of invertebrates. The interior of the concrete box culverts would provide little new habitat for colonization by benthic organisms.

3. Effects on Nekton

Construction activities are expected to temporarily increase turbidity and suspended solids, as well as noise and overall level of habitat disturbance, which could affect the various species present in the streams, including the assemblage of native aquatic species. However, the work area for each measure would be dewatered prior to construction, such that fish and other free-moving organisms would be precluded from the temporarily impacted areas. Once stream flows are returned to the work areas, construction-related impacts are expected to rapidly dissipate such that significant effects on nekton are not anticipated.

All of the measures have been designed to minimize the potential impacts to aquatic habitat. In particular, they have all been design to maintain passage for native species. For example, where practical, the in-stream detention basins incorporate a natural-bottom arch culvert that is expected to accommodate continued passage for native migratory species under all flow conditions. The concrete box culverts necessary at some of the detention basins are expected to have an effect on aquatic organisms similar to that of a short stretch of channelized stream. Passage through the culvert may be limited during peak storm flows when the detention basins are inundated, but these conditions would only occur on an infrequent basis and for short duration, such that impacts are expected to be minor. In addition, the mitigation measures focus on removal of existing passage barriers and improved access to high-quality upstream habitat, and would serve to mitigate for potential impacts associated with the flood management measures.

4. Effects on Aquatic Food Web

The proposed fill activities would temporarily disrupt aquatic biota during project construction, but are not expected to affect overall productivity of the stream ecosystem within the watershed.

5. Effects on Special Aquatic Sites

As previously described, the streams in the Ala Wai watershed occur along a natural gradient, with steep upper reaches, more meandering middle reaches, and lower reaches entering the estuarine environment. Sections of these streams include a range of riffle-pool complexes, to the extent that they exhibit habitat complexity with a combination of higher-gradient riffles of fast-moving water and lower-gradient pools of slow-moving water. The riffle-pool complexes range along a spectrum, generally based on the underlying gradient, where the habitat in the upper reaches tends toward steeper plunge pool features, while the middle reaches tend toward a lower-gradient combination of riffles and pools. However, to the extent that these areas display high complexity with a combination of substrates and velocities that are typical of the underlying gradient (thus providing high quality habitat for the native aquatic species), they have been identified as riffle and pool complexes for the purposes of this evaluation. This includes the habitat within the proposed in-stream debris and detention basis on Waihi, Waiakeakua, Makiki, Pukele and Waiomao Streams.[8] Discharge of fill in these reaches would displace and/or otherwise reduce habitat quality for native aquatic species.

6. Threatened and Endangered Species

As assessment of the federally listed threatened and endangered species that could potentially be affected by the project was conducted, in consultation with the U.S. Fish and Wildlife Service (USFWS). The results of this analysis indicate there are several listed species that the project may affect, but is not likely to adversely affect; these are summarized below. Additional detail, including a discussion of the species that are not

[8] The reach of Manoa Stream adjacent to the Kanewai Field multi-purpose detention basin also exhibits riffle-pool complex characteristics; however, this measure would only affect a short stretch of stream bank, and is not expected to alter any characteristics of the stream bed that may contribute to riffle-pool complex habitat.

expected to be affected by the project is provided in the Biological Assessment, which is included as an appendix to the Draft Feasibility Report/EIS.

- **Hawaiian hoary bat (*Lasiurus cinereus semotus*):** This species roosts in a wide variety of both native and non-native trees, typically at heights more than 20 feet off the ground. Little is known about the species' occurrence across the island of Oahu, including the Ala Wai watershed. However, based on the habitat preferences, it is possible that it could occur within the action area. In particular, all of the detention basins in the mid to upper portions of the watershed include forested habitat with tall trees that may be used for roosting. Although species occurrence within the measure locations is relatively unlikely, should they occur, Hawaiian hoary bats could be impacted by the project. To avoid and minimize the potential for impacts, vegetation clearing would be performed during times of the year when Hawaiian hoary bats are not expected to be breeding to avoid potential for harm or disruption to non-volant juvenile bats; specifically, trees greater than 15 feet in height would not be cleared between July 1 and August 1. In addition, all construction activities would be scheduled to occur during daytime hours, thus avoiding potential bat foraging activities, which typically occur in the evening hours.
- **Oahu elepaio (*Chasiempis sandwichensis ibidis*):** Oahu elepaio nest and forage in a variety of native and non-native forest types across a range of elevations, but are most common in riparian vegetation along streambeds and in mesic forest habitats with continuous tree canopy and dense understory. Based on recent surveys, approximately 12 birds (5 pairs and 2 single males) are known from upper portions of Palolo valley (well above the proposed Waiomao and Pukele debris and detention basin); the species is no longer believed to occur in other portions of the watershed (VanderWerf et al., 2013). Although species occurrence within the measure locations is unlikely, should they occur, Oahu elepaio could be impacted by the project. To minimize the potential for these impacts, trimming or clearing of vegetation in areas of suitable habitat would be restricted during the elepaio nesting season (January through June).
- **Hawaiian waterbirds species (including Hawaiian coot [*Fulica alai*], Hawaiian stilt [*Himantopus mexicanus knudseni*], and Hawaiian moorhen [*Gallinula chloropus sandvicensis*]):** Hawaiian waterbird species typically use a range of low-elevation ponds and wetlands. In general, the only suitable habitat that is expected to support these species within the project site are limited to areas within the Ala Wai golf course and possibly along Hausten Ditch and/or the upper edges of the Ala Wai Canal. These areas provide very minimal habitat value in comparison to other nearby areas (e.g., Pearl Harbor National Wildlife Refuge); they are not expected to provide suitable nesting habitat, but could be used for resting habitat. In the unlikely event that Hawaiian waterbird species are present within the project site, it is expected that they would readily disperse to nearby areas with higher quality habitat in response to disturbance; as such, the potential effects of the proposed action are expected to be limited to temporary construction-related disturbance (e.g., noise).

The Biological Assessment was transmitted to the USFWS with a request for concurrence with the USACE's determination that the project may affect but is not likely to adversely affect the Hawaiian hoary bat, O'ahu elepaio, and Hawaiian waterbirds (Hawaiian coot, Hawaiian stilt, and Hawaiian moorhen); the USACE has determined there would be no effect on all other federally listed/candidate species and/or designated critical habitat. The proposed project has been discussed with the resource agencies, and the Biological Assessment incorporates their input provided to date. Written concurrence with USACE's effects determination is pending, and will be included as part of the Final Feasibility Report/EIS.

7. Other Wildlife

Overall, the project is not expected to substantially affect the diversity or productivity of the project area, but the proposed fill activities would result in loss of habitat for terrestrial and aquatic species, as outlined in Section 5.7 of the Draft Feasibility Report/EIS. Consistent with USACE requirements, the loss of aquatic habitat was quantified using the Hawaii Stream Habitat Evaluation Procedure (HSHEP) and mitigation

measures to offset those impacts have been incorporated into the Tentatively Selected Plan. The mitigation measures are briefly described in Table 1 of this evaluation, with additional detail provided in the Mitigation and Monitoring Plan (Appendix E) of the Draft Feasibility Report/EIS.

8. Actions Taken to Minimize Impacts

The flood risk management measures have been designed to minimize impacts to the aquatic environment, to the extent practicable, both by reducing the overall measure footprint and by incorporating specific features to maintain native species passage (i.e. natural-bottom arch culvert). As previously described, habitat improvements will be implemented as part of the proposed action to compensate for unavoidable impacts to aquatic habitat, as described in Table 1 (and further described in the Mitigation and Monitoring Plan (Appendix E) of the Draft Feasibility Report/EIS).

F. Proposed Disposal Site Determinations

1. Mixing Zone Determination

Discharge of the proposed fill materials at each measure location would be conducted within an area subject to dewatering, and would involve minimal mixing zones. In general, the fill material used for the project would either consist of large components, or would be adequately stabilized, such that very little exposed material could be suspended in the water column.

2. Determination of Compliance with Applicable Water Quality Standards

Specific water quality criteria have been promulgated in the Hawaii Administrative Rules [HAR] §11-54, which, if met, are designed to allow water bodies to achieve designated beneficial uses. Water bodies that do not achieve the criteria are designated as "impaired" and are placed on the CWA §303(d) List of Impaired Waters. Based on the data presented in the 2014 State of Hawai'i Water Quality Monitoring and Assessment Report (DOH, 2014), several locations within the Ala Wai watershed are not in attainment of the designated water quality standards.

Locations with impairment listings in the watershed include the three major streams and the Ala Wai Canal. Manoa Stream is listed for total nitrogen, nitrate and nitrite nitrogen, total phosphorus, turbidity, dieldrin, and chlordane. Palolo Stream is listed for trash, and Makiki Stream is listed for total nitrogen and total phosphorus. The Ala Wai Canal is listed for total nitrogen, nitrate and nitrite nitrogen, total phosphorus, turbidity, enterococci, pathogens, metals, suspended solids, and organochlorine pesticides.

For each water body on the §303(d) list, a pollution budget or Total Maximum Daily Load (TMDL) must be developed to bring that water body into compliance with water quality standards. To date, the only TMDLs that have been developed are for nitrogen and phosphorus in the Ala Wai Canal. Development of the remaining TMDLs has been designated by DOH as a low priority (DOH, 2014).

As described throughout this evaluation, the project would involve discharge of a combination of compacted fill, rip-rap, concrete and base course (gravel), all of which will be adequately stabilized during construction. In general, the size and characteristics of these materials will not substantially contribute to increased turbidity or suspended particulate levels, or other constituents which impair water quality. Some degree of increased turbidity and increased concentration of suspended solids would likely occur during construction of project features. Proper dewatering techniques and other BMPs would be implemented to avoid and minimize the potential for erosion and sedimentation to the degree possible. As such, these are expected to be temporary impacts, and would be relatively minor and restricted to a localized area. No long-term adverse effects on water quality are expected, such that the project is expected to be in compliance with applicable water quality standards. Water quality certification will be obtained from the State of Hawaii Department of Health prior to project construction.

3. Potential Effects on Human Use Characteristics

The proposed project would provide flood protection throughout most of the Ala Wai watershed without significantly affecting human use characteristics such as municipal and private water supplies, and recreational or commercial fisheries.

The project would result in some impacts to recreation, as several of the measures are sited in designated recreational areas. Facilities that would be affected (at least in part) include Manoa District Park, Kanewai Park, Ala Wai Promenade, Ala Wai Community Park, Ala Wai Golf Course, and Ala Wai Canal. In addition, areas within the Honolulu Forest Reserve and Makiki Tantalus Recreation Area would be affected during construction. In general, the measures would displace some areas that are currently used for recreation. However, to the maximum extent possible, they have been designed with the smallest footprint possible, and to minimize impacts to recreational activities during non-flood conditions. For example, the Kanewai and Hausten Ditch detention basins are designed to be multi-purpose facilities, such that the baseball/ softball fields may still be used during non-flood conditions. During a flood event, the measures would function to temporarily detain water and debris, thereby precluding recreational use; however, these sites are expected to have minimal recreational value under flood conditions. Additional detail on potential impacts to recreation is provided in Section 5.10 of the Draft Feasibility Report/EIS.

Other potential impacts on human use characteristics include those associated with aesthetics. In general, the measures would introduce a large-scale built element to the natural environment, which would impact views from and toward the site. In general, the detention features in the upper portions of the watershed will either be screened by dense vegetation or otherwise fit into the natural topography, such that they are not expected to be prominently visible from any readily accessible public locations. The proposed measures along the Ala Wai Canal, including the flood walls, would diminish views along and toward the Ala Wai Canal. In addition to these views being an important resource for the Waikiki District in general, they are also significant in terms of the Ala Wai Canal's listing on the National and State Register of Historic Places (as well as a component of the Kauhale O Hookipa Scenic Byway). In spite of the visual impact of the flood walls, the analysis conducted for this project determined that they are a necessary feature to provide adequate flood protection for Waikiki, such that the impacts are unavoidable. Efforts were made throughout the planning process, to minimize the impacts to the extent possible, particularly through reduction of the overall flood wall heights. Refinements to the measure design will be made during as part of the detailed design phase, and will consider opportunities to further reduce the height of the flood walls, as well as incorporate design details that may otherwise minimize potential visual impacts, such as use of construction materials and/or landscaping to blend the structures into the surrounding environment. Additional detail on potential impacts to visual resources is provided in Section 5.11 of the Draft Feasibility Report/EIS.

G. Determination of Cumulative Effects on the Aquatic Ecosystem

Although there are multiple measures throughout the watershed, they are generally located in geographically distinct areas. BMPs would be implemented for each of the measures to minimize the potential for impacts to the aquatic environment, such that they are not expected to significantly contribute to cumulative impacts. A detailed discussion of cumulative impacts is provided in Section 5.19 of the Draft Feasibility Report/EIS.

H. Determination of Secondary Effects on the Aquatic Ecosystem

No secondary impacts to the aquatic environment are anticipated to occur. Additional detail in provided in the Draft Feasibility Report/EIS.

III. FINDING OF COMPLIANCE WITH RESTRICTIONS ON DISCHARGE

The proposed fill activities would comply with Section 404(b)(1) guidelines of the Clean Water Act, as amended. No significant adaptations of the guidelines were made for this evaluation. As discussed in the Draft Feasibility Report/EIS, other alternatives considered to reduce the flood risk within the Ala Wai Watershed include no action; a large-scale dam; debris and detention basins throughout the urbanized watershed; floodwalls alone; and non-structural solutions. However, it was determined that these

alternatives were prohibitively more costly, were significantly less effective in reducing flood risk, had extensive impacts that would have been difficult to mitigate, and/or did not meet the overall project purpose of reducing flood risk throughout the watershed. Although the tentatively selected plan would involve work in areas that support riffle and pool complexes, this type of habitat occurs throughout the mid to upper reaches of the streams where peak flows are greatest. Detention of water along stream reaches without these special aquatic sites (such as in lower reaches of the watershed, as considered for Alternative 2A) is less effective at achieving the overall purpose of reducing flood risk. No other practicable alternative with less environmental impact has been identified, such that the tentatively selected plan has been identified as the least environmentally damaging practicable alternative. A detailed discussion of the potential effects of the project is presented in the Draft Feasibility Report/EIS.

The proposed fill activities would comply with all State water quality standards, Section 307 of the Clean Water Act, and the Endangered Species Act of 1973, as amended. The proposed fill activities would not have significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife and special aquatic sites. The life stages of aquatic life and other wildlife would not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity, and stability, and on recreational, and economic values would not occur. To avoid and minimize the potential for adverse impacts, the project areas would be properly dewatered and standard BMPs would be implemented. Habitat improvements would be implemented to mitigate for loss of aquatic habitat.

A public meeting will be held for the project as part of the public review process for the Draft Feasibility Report/EIS. This draft evaluation will be included as an attachment to the Draft Feasibility Report/EIS and relevant comments will be received as part of the public review process. Comments received at the public meeting and during the following comment period will be considered and this evaluation will be updated as needed.

On the basis of this evaluation, I have determined that the proposed action complies with the requirements of the 404(b)(1) guidelines for the discharge of fill material.

Date

~~Christopher W. Crary~~
James D. Hoyman
Lieutenant Colonel, U.S. Army
District Engineer

References

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Appendix E4
Coastal Zone Management Federal Consistency Review

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OFFICE OF PLANNING
STATE OF HAWAII

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
DIRECTOR
OFFICE OF PLANNING

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Ref. No. P-15106

April 11, 2016

Mr. Anthony J. Paresa, P.E.
Deputy District Engineer for
Programs and Project Management
U.S. Army Corps of Engineers, Honolulu District
Building 230
Fort Shafter, Hawaii 96858-5440

Attention: Mr. Derek Chow, Chief, Civil and Public Works Branch

Dear Mr. Paresa:

Subject: Coastal Zone Management Act (CZMA) Federal Consistency Review for the Ala Wai Canal Project, Honolulu, Oahu

The Hawaii CZM Program has completed the federal consistency review of the Ala Wai Canal flood reduction project. This CZM federal consistency review covers the "Tentatively Selected Plan," as identified in the Draft Feasibility Study with Integrated Environmental Impact Statement (August 2015), which was submitted in support of the consistency determination. The following flood risk management measures of the Tentatively Selected Plan were included in this federal consistency review: Waihi Debris and Detention Basin; Waiakeakua Debris and Detention Basin; Woodlawn Ditch Detention Basin; Manoa In-stream Debris Catchment; Kanewai Field Multi-Purpose Detention Basin; Waiomao Debris and Detention Basin; Pukele Debris and Detention Basin; Makiki Debris and Detention Basin; Ala Wai Canal Floodwalls; Hausten Ditch Detention Basin; Ala Wai Golf Course Multi-Purpose Detention Basin; and Flood Warning System. We concur with the U.S. Army Corps of Engineers determination that the proposed activity is consistent to the maximum extent practicable with the enforceable policies of the Hawaii CZM Program based on the following conditions.

1. The proposed action, identified as the "Tentatively Selected Plan" in the Draft Feasibility Study with Integrated Environmental Impact Statement (August 2015), shall be implemented as represented in the CZM consistency determination. Any changes to the subject proposal represented in the CZM consistency determination, shall be submitted to the Hawaii CZM Program for review and approval. Changes to the proposal may require a full CZM federal consistency review, including publication of a public notice and provision for public review and comment. This condition is necessary to ensure that the proposed action is implemented as reviewed for consistency with the enforceable policies of the Hawaii CZM Program. Hawaii

Revised Statutes (HRS) Chapter 205A Coastal Zone Management, is the federally approved enforceable policy of the Hawaii CZM Program that applies to this condition.

2. The mitigation measures and best management practices proposed in the "Mitigation, Monitoring and Adaptive Management Plan" (August 2015) presented in Appendix E2 of the Draft Feasibility Study with Integrated Environmental Impact Statement (August 2015), which was submitted as a supporting document for the consistency determination, shall be fully implemented. This condition ensures consistency with the Hawaii CZM Program coastal ecosystem policies in Hawaii Revised Statutes (HRS) Chapter 205A, which is a federally approved enforceable policy of the Hawaii CZM Program.

3. The proposed action shall be conducted in compliance with State of Hawaii water quality standards and requirements, including the Section 401 Water Quality Certification, as specified in Hawaii Administrative Rules (HAR) Chapter 11-54. This condition is necessary to ensure consistency with State of Hawaii water quality standards and requirements. HRS Chapter 342D Water Pollution, and HAR Chapter 11-54 Water Quality Standards, are the federally approved enforceable policies of the Hawaii CZM Program that apply to this condition.

4. As stated in the U.S. Army Corps of Engineers federal consistency supplemental information letter dated March 8, 2016: "The proposed project is subject to Section 401 of the Clean Water Act, and the Corps will be applying for a Section 401 Water Quality Certification from the State of Hawaii." This condition is necessary to ensure consistency with State of Hawaii water quality standards and requirements. HRS Chapter 342D Water Pollution, and HAR Chapter 11-54 Water Quality Standards, are the federally approved enforceable policies of the Hawaii CZM Program that apply to this condition.

5. The proposed activity shall be in compliance with the State Historic Preservation Division requirements pursuant to Hawaii Revised Statutes Chapter 6E - Historic Preservation, which is a federally approved enforceable policy of the Hawaii CZM Program.

If the requirements for conditional concurrences specified in 15 CFR § 930.4(a), (1) through (3), are not met, then all parties shall treat this conditional concurrence letter as an objection pursuant to 15 CFR Part 930, subpart C.

CZM consistency concurrence does not represent an endorsement of the project nor does it convey approval with any other regulations administered by any State or County agency. Thank you for your cooperation in complying with the Hawaii CZM Program. If you have any questions, please call John Nakagawa of our CZM Program at 587-2878.

Sincerely,

Leo R. Asuncion
Director

c: DLNR, Division of Engineering
City & County of Honolulu, Department of Planning & Permitting

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

August 5, 2015

Civil and Public Works Branch
Programs and Project Management Division

SUBJECT: Ala Wai Canal Project Consistency with Coastal Zone Management Act

Mr. John Nakagawa
Federal Consistency Program
Hawaii State Office of Planning
Department of Business,
Economic Development & Tourism
P.O. Box 2359
Honolulu, Hawaii 96804

Dear Mr. Nakagawa:

We are requesting your concurrence that the Ala Wai Canal Project described below is consistent with the Coastal Zone Management Act (CZMA).

At the request of the State of Hawaii Department of Land and Natural Resources, the Honolulu District, U.S. Army Corps of Engineers (Corps), is conducting a feasibility planning study for the proposed Ala Wai Canal Project in Honolulu, Hawaii. The Ala Wai Watershed is located on the southeastern side of the island of Oahu and includes Makiki, Manoa, and Palolo streams, all of which drain into the Ala Wai Canal. Flooding associated with a 1-percent annual chance exceedance rainfall event would affect approximately 1,358 acres within the Ala Wai Watershed, including over 3,000 properties with an estimated $318M in structural damages alone (at 2013 price levels). As such, the purpose of the project is to reduce the threat to life and reduce property damage from riverine flooding.

In response to identified flood-related problems and opportunities, potential flood risk management measures were identified and formulated into alternatives, which were evaluated through an iterative screening and evaluation process, resulting in tentative selection of a plan for implementation. The tentatively selected plan would reduce flood risks by improving the flood warning system, and constructing six in-stream debris and detention basins in the upper reaches of Makiki, Manoa and Palolo Streams, one standalone debris catchment feature, three multi-purpose detention areas in open spaces through the developed watershed, and concrete floodwalls ranging up to 4 feet high, along one or both sides of approximately 1.9 miles of the Ala Wai Canal (including three pump stations). Additional detail, including a more detailed description of the tentatively selected plan and associated maps are enclosed for your consideration. We

will also provide a copy of the Draft Integrated Feasibility Report and Environmental Impact Statement when it is published for public review, which is anticipated to occur in late August 2015.

Section 307(c)(1)(A) of the CZMA requires Federal actions that affect any land or water use or natural resources of the coastal zone will be conducted in a manner that is consistent to the maximum extent practicable with the enforceable policies of an approved state management program. As the proposed project is being undertaken by the Corps, it represents a Federal action that is understood to require compliance under the "Federal consistency" provision of the CZMA. Based on a review relative to the policies and objectives of Hawaii's Coastal Zone Management Program, we have determined that the proposed project is consistent to the maximum extent practicable. We are submitting the attached application (Enclosure 1) and assessment forms (Enclosure 2), with this request for your concurrence with our determination. Additional information on the project can be found in the enclosed Project Summary (Enclosure 3).

If you have any questions, please contact Mr. Derek Chow, Chief of our Civil and Public Works Branch, at (808) 835-4026 or e-mail derek.j.chow@usace.army.mil.

Sincerely,

for Anthony J. Paresa, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

Hawaii CZM Program
Coastal Zone Management

HAWAII CZM PROGRAM
APPLICATION FOR CZM FEDERAL CONSISTENCY REVIEW

Project/Activity Title or Description: Ala Wai Canal Project

Location: Ala Wai Watershed

Island: Oahu

Tax Map Keys: 2-9-054:019, 029, 034, 004, 002; 2-9-055:009, 001; 2-5-020:005, 008, 001; 2-9-036:003; 2-9-029:053; 2-7-036:001; 2-9-043:002; 3-4-016:059; 3-4-034:001, 008, 009; 3-4-019:003 through 010, 052; 2-8-029:011, 004; 2-7-036:002; 2-9-067:008 through 012, 015 through 017

Applicant and Agent Information

1. U.S. Army Corps of Engineers
Name of Applicant

Building 230
Address

Fort Shafter,HI 96858
City & State Zip Code

835-4026
Daytime Phone Fax Number

derek.j.chow@usace.army.mil
E-mail Address

2.
Name of Agent

Address

City & State Zip Code

Daytime Phone Fax Number

E-mail Address

CZM Consistency Determination or Certification

x Check the type of application below and sign.

☒ I. Federal Agency Activity

CZM Consistency Determination: "The proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the Hawaii Coastal Zone Management Program."

Signature _____ Date 8/5/15
(Applicant or responsible party)

☐ II. Federal Permit or License (Please sign below)

CZM Consistency Certification: "The proposed activity complies with the enforceable policies of Hawaii's approved management program and will be conducted in a manner consistent with such program."

Signature _____ Date _____
(Applicant or responsible party)

☐ III. Federal Grants and Assistance (Please sign below)

CZM Consistency Certification: "The proposed activity complies with the enforceable policies of Hawaii's approved management program and will be conducted in a manner consistent with such program."

Signature _____ Date _____
(Applicant or responsible party)

Send To: Office of Planning, P.O. Box 2359, Honolulu, Hawaii 96804

Print Form

HAWAII CZM PROGRAM
FEDERAL CONSISTENCY ASSESSMENT FORM

RECREATIONAL RESOURCES

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

1) Improve coordination and funding of coastal recreation planning and management.

2) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

   a) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

   b) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites and sandy beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

   c) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

   d) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

   e) Encouraging expanded public recreational use of county, State, and Federally owned or controlled shoreline lands and waters having recreational value;

   f) Adopting water quality standards and regulating point and non-point sources of pollution to protect and where feasible, restore the recreational value of coastal waters;

   g) Developing new shoreline recreational opportunities, where appropriate, such as artificial reefs for surfing and fishing; and

   h) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, County planning commissions; and crediting such dedication against the requirements of section 46-6.

RECREATIONAL RESOURCES (continued)

Check either "Yes" or "No" for each of the following questions:		Yes	No
1.	Will the proposed action involve or be near a dedicated public right-of-way?	☐	☒
2.	Does the project site abut the shoreline?	☐	☒
3.	Is the project site near a State or County park?	☒	☐
4.	Is the project site near a perennial stream?	☒	☐
5.	Will the proposed action occur in or affect a surf site?	☐	☒
6.	Will the proposed action occur in or affect a popular fishing area?	☐	☒
7.	Will the proposed action occur in or affect a recreational or boating area?	☒	☐
8.	Is the project site near a sandy beach?	☐	☒
9.	Are there swimming or other recreational uses in the area?	☒	☐

Discussion:

See next page.

RECREATIONAL RESOURCES

Given the project objective of reducing the risk of riverine flooding in the Ala Wai Watershed, the flood risk management features would generally be located within or adjacent to a stream (or the Ala Wai Canal). Several of the features would also be located within or near areas used for recreational purposes. Recreational areas that could be affected (at least in part) include Honolulu Forest Reserve, Kanewai Community Park, Makiki Tantalus Recreation Area, Ala Wai Golf Course, Ala Wai Community Park, and Ala Wai Promenade. In addition, portions of Manoa District Park and Archie Baker Park would be used for staging and access. During construction, recreational activities would be restricted within the construction limits for each feature, thus limiting the range and/or accessibility of recreational opportunities temporarily. Construction activities at Honolulu Forest Reserve and Makiki Tantalus Recreation Area, as well staging at Manoa District Park and Archie Baker Park would involve a very small portion of each facility, and would not significantly impact recreational activities. Construction of the floodwalls would not preclude recreational use of the Ala Wai Canal, but certain access points may be temporarily unavailable during the construction phase.

Over the long-term, berms for the multi-purpose debris and detention basins would occupy a portion of Kanewai Community Park, Ala Wai Community Park and Ala Wai Golf Course. To the extent practicable, the flood risk management feature designs have the smallest footprint possible, and minimize impacts to recreational activities during non-flood conditions. For example, the berm for the Ala Wai Golf Course detention basin design would accommodate the existing golf cart path, such that the layout and use of the golf course would not be significantly affected over the long-term. The berms at Kanewai Community Park and Ala Wai Community Park would be located around the outer perimeter of the parks. The Waiakeakua and Makiki debris and detention basins, which are planned in the Honolulu Forest Reserve and Makiki Tantalus Recreation Area (respectively), would also displace potential recreational area (less than one acre each). These feature designs are not multi-purpose; however, no established recreational activities are known to occur there, and sufficient area surrounding the feature would still be available for use.

In the event of a flood, when the various debris and detention structures would detain floodwaters and capture debris/sediment, the area would be temporarily unavailable for recreation. In the case of a 1 percent ACE flood event, the projected inundation period would be less than 10 hours. Following the flood event, post-flood maintenance would remove accumulated debris/sediment; this could require several days. Potential recreational impacts associated with post-flood maintenance could occur at those sites with multi-purpose detention basins, where established recreational activities regularly occur (e.g., Kanewai Community Park, Ala Wai Community Park, and Ala Wai Golf Course). However, project analyses indicate that these sites already flood (thereby impacting recreational uses) under without-project conditions. Furthermore, project operation and maintenance (O&M) activities would be programmed as part of the standard flood responses activities to minimize post-flood maintenance response time.

Overall, these impacts are not expected to significantly decrease the long-term availability and accessibility to recreational opportunities in the coastal zone management area. Although some limited areas would be affected, the project would also provide flood risk management benefits throughout much of the watershed, including recreational areas such as Kapiolani Park. Additional detail is provided in Section 5.10 of the Draft Feasibility Study Report with Integrated Environmental Impact Statement (EIS), hereafter referred to as “Draft Feasibility Report/EIS.”

HISTORIC RESOURCES

Objective: Protect, preserve, and where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

1) Identify and analyze significant archaeological resources;

2) Maximize information retention through preservation of remains and artifacts or salvage operations; and

3) Support State goals for protection, restoration, interpretation, and display of historic resources.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Is the project site within a historic/cultural district?	☐	☒
2. Is the project site listed on or nominated to the Hawaii or National register of historic places?	☒	☐
3. Does the project site include undeveloped land which has not been surveyed by an archaeologist?	☒	☐
4. Has a site survey revealed any information on historic or archaeological resources?	☒	☐
5. Is the project site within or near a Hawaiian fishpond or historic settlement area?	☒	☐

Discussion:

See next page.

HISTORIC RESOURCES

As detailed in the Draft Feasibility Report/EIS, the project development effort to date has included an assessment of archaeological resources and a historic structure inventory for portions of the project area. The results of these studies indicate that multiple historic properties are located within the project area and could be affected by the project, including the Ala Wai Canal which is listed on the Hawaii Register of Historic Places; a detailed listing of historic properties is provided in Section 5.8 of the Draft Feasibility Report/EIS.

Potential impacts to historic properties include modifications that may affect the integrity and/or characteristics of historic properties as a result of construction and operation of the project. As detailed in Section 5.8 of the Draft Feasibility Report/EIS, treatment recommendations have been identified for properties that are expected to be adversely affected, with the intention of identifying conditions that can be placed on the design and construction to mitigate impacts to the resource. Historic buildings, bridges, and walls affected by construction would undergo appropriate historic documentation, and design input will be solicited from the State Historic Preservation Officer (SHPO); input would be incorporated into the final design where feasible. Where possible, impacts to archaeological resources would be avoided. Where avoidance is not possible, data recovery would be performed. Where practicable, community assistance would be solicited for re-use of materials, and possible reconstruction of features of Native Hawaiian cultural significance that would be disturbed by project actions. During this feasibility phase, a number of variables remain unknown that may result in adverse effects through the future planning, design, and construction phases. A Programmatic Agreement is being developed to establish a process for resolving adverse effects, and expand upon the treatment recommendations. Coordination of this Programmatic Agreement is ongoing with the Advisory Council on Historic Preservation (ACHP), SHPO, and others as appropriate.

SCENIC AND OPEN SPACE RESOURCES

Objective: Protect, preserve and where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

1) Identify valued scenic resources in the coastal zone management area;

2) Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

3) Preserve, maintain and where desirable, improve and restore shoreline open space and scenic resources; and

4) Encourage those developments that are not coastal dependent to locate in inland areas.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Does the project site abut a scenic landmark?	☒	☐
2. Does the proposed action involve the construction of a multi-story structure or structures?	☒	☐
3. Is the project site adjacent to undeveloped parcels?	☒	☐
4. Does the proposed action involve the construction of structures visible between the nearest coastal roadway and the shoreline?	☐	☒
5. Will the proposed action involve construction in or on waters seaward of the shoreline? On or near a beach?	☐	☒

Discussion:

See next page.

SCENIC AND OPEN SPACE RESOURCES

The visual landscape of the proposed project area is generally comprised of natural stream corridor and forested habitat in the upper watershed, and open spaces within the heavily developed middle to lower watershed. The General Plan for the City and County of Honolulu has identified specific views that should be preserved within the watershed, including panoramic views from the Ala Wai Canal promenade and Ala Moana Beach Park toward the Koʻolau Mountains, as well as *mauka-makai* view corridors along major roadways. In addition to these viewplanes, other important scenic resources that have been identified include those in the Waikiki District, including the Ala Wai Canal itself, which is listed as a historic property on the Hawai`i Register of Historic Places. Two scenic byways have also been established in this area under the Hawai'i Scenic Byways Program: the Diamond Head Scenic Byway and the Waikīkī - Kauhale O Hookipa Scenic Byway. The Diamond Head Scenic Byway spans from Kapiʻolani Park to Diamond Head Crater. The Waikiki - Kauhale O Hookipa Scenic Byway includes the major thoroughfares through Waikiki, including Ala Wai Boulevard.

Construction of the debris and detention basins would introduce built elements to the natural environment; however, these features have been sited and designed to blend with the natural characteristics of each site to the extent possible. None of the features are expected to substantially diminish important environmental or landscape views from readily accessible viewing locations, nor are they expected to affect significant view corridors, including those identified in the General Plan.

As planned, the floodwalls along the Ala Wai Canal would be approximately 4 feet high (on average), extending from Kapahulu Avenue to Ala Moana Blvd on the *makai* side, and from the confluence with the Mānoa Pālolo Drainage Canal to Ala Moana Blvd on the *mauka* side. The floodwalls would also include a several pump stations (which could be several stories tall): (1) at the Kapahulu Avenue end of the Canal, (2) on the Ala Wai Golf Course near the Kapahulu storm drain, and (3) at Ala Wai Community Park, near the *makai* end of University Avenue. Neither the floodwalls nor the associated pump stations are expected to substantially obstruct broad landscape views (including those of the Koʻolau Mountains), but could diminish localized views, including those along the Ala Wai Canal. Specifically, the floodwalls are expected to partially obstruct views of the Canal from cars along Ala Wai Boulevard and from pedestrians along both sides of Canal, and will also partially obstruct views from within the Canal (e.g., paddlers and others using the Canal for recreation). In addition to these views being an important resource for the Waikiki District in general, they are also significant in terms of the Ala Wai Canal as a historic property on the Hawai`i Register of Historic Places as well as the Kauhale O Hookipa Scenic Byway (which includes Ala Wai Boulevard). However, the feasibility analysis determined that the floodwalls (and associated pump stations) would be a necessary feature to provide adequate flood protection for this area. Efforts throughout the planning process would minimize the impacts to the extent possible, particularly as related to the overall structure heights. Further refinements would be made during the design phases, and would further evaluate opportunities to reduce the dimensions of the floodwalls and pump stations, as well as incorporate design details to further minimize potential visual impacts, such as use of construction materials and/or landscaping to blend the structures into the surrounding environment.

COASTAL ECOSYSTEMS

Objective: Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

1) Improve the technical basis for natural resources management;
2) Preserve valuable coastal ecosystems of significant biological or economic importance;
3) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land water uses, recognizing competing water needs; and
4) Promote water quantity and quality planning and management practices, which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses, which violate State, water quality standards.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Does the proposed action involve dredge or fill activities?	☒	☐
2. Is the project site within the Shoreline Setback Area (20 to 40 feet inland of the shoreline)?	☐	☒
3. Will the proposed action require some form of effluent discharge into a body of water?	☐	☒
4. Will the proposed action require earthwork beyond clearing and grubbing?	☒	☐
5. Will the proposed action include the construction of special waste treatment facilities, such as injection wells, discharge pipes, or cesspools?	☐	☒
6. Is an intermittent or perennial stream located on or near the project site?	☒	☐
7. Does the project site provide habitat for endangered species of plants, birds, or mammals?	☒	☐
8. Is any such habitat located nearby?	☒	☐
9. Is there a wetland on the project site?	☒	☐
10. Is the project site situated in or abutting a Natural Area Reserve?	☐	☒
11. Is the project site situated in or abutting a Marine Life Conservation District?	☐	☒
12. Is the project site situated in or abutting an estuary?	☒	☐

Discussion:

See next page.

COASTAL ECOSYSTEMS

Given the project objective to reduce riverine flooding, all of the proposed flood risk management features would involve work within or adjacent to a stream or the Ala Wai Canal. The only feature that does not involve work directly within a waterway is the Ala Wai Canal floodwalls (and associated pump stations), as the walls would be set back from the existing edge of the Canal. None of the remaining features will permanently obstruct or change the course of a waterway; however, they would involve placement of fill material within the stream channels. Specifically, construction of the features would require placement of materials including compacted fill, concrete, grouted rip-rap, as well as steel poles for the debris catchment feature. Construction of the Waiomao debris and detention basin would also involve excavation to provide adequate detention capacity. In addition, most of the features would require periodic removal of sediment/debris from the debris catchment features. These activities would impact aquatic habitat, which could indirectly affect native aquatic species. Small pockets of wetland habitat occur along the streams and Canals in a few locations (e.g., along Hausten Ditch), but these are generally within the limits of the defined channel.

Impacts to aquatic habitat would primarily be expected to occur as a result of the in-stream detention basins, as these would involve the greatest extent of in-stream work. The debris catchment structures and multi-purpose detention basins would also displace a small amount of stream habitat. The design process incorporated efforts to avoid and minimize potential impacts to the extent practicable. Project designs reduce the project footprint to the extent practicable, and include design features to minimize habitat impacts and maintain passage for native species (e.g., use of natural-bottom arch culverts). However, even with avoidance and minimization efforts, the proposed project would still result in some impacts to aquatic habitat. As such, the project incorporates compensatory mitigation to offset the anticipated loss of aquatic habitat function. Specifically, the compensatory mitigation measures would improve passage for native aquatic species at two adjacent in-stream barriers in Manoa Stream, as described in Section 5.7.2.2 of the Draft Feasibility Report/EIS.

In general, the terrestrial habitat within the project area is comprised of non-native species, many of which are considered invasive. Federally listed threatened or endangered species that have the potential to occur within the measure locations are Hawaiian hoary bat, O‘ahu elepaio, Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and the blackline Hawaiian damselfly. Pursuant to Section 7 of the ESA, the USACE has been informally consulting with the USFWS and NMFS regarding potential impacts to threatened and endangered species. Based on this ongoing consultation, the USACE evaluated the potential impacts of the proposed project and has determined that the project may affect but is not likely to adversely affect the Hawaiian hoary bat, O‘ahu elepaio, and Hawaiian waterbirds (Hawaiian coot, Hawaiian stilt, and Hawaiian moorhen). Although previously thought to be restricted to higher elevations of the watershed (and therefore not having the potential to occur within the project area), on July 28, 2015, the USFWS identified blackline Hawaiian damselflies within the proposed footprint of the Waihi debris and detention basin. Although the detailed species occurrence information has not yet been provided by USFWS, based on the verbal description provided to date, the proposed action is likely to adversely affect the blackline Hawaiian damselfly and USACE intends to initiate formal Section 7 consultation upon receipt of the species information.

Additional detail regarding potential impacts to these resources is provided in Section 5.7 of the Draft Feasibility Report/EIS.

ECONOMIC USES

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

1) Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy;

2) Insure that coastal dependent development such as harbors and ports, visitor industry facilities, and energy generating facilities are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

3) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such development and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

   a) Utilization of presently designated locations is not feasible;

   b) Adverse environmental effects are minimized; and

   c) Important to the State's economy.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Does the project involve a harbor or port?	☐	☒
2. Is the project site within a designated tourist destination area?	☒	☐
3. Does the project site include agricultural lands or lands designated for such use?	☐	☒
4. Does the proposed activity relate to commercial fishing or seafood production?	☐	☒
5. Does the proposed activity related to energy production?	☐	☒
6. Does the proposed activity relate to seabed mining?	☐	☒

Discussion:

Several of the flood risk management features would be located within the Waikiki District, a prime tourist destination that attracts more than 79,000 visitors per day. In combination with the other flood risk management features included in the proposed project, these would function to reduce flood risk within the watershed (including the Waikiki District), thus providing significant economic benefits. A detailed discussion of the economic benefits is provided in Section 8.2 of the Draft Feasibility Report/EIS.

COASTAL HAZARDS

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.

Policies:

1) Develop and communicate adequate information on storm wave, tsunami, flood erosion, and subsidence hazard;

2) Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard;

3) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

4) Prevent coastal flooding from inland projects.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Is the project site on or abutting a sandy beach?	☐	☒
2. Is the project site within a potential tsunami inundation area as depicted on the National Flood Insurance Program flood hazard map?	☐	☒
3. Is the project site within a potential flood inundation area according to a flood hazard map?	☒	☐
4. Is the project site within a potential subsidence hazard areas according to a subsidence hazard map?	☐	☒
5. Has the project site or nearby shoreline areas experienced shoreline erosion?	☐	☒

Discussion:

The objective of the proposed project is to reduce existing riverine flood risk; as such, the proposed flood risk features are generally located within potential flood inundation areas, as shown on the current Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) flood hazard maps for Hawaii. These features would function to detain floodwaters and/or improve conveyance, so as to reduce the overall risk of flooding within the watershed. In addition, the project would include improvements to the existing flood warning system, which would help to increase life safety during flood events. Additional detail on the potential flood risk reduction is provided in Section 8.3 of the Draft Feasibility Report/EIS.

MANAGING DEVELOPMENT

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

1) Effectively utilize and implement existing law to the maximum extent possible in managing present and future coastal zone development;

2) Facilitate timely processing of application for development permits and resolve overlapping or conflicting permit requirements; and

3) Communicate the potential short- and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Will the proposed activity require more than two (2) permits or approval? (Provide the status of each.)	☒	☐
2. Does the proposed activity conform with the State and County land use designations for the site?	☒	☐
3. Has or will the public be notified of the proposed activity?	☒	☐
4. Has a draft or final environmental impact statement or an environmental assessment been prepared?	☒	☐

Discussion:

The potential impacts of the proposed project are detailed in the Draft Feasibility Report/EIS (Section 5), which is being published for public review. A discussion of the stakeholder involved efforts to date and a detailed list of the permits and approvals that will be required for the proposed project are contained in Sections 6 and 7 of the Draft Feasibility Report/EIS, respectively.

PUBLIC PARTICIPATION

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

1) Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;

2) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal-related issues, developments, and government activities; and

3) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Discussion. Please provide information about the proposal relevant to the Objective and Policies No. 2 and No. 3 above:

The planning process for the proposed project has included an extensive public involvement effort, as needed to disseminate information and obtain stakeholder input relative to the potential impacts and other aspects of the proposed project. A discussion of the public involvement efforts that have been conducted to date is contained in Section 6 of the Draft Feasibility Report/EIS.

BEACH PROTECTION

Objective: Protect beaches for public use and recreation.

Policies:

1) Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;

2) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

3) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Discussion. Please provide information about the proposal relevant to the Objective and Policies above:

The proposed project would not affect any shoreline or beach areas.

MARINE RESOURCES

Objective: Implement the State's ocean resources management plan.

Policies:

1) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

2) Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

3) Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;

4) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

5) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

6) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion. Please provide information about the proposal relevant to the Objective and Policies above:

The proposed project would not affect any marine resources. As listed in Section 6 of the Draft Feasibility Report/EIS, coordination with NOAA and other resource agencies has been conducted as part of the planning process.

Print Form

PROJECT SUMMARY

At the request of the State of Hawaii Department of Land and Natural Resources (DLNR), the Honolulu District, U.S. Army Corps of Engineers (USACE) is conducting a feasibility planning study for the proposed Ala Wai Canal Project in Honolulu, Hawaii. The study is authorized under Section 209 of the Flood Control Act of 1962 (Public Law 87-874), which is a general authority that authorizes surveys in harbors and rivers in Hawaii "with a view to determining the advisability of improvements in the interest of navigation, flood control, hydroelectric power development, water supply, and other beneficial water uses, and related land resources."

The Ala Wai Watershed is located on the southeastern side of the island of Oahu, Hawaii. The watershed encompasses 19 square miles (12,064 acres) and extends from the ridge of the Ko`olau Mountains to the nearshore waters of Mamala Bay. It includes Makiki, Manoa, and Palolo streams, which drain to the Ala Wai Canal, a 2-mile-long, man-made waterway constructed during the 1920s to drain extensive coastal wetlands (see Figure 1). This construction and subsequent draining allowed the development of the Waikiki district.

Purpose and Need

The purpose of the project is to reduce the threat to life and reduce property damage from riverine flooding. A high risk of flooding exists within the Ala Wai watershed due to aging and undersized flood conveyance infrastructure. Based on the peak flows computed for this study, it is estimated that the Ala Wai Canal has the capacity to contain about a 20- to 10-percent annual chance exceedance (ACE) flood[1] before overtopping the banks. The risk of flooding is exacerbated by the flashy nature of the streams in the watershed, with heavy rains flowing downstream extremely quickly due to steep topography and relatively short stream systems.

Overtopping of the Canal has previously flooded Waikiki multiple times, including during the November 1965 and December 1967 storms and during the passage of Hurricane Iniki in 1992. Upstream areas are also at risk of flooding, as demonstrated by several recent events, including the October 2004 storm that flooded Manoa Valley and the March 2006 storm that flooded Makiki. The October 2004 event was estimated to have a 4-percent chance of occurring in any single year, and caused more than $85M in damages (at 2004 price levels) (USACE, 2006a). Multiple other past flood events have been documented within the watershed over the course of the past century. In addition to recorded property damages, these events have contributed to health and safety risks, including two known deaths (associated with flooding in December 1918 and December 1950) (USACE, 2006).

Analyses conducted in support of this project show that the 1-percent ACE floodplain extends over approximately 1,358 acres of the watershed. Within the floodplain, the affected population is comprised of approximately 54,000 residents plus an additional estimated 79,000 visitors in Waikiki on any given day. In addition to threatening the

[1] The 1-percent ACE floodplain is the area that is inundated by a flood with a 1-percent chance (1 in 100) of occurring in any single year. These are also commonly referred to as the 100-year floodplain and 100-year flood (but do not mean that this degree of flooding occurs every 100 years). This definition also applies to floods of other magnitudes (for example, a 20-year flood is a flood that has a 5-percent chance of occurring and a 10-year flood has a 10-percent chance of occurring in any single year, respectively).

safety of both residents and visitors, a major flood event could result in catastrophic damages to structures and property throughout the watershed, with impacts to Waikiki crippling the local economy. Modeling results indicate the 1-percent ACE flood would result in damages to more than 3,000 structures, with approximately $318M in structural damages alone (2013 price levels), not accounting for loss in business income or other similar economic losses.

Project Description

In response to the flood-related problems and opportunities identified for the Ala Wai watershed, a variety of structural and non-structural flood risk management measures were considered, with a focus on the following approaches to flood risk management: (1) peak flow reduction, (2) increased channel capacity, (3) debris management, and (4) minimization of flood damages. The conceptual measures were sited and screened using a set of project-specific criteria, including technical feasibility, availability of land, implementation costs, O&M requirements, legal and public acceptability, and flood risk reduction. Through the screening process, some measures were eliminated while others were further refined and combined into an array of alternatives; this process incorporated the range of agency and public input obtained through scoping efforts and other stakeholder engagement activities conducted to date. This effort resulted in the tentative selection of an alternative plan for implementation (also referred to as the tentatively selected plan. The measures included in this plan are based on the following concepts:

- **Detention basin**: The detention basins are comprised of an earthen structure that would allow high-frequency stream flows to pass, but would capture and delay larger volume stream flows, helping to reduce flood peaks. Detention basins may be located either within a stream channel or in an open space area directly adjacent to a stream/canal.
    - The in-stream detention basins would be comprised of an earthen berm that extends perpendicularly across a stream channel that would, in combination with the natural topography, provide temporary containment of storm flows. The basins would not be designed to permanently contain water; they would include a natural-bottom arch culvert that would maintain passage of low flows and also allow the basin to completely drain into the stream as flood conditions subside. An emergency spillway would allow water to overflow the berm in the event the capacity of the detention basin is exceeded. Debris catchment structures would be incorporated as part of each measure, and would function to capture large in-stream debris. To facilitate safe operation and maintenance of each basin, the area surrounding the berm would be kept clear of woody vegetation.
    - The off-stream detention basins would function similarly to the in-stream detention basins, but would be formed by construction of a berm around the perimeter of a nearby open space; stream flows would be directed into the detention basin (via a spillway along the stream bank), then would drain back into the stream.
- **Debris catchment**: As described above, the in-stream detention basins would include a debris catchment feature. In addition, the TSP also includes a stand-alone debris catchment structure, which would generally consist of a narrow concrete pad that would span the stream, with evenly-spaced steel posts. This

structure would allow stream flows to pass, while functioning to block large debris as it flows downstream. Similar to the in-stream detention basins, the area surrounding the catchment structure would be kept clear of woody vegetation.

- **Floodwalls**: The floodwalls would be comprised of concrete walls that would function to increase existing channel capacity. The floodwalls would range in height (with an average height of 4 feet), and would be constructed with a minimal set back distance from the existing canal walls. Local drainage patterns would be maintained to the extent possible, with flapgates/slidegates and pumps incorporated where necessary.
- **Non-structural measures**: Non-structural measures generally involve the use of knowledge, practices or agreements to change a condition, such as through policies and laws. These may also include efforts such as improved flood warning, greater communication of flood risks, and tools or incentives to property owners to help protect their property (such as flood insurance). The only non-structural measure that has been identified as feasible for this project is improvement to the existing flood warning system.

Consistent with the requirements of the Clean Water Act and USACE planning regulations, and after consideration of avoidance and minimization measures, it was determined that compensatory mitigation would be required for unavoidable impacts to aquatic habitat resulting from implementation of the flood risk management measures. Based on a detailed mitigation development process (which included the use of a habitat-based ecosystem output model to quantify habitat loss), the mitigation measures incorporated into the tentatively selected plan include removal of two existing passage barriers for native aquatic species in Manoa Stream. The flood risk management features and compensatory mitigation measures included in the tentatively selected plan are summarized in Table 1. The location of each measure is shown in Figures 2 and 3; detailed design drawings of the measures will be included in the Draft Feasibility Report with integrated Environmental Impact Statement, which will be available for public review after August 23, 2015.

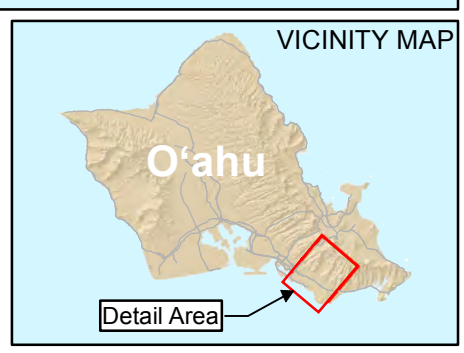
TABLE 1
Description of the Tentatively Selected Plan

Measure	Description of Measure	Operations and Maintenance (O&M) Requirements
Waihi Debris and Detention Basin	Earthen dam, approximately 24' high and 225' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&M.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of dam) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.
Waiakeakua Debris and Detention Basin	Earthen dam, approximately 20' high and 185' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert; energy dissipation structure to be located on downstream end of culvert.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of dam) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.
Woodlawn Ditch Detention Basin	Three-sided berm, approximately 15' high and 840' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm and potential flooded area.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area.
Manoa In-stream Debris Catchment	Concrete pad, approximately 8' wide and 60' across; steel posts (up to approximately 7' high) evenly spaced 4’ apart along concrete pad.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of concrete pad) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.
Kanewai Field Multi-Purpose Detention Basin	Earthen berm, approximately 7' high, around 3 sides of the field; grouted rip-rap inflow spillway along bank of Manoa Stream to allow high flows to enter the basin; existing drainage pipe at south end of basin to allow water to re-enter stream.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area. Area within berm to be maintained as a field for park use (with no woody vegetation) during non-flood conditions.
Waiomao Debris and Detention Basin	Earthen dam, approximately 24' high and 120' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert, with grouted rip rap on upstream and downstream side debris catchment feature located on upstream end of culvert. Excavation of approx. 2,015 cubic yards to provide required detention volume upstream of berm; low-flow channel with existing substrate to be restored following excavation. New access road to be constructed for construction and O&M.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of dam and excavation area) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.
Pukele Debris and Detention Basin	Earthen dam, approximately 24' high and 120' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&M.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of dam) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.

Measure	Description of Measure	Operations and Maintenance (O&M) Requirements
Makiki Debris and Detention Basin	Earthen dam, approximately 24' high and 100' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with grouted rip rap on upstream and downstream side; debris catchment feature located on upstream end of culvert. New access road to be constructed for construction and O&M.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of dam) twice per year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.
Ala Wai Canal Floodwalls	Concrete floodwalls ranging up to approximately 5 feet high, offset from existing Canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to Canal; floodgate to be installed near McCully Street. Three pump stations to accommodate storm flows and gates installed at existing drainage pipes to prevent backflow from the Ala Wai Canal during a flood event.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of floodwalls) twice per year, allowing no woody vegetation to grow in this area. Periodically inspect drainage pipes and gates, and remove any impediments to movement. Paint and/or grease metal parts, as needed.
Hausten Ditch Detention Basin	Concrete floodwalls and an earthen berm (4.3' high) to provide detention for local drainage; install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to prevent a backflow from the Ala Wai Canal during a flood event.	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm and floodwalls) twice per year, allowing no woody vegetation to grow in this area. Area within berm to be maintained as a field for recreational use during non-flood conditions. Periodically inspect slide gates and actuators and remove any impediments to movement. Paint and/or grease metal parts, as needed.
Ala Wai Golf Course Multi-Purpose Detention Basin	Earthen berm, up to approximately 7' high, around the north and east perimeter of the golf course; grouted rip rap inflow spillway along bank of Manoa Palolo Drainage Canal to allow high flows to enter the basin; sediment basin within western portion of golf course; floodgate across the main entrance road; passive drainage back into Ala Wai Canal	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year, allowing no woody vegetation to grow in this area. Area within berm to be maintained as a golf course (with no woody vegetation in sediment basin) for recreational use during non-flood conditions. Periodically inspect floodgate and remove any impediments to movement. Paint and/or grease metal parts, as needed. Inspect, test, and maintain pump system annually. Paint and/or grease metal parts, as needed.
Floodwarning System	Installation of 3 real-time rain gages (Manoa, Makiki and Palolo Streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai watershed	Periodically inspect gages for proper operating conditions. Keep area around sensors free from sediment deposits and plant growth, or other impediments to data collection.
Falls 7 and 8 (Mitigation Measures)	Installation of grouted stones to eliminate passage barrier by providing a suitable surface for migration of native species at 2 in-stream structures on Manoa Stream	Periodically inspect in-stream structure for potential erosion or undercutting; reinforce as needed.

LEGEND

- Stream
- Major Road
- Watershed Boundary



0 0.5 1 Mile

Projection: State Plane Hawaiʻi Zone 3 feet NAD83 HARN

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DISCLAIMER: This map was created by USACE using the best available data at the time (July 2015). It may or may not accurately reflect existing conditions.

FIGURE 1
Overview of the
Ala Wai Watershed
Ala Wai Canal Project
Oʻahu, Hawaiʻi

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Inundation Area
Construction Limits
Footprint
Access Road
Staging Area
Waihi Debris and Detention Basin

Inundation Area
Structure Footprint
Construction Limits
Waiakeakua Debris and Detention Basin
Staging Area

Staging Area
Inundation Area
Access Road
Structure Footprint
Construction Limits
Woodlawn Ditch Detention Basin

Structure Footprint
Inundation Area
Access Road
Staging Area
Pukele Debris and Detention Basin

Excavation Area
Construction Limits
Inundation Area
Staging Area
Access Road
Construction Limits
Structure Footprint
Waiomao Debris and Detention Basin

Structure Footprint
Construction Limits
Staging Area
Manoa In-Stream Debris Catchment

LEGEND

- Stream
- Watershed Boundary
- 1- Percent Annual Chance Exceedance Floodplain (with Implementation of Tentatively Selected Plan)
- Flood Risk Management Measure

0 0.5 1 Miles

Projection: State Plane Hawai'i Zone 3 feet NAD83 HARN

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DISCLAIMER: This map was created by USACE using the best available data at the time (July 2015). It may or may not accurately reflect existing conditions.

VICINITY MAP

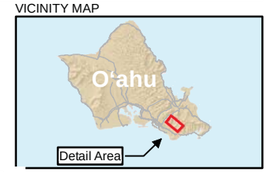

FIGURE 2a
Tentatively Selected Plan (Alternative 3A-2.2) - Upper Watershed
Ala Wai Canal Project
O'ahu, Hawai'i

CH2MHILL

Inundation Area
Construction Limits
Structure Footprint
Staging Area
Access Road
Makiki Debris and Detention Basin
Inundation Area
Construction Limits
Access Road
Staging Area
Structure Footprint
Kanewai Field Multi-Purpose Detention Basin
Hausten Ditch Detention Basin
Staging Area
Inundation Area
Structure Footprint
Staging Area
Staging Area
Pump Station
Construction Limits
Staging Area
Construction Limits
Staging Area
Construction Limits
Ala Wai Golf Course Multi-Purpose Detention Basin
Structure Footprint
Sedimentation Basin
Pump Station
Structure Footprint
Staging Area
Pump Station
Ala Wai Canal Floodwalls

LEGEND
- Stream
- Watershed Boundary
- 1- Percent Annual Chance Exceedance Floodplain (with Implementation of Tentatively Selected Plan)
- Flood Risk Management Measure

VICINITY MAP
O'ahu
Detail Area

0 0.5 1 Miles

Projection: State Plane Hawai'i Zone 3 feet NAD83 HARN

DISCLAIMER: This map was created by USACE using the best available data at the time (July 2015). It may or may not accurately reflect existing conditions.

FIGURE 2b
Tentatively Selected Plan (Alternative 3A-2.2) - Lower Watershed
Ala Wai Canal Project
O'ahu, Hawai'i

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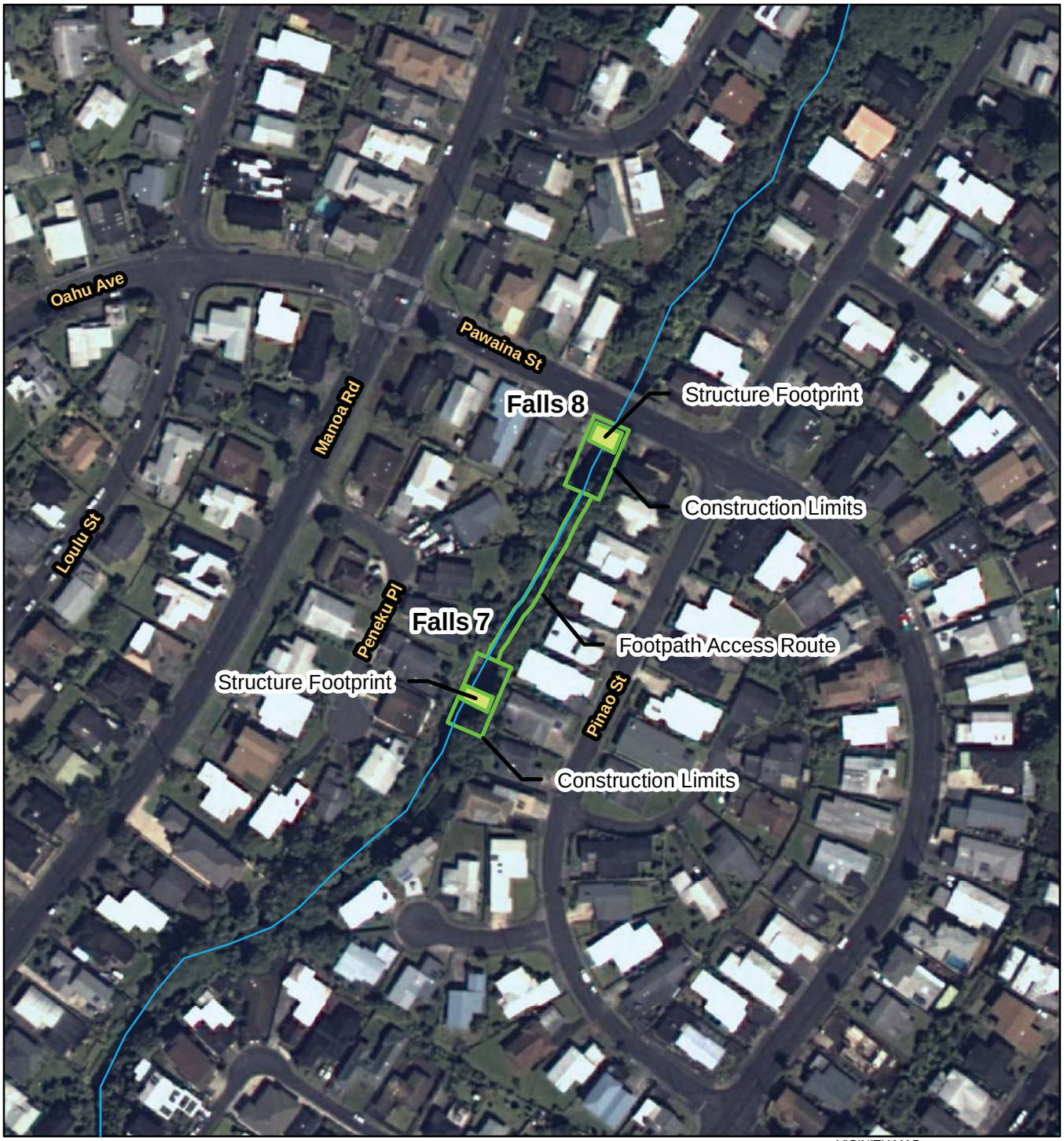

LEGEND

Stream

Compensatory Mitigation Measure

N

0 100 200

Feet

VICINITY MAP

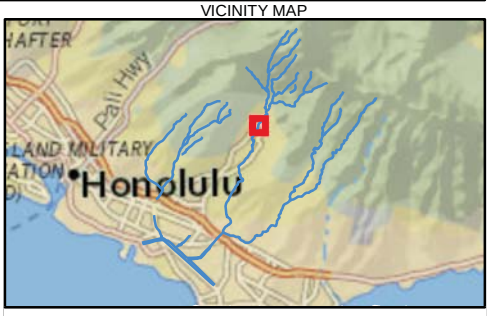

FIGURE 3
Compensatory Mitigation Measures
Ala Wai Canal Project
O'ahu, Hawai'i

DISCLAIMER: This map was created by USACE using the best available data at the time (July 2015). It may or may not accurately reflect existing conditions.

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Appendix E5
Endangered Species Act Section 7 Consultation Documentation

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
12200-2008-SL-0187

MAY 16 2008

RECEIVED 5/19/08

Mr. Anthony Paresa, P.E.
Deputy District Engineer
Programs and Project Management
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

Subject: Species List and Critical Habitat for Ala Wai Canal Project Watershed Plan, Island of Oahu

Dear Mr. Paresa:

Thank you for your letter dated April 9, 2008, received on April 18, 2008, requesting information regarding threatened and endangered species and designated critical habitat that may occur within the proposed project location. The proposed project is the development of the Ala Wai Canal Project (AWCP) Watershed Plan with the U.S. Army Corps of Engineers, Honolulu District, in partnership with the State of Hawaii, Department of Land and Natural Resources. The AWCP encompasses the watersheds of Makiki, Manoa, and Palolo streams on the Island of Oahu.

We have reviewed the information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program and the Hawaii GAP. Enclosure 1 lists the federally listed species and Enclosure 2 identifies federally designated critical habitat known to occur within the proposed project area.

We hope this information assists you in your planning effort and aides in conservation of listed species. If you have questions, please contact Aaron Nadig, Fish and Wildlife Biologist (phone: 808-792-9466; fax: 808-792-9581).

Sincerely,

for Patrick Leonard
Field Supervisor

Enclosures

TAKE PRIDE® IN AMERICA

Enclosure 1. Species List for Ala Wai Canal Project.

Common Name	Scientific Name	Status
Mammals		
Hawaiian hoary bat	*Lasiurus cinereus semotus*	Endangered
Hawaiian monk seal	*Monachus schauinslandi*	Endangered
Birds		
Oahu elepaio	*Chasiempis sandwichensis ibidis*	Endangered
Hawaiian coot	*Fulica alai*	Endangered
Hawaiian stilt	*Himantopus mexicanus knudseni*	Endangered
Hawaiian duck	*Anas wyvilliana*	Endangered
Hawaiian moorhen	*Gallinula chloropus sandvicensis*	Endangered
Invertebrates		
Oahu tree snail	*Achatinella* sp.	Endangered
Plants		
Haha	*Cyanea acuminate*	Endangered
Haha	*Cyanea crispa*	Endangered
Haha	*Cyanea koolauensis*	Endangered
No Common Name	*Diellia erecta*	Endangered
Nanu	*Gardenia mannii*	Endangered
No Common Name	*Gouania meyenii*	Endangered
Wawae iole	*Huperzia nutans*	Endangered
No Common Name	*Lobelia oahuensis*	Endangered
Ihi ihi	*Marsilea villosa*	Endangered
No Common Name	*Pteris lidgatei*	Endangered
No Common Name	*Schiedea nuttallii*	Endangered
No Common Name	*Spermolepis hawaiiensis*	Endangered

Enclosure 2. Critical Habitat for Ala Wai Canal Project.

Common Name	Scientific Name	Status
Birds		
Oahu elepaio	*Chasiempis sandwichensis ibidis*	Endangered
Plants		
Haha	*Cyanea crispa*	Endangered
Haha	*Cyanea humboldtiana*	Endangered
No Common Name	*Delissea subcordata*	Endangered
No Common Name	*Gouania meyenii*	Endangered
No Common Name	*Lobelia monostachya*	Endangered

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, Hawaii 96814-4700
(808) 944-2200 • Fax (808) 973-2941

April 25, 2008

Mr. Anthony Paresa, P.E.
Deputy District Engineer
Department of the Army
U.S. Army Engineer District, Honolulu
Ft. Shafter, Hawaii 96858-5440

Dear Mr. Paresa:

This letter responds to your April 9, 2008, letter received by our office on April 21, 2008, concerning the Ala Wai Canal Project (AWCP) Watershed Plan, located Honolulu County on the Island of Oahu. Your letter requested information on listed species and their critical habitats that may occur within the project area. Under our statutory authorities under the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 *et seq.*), the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) Pacific Islands Regional Office Protected Resources Division provides the following ESA-listed marine protected species information.

As described in your letter, the purpose of the project is to identify and implement measures to address overall watershed health including flood risk management and ecosystem restoration. Based on the map that you provided, the proposed action occurs inland, but is closely linked to the nearshore waters of Malama Bay through down stream transport of potential effects from the proposed project area. Therefore, the ESA-listed marine species that are reasonably likely to occur within the action area are green and hawksbill sea turtles, as well as the Hawaiian monk seals. A complete list of ESA-listed species under NMFS's jurisdiction in the Hawaiian Archipelago is enclosed for your review. No additional marine species are proposed or are candidates for listing under the ESA at this time, and no critical habitat has been designated or proposed for any marine protected species around the Island of Oahu, Hawaii.

Thank you for working with NMFS to protect our nation's living marine resources. Should you have any other questions regarding this project or the consultation process, please contact Donald Hubner on my staff at (808) 944-2233, or at the e-mail address Donald.Hubner@noaa.gov. Please refer to consultation #: I-PI-08-677-CY.

Sincerely,

Chris E. Yates
Assistant Regional Administrator
For Protected Resources

MARINE PROTECTED SPECIES of the HAWAIIAN ISLANDS

National Marine Fisheries Service, Pacific Islands Regional Office

MARINE MAMMALS

All marine mammals are protected under the Marine Mammal Protection Act. Those identified under the ESA Listing are also protected under the Endangered Species Act.

Common Name	Scientific Name	ESA Listing
Blue Whale	*Balaenoptera musculus*	Endangered
Blainville's Beaked Whale	*Mesoplodon densirostris*	
Bryde's Whale	*Balaenoptera edeni*	
Cuvier's Beaked Whale	*Ziphius cavirostris*	
Dwarf Sperm Whale	*Kogia simus*	
False Killer Whale	*Pseudorca crassidens*	
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Killer Whale	*Orcinus orca*	
Longman's Beaked Whale	*Indopacetus pacificus*	
Melon-headed Whale	*Peponocephala electra*	
Minke Whale	*Balaenoptera acutorostrata*	
North Pacific Right Whale	*Eubalaena japonica*	Endangered
Pygmy Killer Whale	*Feresa attenuata*	
Pygmy Sperm Whale	*Kogia breviceps*	
Sei Whale	*Balaenoptera borealis*	Endangered
Short-finned Pilot Whale	*Globicephala macrorhynchus*	
Sperm Whale	*Physeter macrocephalus*	Endangered
Bottlenose Dolphin	*Tursiops truncatus*	
Common Dolphin	*Delphinus delphis*	
Fraser's Dolphin	*Lagenodelphis hosei*	
Pantropical Spotted Dolphin	*Stenella attenuata*	
Risso's Dolphin	*Grampus griseus*	
Rough-toothed Dolphin	*Steno bredanensis*	
Spinner Dolphin	*Stenella longirostris*	
Striped Dolphin	*Stenella coeruleoalba*	
Hawaiian Monk Seal	*Monachus schauinslandi*	Endangered
Northern Elephant Seal	*Mirounga angustirostris*	

SEA TURTLES

All sea turtles are protected under the Endangered Species Act.

Common Name	Scientific Name	ESA Listing
Green Turtle	*Chelonia mydas*	Threatened
Hawksbill Turtle	*Eretmochelys imbricata*	Endangered
Loggerhead Turtle	*Caretta caretta*	Threatened
Leatherback Turtle	*Dermochelys coriacea*	Endangered
Olive Ridley Turtle	*Lepidochelys olivacea*	Threatened

Last updated April 2008

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

August 5, 2015

Civil and Public Works Branch
Programs and Project Management

Ms. Kristi Young
Deputy Field Supervisor
Programmatic Division
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Blvd, Room 3-122
Honolulu, Hawaii 96850-0001

Dear Ms. Young:

For purposes of continuing informal consultation under Section 7 of the Endangered Species Act, the Honolulu District, U.S. Army Corps of Engineers (Corps), transmits the enclosed draft Biological Assessment (BA) for the Ala Wai Canal Project, Oahu, Hawaii. The State of Hawaii Department of Land and Natural Resources (DLNR) is the non-Federal sponsor of this single purpose flood risk management project.

Based on current available documentation, the attached draft BA indicates that the project may affect, but would not likely adversely affect any Federally listed species. However, during a July 29, 2015, Fish and Wildlife Coordination Act meeting, a representative of the U.S. Fish and Wildlife Service (USFWS) verbally informed my staff that USFWS field investigations discovered a population of endangered blackline Hawaiian damselfly (*Megalagrion nigrohamatum nigrolineatum*) in the vicinity of a proposed project feature site.

The endangered blackline Hawaiian damselfly is endemic to the island of Oahu, found historically in stream sites at higher altitudes. We anticipate that upon receipt of the detailed species occurrence information from the USFWS, we may determine that the proposed action is likely to adversely affect the blackline Hawaiian damselfly. If that occurs, we would revise the enclosed draft BA accordingly and request initiation of formal consultation between our agencies on this project. Through consultation with the USFWS, we expect to identify appropriate actions to avoid and minimize any potential impacts to this species.

We greatly appreciate your review of our preliminary impact assessment documents, helpful comments, discussion of potential impacts, and policy review provided by your staff, especially Mr. Kevin Foster, Ms. Jiny Kim, and Mr. Dan Polhemus. Their efforts

aided our task preparing this Biological Assessment. We want to continue our cooperation through completion of this work.

If you have questions, please contact Mr. Derek Chow, Chief of my Civil and Public Works Branch, at (808) 835-4026 or e-mail derek.j.chow@usace.army.mil.

Sincerely,

for Anthony J. Paresa, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

CC:
Ms. Jiny Kim, USFWS
Mr. Aaron Nadig, USFWS
Mr. Patrick Opay, NOAA Fisheries
Mr. David Nichols, NOAA Fisheries

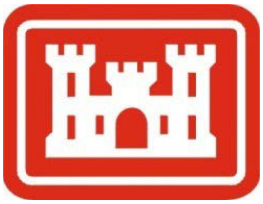
~~DRAFT~~

Biological Assessment of Threatened and Endangered Species for the Ala Wai Canal Project

Under the Endangered Species Act of 1973, As Amended

Submitted by:

U.S. Army Corps of Engineers Honolulu District
Bldg. 230, CEPOH-PP-C
Fort Shafter, HI 96858



Submitted to:

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, HI 96850

~~July~~December 2015

CONTENTS

TABLES

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

At the request of the State of Hawai`i Department of Land and Natural Resources (DLNR), the U.S. Army Corps of Engineers, Honolulu District (USACE) is conducting a feasibility study for the Ala Wai Canal Project[1] (hereafter referred to as "the project"). The purpose of the project is to reduce flood hazards within the watershed, which is comprised of approximately 19 square miles (12,064 acres) on the southeastern side of the island of Oahu in the State of Hawai`i (Figure 1).

In accordance with Section 7 of the Endangered Species Act (ESA) (Title 16, United States Code [USC], Section 1536[c]) and in consultation with the United States Fish and Wildlife Service (USFWS) and the National Marine Fisheries Services (NMFS), this Biological Assessment (BA) defines and evaluates the potential effects of the proposed project on ESA-listed species and their designated critical habitats.

1.1 Project Authority

The project is authorized under Section 209 of the Flood Control Act of 1962. Section 209 is a general authority that authorizes surveys in harbors and rivers in Hawai`i "with a view to determining the advisability of improvements in the interest of navigation, flood control, hydroelectric power development, water supply, and other beneficial water uses, and related land resources."

1.2 Project Purpose and Need

The purpose of the project is to reduce flood hazards within the watershed. A high risk of flooding exists within the Ala Wai watershed due to aging and undersized flood conveyance infrastructure. Based on the peak flows computed for this study, it is estimated that the Ala Wai Canal has the capacity to contain about a 20- to 10-percent annual chance exceedance (ACE) flood[2] before overtopping the banks. The risk of flooding is exacerbated by the flashy nature of the streams in the watershed, with heavy rains flowing downstream extremely quickly due to steep topography and relatively short stream systems.

Overtopping of the Canal has previously flooded Waikiki multiple times, including during the November 1965 and December 1967 storms and during the passage of Hurricane Iniki in 1992. Upstream areas are also at risk of flooding, as demonstrated by several recent events, including the October 2004 storm that flooded Manoa Valley and the March 2006 storm that flooded Makiki. The October 2004 event was estimated to have a 4-percent chance of occurring in any single year, and caused more than $85 million in damages (USACE, 2006a). Multiple other past flood events have been documented within the watershed over the course of the past century. In addition to recorded property damages, these events have contributed to health and safety risks, including two known deaths (associated with flooding in December 1918 and December 1950) (USACE, 2006).

Analyses conducted in support of this project show that the 1-percent ACE floodplain extends over approximately 1,358 acres of the watershed. Within this area, the affected population is comprised of approximately 54,000 residents plus an additional estimated 79,000 visitors in Waikiki on any given day. In addition to threatening the safety of both residents and visitors, a major flood event could result in catastrophic damages to structures and property throughout the watershed, with impacts to Waikiki crippling the local economy. Modeling results indicate the 1-percent ACE flood would result in damages to more than 3,000 structures, with approximately $723 million in structural damages alone (2013 price levels).

1.3 Project History

In response to a request from DLNR, the reconnaissance phase of the Ala Wai Canal Project was initiated in April 1999. At that time, Federal, State, and local agencies sought a comprehensive management and

---

[1] The project has also previously been referred to as the "Ala Wai Watershed Project"; for consistency with the congressional documentation, the project will continue to be referred to as the "Ala Wai Canal Project."

[2] The 1-percent ACE floodplain is the area that is inundated by a flood with a 1-percent chance (1 in 100) of occurring in any single year. These are also commonly referred to as the 100-year floodplain and 100-year flood (but do not mean that this degree of flooding occurs every 100 years). This definition also applies to floods of other magnitudes (for example, a 20-year flood is a flood that has a 5-percent chance of occurring and a 10-year flood has a 10-percent chance of occurring in any single year, respectively).

restoration plan to restore aquatic habitat and biological diversity in the Canal and upstream tributaries. The reconnaissance report was submitted in August 1999 and recommended that the USACE assist the State with restoration of the Canal. Approval by USACE for continuation into the feasibility phase was granted in September 1999.

Independently, the Ala Wai Flood Study was initiated in September 1998 under the Planning Assistance to States (PAS) Program (Section 22 of the Water Resources Development Act of 1974) to determine the potential flood risk to the Waikiki area, in response to a request by the Land Division of DLNR. The study was completed in October 2001 and documented a high flood hazard associated with potential overtopping of the Ala Wai Canal. This study identified several mitigative measures and conceptual alternatives that could potentially minimize flood damages to Waikiki and surrounding area. The results of this technical study were used to establish that the USACE could be involved in the investigation of flood damage reduction in the Canal. As a result, a flood risk management objective was added to the Ala Wai Canal Project, thus expanding the project focus to both ecosystem restoration and flood risk management in the Canal area.

The FCSA was executed between USACE and the non-Federal sponsor, DLNR Engineering Division, in 2001. The feasibility phase of the project was initiated in July 2002, and an EIS scoping meeting was held in June 2004. Subsequently, in October 2004, heavy rains caused Manoa Stream to overtop its banks, resulting in significant damages. In response, the USACE temporarily ceased work on the feasibility study, such that the project could be expanded to include the upstream portions of the Ala Wai watershed. While the cost-share agreement was being amended to address a more comprehensive scope, the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) received federal funds to identify specific actions to address flooding in Manoa Valley. The Manoa Watershed Project was initiated in 2006 and resulted in detailed topographic mapping, hydrologic and hydraulic modeling, and identification of potential measures to address specific flood problems.[3] However, because of insufficient federal funding to complete the project, the Manoa Watershed Project was terminated before implementation.

Information developed through the Manoa Watershed Project was subsequently incorporated into the Ala Wai Canal Project, which was re-started in 2007. A second EIS scoping meeting was held in October 2008. Project-related efforts were primarily focused on bringing the technical information for the entire watershed up to the same level of detail as produced for Manoa under the Manoa Watershed Project.

In October 2012, a charette was held to re-scope the project as part of the USACE Civil Works Planning Modernization process.[4] The purpose of the charrette was to bring together the USACE project delivery team (PDT), Pacific Ocean Division and Headquarters staff, with the non-federal sponsor and other cooperating agencies, in order to determine the path forward for completing the feasibility study in compliance with current USACE planning requirements. Key outcomes of the charrette included consensus on the problems and opportunities, objectives and constraints, screening and decision criteria, the array of alternatives, and a framework for identification of the tentatively selected plan. Based on the project review at the charette, ecosystem restoration was eliminated as a study objective, as it was determined that the biological resources within the watershed do not have enough national significance to adequately justify ecosystem restoration as an objective. However, the ecosystem-related information previously identified as part of the study is being incorporated as part of environmentally sustainable design considerations, particularly as related to maintaining in-stream habitat and migratory pathways for native aquatic species.

[3] This work was conducted by the USACE on behalf of NRCS via a Support Agreement in compliance with a Memorandum of Agreement between USACE and USDA, pursuant to the Economy in Government Act (31 USC S. 1535.).

[4] The charrette was held on October 16-19, 2012 with the purpose of reaching consensus on the actions needed to complete the project on budget and schedule, including a clear path for identification of the TSP (USACE, 2012). Participants included the project delivery team, non-federal sponsors, USACE Division and Headquarters staff, and cooperating agency representatives.

1.4 Consultation History

The ESA is administered by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS), and establishes protection and conservation of threatened and endangered species and the ecosystems upon which they depend. Section 7 of the ESA requires that all federal agencies consult with the USFWS before initiating any action that could affect a listed species. Section 7 states that any project authorized, funded, or conducted by any federal agency should not "…jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined to be critical."

In compliance with ESA consultation requirements, USACE requested information from USFWS regarding threated and endangered species and designated critical habitat within the overall Ala Wai watershed in April 2008. The USFWS responded in May 2008, and provided a list of federal listed species and designed critical habitat that could occur within the watershed (see Attachment 1). Follow-up meetings were held with agency staff on October 14, 2014; January 23, 2015; April 14, 2015; May 26, 2015; June 5, 2015; and June 29, 2015. The purpose of these meetings was to update agency staff on the current project status, discuss the project features, and to obtain any additional input on ESA-related issues. As part of the initial meeting on October 14, 2014, USFWS staff indicated that the original species list is still considered valid (such that a new list does not need to be generated), but stated that several species of Hawaiian damselfly (*Megalagrion* spp.) were federally listed in 2012 and should also be considered; in particular, a population of blackline Hawaiian damselfly (*Megalagrion nigrohamatum nigrolineatum*) is known from the upper reaches of Manoa Stream.

Consultation was also initiated with NMFS in 2008; in response to USACE's request, NMFS provided a complete list of ESA-listed species under their jurisdiction in the Hawaiian Archipelago on April 25, 2008 (see Attachment 1). At the time of the original consultation, the project scope and objectives were more broadly defined, with the project area extending to include the nearshore marine waters. As the objectives and scope of the project were subsequently narrowed to focus on riverine-based flood risk management, the project is not expected to directly or indirectly affect the nearshore marine waters. Therefore, species that are restricted to the marine environment do not occur within the action area, such that the proposed project would have no effect on these species.

1.5 USACE Planning Process

General investigations, such as those carried out under Section 209 of the Flood Control Act of 1962, are funded by specific appropriations and are conducted through a feasibility planning process. The USACE feasibility planning process is comprised of six steps, as specified by the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (Principles and Guidelines [P&G]) (U.S. Water Resources Council, 1983) and USACE planning regulations and guidance, including Engineer Regulation (ER) 1105-2-100 "Planning Guidance Notebook" (USACE, 2000). These steps include: (1) specification of water and related land resources problems and opportunities; (2) inventory, forecast, and analysis of water and related land resources conditions within the study area; (3) formulation of alternative plans; (4) evaluation of the effects of the alternative plans; (5) comparison of the alternative plans; and (6) identification of a tentatively selected plan based upon the comparison of the alternative plans.

Recognizing the need to modernize their planning process with an emphasis on delivering high-quality feasibility studies within shorter timeframes and at lower costs, the USACE has recently applied a SMART planning approach to the six-step process (USACE, 2012a). The SMART planning approach emphasizes risk-based decision making and includes three primary requirements for feasibility studies (referred to as the "3x3x3 Rule"): completion within 3 years, at a cost of no more than $3 million, and of a "reasonable" report size (approximately 100-page report, with appendices not exceeding 3 inches). Other key components include: (1) engagement of a coordinated vertical team (comprised of USACE District, Division, and

Headquarters staff) throughout the project development process as needed to identify and resolve policy, technical, and legal issues early in the process, (2) focusing the detailed analysis and design on the tentatively selected plan, and (3) identification of the appropriate level of detail, data collection, and modeling based only on what is necessary to complete the feasibility study.

1.6 Purpose and Scope of Biological Assessment

This BA has been prepared as part of the Section 7 consultation process to provide the necessary information to support the USACE's determination as to whether the proposed project is likely to adversely affect or jeopardize the continued existence of the listed species that may occur in the project area or result in the destruction or adverse modification of critical habitat. All ESA-listed species whose known or potential distribution intersects with the action area are listed in Table 1; these are the species that are addressed by this BA. As previously described, species that are restricted to the marine environment do not occur within the action area, such that the proposed project would have no effect on these species.

TABLE 1
Federally-Listed Species Addressed by the Biological Assessment

Common Name	Scientific Name	ESA Status
MAMMALS		
Hawaiian hoary bat	*Lasiurus cinereus semotus*	Endangered
Hawaiian monk seal	*Monachus schauinslandi*	Endangered
BIRDS		
Oahu `elepaio	*Chasiempis sandwichensis ibidis*	Endangered
Hawaiian coot	*Fulica alai*	Endangered
Hawaiian stilt	*Himantopus mexicanus knudseni*	Endangered
Hawaiian duck	*Anas wyvilliana*	Endangered
Hawaiian common moorhen	*Gallinula chloropus sandvicensis*	Endangered
INVERTEBRATES		
Oahu tree snail	*Achatinella* sp.	Endangered
INSECTS		
Blackline Hawaiian damselfly	*Megalagrion nigrohamatum nigrolineatum*	Endangered
Crimson Hawaiian damselfly	*Megalagrion leptodemas*	Endangered
Oceanic Hawaiian damselfly	*Megalagrion oceanicum*	Endangered
Orangeblack Hawaiian damselfly	*Megalagrion xanthomelas*	Candidate
PLANTS		
Haha	*Cyanea acuminate*	Endangered
Haha	*Cyanea crispa*	Endangered
Haha	*Cyanea koolauensis*	Endangered
No Common Name	*Diellia erecta*	Endangered
Nanu	*Gardenia mannii*	Endangered
No Common Name	*Gouania meyenii*	Endangered
Wawae iole	*Huperzia nutans*	Endangered
No Common Name	*Lobelia oahuensis*	Endangered
Ihi ihi	*Marsilea villosa*	Endangered
No Common Name	*Pteris lidgatei*	Endangered
No Common Name	*Schiedea nuttallii*	Endangered
No Common Name	*Spermolepis hawaiiensis*	Endangered

Critical habitat has been designated within the Ala Wai watershed for the Oahu `elepaio and for a variety of federally listed plant species, including several species listed in Table 1. The location of designated critical habitat in the Ala Wai watershed is shown in Figure 2.

2.0 DESCRIPTION OF PROPOSED ACTION AND ACTION AREA

In response to the flood-related problems and opportunities identified for the Ala Wai watershed, a variety of structural and non-structural flood risk management measures were identified, with a focus on the following approaches to flood risk management: (1) peak flow reduction, (2) increased channel capacity, (3) debris management, and (4) minimization of flood damages. The measures are generally based on the concepts originally developed in support of the Ala Wai Flood Study (USACE, 2006) and the Manoa Watershed Project (Oceanit, 2008). The conceptual measures were sited and screened using a set of project-specific criteria, including technical feasibility, availability of land, implementation costs, O&M requirements, legal and public acceptability, and flood risk reduction. Through the screening process, some measures were eliminated while others were further refined and combined into an array of alternatives; this process incorporated the range of agency and public input obtained through scoping efforts and other stakeholder engagement activities conducted to date. This effort resulted in the tentative selection of an alternative plan for implementation (also referred to as the Tentatively Selected Plan); this alternative plan constitutes the proposed action. The measures included in the Tentatively Selected Plan are based on the following concepts:

- **Detention basin**: This measure is an earthen structure that would allow high-frequency stream flows to pass, but would capture and delay larger volume stream flows, helping to reduce flood peaks. Detention basins may be located either within a stream channel or in an open space area directly adjacent to a stream/canal.
    - The in-stream detention basins would be comprised of an earthen berm that extends perpendicularly across a stream channel that would, in combination with the natural topography, provide temporary containment of storm flows. The basins would not be designed to permanently contain water; they would include a natural-bottom arch culvert that would maintain passage of low flows and also allow the basin to completely drain into the stream as flood conditions subside. An emergency spillway would allow water to overflow the berm in the event the capacity of the detention basin is exceeded. Debris catchment structures would be incorporated as part of each measure, and would function to capture large in-stream debris. To facilitate safe operation and maintenance of each basin, the area surrounding the berm would be kept clear of woody vegetation.
    - The off-stream detention basins would function similarly to the in-stream detention basins, but would be formed by construction of a berm around the perimeter of a nearby open space; stream flows would be directed into the detention basin (via a spillway along the stream bank), then would drain back into the stream.
- **Debris catchment**: As described above, the in-stream detention basins would include a debris catchment feature. In addition, the Tentatively Selected Plan also includes a stand-alone debris catchment structure, which would generally consist of a narrow concrete pad that would span the stream, with evenly-spaced steel posts. This structure would allow stream flows to pass, while functioning to block large debris as it flows downstream. Similar to the in-stream detention basins, the area surrounding the catchment structure would be kept clear of woody vegetation.
- **Floodwalls**: The floodwalls would be comprised of concrete walls that would function to increase existing channel capacity. The floodwalls would range in height, and would be either constructed with a minimal set back distance from the existing stream or canal walls. Local drainage patterns would be maintained to the extent possible, with flapgates/slidegates and pumps incorporated where necessary.
- **Non-structural measures**: Non-structural measures generally involve the use of knowledge, practices or agreements to change a condition, such as through policies and laws. These may also include efforts such as improved flood warning, greater communication of flood risks, and tools or incentives to property owners to help protect their property (such as flood insurance). Non-structural measures

that have been identified as feasible options for this project include improvements to the flood warning system.

The specific measures included in the Tentatively Selected Plan (and the approximate area of disturbance associated with each) is summarized in Table 2. The location of each measure is shown in Figure 3; detailed design drawings of each measure are included in Attachment 2.

Based on the requirements of the Clean Water Act and USACE planning regulations, and after consideration of avoidance and minimization measures, it was determined that compensatory mitigation would be required for unavoidable impacts to aquatic habitat resulting from implementation of the flood risk management measures. The USACE planning process requires that the mitigation requirement be based on functional habitat loss and quantified using a habitat-based methodology (i.e., ecosystem output model). As such, the Hawai`i Stream Habitat Equivalency Procedure (HSHEP) was used to quantify the loss of habitat function.[5] Detailed stream surveys were conducted, with the resulting data processed according to the variables in the HSHEP model, as needed to quantify the habitat value of the existing and future without-project condition (in terms of habitat units [HUs]). Anticipated changes in the model variables were then defined for the with-project condition, and the modeling results were then compared to quantify the anticipated habitat loss (i.e., the mitigation requirement). Potential mitigation concepts that could be implemented to offset the anticipated loss of habitat quality were then identified, and were refined through an iterative process, in coordination with the resource agencies. The increase in habitat quality associated with each of the mitigation measures was quantified using the HSHEP model, and these results were used to combine the measures into different mitigation alternatives that could be implemented to compensate for the loss of habitat quality associated with the tentatively selected plan. The habitat modeling results and cost estimates for each mitigation alternatives were then used to complete a Cost Effectiveness and Incremental Cost Analysis (CE/ICA), which provided the basis for selection of the mitigation alternative to be included as part of the tentatively selected plan.

Based on this process, the selected mitigation alternative is comprised of two measures, both of which involve removal of a passage barrier for native aquatic species in Manoa Stream (Falls 7 and Falls 8). The location of these measures is shown in Figure 4. In each location, there is currently an in-stream structure where undercutting has resulted in an overhanging lip, which creates a passage barrier for native aquatic species. Specifically, the stream flow over these structures is free-falling and does not maintain contact with the surface of the structure, such that the native species do not have any means to migrate upstream. The proposed mitigation involves installation of grouted riprap as part of the existing in-stream structure to provide a suitable surface for migration of the native species to upstream habitat. The location of the mitigation measures are shown in Figure 4; conceptual design drawings for all of the measures that were considered (including Falls 7 and 8) are included in Attachment 2.

[5] The HSHEP model was developed to support management of Hawaii's streams and associated habitat for freshwater flora and fauna through a collaborative effort by biologists at the State of Hawai`i Division of Aquatic Resources (DAR) and researchers at various universities, agencies, museums, and private companies. To confirm its applicability to the Ala Wai Canal Project, the model was reviewed by the USACE Ecosystem Planning Center of Expertise (EOC-PCX), and was certified for project use on May 19, 2015.

TABLE 2
Flood Risk Management Measures in the Tentatively Selected Plan

Measure[1]	Description of Measure	Total Area of Disturbance (acres)	Permanent Footprint (acres)	Vegetation Management (acres)	Inundation Area[2] (acres)
Waihi debris and detention basin	Earthen berm, approximately 24' high and 225' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with riprap on upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm	1.0	0.5	0.3	0.6
Waiakeakua debris and detention basin	Earthen berm, approximately 20' high and 185' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with riprap on upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm	1.2	0.7	0.5	0.9
Woodlawn Ditch detention basin	Three-sided berm, approximately 15' high and 840' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with riprap on upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm and potential flooded area	1.9	1.1	1.0	1.7
Manoa in-stream debris catchment	Concrete pad, approximately 8' wide and 60' across; steel posts (up to approximately 7' high) evenly spaced 4’ apart along concrete pad	0.1	0.01	0.1	0
Kanewai Field multi-purpose detention basin	Earthen berm, approximately 7' high around 3 sides of field; inflow spillway on northwest end that allows high flows to enter basin; existing drainage pipe at south end to allow water to re-enter stream; 20-foot-wide perimeter to be maintained as cleared around the perimeter of the berm and the potential flooded area	6.5	0.9	5.5	5.1
Waiomao debris and detention basin	Earthen berm, approximately 24' high and 120' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with riprap on upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm; excavate behind berm to provide required detention volume	1.6	0.3	1.1	0.7
Pukele debris and detention basin	Earthen berm, approximately 24' high and 120' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with riprap on upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm	0.5	0.2	0.1	0.4
Makiki debris and detention basin	Earthen berm, approximately 24' high and 100' across; arch culvert to allow small storm flows to pass; concrete spillway above culvert with riprap on upstream and downstream side; 20-foot-wide perimeter to be maintained as cleared around perimeter of berm	0.6	0.3	0.1	0.5
Ala Wai Canal floodwalls	Concrete floodwalls along Ala Wai Canal; ranging up to approximately 5 feet high; three pump stations and gates for existing drainage pipes	11.8	0.3	0	0
Hausten Ditch detention basin	Concrete floodwalls and earthen berm (4.3' high) to provide detention for local drainage; install slide gates at existing bridge to control flow of floodwaters between Hausten Ditch and Ala Wai Canal	1.4	0.2	1.1	3.5
Ala Wai Golf Course multi-purpose detention basin	Earthen berm, approximately up to 7' high around outside perimeter of golf course property with floodgate across main entrance road; passive drainage back into Ala Wai Canal	25.6	4.0	8.4	134.3

NOTES:
[1] In addition to these structural measures, the Tentatively Selected Plan would also include improvements to the existing flood warning system.
[2] Inundation area is the area behind the detention basin that is expected to be inundated during a 1-percent annual chance exceedance flood event.

Following construction, each of the flood risk management measures will be operated and maintained by the non-federal sponsor. The operations and maintenance requirements for each measure type are summarized in Table 3.

TABLE 3
Proposed Operations and Maintenance Activities

Measure Type	Summary of O&M Activities
Debris and Detention Basin	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year Clear accumulated debris following flood event or annually (whichever is greater)
Multi-Purpose Detention Basin	Cut/clear vegetation within cleared zoned (20 feet around perimeter of berm) twice per year Assumes minimal sediment or debris removal would be required
Debris Catchment	Clear accumulated debris twice per year
Floodwalls	Inspect and maintain gates (e.g., greased) annually Inspect, test, and maintain pump system annually Inspect floodwalls and repair as needed (e.g., patching)
Flood Warning System	Inspect and test annually (includes annual operating cost)

NOTES:
[1] Debris and sediment cleared from the flood risk management measure locations would be disposed at an existing authorized location.

Separate from the Ala Wai Canal Project, the State of Hawai`i DLNR is pursuing the Woodlawn Chute Structure. Although it was originally contemplated as part of the Ala Wai Canal Project, it is now being implemented as a stand-alone project (with independent utility). No interdependent or interrelated actions have been identified to date.

2.1 Action Area

The regulations governing consultations under the ESA define action area as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the area." The action area should be determined based on all direct and indirect effects of the proposed action (Federal Register, 1986).

The areas that are expected to be directly affected by project implementation include those areas within which ground-disturbing activities are proposed (including clearing, grading, vegetation trimming, staging, access, construction activities, and operations and maintenance). The areas within which these activities would occur have been delineated as the construction limits, as indicated in Figure 3 (the acreage for which is summarized in Table 2) and Figure 4 (for the compensatory mitigation measures).

Indirect effects (for example, noise-related impacts) could occur both within the construction limits, as well in those areas immediately adjacent the construction limits; for the purposes of this assessment, it is assumed that indirect effects could extend 100 feet beyond the edge of the construction limits (based on the types of potential indirect impacts). As the proposed action would modify the hydraulics within the watershed, indirect effects could also occur along the length of the stream corridors, as well as in those areas that may be inundated as a result of the flood risk reduction measures (which are also shown in Figure 3, with acreages indicated in Table 2).

Based on this rationale, the action area for the proposed project has been defined to consist of the construction limits plus a 100-foot buffer for each measure (including the compensatory mitigation measures), plus the stream corridors (Makiki, Manoa and Palolo Streams) extending downstream from the proposed measures to the mouth of the Ala Wai Canal.

3.0 EXISTING ENVIRONMENTAL CONDITIONS

In general, the natural environments within the watershed generally vary along a gradient from the ridge of the Ko‘olau Mountains down to the coastal plain, with similar distribution of natural and urbanized environments in Makiki, Manoa, and Palolo valleys. Dense urban development covers the coastal plain, extending to the back of each valley floor. Several of the ridges between these major valleys are also developed, in some cases to the same degree as the valley floor (for example, Makiki Heights and St. Louis Heights), at least up to where the ridgelines narrow appreciably. Given this pattern of development, most of the natural environments are concentrated within the undeveloped portions of the upper watershed, and along the stream corridors through the urban district.

A general overview of the existing environmental conditions in the watershed is provided below, followed by a more detailed summary for each measure location in Table 4. This information is based on a series of surveys conducted within the watershed, as summarized in a natural resources assessment for the project (AECOS, 2010 and 2014). A copy of these assessments are provided in Attachment 3.

3.1 Vegetation

Vegetation communities in the upper watershed include shrubland, wet forest, and mesic forest habitats, which generally occur along a decreasing precipitation gradient, ranging from the highest elevations in the watershed down to the interface with the urban areas. The steeper slopes at and below the Ko‘olau ridgeline to roughly about the 1500-foot contour are relatively undisturbed and mostly dominated by native vegetation; these windswept ridge areas support what has been classified as “Montane Wet Shrubland” (Gagne and Cuddihy, 1990), or specifically on O‘ahu as “Mixed Fern Shrubland.” Below the shrubland is a wet forest, which grades into a mesic forest at lower elevations just above the urban zone. Introduced species dominate these habitats, particularly trees and shrubs such as albizia (*Falcateria moluccana*), eucalyptus (*Eucalyptus globulus* and *E. robusta*), Chinese banyan (*Ficus microcarpa*), octopus tree (*Schefflera actinophylla*), guava, java plum (*Syzygium cumini*), Christmas berry (*Schinus terebinthefolius*), mango (*Mangifera indica*), and shoebutton ardisia (*Ardisia elliptica*). Many of these species are considered to be invasive. All of the flood risk measures that are located in the undeveloped upper watershed (e.g., Waihi, Waiakeakua, Pukele, Waiomao and Makiki debris basins) are generally dominated by these vegetation types.

Riparian vegetation is present along all of the upper stream reaches, and is generally dominated by non-native species (many of which are considered invasive), including large trees such as Chinese banyan, *kukui* (*Aleurites moluccana*), mango, octopus tree, *hau* (*Hibiscus tiliaceus*), fiddlewood (*Citharexylum spinosum*), mountain apple (*Syzygium malaccense*), gunpowder tree (*Trema orientalis*), and gum (*Eucalyptus* sp.), as well as smaller herbaceous species such as exotic ginger (*Hedychium* sp.) and Job’s tears (*Coix lachryma-jobi*) (Kido, 2006; Kido, 2007; Kido, 2008a; Oceanit, 2004). Within the urbanized portion of the watershed, riparian vegetation is generally limited to unchannelized stream reaches, such as along portions of Manoa Stream (for example, near the Dole Street Bridge). A majority of Palolo and Makiki streams are channelized and lack a riparian zone (Oceanit, 2004; Englund and Arakaki, 2004; Kido, 2008a). Mangrove trees (*Rhizophora mangle*) are present in some areas in the lower estuarine reaches of the Manoa–Palolo Drainage Canal and the Ala Wai Canal, although most of these reaches are comprised of concrete and

As further described in Section 4, the occurrence of federally-listed plant species is generally restricted to the higher elevations of the upper watershed. These areas, as well as the slopes of Diamond Head, have been designated as critical habitat for the conservation of these species (Figure 2). However, not all of the listed species are presently known to occupy the designated critical habitat; some have not been recorded from the watershed since early in the last century and some are possibly extinct (Federal Register, 2012). No federally-listed plant species (or designated critical habitat) are known to occur in the action area.

A summary of the existing vegetation at each measure location is provided in Table 4.

3.2 Terrestrial Wildlife

A variety of terrestrial wildlife species occur throughout the watershed, including mammals, birds, invertebrates and insects (Mitchell et al., 2005). The vast majority of these species are non-native, many of which are considered invasive and pose a significant management concern (e.g., feral pig [*Sus scrofa*], mongoose [*Herpestes aruopunctatus*], and various bird species). However, there are several federally listed species that could potentially occur within the watershed.

The forested areas of the watershed provide habitat for native bird populations, including the federally listed Oahu *`elepaio* (*Chasiempis sandwichensis ibidis*); the upper-most portion of the watershed is designated as critical habitat for this species, although it is not believed to be currently occupied. Other federally listed species that are known from the upper watershed include endemic tree snails (*Achatinella* sp.) and the blackline Hawaiian damselfly species (*Megalagrion nigrohamatum nigrolineatum*). In addition, the Hawaiian hoary bat *ʻōpeʻapeʻa* [*Lasiurus cinereus semotus*], the only land mammal native to Hawaii, could potentially occur in the watershed.

In the lower portions of the watershed, federally listed waterbird species could potentially occur; these include the Hawaiian coot (*ʻalae keʻokeʻo*), Hawaiian stilt (*aeʻo*), Hawaiian duck (*Anas wyvilliana*), and Hawaiian moorhen (*ʻalae ʻula*). Although unlikely given their known distribution, these species could possibly use estuarine areas within the watershed as resting habitat.

Federally listed species, including those described above, are further discussed in Section 4.

3.3 Aquatic Species

Native freshwater fish in Hawai'i are limited to five gobiid species (*o'opu*), including one indigenous (*o'opu nakea* [*Awaous guamensis*]) and three endemic (*o'opu alamoʻo* [*Lentipes concolor*], *o'opu nopili* [*Sicyopterus stimpsoni*], and *o'opu naniha* [*Stenogobius hawaiiensis*]) gobies, and one endemic eleotrid (*o'opu akupa*, *Eleotris sandwicensis*) (Kinzie, 1990). The native stream macrofauna assemblage also includes several shrimp species (*'opae kala'ole* [*Atyoida bisulcata*] and *ʻopae 'oeha'a* [*Macrobrachium grandimanus*]), and mollusk species (*hapawai* [*Neritina vespertina*] and *hihiwai* [*Neritina granosa*]). As part of their lifecycle, the adults of each of these species live and breed in freshwater streams; newly hatched larvae drift to the ocean, remaining there for several months before migrating back to freshwater habitat, cued by freshets (Yamamoto and Tagawa, 2000). None of the native stream species are federally listed under the ESA.

All of these native species have been recently documented in the Ala Wai watershed, with the exception of *o'opu alamoʻo* and *hihiwai* (Parnham et al., 2008; Kido, 2008a). The presence of native species of stream macrofauna can often be used as an indicator of stream ecosystem health (Kido, 2008b). In this context, portions of the watershed display signs of good stream habitat. However, the overall watershed lacks healthy populations of native fishes and aquatic invertebrates, likely because of degradation and fragmentation of usable habitat in the urban zone (Oceanit, 2004). Recent observations of native species are typically limited to only a few individuals in the higher reaches of the upper watershed and in the estuarine environment. With these notable exceptions, the extant aquatic macrofauna is dominated by non-native species (Englund and Arakaki, 2004; Kido, 2008a).

TABLE 4
Existing Conditions at Flood Risk Management Measure Locations (summarized from AECOS, 2014)

Measure	General Location	Existing Environmental Conditions
Waihi debris and detention basin	Waihi Stream, ~1,200 feet above the upper extent of development in Manoa Valley (~380' in elevation).	Site is characterized by forested habitat, with dominant species including monkeypod (*Albizia saman*), Chinese banyan, gunpowder, *kukui*, swamp mahogany (*Eucalyptus robusta*), mango, Java plum, and Christmas berry; pothos vine (*Epipremnum pinnatum*) is prominent climbing the trees. Site is located on the lower edge of a prominent belt of albizia trees.
Waiakeakua debris and detention basin	Waiakeakua Stream, ~200 feet above the upper extent of	Site (including the staging area) is characterized by forested habitat, with species including guarumo (*Cecropia obtusifolia*), macaranga (*Macaranga tanarius*), hau (*Hibiscus tiliaceus*), bamboo, and the shrub *Odontonema strictum*. Other species

TABLE 4
Existing Conditions at Flood Risk Management Measure Locations (summarized from AECOS, 2014)

Measure	General Location	Existing Environmental Conditions
	development in Manoa Valley (~300' in elevation).	include red ginger (*Alpinia purpurata*), shoebutton ardesia (*Ardisia elliptica*), and white shrimp plant (*Justicia betonica*); pothos vine is prominent climbing the trees; site is located on the lower edge of a prominent belt of albizia trees.
Woodlawn Ditch detention basin	Woodlawn Ditch (manmade tributary to Manoa Stream), adjacent to E. Manoa Road (~200' in elevation)	Site is characterized by mixed secondary forest and tended farm/garden areas; forest is nearly monotypic stand of macaranga (*Macaranga tanarius*), with a limited number of tropical almond (*Terminalia catappa*), shoebutton ardisia, Chinese hibiscus (*Hibiscus rosa-sinensis*), coconut (*Cocos nucifera*), African tulip (*Spathodea campanulata*), and small albizia.
Manoa in-stream debris catchment	Middle reach of Manoa Stream, directly adjacent to lower edge of Manoa District Park (~160' in elevation)	Site is characterized as open stream channel, with minimal riparian vegetation (some shade is provided by trees in the adjacent residential properties); the staging areas within Manoa District Park is dominated by lawn, with some planted trees including Formosan *koa* (*Acacia confusa*), *kukui*, coconut, and royal palms (*Roystonia regia*).
Kanewai Field multi-purpose detention basin	Lower reach of Manoa Stream, just below Dole Street	Site is comprised of maintained field for park; predominantly a mowed lawn with two large mango trees near the west corner site; adjacent stream includes a riparian corridor with various mature trees of Java plum, *hau*, mango, macaranga, and monkeypod.
Waiomao debris and detention basin	Pukele Stream, adjacent to residences on Waiomao Rd. (~380' in elevation)	Site is comprised of a heavily forested riparian zone adjacent to residential properties; dominated by non-native species including octopus tree, gunpowder, monkeypod, macaranga (Macaranga tanarius), mango, and fiddlewood; pothos vine is prominent climbing the trees.
Pukele debris and detention basin	Pukele Stream, adjacent to residences on Ipulei Place (~400' in elevation)	Site includes the maintained lawns of two residential homes; right bank of the stream is dominated by weedy species including Guinea grass (*Panicum maximum*) and castor bean (*Ricinus communis*); left bank is forested with non-native species including Chinese banyan, swamp mahogany, and Java plum
Makiki debris and detention basin	Makiki Stream, directly adjacent to Makiki Heights Drive (~160' in elevation).	Site is characterized by dense riparian forest; dominant species include Chinese banyan, African tulip (*Spathodea campanulata*), gunpowder tree, she oak (*Grevillea robusta*), and mango. The understory is as well dominated by a variety of nonnative shrubs and vines, notably pothos (*Epipremnum pinnatum*), shrimp plant (Justicia betonica), and Madeira vine (*Anredera cordifolia*). Staging area includes open *kukui* copse, with open floor.
Ala Wai Canal floodwalls	Ala Wai Canal	Vegetation along the Canal is generally limited to landscaping, with a single row of trees lining most of both sides of Canal, including *niu* (*Cocos nucifera*), with some milo (*Thespesia populnea*) and monkeypod.
Hausten Ditch detention basin	Hausten Ditch (drainage input to Ala Wai Canal)	Hausten Ditch is dominated by non-native species, including mangroves; native species that occur along ditch (including '*akulikuli* [*Sesuvium portulacastrum*]; *kou* [*Cordia subcordata*], and *kīpūkai* [*Heliotropium Curassavicum*]) are common species. The remainder of the site is a maintained lawn, with scattered *niu*, milo and monkeypod trees.
Ala Wai Golf Course multi-purpose detention basin	Ala Wai Canal	Landscaped vegetation for golf course greens and fairways; site also includes two shallow basins and a ditch that are identified as seasonally flooded wetland features on the National Wetlands Inventory (USFWS, 2006a)

4.0 POTENTIALLY AFFECTED LISTED SPECIES AND CRITICAL HABITAT

In order to identify whether any of the listed species potentially occurring in the watershed could be affected by the project, the species habitat requirements and known distribution was assessed relative to the action area. In addition, the location of designated critical habitat was mapped to identify any potential overlap with the action area. Following is a summary of the potentially affected species within the watershed, and the effects analysis for each.

4.1 Hawaiian hoary bat (*Lasiurus cinereus semotus*)

The Hawaiian hoary bat (*ope'ape'a*) was listed as an endangered species in October 1970 (Federal Register, 1970). The original recovery plan was approved in May 11, 1998; a five-year review was conducted in September 2011 (USFWS, 2011a). Critical habitat has not been designated for this species.

The species is endemic to Hawaii; it is the only native terrestrial mammal that occurs in the State. It is still believed to be present on all of the main islands, with the largest populations known from Hawai`i and Kauai. Information about the species abundance is currently based on localized survey information, such that there are no reliable current population estimates. There is also limited information relative to species distribution, but the species has been observed year-round across a variety of habitats and elevations, generally ranging from the coast up to elevations of 7,500 feet (but possibly as high as 13,000 feet) (USFWS, 2011b).

The Hawaiian hoary bat is a solitary species that typically leaves its roost shortly before or after sunset and returns before sunrise. Roosting has been documented in a wide variety of both native and non-native trees, including native species (e.g., *ohia lehua* [*Metrosideros polymorpha*], *hala* [*Pandanus tectorius*], *pukiawe* [*Styphelia tameiameiae*], Polynesian-introduced species (e.g., *kukui* [*Aleurites moluccana*], and non-native species (e.g., Java plum [*Syzygium cumini*]) (USFWS, 1998a). Recent data from Hawai`i Island suggest that roosting occurs in trees at heights more than 20 feet off the ground (Bonaccorso, as reported in USFWS, 2011a). Hawaiian hoary bats forage across a range of open areas (e.g., fields, shoreline, and streams/ponds), as well as forest edges and clearings.

Threats to this species include habitat loss, predation, roost disturbance, and disease. The species' decline may have primarily been due to the historic loss of tree cover associated with deforestation in the early 19th century. Current threats may also include barbed wire fences, wind turbines, and pesticides (including contamination of prey) (USFWS, 1998a).

Potential to Occur in the Action Area

Little is known about the species' occurrence across the island of Oahu, including the Ala Wai watershed. However, based on the habitat preferences, it is possible that it could occur within the action area. Specifically, all of the detention basins in the mid to upper portions of the watershed (including those on Waihi, Waiakeakua, Woodlawn Ditch, Pukele, Waiomao, and Makiki Streams) include forested habitat with tall trees that may be used for roosting. Several of the measure locations in the lower watershed, such as the Kanewai Field, Hausten Ditch and Ala Wai golf course detention basins, may also provide suitable foraging habitat; however, the habitat value of these sites is likely diminished by the extensive urbanization in the surrounding areas.

Potential Effects of the Proposed Action

Should they occur, Hawaiian hoary bats could be directly or indirectly impacted by the project. Direct effects could include mortality or other forms of take (e.g., harm or harrassment) to individual bats as a result of heavy equipment used to clear the site and construct the flood risk management structures. The use of heavy equipment would also generate noise, which could disrupt bats that are present within the action area. To avoid and minimize the potential for these impacts, vegetation clearing for the project would be performed during times of the year when Hawaiian hoary bats are not expected to be breeding to avoid potential for harm or disruption to non-volant juvenile bats; specifically, trees greater than 15 feet in height

would not be cleared between July 1 and August 1. In addition, all construction activities would be scheduled to occur during daytime hours, thus avoiding potential bat foraging activities, which typically occur in the evening hours.

Other effects could include permanent loss or temporary impacts to habitat. However, given the amount of habitat available throughout the upper watershed, tree clearing within the action area is not expected to measurably decrease the amount of forest available to the local population of bats for roosting. In addition, as the total population of bats on Oahu is believed to be small (USFWS, 1998a) and trees are plentiful, roost trees are not expected to be a limiting factor for the species on Oahu. The forest habitat in the upper portions of the watershed is fairly homogenous, and does not vary significantly in composition or structure between adjacent patches. For these reasons, it is expected that any bats displaced by the clearing would readily find alternate roost sites in surrounding undisturbed forest.

Effects Determination

As described above, seasonal restrictions for tree trimming/clearing and enforcement of construction hours will be incorporated to avoid and/or minimize the potential for impacts to the Hawaiian hoary bat, should the species be present in the action area. With implementation of these measures, impacts to the Hawaiian hoary bat are expected to be insignificant, such that the proposed action may affect, but is not likely to adversely affect the species.

4.2 Hawaiian monk seal (*Monachus schauinslandi*)

The Hawaiian monk seal (‘*ilio-holo-i-ka-uaua*) was listed as endangered under the ESA in November 1976 (Federal Register, 1876). The original recovery plan was approved in March 1983; the most recent revision was made in August 2007 (NMFS, 2007). Critical habitat was designated in the northwest Hawaiian Islands for this species in 1986 (NMFS, 2007); no critical habitat occurs within the action area.

The species is endemic to the Hawaiian archipelago; it is one of only two remaining monk seal species, and is considered to be one of the rarest marine mammals in the world. Its range is generally limited to the Hawaiian archipelago, with most of the population occurring in the northwestern Hawaiian Islands, but the population in the main Hawaiian Islands appears to be expanding. Overall, the species has been steadily declining over time, with an estimated total of 1,200 seals remaining throughout the species’ entire range. This population size is considered to be very small, raising concerns about the long-term maintenance of genetic diversity (NMFS, 2007).

Hawaiian monk seals spend approximately two-thirds of their time in marine waters, primarily in areas surrounding atolls, islands, and areas farther offshore on reefs and submerged banks. They forage for food across a range of benthic substrates (generally in waters 60-300 feet deep), feeding on a variety of fish, cephalopods and crustaceans; they may also use deepwater coral beds as foraging habitat. Terrestrial habitats are primarily sandy beaches (and occasionally other shoreline areas), which are used as haul-outs for pupping, nursing, molting and resting.

Threats to Hawaiian monk seals include both natural and human-induced factors, including reduction of habitat and prey (at least in part due to environmental change), predations by sharks, disease, entanglement in marine debris, and human disturbance (NMFS, 2007).

Potential to Occur in the Action Area

The proposed action is focused on stream-related flood risk reduction and the action area does not include any marine or coastal habitat. As such, there is no potential for the Hawaiian monk seal to occur in the action area.

Potential Effects of the Proposed Action

The proposed action will not directly or indirectly affect the Hawaiian monk seal, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on the Hawaiian monk seal.

4.3 Oahu `*Elepaio* (*Chasiempis sandwichensis ibidis*)

The Oahu `elepaio was listed as endangered under the ESA on April 18, 2000; the recovery plan for the species was approved in 2006 (USFWS, 2006b). Critical habitat for the Oahu `elepaio was designated in December 2001. The critical habitat consists of five units, which encompass a total area of approximately 65,879 acres in the Ko`olau and Wai`anae Mountains (Federal Register, 2001). Unit 5 encompasses over 10,000 acres of the southern Ko`olau Mountains and, in the Ala Wai watershed, includes most of the undeveloped upland areas from Tantalus to Mau'umae Ridge and beyond (Figure 2); the action area does not overlap with any portion of the designated critical habitat.

Historically, the species is believed to have been abundant across the more than 300,000 acres of forest habitat on Oahu. The geographic range of Oahu `elepaio has declined significantly, with the species currently occupying only about 12,811 acres, or approximately 4 percent of its former range (USFWS, 2006; Vander Werf et al., 2013). As of 2001, the population was estimated to include approximately 1,980 birds distributed across fragmented habitat in the Wai`anae Mountains and the Ko`olau Mountains, with three relatively large populations and several smaller remnant populations in each mountain range. Recent surveys indicate continued decline of the species, with a total estimated population size of 1,261 birds that have been fragmented into four large subpopulations and 12 smaller subpopulations (VanderWerf et al., 2013).

Oahu `*elepaio* nest and forage in a variety of native and non-native forest types across a range of elevations, but are most common in riparian vegetation along streambeds and in mesic forest habitats with continuous tree canopy and dense understory. Habitat structure appears to be more important than species composition, and the species has adapted to use introduced species in disturbed forest habitat (VanderWerf et al., 1997). Common native plants in areas where *`elepaio* occur include *alahe`e* (*Psydrax odorata*), *pāpala kēpau* (*Pisonia umbellifera*), *lama* (*Diospyros sandwicensis*), *hame* (*Antidesma platyphyllum*), *māmaki* (*Pipturus albidus*), *kaulu* (*Sapindus oahuensis*), and *`āla`a* (*Pouteria sandwicensis*); common introduced plants include strawberry guava (*Psidium cattleianum*), common guava (*Psidium guajava*), *kukui* (*Aleurites moluccana*), mango (*Mangifera indica*), and Christmas berry (*Schinus terebinthifolius*). The nesting season usually extends from February to May, but active nests have been documented from January to July (VanderWerf, 1998).

Much of the species' historic decline is believed to be attributed to habitat loss, particularly as a result of extensive development and urbanization at lower elevations. In recent years, the greatest threat to the species is associated with predation by alien black rats (*Rattus rattus*) and mosquito-borne diseases (VanderWerf et al., 2013). Other current threats include avian malaria and pox, although there is some evidence that the species is building an immunity to the poxvirus. In addition to these threats, natural processes (e.g., loss of genetic variability, natural disasters, etc.) further threaten the small, remnant populations.

Potential to Occur in the Action Area

A recent survey for Oahu `elepaio indicated that the population in the Ko`olau Mountains is comprised of 545 males and 317 females. The geographic range is approximately 9,749 acres, and is fragmented into 2 larger subpopulations in the central and southeastern Ko`olau Mountain (each with more than 400 birds), a smaller subpopulation in Waikane and Kahana Valleys (25 birds), and three small remnant populations in Nuuanu, Waihee and Waiahole Valleys (less than 4 birds each) (VanderWerf et al., 2013). Previous data indicated populations in both Manoa and Palolo Valleys (with 2 birds and 46 birds, respectively); as of 2012, approximately 12 birds (5 pairs and 2 single males) are known from Palolo valley, and the species is no longer believed to occur in Manoa valley (VanderWerf et al., 2013).

The portions of the action area within Manoa Valley (i.e., Waihi and Waiakeakua detention basins) contain suitable habitat; however, as described above, the species is no longer believed to occupy any portion of Manoa Valley. The portions of the action area within Palolo Valley (i.e., Pukele and Waiomao detention basins) also contain suitable habitat, but these areas are considerably downslope from the lower edge of the species' current geographic range. Given the proximity to the known range, it is possible (although unlikely) that the species could reoccupy portions of the action area.

Critical habitat for this species is located in the upper portions of the watershed, but none is present within the action area.

Potential Effects of the Proposed Action

Although species occurrence within the measure locations is unlikely, should they occur, Oahu `elepaio could be directly or indirectly impacted by the project. Direct effects could include mortality or other forms of take (e.g., harm or harassment) to individual birds or destruction of their nests as a result of heavy equipment used to clear the site and construct the flood risk management structures. The use of heavy equipment would also generate noise, which could disrupt birds that are present within the action area. To avoid and minimize the potential for these impacts, trimming or clearing of vegetation in areas of suitable habitat would be restricted during the `elepaio nesting season (January through June).

Other effects could include permanent loss or temporary impacts to habitat. However, vegetation clearing within the action area is not expected to measurably decrease the amount of forest available for `elepaio habitat. The total population of `elepaio in this region is small, and forested areas are readily available, such that habitat is not expected to be a limiting factor for the species. In addition, the forest habitat in the upper portions of the watershed is fairly homogenous, and does not vary significantly in composition or structure between adjacent patches. Therefore, in the unlikely event that `elepaio were to reoccupy this area, it is expected that they would readily find alternate habitat in the surrounding undisturbed forest.

Effects Determination

As described above, species occurrence within the action area is unlikely, but seasonal restrictions for trimming/clearing of vegetation would be incorporated to avoid and/or minimize the potential for impacts to the Oahu `elepaio, should it occur in the action area. With implementation of these measures, impacts to the Oahu `elepaio are expected to be discountable, such that the proposed action may affect, but is not likely to adversely affect the species.

As no designated critical habitat occurs within the action area, there will be no effect on critical habitat for Oahu `elepaio.

4.4 Hawaiian coot (*Fulica alai*)

The Hawaiian coot (*Fulica alai*) was listed as endangered in 1970. The original recovery plan was approved in 1978, and most recently revised in 2011 (USFWS, 2011c). Critical habitat has not been designated for this species.

The Hawaiian coot is an endemic, non-migratory waterbird species that was historically known to occur on all of the main Hawaiian islands, except Lana`i and Kaho`olawe. No population estimates are available for the early 1900s, but the species' decline and potential threat of extinction was documented in the mid-1900s (Schwartz and Schwartz, 1949); the population was documented at fewer than 1,000 in the 1950 and 1960s (USFWS, 1978). Currently, Hawaiian coots inhabit all of the main Hawaiian islands except Kaho`olawe. Biannual waterbird surveys from 1997 through 2006 indicate the Hawaiian coot population generally averages between approximately 1,500 and 2,800 birds; on Oahu, the population generally fluctuates between 500 and 1000 birds (DOFAW, 1976-2008). Most of these occur in coastal wetlands, including the James Campbell National Wildlife Refuge, the Kahuku aquaculture ponds, the Kuilima wastewater treatment plant, Ka`elepulu Pond in Kailua, Pearl Harbor National Wildlife Refuge, and the Hawai`i Prince Golf Course (USFWS, 2011c).

Coots typically use naturally occurring ponds and wetlands on the coastal plain, in areas with emergent plant growth interspersed with open water (Brisbin et al., 2002). They also use aquatic features actively managed for taro cultivation and fish production, and are known to readily disperse between areas of suitable habitat (USFWS, 2011c; Engilis and Pratt, 1993). Primary food sources include invertebrates and aquatic vegetation, with foraging in mud/sand substrate and diving near the water surface. They nest in open freshwater and brackish ponds, constructing floating or semi-floating nests using aquatic vegetation; false nests are also constructed for use as loafing or brooding platforms (USFWS, 2011c). Habitat suitability is limited in large, deep ponds (USFWS, 2011c). Although coots may prefer freshwater for nesting, they are commonly found in brackish water (Berger, 1981), loafing on rafts of vegetation, mud bars, and false nests, as well as on open water.

Potential to Occur in the Action Area

The only suitable habitat that could support this species within the action area are very small pockets of wetland habitat; these are limited to isolated features within the Ala Wai golf course and possibly along Hausten Ditch and/or the upper edges of the Ala Wai Canal. However, these areas are very small and provide very minimal habitat value in comparison to other nearby areas (e.g., Pearl Harbor National Wildlife Refuge); they are not expected to provide suitable nesting habitat, but could be used for resting habitat. As such, it is possible (though unlikely), that Hawaiian coots could occur in the action area.

Potential Effects of the Proposed Action

As described above, the extent and quality of potentially suitable habitat within the action area is very limited, and is likely to only be used as resting habitat (if at all). In the unlikely event that coots are present within the action area, it is expected that they would readily disperse to nearby areas with higher quality habitat (e.g., Pearl Harbor National Wildlife Refuge) in response to disturbance; as such, the potential effects of the proposed action are expected to be limited to temporary construction-related disturbance (e.g., noise). Injury or mortality of coots (or their nests) is not expected.

Areas of potentially suitable wetland habitat may be temporarily unavailable during construction (due to increased levels of disturbance), but sufficient habitat is expected to be available in nearby areas (e.g., Pearl Harbor National Wildlife Refuge). Following construction, the extent and quality of habitat is expected to be the same as the existing condition. During large-scale flood events, the detention basins would be inundated for short periods (i.e., less than 24 hours) which could temporarily increase the extent of potential habitat. Although increased habitat may be viewed as a benefit, in heavily urbanized areas (such as the Ala Wai watershed), it can also create an attractive nuisance for waterbird species. Specifically, areas of increased habitat may attract waterbirds, which are then vulnerable to predator species that are prevalent in an urban environment (e.g., feral cats, mongoose). However, given the low probability of species occurrence and the infrequent recurrence and short-term duration of flooding, these conditions are not expected to significantly affect coots.

Effects Determination

Based on the minimal extent and quality of suitable habitat, there is a low probability of species occurrence in the action area. Given this fact, coupled with the nature of activities proposed in these areas, impacts to the Hawaiian coot are expected to be insignificant, such that the proposed action may affect, but is not likely to adversely affect the species.

4.5 Hawaiian stilt (*Himantopus mexicanus knudseni*)

The Hawaiian stilt (*Himantopus mexicanus knudseni*) was listed as endangered in 1970. The original recovery plan was approved in 1978, and most recently revised in 2011 (USFWS, 2011c). Critical habitat has not been designated for this species.

The Hawaiian stilt is endemic to Hawai`i and was historically known to occur all of the major islands except Lāna`i and Kaho`olawe (but were subsequently documented on Lāna`i starting in 1989) (Engilis and Pratt,

1993). Although there is no estimate of historical numbers, stilts were identified as common in the late 1800s. Population declines were documented as early as 1900, with loss of wetland habitat identified as the primary cause of decline; other contributing factors include predation by introduced species, habitat overgrowth by invasive plant species, and hunting (USFWS, 2011c).

Biannual surveys conducted from 1998 through 2007 suggest that, on average, the population is comprised of approximately 1,500 stilts and is relatively stable (DOFAW, 1976-2008; Reed and Oring, 1993; USFWS, 2011c). Oahu supports the largest number of Hawaiian stilts, with approximately 450 to 700 birds in any given year (Engilis, 1988; DOFAW, 1976-2008). Most of these occur at the James Campbell National Wildlife Refuge, the Kahuku aquaculture ponds, the Pearl Harbor National Wildlife Refuge, and on Nu`upia Ponds in Kaneohe; populations also exist at the Chevron Refinery, the fishponds at Kualoa Beach Park, at Salt Lake District Park, and at scattered locations along the northern and eastern coasts.

The Hawaiian stilt is primarily found in low-elevation wetlands with sparse, low-growing vegetation and water depths less than approximately 9 inches. Stilts forage for a variety of invertebrates in fresh, brackish, or saline waters. Stilts use open or sparsely vegetated flats and pasture lands for loafing, as well as other open areas with good visibility. Nesting predominantly occurs in areas with little to no cover, which most likely allows predators to be easily spotted.

Potential to Occur in the Action Area

A small amount of potentially suitable habitat occurs within the action area; these areas include the aquatic features within the Ala Wai golf course, Hausten Ditch and possibly the upper reaches of the Ala Wai Canal. However, these areas are limited in size and provide very minimal habitat value in comparison to other nearby areas (e.g., Pearl Harbor National Wildlife Refuge); they are not expected to provide suitable nesting habitat, but could be used for resting habitat. As such, it is possible (though relatively unlikely), that Hawaiian stilts could occur in the action area.

Potential Effects of the Proposed Action

As described above, the extent and quality of potentially suitable habitat within the action area is very limited, and is likely to only be used as resting habitat (if at all). In the unlikely event that stilts are present within the action area, it is expected that they would readily disperse to nearby areas with higher quality habitat (e.g., Pearl Harbor National Wildlife Refuge) in response to disturbance; as such, the potential effects of the proposed action are expected to be limited to temporary construction-related disturbance (e.g., noise). Injury or mortality of stilts (or their nests) is not expected.

Areas of potentially suitable wetland habitat may be temporarily unavailable during construction (due to increased levels of disturbance), but sufficient habitat is expected to be available in nearby areas (e.g., Pearl Harbor National Wildlife Refuge). Following construction, the extent and quality of habitat is expected to be the same as the existing condition. During large-scale flood events, areas within the Hausten Ditch and Ala Wai golf course detention basins would be inundated for short periods (i.e., less than 24 hours) which could temporarily increase the extent of potential habitat. Although increased habitat may be viewed as a benefit, in heavily urbanized areas (such as the Ala Wai watershed), it can also create an attractive nuisance for waterbird species. Specifically, areas of increased habitat may attract a larger number of waterbirds, which are then vulnerable to predator species that are prevalent in an urban environment (e.g., feral cats, mongoose). However, given the low probability of species occurrence and the infrequent recurrence and short-term duration of flooding, these conditions are not expected to significantly affect stilts.

Effects Determination

Based on the minimal extent and quality of suitable habitat, there is a low probability that Hawaiian stilts would occur in the action area. Given this fact, coupled with the nature of the proposed activities, impacts to the Hawaiian stilt are expected to be insignificant, such that the proposed action may affect, but is not likely to adversely affect the species.

4.6 Hawaiian duck (*Anas wyvilliana*)

The Hawaiian duck (*Anas wyvilliana*) was listed as endangered in 1967. The original recovery plan was approved in 1978, and most recently revised in 2011 (USFWS, 2011c). Critical habitat has not been designated for this species.

Hawaiian ducks were known historically from all of the main Hawaiian Islands except Lāna`i and Kaho`olawe. Although there is no estimate of historical numbers, Hawaiian ducks were identified as common in the 1800s. By the 1960s, Hawaiian ducks were nearly extirpated on all islands, except Kauai and possibly Niihau; Hawaiian ducks were subsequently reintroduces to Oahu, Maui and Hawai`i (USFWS, 2011c).

Although populations of Hawaiian ducks are believed to still exist on each of these islands, the remaining populations are affected by hybridization with feral mallards. Engilis et al. (2002) estimated the statewide population of pure Hawaiian ducks to be 2,200 birds, with 2,000 on Kaua`i and 200 on Hawai`i. Allozyme data indicate there has been extensive hybridization between Hawaiian ducks and feral mallards on O`ahu, with the near disappearance of Hawaiian duck alleles from the population (Browne et al. 1993). Hawaiian ducks are still reported from wetlands on O`ahu's windward coast (Kawainui, Hāmākua, and He`eia Marshes, Ka`elepulu and Nu`upia Ponds, and Ho`omaluhia Botanical Garden), north shore (James Campbell National Wildlife Refuge, Kahuku aquaculture ponds, Punaho`olapa, Hale`iwa), Pearl Harbor area (Pearl Harbor National Wildlife Refuge, Pouhala Marsh), and Lualualei; however, it is not known whether these individuals are actually Hawaiian ducks or hybrids (USFWS, 2011c).

The Hawaiian duck historically used a wide variety of natural habitats for nesting and feeding, including freshwater marshes, flooded grasslands, coastal ponds, and streams at elevations ranging from sea level to 3,000 meters (9,900 feet); other areas that may be utilized as habitat include agricultural and artificial wetlands, sewage treatment ponds, irrigation ditches, and reservoirs. Wetlands that are relatively small, isolated, or close to houses are less likely to be occupied (Uyehara et al., 2008). Nests are established on the ground, which makes them highly vulnerable to predators (e.g., mongoose, cats).

Potential to Occur in the Action Area

The aquatic environments within the action area provide suitable habitat for the Hawaiian duck. However, given the extensive urban development, it is unlikely that these areas would be utilized by the species. Coupled with the very low number of Hawaiian ducks that remain on Oahu (none of which have been reported from this region on Oahu), the species is not expected to occur in the action area.

Potential Effects of the Proposed Action

As the Hawaiian duck is not expected to occur in the action area, the proposed action is not expected to affect this species.

Effects Determination

The proposed action is expected to have no effect on the Hawaiian duck.

4.7 Hawaiian moorhen (*Gallinula chloropus sandvicensis*)

The Hawaiian moorhen (*Gallinula chloropus sandvicensis*) was listed as endangered in 1967. The original recovery plan was approved in 1978, and most recently revised in 2011 (USFWS, 2011c). Critical habitat has not been designated for this species.

Historically, the Hawaiian moorhen was found on all of the main Hawaiian Islands except Lāna`i and possibly Ni`ihau. The population (especially on Oahu, Maui and Molokai) was drastically reduced by the late 1940s; the species was subsequently extirpated on Maui and Molakai and reintroduction efforts failed (presumably due to nest predation). Hawaiian moorhens are currently found only on the islands of Kaua`i and O`ahu. The population is small, but relatively stable, with an average of 287 birds from 1998 to 2007 (DOFAW 1976-2008). Approximately half of the birds are found on Oahu; they are widely distributed on the island, but are most prevalent on the northern and eastern coasts between Hale`iwa and Waimanalo. Small numbers occur

in Pearl Harbor, where they foraging in semi-brackish water. The population on the leeward coast is limited to Lualualei Valley (USFWS, 2011c).

Hawaiian moorhen habitat consists of freshwater marshes, taro patches, reedy margins of water courses (e.g., streams, irrigation ditches), reservoirs, wet pastures, and occasionally saline and brackish water areas. They appear to prefer lowland freshwater habitats. Key habitat features include dense stands of robust emergent vegetation near open water, floating mats of vegetation, water depths less than 1 meter (3.3 feet), and fresh water (as opposed to saline or brackish water). Interspersion of emergent vegetation and open water is also believed to be important.

Potential to Occur in the Action Area

The only suitable habitat that could support this species within the action area are very small pockets of wetland habitat; these are limited to isolated features within the Ala Wai golf course, and possibly Hausten Ditch and the upper reaches of the Ala Wai Canal. However, these areas lack some of the key habitat features, and therefore are expected to provide very minimal habitat value in comparison to other nearby areas (e.g., Pearl Harbor National Wildlife Refuge); these areas are not expected to provide suitable nesting habitat, but could be used for resting habitat. As such, it is possible (though unlikely), that Hawaiian moorhens could occur in the action area.

Potential Effects of the Proposed Action

As described above, the extent and quality of potentially suitable habitat within the action area is very limited, and is likely to only be used as resting habitat (if at all). In the unlikely event that moorhens are present within the action area, it is expected that they would readily disperse to nearby areas with higher quality habitat (e.g., Pearl Harbor National Wildlife Refuge) in response to disturbance; as such, the potential effects of the proposed action are expected to be limited to temporary construction-related disturbance (e.g., noise). Injury or mortality of moorhens (or their nests) is not expected.

Areas of potentially suitable wetland habitat may be temporarily unavailable during construction (due to increased levels of disturbance), but sufficient habitat is expected to be available in nearby areas (e.g., Pearl Harbor National Wildlife Refuge). Following construction, the extent and quality of habitat is expected to be the same as the existing condition. During large-scale flood events, the detention basins would be inundated for short periods (i.e., less than 24 hours) which could temporarily increase the extent of potential habitat. Although increased habitat may be viewed as a benefit, in heavily urbanized areas (such as the Ala Wai watershed), it can also create an attractive nuisance for waterbird species. Specifically, areas of increased habitat may attract waterbirds, which are then vulnerable to predator species that are prevalent in an urban environment (e.g., feral cats, mongoose). However, given the low probability of species occurrence and the infrequent recurrence and short-term duration of flooding, these conditions are not expected to significantly affect moorhen.

Effects Determination

Based on the minimal extent and quality of suitable habitat, there is a low probability of species occurrence in the action area. Given this fact, coupled with the nature of activities proposed in these areas, impacts to the Hawaiian moorhen are expected to be insignificant, such that the proposed action is not likely to adversely affect the species.

4.8 Blackline Hawaiian Damselfly (*Megalagrion nigrohamatum nigrolineatum*)

The blackline Hawaiian damselfly (*Megalagrion nigrohamatum nigrolineatum*) was listed as endangered in September 2012; a recovery plan has not yet been approved. Critical habitat was also designated in 2012; Unit 11 is located within the upper portions of the Ala Wai watershed (Federal Register, 2012).

The blackline Hawaiian damselfly was known historically from the Ko`olau and Wai`anae Mountains, at elevations ranging from sea level to over 2,400 feet (730 m) (Williams, 1936; Polhemus, 1994). There are

currently 17 known populations from lowland wet ecosystem in the headwaters and upper reaches of streams of the Ko`olau Mountains.

This species occurs in the slow sections or pools along mid-reach and headwater sections of perennial upland streams and in seep-fed pools along overflow channels bordering such streams. Colonies are constrained to portions of streams not occupied by non-native predatory fish (for example, stream reaches above geologic or manmade barriers) (Federal Register, 2012).

The blackline Hawaiian damselfly is threatened by habitat loss, as well as competition and predation by non-native fish species. Habitat loss may occur as a result of invasive California grass (*Brachiaria mutica*), which forms dense stands that can eliminate standing water.

Potential to Occur in the Action Area

~~Based on initial information provided by the USFWS, it is understood that the species occurs in areas along Manoa Stream, but is restricted to elevations higher than 2,000 feet. Based on this information, the species is not expected to not have the potential to occur within the action area. This conclusion is being validated as part of a field investigation by USFWS biologists.~~

The blackline Hawaiian damselfly has been observed in and in the immediate vicinity of the proposed Waihi Stream debris and detention basin's footprint (Figures 5 and 6). Observations of individual sightings and potential breeding areas by FWS biologists were documented in the Draft Fish and Wildlife Coordination Act Report dated November 2015 that was developed for this project under consultation with the Service under the Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661 *et seq.*; 48 Stat. 401), as amended.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

~~Based on currently available information, the proposed action is not expected to directly affect the blackline Hawaiian damselfly, or its critical habitat. As previously described, the proposed mitigation measures are intended to improve access for native aquatic species to the upper reaches of Manoa Stream. Recognizing the threat that invasive aquatic species pose to the blackline Hawaiian damselfly, it is possible that increased access or abundance of invasive aquatic species could indirectly affect the blackline Hawaiian damselfly. However, recent stream surveys indicate that invasive aquatic species are already abundant in the reaches above the proposed mitigation measures, such that these features are not expected to measurably increase abundance (G. Higashi, State Division of Aquatic Resources, personal communication, May 26, 2015).~~

At Waihi Stream, both riffle and pool habitat and riparian habitat contribute to supporting the extant population of federally listed damselflies. Some indirect and direct permanent loss of habitat due to the construction of the basin, staging area and access road would be anticipated. Additional permanent loss of habitat due to maintenance removal of debris in the detention catchment area is also likely.

Effects Determination

~~The proposed action is expected to have **No Effect** on the blackline Hawaiian damselfly.~~

Due to the documented observation of the species and potential breeding habitat within and in the vicinity of the proposed basin footprint, indirect and direct impacts during construction and maintenance operations is likely to result in a "take" of the species as defined under the ESA. Therefore, the proposed action may affect and is likely to adversely affect the blackline Hawaiian damselfly.

4.9 Crimson Hawaiian Damselfly (*Megalagrion leptodemas*)

The crimson Hawaiian damselfly (*Megalagrion leptodemas*) was listed as endangered in September 2012; a recovery plan has not yet been approved. Critical habitat was designated in 2012; Unit 11 is within the upper portions of the Ala Wai watershed (Federal Register, 2012).

The crimson Hawaiian damselfly was known historically from the windward side of the Wai`anae Mountains

and scattered locations in the Ko`olau Mountains, but is currently only known from 3 locations in the Ko`olau Mountains: Moanalua, north Halawa, and Maakua (Federal Register, 2012). This species is found in lowland wet and wet cliff ecosystems, and breeds in the slow reaches of streams and seep-fed pools (Williams, 1936; Polhemus, 1994). All colonies are constrained to portions of streams not occupied by non-native predatory fish (for example, stream reaches above geologic or manmade barriers) (Federal Register, 2012).

The crimson Hawaiian damselfly is threatened by habitat loss and alteration, as well as competition and predation by non-native fish species. Given the small remaining populations sizes, the species is also threatened by natural events (e.g., drought) that could extirpate the remaining populations.

Potential to Occur in the Action Area

Pockets of suitable habitat for this species occurs in the upper reaches of the action area; however, it is now restricted to three locations in the Ko`olau Range (Federal Register, 2012). Given its current range, this species is not expected to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect the crimson Hawaiian damselfly, or its critical habitat.

Effects Determination

The proposed action is expected to have **No Effect** on the crimson Hawaiian damselfly.

4.10 Oceanic Hawaiian Damselfly (*Megalagrion oceanicum*)

The oceanic Hawaiian damselfly (*Megalagrion oceanicum*) was listed as endangered in September 2012; a recovery plan has not yet been approved. Critical habitat was designated in 2012; Unit 12 is within the upper portions of the Ala Wai watershed (Federal Register, 2012).

The oceanic Hawaiian damselfly is endemic to the island of Oahu, and was known historically from both the Ko`olau and Wai`anae Mountains. It is now believed to be extirpated from the Wai`anae Mountains, and is only known to occupy the upper reaches (above 100 meters [300 feet]) of perennial streams on the windward side of the Ko`olau Range (Polhemus, 1994; Federal Register, 2012).

Immature stages of this species are found in swiftly flowing sections of streams, usually amid rocks and gravel in stream riffles and small cascades (Williams, 1936; USFWS, 2007). The naiads usually crawl among gravel or submerged vegetation; older naiads often forage out of the actual stream channel and have been observed among wet moss on rocks, and wet rock walls and seeps (Williams, 1936). Adults are strong flyers, and when disturbed frequently fly upward into the forest canopy overhanging the stream (Williams, 1936; Polhemus, 1994).

The oceanic Hawaiian damselfly is threatened by habitat loss and alteration (e.g., water diversions), as well as competition and predation by non-native fish and insect species. Habitat loss may occur as a result of invasive California grass, which forms dense stands that can eliminate standing water. Given the small remaining populations sizes, the species is also threatened by natural events (e.g., drought) that could extirpate the remaining populations.

Potential to Occur in the Action Area

Pockets of suitable habitat for this species occurs in the upper reaches of the action area; however, it is now restricted to a handful of locations on the windward side of the Ko`olau Range (Polhemus, 1994; USFWS, 2012b). Given its current range, this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect the oceanic Hawaiian damselfly, or its critical habitat.

Effects Determination

The proposed action is expected to have **No Effect** on the oceanic Hawaiian damselfly.

4.11 Orangeblack Damselfly (*Megalagrion xanthomelas*)

The orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*) is currently a candidate for listing under the ESA (Federal Register, 2014; USFWS, 2014a).

This species was historically the most abundant damselfly species in Hawaii, and occurred on all the major islands except Kahoolawe. It is now restricted to a total of 16 populations distributed across the islands of Oahu, Maui, Molokai, Lanai, and Hawai`i (Perkins, 1913; Polhemus, 1996; USFWS, 2014a). Currently, the only known population on Oahu is located near Tripler Army Medical Facility(Englund, 2001).

Orangeblack Hawaiian damselflies generally occur in lowland aquatic habitats, and prefer standing or very slow moving bodies of water. The most common habitat in which this species was found during surveys across its current distribution include coastal wetlands fed by basal springs, and terminal or lower mid-reaches of perennial streams (Polhemus, 1996).

Threats to this species include predation from nonnative aquatic species (including fish and insects), and habitat loss due to dewatering of streams and invasion by nonnative plants. Invasive plants (e.g., California grass (*Brachiaria mutica*)) also contribute to loss of habitat by forming dense, monotypic stands that completely eliminate open water (Federal Register, 2014).

Potential to Occur in the Action Area

Pockets of suitable habitat for this species occurs within the action area; however, the last report of this species on Oahu was in 1935 (Williams, 1936), with the exception of one remnant population recently discovered near Tripler Army Medical Facility. Given its current range, this species is not expected to not have the potential to occur within the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect the orangeblack Hawaiian damselfly.

Effects Determination

The proposed action is expected to have **No Effect** on the orangeblack Hawaiian damselfly.

4.12 Oahu tree snail (*Achatinella* sp.)

All 41 species of the genus *Achatinella* (Oahu tree snails) were listed as endangered in February 1981. The original recovery plan was approved 1992; a five-year review was most recently conducted in 2011 (USFWS, 2012). Critical habitat has not been designated for this species.

The genus is endemic to Oahu, where it was once common in the native forests of the Ko`olau and Wai`anae Ranges. At the time the recovery plan was written in 1993, approximately half of the species were either extinct or had not been seen for a significant length of time; nearly all of the remaining species have extremely small populations in areas restricted to the high ridges of the mountain ranges. Surveys conducted from 2005 to 2009 indicate *Achatinella mustelina*, a species restricted to the Wai`anae Range, is the most abundant of the Hawaiian tree snails. *Achatinella sowerbyana*, from the northern Ko‘olau Mountains, is the next most abundant species (USFWS, 2012).

Members of the genus Achatinella are currently found in mountainous areas of dry to wet forests and shrublands at elevations of 1300 feet (400 meters). They are arboreal, nocturnal, and feed by grazing fungus from the surface of native plant leaves and trunks. Species that *Achatinella* sp. have been observed inhabiting including *koa* (*Acacia koa*), *kukui* (*Aleurites moluccana*), *hame* (*Antidesma* sp.), *banana* (*musa paradisiaca*), *kookoolau* (*Bidens* spp.), *ahakea* (*Bobea elatior*), *ohia lehua* (*Metrosideros polymorpha*), *kopiko* (*Psychotria* spp.), and *papala kepau* (*Pisonia umbellifera*) (USFWS, 1992).

Historically, the primary causes of reduction in the species' range and abundance were likely destruction of native forest habitat and the introduction of predators, such as rats. More recently, the genus is threatened

by predation by introduced snails and rats, and the spread of non-native vegetation into higher elevation forests (USFWS, 1992).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Achatinella* sp. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect Oahu tree snails, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on Achatinella sp.

4.13 *Haha* (*Cyanea acuminata*)

Cyanea acuminata was listed as endangered in October 1996 (Federal Register, 1996). The original recovery plan was approved in 1998; a five-year review was most recently conducted in 2013 (USFWS, 2013a). Critical habitat was designated for this species in 2012; Lowland Wet Unit 16 is located in the upper-most slopes of the Ala Wai watershed (Federal Register, 2012).

Cyanea acuminata is a short-lived perennial shrub that is endemic to the island of Oahu. When listed, there were 15 populations with a total of less than 100 individuals (USFWS, 1998b). The total population has increased over time, with a total of 458 plants documented in 2012; this includes three populations with 50 or more mature individuals (USFWS, 2013a).

This species typically grows on slopes, ridges, or stream banks from 305 to 915 meters (1,000 to 3,000 feet) elevation. The plants are found in mesic to wet *ohia-uluhe*, *koa-ohia,* or *Diospyros sandwicensis* (*lama*)-*ohia* forest (HHP 1997, Lammers 1990 as reported in USFWS, 1998b). The major threats to *Cyanea acuminata* are habitat degradation and/or destruction by feral pigs; predation by rats and slugs; competition with non-native plant species; and climate change (USFWS, 2013a).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Cyanea acuminata*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Cyanea acuminata*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Cyanea acuminata*.

4.14 *Haha* (*Cyanea crispa*)

Cyanea crispa was listed as endangered in October 1996 (Federal Register, 1996). The original recovery plan was approved in 1998; a five-year review was most recently completed in 2009 (USFWS, 2009a). Critical habitat was designated for this species in 2003 and 2012; Lowland Wet Unit 16 is located in the upper-most slopes of the Ala Wai watershed (Federal Register, 2012).

Cyanea crispa is a short-lived perennial shrub that is endemic to the Ko`olau Mountains of Oahu. It was historically known from the upper elevations of the Ko`olau Mountains, from Kaipapau Valley to Waialae Iki Ridge. At the time critical habitat was designated in 2003, there were 11 occurrences with a total of 56 individuals in locations including Hidden Valley, Palolo Valley, Kapakahi Gulch, Moanalua Valley, Wailupe, Ko`olau Summit Trail, Kawaipapa Gulch, Maakua Gulch, Kaipapa Gulch, Maunawili, and Pia Valley. As of 2012, there were 7 occurrences with a total of 56 individuals.

Cyanea crispa occurs in habitats ranging from steep, open mesic forests to gentle slopes or moist gullies of closed wet forests, at elevations between 185 and 730 meters (600 and 2,400 feet). Species that commonly occur in association with *Cyanea crispa* include *Cyrtandra* species (*haiwale*), *papala kepau*, and *Touchardia latifolia* (*olona*). The major threats to *Cyanea cripsa* are habitat alteration; predation by rats, slugs and feral pigs; competition with non-native plant species; and extinction due to naturally occurring events and/or reduced reproductive vigor due to the small number of remaining individuals, their limited gene pool, and restricted distribution (USFWS, 2009a).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Cyanea crispa*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Cyanea crispa*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Cyanea crispa*.

4.15 *Haha* (*Cyanea koolauensis*)

Cyanea koolauensis was listed as endangered in October 1996 (Federal Register, 1996). The original recovery plan was approved in 1998; a five-year review was most recently completed in 2013 (USFWS, 2013b). Critical habitat was designated for this species in 2003 and 2012; Lowland Wet Unit 16 is located in the upper-most slopes of the Ala Wai watershed (USFWS, 2012b).

Cyanea koolauensis is a short-lived perennial shrub that is endemic to the Ko`olau Mountains of Oahu. At the time critical habitat was designated in 2003, there were 42 occurrences with a total of less than 80 individuals, known from Waimea-Malaekahana Ridge to Hawai`i Loa Ridge in the Ko`olau Mountains. As of 2012, there were 15 occurrences with approximately 100 individuals (USFWS, 2012b).

Cyanea koolauensis is usually found on slopes, stream banks, and ridge crests in wet *Metrosideros polymorpha-Dicranopteris linearis* forest or shrubland at elevations between 163 and 959 m (535 and 3,146 ft). Associated native plant species include *Acacia koa*, *Antidesma platyphyllum*, *Bidens* sp., *Bobea elatior*, *Broussaisia arguta*, *Cibotium* sp., *Diplopterygium pinnatum*, *Dubautia* sp., *Hedyotis* sp., *Machaerina* sp.,

Melicope sp., *Pittosporum* sp., *Pritchardia martii* (*loulu hiwa*), *Psychotria mariniana*, *Sadleria* sp., *Scaevola* sp. (*naupaka*), *Syzygium sandwicensis*, or *Wikstroemia* sp. (HINHP Database 2001; Lammers 1999; in Federal Register, 2003). The major threats to this species are habitat destruction by feral pigs; pherbivory by rats and slugs, trampling by hikers and military activities; competition with aggressive nonnative plant species; and climate change (USFWS, 2013b).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Cyanea koolauensis*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Cyanea koolauensis*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Cyanea koolauensis*.

4.16 No Common Name (*Diellia erecta*)

Diellia erecta was listed as endangered in October 1994. The original recovery plan was approved in 1999; a five-year review was most recently conducted in 2009 (USFWS, 2009b). Critical habitat was designated for this species in 2003 and 2012. None of the critical habitat is within the Ala Wai watershed (Federal Register, 2012).

Diellia erecta is a short-lived perennial fern that was historically known from the Kokee area of Kauai, the Ko`olau Mountains on Oahu, Molokai, Lanai, Maui, and the island of Hawaii. As the time that critical habitat was designated in 2003, this species was known from Kauai, Molokai, Maui, and Hawaii; there was 1 known occurrence of 20 individuals on Hawai`i Loa Ridge on Oahu (Federal Register, 2012). In 2008, fewer than 100 wild individuals were known, with the remaining Oahu population consisting of four mature and 10 immature individuals (USFWS, 2009b).

Diellia erecta is typically found on moderate to steep gulch slopes or sparsely vegetated rock faces, in lowland mesic forests at elevations between 210 and 1,590 meters (700 and 5,200 feet); most populations occur in remote and highly fragmented native communities. Associated plant species include *pilo* (*Coprosma* sp.), *Dodonaea viscosa* (*aalii*), *Dryopteris unidentata*, *kolea* (*Myrsine* sp.), *kopiko* (*Psychotria* sp.), *halapepe* (*Pleomele auwahiensis*), *ohia ha* (*Syzygium sandwicensis*), and *akia* (*Wikstroemia* sp.) (USFWS, 2009b). The major threats to *Diellia erecta* are habitat degradation by pigs, goats, and cattle; competition with alien plant species; and random naturally occurring events causing extinction due to the small number of existing individuals (USFWS, 2009b).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Diellia erecta*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Diellia erecta*.

Effects Determination

The proposed action is expected to have **No Effect** on *Diellia erecta*.

4.17 *Nanu* (*Gardenia mannii*)

Gardenia mannii was listed as endangered in October 1994. The original recovery plan was approved in 1998; a five-year review was most recently completed in 2013 (USFWS, 2013c). Critical habitat was designated for this species in 2003 and 2012; Lowland Wet Unit 16 is located in the upper-most slopes of the Ala Wai watershed (Federal Register, 2012).

Gardenia mannii is a tree species that is endemic to Oahu, and was historically known from 7 widely scattered occurrences in the Wai`anae Mountains and 39 occurrences distributed along the length of the Ko`olau Mountains of Oahu (Federal Register, 2003). At the time of listing, there were 27 known populations with a total of 70-100 individuals, with only 3 populations having at least 25 mature individuals (USFWS, 1998b). By 2003, there were 49 occurrences in both the Wai`anae and Ko`olau Mountains, totaling between 69 and 80 individuals (USFWS, 2012b). As of the last 5-review in 2013, a total of 96 individuals are known, a decline from the approximately 110 individuals reported in the previous 5-year review (USFWS, 2013c).

This species is usually found on moderate to moderately steep gulch slopes between 300 and 750 meters (980 and 2,460 feet) in elevation. It typically occurs with other native mesic or wet forest species, with species including ohia, alaa, koa, and uluhe. Other associated plants include *kalia*, *hoio* (*Diplazium sandwichianum*), *alani*, *hoawa*, *ohe mauka* (*Tetraplasandra oahuensis*), *hame*, *kanawao*, *pilo*, *kawau*, *maile* (*Alyxia oliviformia*), and *kopiko* (USFWS, 1998b).

The major threats to *Gardenia mannii* are habitat degradation and/or destruction by feral pigs; potential impacts from military activities; competition with nonnative plant species; fire; and risk of extinction from random environmental events and/or reduced reproductive vigor due to the widely dispersed, small number of remaining individuals.

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Gardenia mannii*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Gardenia mannii*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Gardenia mannii*.

4.18 No Common Name (*Gouania meyenii*)

Gouania meyenii was listed as endangered in October 1991. The original recovery plan was approved in 1998; a five-year review was most recently conducted in 2010 (USFWS, 2010a). Critical habitat was

designated for this species in 2003 and 2012; Lowland Dry Unit 16 is located on the slopes of Diamond Head within the Ala Wai watershed (Federal Register, 2012).

Gouania meyenii is a short-lived perennial shrub that was historically known from the Wai`anae Mountains; it was also recorded from Diamond Head in 1831. Currently, on Oahu, this species is found on Kamaileunu Ridge and Makaha-Wai`anae Kai Ridge; as of 2009, there are believed to be a total of 20-40 individuals (USFWS, 2010a).

This species typically grows on rocky ledges, cliff faces, and ridge tops in dry shrubland or *ohia* lowland mesic forest at an elevation of 580 to 820 meters (1,900 to 2,700 feet). Associated plants include *aalii*, *akoko*, *kopiko*, *manono*, *alani*, *olopua*, *kookoolau*, *Carex meyenii*, *lama*, *kolokolo kuahiwi*, and *Senna gaudichaudii* (*kolomona*) (USFWS, 1998b).

The major threats to *Gouania meyenii* are competition from alien plants, fire, habitat degradation by feral pigs and goats, and the small number of remaining populations (USFWS, 2010a).

Potential to Occur in the Action Area

The only portion of the watershed that has suitable habitat that could support this species occurs on the slopes of Diamond Head; the species was documented in this area in 1831 and critical habitat has since been designated. The proposed project does not involve any work on or near the slopes of Diamond Head, and no portion of the project otherwise supports suitable habitat for *Gouania meyenii*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Gouania meyenii*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Gouania meyenii*.

4.19 *Wawae iole* (*Huperzia nutans*)

Huperzia nutans (formerly *Phlegmariurus nutans*) (*wawae iole*) was listed as endangered in March 1994. The original recovery plan was approved in 1998; a five-year review was most recently completed in 2013 (USFWS, 2013d). Critical habitat was designated for this species in 2003 and 2012; Lowland Wet Unit 16 is located in the upper-most slopes of the Ala Wai watershed, but is unoccupied (Federal Register, 2012).

Huperzia nutans is a short-lived fern ally, historically known from Kauai and Oahu. At the time critical habitat was designated in 2003, there were 3 occurrences containing 7 individuals in the Ko`olau Mountains of Oahu (Kaukonahua Ridge, Kaukonahua Gulch, and along Waikane-Schofield Trail). The most recent survey data found 5 small fragmented populations with a total of 11 individuals (USFWS, 2013d).

This species grows on tree trunks, usually on open ridges and slopes in *ohia*-dominated wet forests and occasionally mesic forests between 600 and 1,070 meters (2,000 and 3,500 feet) in elevation. Commonly occurring native species in these areas typically include *kanawao*, *kopiko*, *uluhe*, *uki*, *kokio*, *keokeo*, and *hame* (USFWS, 1998b).

The primary threat to *Huperzia nutans* is extinction due to naturally-occurring events and/or reduced reproductive vigor due to the limited distribution and small number of remaining individuals. Additional threats to the species are feral pigs and the noxious alien plants.

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Huperzia nutans*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Huperzia nutans*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Huperzia nutans*.

4.20 No Common Name (*Lobelia oahuensis*)

Lobelia oahuensis was listed as endangered in March 1994. The original recovery plan was approved in 1998; a five-year review was most recently conducted in 2011 (USFWS, 2011d). Critical habitat was designated for this species in 2003 and 2012; Lowland Wet Unit 16 is located in the upper-most slopes of the Ala Wai watershed, but is unoccupied (Federal Register, 2012).

Lobelia oahuensis is a short-lived shrub that was historically known from Kahana Ridge, Kipapa Gulch, and the southeastern Ko`olau Mountains of Oahu (from Waikane and Halawa to Mount Olympus and the summit ridges above Kuliouou and Waimanalo) (Federal Register, 2012). At the time of listing, there were approximately 100-200 individuals; as of 2011, there were approximately 48 to 68 individuals of *Lobelia oahuensis* known from seven or eight locations.

The species occurs on summit cliffs in cloud-swept wet forests or in areas of low-shrub cover that are frequently exposed to heavy wind and rain. Associated plants include *akia*, *kanawao*, *manono*, *hapuu*, *ohia*, *uluhe*, *pilo*, *uki*, *olapa* (*Cheirodendron trigynum*), *naenae pua melemele* (*Dubautia laxa*), and *Labordia hosakana* (*kamakahala*).

The primary threats to *Lobelia oahuensis* are competition with nonnative plant species, and habitat degradation by feral pigs, predation by rats and slugs, and a risk of extinction from naturally-occurring events and/or reduced reproductive vigor due to the small remaining population size (Federal Register, 2012).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the habitat conditions or native species that are typically associated with *Lobelia oahuensis*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Lobelia oahuensis*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Lobelia oahuensis*.

4.21 *Ihi ihi* (*Marsilea villosa*)

Marsilea villosa (*ihihi*) was listed as endangered in June 1992. The original recovery plan was approved in 1996; a five-year review was most recently completed in 2011 (USFWS, 2011e). Critical habitat was designated for this species in 2003 and 2012; Lowland Dry Unit 7 is within the Ala Wai watershed, but is unoccupied (Federal Register, 2012).

Lobelia oahuensis is an endemic fern that was historically known from Oahu, Molokai and Niihau; populations on Oahu were reported from Kokohead, Lualualei, Ewa Plains, Nuuanu Valley, Palolo Valley and Makapuu. There were previously 11 populations documented across the islands, but as of 2010, only 6 populations are believed to be remaining. On Oahu, these include naturally occurring populations at Kokohead and Lualualei, and planted populations at Makapuu and Hanauma Bay (USFWS, 1996).

Marsilea villosa typically grows in cinder craters, vernal pools, mud flats, or lowland grasslands. It is found in areas that periodically flood, such as small depressions with clay soils; it requires standing water and drying to complete its life cycle. It can withstand shade, but is most vigorous in open areas.

The main reason for the decline of *Marsilea villosa* on Oahu is habitat degradation and destruction of natural hydrology. The greatest immediate threats to the survival of this species are encroachment and competition from naturalized, nonnative plants; continued development and habitat degradation; fire; small population size; and fragmentation, trampling, and other impacts from humans and introduced mammals (USFWS, 2011e).

Potential to Occur in the Action Area

The action area is generally comprised of either densely vegetated non-native riparian/forest habitat (such as that associated with the upper watershed detention basins), or developed areas (such as that associated with the multi-purpose detention basins and floodwalls). No portion of the action area supports regularly flooded depressional features. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Marsilea villosa*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Marsilea villosa*.

4.22 No Common Name (*Pteris lidgatei*)

Pteris lidgatei was listed as endangered in September 1994. The original recovery plan was approved in 1998; a five-year review was most recently completed in 2014 (USFWS, 2014b). Critical habitat was designated for this species in 2003 and 2012; Lowland Wet Unit 16 is located in the upper-most slopes of the Ala Wai watershed, but is unoccupied (USFWS, 2012b).

Lobelia oahuensis is a short-lived terrestrial fern that was historically known from Oahu, Molokai, and Maui. At the time of listing, there were 7 populations with 33 individuals on Oahu and Maui, with Oahu populations located at Kawaliki Stream, North Waimano Gulch (two populations), Kawainui Drainage, and S. Kaukonahua Gulch (USFWS, 1998c). As of 2014, only a total of 18 individuals remain (USFWS, 2014b).

This species is found in lowland wet forest habitats, at elevations ranging from 530 to 910 meters (1,750 to 3,000 feet). It typically occurs on streambanks and near waterfalls with mosses and other species of ferns. Ohia is the dominant native overstory tree species (USFWS, 2014b).

The primary threats to *Pteris lidgatei* are competition with non-native plant species; habitat destruction by feral pigs; slug herbivory; landslides and flooding; and a risk of extinction from naturally occurring events and/ or reduced reproductive vigor due to the small number of remaining individuals (USFWS 1998b; USFWS, 2014b).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Pteris lidgatei*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the upper portions of the watershed, but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Pteris lidgatei*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Pteris lidgatei*.

4.23 No Common Name (*Schiedea nuttallii*)

Schiedea nuttallii was listed as endangered in October 1996. The original recovery plan was approved in 1999; a five-year review was most recently completed in 2013 (USFWS, 2013e). Critical habitat was designated for this species in 2003 and 2012; no designated critical habitat occurs within the Ala Wai watershed (Federal Register, 2012).

Schiedea nuttallii is a short-lived shrub that was historically known from Kauai, Oahu, Molokai, and Maui. At the time of listing, there were approximately 75 wild individuals. As of 1996, there were a total of 40-100 individuals; locations on Oahu include Kahanahaiki Valley on the Army's Makua Military Reservation, Pahole Natural Area Reserve, and Ekahanui Gulch in the Honouliuli Preserve. Since that time, the total number of wild individuals has decreased to a total of 11, but approximately 225 individuals exist in outplanted populations.

Schiedea nuttallii on Oahu typically grows on steep rock walls and forested slopes in *Acacia koa-Metrosideros polymorpha* lowland mesic forest and *Metrosideros polymorpha-Dodonaea viscosa* forest at elevations between 436 and 1,185 m (1,430 and 3,887 feet). Associated plants include *hame*, *kopiko*, *olomea*, *papala kepau*, and *Hedyotis acuminata* (USFWS, 1999).

Schiedea nuttalii on Oahu is threatened by competition with nonnative plant species; predation by the black twig borer, slugs, and snails; habitat degradation by feral pigs; and a risk of extinction from naturally occurring events (e.g., landslides) and/or reduced reproductive vigor due to the small number of individuals (USFWS, 1999).

Potential to Occur in the Action Area

The upper-most extent of the action area is comprised of the detention basin measure locations along Waihi, Waiakeakua, Pukele and Waiomao Streams. These sites are located near the urban-conservation interface at elevations generally ranging between 300-400 feet, and are dominated by non-native vegetation; none of the sites support the native species that are typically associated with *Schiedea nuttallii*.

As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

No critical habitat has been designated for this species within the Ala Wai watershed.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Schiedea nuttallii*.

Effects Determination

The proposed action is expected to have **No Effect** on *Schiedea nuttallii*.

4.24 No Common Name (*Spermolepis hawaiiensis*)

Spermolepis hawaiiensis was listed as endangered in November 1994. The original recovery plan was approved in 1999; a five-year review was most recently completed in 2010 (USFWS, 2010b). Critical habitat was designated for this species in 2003 and 2012; Lowland Dry Unit 6 and 7 is within the Ala Wai watershed (Federal Register, 2012).

Spermolepis hawaiiensis is an endemic herb that was historically known from Waimea on Kauai, Kokohead on Oahu, Paomai and Kahinahina on Lanai and Apua on Hawai`i (USFWS, 1999). At the time critical habitat was designated in 2003, there were 6 occurrences totaling between 110 and 910 individuals in the Wai`anae and Ko`olau Mountains (Diamond Head). As of 2012, the number of individuals ranged between several hundred to thousands of individuals, depending on annual weather conditions (Federal Register, 2012).

Spermolepis hawaiiensis on Oahu typically grows on steep to vertical cliffs or at the base of cliffs and ridges in coastal dry cliff vegetation at elevations of 25 to 839 m (82 to 2,752 ft). Associated native plant species include *Artemisia australis*, *Bidens* sp., *Dodonaea viscosa*, *Doryopteris* sp., *Heteropogon contortus*, *Santalum ellipticum*, or *Waltheria indica*.

The primary threats to *Spermolepis hawaiiensis* on Oahu are habitat degradation by feral goats; competition with nonnative plant species; and habitat destruction and death of plants due to erosion, landslides, and rock slides resulting from natural weathering (USFWS, 1999).

Potential to Occur in the Action Area

The only portion of the watershed that has suitable habitat that could support this species occurs on the slopes of Diamond Head. The proposed project does not involve any work on or near the slopes of Diamond Head, and no portion of the project otherwise supports suitable habitat for *Spermolepis hawaiiensis*. As such, suitable habitat is not present and this species is not expected to not have the potential to occur within the action area.

Critical habitat for this species is located in the watershed (surrounding Diamond Head), but does not overlap with the action area.

Potential Effects of the Proposed Action

The proposed action is not expected to directly or indirectly affect *Spermolepis hawaiiensis*, or critical habitat designated for this species.

Effects Determination

The proposed action is expected to have **No Effect** on *Spermolepis hawaiiensis*.

5.0 EFFECTS DETERMINATION

Based on the information presented in Section 4.0, the effects determinations for the species addressed in this BA are summarized in Table 5. As no critical habitat occurs within the action area, there will be no effect on any critical habitat. As previously noted, species that are restricted to the marine environment do not occur within the action area, such that the proposed project would have no effect on these species.

TABLE 5
Summary of Effects Determination

Common Name	Scientific Name	Potential to Occur in Action Area	Potential Effects	Effects Determination
Hawaiian hoary bat	*Lasiurus cinereus semotus*	Possibly (though unlikely); bats could roost in the forested portions of the action area	Harm/harassment as a result of clearing and construction, but potential impacts to be minimized with seasonal restrictions on tree clearing	May affect, but not likely to adversely affect
Hawaiian monk seal	*Monachus schauinslandi*	No; no marine or coastal habitat present within action area	None	No Effect
Oahu `elepaio	*Chasiempis sandwichensis ibidis*	Unlikely given the current distribution (although birds could possibly reoccupy habitat)	Harm/harassment as a result of clearing and construction, but potential impacts to be minimized with seasonal restrictions on vegetation clearing	May affect, but not likely to adversely affect
Hawaiian coot	*Fulica alai*	Unlikely given the minimal extent/quality of habitat and current species distribution	Temporary disturbance during construction; short-term habitat increase (and attractive nuisance) during flood events	May affect, but not likely to adversely affect
Hawaiian stilt	*Himantopus mexicanus knudseni*	Unlikely given the minimal extent/quality of habitat and current species distribution	Temporary disturbance during construction; short-term habitat increase (and attractive nuisance) during flood events	May affect, but not likely to adversely affect
Hawaiian duck	*Anas wyvilliana*	No; not expected given the extent of habitat disturbance and current species distribution	None	No Effect
Hawaiian common moorhen	*Gallinula chloropus sandvicensis*	Unlikely given the minimal extent/quality of habitat and current species distribution	Temporary disturbance during construction; short-term habitat increase (and attractive nuisance) during flood events	May affect, but not likely to adversely affect
Blackline Hawaiian damselfly	*Megalagrion nigrohamatum nigrolineatum*	~~No; outside known range~~Individuals and potential breeding habitat has been observed within and near the proposed	~~None~~A "take" of the species is likely due to construction and maintenance activities.	~~No Effect~~May affect, and is likely to adversely affect
Crimson Hawaiian damselfly	*Megalagrion leptodemas*	No; outside known range	None	No Effect
Oceanic Hawaiian damselfly	*Megalagrion oceanicum*	No; outside known range	None	No Effect
Orangeblack Hawaiian damselfly	*Megalagrion xanthomelas*	No; outside known range	None	No Effect
Oahu tree snail	*Achatinella* sp.	No; no suitable habitat, and outside known range	None	No Effect
Haha	*Cyanea acuminata*	No; no suitable habitat, and outside known range	None	No Effect
Haha	*Cyanea crispa*	No; no suitable habitat, and outside known range	None	No Effect
Haha	*Cyanea koolauensis*	No; no suitable habitat, and outside known range	None	No Effect
No Common Name	*Diellia erecta*	No; no suitable habitat, and outside known range	None	No Effect

Common Name	Scientific Name	Potential to Occur in Action Area	Potential Effects	Effects Determination
Nanu	*Gardenia mannii*	No; no suitable habitat, and outside known range	None	No Effect
No Common Name	*Gouania meyenii*	No; no suitable habitat, and outside known range	None	No Effect
Wawae iole	*Huperzia nutans*	No; no suitable habitat, and outside known range	None	No Effect
No Common Name	*Lobelia oahuensis*	No; no suitable habitat, and outside known range	None	No Effect
Ihi ihi	*Marsilea villosa*	No; no suitable habitat, and outside known range	None	No Effect
No Common Name	*Pteris lidgatei*	No; no suitable habitat, and outside known range	None	No Effect
No Common Name	*Schiedea nuttallii*	No; no suitable habitat, and outside known range	None	No Effect
No Common Name	*Spermolepis hawaiiensis*	No; no suitable habitat, and outside known range	None	No Effect

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Biological Opinion and Informal Consultation of the U.S. Fish and Wildlife Service for the Proposed Construction, Operation, and Maintenance of the Ala Wai Canal Project, Island of O‘ahu

Photo Credit: Dan Polhemus

August 12, 2016
(01EPIF00-2016-F-0157)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai‘i 96850

In Reply Refer To:
01EPIF00-2016-F-0157

Mr. Anthony J. Paresa, P.E.
Deputy District Engineer
Programs and Project Management Division
Department of the Army
Honolulu District
U.S. Army Corps of Engineers
Fort Shafter, Hawai‘i 96858-5440

Subject: Biological Opinion and Informal Consultation for the Proposed Construction, Operation, and Maintenance of the Ala Wai Canal Project, Island of O‘ahu

Dear Mr. Anthony J. Paresa, P.E:

This document transmits the U.S. Fish and Wildlife Service’s (Service) biological opinion based on our review of the proposed Ala Wai Canal Project, located within the Ala Wai watershed, on the island of O‘ahu, and its effects on the federally endangered blackline Hawaiian damselfly (*Megalagrion nigrohamatum nigrolineatum*) in accordance with section 7 of the Endangered Species Act of 1973 as amended (ESA) (16 U.S.C. 1531 *et seq*.). Your January 11, 2016, request for formal consultation was received on January 13, 3016.

A separate informal consultation is found in Appendix A for project impacts that may affect but are not likely to adversely affect the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), O‘ahu ‘elepaio (*Chasiempis ibidis*), Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian common gallinule (*Gallinula chloropus sandvicensis*), and the Hawaiian duck (*Anas wyvilliana*). The U.S. Army Corps of Engineers, Honolulu District (USACE) made a no-effect determination for project impacts to the federally endangered crimson Hawaiian damselfly (*Megalagrion leptodemas*), oceanic Hawaiian damselfly (*Megalagrion oceanicum*), orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*), O‘ahu tree snails (*Achatinella* sp.), hāhā (*Cyanea acuminata*), hāhā (*Cyanea crispa*), hāhā (*Cyanea koolauensis*), *Diellia erecta*, nānū (*Gardenia mannii*), *Gouania meyenii*, wāwae ‘iole (*Huperzia nutans*), *Lobelia oahuensis*, ‘lhi‘ihi (*Marsilea villosa*), *Pteris lidgatei*, *Schiedea nuttallii*, and *Spermolepis hawaiiensis*.

This biological opinion is based on information provided in the March 2016 Revised Biological Assessment (BA) of Threatened and Endangered Species for the Ala Wai Canal Project, the December 2015 BA of Threatened and Endangered Species for the Ala Wai Canal Project, the

August 24, 2015 Draft Feasibility Study with Integrated Environmental Impact Statement for the Ala Wai Canal Project, and other information available to us. A complete administrative record of this consultation is on file in our office.

CONSULTATION HISTORY

May 16, 2008 – The Service provided a species list (2008-SL-0187) to the USACE for the proposed Ala Wai Canal Project Watershed Plan.

October 14, 2014 – The USACE (Athlene M. Clark) coordinated an Ala Wai Resource Agency Meeting with the State of Hawai‘i, U.S. Environmental Protection Agency, the Service and USACE’s consultants to discuss the tentatively selected plan for the Ala Wai Canal study; provide the background on the approach to assessing any compensatory mitigation requirements through the Hawai‘i Stream HEP Model approach; get concurrence on any required ESA consultation; and discuss the next steps for a Fish and Wildlife Coordination Act (FWCA) 2b report. The Service advised the USACE that the 2008 species list was still considered valid, that a new species list does not need to be generated, that several species of Hawaiian damselfly (*Megalagrion* spp.) were federally listed in 2012 and should also be considered; in particular, a population of blackline Hawaiian damselfly was known from the upper reaches of Mānoa Stream.

February 23, 2015 – The USACE emailed the draft BA for the Ala Wai Canal Study and requested review and input regarding ESA species information, and advised the Service that they were still waiting on information on the presence or absence of damselfly species to be input into the draft BA.

May 26, 2015 – The USACE coordinated a meeting to discuss schedules and work needed before the Public Release of the Draft Feasibility Study/Environmental Impact Statement (EIS) for the Ala Wai Canal Project. The primary objective was to coordinate the Feasibility Study/EIS Report process with the Service. The USACE (Steve Johnson, new acting Project Manager) explained that a BA had been drafted, but damselfly information was still needed before the documentation could be finalized. The USACE’s consultant noted a preliminary draft had previously been sent to the Service for input. The Service stated the review of the preliminary draft would focus on recommendations for avoidance and minimization measures to listed species (damselflies, Hawaiian hoary bats, and Hawaiian waterbirds). The USACE noted that the Service was funded in April 2015 to complete the FWCA Draft Coordination Report, including damselfly surveys in the upper portions of the watershed.

June 16, 2015 – The Service provided technical assistance for the draft BA and recommended the USACE to include measures to reduce the spread of invasive species as a result of their project.

June 29, 2015 – Follow-up meeting with resource agencies to discuss contaminated sediments and project planning documents.

September 30, 2015 – The Service received the Draft Feasibility Study with Integrated EIS for the Ala Wai Canal Project and returned comments on November 9, 2015.

December 18, 2015 – A meeting was held with resource agencies to discuss the draft FWCA report, concerns regarding contaminants, proposed January surveys for blackline Hawaiian damselflies within the Waiakeakua stream action area, and timing of ESA section 7 consultation. The Service stated they would wait for the USACE request letter to start the process for section 7 consultation.

January 13, 2016 – The Service received the January 11, 2016 USACE letter request for informal and formal consultation and associated BA, which included a likely to adversely affect determination at Waihī Stream for the blackline Hawaiian damselfly.

February 11, 2016 – The Service, USACE, and the State of Hawai‘i Department of Land and Natural Resources (DLNR) – Division of Aquatic Resources (DAR) conducted a site visit and survey and to document the presence or absence of the blackline Hawaiian damselfly within the Waiakeakua Stream.

February 18, 2016 – The Service requested the BA be updated to include the revised project description based on the presence of the blackline Hawaiian Damselfly at the proposed Waiakeakua Stream Debris and Detention Basin location and a discussion of proposed project mitigation measures to avoid and minimize adverse effects to the species. Additionally based on additional information within the project action areas, the Service recommended the Hawaiian duck be incorporated into the USACE analysis that the proposed project may affect, but was not likely to adversely affect, the Hawaiian duck.

February 26, 2016 – The Service had a meeting with the USACE to present appropriate FWCA mitigation to address the loss of riffle and pool habitat and indirect impacts to coral reef resources due to sedimentation. The Service reminded the USACE there were additional damselflies found within the Waiakeakua project area. FWCA mitigation was proposed to conduct mitigation work at Falls 7 and 8 to assist native species to migrate upstream. The proposal was accepted on the condition that the City and County of Honolulu plan to repair Fall 6.

March 30, 2016 – The USACE submitted a revised BA and Formal consultation was initiated.

June 22, 2016 – The USACE notified the Service that they would be submitting revised drawings of the Waihī and Waiakeakua Debris and Detention Basin footprints. The design changes would change the original project footprints. The revised structures would be increased slightly in size and change in shape to increase the amount of water to be temporarily impounded and include rip rap for scour protection on the downstream end.

June 30, 2016 – The USACE submitted the revised footprints for the Waihī and Waiakeakua basins and the revised drawings for the structures based on the refinements for the entire project and the drawings that depict the structure for each. The drawing set included changes to other features that would also change previous information for the FWCA.

July 18, 2016 – The USACE and the Service met via teleconference to discuss the new proposed changes to the construction footprint. The Service notified the USACE that any major changes in the project description could change the analysis portion of the opinion and may delay the timeline. The USACE submitted changes to the basin designs. Changes included the magnitude of impacts from the project, but not changes in location.

DESCRIPTION OF THE PROPOSED ACTION

History and Background

The State of Hawai‘i DLNR and the USACE conducted a feasibility study for the Ala Wai Canal Project (Project) to restore and manage for flood control within the Ala Wai watershed, in Honolulu, on the island of O‘ahu. The watershed is comprised of approximately 19 square miles (12,064 acres) on the southeastern side of the island of O‘ahu in the State of Hawai‘i (Figure 1).

A high risk of flooding exists within the Ala Wai watershed due to aging and undersized flood conveyance infrastructure. Based on the peak flows computed for the feasibility study, it was estimated that the Ala Wai Canal (Canal) has the capacity to contain about a 20- to 10-percent annual chance exceedance (ACE) flood before overtopping the banks. The risk of flooding is exacerbated by the flashy nature of the streams in the watershed, with heavy rains flowing downstream extremely quickly due to steep topography and relatively short stream systems (USACE 2016, p. 1).

Overtopping of the Canal has previously flooded Waikīkī multiple times, including during the November 1965 and December 1967 storms and during the passage of Hurricane Iniki in 1992. Upstream areas are also at risk of flooding, as demonstrated by several recent events, including the October 2004 storm that flooded Mānoa Valley and the March 2006 storm that flooded Makiki. The October 2004 event was estimated to have a 4-percent chance of occurring in any single year, and caused more than $85 million in damages (USACE 2006, p. 1). Multiple other past flood events have been documented within the watershed over the course of the past century (USACE 2016, p. 1). In addition to recorded property damages, flooding events in the Ala Wai have contributed to health and safety risks, including two known deaths (associated with flooding in December 1918 and December 1950) (USACE 2006 as cited in USACE 2016, p. 1).

Analyses conducted in support of this project show that the 1-percent ACE floodplain extends over approximately 1,358 acres of the watershed. Within this area, the affected population is comprised of approximately 54,000 residents plus an additional estimated 79,000 visitors in Waikīkī on any given day. In addition to threatening the safety of both residents and visitors, a major flood event could result in catastrophic damages to structures and property throughout the watershed, with impacts to Waikīkī crippling the local economy. Modeling results indicate the 1-percent ACE flood would result in damages to more than 3,000 structures, with approximately $723 million in structural damages alone (2013 price levels) (USACE 2016, p. 1).

In response to a request from DLNR, the reconnaissance phase of the Ala Wai Canal Project was initiated in April 1999. At that time, Federal, State, and local agencies sought a comprehensive management and restoration plan to restore aquatic habitat and biological diversity in the Canal and upstream tributaries. The reconnaissance report was submitted in August 1999 and

recommended that the USACE assist the State with restoration of the Canal. Approval by the USACE for continuation into the feasibility phase was granted in September 1999.

Independently, the Ala Wai Flood Study was initiated in September 1998 under the Planning Assistance to States (PAS) Program (Section 22 of the Water Resources Development Act of 1974) to determine the potential flood risk to the Waikīkī area, in response to a request by the Land Division of DLNR. The study was completed in October 2001 and documented a high flood hazard associated with potential overtopping of the Ala Wai Canal. This study identified several measures and conceptual alternatives that could potentially minimize flood damage to Waikīkī and surrounding areas. The results of the technical study were used to establish that the USACE could be involved in the investigation of flood damage reduction in the Canal. As a result, a flood risk management objective was added to the Ala Wai Canal Project, thus expanding the project focus to both ecosystem restoration and flood risk management in the Canal area.

The Feasibility Cost Sharing Agreement was executed between the USACE and the non-Federal sponsor, DLNR Engineering Division, in 2001. The feasibility phase of the project was initiated in July 2002, and an EIS scoping meeting was held in June 2004. Subsequently, in October 2004, heavy rains caused Mānoa Stream to overtop its banks, resulting in significant damages. In response, the USACE temporarily ceased work on the feasibility study so that the project could be expanded to include the upstream portions of the Ala Wai watershed. While the cost-share agreement was being amended to address a more comprehensive scope, the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) received federal funds to identify specific actions to address flooding in Mānoa Valley. The Mānoa Watershed Project was initiated in 2006 and resulted in detailed topographic mapping, hydrologic and hydraulic modeling, and identification of potential measures to address specific flood problems. However, because of insufficient federal funding to complete the project, the Mānoa Watershed Project was terminated before implementation.

Information developed through the Mānoa Watershed Project was subsequently incorporated into the Ala Wai Canal Project, which was re-started in 2007. A second EIS scoping meeting was held in October 2008. Project-related efforts were primarily focused on bringing the technical information for the entire watershed up to the same level of detail as produced for Mānoa under the Mānoa Watershed Project.

Figure 1. Ala Wai Watershed, O‘ahu

In October 2012, a charrette was held to re-scope the project as part of the USACE Civil Works Planning Modernization process. The purpose of the charrette was to bring together the USACE project delivery team (PDT), Pacific Ocean Division and Headquarters staff, with the non-federal sponsor and other cooperating agencies, in order to determine the path forward for completing the feasibility study in compliance with current USACE planning requirements. Key outcomes of the charrette included consensus on the problems and opportunities, objectives and constraints, screening and decision criteria, the array of alternatives, and a framework for identification of the tentatively selected plan. Based on the project review at the charrette, ecosystem restoration was eliminated as a study objective, as it was determined that the biological resources within the watershed do not have enough national significance to adequately justify ecosystem restoration as an objective. However, the ecosystem-related information previously identified as part of the study is being incorporated as part of environmentally sustainable design considerations, particularly as related to maintaining in-stream habitat and migratory pathways for native aquatic species.

Mānoa Stream is a large stream in a bowl-like catchment, originating near 855 m (2800 ft) on the southwestern flank of Kōnāhuanui peak and adjacent ridgelines in the Koʻolau Mountains, and flows southwestwards for approximately 9.25 km (5.75 mi) to its terminus in the Ala Wai canal. The stream has two major branches, these being the Waihī on the west side of the basin, and the Waiakeakua on the east. The upper half of the Mānoa catchment lies in steep, forested terrain on the slopes of the Koʻolau Mountains, in a very wet area that receives up to 3850 mm (~151 in, or 12.6 ft) of rain annually at the headwaters of the Waihī branch, and 3550 mm (~140 in, or 12 ft) annually at the headwaters of the Waiakeakua branch (Giambelluca *et al*. 2013 as cited in Polhemus 2015, in litt.). The stream in its upper reaches flows in natural, unmodified channels for approximately 3.6 km (2.25 mi), being heavily shaded by a forest of introduced tree species intermixed with some native vegetation on the upper slopes. Below Paradise Park, the stream passes through suburban neighborhoods in a partially modified channel for about 1.6 km (1.0 mi). At the Mānoa District Park, near 50 m (160 ft) elevation the stream becomes confined within an artificial concrete channel, which continues downstream to the East Mānoa Road bridge. Downstream from this bridge the stream flows in a re-aligned but partially natural channel, mostly following the base of the steep eastern wall of Mānoa Valley. Downstream from Kānewai Park, at approximately 9 m (30 ft) elevation, the stream channel has been straightened, but not concrete-lined, and continues in this fashion for 2.25 km (1.4) miles, passing below the H-1 freeway and then continuing to its confluence with the Ala Wai Canal.

Project Description

The proposed Ala Wai Canal Project consists of a variety of structural and non-structural flood risk management measures, with a focus on the following approaches to flood risk management: (1) peak flow reduction, (2) increased channel capacity, (3) debris management, and (4) minimization of flood damage.

These measures included the following:

- Detention basin: This measure is an earthen structure that would allow high-frequency stream flows to pass, but would capture and delay larger volume stream flows, helping to reduce flood peaks. Detention basins may be located either within a stream channel or in an open space area directly adjacent to a stream/canal.

- The in-stream detention basins would be comprised of an earthen berm that extends perpendicularly across a stream channel that would, in combination with the natural topography, provide temporary containment of storm flows. The basins would not be designed to permanently contain water; they would include a natural-bottom arch culvert that would maintain passage of low flows and also allow the basin to completely drain into the stream as flood conditions subside. An emergency spillway would allow water to overflow the berm in the event the capacity of the detention basin is exceeded. Debris catchment structures would be incorporated as part of each measure, and would function to capture large in-stream debris. To facilitate safe operation and maintenance of each basin, the area surrounding the berm would be kept clear of woody vegetation.
- The off-stream detention basins would function similarly to the in-stream detention basins, but would be formed by construction of a berm around the perimeter of a nearby open space; stream flows would be directed into the detention basin (via a spillway along the stream bank), then would drain back into the stream.

- Debris catchment: As described above, the in-stream detention basins would include a debris catchment feature. In addition, the Tentatively Selected Plan also includes a stand-alone debris catchment structure, which would generally consist of a narrow concrete pad that would span the stream, with evenly-spaced steel posts. This structure would allow stream flows to pass, while functioning to block large debris as it flows downstream. Similar to the in-stream detention basins, the area surrounding the catchment structure would be kept clear of woody vegetation. The extent and duration of in-stream work would be minimized to the extent practicable.

The location of each proposed measure is shown in Figure 2; detailed design drawings of each measure are included in Appendix B. These specific measures and the approximate area of disturbance associated with each proposed location within the watershed is summarized in Table 1. Following construction, the proposed operation and maintenance required for each of the flood risk management measures will be operated and maintained by the non-federal sponsor and are summarized in Table 2. Each of the measures described below is assumed to have a life expectancy of 50 years, with maintenance performed on a routine basis.

Additionally, a Flood Warning System would be incorporated into the proposed project. Three real-time rain gauges (Mānoa, Makiki and Pālolo Streams) and one real-time streamflow or stage gauge (in Ala Wai Canal) would be installed as part of the flood warning system for the watershed. Locations of gauging stations are to be determined, but will be sited based on flood warning need, peak flow locations, and accessibility to site.

Based on the requirements of the Clean Water Act and the USACE planning regulations, and after consideration of avoidance and minimization measures, it was determined that FWCA compensatory mitigation would be required for unavoidable impacts to aquatic habitat resulting from implementation of the flood risk management measures. The USACE planning process requires that the FWCA mitigation requirement be based on functional habitat loss and quantified using a habitat-based methodology (i.e., ecosystem output model). As such, the

Hawai‘i Stream Habitat Equivalency Procedure (HSHEP) was used to quantify the loss of habitat function. Detailed stream surveys were conducted, with the resulting data processed according to the variables in the HSHEP model, as needed to quantify the habitat value of the existing and future without-project condition (in terms of habitat units [HUs]). Anticipated changes in the model variables were then defined for the with-project condition, and the modeling results were then compared to quantify the anticipated habitat loss (i.e., the mitigation requirement). Potential mitigation concepts that could be implemented to offset the anticipated loss of habitat quality were then identified, and were refined through an iterative process, in coordination with the resource agencies. The increase in habitat quality associated with each of the mitigation measures was quantified using the HSHEP model, and these results were used to combine the measures into different mitigation alternatives that could be implemented to compensate for the loss of habitat quality associated with the proposed project.

The selected mitigation alternative is comprised of two measures, both of which involve removal of a passage barrier for native aquatic species in Mānoa Stream (Falls 7 and Falls 8). The location of these measures is shown in Appendix C and described below. In each location, there is currently an in-stream structure where undercutting has resulted in an overhanging lip, which creates a passage barrier for native aquatic species. Specifically, the stream flow over these structures is free-falling and does not maintain contact with the surface of the structure, such that the native species do not have any means to migrate upstream. The proposed mitigation involves installation of grouted riprap as part of the existing in-stream structure to provide a suitable surface for migration of the native species to upstream habitat.

Proposed FWCA mitigation:

- Remove existing passage barriers: A combination of demolition/removal of existing concrete, and reconstruction with a boulder and/or riprap step-pool structure to create continuous water surface contact for fish passage.
    - Falls 7 (0.6 mile above Mānoa District Park)
    - Falls 8 (0.7 mile above Mānoa District Park)

Figure 2. Locations of proposed flood control measures for the Ala Wai Canal Project.

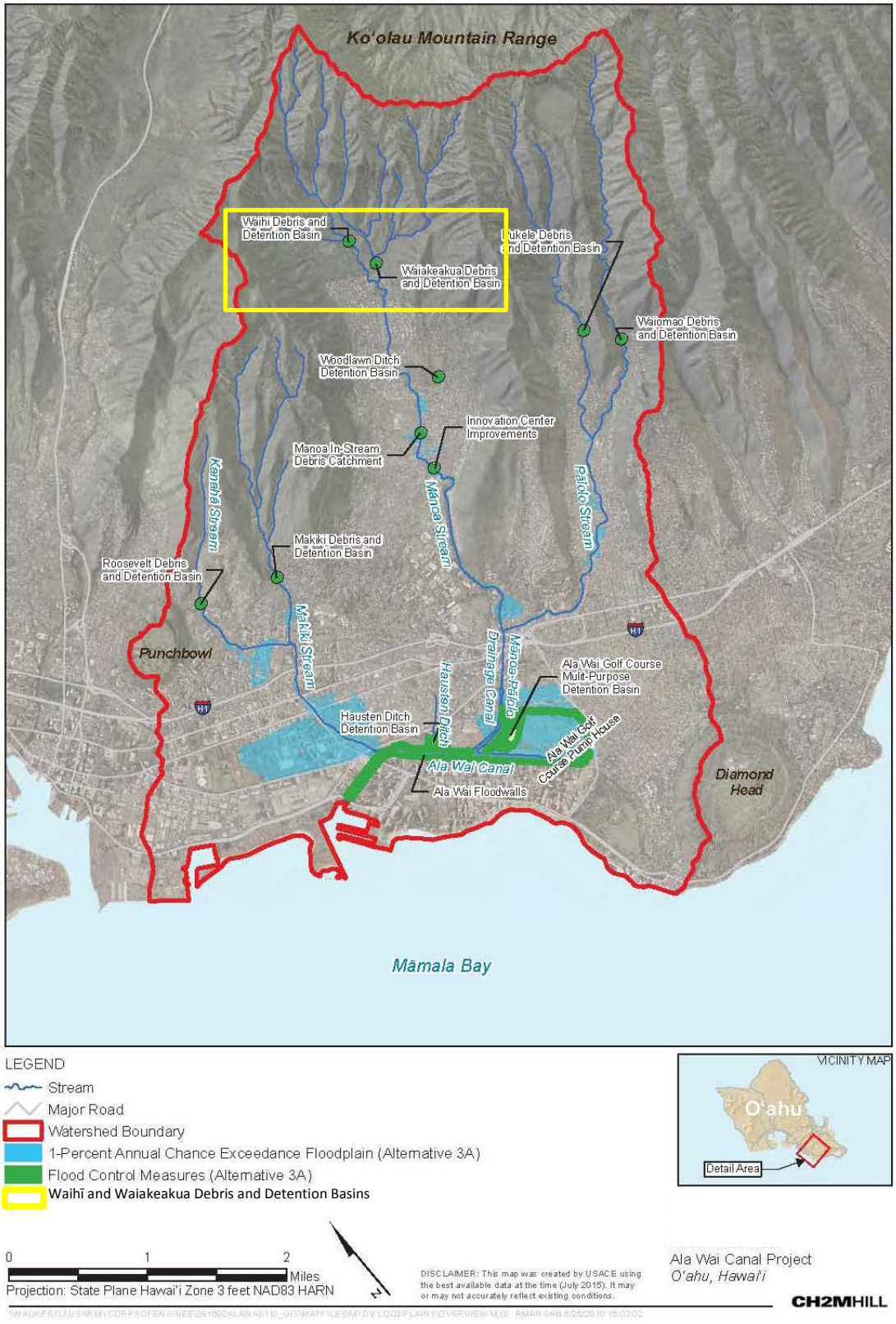


Table 1. Proposed Flood Risk Management Measures for the Ala Wai Canal Project.

Measure[1]	Description of Measure	Total Area of Disturbance		Permanent Structure Footprint		Temporary Disturbance (e.g., Staging) (ac)	Vegetation Management		Extent of Inundation (duration for 1% ACE)
		Total Area (ac)	Length of Steam (ft)	Total Area (ac)	Length of Steam (ft)		Total Area (ac)	Length of Steam (ft)	
Waihī Debris and Detention Basin	Earthen dam, approximately 37' high and 225' across; with a 12' x 6' box culvert to allow small storm flows to pass. Culvert length will be 205 ft. Construct a 124' wide concrete spillway above culvert with grouted riprap on the upstream and downstream side. Downstream side riprap scour protection will be approximately 150' linear length. Debris catchment feature located on upstream end of culvert. Create new access road for construction and operation and maintenance. A fence will be built along the access roads, and is meant to be a deterrent to prevent people from readily accessing the basin areas from nearby roadways but will not encompass the entire area. A 20-foot-wide area around the perimeter of the berm will be cleared and maintained. Construction footprint will be 35,000 ft^2.	1.5	335	0.8	335	0.1	0.3	40	1.35 acres inundated for up to 4.5 hours
Waihī Debris Catchment	Concrete pad, approximately 8' wide and 140' across; steel posts (up to approximately 7' high) evenly spaced 4' apart along a concrete pad.	0.3	48	0.07	8	0.1	0.2	40	None
Waiakeakua Debris and Detention Basin	Earthen dam, approximately 34' high and 185' across; with a 200' length arch culvert to allow small storm flows to pass. Construct a 105' wide concrete spillway above culvert with grouted riprap on upstream and downstream side. Downstream side of riprap will be approximately 150' linear length. Debris catchment feature to be located on upstream end of culvert, and energy dissipation structure (concrete blocks) to be located on downstream end of culvert. A fence will be built along the access roads, and is meant to be a deterrent to prevent people from	1.7	350	1.0	350	0.1	0.5	40	3.2 acres inundated for up to 9 hours

	readily accessing the basin areas from nearby roadways but will not encompass the entire area. A 20-foot-wide area around the perimeter of the berm will be cleared and maintained. Construction footprint will be approximately 41,620 ft^2.								
Waiakeakua Debris Catchment	Concrete pad, approximately 8' wide and 140' across; steel posts (up to approximately 7' high) evenly spaced 4' apart along a concrete pad.	0.2	48	0.03	8	0.1	0.2	40	None

NOTES:
[1] In addition to these structural measures, the proposed project would also include improvements to the existing flood warning system.
[2] Inundation area is the area behind the detention basin that is expected to be inundated during a 1-percent annual chance exceedance flood event.

Table 2. Proposed Operation and Maintenance Activities.

Measure Type	Summary of Operation and Maintenance Activities
Debris and Detention Basin	Cut/clear vegetation within cleared zoned (20 feet around perimeter of structures) twice a year, allowing no woody vegetation to grow in this area. Clear accumulated debris following flood event and annually.

NOTES:
[1]Debris and sediment cleared from the flood risk management measure locations would be disposed at an existing authorized location.

Conservation Measures to Avoid and Minimize Effects to Listed Species

- Construction activities within the stream channels would be limited to low-flow conditions. In addition to minimizing the extent of dewatering required, this would also serve to minimize the potential to disrupt migration of native aquatic species.
- Proper dewatering techniques would be implemented, as needed. For example, sand bags or a cofferdam could be used to isolate the work area and to concentrate upstream flows into a large diameter pipe. The pipe would extend downstream thus allowing the stream flow to bypass the construction area and maintain downstream flows.
- If needed, a pump would be used to dewater the construction area, once the pipe is effectively bypassing stream flows. The pump would be properly screened to preclude entrapment of fish, and the area would be adequately inspected to ensure no fish are stranded.
- Turbidity and siltation from project-related work will be minimized and contained to within the vicinity of the site through the appropriate use of silt containment devices.
- Phasing of project features will be implemented to the extent practicable to aid in the capture of silt that may be released when constructing other project features (e.g. a downstream basin could be constructed prior to an upstream basin to help capture sediments that could be released into the waterway during construction of the upstream basin).
- Exposed soil near water will be protected from erosion after exposure and stabilized as soon as practicable (e.g. hydroseeded with certified weed-free seed mixes)
- All project-related materials and equipment to be placed in the water shall be cleaned of pollutants prior to use.
- No project-related materials will be stockpiled in the water.
- All debris will be disposed of off-site at an approved disposal and/or composting site.
- Fueling of project-related vehicles and equipment will take place away from the water.
- A Spill Control Plan will be developed and implemented that will describe the procedures and equipment that will be used to stop, contain and clean up any accidental releases of petroleum and/or hazardous materials to the environment.
- All construction equipment, materials and vehicles arriving from outside the island of O‘ahu will be washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful non-invasive species before transportation to the project site; import of materials that are known or likely to contain seeds or propagules of invasive species will be prohibited.
- Offsite sources of revegetation materials (such as seed mixes) will be certified as weed-free or inspected before transport to the project area.

- All areas that are hydroseeded will be monitored for six months after hydroseeding to identify invasive plants that establish from seeds inadvertently introduced as part of the seed mix; all invasive plants identified within the hydroseeded area will be removed.
- At the end of the construction period, areas impacted by construction of the project will be surveyed to confirm that no problematic and/or invasive species had been introduced and become established. Appropriate remedial actions will be undertaken to facilitate containment or eradication of the target species as soon as reasonably possible.
- All project personnel will be briefed on ESA-listed species that could be present on the project site and on the protections afforded to these species under the ESA. This information will also be included in the USACE Operations and Maintenance Manual for the project for the use and reference by maintenance personnel.
- No attempt will be made by project personnel to feed, touch or otherwise intentionally interact with any ESA protected species. If a protected species is present in the vicinity of any active work area, they must be allowed to leave the area on their own accord before work in that area can resume.

ACTION AREA

The action area of a project is defined by regulation as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). The action area for this formal consultation is 49,870 feet^2 and 58,075 feet^2 of Waihī and Waiakeakua Streams, respectively, plus all areas of downstream habitat including side seeps and canopy from vegetation along stream corridors which support habitat for the blackline Hawaiian damselfly. This action area includes the proposed construction footprint (including all ground-disturbing activities, clearing, grading, vegetation trimming, staging, access roads, construction activities, operations and maintenance) as well as the installation of 150 feet of riprap that will preclude habitat and change the ecosystem downstream.

Figure 2. Waihī Debris and Detention Basin.

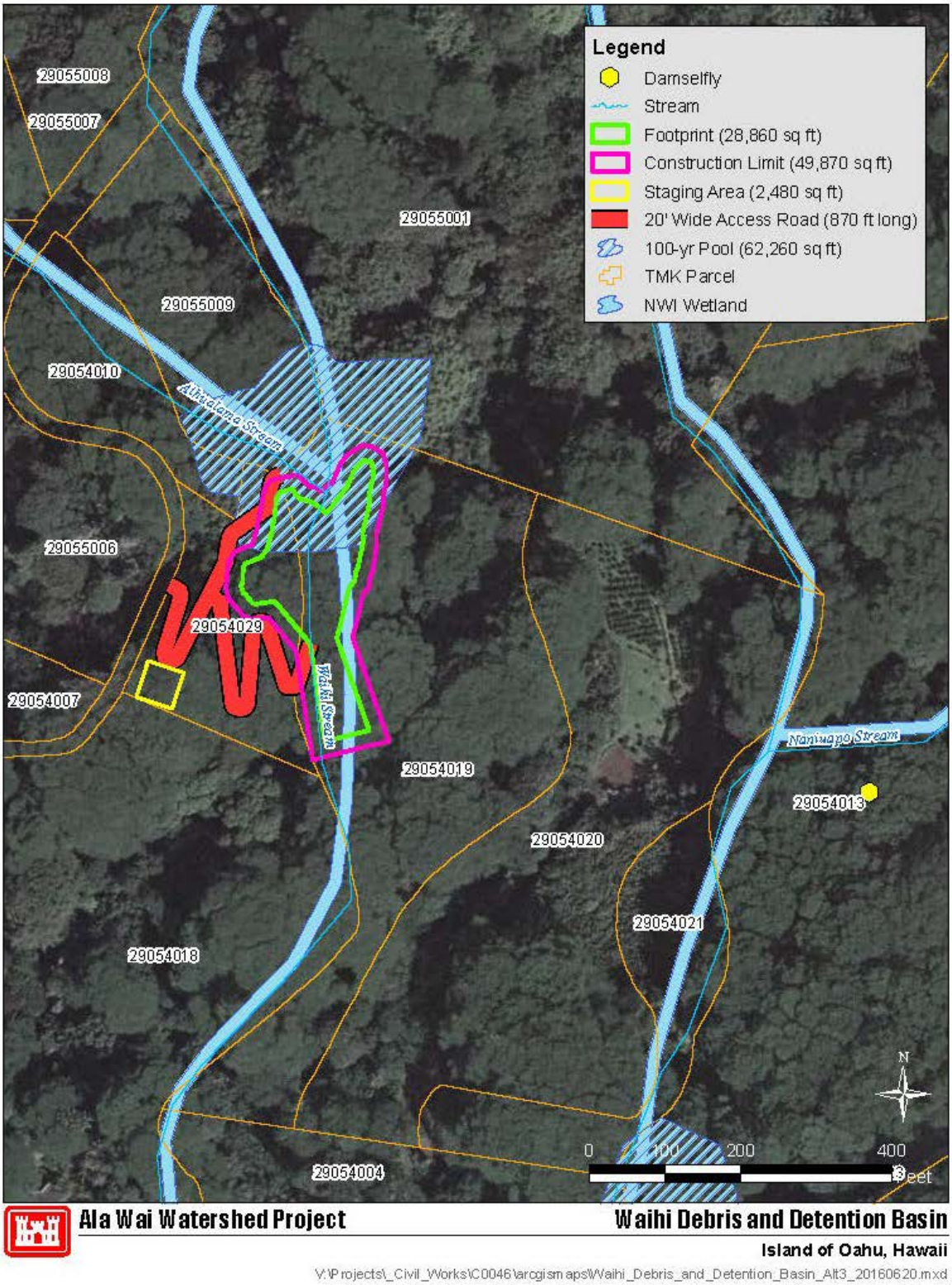
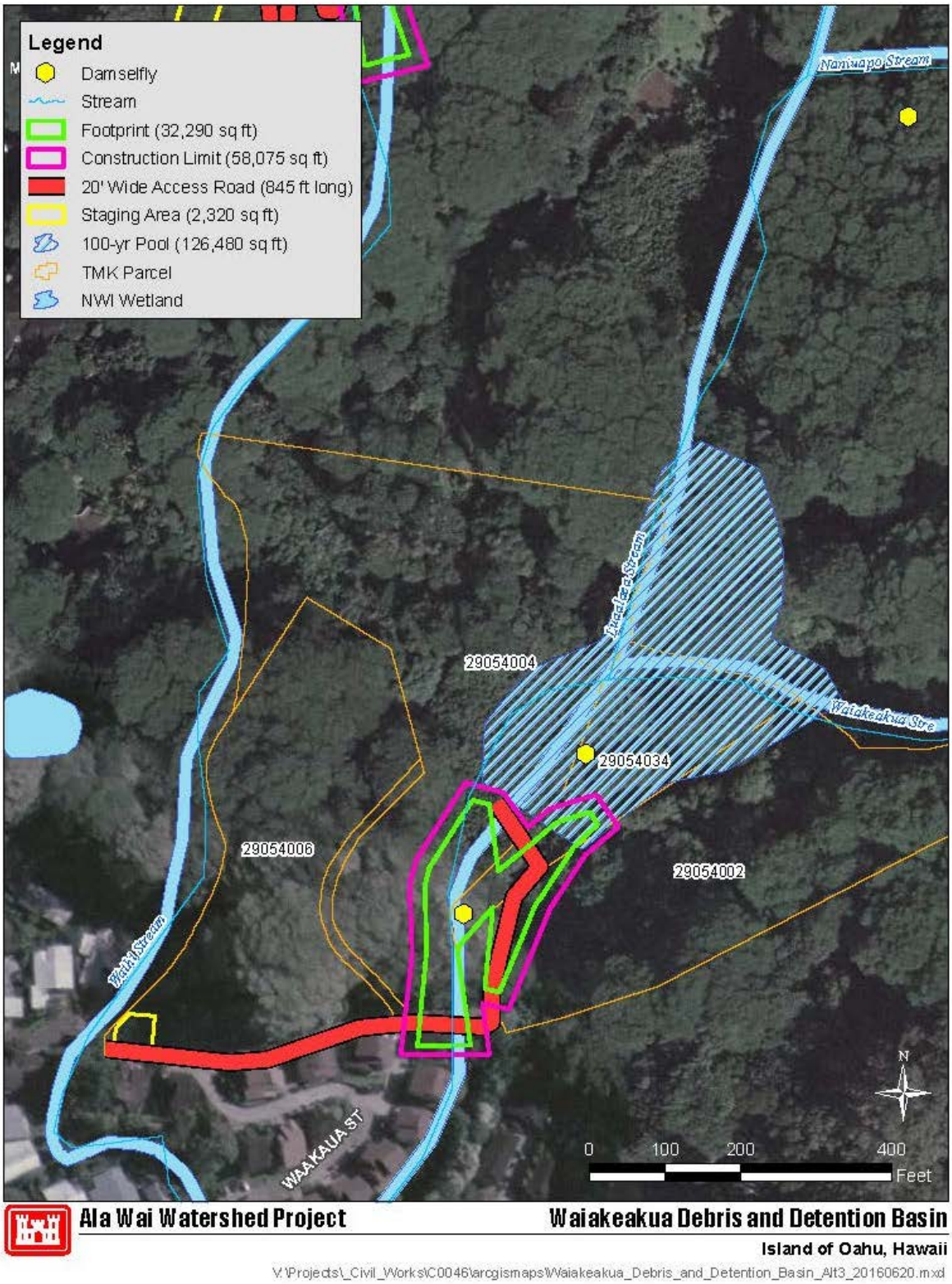


Figure 3. Waiakeakua Debris and Detention Basin.



ANALYTICAL FRAMEWORK FOR THE JEOPARDY/ADVERSE MODIFICATION ANALYSES

In accordance with policy and regulation, the jeopardy analysis of this Biological Opinion relies on four components: (1) Status of the Species, which evaluates the range-wide condition of the blackline Hawaiian damselfly, the factors responsible for that condition, and the survival and recovery needs of this species; (2) the Environmental Baseline, which evaluates the current condition of the blackline Hawaiian damselfly in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the blackline Hawaiian damselfly; and (4) Cumulative Effects; which evaluates the effects of future, non-Federal activities in the action area on the blackline Hawaiian damselfly.

In accordance with the policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the blackline Hawaiian damselfly current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the blackline Hawaiian damselfly in the wild.

The jeopardy analysis in this Biological Opinion places an emphasis on consideration of the range-wide survival and recovery needs of the blackline Hawaiian damselfly and the role of the action area in the survival and recovery of these species as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

STATUS AND ENVIRONMENTAL BASELINE OF THE SPECIES

Status of Species

Blackline Hawaiian Damselfly

The blackline Hawaiian damselfly was listed as an endangered subspecies on October 18, 2012. Previously, the damselfly had been on the candidate species list since 1984. Critical habitat was designated on October 18, 2012. Unique primary constituent elements for the 11 lowland wet critical habitat units for the blackline Hawaiian damselfly include perennial and slow reaches of streams or pools.

Historic and Current Distribution

The blackline Hawaiian damselfly is endemic to the island of Oʻahu, where it was known historically from the Koʻolau and Waiʻanae Mountains (Polhemus 1994a, pp. 6-11) and relatively widespread from sea level to over 2,400 ft (730 m) (Williams 1936, p. 318). Although native damselflies were formerly one of the most conspicuous elements of Hawaiian stream and wetland communities, many species became increasingly rare or have disappeared altogether where they were historically found (Englund 1999, pp. 225, 228).

Currently, the species is found in the lowland wet ecosystem on the windward and leeward sides of the Koʻolau Mountains, in the headwaters and upper reaches of 17 streams: Koloa, Kaipapaʻu, Maʻakua, upper Kaluanui, Helemano headwaters, Poamoho, Kahana, Waiāhole, Waiawa, Kaʻalaea, Waiheʻe, Kahaluʻu, Punaluʻu, north Hālawa, Heʻeia, Kalihi, and Maunawili (TNC 2007; Polhemus 2008b, in litt.; Wolff 2008, in litt.; HBMP 2008; Preston 2011, in litt.; Polhemus 2016a, in litt.; Polhemus 2016b, in litt.). The 17 stream colonies are estimated to total 800 to 1,000 individuals, with approximately 50 individuals per stream (Polhemus 2008a, in litt.). Recent surveys have documented damselflies in an additional 3 new locations: Kalihi (Stream 2) and Mānoa Stream (Waihī and Waiakeakua Streams) (Polhemus 2016a, in litt). Population estimates were not known for Kalihi Stream. However, population estimates for Waihī and Waiakeakua Streams totaled 66 and 36, respectively, increasing our estimate to total 902-1,102 blackline Hawaiian damselflies. Due to rugged terrain, the upper elevation sections of many streams are difficult to access, and have not yet been surveyed. Therefore, the total population number for the species is unknown.

Life History

The blackline Hawaiian Damselfly is a moderately-sized and delicate subspecies (Polhemus and Asquith 1996, p. 73), that breeds in the slow sections or pools along the mid-reach and headwater sections of perennial upland streams, and in seepage fed pools along overflow channels bordering such streams (Polhemus 1994b, p. 44).

Males and females are frequently observed in tandem, the female having then been noticed inserting her eggs, or attempting to, in plant tissue in running water, and may also place them above water (Williams 1936, p. 318). Like most damselflies, the blackline Hawaiian damselfly, are aquatic as immatures (Polhemus and Asquith 1996, p. 4). The naiads can swim but prefer to remain concealed, typically occurring under stones or in mats of algae (Williams 1936, p. 318). Adults are relatively weak fliers, and often perch on streamside rocks and vegetation. The males of most native aquatic *Megalagrion* species are territorial, guarding areas around water where females lay eggs (Moore 1983, p. 89).

The following description of adults is similar for all *Megalagrion* species, and not specific to the blackline Hawaiian damselfly. When mature, damselfly naiads crawl out of the water onto rocks or vegetation and molts into a winged adult (Polhemus and Asquith 1996, p. 4). The emerged adults are poor fliers and thus susceptible to predators; they immediately fly into nearby vegetation where they rest until completely dried and hardened (Polhemus and Asquith 1996, p. 4). Adult damselflies are predacious and capture small insects out of the air with their legs; adults will range widely when hunting for insect prey (Polhemus and Asquith 1996, p. 4).

In Hawaiʻi, damselflies do not appear to be seasonal, except at elevations above 1,500 meters, and adults can be found in most areas throughout the year. Even so, adults of many species are sensitive to weather and time of day, tending to be inactive during periods of rain and cloud cover, and most active in full sunlight (Polhemus and Asquith 1996, p. 7).

Threats

Habitat Destruction and Modification by Agriculture and Urban Development

Although we are unaware of any comprehensive, site-by-site assessment of wetland loss in

Hawaii, Erikson and Puttock (2006, p. 40) and Dahl (1990, p. 7) estimated that at least 12 percent of lowland to upper-elevation wetlands in Hawai‘i had been converted to non-wetland habitat by the 1980s. If only coastal plain (below 1,000 ft (300 m)) marshlands and wetlands are considered, it is estimated that 30 percent have been converted to agricultural and urban development (Kosaka 1990, in litt.). Historical records show these marshlands and wetlands provided habitat for many damselfly species, including the blackline Hawaiian damselfly (Polhemus 2007, pp. 233, 237–239; HBMP 2008).

Although filling of wetlands is regulated by permitting today, the loss of riparian or wetland habitats used by the blackline Hawaiian damselfly may still occur due to O‘ahu’s population growth and development, with concurrent demands on limited developable land and water resources (Lester 2007, in litt.). In addition, marshes have been slowly filled and converted to meadow habitat, as a result of sedimentation from increased storm water runoff from upslope development, the accumulation of uncontrolled growth of invasive vegetation, and blockage of downslope drainage (Wilson Okamoto & Associates, Inc. 1993, pp. 3-4, 3-5).

The threats posed by conversion of wetland and other aquatic habitat for agriculture and urban development are ongoing and are expected to continue into the future. Hawai‘i’s population has increased almost 9 percent in the past 14 years, along with the associated increased demands on limited land and water resources (Hawai‘i Department of Business, Economic Development and Tourism (HDBEDT) 2013). These modified areas lack the aquatic habitat features that the blackline Hawaiian damselfly requires for essential life-history needs, such as slow sections of and sidepools along perennial streams, and they no longer support populations of the species. Agriculture and urban development have thus contributed to the present curtailment of the habitat of the blackline Hawaiian damselfly, and we have no indication that this threat is likely to be significantly ameliorated in the near future.

Habitat Destruction and Modification by Stream Diversion
By the 1930s, water diversions had been developed on all of the main Hawaiian Islands, and by 1978, the stream flow in more than half the 366 perennial streams in Hawai‘i had been altered in some manner (Brasher 2003, p. 1,055). Some stream diversion systems are extensive, such as the Waiāhole Ditch on O‘ahu, built in the early 1900s, which diverts water from 37 streams within the ranges of the blackline damselfly, on the windward side of O‘ahu to the dry plains on the leeward side of the island via a tunnel cut through the Ko‘olau range (Stearns and Vaksvik 1935, pp. 399–403; Tvedt and Oestigaard 2006, pp. 43–44). Historically, damselflies in the genus *Megalagrion* were a common component of Hawaiian streams and wetlands at elevations ranging from sea level to the summit of the Ko‘olau range on O‘ahu. This loss of stream habitat may have contributed to the extirpation of populations of the three damselflies from lower elevations (Polhemus 2007, pp. 233–234, 238–239).

Habitat Destruction and Modification by Dewatering of Aquifers
In addition to the diversion of stream water and the resultant downstream dewatering, many streams on O‘ahu have experienced reduced or zero surface flow as a result of the dewatering of their source aquifers. Often these aquifers, which previously fed the streams, were tapped by tunneling or through the placement of wells (Stearns and Vaksvik 1935, pp. 386–343; Stearns 1985, pp. 291–305). These groundwater sources were diverted for both domestic and

agricultural use, and in some areas have completely depleted nearby stream and spring flows. For example, both the bore tunnels and the contour tunnel of the Waiāhole Ditch system intersect perched aquifers (aquifers above the primary ground water table), which subsequently are drained to the elevation of the tunnels (Stearns and Vaksvik 1935, pp. 399–406). This has reduced stream habitat available to the blackline Hawaiian damselfly. Likewise, the boring of the Haʻikū tunnel on Oʻahu in 1940 caused a 25 percent reduction in the base flow of Kahaluʻu Stream, which is more than 2.5 mi (4 km) away (Takasaki *et al*. 1969, pp. 31–32), and has reduced available habitat for the blackline Hawaiian damselfly (HBMP 2008). Many of these aquifers were also the sources of springs that contributed flow to Oahu's windward streams; draining of these aquifers caused many of the springs to dry up, including some more than 0.3 mi (0.5 km) away from the bore tunnels (Stearns and Vaksvik 1935, pp. 379–380).

Habitat Destruction and Modification due to Vertical Wells

Surface flow of streams has also been affected by vertical wells drilled in premodern times, because the basal aquifer (lowest groundwater layer) and alluvial caprock (sediment-deposited harder rock layer) through which the lower sections of streams flow can be penetrated and hydraulically connected by wells (Gingerich and Oki 2000, p. 6; Stearns 1940, p. 88). This allows water in aquifers normally feeding the stream to be diverted elsewhere underground. Dewatering of the streams by tunneling and well placement near or in streams was a significant cause of habitat loss, and these effects continue today. Historically, for example, there was sufficient surface flow in Mākaha and Nānākuli Streams on Oʻahu to support loʻi kalo (artificial ponds for kalo (taro) cultivation) in their lower reaches, but this flow disappeared subsequent to construction of vertical wells upstream (Devick 1995, pers. comm.). The inadvertent dewatering of streams through the penetration of their aquifers (which are normally separated from adjacent waterbearing layers by an impermeable layer), by tunneling or through placement of vertical wells, caused the loss of habitat of blackline Hawaiian damselfly habitat, as this species was historically known from these areas.

Habitat Destruction and Modification by Stream Channelization

Stream degradation has been particularly severe on the island of Oʻahu where, by 1978, 58 percent of the perennial streams and banks had been channelized (e.g., concrete lined, partially lined, or altered) to control flooding (Polhemus and Asquith 1996, p. 24; Brasher 2003, p. 1,055). These alterations have resulted in an overall 89 percent loss of the total stream length island-wide (Polhemus and Asquith 1996, p. 24; Parrish *et al*. 1984, p. 83). The channelization of streams creates artificial, wide-bottomed stream beds, and often results in removal of riparian vegetation, which reduces shading, increases substrate homogeneity, increases temporal water velocity (increased water flow speed during times of higher precipitation including minor and major flooding), and causes higher water temperatures (Parrish *et al*. 1984, p. 83; Brasher 2003, p. 1,052). Tests conducted on native aquatic species showed that the higher water temperatures in channelized streams caused stress, and sometimes death (Parrish *et al*. 1984, p. 83). Natural streams meander and are lined with rocks, trees, and natural debris, and during times of flooding, jump their banks. Channelized streams are straightened and often lack natural obstructions, and during times of higher precipitation or flooding, facilitate a higher water flow velocity. Hawaiian damselflies are largely absent from channelized portions of streams (Polhemus and Asquith 1996, p. 24), which has likely contributed to a reduction in the historical range of Hawaiian damselfly species, including the blackline Hawaiian damselfly. In contrast,

undisturbed Hawaiian stream systems exhibit a greater amount of riffle and pool habitat canopy closure, higher consistent flow velocity, and lower water temperatures that are characteristic of streams to which the Hawaiian damselflies, in general, are adapted (Brasher 2003, pp. 1,054–1,057).

Channelization of streams has not been restricted to lower stream reaches. For example, there is extensive channelization of O‘ahu’s Kalihi Stream above 1,000 ft (300 m) elevation. Extensive stream channelization on O‘ahu has also contributed to the loss of habitat for the blackline Hawaiian damselfly (Englund 1999, p. 236; Polhemus 2008c, p. 45, in litt.).

Stream diversion, channelization, dewatering, and vertical wells represent serious and ongoing threats to the blackline Hawaiian damselfly for the following reasons: (1) They reduce the amount and distribution of stream habitat available to the species; (2) they reduce stream flow, leaving lower elevation stream segments completely dry except during storms, or leaving many streams completely dry year round, thus reducing or eliminating stream habitat; and (3) they indirectly lead to an increase in water temperature that results in physiological stress and to the loss of blackline Hawaiian damselfly naiads. The blackline Hawaiian damselfly is particularly vulnerable to extinction due to such changes (i.e., stream diversion, channelization, and dewatering), a vulnerability which is exacerbated by their range and habitat constrictions and declines in their population numbers.

Habitat Destruction and Modification by Climate Change
The blackline Hawaiian damselfly may also be affected by temporary habitat loss associated with droughts which are not uncommon in the Hawaiian Islands. Between 1860 and 1986 the island of O‘ahu has been affected by 48 periods of drought, 28 of which have affected the water supply on the island (Giambelluca *et al.* 1991, pp. 3–4).

Climate change will be a particular challenge for biodiversity because the introduction and interaction of additional stressors may push species beyond their ability to survive (Lovejoy 2005, pp. 325-326). The synergistic implications of climate change and habitat fragmentation are the most threatening facet of climate change for biodiversity (Hannah *et al*. 2005, p. 4). The magnitude and intensity of the impacts of global climate change and increasing temperatures on native Hawaiian ecosystems are unknown. We are not aware of climate change studies specifically related to the blackline Hawaiian damselfly. Based on the best available information, climate change impacts could lead to the decline or loss of native species that comprise the communities in which the blackline Hawaiian damselfly occur (Pounds *et al*. 1999, pp. 611–612; Still *et al*. 1999, p. 610; Benning *et al*. 2002, pp. 14,246 and 14,248). In addition, weather regime changes (e.g., droughts, floods) will likely result from increased annual average temperatures related to more frequent El Niño episodes in Hawai‘i. These changes may decrease water availability and increase the consumptive demand on O‘ahu’s natural streams and reservoirs by O‘ahu’s residents (Giambelluca *et al*. 1991, p. v). The effects of increasing temperatures on the aquatic habitat of the blackline Hawaiian damselfly species are not specifically known, but likely include the loss of aquatic habitat from reduced stream flow, evaporation of standing water, and increased water temperature (Pounds *et al*. 1999, pp. 611–612; Still *et al*. 1999, p. 610; Benning *et al*. 2002, pp. 14,246 and 14,248). Research, however, have been done for the orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*); laboratory

studies indicate the eggs and naiads of the damselfly are sensitive to increased salinity and temperature, and no naiads survived at 20 ppt (about 57 percent seawater) (Tango 2010, p. 23). Egg hatch increased with increased temperature and decreased salinity, whereas naiad survival increased with decreased temperature and was greatest at intermediate salinity (5 and 10 ppt) (Tango 2010, p. 27). We can assume the blackline Hawaiian damselfly likely are also sensitive to changes in water temperature and salinity.

Oki (2004, p. 4) has noted long-term evidence of decreased precipitation and stream flow on the Hawaiian Islands, based upon evidence collected by stream gauging stations. This long-term drying trend, coupled with existing ditch diversions and periodic El Niño caused drying events, has created a pattern of severe and persistent stream dewatering events (Polhemus 2008c, in litt.). Future changes in precipitation and the forecast of those changes are highly uncertain because they depend, in part, on how the El Niño – La Niña weather cycle (a disruption of the ocean atmospheric system in the tropical Pacific having important global consequences for weather and climate) might change (Hawai‘i Climate Change Action Plan 1998, pp. 2–10).

The blackline Hawaiian damselfly may be especially vulnerable to extinction due to anticipated environmental changes that may result from global climate change. Environmental changes that may affect these species are expected to include habitat loss or alteration and changes in disturbance regimes (e.g., storms and hurricanes), in addition to direct physiological stress caused by increased stream water temperatures to which the native Hawaiian damselfly fauna are not adapted. The probability of a species going extinct as a result of these factors increases when its range is restricted, habitat decreases, and population numbers decline (Intergovernmental Panel on Climate Change 2007, p. 8). The blackline Hawaiian damselfly has limited environmental tolerances, limited range, specific habitat requirements, small population size, and low numbers of individuals. Therefore, we would expect these species to be particularly vulnerable to projected environmental impacts that may result from changes in climate, and subsequent impacts to their habitats (e.g., Pounds *et al*. 1999, pp. 611–612; Still *et al*. 1999, p. 610; Benning *et al*. 2002, pp. 14,246 and 14,248). We believe changes in environmental conditions that may result from climate change may negatively impact the blackline Hawaiian damselfly and their habitat, and we do not anticipate a reduction in this potential threat in the near future.

Habitat Destruction and Modification by Invasive Species

The threat posed by introduced ungulates to the blackline Hawaiian damselfly and their habitats is serious, because they cause: (1) Trampling and grazing that directly disturb plant communities in riparian areas used by the blackline Hawaiian damselfly for perching, reproduction, and hunting for prey; (2) increased soil disturbance, leading to mechanical damage to plants in riparian areas used by the damselflies for perching, reproduction, and hunting for prey; and (3) increased watershed erosion and sedimentation, which negatively affects aquatic habitats used by the blackline Hawaiian damselfly. Although plants used for perching by damselflies are not necessarily native plants, ungulate activity damages or removes all plants near the stream. Damselflies depend on plants near the stream for their daily activities, territory establishment, reproduction, and hunting activities. These threats are expected to continue or increase without ungulate control or eradication (USFWS 2012, p. 57676).

Predation by Nonnative Fish

Predation by nonnative fish is a serious and ongoing threat to the blackline Hawaiian damselfly. blackline Hawaiian damselfly naiads occur in standing or seep-fed pools, slow-flowing sections of streams, under stones or mats of moss, and algae in streams, where they are vulnerable to predation by nonnative fish. Information suggests that Hawaiian damselflies experience limited natural predation pressure from the five species of freshwater fish native to Hawai‘i—gobies (Gobiidae) and sleepers (Eleotridae) (Ego 1956, p. 24; Kido *et al*. 1993, pp. 43–44; Englund 1999, pp. 236–237). Hawai‘i’s native fishes are benthic (bottom) feeders, and stream dwelling Hawaiian damselfly species, including the blackline Hawaiian damselfly, avoid these areas in preference for shallow side channels, sidepools, and higher velocity riffles and seeps (Englund 1999, pp. 236–237). While fish predation has been an important factor in the evolution of behavior in damselfly naiads in continental systems (Johnson 1991, p. 8), it can only be speculated that Hawai‘i’s stream-dwelling damselflies adapted behaviors to avoid the benthic feeding habits of native fish species.

Over 70 species of nonnative fish have been introduced into Hawaiian freshwater habitats (Devick 1991, p. 190; Englund 1999, p. 226; Englund and Eldredge 2001, p. 32; Brasher 2003, p. 1,054; Englund 2004, p. 27; Englund *et al*. 2007, p. 232), with at least 51 species now established (Freshwater Fishes of Hawai‘i 2008). The initial introduction of nonnative fish to Hawai‘i began with the release of food stock species by Asian immigrants at the beginning of the 20th century; however, the impact of these first introductions on Hawaiian damselflies cannot be assessed because they predated the initial collection of damselflies in Hawai‘i (Perkins 1899, pp. 64–76). Between 1905 and 1922, poeciliid fish were introduced for biological control of mosquitoes, including the mosquito fish (*Gambusia affinis*), sailfin molly (*Poecilia latipinna*), green swordtail (*Xiphophorus helleri*), moonfish (*Xiphophorus maculatus*), and guppy (*Poecilia reticulata*) (Van Dine 1907, p. 9; Englund 1999, p. 225; Brasher 2003, p. 1,054). By 1935, some O‘ahu damselflies were becoming less common, and these introduced fish were the suspected cause of their decline (Williams 1936, p. 313; Zimmerman 1948, p. 341). From 1946 through 1961, several additional nonnative fish were introduced for the purpose of controlling nonnative aquatic plants and for recreational fishing (Brasher 2003, p. 1,054). During the 1980s, additional nonnative fish species were established in O‘ahu waters, including aggressive predators and habitat-altering species such as the channel catfish (*Ictalurus punctatus*), cichlids (e.g., *Tilapia* spp.), sailfin catfish (*Liposarcus multiradiatus*), top minnows (*Limia vittata*), and piranha (*Serrasalmus* sp.) (Devick 1991, pp. 189, 191–192; Brasher 2003, p. 1,054; Freshwater Fishes of Hawai‘i 2008). Englund (1999, p. 233) found several of these species to be abundant in nearly all lowland O‘ahu streams and water systems, although not all were as capable of colonizing higher elevation stream reaches as the introduced poeciliid species.

Geologic or manmade barriers (e.g., waterfalls, steep gradients, dry stream midreaches, or constructed diversions) appear to prevent access by nonnative fish species to stream areas above these barriers; however, there is still a chance of facilitated fish movement. For example, in 2000, a maintenance worker introduced *Tilapia* spp. into ponds located on the grounds of Tripler Medical Army Hospital that were upslope from the remaining O‘ahu population of the orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*) (Englund 2000, in litt.). The ponds were drained and the *Tilapia* spp. removed. The importance of their removal was underscored by the fact that a large storm caused the ponds to fill and overflow downslope into the stream

supporting the damselflies soon after the *Tilapia* spp. were removed (Preston *et al*. 2007, p. 263). Current literature indicates that the extirpation of Hawaiian damselflies from nearly all of their historical lowland habitat sites on O‘ahu is the result of predation by introduced nonnative fish (Moore and Gagne 1982, p. 4; Liebherr and Polhemus 1997, p. 502; Englund 1999, pp. 235–237; Brasher 2003, p. 1,055; Englund *et al*. 2007, p. 215; Polhemus 2007, pp. 238– 239). The threats posed by continued introduction and establishment of nonnative fish in Hawaiian waters, and the possible movement of those nonnative species to new streams and other aquatic habitat, are ongoing and expected to continue into the future. This represents a serious threat to the survival of the blackline Hawaiian damselfly.

Additional impacts from other invasive species
Bullfrogs and toads have a negatively correlated pattern of occurrence with the blackline Hawaiian damselfly (USFWS 2012, p. 57679). The damselfly also faces the threat of predation by ants (Borror *et al*. 1989, pp. 737–741).

Small number of populations and individuals
Species that are endemic to single islands, like the blackline Hawaiian damselfly, are inherently more vulnerable to extinction than widespread species because of the increased risk of genetic bottlenecks; random demographic fluctuations; climate change; and localized catastrophes such as hurricanes, landslides, rockfalls, drought, and disease outbreaks (Mangel and Tier 1994, p. 607; Pimm *et al.* 1988, p. 757). These problems are further magnified when populations are few and restricted to a very small geographic area, and when the number of individuals is very small. Populations with these characteristics face an increased likelihood of stochastic extinction due to changes in demography, the environment, genetics, or other factors (Gilpin and Soulé 1986, pp. 24–34).

Small, isolated populations often exhibit reduced levels of genetic variability, which diminishes the species’ capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence (e.g., Barrett and Kohn 1991, p. 4; Newman and Pilson 1997, p. 361). The problems associated with small population size and vulnerability to random demographic fluctuations or natural catastrophes are further magnified by synergistic interactions with other threats, such as those discussed above.

The threat to the blackline Hawaiian damselfly from limited numbers of populations (i.e., known from only 18 streams) and individuals, and impacts to water quality and quantity is immediate and significant for the following reasons: this species may experience reduced reproductive vigor due to inbreeding depression; this species may experience reduced levels of genetic variability leading to diminished capacity to adapt and respond to environmental changes, thereby lessening the probability of long-term persistence; and a single catastrophic event (e.g., hurricane, landslide, introduction of nonnative predators into the habitat) may result in extirpation of an entire stream population.

Environmental Baseline for Blackline Hawaiian Damselfly

The blackline Hawaiian damselfly occurs in Waihī Stream within habitat consisting of rocky riffles and shallow pools, with small tributaries entering from along the banks and forming small, shallow, standing pools lateral to the main stream channel (Foster *et al*. 2015, in litt.). The

stream channel at the upper end of the stream reach is open and unshaded, making an abrupt transition downstream to a heavily shaded area from large figs and other introduced trees. The damselfly is found throughout shaded sections of the channel, particularly in lateral pools formed by small tributaries, with both mating pairs and ovipositing females observed (Foster *et al*. 2015, in litt.). At certain sites up to 7 individuals were observed simultaneously. The total population estimate for the blackline Hawaiian damselfly in Waihī is 66 individuals (Vorsino *et al*. 2016, in litt.).

The damselfly also occurs in concentrated numbers in riffles at slower sections of stream, shaded by nonnative vegetation and at stream forks to the upper limit of where the Waiakeakua Stream begins to become confined between bedrock walls (Polhemus 2016c, in litt.). A survey for damselflies documented 11 adults sporadically along the stream reaches within the action area for the Waiakeakua Stream. The total population estimate for the blackline Hawaiian damselfly in Waiakeakua is 36 individuals (Vorsino 2015, in litt.).

The populations of blackline damselflies occur directly within the boundaries of the action area, including several pools within and immediately adjacent to the delineated Project (Figures 4 and 5). Blackline Hawaiian damselflies were more numerous in shallow side channels that likely precluded fish. Damselflies were observed in mainstream channel areas as well, however, were less numerous and more dispersed (Smith 2016, in litt.). The damselfly's distribution within the project action area is likely limited by a higher abundance of nonnative fish species in the lower reaches of the Mānoa stream.

High Definition Stream Surveys (HDSS) were conducted in the upper Mānoa Stream to document the presence of certain fish species (Table 3). State biologists and technicians found bristlenose catfish and mosquitofish as the most common species. Some native gobies likely exist in this section of the stream, but were not observed. Instream habitat appeared to be good for native fish species. Bristlenose catfish were observed all the way to the falls (Parham and Higashi 2015, p. 27, in litt.). Although nonnative fish occur within the stream, a limited number of damselflies are able to persist. However, these damselflies would not likely persist in the absence of side pools and riffle habitat.

Table 3. Species observed during the HDSS effort in upper Mānoa Stream. Species listed in order of most to least common (Parham and Higashi 2015, p. 27, in litt.).

Scientific Name	Common Name	Observations
Procambarus clarkii	Crayfish	9
Ancistrus cf. temminckii	Bristlemouth catfish, bristlenose/bearded catfish (Yamamoto and Tagawa, 2000)	7
Gambusia affinis	Western mosquitofish	4
Poecilia sphenops	Liberty molly	2
Pterygoplichthys multiradiatus	Sailfin catfish (AFS), long-fin armored catfish (Yamamoto and Tagawa, 2000)	1

These two locations of the blackline Hawaiian damselfly are partially contained within the action area. These two populations represent 2 of the 20 known populations and approximately 102 of the total 902-1,102 total individuals within the species' total range (roughly 10 percent).

The presence of this species in both Waihī and Waiakeakua Streams indicate that additional populations of *M. nigrohamatum nigrolineatum* are likely to occur along all of the upper portions of Mānoa Stream. Additional survey work in the upper Mānoa catchment would be useful to verify the complete status of the species within the action area as well as the status of the population as a whole.

Figure 4. Proposed Waihī Debris and Detention Basin with Observed Damselfly Points.

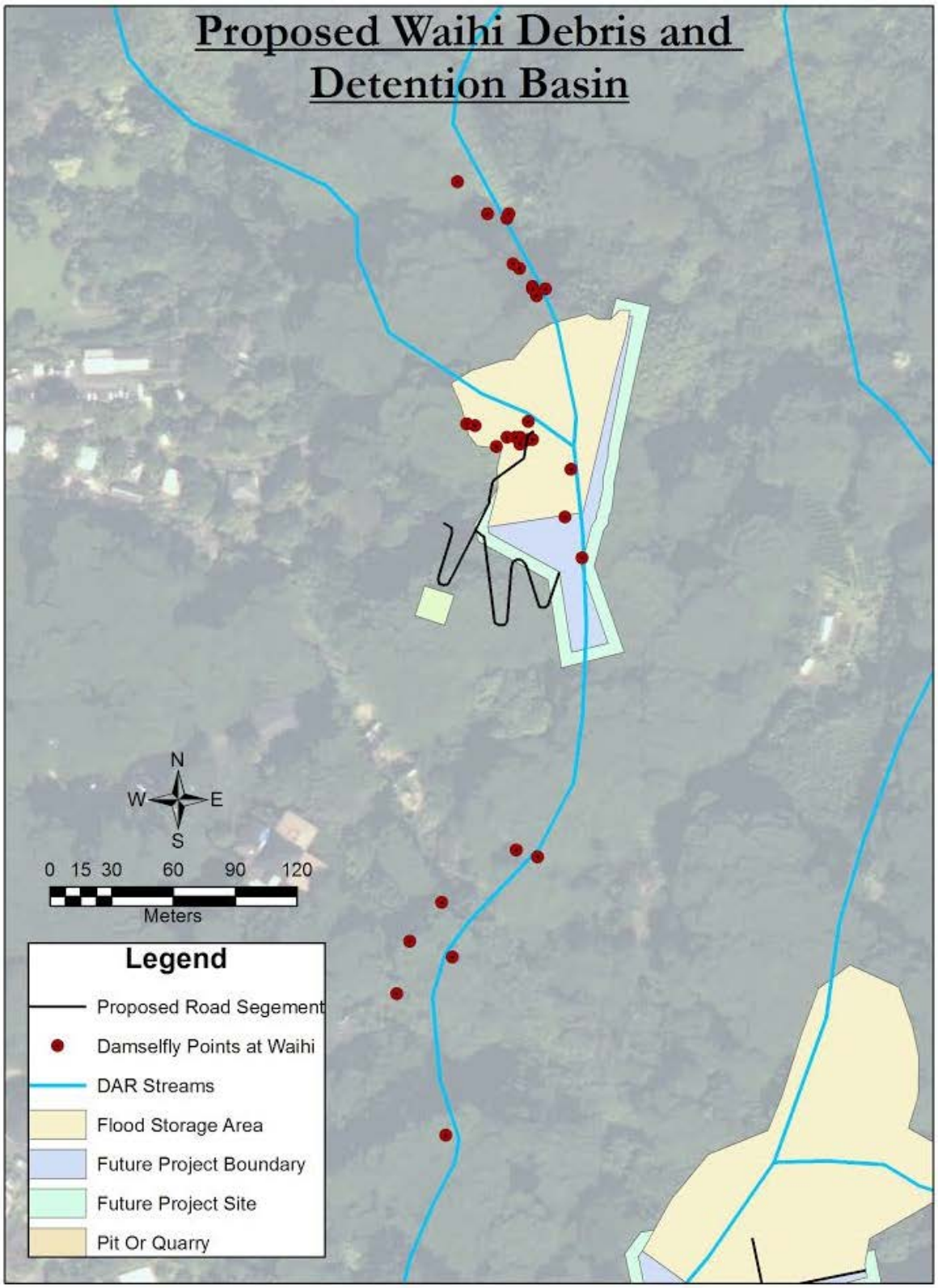
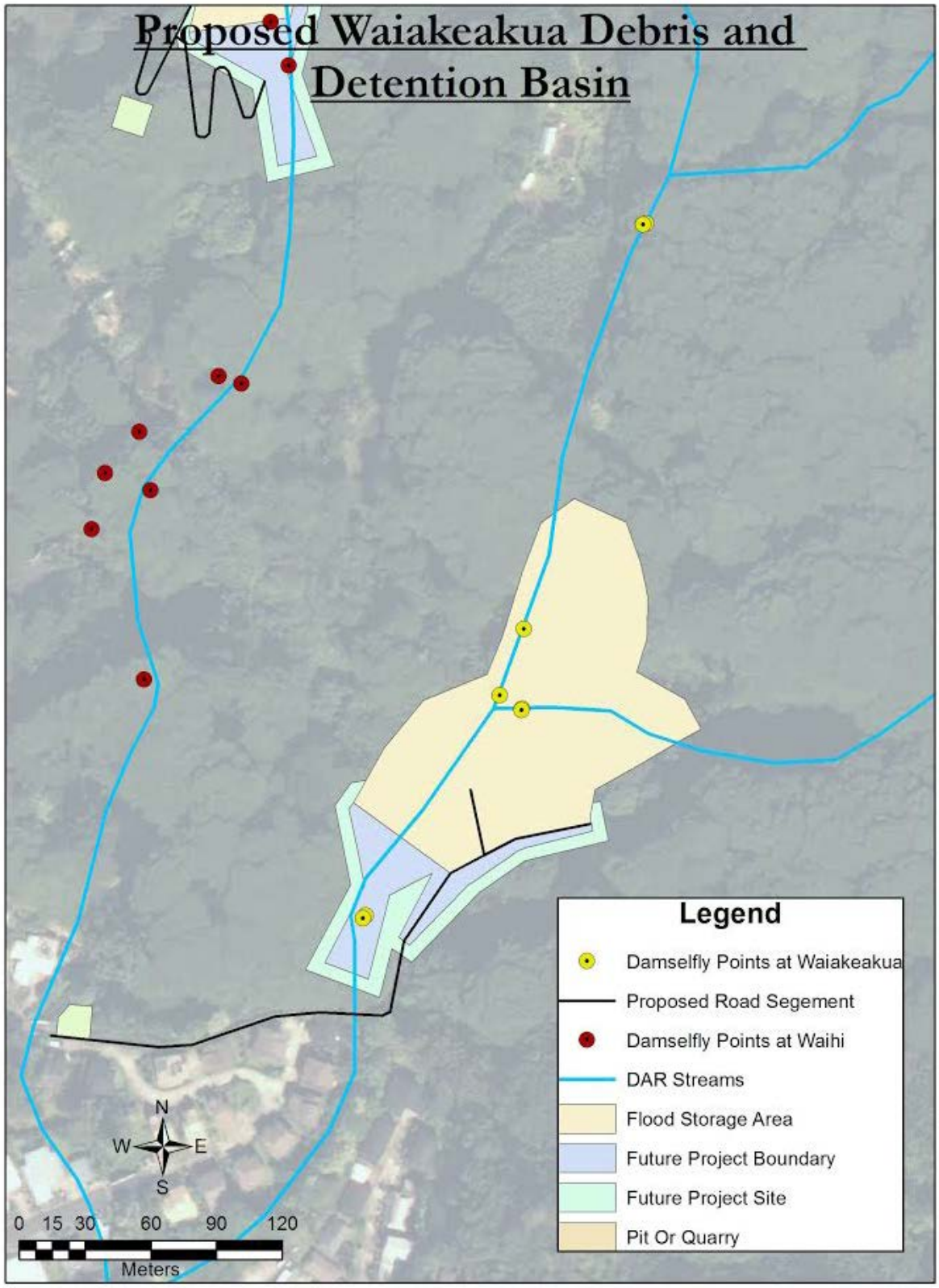


Figure 5. Proposed Waiakeakua Debris and Detention Basin with Observed Damselfly Points.



EFFECTS OF THE ACTION

Exposure Analysis Approach

The Service has developed an analysis framework for section 7 consultations that incorporates the general structure, primary concepts, and nomenclature of the U.S. Environmental Protection Agency's ecological risk assessment framework (USFWS 2005b). Factors causing adverse effects are called "stressors" and beneficial effects are called benefits. In this approach, the Service determines the resources that will be exposed to the proposed action's stressors and benefits by evaluating the location, timing, duration, frequency, and intensity of potential exposure to each stressor and benefit, and identifying the physical, chemical, and biotic features that will be directly and indirectly exposed. Then the causal relationships between sources of stressors and benefits and the response of listed resources are analyzed. The exposure analysis also estimates future changes in the abundance or distribution of listed species expected to result from exposure to stressors and benefits.

The proposed action's stressors and benefits may include the following actions at Waihī and Waiakeakua Streams:

- Construction of detention basins
- Construction of debris catchments
- Placement of culverts
- Placement of riprap
- Construction of access roads

Effects to Blackline Hawaiian Damselfly

Construction of detention basins

The proposed action is expected to have direct effects on the blackline Hawaiian damselfly population within the action area. The proposed construction of the Waihī and Waiakeakua detention basins will eliminate the habitat where the blackline Hawaiian damselflies occur at the proposed detention basins and below each construction site. Additionally, damselflies will be taken if run over, walked on, buried, etc. Although, the proposed construction of the detention basis is expected to take out habitat used by the damselfly, we do not anticipate any changes to the habitat upstream of the action area because the detention basins are not designed to hold water permanently and will not remove any habitat upstream. We anticipate adverse effects to adult blackline Hawaiian damselflies and associated life stages due to complete habitat loss and mortality at both locations as a result of the construction of detention basins.

Construction of debris catchments

The proposed action is expected to have direct effects on the blackline Hawaiian damselfly population within the action area. The proposed construction of the Waihī and Waiakeakua debris catchment areas will eliminate the habitat where the blackline Hawaiian damselflies occur at the construction sites. Additionally, damselflies will be taken if run over, walked on, buried, etc. We anticipate adverse effects to adult blackline Hawaiian damselflies and associated life stages due to complete habitat loss and mortality at both locations as a result of the construction of debris catchment areas.

Placement of culverts
The proposed action is expected to have direct effects on the blackline Hawaiian damselfly population within the action area. The proposed placement of culverts within the Waihī and Waiakeakua Streams will eliminate the habitat where the blackline Hawaiian damselflies occur at the culverts and below the culvert sites. Additionally, damselflies will be taken if run over, walked on, buried, etc. We anticipate adverse effects to adult blackline Hawaiian damselflies and associated life stages due to complete habitat loss and mortality at both locations as a result of the placement of culverts.

Placement of riprap
The proposed action is expected to have direct effects on the blackline Hawaiian damselfly population within the action area. The proposed placement of riprap upstream and downstream of the debris and detention basins in the Waihī and Waiakeakua Streams will eliminate the habitat where the blackline Hawaiian damselflies occur at each location where riprap is placed. Changes of stream flow will alter the water regime and vegetation which provide canopy cover that provide habitat for damselflies. Additionally, damselflies will be taken if run over, walked on, buried, etc. We anticipate adverse effects to adult blackline Hawaiian damselflies and associated life stages due to complete habitat loss and mortality at both locations as a result of the placement of riprap at upstream and downstream.

Construction of access roads
The proposed action is expected to have direct effects on the blackline Hawaiian damselfly population within the action area. The proposed construction of the Waihī access roads will eliminate the habitat where the blackline Hawaiian damselfly occurs at all locations where there is construction of an access road. Additionally, damselflies will be taken if run over, walked on, buried, etc. We anticipate adverse effects to adult blackline Hawaiian damselflies and associated life stages due to complete habitat loss and mortality as a result of the construction of access roads at Waihī Stream.

In summary, we anticipate adverse effects to 46 and 20 adult blackline Hawaiian damselflies and associated life stages in Waihī and Waiakeakua Streams, respectively, due to complete loss of riffle and pool habitat within the action area as a result of the proposed project.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future non-Federal actions that are reasonably certain to occur within the action area subject to consultation. Future federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative for the proposed action. The Service is unaware of any foreseeable actions within the action area.

CONCLUSION

After reviewing the current status, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the proposed construction, operation and maintenance of the Ala Wai Canal Project discussed herein is not likely to

jeopardize the continued existence of the blackline Hawaiian damselfly. As stated in the Effects section above, a loss of features, such as side channels and scour pools free from nonnative fish, will be lost as a result of the proposed project, preventing these areas from becoming and persisting as habitat for damselflies. While 66 damselflies will be lost, this will result in a 6-7.3 percent decrease to the estimated total population number of the blackline Hawaiian damselflies as a whole. These impacts are not expected to affect the damselfly population at other stream locations and are expected to have a small effect to the total population of the species.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations promulgated pursuant to section 4(d) of the Act prohibit the take of endangered or threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, hut arc not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the USACE so that they become binding conditions for the exemption in section 7(o)(2) to apply. If the USACE (1) fails to assume and implement the terms and conditions or (2) fails to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the USACE must report the progress of the action and its impact on the species to the Service as specified in this incidental take statement and reporting requirements below [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Based on our analysis presented in this Biological Opinion, the Service anticipates the following take may occur for as long as the Ala Wai Canal Project construction, operation, and maintenance are active and in place:

1) Up to 66 blackline Hawaiian damselfly adults and associated life cycle stages over the life of the project due to elimination of breeding habitat and mortality as a result of the proposed action.

Effect of the Take

In this Biological Opinion, the Service determined that this level of anticipated take is not likely to jeopardize the continued existence of the blackline Hawaiian damselfly based on the information provided in this document.

Reasonable and Prudent Measures

The reasonable and prudent measures given below, with their implementing term and conditions, are designed to minimize the impacts of incidental take that might otherwise result from the proposed actions. If, during the course of the action, the level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. In addition, the action that caused the taking must cease; the action agency must immediately provide an explanation of the causes of the taking; and must review with the Service the need for possible modification of the reasonable and prudent measures. The following reasonable and prudent measures are necessary and appropriate to minimize the effect of take on the blackline Hawaiian damselfly.

1. The USACE shall minimize the loss of blackline Hawaiian damselfly.
2. The USACE shall minimize the loss of habitat.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the USACE must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

In order to implement the reasonable and prudent measure #1 above, the following terms and conditions apply:

1. The USACE shall hire a qualified biologist (approved by the Service) to collect damselflies to be relocated to another protected location or to be held in captivity in a qualified facility until site is identified.
2. The USACE shall monitor and report on the levels of take that occur on an annual basis. To determine the level of incidental take the USACE shall:
    a. Monitor and report any observed blackline Hawaiian damselflies prior to construction of the access roads and debris and detention basins at the Waihī and Waiakeakua construction footprints. The USACE will monitor blackline Hawaiian damselfly information for one year after the completion of construction at these sites. The monitoring methodology will be approved by the Service prior to construction implementation, and will, at a minimum, include counts of adult blackline Hawaiian damselflies.
    b. Submit reports summarizing the methods and results of the above monitoring efforts to the Service's Pacific Islands Fish and Wildlife Office (300 Ala Moana Blvd., Room 3-122, Honolulu, Hawai'i 96850) annually until the monitoring is complete.
3. The USACE shall submit annual reports detailing the implementation of the above Reasonable and Prudent Measures and Terms and Conditions. The first report shall be

due at the end of January of the first year after the project is initiated. Annual reports shall be submitted throughout the duration of the proposed action.

In order to implement the reasonable and prudent measure #2 above, the following terms and conditions apply:

1. The USACE shall consider purchasing private land to relocate the access roads downstream of the proposed Waihī debris and detention basin to minimize loss of riffle and pool habitat.
2. The USACE shall limit the removal of tree canopy cover over areas of damselfly habitat.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs all Federal agencies to use their authority to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as suggestions from the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's 7(a)(1) responsibility for the species.

1. The USACE should control or eliminate nonnative fish, e.g. poeciliids, within upstream areas of the Mānoa stream with appropriate use of chemical or rotenone treatments to allow establishment of additional populations of endemic damselflies such as *Megalagrion leptodemas*, *M. oceanicum* and *M. xanthomelas*.
2. Once poeciliids are removed from a reach of stream, the USACE should create fish barriers that could prevent poeciliid fish from recolonizing upstream areas.
3. The USACE should construct or fund stream restoration to allow for persistence and/or re-establishment of native fish and invertebrates (while providing a barrier to exclude nonnative fish passage) into essential headwater stream reaches at Falls 7 and 8.
4. The USACE should construct or fund stream restoration to allow for persistence and/or re-establishment of native fish and invertebrates (while providing a barrier to exclude nonnative fish passage) into essential headwater stream reaches within the Ala Wai watershed.
5. The USACE should initiate restoration of habitat for native fish and the blackline Hawaiian damselfly at the lower elevations of the Mānoa stream.
6. The USACE should implement an effective program to educate the public to the harmful effects of releasing aquarium fish into Hawaiian waters.

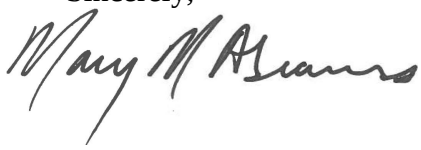
REINITIATION-CLOSING STATEMENT

This concludes formal consultation on this action. As required in 50 CFR §402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the

agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operation causing such take must cease pending reinitiation.

We appreciate your efforts to conserve protected species. If you have any questions concerning this biological opinion, please contact Jiny Kim of the USFWS Pacific Islands Fish and Wildlife Office at (808) 792-9400.

Sincerely,



Mary M. Abrams, Ph.D.
Field Supervisor

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Appendix A.
Not Likely to Adversely Affect Determination for the Hawaiian hoary bat, Oʻahu ʻelepaio, Hawaiian stilt, Hawaiian coot, Hawaiian gallinule, and the Hawaiian duck

This Appendix is in response to your request for our concurrence with your determination that the proposed Ala Wai Canal Project, as described above, will not adversely affect the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), Oʻahu ʻelepaio (*Chasiempis ibidis*), Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian gallinule (*Gallinula chloropus sandvicensis*), and the Hawaiian duck (*Anas wyvilliana*). We acknowledge that you have made the determination that the proposed Ala Wai Canal Project will have no effect to other species, including the endangered crimson Hawaiian damselfly (*Megalagrion leptodemas*), oceanic Hawaiian damselfly (*Megalagrion oceanicum*), orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*), Oʻahu tree snails (*Achatinella* sp.), hāhā (*Cyanea acuminata*), hāhā (*Cyanea crispa*), hāhā (*Cyanea koolauensis*), *Diellia erecta*, nānū (*Gardenia mannii*), *Gouania meyenii*, wāwae ʻiole (*Huperzia nutans*), *Lobelia oahuensis*, ʻlhiʻihi (*Marsilea villosa*), *Pteris lidgatei, Schiedea nuttallii, Spermolepis hawaiiensis*, and designated critical habitat for Oʻahu ʻelepaio. The findings and recommendations in this consultation are based on: (1) your Revised Biological Assessment dated March 2016, and (2) other information available to us. A complete administrative record is on file in our office. This response is in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*).

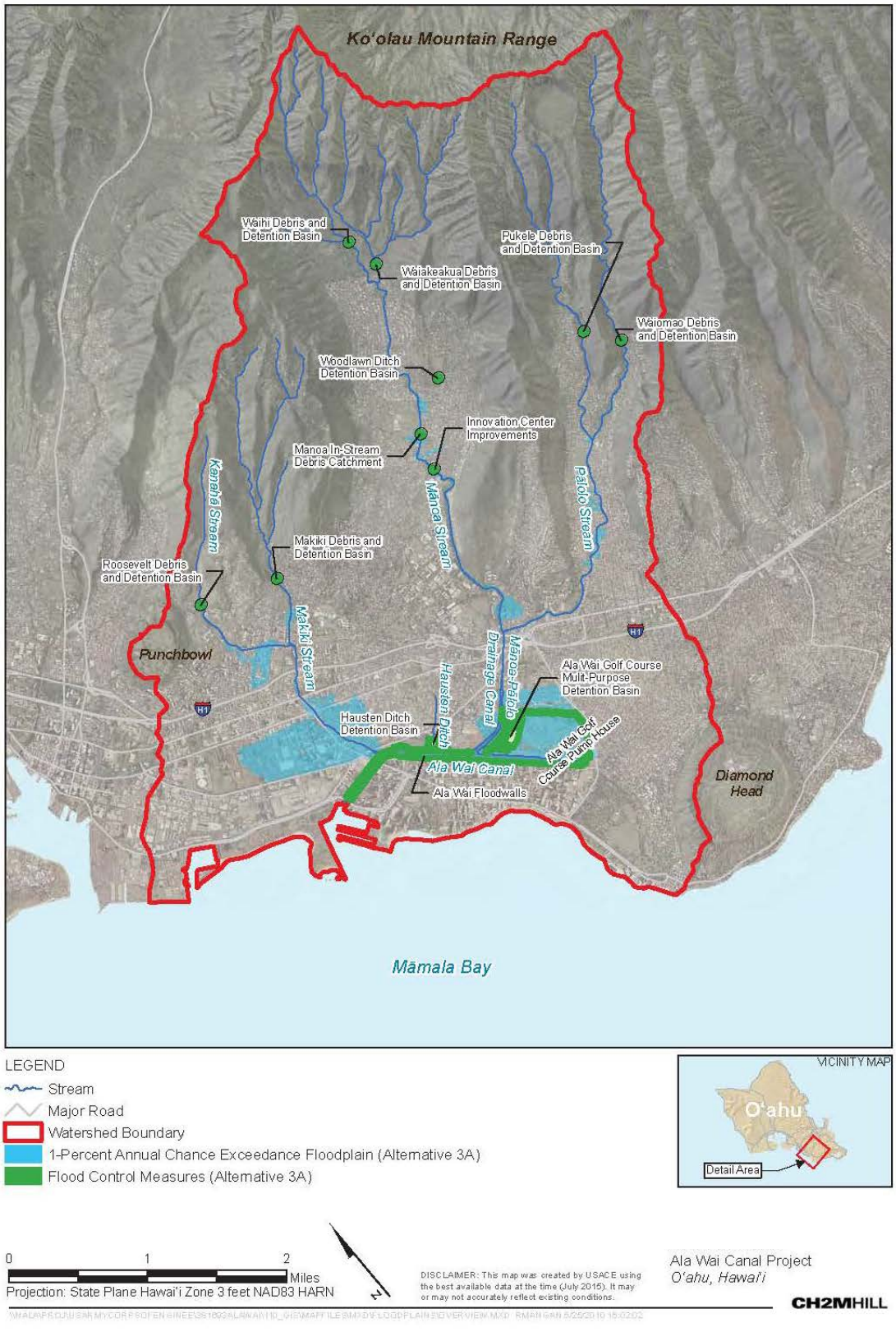
Project Description

The project description and action areas are the same as described above for the formal consultation with the addition of the following described below.

Additional project locations:

- **Woodlawn Ditch detention basin**: Woodlawn Ditch (a manmade tributary to Mānoa Stream), adjacent to East Mānoa Road.
- **Mānoa in-stream debris catchment**: Middle reach of Mānoa Stream, directly adjacent to lower edge of Mānoa District Park.
- **Kānewai Field multi-purpose detention basin**: Lower reach of Mānoa Stream, just below Dole Street.
- **Waiʻōmaʻo debris and detention basin**: Pūkele Stream, adjacent to various residences on Waiʻōmaʻo Road.
- **Pūkele debris and detention basin**: Pūkele Stream, adjacent to residences on Ipulei Place.
- **Makiki debris and detention basin**: Makiki Stream, directly adjacent to Makiki Heights Drive.
- **Ala Wai Canal floodwalls**: Ala Wai Canal
- **Hausten Ditch detention basin**: Hausten Ditch (drainage input to Ala Wai Canal)
- **Ala Wai Golf Course multi-purpose detention basin**: Ala Wai Canal

Figure 1. Locations of proposed flood control measures for the Ala Wai Canal Project.



Additional project measures:

- **Floodwalls**: The floodwalls would be comprised of concrete walls that would function to increase existing channel capacity. The floodwalls would range in height, and would be either constructed with a minimal set back distance from the existing stream or canal walls. Local drainage patterns would be maintained to the extent possible, with flapgates/slidegates and pumps incorporated where necessary.
- **Non-structural measures**: Non-structural measures generally involve the use of knowledge, practices or agreements to change a condition, such as through policies and laws. These may also include efforts such as improved flood warning, greater communication of flood risks, and tools or incentives to property owners to help protect their property (such as flood insurance). Non-structural measures that have been identified as feasible options for this project include improvements to the flood warning system.

These specific measures and the approximate area of disturbance associated with each proposed location within the watershed is summarized in Table 1. Following construction, the proposed operation and maintenance required for each of the flood risk management measures will be operated and maintained by the non-federal sponsor and are summarized in Table 2. Each of the measures described is assumed to have a life expectancy of 50 years, with maintenance performed on a routine basis.

Table 1. Proposed Flood Risk Management Measures for the Ala Wai Canal Project.

Measure[1]	Description of Measure	Total Area of Disturbance		Permanent Structure Footprint		Temporary Disturbance (e.g., Staging) (ac)	Vegetation Management		Extent of Inundation (duration for 1% ACE)
		Total Area (ac)	Length of Steam (ft)	Total Area (ac)	Length of Steam (ft)		Total Area (ac)	Length of Steam (ft)	
Woodlawn Ditch Detention Basin	Construct a three-sided berm, approximately 15' high and 840' across to create the detention basin. Construct arch culvert with 80' wide concrete spillway above culvert with riprap on upstream and downstream side. Arch culvert and spillway will tie into Woodlawn ditch for drainage. A 20-foot-wide area around the perimeter of the berm and potentially flooded area will be cleared and maintained.	1.9	120	1.1	60	0.1	1	40	1.7 acres inundated for up to 10 hours
Mānoa In-Stream Debris Catchment	Construct concrete pad over stream bed, approximately 8' wide and 60' across; with steel posts (up to approximately 7' high) evenly spaced 4' apart along concrete pad.	0.1	48	0.01	8	0.1	0.1	40	None
Kānewai Field Multi-Purpose Detention Basin	Construct earthen berms, approximately 9' high around 3 sides of field to create a detention basin. Construct 60' wide grouted riprap inflow spillway of concrete along bank of Mānoa Stream (on northwest end) to allow high stream flows to enter the new detention basin. Existing drainage pipe at south end of basin will allow water to re-enter stream. A 20-foot-wide area around the perimeter of the berm and potentially flooded area will be cleared and maintained.	6.1	70	0.9	70	0.1	5.5	0	5.1 acres inundated for up to 10 hours
Waiʻōmaʻo Debris and Detention Basin	Earthen dam, approximately 33.5' high and 120' across; with an arch culvert to allow small storm flows to pass. Culvert length will be 170' in length. Construct a 110' wide concrete spillway above culvert with grouted riprap on upstream and downstream side. Downstream riprap scour protection will be approximately 150 linear feet. Construct an energy dissipation structure on downstream end of culvert. Debris catchment feature located on upstream end of culvert. Excavate approximately 3,060	1.6	720	0.5	320	0.1	1.1	40	1.0 acre inundated for up to 10 hours

	cubic yards of soil to provide required detention volume upstream of berm. Low-flow channel with existing substrate to be restored following excavation. Create new access road for construction and operation and maintenance. A 20-foot-wide area around the perimeter of the berm will be cleared and maintained. Existing Waiʻōmaʻo USGS Gauging Station will be demolished during construction. Project footprint will be 19,890 square feet.								
Waiʻōmaʻo Debris Catchment	Construct a concrete pad, approximately 8' wide and 50' across with steel posts (up to approximately 7' high) evenly spaced 4' apart along concrete pad.	0.4	48	0.1	8	0.1	0.1	40	None
Pūkele Debris and Detention Basin	Earthen berm, approximately 30' high and 120' across; with an arch culvert to allow small storm flows to pass. Culvert length will be 160 feet. Construct a 110' wide concrete spillway above culvert with grouted riprap on upstream and downstream side. Downstream riprap will be approximately 150 linear feet for scour protection. Debris catchment feature located on upstream end of culvert. Energy dissipation structure to be located on downstream end of culver. Excavate 14,330 square yards upstream of dam to provide required detention volume upstream of berm. Create new access road for construction and operation and maintenance. A 20-foot-wide area around the perimeter of the berm will be cleared and maintained. Project footprint will be 16,660 square feet.	1.6	810	0.4	310	0.1	0.1	40	0.8 acre inundated for up to 9 hours
Pūkele Debris Catchment	Concrete pad, approximately 8' wide and 25' across; steel posts (up to approximately 7' high) evenly spaced 4' apart along concrete pad.	0.2	48	0.1	8	0.1	0.1	40	None
Makiki Debris and Detention Basin	Earthen dam, approximately 24' high and 100' across; with an arch culvert to allow small storm flows to pass. Arch culvert length will be 160 ft. Construct a 90' wide	1.5	780	0.4	310	0.1	0.1	40	0.5 acre inundated for up to 9 hours

	concrete spillway above culvert with grouted riprap on the upstream and downstream side. Downstream side riprap will be approximately 150 linear feet for scour protection. Debris catchment feature located on upstream end of culvert. Energy dissipation structure to be located on downstream end of culvert. Excavate 14,040 square feet upstream of dam for required detention capacity. Create new access road for construction and operation and maintenance. A 20-foot-wide area around the perimeter of the berm will be cleared and maintained. Project footprint will be 17,165 square feet.								
Ala Wai Canal Floodwalls and Pump Station	Add concrete floodwalls along Ala Wai Canal ranging in height up to approximately 5 feet high. Floodwalls will be offset from existing canal walls. Existing stairs to be extended and new ramps to be installed to maintain access to canal. Add three pump stations and gates to existing drainage pipes to prevent drainage flooding that may be caused on the exterior of the new Ala Wai floodwalls. Pump stations to be located at diamond head end of Ala Wai canal, within Ala Wai Golf Course at head of Kapahulu Ditch, and in Ala Wai Park, near Hausten Ditch detention basin. Slide and flap gates will be installed at existing drainage pipes along the entire canal to prevent backflow out of the canal. New floodgate to be installed at Ala Wai Clubhouse near McCully Street.								
Hausten Ditch Detention Basin	Construct concrete floodwalls and earthen berm (approximately 7’ high) around a portion of the Ala Wai Park to provide detention for local drainage. Install concrete wall with four slide gates adjacent to the upstream edge of the existing bridge to control flow and prevent a backflow of floodwaters between Hausten Ditch and Ala Wai Canal during a flood event. The area within the berm to be maintained as a field	1.4	70	0.2	35	0.1	1.1	35	3.5 acres inundated for up to 4 hours

	for recreational use during non-flood conditions.								
Ala Wai Golf Course Multi-Purpose Detention Basin	Construct earthen berm approximately 7' high around northern and eastern outside perimeter of golf course property. Add floodgate across main entrance road. Construct 60' long concrete inflow spillway with grouted riprap along bank of Mānoa-Pālolo Drainage Canal to allow high flows to enter the basin. Excavate sediment basin within "rough" (out of bounds; western portion) areas of the golf course to act as sediment catchment during storm events with passive drainage back into Ala Wai Canal.	25.6	70	4	70	0.6	8.4	0	134 acres inundated for up to 10 hours
Flood Warning System	Installation of 3 real-time rain gages (Mānoa, Makiki, and Pālolo Streams) and 1 real-time streamflow or stage gage (Ala Wai Canal) as part of flood warning system for Ala Wai Watershed.	minimal	minimal	minimal	minimal	minimal	0	0	None
Falls 7 and 8	Installation of grouted stones to eliminate passage barrier by providing a suitable surface for migration of native species at 2 in-stream structures.	0.05	110	0.004	10	0.05	0	0	None

NOTES:
[1] In addition to these structural measures, the proposed project would also include improvements to the existing flood warning system.
[2] Inundation area is the area behind the detention basin that is expected to be inundated during a 1-percent annual chance exceedance flood event.

Table 2. Proposed Operation and Maintenance Activities.

Measure Type	Summary of Operation and Maintenance Activities
Multi-Purpose Detention Basin	Cut/clear vegetation within cleared zoned (20 feet around perimeter of structures) twice a year, allowing no woody vegetation to grow in this area.
Debris Catchment	Clear accumulated debris twice per year.
Floodwalls	Periodically inspect drainage pipes and gates, and remove any impediments to movement. Inspect, test, and maintain pump systems annually. Paint and/or grease metal parts, as needed (e.g. patching).
Flood Warning System	Periodically inspect gages for proper operating conditions. Keep area around sensors free from sediment deposits and plant growth, or other impediments to data collection. Inspect and test annually (includes annual operating cost).
Falls 7 and 8	Periodically inspect in-stream structure for potential erosion or undercutting; reinforce as needed.

NOTES:
[1]Debris and sediment cleared from the flood risk management measure locations would be disposed at an existing authorized location.

Conservation Measures to Avoid and Minimize Effects to Listed Species
The following conservation measures identified in your Revised Biological Assessment will be implemented at the project sites to avoid and minimize effects to the Hawaiian hoary bat, O‘ahu ‘elepaio, Hawaiian stilt, Hawaiian coot, Hawaiian gallinule, and Hawaiian duck. These conservation measures are considered part of the project description. Any changes to, modifications of, or failure to implement these conservation measures may result in the need to reinitiate this consultation.

- No woody plants greater than 15 ft (5 m) in height will be removed or trimmed during the Hawaiian hoary bat-breeding season (June 1 to September 15). Removal of any woody vegetation that exceeds 15 feet in height would be conducted outside of the Hawaiian hoary bat’s pupping season (June 1 through September 15) during construction and operation of the project’s features. In addition, construction and maintenance operations would be restricted to daylight hours to avoid potential bat foraging activities.
- The trimming and clearing of vegetation in areas of suitable ‘elepaio habitat would be restricted during their nesting season (January through June). Seasonal restrictions for trimming/clearing of vegetation would be incorporated to avoid and/or minimize the potential for impacts to the O‘ahu ‘elepaio, should it occur in the action area.
- All project personnel will be briefed on ESA-listed species that could be present on the project site and on the protections afforded to these species under the ESA. This information will also be included in the USACE Operations and Maintenance Manual for the project for the use and reference by maintenance personnel.
- No attempt will be made by project personnel to feed, touch or otherwise intentionally interact with any ESA protected species. If a protected species is present in the vicinity of any active work area, they must be allowed to leave the area on their own accord before work in that area can resume.

<u>Hawaiian hoary bat</u>
The Hawaiian hoary bat is a medium-sized [0.5-0.8 ounces (14-22 grams)], nocturnal, insectivorous bat. The Hawaiian hoary bat is known from the islands of Hawai‘i, Maui, O‘ahu,

Kauaʻi, and Molokaʻi. There is a general lack of historic and current data on this subspecies, and its present status and habitat requirements are not well understood. Bats are most often observed foraging in open areas, near the edges of native forests, or over open water, although this may be due to the ease of detection in these habitats. Hawaiian hoary bats roost solitarily in the foliage of trees.

Threats to the Hawaiian hoary bat include habitat destruction (elimination of roosting sites), direct and indirect effects of pesticides, disease and entanglement on barbed wire fences. In addition, Hawaiian hoary bats roost in both exotic and native woody vegetation and, while foraging, will leave young unattended in "nursery" trees and shrubs. If trees or shrubs suitable for bat roosting are cleared during the breeding season, there is a risk that young bats could inadvertently be harmed or killed. By implementing the above conservation measure, the proposed project will avoid potential adverse effects to Hawaiian hoary bats.

<u>Oʻahu ʻelepaio</u>
The Oʻahu ʻelepaio is a small [12.5 grams (0.44 ounces) average weight; 15 centimeters (cm) (5.9 inches (in)) total body length] territorial, non-migratory monarch flycatcher endemic to the island of Oʻahu. Oʻahu ʻelepaio are found in a variety of forest types ranging from wet to dry, including wet, mesic, and dry forest consisting of native and/or introduced plant species, but higher population density can be expected in closed canopy riparian forest with a continuous canopy and dense understory.

The breeding season occurs from January to June, where they weave nests from a variety of vegetation, spending time both in trees and leaf litter while searching for food. The primary threat to the Oʻahu ʻelepaio is loss of habitat, as well as predation from introduced predators. If potentially disruptive activities, such as tree removal (including trimming), are implemented during the breeding season, there is a risk that nests (eggs and chicks) could be inadvertently harmed or killed. By implementing the above conservation measure, the proposed project will avoid potential adverse effects to Oʻahu ʻelepaio.

<u>Hawaiian stilt, Hawaiian coot, Hawaiian gallinule, and Hawaiian duck</u>
Hawaiian stilts use a variety of aquatic habitats but are limited by water depth and vegetation cover. Hawaiian stilts are known to use ephemeral lakes, anchialine ponds, prawn farm ponds, marshlands and tidal flats. Foraging habitat for Hawaiian stilt is early successional marshland or other aquatic habitat with a water depth less than nine inches and perennial vegetation that is limited and low-growing. Hawaiian stilts prefer to nest on freshly exposed mudflats interspersed with low growing vegetation (Service 2011, p. 57). Nesting also occurs on islands (natural and manmade) in freshwater or brackish ponds (Shallenberger 1977, p. 23, Coleman 1981, p. 42, Morin 1994, p. 68-69). The nesting season normally extends from mid-February through August, with peak nesting varying among years (Robinson *et al*. 1999, pg. 14).

The Hawaiian coot generally occurs within wetland habitats with suitable emergent plant growth interspersed with open water, especially freshwater wetlands, but also freshwater reservoirs, cane field reservoirs, sewage treatment ponds, taro loʻi, brackish wetlands, and limited use of saltwater habitats (Service 2011, p. 33). The species typically forages in water less than 12 in (30 cm) deep, but will dive in water up to 48 in (120 cm) deep (Service 2011, p. 33). Hawaiian coots prefer to forage in more open water. Logs, rafts of vegetation, narrow dikes, mud bars, and

artificial islands are utilized for resting. Ephemeral wetlands support large numbers of coots during the non-breeding season.

Nesting habitat includes freshwater and brackish ponds, irrigation ditches, reservoirs, small openings in marsh vegetation, commercial prawn farm ponds and taro fields (Shallenberger 1977, p. 27; Udvardy 1960, pp. 20-21). Nesting occurs primarily from March through September, although some nesting occurs in all months of the year (Shallenberger 1977, p. 27; Morin 1998, p. 10). The timing of nesting appears to correspond with seasonal weather conditions (Byrd *et al*. 1985, p. 59; Engilis and Pratt 1993, pp. 154-155). Nest initiation is tied to rainfall as appropriate water levels are critical to nest success.

Hawaiian coots are generalists and feed on land, grazing on grass adjacent to wetlands, or in the water. They have been observed grazing from the surface of the water, or foraging by diving to obtain food resources (Shallenberger 1977, p. 27). Coots will travel long distances, including between islands, when local food sources are depleted (Engilis and Pratt 1993, pp. 154-155).

The Hawaiian gallinule is a secretive waterbird, preferring to forage, nest and rest in dense, late-succession wetland vegetation. Most birds feeding along the water's edge or in open water will quickly seek cover when disturbed. Preferred habitat for the Hawaiian gallinule includes: interspersed dense stands of robust late succession vegetation near open water (approximately 50 percent water to 50 percent vegetation), floating or barely emergent mats of vegetation, and water depth less than 3 feet (Service 2005).

Birds nest year-round but appear to have two active seasons, from November through February and May through August (Service 2005). The timing of nesting is believed to be related to water levels and late succession wetland vegetation. Nesting phenology is apparently tied to water levels and the presence of appropriately dense vegetation. The particular species of emergent plant used for nest construction is not as important as stem density and vegetation height (Service 2005).

The Hawaiian duck is one of two extant native duck species (Family: Anatidae) found in Hawai‘i and is closely related to the well-known, but non-native, mallard. Hawaiian ducks occur in a wide variety of natural and artificial wetland habitats including freshwater marshes, flooded grasslands, coastal ponds, streams, montane pools, forest swamplands, taro, lotus, shrimp, and fish ponds, irrigation ditches, reservoirs, and mouths of larger streams (Service 2005). Some important habitats are located on National Wildlife Refuges or on State lands and receive management attention. However, other important habitats are not protected.

Hawaiian duck nesting biology is poorly understood. Nesting occurs year-round, but most activity occurs between January and May (Engilis *et al*. 2002). Nests are usually on the ground near water, but few nests are found in areas frequented by humans or areas supporting populations of mammalian predators.

The primary causes of the decline of the Hawaiian stilt, Hawaiian coot, Hawaiian gallinule, and Hawaiian duck (collectively referred to as Hawaiian waterbirds) are the loss of wetland habitat, predation by introduced animals, over-hunting in the late 1800s and early 1900s, disease, and

environmental contaminants (Service 2011, p. iv-v). A significant amount of Hawai‘i’s wetlands have been lost due to human activities, including filling and drilling for agriculture, houses, hotels, and golf courses. The majority of the remaining wetlands are degraded by altered hydrology, invasive species, human encroachment, and contaminants. Hydrologic alterations of wetlands, including flood control and channelization, often make wetland habitat less suitable by altering water depth and timing of water level fluctuations (Service 2011, p. 79-80).

Introduced alien predators, such as small Indian mongoose (*Herpestes auropunctatus*), cats (*Felis catus*), dogs (*Canis lupus familiaris*), rats (*Rattus sp*.), cattle egret, non-native fish, and bull frog (*Rana catesbeiana*) are all presently found within wetlands and pose a serious threat to Hawaiian waterbird reproductive success by taking eggs, young birds, and even adults (Service 2011, p. 82-83).

Disease such as avian botulism type C pose a threat to Hawaiian waterbirds. Botulism can occur in any area with standing fresh or brackish water frequented by waterbirds. Botulism is a continuing threat that kills or sickens waterbirds every year in Hawai‘i.

Waterbirds have been negatively affected through direct mortality, decreased reproductive success, or degradation of feeding habitat from contaminants (Parnell *et al*. 1988, p. 135). Because waterbirds are predators, they are susceptible to contaminants accumulated in the food chain.

A potential new threat to Hawaiian waterbirds is climate change. Sea level rise may result in the loss of some wetland habitat and affect the suitability of other wetlands for waterbirds (Service 2010, p. 7). The projected landcape- or island-scale changes in temperature and precipitation, as well as the potentially catastrophic effects of projected increases in storm frequency and severity, point to likely adverse effects of climate change to Hawaiian waterbirds.

Because the proposed project will not decrease habitat currently used by Hawaiian waterbirds, increase predation or disease and contaminant exposure to waterbirds, or increase the effects of climate change to Hawaiian waterbirds we do not anticipate potential impacts as a result of the project. And by implementing the above conservation measures, the proposed project will avoid potential adverse effects to the Hawaiian stilt, Hawaiian coot, Hawaiian gallinule, and Hawaiian duck.

Summary

We concur that the proposed project may affect, but is not likely to adversely affect, the Hawaiian hoary bat, O‘ahu ‘elepaio, Hawaiian stilt, Hawaiian coot, Hawaiian gallinule, and Hawaiian duck. Unless the project description changes, or new information reveals that the proposed project may affect listed species in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to section 7 of the Act is necessary.

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Appendix B. Figures

All figures provided by the U.S. Army Corps of Engineers. 2016.

Figure 1. Ala Wai Canal Floodwalls Design Plan.

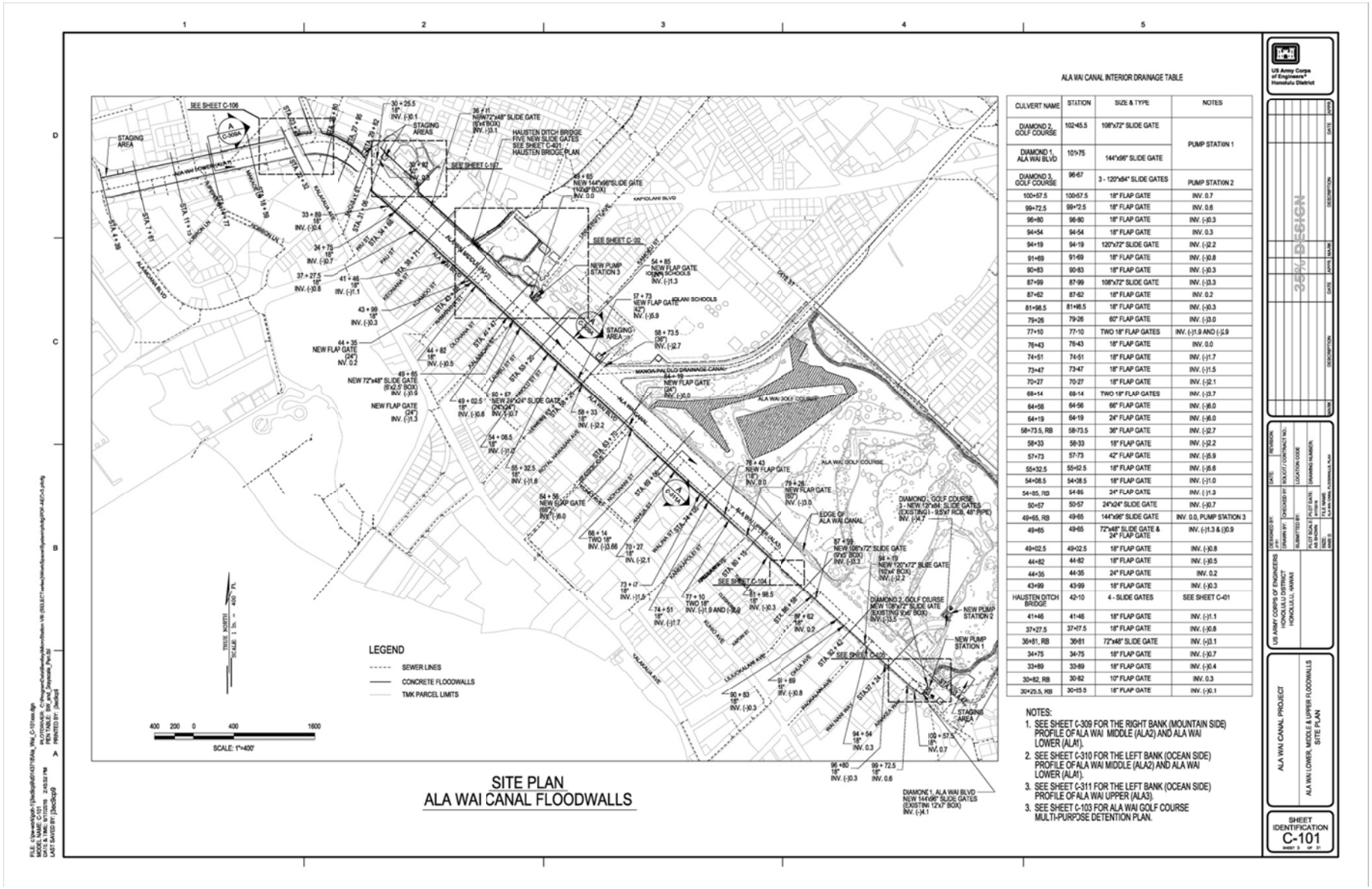


Figure 2. Ala Wai Canal Middle and Lower Left Bank Floodwalls Design Plan.

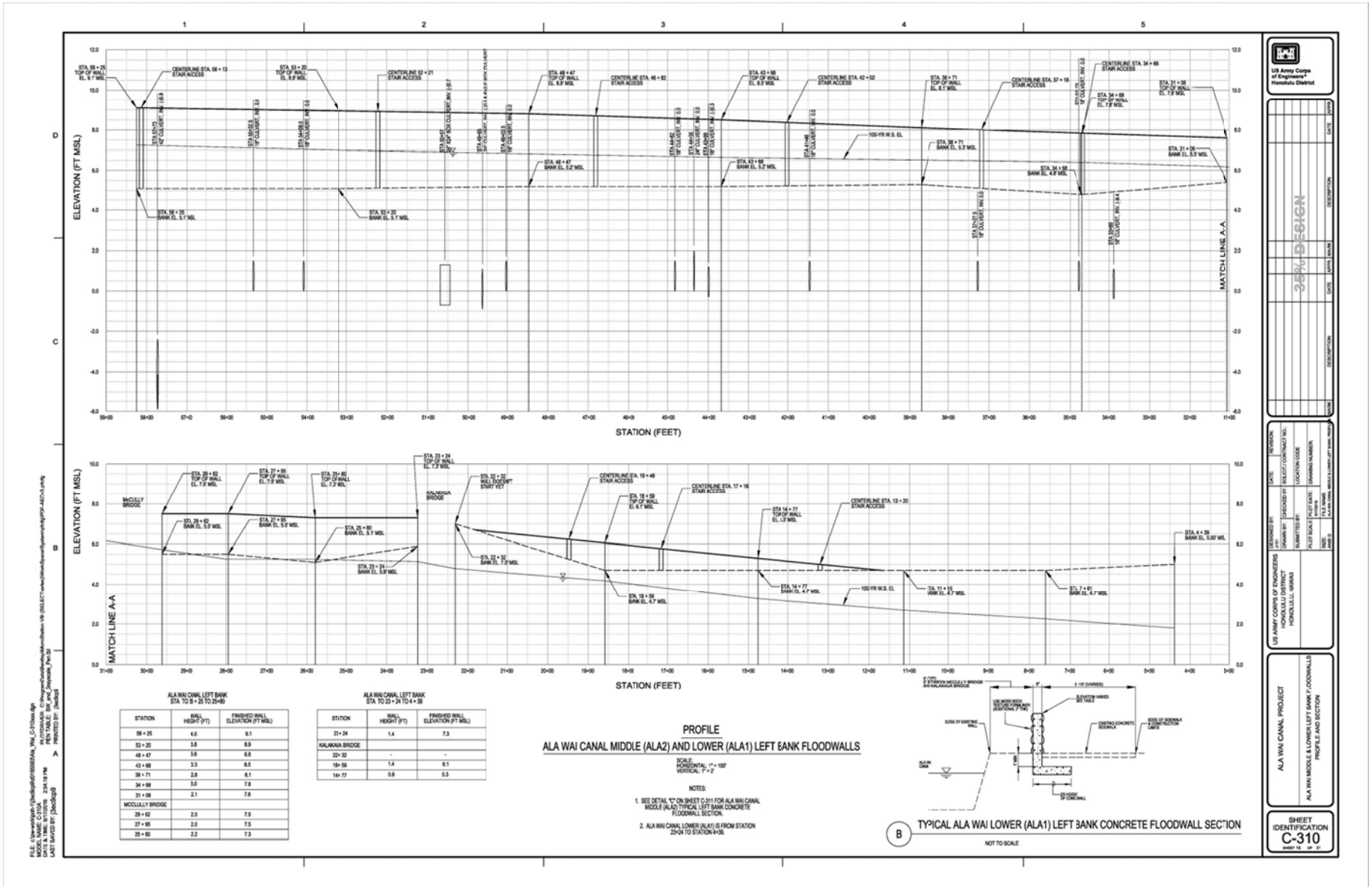
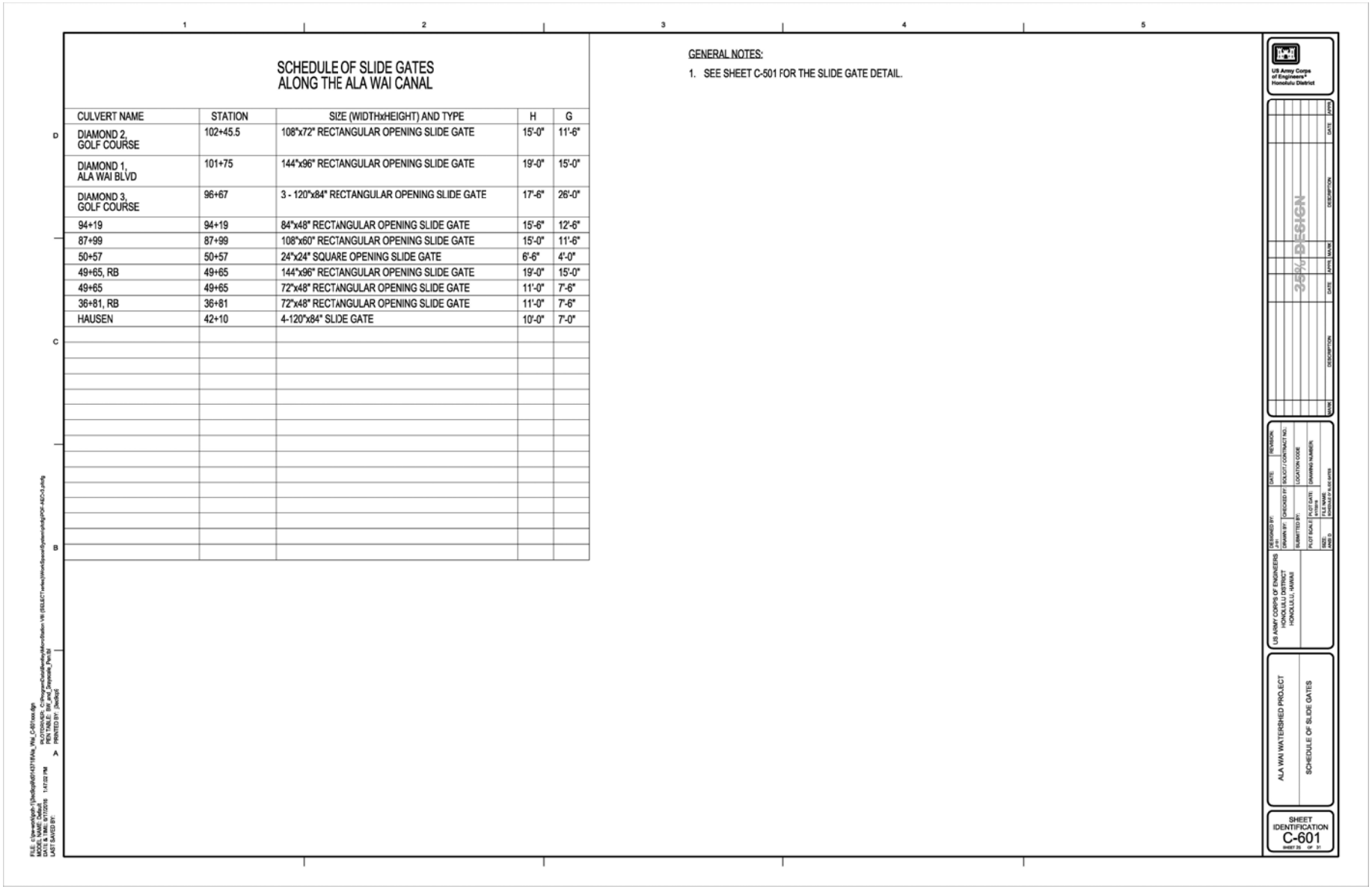


Figure 3. Schedule of Slide Gates along the Ala Wai Canal Design Plan.



SCHEDULE OF SLIDE GATES
ALONG THE ALA WAI CANAL

CULVERT NAME	STATION	SIZE (WIDTHxHEIGHT) AND TYPE	H	G
DIAMOND 2, GOLF COURSE	102+45.5	108"x72" RECTANGULAR OPENING SLIDE GATE	15'-0"	11'-6"
DIAMOND 1, ALA WAI BLVD	101+75	144"x96" RECTANGULAR OPENING SLIDE GATE	19'-0"	15'-0"
DIAMOND 3, GOLF COURSE	96+67	3 - 120"x84" RECTANGULAR OPENING SLIDE GATE	17'-6"	26'-0"
94+19	94+19	84"x48" RECTANGULAR OPENING SLIDE GATE	15'-6"	12'-6"
87+99	87+99	108"x60" RECTANGULAR OPENING SLIDE GATE	15'-0"	11'-6"
50+57	50+57	24"x24" SQUARE OPENING SLIDE GATE	6'-6"	4'-0"
49+65, RB	49+65	144"x96" RECTANGULAR OPENING SLIDE GATE	19'-0"	15'-0"
49+65	49+65	72"x48" RECTANGULAR OPENING SLIDE GATE	11'-0"	7'-6"
36+81, RB	36+81	72"x48" RECTANGULAR OPENING SLIDE GATE	11'-0"	7'-6"
HAUSEN	42+10	4-120"x84" SLIDE GATE	10'-0"	7'-0"

GENERAL NOTES:

1. SEE SHEET C-501 FOR THE SLIDE GATE DETAIL.

US Army Corps of Engineers® Honolulu District

35% DESIGN

US ARMY CORPS OF ENGINEERS HONOLULU DISTRICT HONOLULU, HAWAII

ALA WAI WATERSHED PROJECT

SCHEDULE OF SLIDE GATES

SHEET IDENTIFICATION C-601

Figure 4. Ala Wai Canal and McCully Street Design Plan.

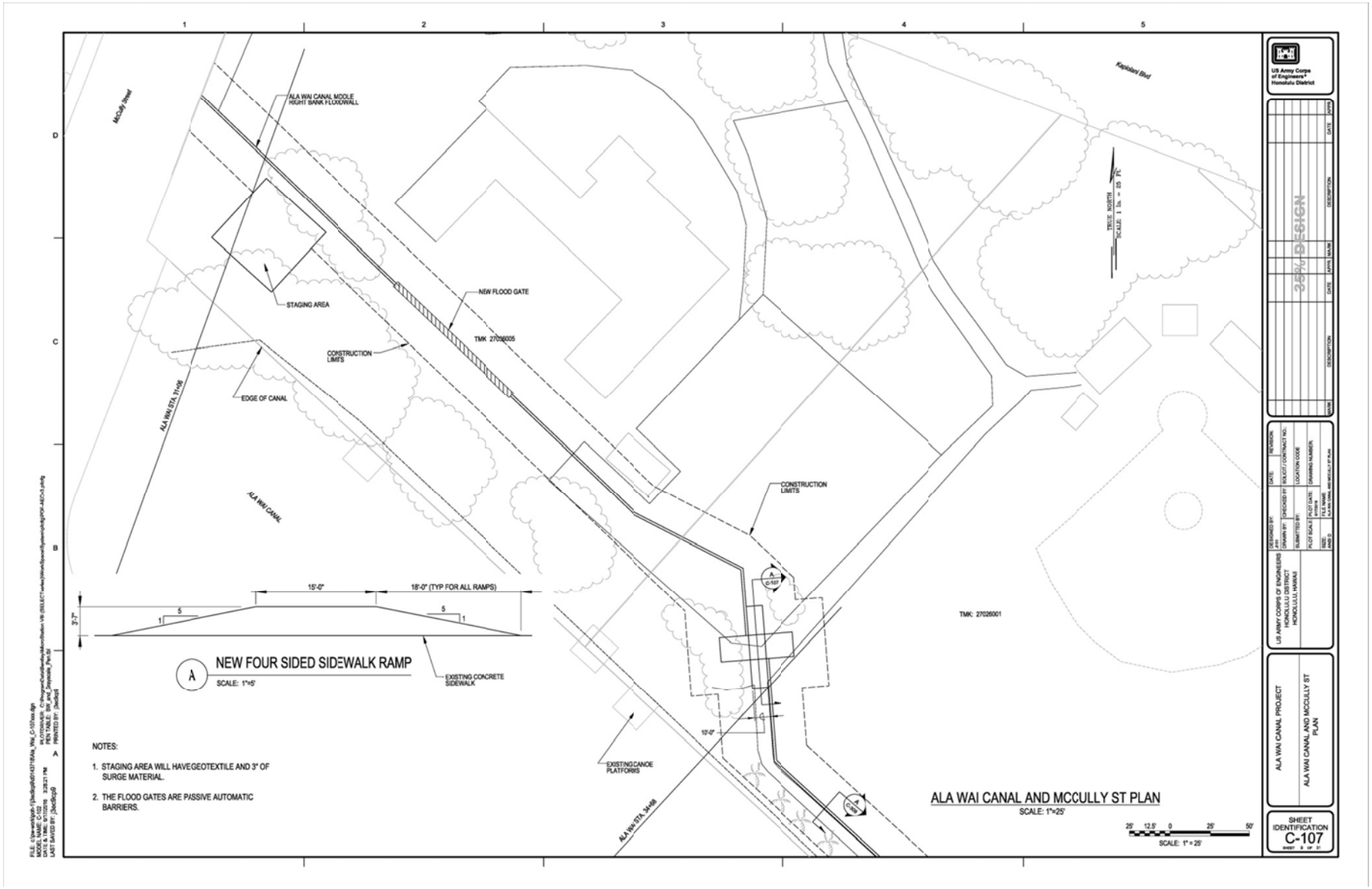


Figure 5. Waihī Debris and Detention Basin Design Plan.

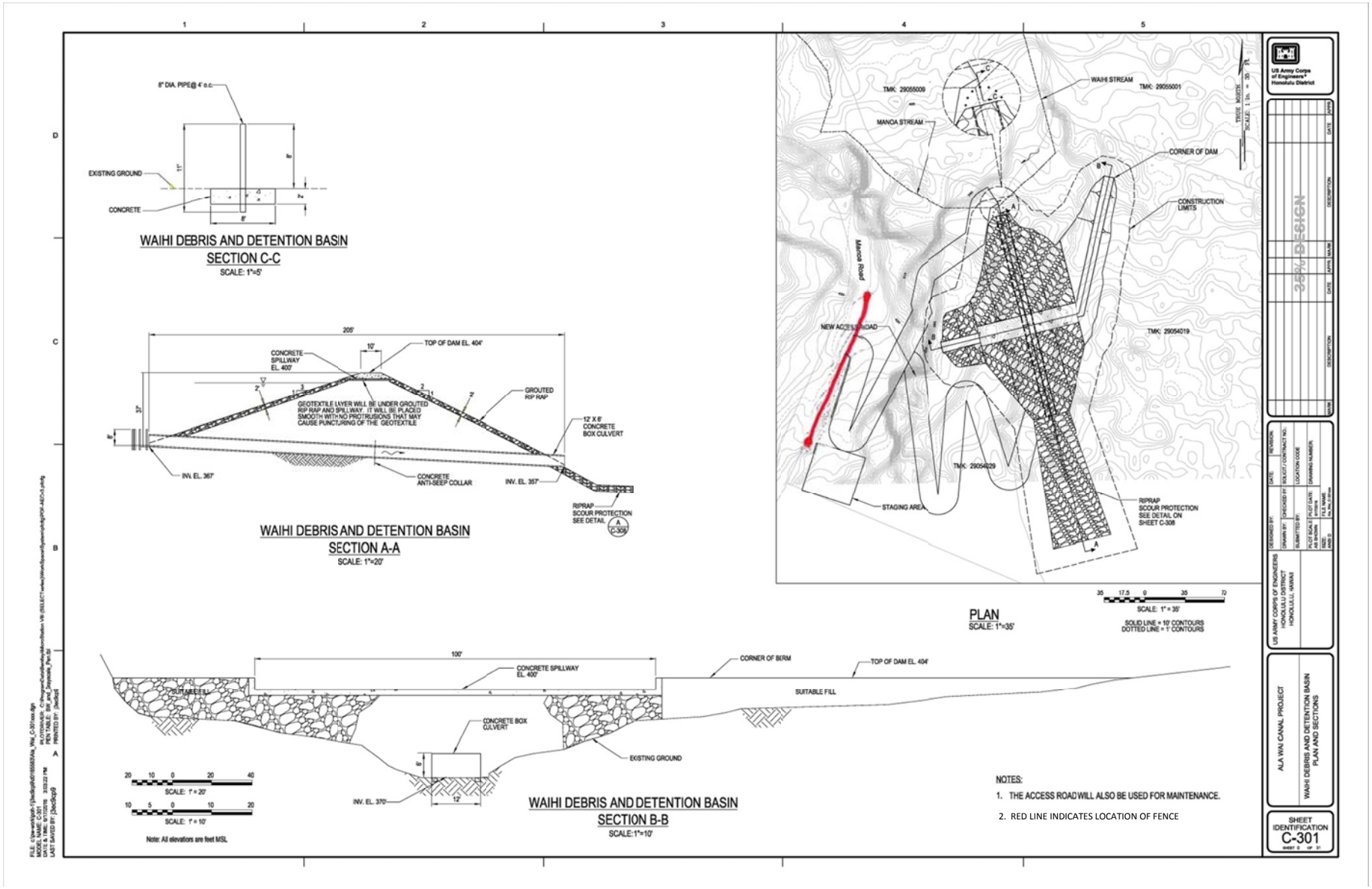


Figure 6. Waiakeakua Debris and Detention Basin Design Plan.

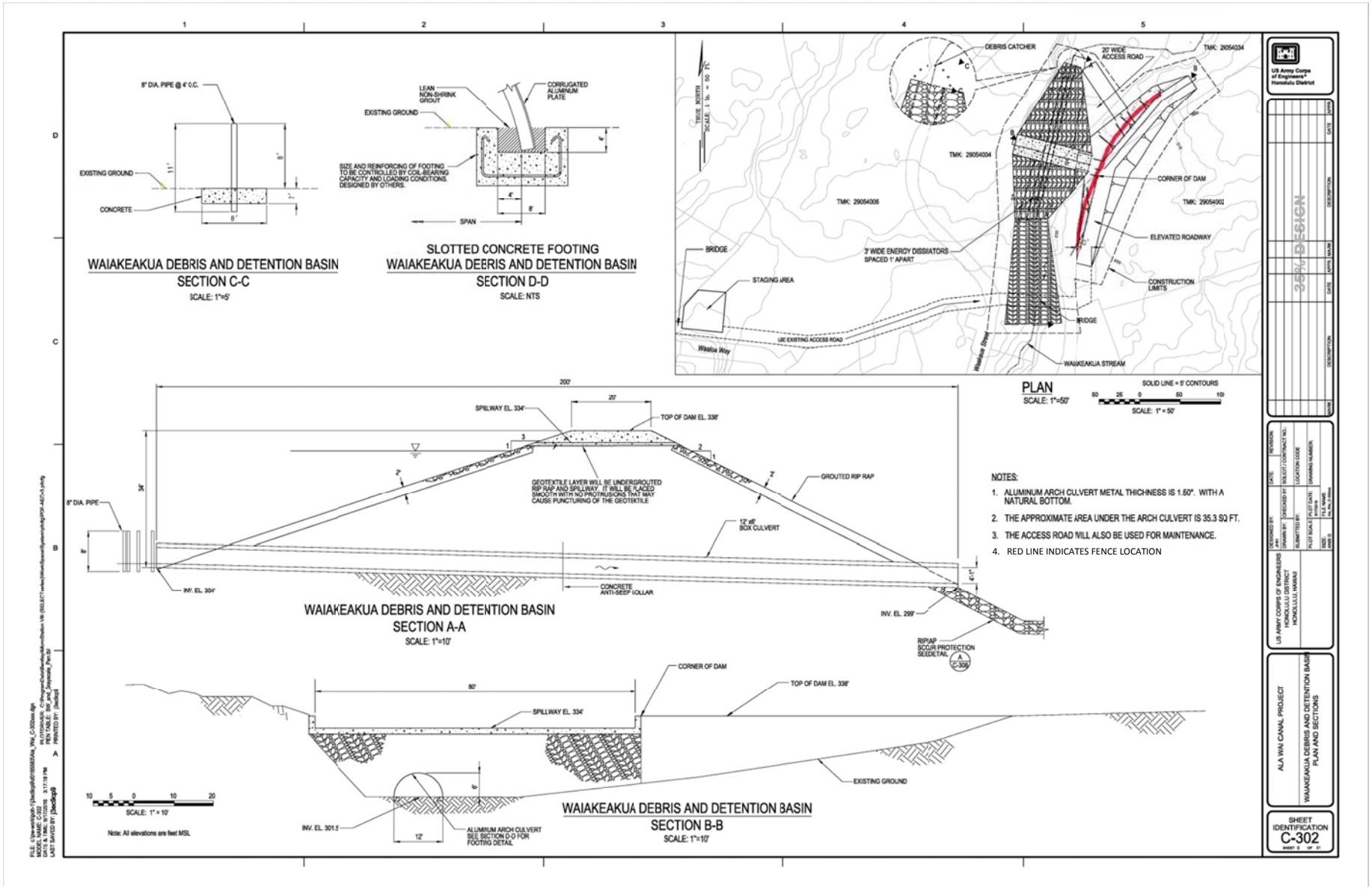


Figure 7. Kānewai Field Multi-Purpose Detention Basin Design Plan.

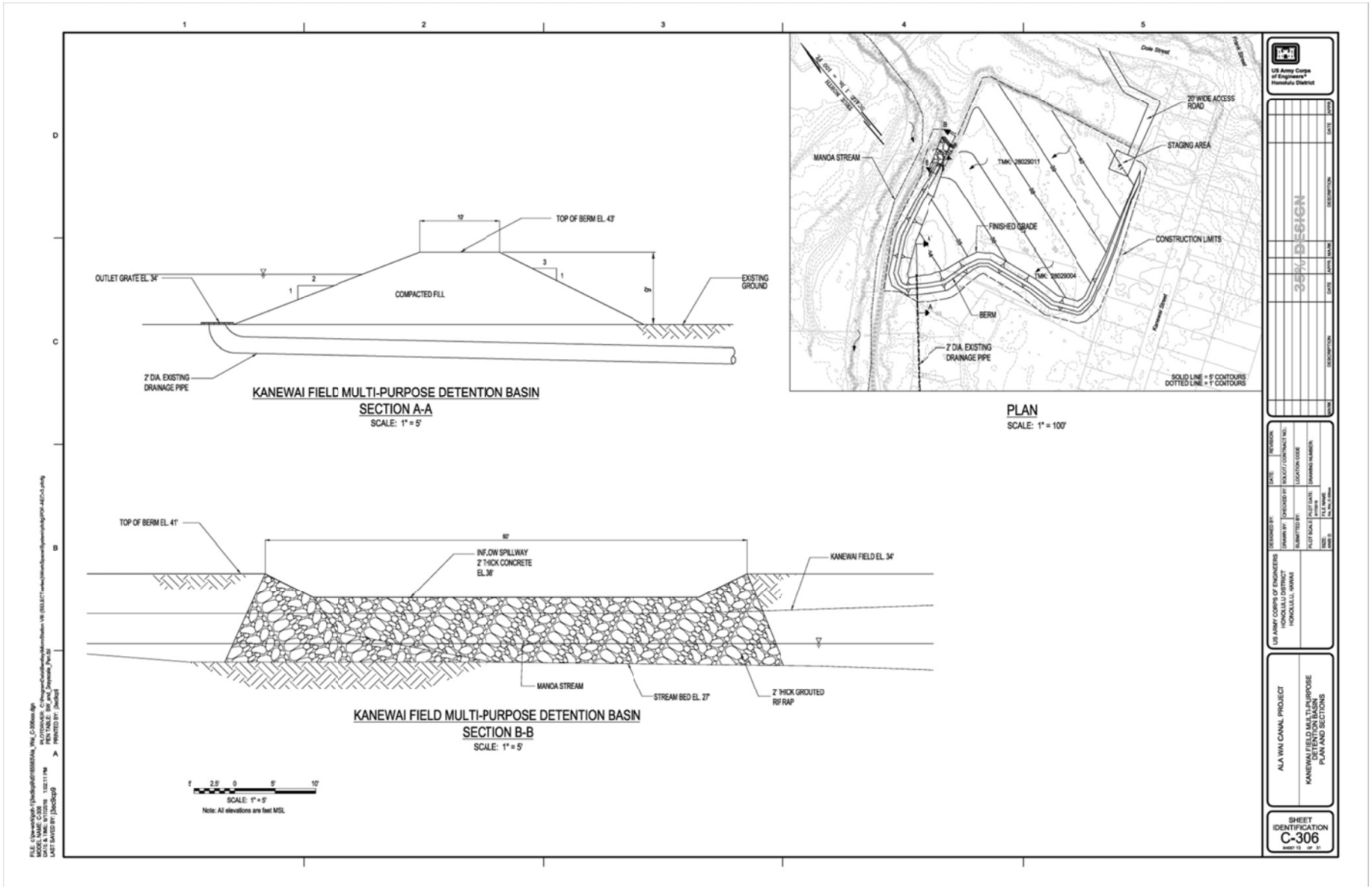


Figure 8. Waiʻōmaʻo Debris and Detention Basin Design Plan.

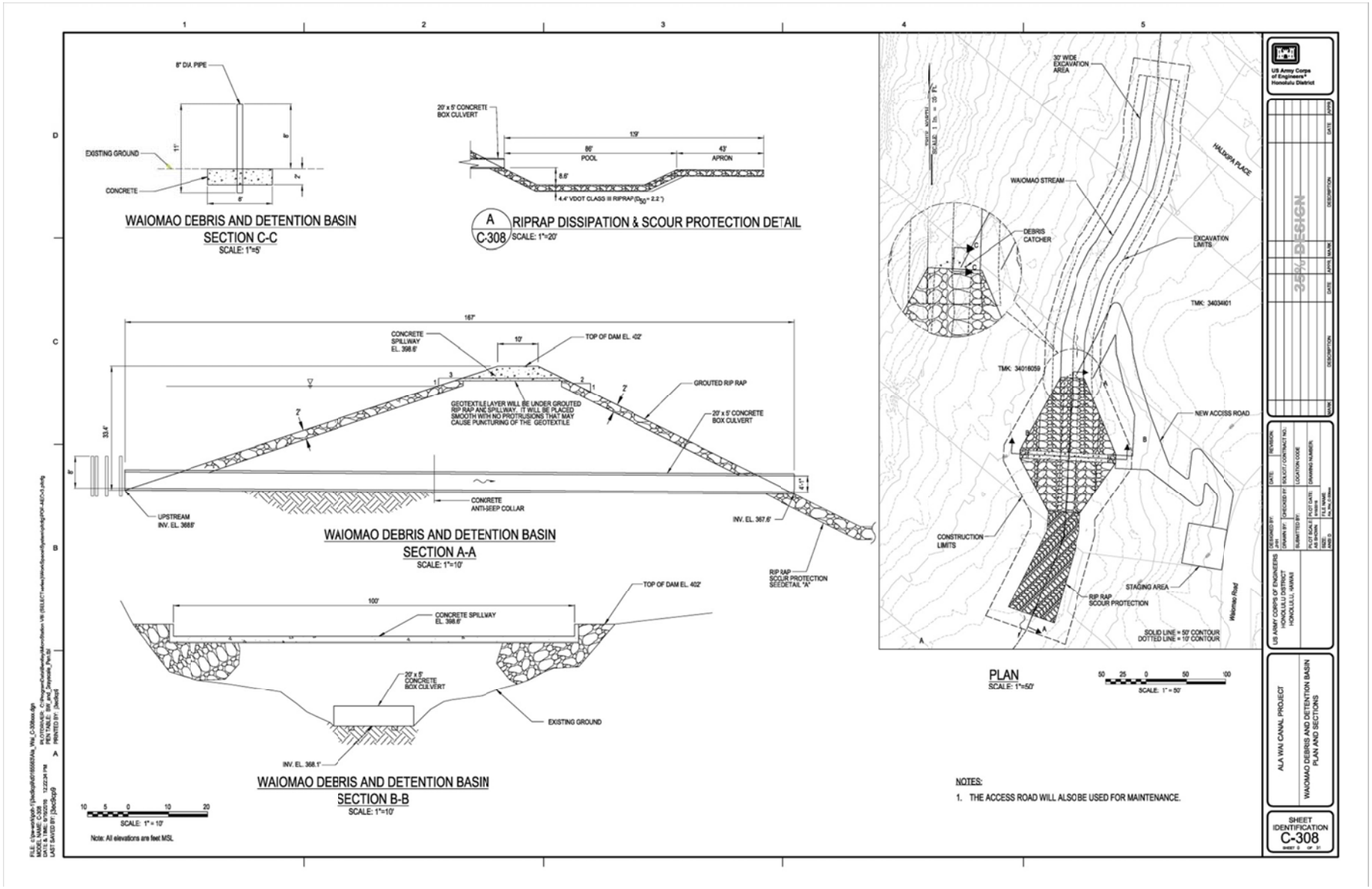


Figure 9. Pūkele Debris and Detention Basin Design Plan.

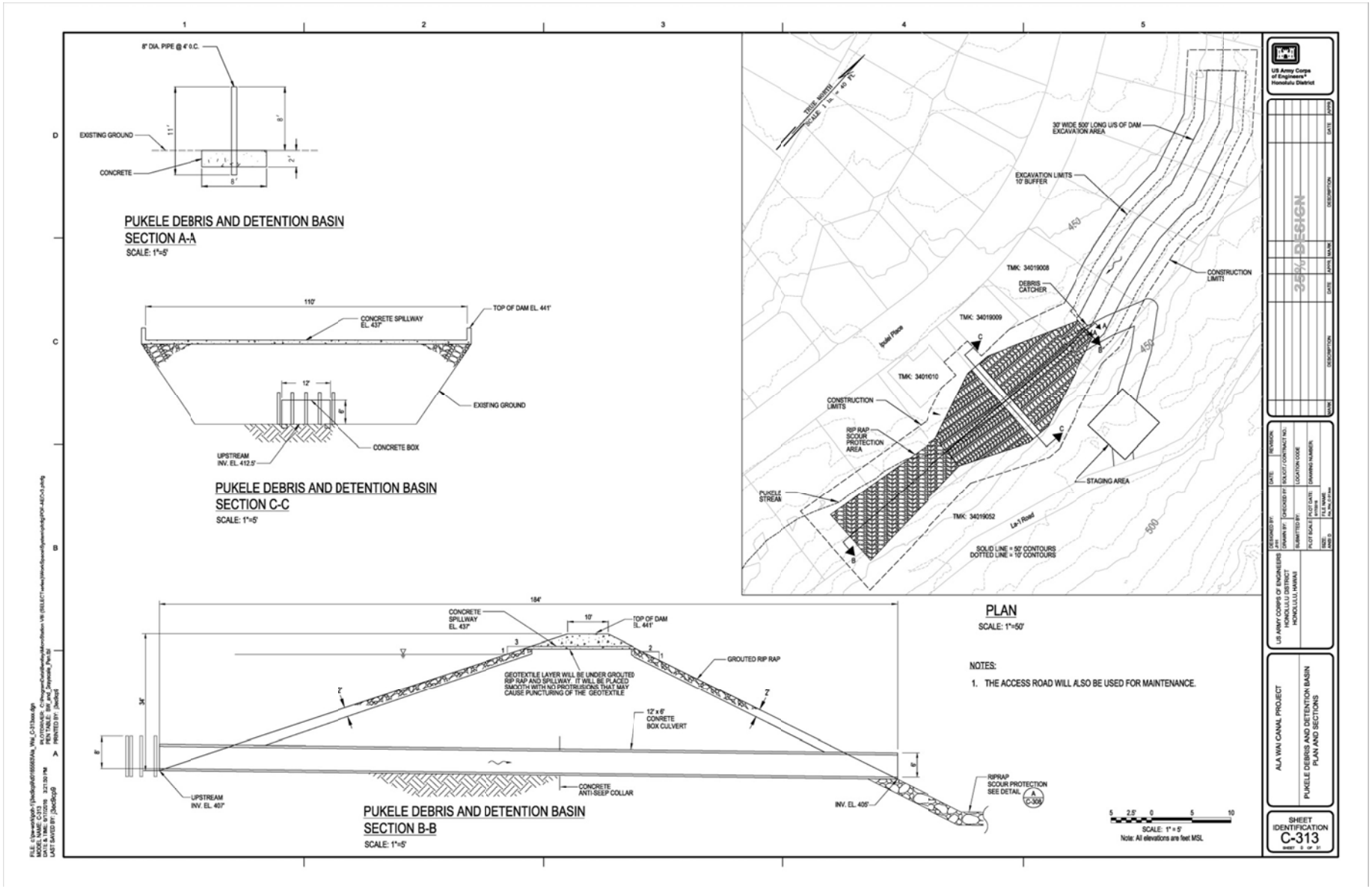


Figure 10. Makiki Debris and Detention Basin Design Plan.

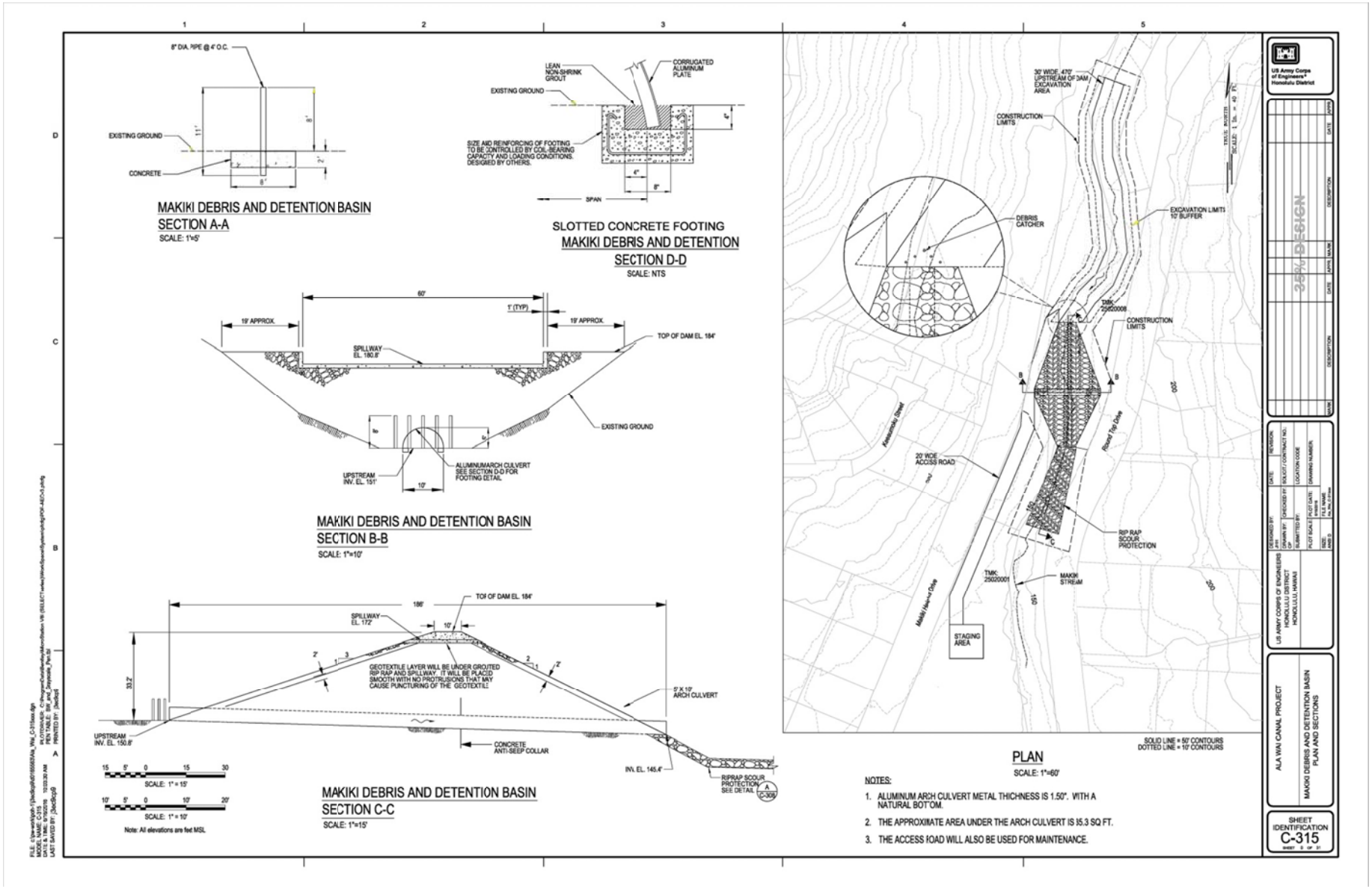


Figure 11. Waiʻōmaʻo Debris and Detention Basin.

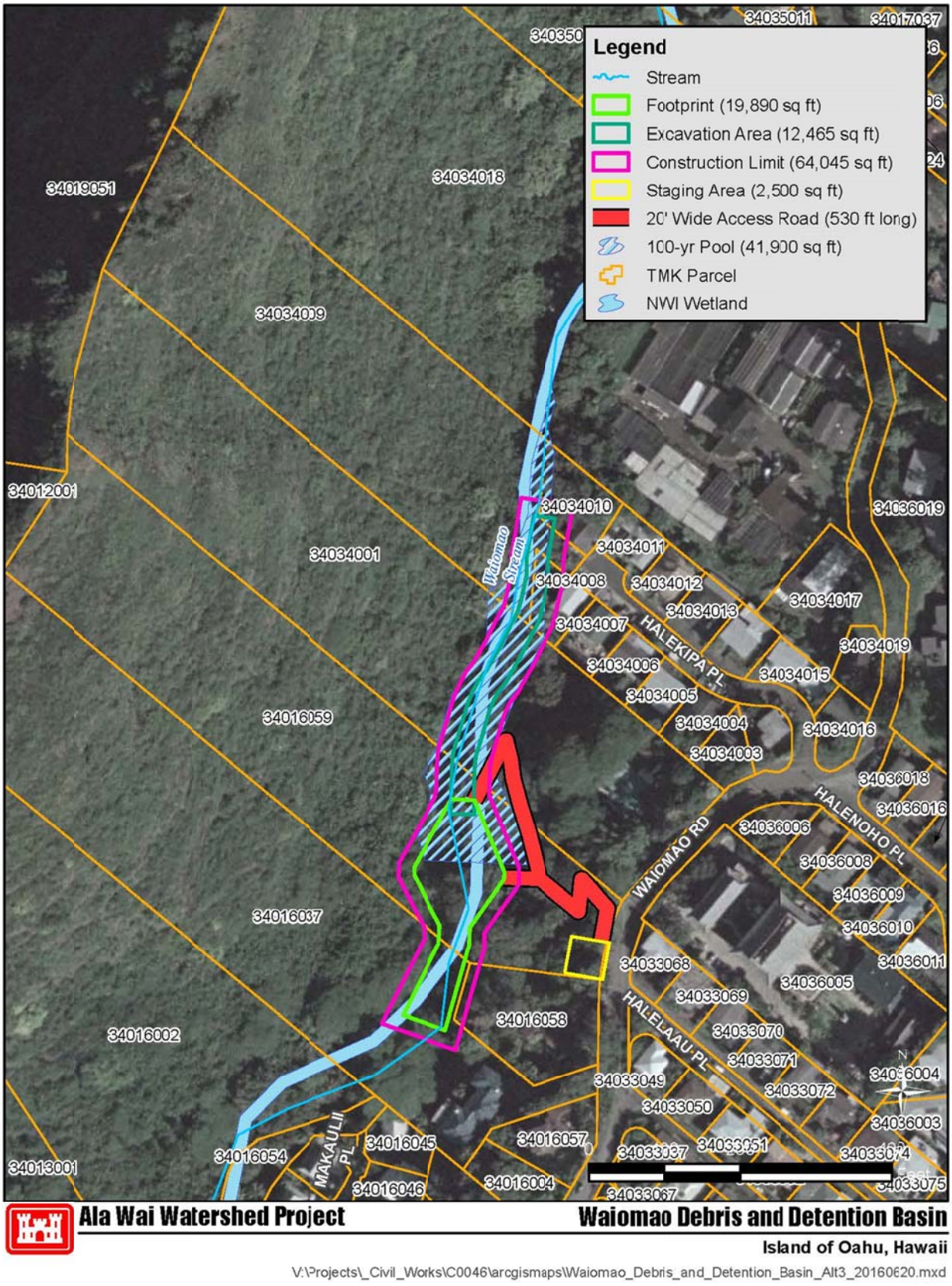


Figure 12. Pūkele Debris and Detention Basin.

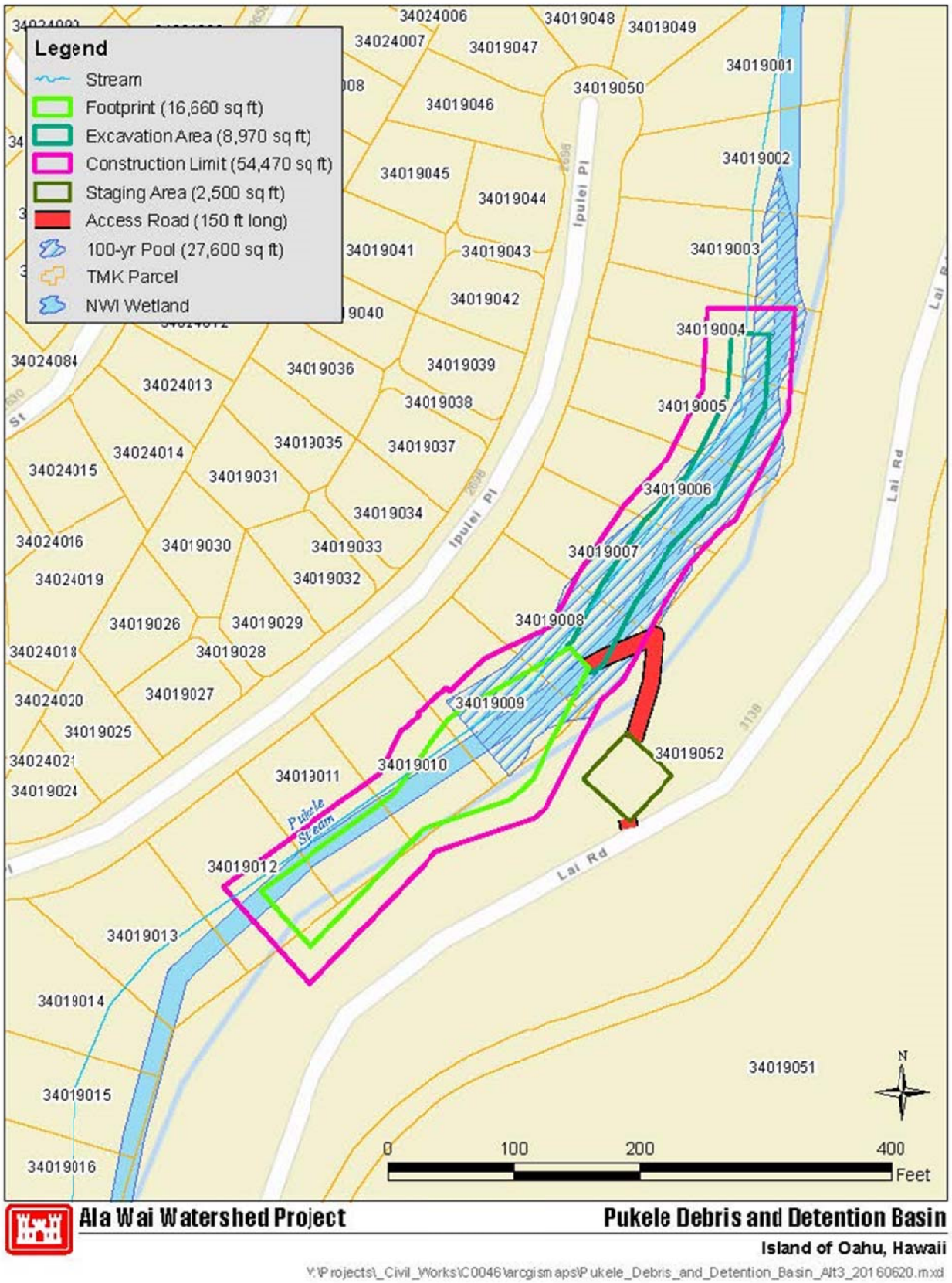
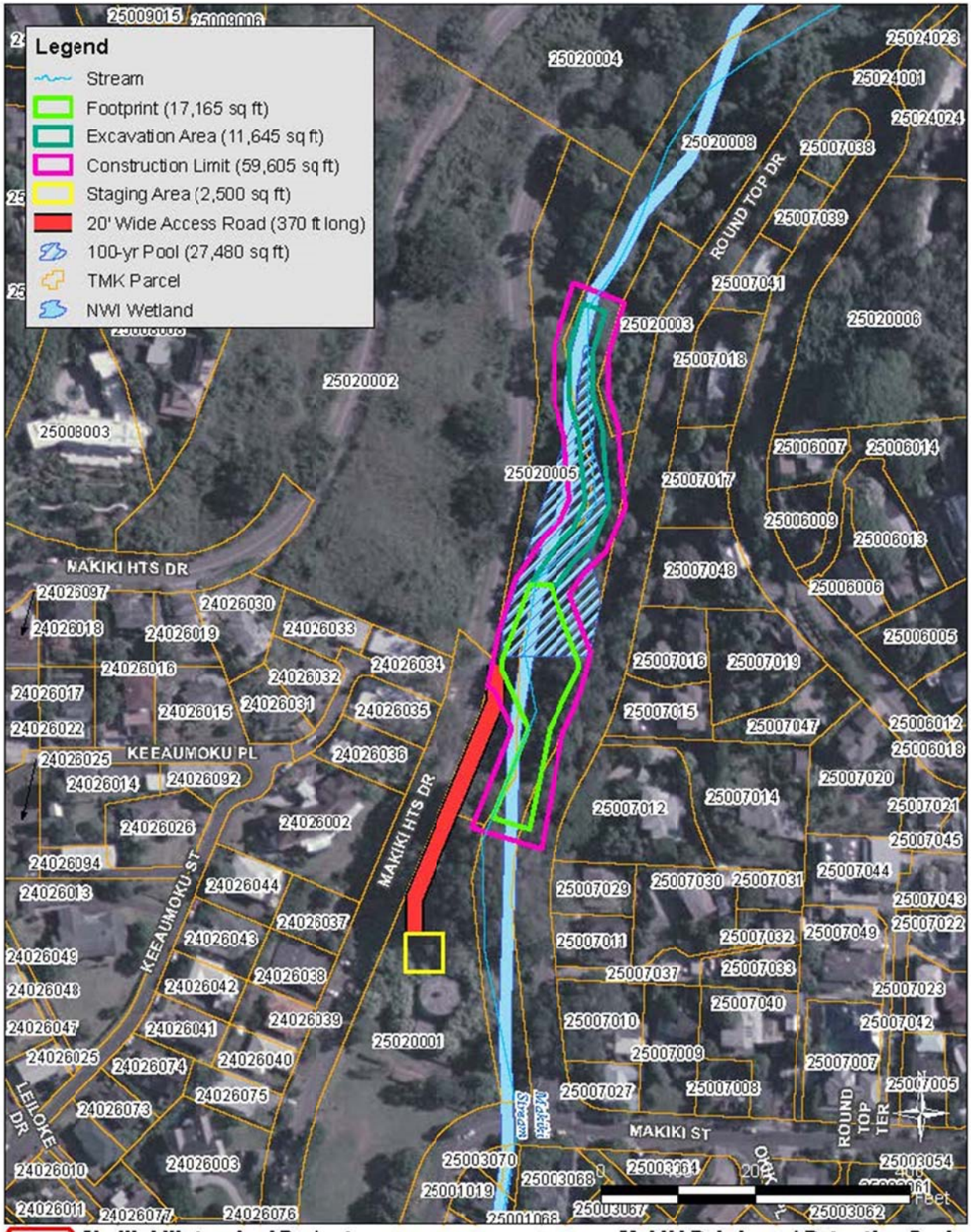


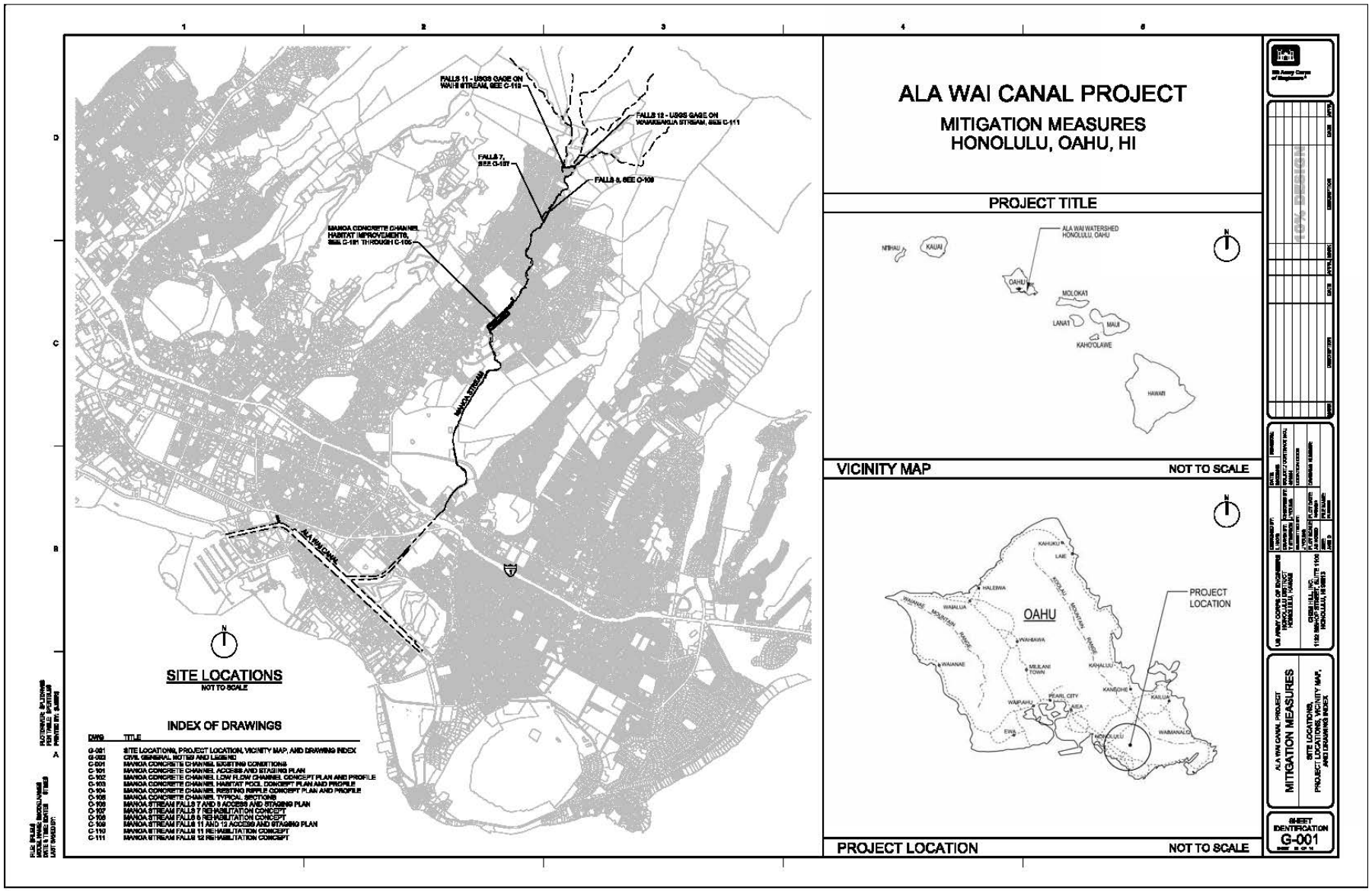
Figure 12. Makiki Debris and Detention Basin.

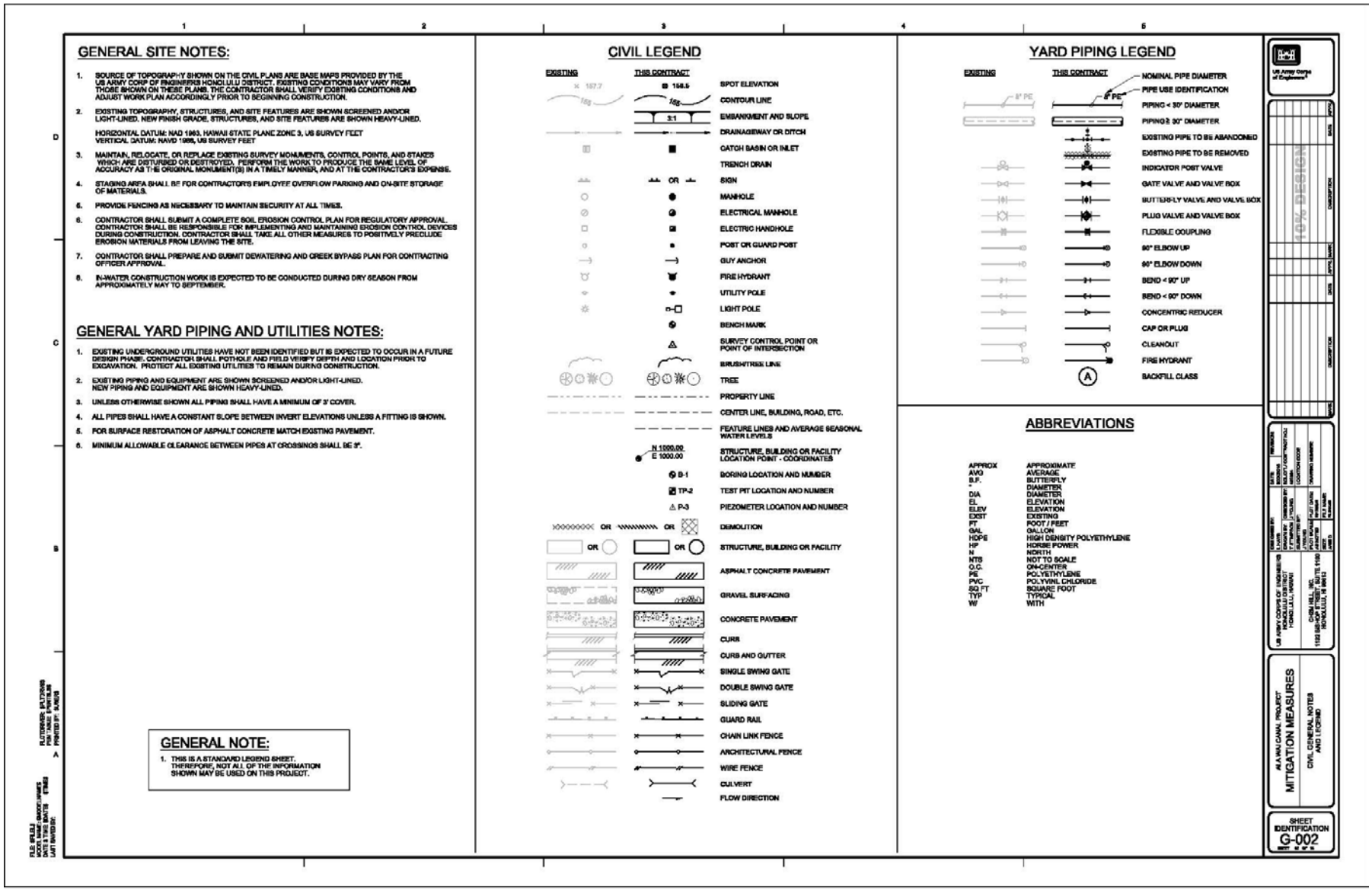


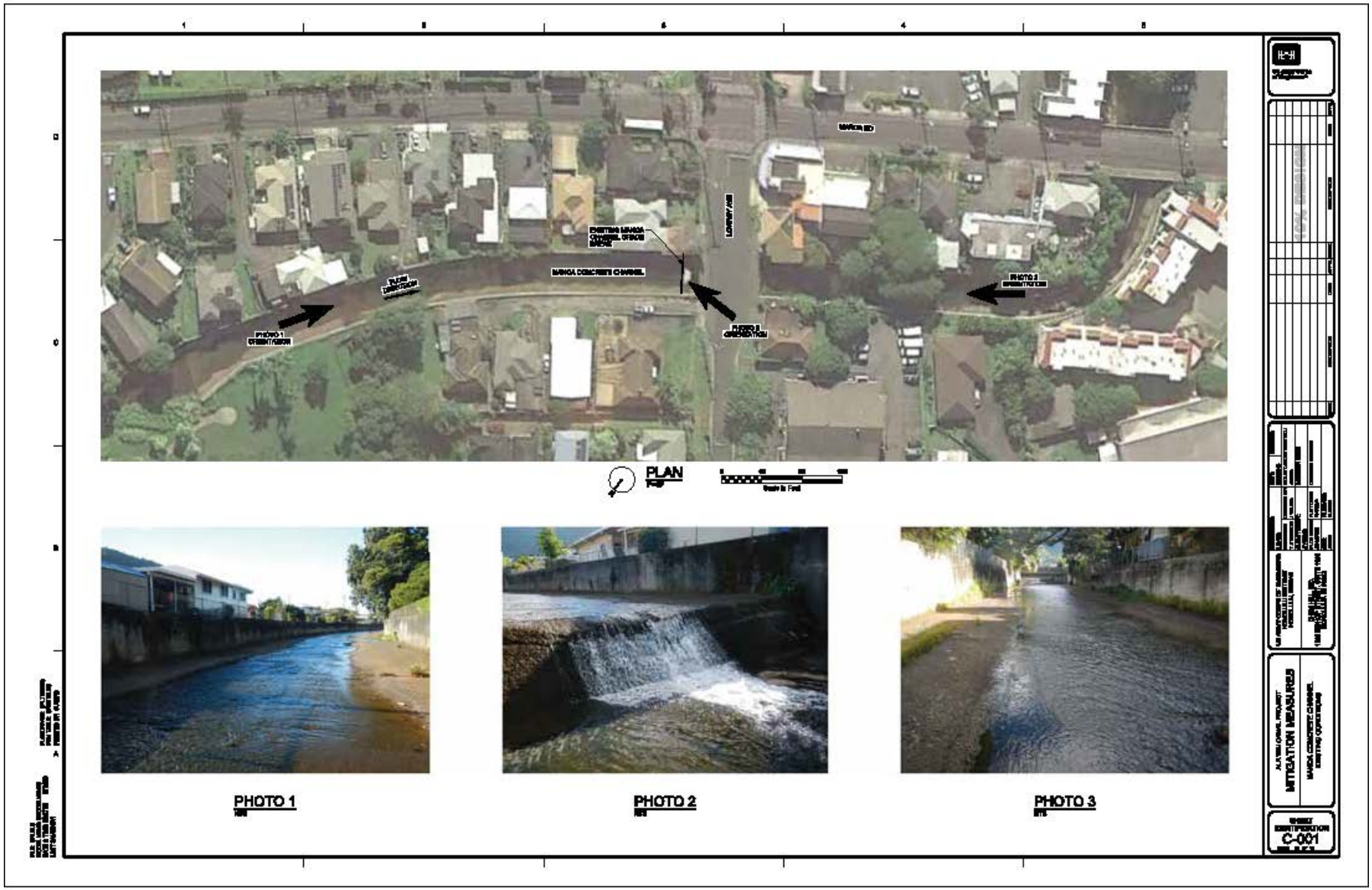
Appendix C.

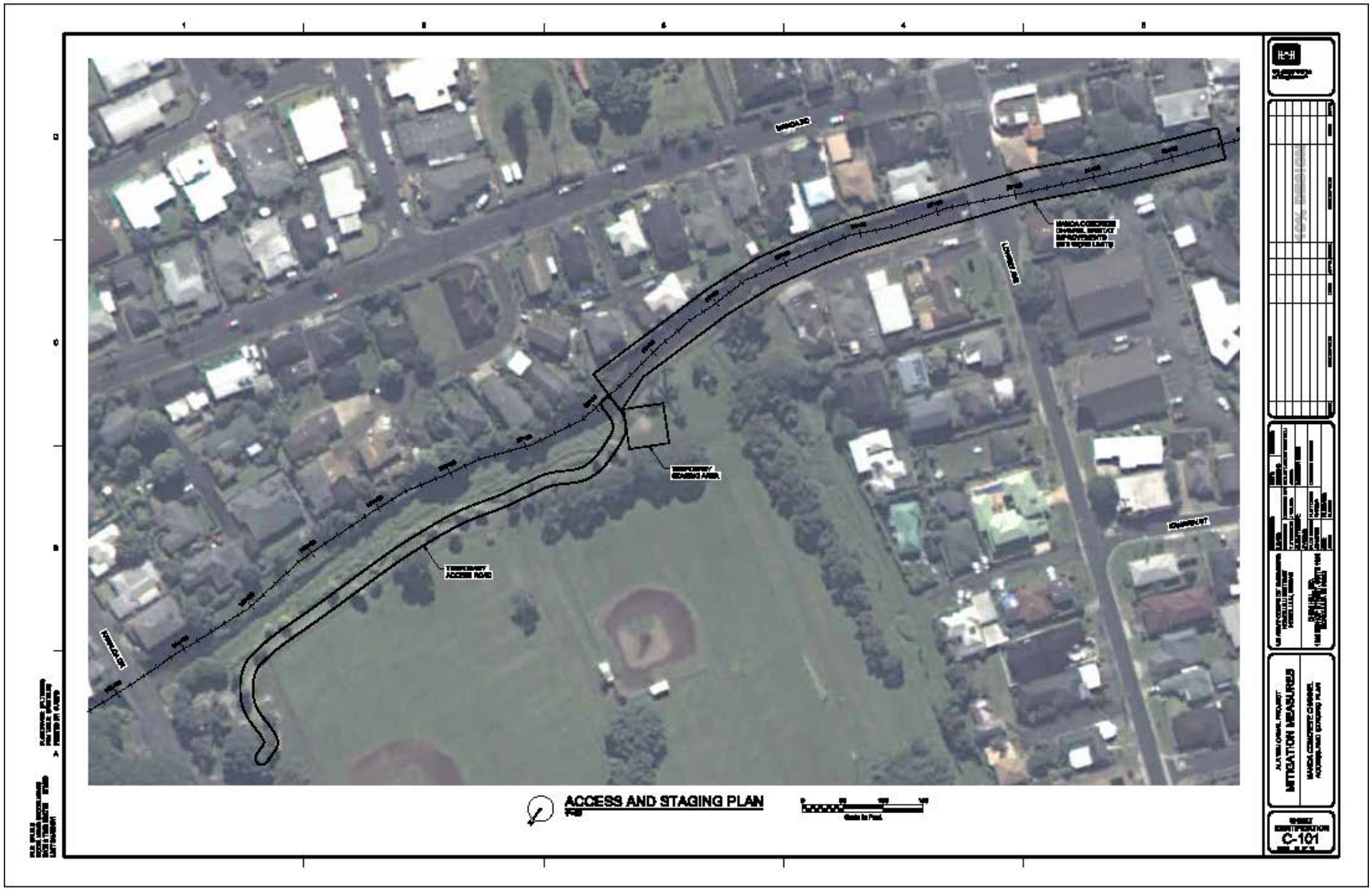
Figures and Project Details for Falls 7 and 8 (FWCA Compensatory Mitigation).

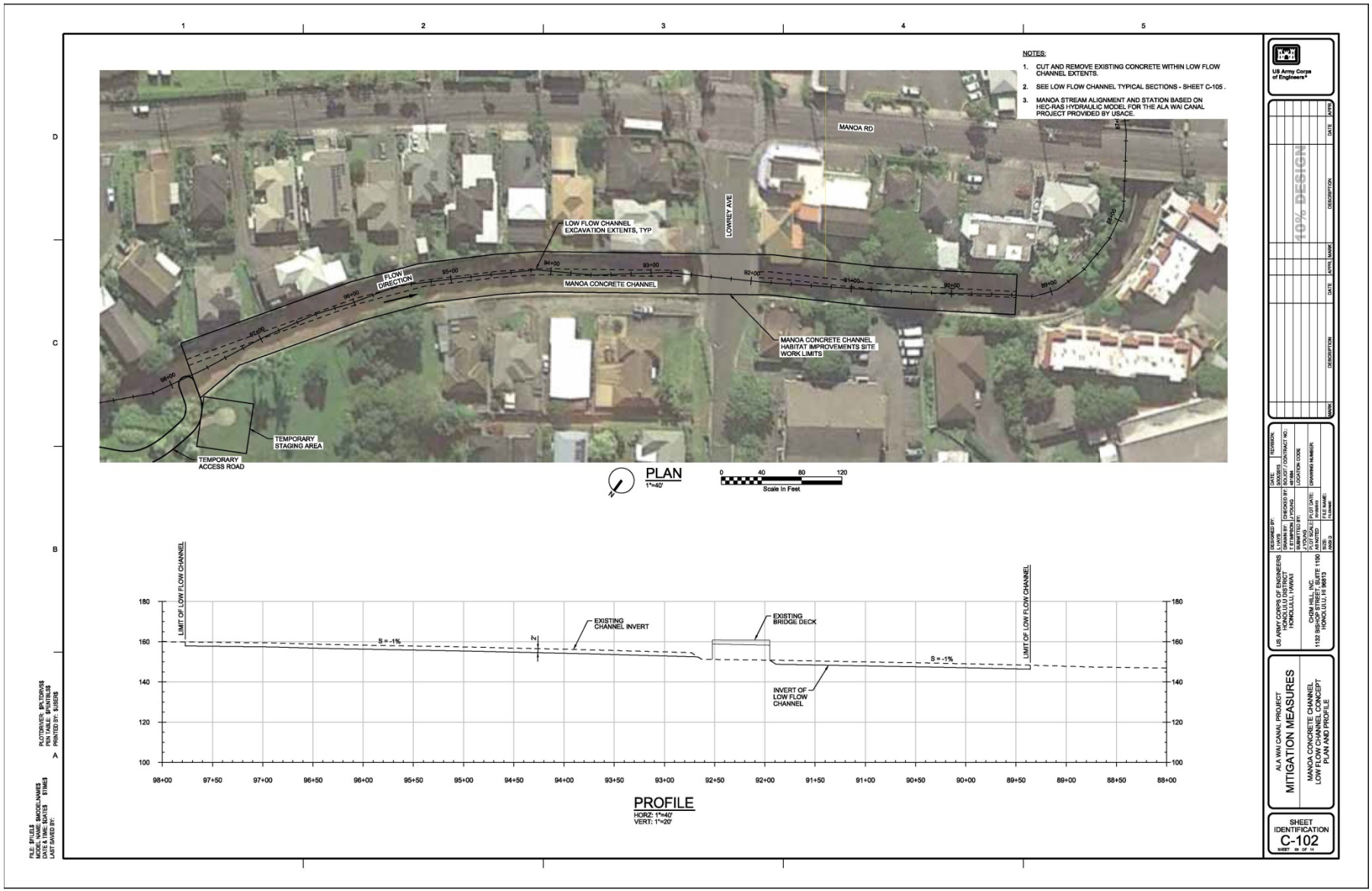
All figures provided by the U.S. Army Corps of Engineers. 2016.

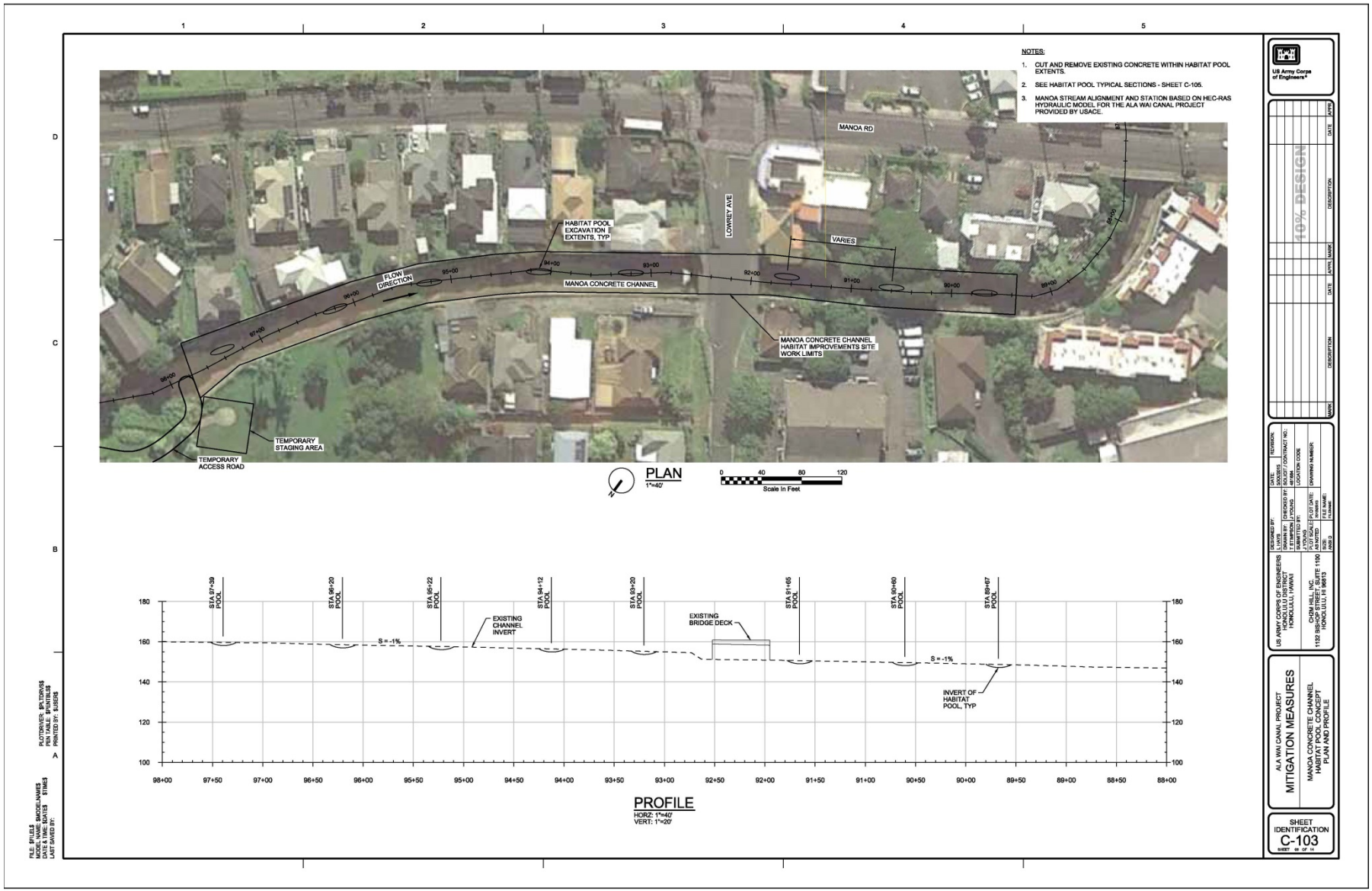

ALA WAI CANAL PROJECT
MITIGATION MEASURES
HONOLULU, OAHU, HI
PROJECT TITLE
FALLS 11 - USGS GAGE ON WAIHI STREAM, SEE C-110
FALLS 12 - USGS GAGE ON WAIAKEAKUA STREAM, SEE C-111
FALLS 7, SEE C-107
FALLS 8, SEE C-108
MANOA CONCRETE CHANNEL HABITAT IMPROVEMENTS, SEE C-101 THROUGH C-105
MANOA STREAM
ALA WAI CANAL
SITE LOCATIONS
NOT TO SCALE
INDEX OF DRAWINGS
DWG TITLE
G-001 SITE LOCATIONS, PROJECT LOCATION, VICINITY MAP, AND DRAWING INDEX
G-002 CIVIL GENERAL NOTES AND LEGEND
C-001 MANOA CONCRETE CHANNEL EXISTING CONDITIONS
C-101 MANOA CONCRETE CHANNEL ACCESS AND STAGING PLAN
C-102 MANOA CONCRETE CHANNEL LOW FLOW CHANNEL CONCEPT PLAN AND PROFILE
C-103 MANOA CONCRETE CHANNEL HABITAT POOL CONCEPT PLAN AND PROFILE
C-104 MANOA CONCRETE CHANNEL RESTING RIPPLE CONCEPT PLAN AND PROFILE
C-105 MANOA CONCRETE CHANNEL TYPICAL SECTIONS
C-106 MANOA STREAM FALLS 7 AND 8 ACCESS AND STAGING PLAN
C-107 MANOA STREAM FALLS 7 REHABILITATION CONCEPT
C-108 MANOA STREAM FALLS 8 REHABILITATION CONCEPT
C-109 MANOA STREAM FALLS 11 AND 12 ACCESS AND STAGING PLAN
C-110 MANOA STREAM FALLS 11 REHABILITATION CONCEPT
C-111 MANOA STREAM FALLS 12 REHABILITATION CONCEPT
VICINITY MAP
NOT TO SCALE
NIIHAU
KAUAI
OAHU
ALA WAI WATERSHED HONOLULU, OAHU
MOLOKAI
LANAI
MAUI
KAHOOLAWE
HAWAII
PROJECT LOCATION
NOT TO SCALE
KAHUKU
LAIE
HALEIWA
WAIALUA
WAIANAE MOUNTAIN RANGE
KOOLAU MOUNTAIN RANGE
WAHIAWA
MILILANI TOWN
KAHALUU
KANEOHE
KAILUA
WAIPAHU
PEARL CITY
EWA
HONOLULU
WAIMANALO
PROJECT LOCATION
US ARMY CORPS OF ENGINEERS HONOLULU DISTRICT FORT SHAFTER, HAWAII
CH2M HILL, INC. 1132 BISHOP STREET, SUITE 1100 HONOLULU, HI 96813
ALA WAI CANAL PROJECT
MITIGATION MEASURES
SITE LOCATIONS, PROJECT LOCATIONS, VICINITY MAP, AND DRAWING INDEX
SHEET IDENTIFICATION
G-001

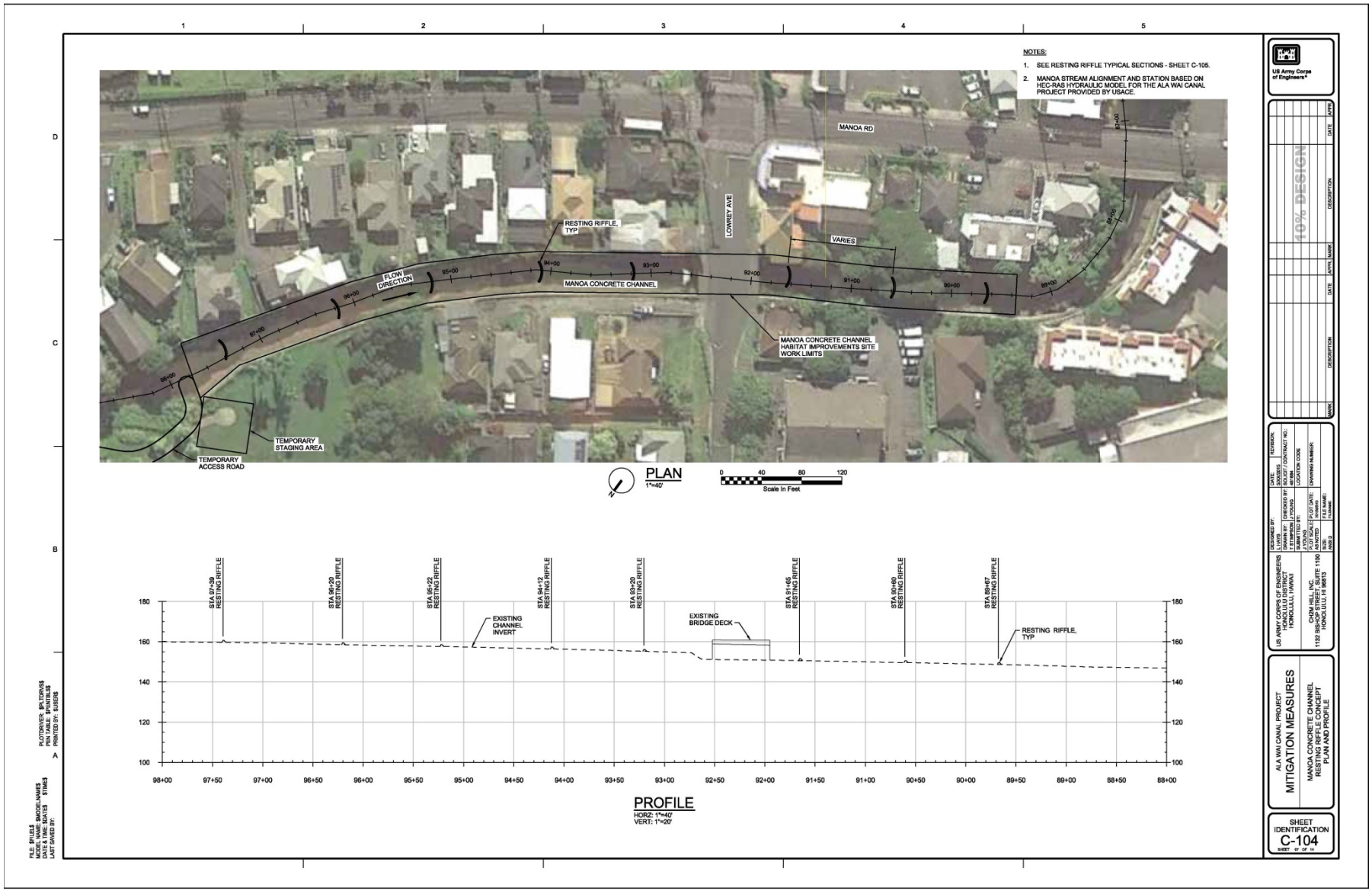

GENERAL SITE NOTES:
1. SOURCE OF TOPOGRAPHY SHOWN ON THE CIVIL PLANS ARE BASE MAPS PROVIDED BY THE US ARMY CORP OF ENGINEERS HONOLULU DISTRICT. EXISTING CONDITIONS MAY VARY FROM THOSE SHOWN ON THESE PLANS. THE CONTRACTOR SHALL VERIFY EXISTING CONDITIONS AND ADJUST WORK PLAN ACCORDINGLY PRIOR TO BEGINNING CONSTRUCTION.
2. EXISTING TOPOGRAPHY, STRUCTURES, AND SITE FEATURES ARE SHOWN SCREENED AND/OR LIGHT-LINED. NEW FINISH GRADE, STRUCTURES, AND SITE FEATURES ARE SHOWN HEAVY-LINED.
HORIZONTAL DATUM: NAD 1983, HAWAII STATE PLANE ZONE 3, US SURVEY FEET
VERTICAL DATUM: NAVD 1988, US SURVEY FEET
3. MAINTAIN, RELOCATE, OR REPLACE EXISTING SURVEY MONUMENTS, CONTROL POINTS, AND STAKES WHICH ARE DISTURBED OR DESTROYED. PERFORM THE WORK TO PRODUCE THE SAME LEVEL OF ACCURACY AS THE ORIGINAL MONUMENT(S) IN A TIMELY MANNER, AND AT THE CONTRACTOR'S EXPENSE.
4. STAGING AREA SHALL BE FOR CONTRACTOR'S EMPLOYEE OVERFLOW PARKING AND ON-SITE STORAGE OF MATERIALS.
5. PROVIDE FENCING AS NECESSARY TO MAINTAIN SECURITY AT ALL TIMES.
6. CONTRACTOR SHALL SUBMIT A COMPLETE SOIL EROSION CONTROL PLAN FOR REGULATORY APPROVAL. CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND MAINTAINING EROSION CONTROL DEVICES DURING CONSTRUCTION. CONTRACTOR SHALL TAKE ALL OTHER MEASURES TO POSITIVELY PRECLUDE EROSION MATERIALS FROM LEAVING THE SITE.
7. CONTRACTOR SHALL PREPARE AND SUBMIT DEWATERING AND CREEK BYPASS PLAN FOR CONTRACTING OFFICER APPROVAL.
8. IN-WATER CONSTRUCTION WORK IS EXPECTED TO BE CONDUCTED DURING DRY SEASON FROM APPROXIMATELY MAY TO SEPTEMBER.
GENERAL YARD PIPING AND UTILITIES NOTES:
1. EXISTING UNDERGROUND UTILITIES HAVE NOT BEEN IDENTIFIED BUT IS EXPECTED TO OCCUR IN A FUTURE DESIGN PHASE. CONTRACTOR SHALL POTHOLE AND FIELD VERIFY DEPTH AND LOCATION PRIOR TO EXCAVATION. PROTECT ALL EXISTING UTILITIES TO REMAIN DURING CONSTRUCTION.
2. EXISTING PIPING AND EQUIPMENT ARE SHOWN SCREENED AND/OR LIGHT-LINED. NEW PIPING AND EQUIPMENT ARE SHOWN HEAVY-LINED.
3. UNLESS OTHERWISE SHOWN ALL PIPING SHALL HAVE A MINIMUM OF 3' COVER.
4. ALL PIPES SHALL HAVE A CONSTANT SLOPE BETWEEN INVERT ELEVATIONS UNLESS A FITTING IS SHOWN.
5. FOR SURFACE RESTORATION OF ASPHALT CONCRETE MATCH EXISTING PAVEMENT.
6. MINIMUM ALLOWABLE CLEARANCE BETWEEN PIPES AT CROSSINGS SHALL BE 3".
GENERAL NOTE:
1. THIS IS A STANDARD LEGEND SHEET. THEREFORE, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.
CIVIL LEGEND
EXISTING
THIS CONTRACT
SPOT ELEVATION
CONTOUR LINE
EMBANKMENT AND SLOPE
DRAINAGEWAY OR DITCH
CATCH BASIN OR INLET
TRENCH DRAIN
SIGN
MANHOLE
ELECTRICAL MANHOLE
ELECTRIC HANDHOLE
POST OR GUARD POST
GUY ANCHOR
FIRE HYDRANT
UTILITY POLE
LIGHT POLE
BENCH MARK
SURVEY CONTROL POINT OR POINT OF INTERSECTION
BRUSH/TREE LINE
TREE
PROPERTY LINE
CENTER LINE, BUILDING, ROAD, ETC.
FEATURE LINES AND AVERAGE SEASONAL WATER LEVELS
STRUCTURE, BUILDING OR FACILITY LOCATION POINT - COORDINATES
B-1 BORING LOCATION AND NUMBER
TP-2 TEST PIT LOCATION AND NUMBER
P-3 PIEZOMETER LOCATION AND NUMBER
DEMOLITION
STRUCTURE, BUILDING OR FACILITY
ASPHALT CONCRETE PAVEMENT
GRAVEL SURFACING
CONCRETE PAVEMENT
CURB
CURB AND GUTTER
SINGLE SWING GATE
DOUBLE SWING GATE
SLIDING GATE
GUARD RAIL
CHAIN LINK FENCE
ARCHITECTURAL FENCE
WIRE FENCE
CULVERT
FLOW DIRECTION
YARD PIPING LEGEND
EXISTING
THIS CONTRACT
NOMINAL PIPE DIAMETER
PIPE USE IDENTIFICATION
PIPING < 30" DIAMETER
PIPING ≥ 30" DIAMETER
EXISTING PIPE TO BE ABANDONED
EXISTING PIPE TO BE REMOVED
INDICATOR POST VALVE
GATE VALVE AND VALVE BOX
BUTTERFLY VALVE AND VALVE BOX
PLUG VALVE AND VALVE BOX
FLEXIBLE COUPLING
90° ELBOW UP
90° ELBOW DOWN
BEND < 90° UP
BEND < 90° DOWN
CONCENTRIC REDUCER
CAP OR PLUG
CLEANOUT
FIRE HYDRANT
BACKFILL CLASS
ABBREVIATIONS
APPROX APPROXIMATE
AVG AVERAGE
B.F. BUTTERFLY
" DIAMETER
DIA DIAMETER
EL ELEVATION
ELEV ELEVATION
EXIST EXISTING
FT FOOT / FEET
GAL GALLON
HDPE HIGH DENSITY POLYETHYLENE
HP HORSE POWER
N NORTH
NTS NOT TO SCALE
O.C. ON-CENTER
PE POLYETHYLENE
PVC POLYVINL CHLORIDE
SQ FT SQUARE FOOT
TYP TYPICAL
W/ WITH
10% design
US ARMY CORPS OF ENGINEERS HONOLULU DISTRICT HONOLULU, HAWAII
CH2M HILL, INC. 1132 BISHOP STREET, SUITE 1100 HONOLULU, HI 96813
#LA WAI CANAL PROJECT
MITIGATION MEASURES
CIVIL GENERAL NOTES AND LEGEND
SHEET IDENTIFICATION
G-002

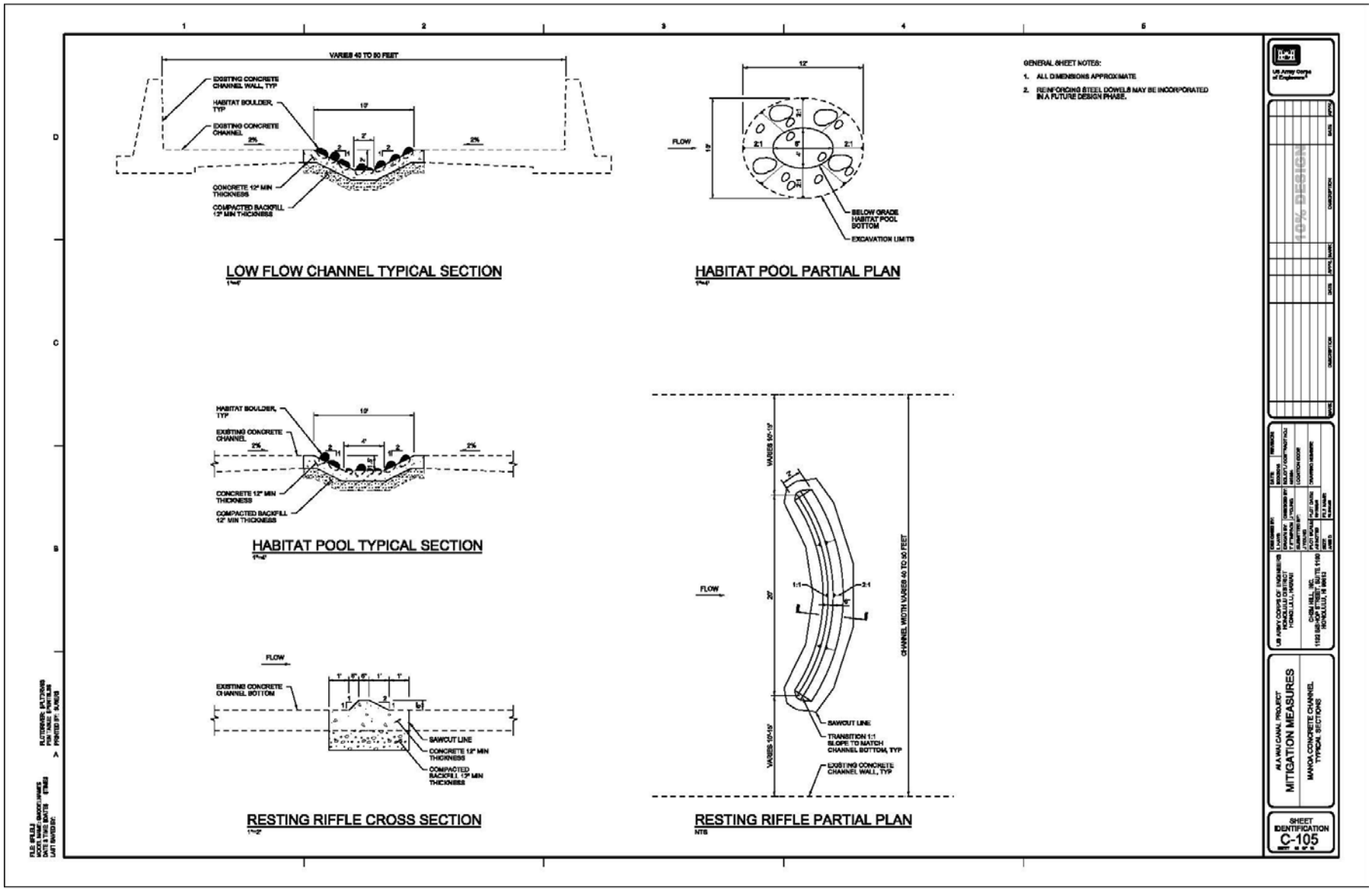

PLAN
PHOTO 1
PHOTO 2
PHOTO 3
MITIGATION MEASURES
C-001

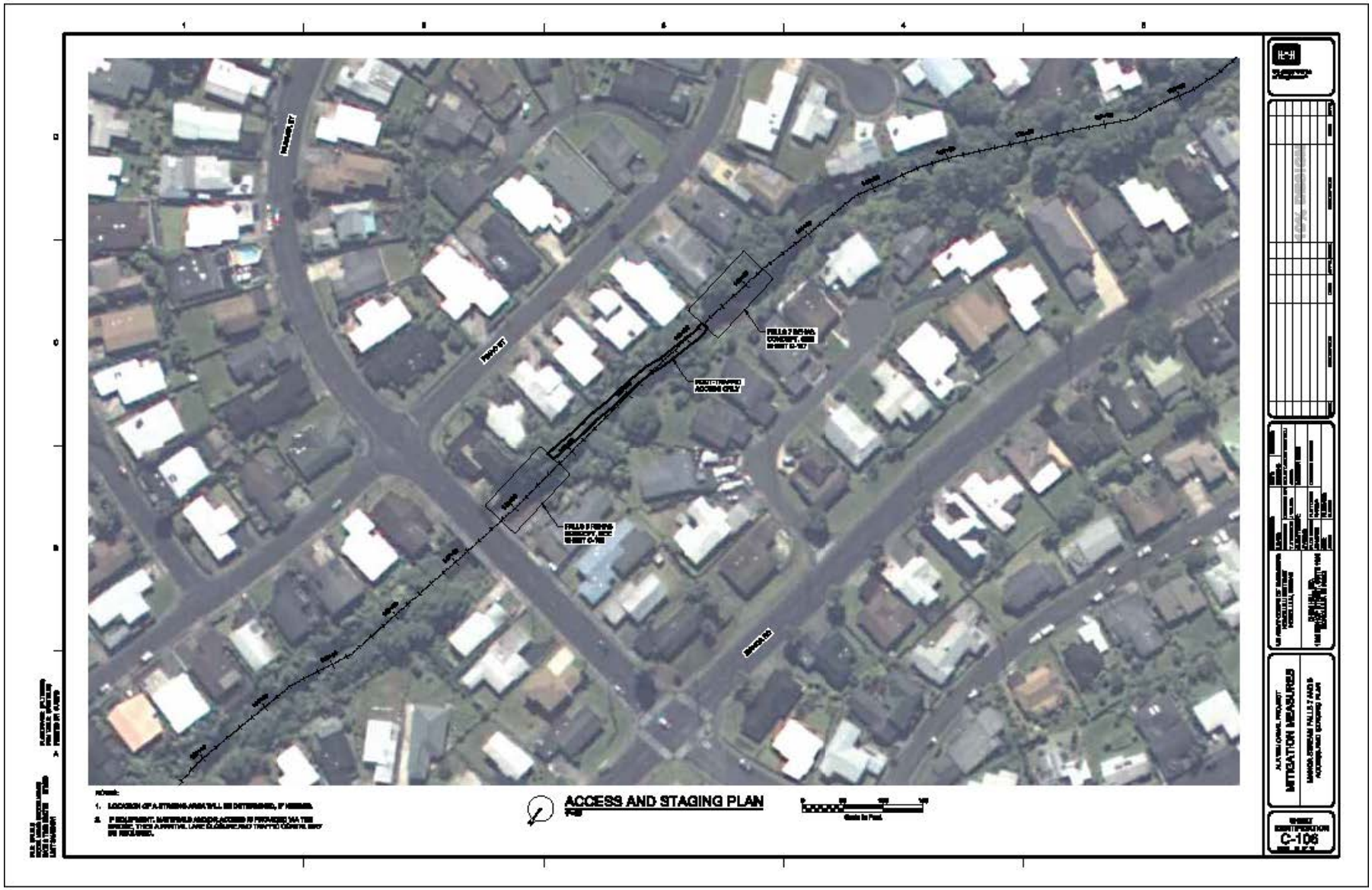

ACCESS AND STAGING PLAN
MITIGATION MEASURES
C-101

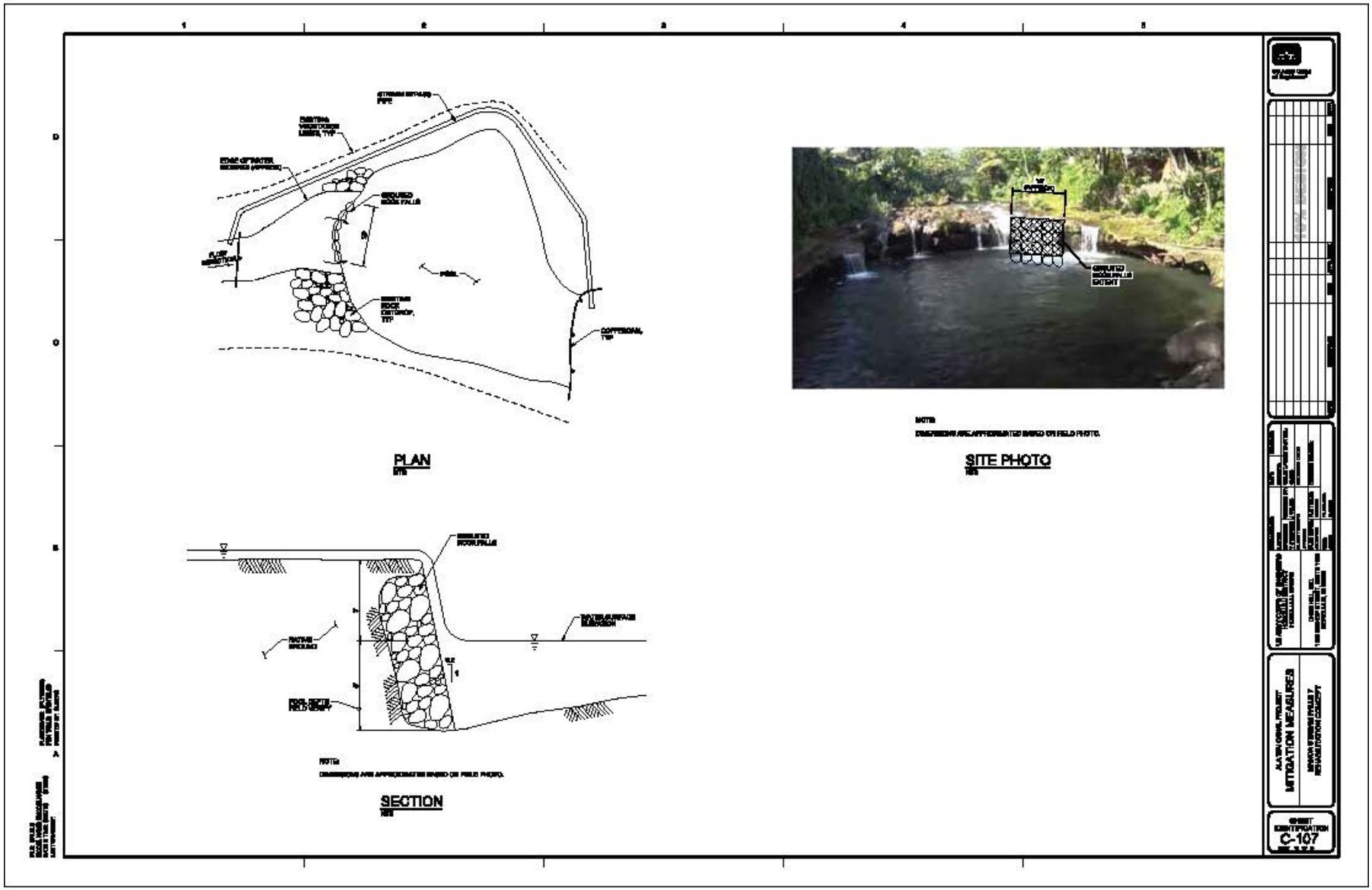

NOTES:
1. CUT AND REMOVE EXISTING CONCRETE WITHIN LOW FLOW CHANNEL EXTENTS.
2. SEE LOW FLOW CHANNEL TYPICAL SECTIONS - SHEET C-105 .
3. MANOA STREAM ALIGNMENT AND STATION BASED ON HEC-RAS HYDRAULIC MODEL FOR THE ALA WAI CANAL PROJECT PROVIDED BY USACE.
MANOA RD
LOWREY AVE
LOW FLOW CHANNEL EXCAVATION EXTENTS, TYP
FLOW DIRECTION
MANOA CONCRETE CHANNEL
MANOA CONCRETE CHANNEL HABITAT IMPROVEMENTS SITE WORK LIMITS
TEMPORARY STAGING AREA
TEMPORARY ACCESS ROAD
PLAN
1"=40'
0 40 80 120
Scale In Feet
LIMIT OF LOW FLOW CHANNEL
EXISTING CHANNEL INVERT
EXISTING BRIDGE DECK
S = -1%
INVERT OF LOW FLOW CHANNEL
PROFILE
HORZ: 1"=40'
VERT: 1"=20'
US Army Corps of Engineers
10% DESIGN
US ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT
HONOLULU, HAWAII
CH2M HILL, INC.
1132 BISHOP STREET, SUITE 1100
HONOLULU, HI 96813
ALA WAI CANAL PROJECT
MITIGATION MEASURES
MANOA CONCRETE CHANNEL
LOW FLOW CHANNEL CONCEPT
PLAN AND PROFILE
SHEET IDENTIFICATION
C-102

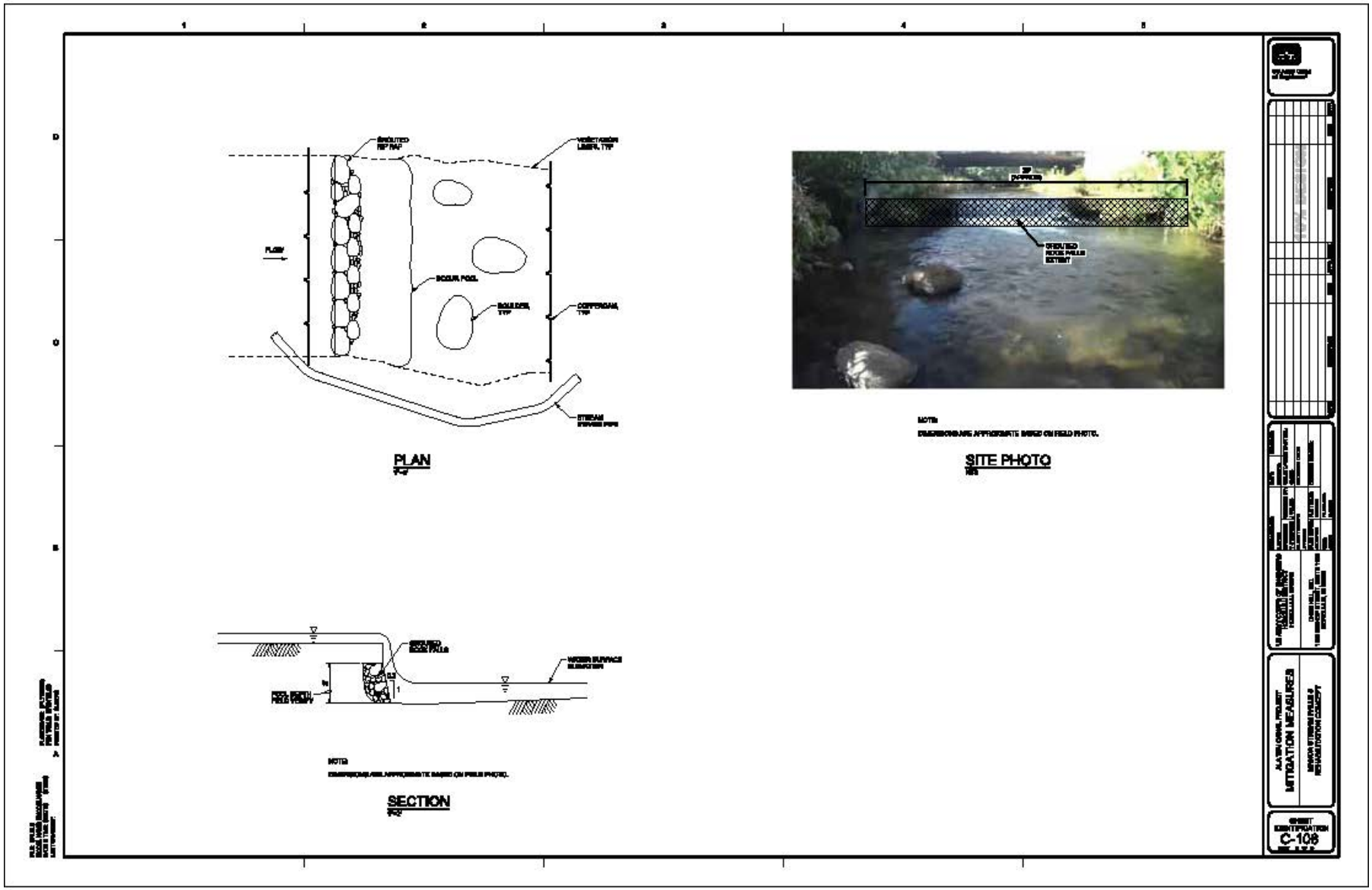

NOTES:
1. CUT AND REMOVE EXISTING CONCRETE WITHIN HABITAT POOL EXTENTS.
2. SEE HABITAT POOL TYPICAL SECTIONS - SHEET C-105.
3. MANOA STREAM ALIGNMENT AND STATION BASED ON HEC-RAS HYDRAULIC MODEL FOR THE ALA WAI CANAL PROJECT PROVIDED BY USACE.
MANOA RD
LOWREY AVE
HABITAT POOL EXCAVATION EXTENTS, TYP
VARIES
FLOW DIRECTION
MANOA CONCRETE CHANNEL
MANOA CONCRETE CHANNEL HABITAT IMPROVEMENTS SITE WORK LIMITS
TEMPORARY STAGING AREA
TEMPORARY ACCESS ROAD
PLAN
1"=40'
Scale In Feet
STA 97+39 POOL
STA 96+20 POOL
STA 95+22 POOL
STA 94+12 POOL
STA 93+20 POOL
STA 91+65 POOL
STA 90+60 POOL
STA 89+67 POOL
EXISTING CHANNEL INVERT
EXISTING BRIDGE DECK
S = -1%
S = -1%
INVERT OF HABITAT POOL, TYP
PROFILE
HORZ: 1"=40'
VERT: 1"=20'
10% DESIGN
US Army Corps of Engineers
US ARMY CORPS OF ENGINEERS HONOLULU DISTRICT HONOLULU, HAWAII
CH2M HILL, INC. 1132 BISHOP STREET, SUITE 1100 HONOLULU, HI 96813
ALA WAI CANAL PROJECT
MITIGATION MEASURES
MANOA CONCRETE CHANNEL HABITAT POOL CONCEPT PLAN AND PROFILE
SHEET IDENTIFICATION
C-103


NOTES:
1. SEE RESTING RIFFLE TYPICAL SECTIONS - SHEET C-105.
2. MANOA STREAM ALIGNMENT AND STATION BASED ON HEC-RAS HYDRAULIC MODEL FOR THE ALA WAI CANAL PROJECT PROVIDED BY USACE.
MANOA RD
LOWREY AVE
RESTING RIFFLE, TYP
VARIES
FLOW DIRECTION
MANOA CONCRETE CHANNEL
MANOA CONCRETE CHANNEL HABITAT IMPROVEMENTS SITE WORK LIMITS
TEMPORARY STAGING AREA
TEMPORARY ACCESS ROAD
PLAN
1"=40'
Scale In Feet
STA 97+39 RESTING RIFFLE
STA 96+20 RESTING RIFFLE
STA 95+22 RESTING RIFFLE
EXISTING CHANNEL INVERT
STA 94+12 RESTING RIFFLE
STA 93+20 RESTING RIFFLE
EXISTING BRIDGE DECK
STA 91+65 RESTING RIFFLE
STA 90+60 RESTING RIFFLE
STA 89+67 RESTING RIFFLE
RESTING RIFFLE, TYP
PROFILE
HORZ: 1"=40'
VERT: 1"=20'
US Army Corps of Engineers
10% DESIGN
US ARMY CORPS OF ENGINEERS HONOLULU DISTRICT HONOLULU, HAWAII
CH2M HILL, INC. 1132 BISHOP STREET, SUITE 1100 HONOLULU, HI 96813
ALA WAI CANAL PROJECT
MITIGATION MEASURES
MANOA CONCRETE CHANNEL RESTING RIFFLE CONCEPT PLAN AND PROFILE
SHEET IDENTIFICATION
C-104

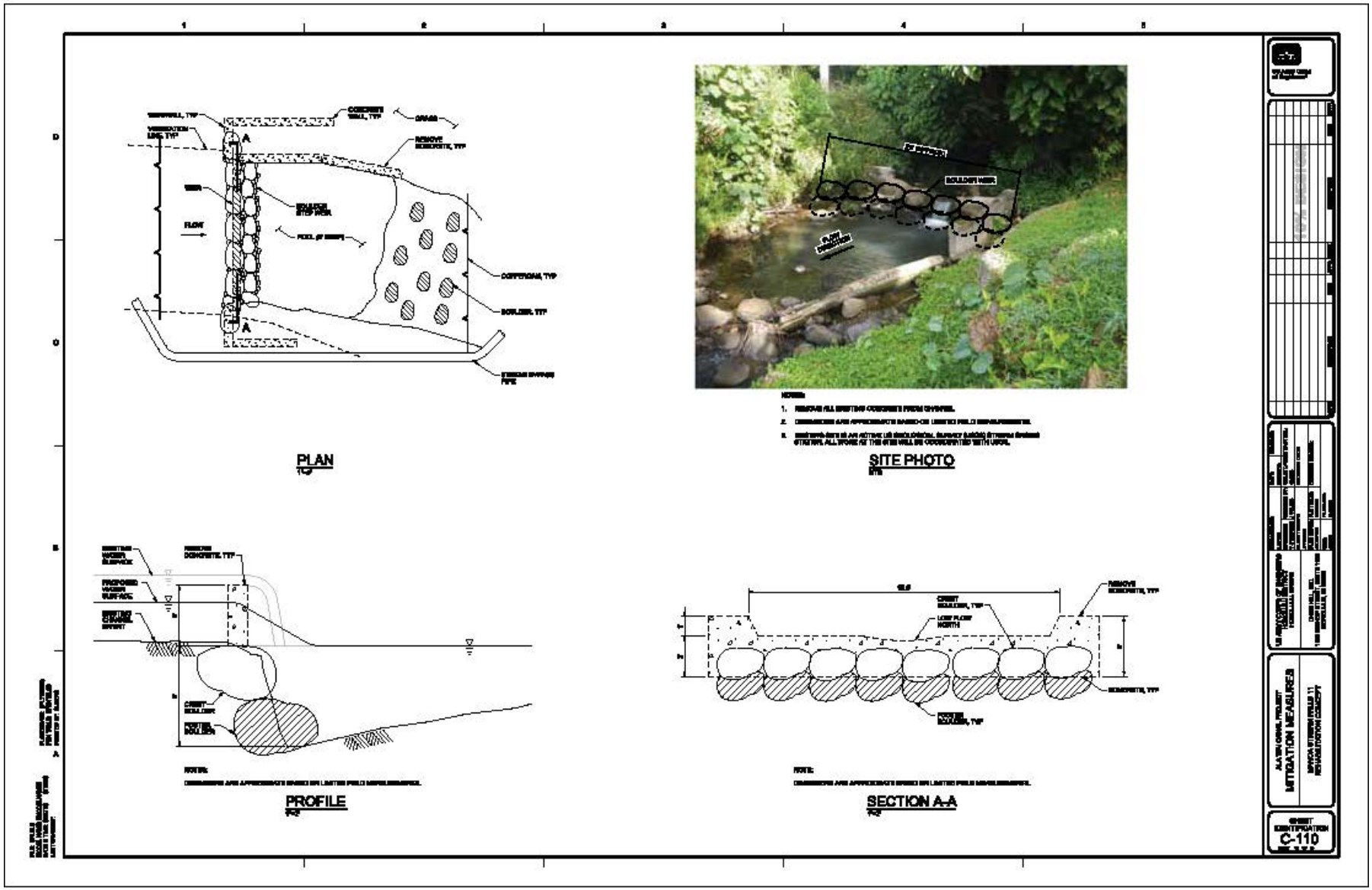

VARIES 40 TO 80 FEET
EXISTING CONCRETE CHANNEL WALL, TYP
HABITAT BOULDER, TYP
EXISTING CONCRETE CHANNEL
2%
CONCRETE 12" MIN THICKNESS
COMPACTED BACKFILL 12" MIN THICKNESS
LOW FLOW CHANNEL TYPICAL SECTION
12'
FLOW
2:1
BELOW GRADE HABITAT POOL BOTTOM
EXCAVATION LIMITS
HABITAT POOL PARTIAL PLAN
GENERAL SHEET NOTES:
1. ALL DIMENSIONS APPROXIMATE
2. REINFORCING STEEL DOWELS MAY BE INCORPORATED IN A FUTURE DESIGN PHASE.
HABITAT BOULDER, TYP
EXISTING CONCRETE CHANNEL
CONCRETE 12" MIN THICKNESS
COMPACTED BACKFILL 12" MIN THICKNESS
HABITAT POOL TYPICAL SECTION
FLOW
EXISTING CONCRETE CHANNEL BOTTOM
SAWCUT LINE
CONCRETE 12" MIN THICKNESS
COMPACTED BACKFILL 12" MIN THICKNESS
RESTING RIFFLE CROSS SECTION
VARIES 10'-15'
FLOW
20'
1:1
2:1
CHANNEL WIDTH VARIES 40 TO 80 FEET
SAWCUT LINE
TRANSITION 1:1 SLOPE TO MATCH CHANNEL BOTTOM, TYP
EXISTING CONCRETE CHANNEL WALL, TYP
VARIES 10'-15'
RESTING RIFFLE PARTIAL PLAN
10% DESIGN
US ARMY CORPS OF ENGINEERS HONOLULU DISTRICT
CH2M HILL, INC.
ALA WAI CANAL PROJECT
MITIGATION MEASURES
MANOA CONCRETE CHANNEL TYPICAL SECTIONS
SHEET IDENTIFICATION
C-105

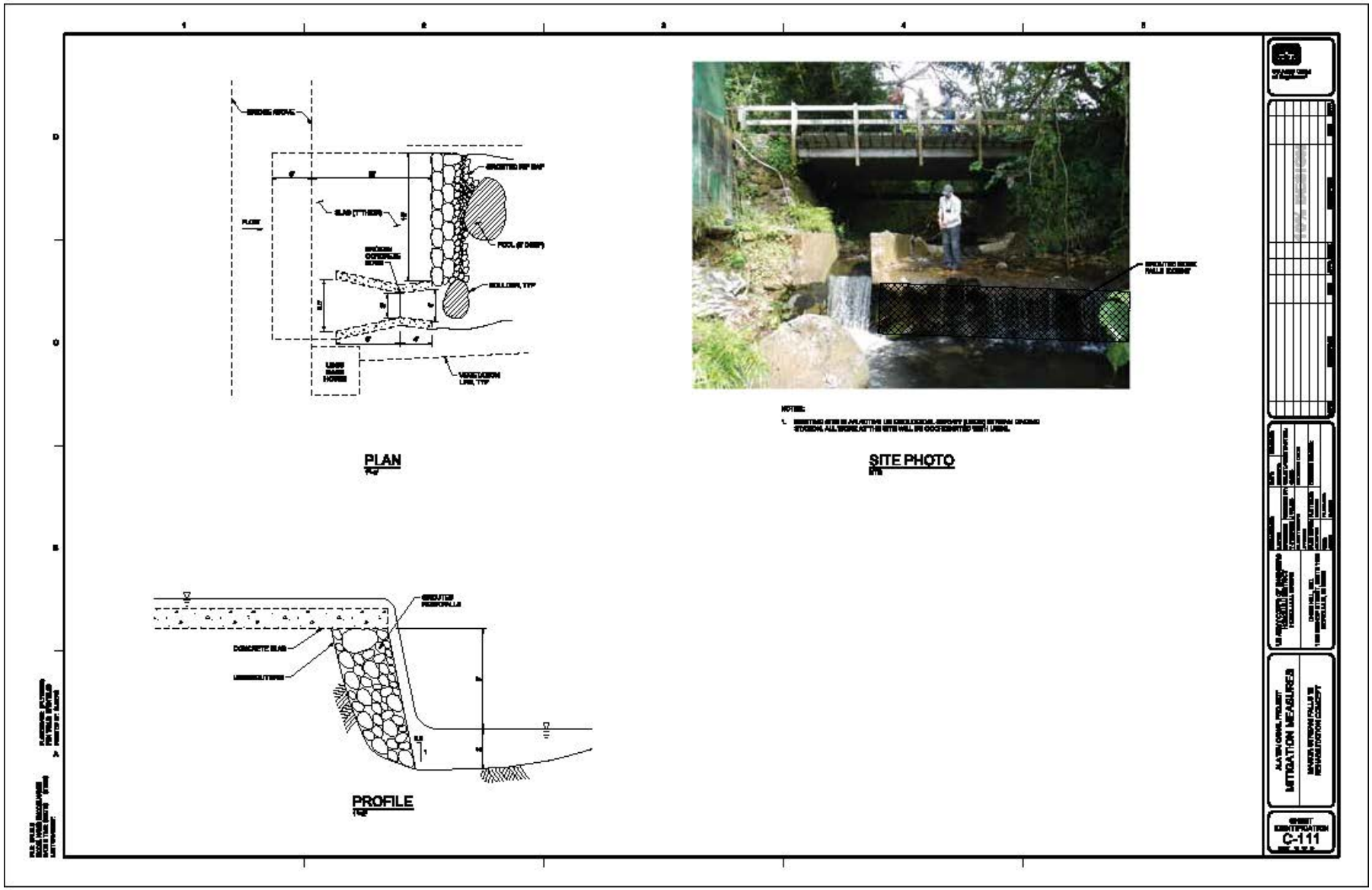

ACCESS AND STAGING PLAN
MITIGATION MEASURES
C-106


PLAN
SITE PHOTO
SECTION
MITIGATION MEASURES
C-107


PLAN
SITE PHOTO
SECTION
MITIGATION MEASURES
C-106


ACCESS AND STAGING PLAN
MITIGATION MEASURES
C-109


PLAN
SITE PHOTO
PROFILE
SECTION A-A
MITIGATION MEASURES
C-110


PLAN
SITE PHOTO
PROFILE
MITIGATION MEASURES
C-111

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, U.S. ARMY CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

21 OCT 2016

Civil and Public Works Branch
Programs and Project Management Division

Dr. Mary M. Abrams
Field Supervisor
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

Dear Dr. Abrams:

The Honolulu District, U.S. Army Corps of Engineers (USACE) seeks your concurrence with clarifications we propose to the U.S. Fish and Wildlife Service's (USFWS) Biological Opinion (BO) for the Ala Wai Canal Flood Risk Management Study. It is our understanding that this opinion is final which concludes the consultation process under Section 7 of the Endangered Species Act (ESA). However, based on discussions with your staff at a meeting held on October 11, 2016, we have jointly come to the conclusion that it will be beneficial to further clarify the terminology used in the biological opinion and reiterate our understanding of the USFWS's intent for executing the terms and conditions in the incidental take statement. The sections below discuss the items for clarification that include; the amount or extent of take and the terms and conditions.

I. Amount or Extent of Take.

The section of the BO that addressed the amount or extent of take is transcribed below:

"Based on our analysis presented in this Biological Opinion, the Service anticipates the following take may occur for as long as the Ala Wai Canal Project construction, operations, and maintenance are active and in place:

1) *Up to 66 blackline Hawaiian damselfly adults and associated life cycle stages over the life of the project due to elimination of breeding habitat and mortality as a result of the proposed action."*

Clarification: The number of blackline Hawaiian damselfly adults and associated life cycles were based upon the observed sightings during the field surveys through

application of a model that provided a reasonable estimation of the numbers of damselflies that would be affected. Per discussion with your staff, the 66 blackline Hawaiian damselflies includes all life cycles and assumes total loss at both the Waihi and Waiakeakua project areas for the entire life of the project (construction, operations and maintenance).

II. Terms and Conditions

The terms and conditions describe how USACE must comply with the reasonable and prudent measures described in the incidental take statement to minimize the amount of Incidental take of the damselfly. Applicable paragraphs are transcribed below in italics. Based upon discussion and agreement with your staff, proposed clarifications follow that describe how USACE will execute the terms and conditions.

A. Reasonable and prudent measure: "*1. The USACE shall minimize the loss of blackline Hawaiian damselfly."*

"In order to implement the reasonable and prudent measure #1 above, the following terms and conditions apply:

1. The USACE shall hire a qualified biologist (approved by the Service) to collect damselflies to be relocated to another protected location or to be held in captivity in a qualified facility until site is identified."

Clarification: USFWS has provided options for compliance which USACE and the sponsor can exercise at their discretion.

If the option to relocate damselflies is executed, USACE will coordinate with USFWS on the selection of the qualified biologist and relocation site and the procedures to be followed for the relocation effort. Relocation would be conducted by a qualified biologist hired by USACE and USFWS will not unreasonably withhold concurrence of the use of an individual or contractor with suitable qualifications. The relocation site will occur directly upstream of the project areas, outside of the footprint of construction. Relocation will only include the damselfly larva life stage. USFWS has advised that the larval stage has the greatest potential to survive the relocation effort. Relocation or collection for storage will occur one time at each project site, immediately prior to construction. USACE is not required to demonstrate success with the relocation effort. The relocation effort is to reduce the amount of take of damselflies.

The option to hold damselflies in captivity until they can be relocated to another site cannot be executed at this time. The Division of Forestry and Wildlife (DOFAW),

Department of Land and Natural Resources (DLNR), State of Hawaii has a facility that can hold damselflies and is currently seeking a permit from the USFWS to work with the species. With this permit, DOFAW would be able to collect blackline Hawaiian damselfly adults, larvae and eggs for holding and rearing at their facility from the Waihi and Waiakeakua project areas before the start of construction. Relocation of the damselflies would be coordinated and executed under terms of their permit with the USFWS. Biologists from DOFAW will collect blackline Hawaiian damselfly adults, larvae and eggs (all life stages) and store acquired specimens at a DOFAW-owned and operated facility. Release of adult individuals or relocation of lavae and eggs outside of the facility to the natural environment will be at the discretion of the DLNR. Collection and holding of damselflies by the DOFAW is the preferred method by USFWS to reduce the amount of take.

"2. The USACE shall monitor and report on the levels of take that occur on an annual basis.

To determine the level of incidental take the USACE shall:

a. Monitor and report any observed blackline Hawaiian damselflies prior to construction of the access roads and debris and detention basins at the Waihī and Waiakeakua construction footprints. The USACE will monitor blackline Hawaiian damselfly information for one year after the completion of construction at these sites. The monitoring methodology will be approved by the Service prior to construction implementation, and will, at a minimum, include counts of adult blackline Hawaiian damselflies.

b. Submit reports summarizing the methods and results of the above monitoring efforts to the Service's Pacific Islands Fish and Wildlife Office (300 Ala Moana Blvd., Room 3-122, Honolulu, Hawai'i 96850) annually until the monitoring is complete.

3. The USACE shall submit annual reports detailing the implementation of the above Reasonable and Prudent Measures and Terms and Conditions. The first report shall be due at the end of January of the first year after the project is initiated. Annual reports shall be submitted throughout the duration of the proposed action."

Clarification: For Terms and Conditions #2 and #3, USFWS has requested three monitoring events which will result in the submittal of reports by USACE. These include a preconstruction survey, a post-construction survey, and a survey of the completed project area within one year of construction completion. Reports will be provided to the designated receiving office by the end of January of the year following the completion of

the report. If DOFAW performs the collection of damselflies prior to construction, it will provide the numbers of adults, larvae and eggs collected to USACE for reporting to USFWS.

B. Reasonable and prudent measure: *"2. The USACE shall minimize the loss of habitat."*

"In order to implement the reasonable and prudent measure #2 above, the following terms and conditions apply:

1. The USACE shall consider purchasing private land to relocate the access roads downstream of the proposed Waihi debris and detention basin to minimize loss of riffle and pool habitat."

Clarification: Based on email correspondence received from USFWS staff on October 11, 2016, it is USACE's understanding that the concern regarding habitat loss due to the location of the road is focused on the loss of hillside seep habitat, not riffle and pool habitat as noted above. While the concern is noted, operations and maintenance requires access to the upstream side of the structure in order to perform debris removal activities. Relocating this road on the downstream side of the structure would significantly increase the distance and subsequent environmental impacts of the roadway and also require a stream crossing in order to access the upstream side of the structure. USACE has considered relocating the Waihi access road and determined that due to the greater environmental damage and costs, relocating the road is not feasible.

"2. The USACE shall limit the removal of tree canopy cover over areas of damselfly habitat."

Clarification: USACE will limit tree removal to the greatest extent practicable. However, USACE activities will only occur on-site during the construction period. Following completion of construction, USACE cannot control the actions of others within the project area.

In the future, we request receipt of a draft BO prior to finalization in order ensure that the federal action is properly defined and that the parties' mutual understanding of the terms and conditions are clearly set forth in the BO.

We request a letter of concurrence from you regarding the information above at your earliest opportunity. Our understanding is that your staff will utilize the information of this letter to append the existing BO. If you have any questions or require additional

information, please contact Mr. Michael Wyatt, Project Manager of my Civil and Public Works Branch, at (808) 835-4031 or email michael.d.wyatt@usace.army.mil.

Sincerely,

James D. Hoyman, P.E.
Lieutenant Colonel, U.S. Army
District Engineer

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850

In Reply Refer To:
01EPIF00-2016-F-0157

NOV 17 2016

Colonel James D. Hoyman, P.E.
Lieutenant Colonel, U.S. Army
District Engineer
Honolulu District
U.S. Army Corps of Engineers
Fort Shafter, Hawai'i 96858-5440

Subject: Request for Clarification of the Terms and Conditions of the Ala Wai Canal Project Biological Opinion, Island of O'ahu

Dear Colonel Hoyman:

This U.S. Fish and Wildlife Service's (Service) received your letter on October 21, 2016, requesting our agreement with your proposed clarifications to our Biological Opinion and Informal Consultation for the Proposed Construction, Operation, and Maintenance of the Ala Wai Canal Project (BO). Based on meeting discussions with the staff of the U.S. Army Corps of Engineers, Honolulu District (USACE) and the Service (October 11, 2016) we have jointly agreed that the Service could agree on a written letter from the USACE for ways to implement the terms and conditions as issued in our BO. This agreed upon document would fulfill some of the requirements for the USACE clarification questions on implementation of our terms and conditions for the blackline Hawaiian damselfly (*Megalagrion nigrohamatum nigrolineatum*). The sections below discuss the items for your clarification and our comments.

Our BO states: The amount or extent of take is "*...up to 66 blackline Hawaiian damselfly adults and associated life cycle stages over the life of the project due to elimination of breeding habitat and mortality as a result of the proposed action*".

Your clarification: "*The number of blackline Hawaiian damselfly adults and associated life cycles were based upon the observed sightings during the field surveys through application of a model that provided a reasonable estimation of the numbers of damselflies that would be affected. Per discussion with your staff, the 66 blackline Hawaiian damselflies includes all life cycles and assumes total loss at both the Waihī and Waiakeakua project areas for the entire life of the project (construction, operations and maintenance).*"

We agree with your clarification above.

Our BO states: "*In order to implement the reasonable and prudent measure #1 above, the following terms and conditions apply:*

1. *The USACE shall hire a qualified biologist (approved by the Service) to collect damselflies to be relocated to another protected location or to be held in captivity in a qualified facility until site is identified."*

Your clarification: "*USFWS has provided options for compliance which USACE and the sponsor can exercise at their discretion.*

If the option to relocate damselflies is executed, USACE will coordinate with USFWS on the selection of the qualified biologist and relocation site and the procedures to be followed for the relocation effort. Relocation would be conducted by a qualified biologist hired by USACE and USFWS will not unreasonably withhold concurrence of the use of an individual or contractor with suitable qualifications. The relocation site will occur directly upstream of the project areas, outside of the footprint of construction. Relocation will only include the damselfly larva life stage. USFWS has advised that the larval stage has the greatest potential to survive the relocation effort. Relocation or collection for storage will occur one time at each project site, immediately prior to construction. USACE is not required to demonstrate success with the relocation effort. The relocation effort is to reduce the amount of take of damselflies."

We agree with your clarification above.

Your clarification: "*The option to hold damselflies in captivity until they can be relocated to another site cannot be executed at this time. The Division of Forestry and Wildlife (DOFAW), Department of Land and Natural Resources (DLNR), State of Hawaii has a facility that can hold damselflies and is currently seeking a permit from the USFWS to work with the species. With this permit, DOFAW would be able to collect blackline Hawaiian damselfly adults, larvae and eggs for holding and rearing at their facility from the Waihi and Waiakeakua project areas before the start of construction. Relocation of the damselflies would be coordinated and executed under terms of their permit with the USFWS. Biologists from DOFAW will collect blackline Hawaiian damselfly adults, larvae and eggs (all life stages) and store acquired specimens at a DOFAW-owned and operated facility. Release of adult individuals or relocation of lavae and eggs outside of the facility to the natural environment will be at the discretion of the DLNR. Collection and holding of damselflies by the DOFAW is the preferred method by USFWS to reduce the amount of take.*"

We appreciate your efforts to describe the proposed implementation of the terms and conditions #1, however, the Hawai'i Department of Land and Natural Resources – Division of Forestry and Wildlife (DOFAW) does not currently have a facility that can hold blackline damselflies. As we discussed in our meeting on October 11, the Service is not able to agree to this commitment on behalf of DOFAW. We recommend you work with our office to create further dialogue and details with DOFAW for the proposed work. Furthermore, the collection and holding damselflies is the preferred method by the Service to minimize the extent of take of adult damselflies and all associated life stages as the result of your proposed project.

Our BO states: "*to implement the reasonable and prudent measure #1 above, the following terms and conditions apply…*

2. *The USACE shall monitor and report on the levels of take that occur on an annual basis. To determine the level of incidental take the USACE shall:*

    a. *Monitor and report any observed blackline Hawaiian damselflies prior to construction of the access roads and debris and detention basins at the Waihī and Waiakeakua construction footprints. The USACE will monitor blackline Hawaiian damselfly information for one year after the completion of construction at these sites. The monitoring methodology will be approved by the Service prior to construction implementation, and will, at a minimum, include counts of adult blackline Hawaiian* damselflies."
    b. *Submit reports summarizing the methods and results of the above monitoring efforts to the Service's Pacific Islands Fish and Wildlife Office (300 Ala Moana Blvd., Room 3-122, Honolulu, Hawai'i 96850) annually until the monitoring is complete.*

3. *The USACE shall submit annual reports detailing the implementation of the above Reasonable and Prudent Measures and Terms and Conditions. The first report shall be due at the end of January of the first year after the project is initiated. Annual reports shall be submitted throughout the duration of the proposed action.*"

Your clarification: "*For Terms and Conditions #2 and #3, USFWS has requested three monitoring events which will result in the submittal of reports by USACE. These include a preconstruction survey, a post-construction survey, and a survey of the completed project area within one year of construction completion. Reports will be provided to the designated receiving office by the end of January of the year following the completion of the report. If DOFAW performs the collection of damselflies prior to construction, it will provide the numbers of adults, larvae and eggs collected to USACE for reporting to USFWS.*"

We agree with your clarification, however, disagree with obligating DOFAW to provide "*…numbers of adults, larvae and eggs collected to USACE for reporting…*" We agree this information should be provided by the party who will perform the collection of damselflies, but the Service is not able to commit DOFAW to these requirements. We recommend you work with our office and DOFAW to create the dialogue to request and initiate a proposed work plan.

Our BO states: "*In order to implement the reasonable and prudent measure #2 above, the following terms and conditions apply:*

1. *The USACE shall consider purchasing private land to relocate the access roads downstream of the proposed Waihī debris and detention basin to minimize loss of riffle and pool habitat.*"

Your clarification: "*Based on email correspondence received from USFWS staff on October 11, 2016, it is USACE's understanding that the concern regarding habitat loss due to the location of the road is focused on the loss of hillside seep habitat, not riffle and pool habitat as noted above. While the concern is noted, operations and maintenance requires access to the upstream side of the structure in order to perform debris removal activities. Relocating this road on the*

downstream side of the structure would significantly increase the distance and subsequent environmental impacts of the roadway and also require a stream crossing in order to access the upstream side of the structure. USACE has considered relocating the Waihi access road and determined that due to the greater environmental damage and costs, relocating the road is not feasible."

As stated in our email, we clarified the construction of the access roads at Waihī stream will result in the loss of seep habitat, not riffle and pool habitat; therefore, we agree with your clarification above. However, the blackline Hawaiian damselfly occurs in both slow sections or pools along mid-reach and headwater sections of perennial upland streams, as well as in seep-fed pools along overflow channels bordering such streams. Therefore, we recommended you consider the purchase of private land or other options to relocate the access roads downstream of the current proposed areas in Waihī to minimize loss of seep habitat. If after further development of your project plans this becomes an option, we recommend you relocate the proposed road to minimize habitat loss for the blackline Hawaiian damselfly.

Our BO states: "*...to implement the reasonable and prudent measure #2...*

2. *The USACE shall limit the removal of tree canopy cover over areas of damselfly habitat.*"

Your clarification: "*USACE will limit tree removal to the greatest extent practicable. However, USACE activities will only occur on-site during the construction period. Following completion of construction, USACE cannot control the actions of others within the project area.*"

We agree with your clarification.

Your comments: "*In the future, we request receipt of a draft BO prior to finalization in order ensure that the federal action is properly defined and that the parties' mutual understanding of the terms and conditions are clearly set forth in the BO.*"

We acknowledge your request for a draft opinion for future projects, however, we advise you to request for a draft BO when initiating consultation to allot for scheduling of document reviews. Additionally, each project will likely be assigned to different biologists or Team leaders; therefore, we recommend you communicate early with Service biologists to ensure advanced notice and timely submission of draft documents.

We will add your clarification letter and this response letter to our project files. To reiterate, our existing BO is a standalone document and should be considered as such. Additional documentation is beneficial to clarifying any underlying questions and conversations as documentations for the project.

We appreciate your willingness to work with our office and encourage you to continue conversations to further protect Hawai'i's endangered species. Please contact Jiny Kim, Fish and Wildlife Biologist (phone: 808-792-9400, email: Jiny_Kim@fws.gov) should you have any questions or concerns about this letter.

Sincerely,

Aaron Nadig
Island Team Manager
O'ahu, Kaua'i, Northwestern Hawaiian Islands, and American Samoa

Appendix E6
Renderings of Flood Risk Management Measures

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