US Army Corps of Engineers
Honolulu District

FINAL
ENGINEERING DOCUMENTATION REPORT AMENDMENT
MODIFICATON TO THE
IAO STREAM FLOOD CONTROL PROJECT
WAILUKU RIVER, WAILUKU, MAUI, HAWAII

September 2021

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ERRATA SHEET

Final Engineering Documentation Report Amendment Modification to the Iao Stream Flood Control Project, Wailuku River, Wailuku, Maui, Hawaii

03 January 2022

The intent of this errata sheet is to document revisions to the report resulting from the change in cost indices from fiscal year (FY) 2021 to FY 2022 impacting the cost of the project. Additional changes to the report include updates to the Engineering Documentation Report (EDR) Amendment and Supplemental Environmental Assessment (SEA) to provide clarification of compliance with applicable laws and regulation. The revisions do not affect the selection of the recommended plan or other considerations contemplated by the EDR Amendment. Each edit is discussed further below.

1. Executive Summary. Page ES-1. Replace $5.5 million at the FY21 price level with $6.4 million at the FY22 price level.

2. Section 4.7.2. Economic Considerations: Reduction in OMRR&R, Page 36. Revise the Section 4.7.2 title to be “Economic Considerations: Reduction in OMRR&R and Repair Costs.”

3. Section 4.7.2. Economic Considerations: Reduction in OMRR&R, Page 36. Insert new language and table after Paragraph 2 to clarify the expected annual savings for both OMRR&R and repair costs to read as:

“Expected annual savings in repair costs were derived based upon reductions in expected repair costs by annual exceedance probability. The annual routine OMRR&R savings were added to the expected annual repair savings to obtain a total expected annual savings. The breakdown of each benefit category and the total average annual benefits by alternative are displayed in the table below.”

Table 4-4B. Expected Annual Savings by Alternative

Alternative	Expected Annual Repair Savings	Expected Annual Routine OMRR&R Savings	Total Expected Annual Savings
Revetment X Removal (Alt. 2)	$20,900	$75,000	$95,900
Pre-Formed Scour Hole (Alt. 6)	$95,000	$55,000	$150,000
Combination (Alt 2 + Alt 6)	$115,900	$130,000	$245,900

4. Section 4.7.2. Economic Considerations: Reduction in OMRR&R, Page 37. Replace text under sub-heading Alternative 12: Combination Plan that reads “Ultimately, the combination of all alternatives would result in a cumulative reduction in OMRR&R requirements for the project, with OMRR&R requirements decreasing from approximately $135,000 annually to $15,000 annually.” with the following text “Ultimately, the combination of all alternatives would result in a cumulative reduction in OMRR&R requirements for the project, with OMRR&R savings benefits of $130,000.”

5. Section 5.4, Environmental Compliance, Page 47. FISH AND WILDLIFE COORDINATION ACT is replaced with the following for clarification of compliance:

“FISH AND WILDLIFE COORDINATION ACT. Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1934, as amended (16 U.S.C. §§ 661–667e), the intent of the preferred alternative is to address a design deficiency of an existing federally authorized project. No modification or supplement of the original authorization is proposed. The Corps consulted USFWS, NMFS and the State Department of Land and Natural Resources on the effect of removal of Revetment X (Alternative 2) on fish and wildlife resources, as documented in the 2017 Final EA and a Planning Aid Letter, dated April 22, 2014, from the USFWS. The construction of the pre-formed scour hole (Alternative 6) within the Iao Stream Flood Control Project channel invert would not modify or otherwise control the presently modified Wailuku River at this location and the proposed nonstructural public flood warning system (Alternative 11) proposes no modification to the Wailuku River. Accordingly, Alternatives 6 and 11 do not require FWCA consultation. No further consultation with the Services is required under the FWCA for Alternative 12, combining the alternatives listed above. The Corps has satisfied statutory requirements for the proposed federal action under the FWCA.”

6. Section 5.4, Environmental Compliance, Page 48. COASTAL ZONE MANAGEMENT ACT is replaced with the following for clarification of compliance:

COASTAL ZONE MANAGEMENT ACT. The Corps submitted its application, assessment form with substantiating documentation and request for federal consistency review to the State CZM Office on July 26, 2021. On September 14, 2021, the State CZM Office provided the Corps comments from their public review process to address. The Corps submitted to the State CZM Office the responses to those comment on September 24, 2021. The State CZM Office conditionally concurred with the Corps’ federal consistency determination on September 28, 2021, requiring submission of additional information during the design phase and prior to construction. By email dated September 30, 2021, USACE accepted all seven (7) conditions of the State conditional concurrence. Upon further review of the State CZM Office’s conditional concurrence, the Corps coordinated directly with the State CZM to remove Condition #5 from the conditional concurrence dated September 28, 2021, as the Corps could not accept nor comply with Condition #5 as the condition places a requirement on another entity, the County of Maui. On December 21, 2021, the State CZM officed issued a supplemental federal consistency decision letter, superseding the federal consistency decision that was previously issued on September 28, 2021, removing the former Condition #5. The Corps will incorporate all conditions identified in the December 21, 2021, supplemental federal consistency decision letter into the Iao Stream FCP. Accordingly, the Corps has satisfied the statutory requirements under Section 307 of the CZMA for the proposed action. 7. Table 5-2. Project First Cost Summary, Page 48. Table 5-2 is replaced with the following to update the cost based on FY22 cost levels.

Table 5-2. Project First Cost Summary

Construction Item Cost	Project First Cost (FY22 Price Level; $1000s)
Construction	$4,595
LERRDs	$8
Preconstruction Engineering & Design	$1,178
Construction Management	$588
Total First Cost ($1000s)	$6,369

7. Table 5-3. Project First Cost Summary, Page 48. Table 5-3 is replaced with the following to update the cost based on FY22 cost levels.

Table 5-3. Estimated Project First Cost and Cost Share - FY 22 Price Levels ($1,000s)

Item	Federal Cost	Non-Federal Cost	Project First Cost
Construction	$4,595	$0	$4,595
Preconstruction Engineering and Design	$1,178	$0	$1,178
Construction Management	$588	$0	$588
LERRDs (non-cash contribution)	$0	$8	$8
Non-Federal Cash Contribution	-$2,221	$2,221	$0
TOTAL	**$4,140**	**$2,229**	**$6,369**
Cost Share Percentage	**65%**	**35%**	**100%**

8. Appendix D: Cost Engineering. Cost Agency Technical Review, Certification Statement and Total Project Cost Summary are replaced with an updated version to reflect FY22 Price Levels and project costs, as shown above in revised Tables 5-2 and 5-3.

9. Appendix F: Final Supplemental Environmental Assessment, Section 4, Compliance With Applicable Environmental Laws And Regulations. Section 4.5, Coastal Zone Management Act, the final paragraph in this section is replaced with the following paragraph to provide clarification of compliance.

USACE has determined that Alternative 6, Install Pre-formed Scour Hole, of the Preferred Alternative, also is consistent to the maximum extent practicable with the State CZM program policies and objectives. USACE submitted its application, assessment form with substantiating documentation and request for Federal consistency review to the State CZM Office on July 26, 2021. On September 14, 2021, the State CZM Office provided USACE comments from their public review process to address. USACE submitted to the State CZM Office responses to those comment on September 24, 2021. The State CZM Office conditionally concurred with USACE's Federal consistency determination on September 28, 2021, requiring submission of additional information during the design phase and prior to construction. By email dated September 30, 2021, USACE accepted all seven (7) conditions of the State conditional concurrence. Upon further review of the State CZM Office's conditional concurrence, the Corps coordinated directly with the State CZM to remove Condition #5 from the conditional concurrence dated September 28, 2021, as the Corps could not accept nor comply with Condition #5 as the condition places a requirement on another entity, the County of Maui. On December 21, 2021, the State CZM officed issued a supplemental federal consistency decision letter, superseding the federal consistency decision that was previously issued on September 28, 2021, removing the former Condition #5. The Corps will incorporate all conditions identified in the December 21, 2021, supplemental federal consistency decision letter into the Iao Stream FCP. Accordingly, the Corps has satisfied the statutory requirements under Section 307 of the CZMA for the proposed action.

10. Appendix F: Final Supplemental Environmental Assessment, Section 4, Compliance With Applicable Environmental Laws And Regulations. Section 4.7, Fish and Wildlife Coordination Act is replaced with the following paragraphs to provide clarification of compliance.

4.7 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) of 1934, as amended (16 U.S.C. §661–667e), provides authority for USFWS and NMFS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other development project features. It requires Federal agencies that construct, license, or permit water resource development projects to consult with the USFWS, NMFS, and state resource agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts when waters of any stream or other body of water are “proposed . . . to be impounded, diverted . . . or . . . otherwise controlled or modified . . .” The intent of the preferred alternative is to address a design deficiency of an existing federally authorized project. No modification or supplement of the original authorization is proposed.

USACE will not pursue further coordination with the services on Alternative 12, which combines the actions under Alternatives 2, 6 and 11 based on the following FWCA coordination history: A Planning Aid Letter was issued dated April 22, 2014 for Alternative F of the 2017 Final EA, which includes Alternative 2 of this SEA and can be found in Appendix F of the 2017 Final EA, documenting Alternative 2 compliance with the FWCA. Regarding Alternative 6 of the Preferred Alternative, USACE proposes rehabilitation of the existing Iao Stream Flood Control Project channel invert, an existing, constructed, modification of the Wailuku River. The construction of the pre-formed scour hole within the Iao Stream Flood Control Project channel invert would not modify or otherwise control the presently modified Wailuku River at this location therefore, the FWCA is not applicable. No FWCA coordination is required for Alternative 6. Alternative 11 is a non-structural alternative that does not propose to control or modify a body of water. Likewise, FWCA is not applicable; no FWCA coordination is required for Alternative 11.

10. Appendix F: Final Supplemental Environmental Assessment, Appendix B, Finding of No Significant Impact (FONSI), Section 4, Coastal Zone Management Act Compliance (CZMA), the paragraph is replaced with the following for clarification of compliance.

CZMA CONSISTENCY CONDITIONAL CONCURRENCE OBTAINED. A determination of consistency with the State of Hawaii Coastal Zone Management program pursuant to the Coastal Zone Management Act of 1972 was obtained from the State of Hawaii Coastal Zone Management (CZM) Office by letter dated 21 December 2021, including conditions necessary to be implemented in the design phase to ensure consistency. All conditions of the consistency determination shall be implemented as stated in the State's conditional concurrence in order to minimize adverse impacts to the coastal zone.

11. Appendix F: Final Supplemental Environmental Assessment, Appendix D, Coastal Zone Management Act, the Appendix is replaced in its entirety with the attached Appendix D to complete compliance with Coastal Zone Management Act. The changes include additional letters and correspondence with the Hawaii State Office of Planning and County of Maui, Hawaii.

FINDING OF NO SIGNIFICANT IMPACT

Address Design Deficiency of the Iao Stream Flood Control Project
Wailuku River, Wailuku, Island of Maui, Hawaii

The USACE, Honolulu District has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The amended Engineering Documentation Report (EDR) and Supplemental Environmental Assessment (SEA) dated 30 September 2021, to Address the Design Deficiency of the Iao Stream Flood Control Project addresses design deficiency and flood risk reduction opportunities for the Wailuku community. The final recommendation is contained in both the Final EDR and SEA.

The Final EDR and SEA, incorporated herein by reference, evaluated various alternatives that would address design deficiency and reduce flood risk in the Wailuku community. The recommended plan is the National Economic Development (NED) Plan and includes:

- Removal of approximately 290 feet of the remaining portion of Revetment X along the left back,
- Excavation of the eroded channel invert and construction of a pre-formed scour hole, and
- Installation of a stream gage or other climate gage as part of a public flood warning system.

In addition to a "no action" plan, four alternatives were evaluated.[1] The alternatives are included in Section 2 of the SEA:

- No Action Alternative
- Alternative 2: Remove Revetment X
- Alternative 6: Install Pre-Formed Scour Hole
- Alternative 11: Non-Structural Plan (Public Flood Warning System)
- Alternative 12: Combination Plan: Alternative 2 + Alternative 6 + Alternative 11 (Recommended Plan)

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the recommended plan are listed in Table 1:

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[1] **40 CFR 1505.2(b) requires a summary of the alternatives considered.**

Table 1: Summary of Potential Effects of the Recommended Plan

	Insignificant effects	Insignificant effects as a result of mitigation*	Resource unaffected by action
Aquatic resources/wetlands	☒	☐	☐
Fish and wildlife habitat	☒	☐	☐
Threatened/Endangered species/critical habitat	☐	☐	☒
Historic properties	☐	☐	☒
Other cultural resources	☐	☐	☒
Floodplains	☐	☐	☒
Land use	☐	☐	☒
Noise	☐	☐	☒
Public infrastructure	☐	☐	☒
Socio-economics	☐	☐	☒
Environmental justice	☐	☐	☒
Geological Resources	☐	☐	☒
Recreational Resources	☐	☐	☒
Solid and Hazardous Waste	☐	☐	☒
Visual Aesthetics	☐	☐	☒
Water quality	☒	☐	☐
Climate, Air Quality, Greenhouse Gases	☐	☐	☒
Traffic and Circulation	☐	☐	☒

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the EDR and EA will be implemented, if appropriate, to minimize impacts.[2] Standard BMPs will be implemented throughout the duration of construction to avoid and minimize adverse impacts to natural resources. For example, silt fencing and other sediment erosion control measures to prevent inadvertent discharges to surface waters.

No compensatory mitigation is required as part of the recommended plan.

Public review of the draft SEA and FONSI was completed on 13 September 2021. All comments submitted during the public review period were responded to in the Final SEA and FONSI.

[2] 40 CFR 1505.2(C) all practicable means to avoid and minimize environmental harm are adopted.

OTHER ENVIRONMENTAL AND CULTURAL COMPLIANCE REQUIREMENTS:

ENDANGERED SPECIES ACT

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, USACE determined that the recommended plan will have no effect on federally listed species or their designated critical habitat.

NATIONAL HISTORIC PRESERVATION ACT

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that the recommended plan would have no effect on historic properties including cultural resources. The State Historic Preservation Division concurred with the determination on 29 September 2021.

CLEAN WATER ACT SECTION 404(B)(1) COMPLIANCE

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the recommended plan has been found to be compliant with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Section 7 of the USACE Final Decision Document for the 2017 Nationwide Permit (NWP) #3, Maintenance dated 21 December 2016 as referenced in Section 4.4 of the Final SEA. All applicable general and regional conditions of NWP #3 will be incorporated as specification of any construction contract.

CLEAN WATER ACT SECTION 401 COMPLIANCE:

401 WQC TO BE OBTAINED IN THE DESIGN PHASE.

A water quality certification pursuant to section 401 of the Clean Water Act will be obtained from the State of Hawaii Department of Health, Clean Water Branch prior to construction. In a letter of confirmation dated 9 September 2021, the State acknowledged USACE's coordination on this project, stated it had no preliminary issues with the USACE moving forward with further designs of this project and seeking Section 401 WQC from the State prior to construction. All conditions of any water quality certification obtained will be implemented in order to minimize adverse impacts to water quality.

COASTAL ZONE MANAGEMENT ACT COMPLIANCE (CZMA):

CZMA CONSISTENCY CONDITIONAL CONCURRENCE OBTAINED.

A determination of consistency with the State of Hawaii Coastal Zone Management program pursuant to the Coastal Zone Management Act of 1972 was obtained from the State of Hawaii Coastal Zone Management (CZM) Office by letter dated 21 December 2021, including conditions necessary to be implemented in the design phase to ensure consistency. All conditions of the consistency determination shall be implemented as stated in the State's conditional concurrence in order to minimize adverse impacts to the coastal zone.

FINDING:

Technical, environmental, and economic criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives; coordination with appropriate agencies and officials have been completed.[3] Based on this report, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the recommended plan would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.[4]

21 MAR 23
Date

Christopher Ryan Pevey
Lieutenant Colonel, Corps of Engineers
District Commander

[3] 40 CFR 1505.2(B) requires identification of relevant factors including any essential to national policy which were balanced in the agency decision.

[4] 40 CFR 1508.13 stated the FONSI shall include an EA or a summary of it and shall note any other environmental documents related to it. If an assessment is included, the FONSI need not repeat any of the discussion in the assessment but may incorporate by reference.

Iao Stream Flood Control Project Engineering Documentation Report Amendment

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EXECUTIVE SUMMARY

The Iao Stream Flood Control Project (FCP) is located in the town of Wailuku, on the island of Maui, in the state of Hawaii, and was authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483). The Iao Stream FCP was constructed in October 1981 by the U.S. Army Corps of Engineers (Corps) and consists of a debris basin located 2.5 miles upstream of the stream mouth, a 3,500 feet (ft) long lined channel downstream from the debris basin, levees along the left and right banks of the stream, and a revetment along both banks in one section of the stream. The non-federal sponsor (NFS) is the County of Maui, represented by the Department of Public Works.

Since its completion in 1981, numerous storm events of high velocity flows within the steeply sloped channel severely eroded key portions of its levees and channel invert, particularly the right bank levee toe, which is experiencing significant undercutting. Scour depths have extended to a maximum of 6 to 10 ft below the existing boulder concrete slope lining and repairs to the levees have proven costly and ineffective. A Design Deficiency Report, completed in March 1995, identified the need to address the undermining of the levee toe and excessive erosion within the flood control project. The report was approved by the acting Assistant Secretary of the Army for Civil Works (ASA(CW)) in November 1995. The original solution to address this design deficiency was to line the channel to preserve the integrity of the FCP. However, that solution was determined not technically feasible and additional alternatives have been formulated and evaluated since 1995.

This report is intended to respond to the Memorandum from the ASA(CW) to the Director of Civil Works, dated 24 November 1995. The memorandum identified two alternatives already evaluated by the Corps, a $5.5 million (FY 1995 price level) plan to reconstruct levee toes and a $15 million plan (FY 1995 price level) to line the entire channel with concrete. Per the subject memorandum, a project to correct the deficiency associated with the existing project will be considered approved subject to three conditions:

1. Evaluate the $5.5 million alternative originally prepared by the Pacific Ocean Division and specifically identify the residual risks and economic impacts and/or increased costs associated with those risks.
2. Evaluate measures to avoid the residual risks and costs and verify that the recommended $15 million deficiency correction identified in the 1995 Design Deficiency Report is less costly than mitigating for the risks and costs associated with the $5.5 million alternative.
3. If the $15 million solution is the only acceptable solution, a value engineering study should be conducted with a goal of reducing the costs.

The study has a long and iterative history of plan formulation. The team has formulated and evaluated dozens of alternatives, starting with the $5.5 million and $15 million alternatives identified in the 1995 Design Deficiency Report and resulting in a comprehensive plan to reconnect the floodplain and address the design deficiency that exceeded the original Congressional Authorization in the 2017 Engineering Documentation Report (EDR). This report amends the 2017 EDR with evaluation of alternatives to support this effort.

The Recommended Plan (Alternative 12, Figure ES-1) includes three features: removal of Revetment X (Alternative 2), installation of a pre-formed scour hole (Alternative 6), and a non-structural, public flood warning system (Alternative 11). The project first cost of the recommended plan is $5.5 million at the FY21 price level and 2.5% discount rate. The recommended plan is justified based on both safety and economic considerations, with substantial improvements to community safety and long-term reductions in operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) requirements for the NFS.

While the recommendations have changed from 1995, 2017 to 2021, the design deficiency remains the same, insufficient levee toe protection and excessive erosion within the Iao Stream FCP.

No mitigation is proposed for the Recommended Plan as the Corps has preliminarily concluded a finding of no significant impact (FONSI) with no loss of wetlands or other special aquatic sites, no adverse effects to fish and wildlife resources and no adverse effect to historic properties and cultural resources. The Corps' evaluation of environmental effects and documentation of stakeholder, agency, and public outreach efforts is presented in the Supplemental Environmental Assessment (SEA) attached to this document (Appendix F). The project is not considered controversial as the Corps received general support for the Recommended Plan from the NFS, stakeholders, agencies and interested public.

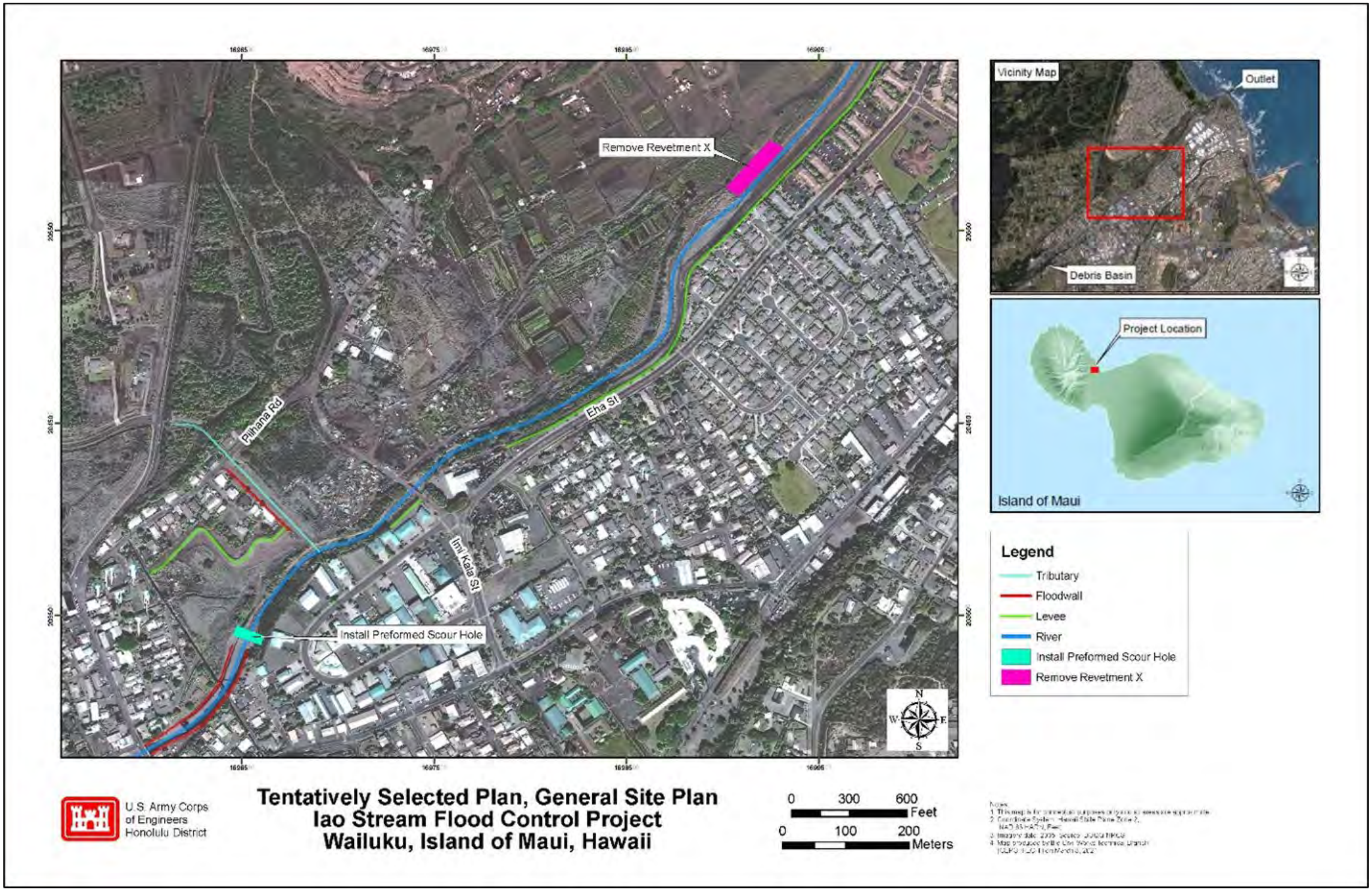

Figure ES-1. Recommended Plan

1 Introduction

The U.S. Army Corps of Engineers, Honolulu District (Corps) is investigating solutions to address an existing design deficiency of the Iao Stream Flood Control Project (FCP) along the Wailuku River (formally named Iao Stream) in the town of Wailuku, Island of Maui, Hawaii. This Engineering Documentation Report (EDR) Amendment provides engineering analysis and a preliminary design, along with updated cost estimates, economic and safety analysis, and environmental documentation for modifications to the existing Iao Stream FCP.

1.1 Study Purpose and Scope

Using current Corps criteria and policies, this EDR Amendment includes review and evaluation of the alternatives presented in past study efforts and additional alternatives generated through incorporation of updated economic, real estate, and cost data, as well as updated hydraulic modeling, which more accurately characterizes the effectiveness of proposed design deficiency measures, per Engineer Regulation (ER) 1110-2-1150. This report documents the evaluation of design deficiency recommendations per Corps Planning policy in ER 1165-2-119.

1.2 Project Authorization

The Iao Stream FCP was authorized for construction by the Corps on August 13, 1968 under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 in accordance with the recommendations of the Chief of Engineers in House Document Number 151, 90th Congress. The non-Federal sponsor (NFS) is the County of Maui. The original project, which consisted of enlarging, straightening, and stabilizing the channel and constructing levees, walls, and a debris basin, was completed in October 1981. Details about the authorized project are included in Section 1.3.

1.3 Location and Description of the Authorized Project

The Iao Stream FCP is located along the Wailuku River in the town of Wailuku on the northeast coast of the island of Maui, state of Hawaii (**Figure 1-1**). The Wailuku River is located within a drainage basin on the eastern slopes of the West Maui Mountains, near the north end of the isthmus connecting East and West Maui. The river is approximately 8 miles long and drains the steep Iao Valley, meandering eastward to the Pacific Ocean, through the town of Wailuku. The FCP is located in the lower reach of Wailuku River, extending approximately 2.5 miles upstream of the river mouth (Figure 1-2). The area of concern is primarily within a reach that is approximately 1-mile long upstream of the Waiehu Beach Road.

The Wailuku River can be described as four distinct reach segments:

1. Natural Upstream Reach
2. Upper Concrete Channel
3. Natural Reach
4. Lower Reach and Outlet

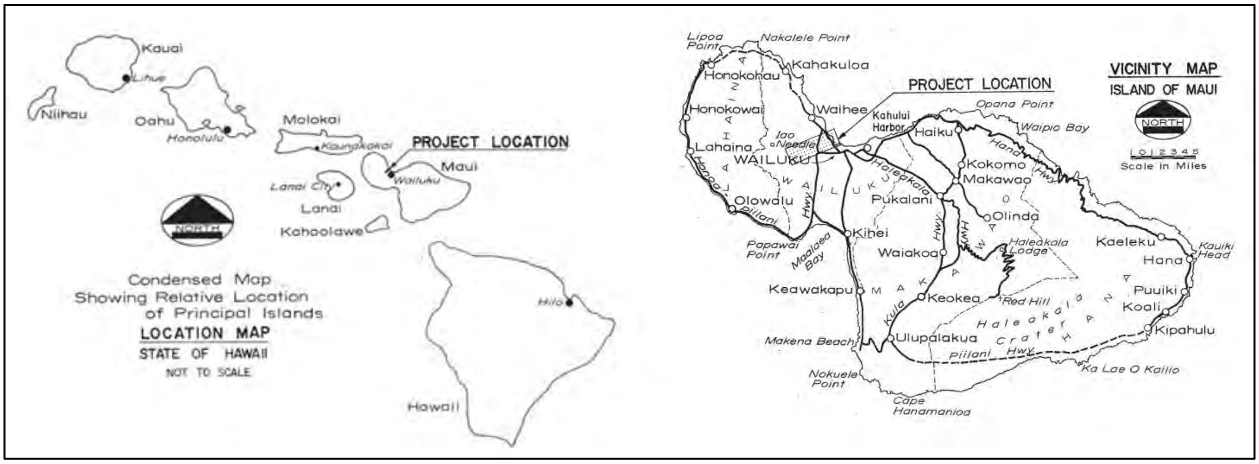

Figure 1-1. Study Area Map

Figure 1-2. Project Area

The existing FCP was designed to provide protection against the Standard Project Flood (SPF) which, under project conditions, would have a discharge of 26,000 cubic feet per second (cfs) at the upper limits of the project at the debris basin and 26,500 cfs at the mouth of Wailuku River. The floodplain between the channel improvements incorporates the 1,500 cfs discharge from the Happy Valley Flood Prevention Project for a total discharge of 27,500 cfs (USACE, 1976).

The completed project (Figure 1-3) consists of the following features included in three of the four reach segments described above:

1. **Natural Upstream Reach:** There are no Federally authorized project features included in this reach.
2. **Upper Concrete Channel:** The Iao Stream FCP begins within this reach. A debris basin is located at the upstream end of the Federal project, approximately 2.5 miles upstream from the stream mouth. The debris basin is intended to prevent large boulders and debris from entering the lower reaches of the stream.
3. **Natural Reach:** Project features in this reach include channel improvements extending 3,500 feet (ft) downstream from the debris basin, levees along the right bank, and levees and a designated floodplain along the left bank for 6,950 ft of natural stream channel.

   Project levees “A,” “B,” “C,” “D,” and “E” are intermittently situated upon the right bank of the stream; levees “F” and “G” are located on the left bank.

   This reach also includes Revetment X on both banks of the river between levees “C” and “B”. Within the vicinity of Revetment X, the meandering natural channel was straightened and narrowed with boulder concrete lining as part of the original project.

   Finally, an area zoned for floodplain management is designated on the left bank within this reach. It is primarily used for agricultural purposes. The natural stream bed consists of boulders and scrub brush. The bed ranges in width from 40 to 60 ft and has an average slope of 2.6 percent.
4. **Lower Reach and Outlet:** Features include stream realignment with channel improvements for a reach of 1,730 ft that extends to the downstream limit of the project located near the shoreline.

For the purposes of this report, left bank refers to the left bank of Wailuku River when looking downstream. Likewise, right bank refers to the right bank when looking downstream. Documentation of the project design can be found in the three General Design Memorandums (GDMs) published in 1974, 1975, and 1976, and in the as-built drawings.

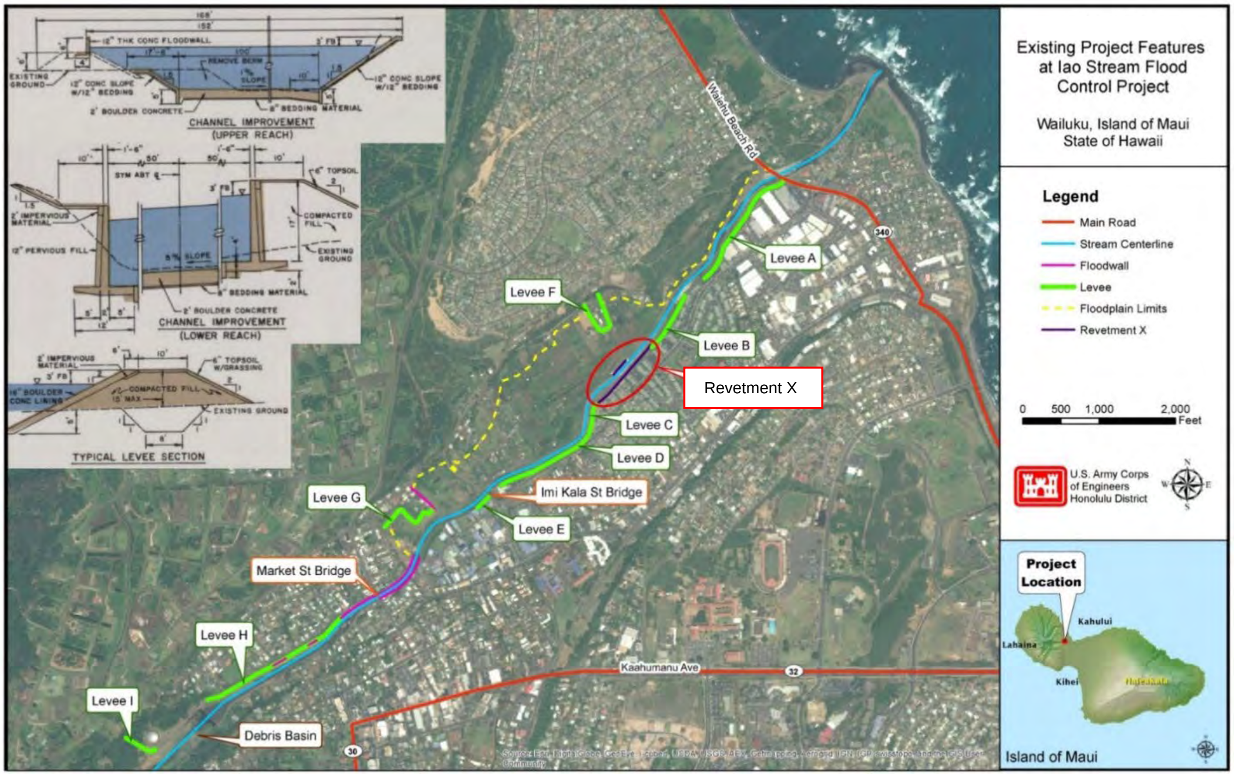

Figure 1-3. Existing Authorized Project

1.4 Prior Reports and History of Remedial Study Efforts

Various reports were prepared for the Iao Stream FCP since authorization. Two key reports are summarized below.

- **Engineering Documentation Report (EDR; USACE, 2017):** Provides engineering analysis and a preliminary design, along with updated cost estimates, economic analysis, and environmental documentation for modifications to the existing Iao Stream FCP to correct design deficiencies associated with the authorized project.
- **Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) (USACE, 2017):** Final EA and FONSI associated with the recommended plan presented in the 2017 EDR.

Additional reference reports include the following and are described in more detail in Appendix A:

- USACE Committee on River Engineering Report (2019)
- Upper Wailuku Flood Study (2017)
- Iao Stream Hydraulic Analysis (2008)
- Iao Stream Hydraulic Design Study (2000)
- Channel and Slope Stability Assessments (1997-2000)
- General Design Memorandums (1974-1976)

The history of study efforts is summarized in Figure 1-4. The original project was completed in October 1981. Since its completion, numerous storm events of high velocity flows within the steeply sloped channel have severely eroded key portions of its levees and channel invert, leading the Corps to identify a design deficiency at the project.

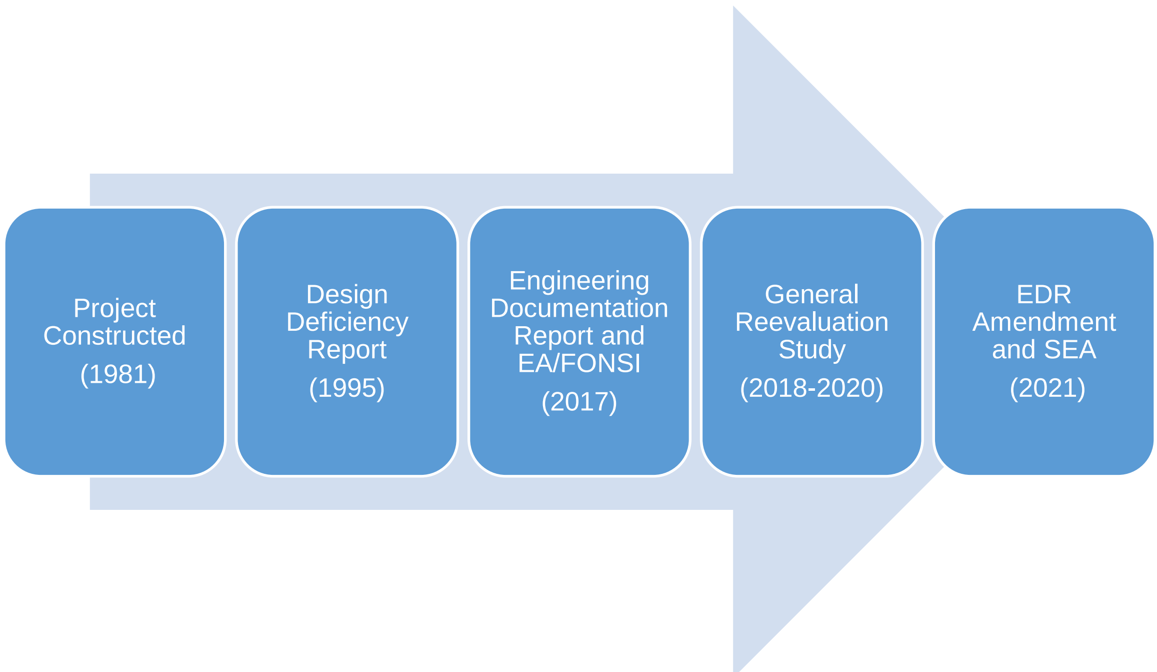

Figure 1-4. History of Study Efforts

Continued erosion caused more costly and extensive long-term operation, maintenance, repair, rehabilitation, and replacement (OMRR&R) costs for the NFS, as well as emergency response from the Corps under Public Law 84-99 to rehabilitate after damage occurs during flood events. The maintenance burden on the NFS is above and beyond the planned and anticipated routine maintenance activities in the OMRR&R manual provided by the Corps and is occurring with higher frequency than originally designed. As described in Appendix C, OMRR&R costs exceed anticipated levels by approximately 215% to 1,100% (adjusted for inflation), with annual OMRR&R costs expected to increase under the future without-project condition. Deficiencies at the FCP are not a result of NFS lack of maintenance.

A Design Deficiency Report (DDR) was completed in March 1995 and approved by the acting Assistant Secretary of the Army for Civil Works (ASA(CW)) in November 1995. The DDR concluded insufficient levee toe protection and excessive erosion within the Iao Stream FCP led to the design deficiency. It recommended that lining the unlined portions of the channel would resolve the design deficiency at Iao Stream FCP. However, additional analysis demonstrated the identified solution was not feasible due to excessive costs and potentially significant environmental impacts. For these reasons, the Corps decided not to implement the DDR recommendation, leaving the design deficiency unaddressed.

Since 1995, several iterations of EDR development have been conducted to investigate multiple alternatives to address the design deficiency. The Corps thoroughly evaluated the overall function of the FCP as it relates to the design deficiency and has analyzed numerous alternatives throughout the study process. In 2017, a Final EDR was completed by the Corps. Under the 2017 EDR, six alternatives were evaluated to address the design deficiency. A less expensive, more environmentally acceptable design was identified through the EDR process, including recommendation of a comprehensive plan, "*Alternative F*" to reconnect the floodplain and provide a more holistic response to the design deficiency based on the engineering data available.

Alternative F proposed new features not included in the original authorized project that were deemed to beyond the authority of the current authorized project. Accordingly, the Corps was directed to complete a General Reevaluation Report (GRR) as the mechanism to receive Congressional authorization on a project with new flood risk management (FRM) features.

The GRR was initiated in October 2018 through execution of a Feasibility Cost Share Agreement between the Corps and the NFS. Contrary to conclusions drawn under the 2017 EDR, updated modeling and engineering analysis indicated that the previously recommended plan was no longer technically feasible. Alternative F, as designed, induced additional flood risks to the community and lacked cost-effective means to engineer the alternative to achieve the desired benefits of reduced flood risk. Rather than terminate the study and efforts, the project delivery team evaluated alternatives to solely address the design deficiency.

The study team evaluated alternatives with the objective to address the design deficiency justified based on safety and economic considerations. The final recommendations are presented in this EDR Amendment to the 2017 EDR. While recommendations since 1995 have changed in both scope and cost, the design deficiency remained the same - insufficient levee toe protection and excessive erosion of the flood control project.

2 Purpose and Need for Action

This chapter summarizes the problems, opportunities, objectives, and constraints of the design deficiency based on the existing and future without-project conditions (FWOPC) within the study area.

2.1 Summary of Existing and Future Without-Project Conditions

The existing and FWOPC for the study area are summarized below. Additional detail about the affected environment and environmental consequences of alternatives can be found in Section 5.4 and Appendix F.

Hydrology and Hydraulics: Wailuku River begins in the upper elevations of the Iao Valley and flows eastward towards the Pacific Ocean, discharging into Kahului Bay. The Wailuku watershed is subject to intermittent, high intensity rainfall. The most significant floods occurred in January 1916, November 1930, January 1948, December 1950, November 1961, January 1971, and September 2016. The flood of 1916 was the worst flood to hit the area, with peak discharge estimated to be 17,000 cfs.

A combined one-dimensional (1D) and two-dimensional (2D), unsteady flow hydraulic model was created for this study using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software (version 5.0.7, HEC, 2019). Peak flow rates were used to represent the amount of water in the system for the 50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% annual exceedance probability (AEP) flood events. Under the FWOPC, continued erosion of the stream bank will occur regardless of frequency or magnitude of future storm events. Overtopping is likely to first occur during a 4% AEP event, over the left and right bank floodwalls downstream from Market Street Bridge. Overtopping also occurs during a 2% AEP at the drop structures along the upper concrete channel. Additional H&H modeling results for specific areas of the system are summarized below and presented in Appendix A.

> **Upper Concrete Channel:** Inundation of the upper left bank begins at the 2% AEP flood. Even during the 0.2% AEP flood, depths remain shallow (< 2 feet).
>
> **Natural Reach:** Inundation in the designated floodplain along the left bank begins with minor overflow near the tributary junction during the 50% AEP flood to quite extensive coverage during the 0.2% AEP flood. Typical depths in the floodplain remain shallow (< 2 feet), except at ineffective flow areas where high ground barriers can result in depths up to 10 feet. Inundation in the right bank consequence area remains very shallow (< 1 feet), even during the 0.2% AEP flood and typically follows the roads. Velocities in the floodplain vary greatly, with some speeds reaching up to an erosive 13 ft/s near Levee F for the 0.2% AEP flood.
>
> **Lower Reach and Outlet:** Residential structures near the outlet appear to become inundated just beyond the 1% AEP flood as floodwaters wrap around the end of the floodwall into the consequence area. Flood depths remain shallow (< 2 ft), even for the 0.2% AEP (500-year) flood.

Erosion and incision will continue to be a problem in the FWOPC. In the next fifty years, the channel could incise as much as 20 feet in some locations from its original invert elevations in 1981. While the NFS has patched undermined revetment with shotcrete in the past, such extreme levels of incision would require a more significant action. The most critical locations where failure of a Federally constructed feature is likely to occur are in the upper concrete channel or natural reach, including:

1. The transition between the Upper Concrete Channel and the Natural Reach near River Station (RS) 91+50.
2. The right bank segment between Waiehu Beach Road and Imi Kala Street Bridge in the Natural Reach, including Levees A, B, C, and D.
3. The concrete channel constriction within the natural reach known as "Revetment X," located between RS 59+00 and 49+00 in the Natural Reach.

Fish and Wildlife Resources: Appendix F contains a summary of fish and wildlife resources in the project area. Biological surveys of the project area were conducted in 2012 and 2016. A Phase I marine habitat characterization survey was also completed. None of the plant species recorded during the botanical surveys are listed as endangered or threatened or proposed for inclusion as a listed species by federal or state agencies. In addition, no state-protected aquatic species or federally listed threatened or endangered species were observed in the Iao Stream FCP during the aquatic biota surveys.

Under the FWOPC, there would be continued significant impacts to the downstream marine ecosystem caused by sediment runoff resulting from erosion of the stream bank upstream during storm events. Biological resources within the marine habitat within the vicinity of the stream mouth would continue to be impacted from sedimentation suspended in runoff waters.

Cultural Resources: Previous work included archaeological assessments, archaeological surface survey, archaeological inventory survey, archaeological subsurface testing, and archaeological monitoring. Based on past surveys, there are no historic properties listed on the National or State Register of Historic Places within the area of potential effect for the recommended plan. Under the FWOPC, no archaeological, historic, or cultural resources would be affected within the Iao Stream FCP.

Economics: Overall, there are a total of 690 structures within the designated floodplain, including 543 residential structures, 146 commercial structures, and one public structure. The total valuation of structure and contents is approximately $433.3 million. During a 2019 site visit, no new structures were identified. Most of the structures in the area are residential; however, commercial structures start to become more prevalent as the stream approaches the ocean.

Under the FWOPC, significant changes to the regional population structure or social characteristics within the study area are not expected. While population changes are not anticipated under the FWOPC, residents will continue to experience flood damages during the 1% AEP event. Though not extensive, damage to homes and commercial buildings can occur from inundation as shallow as 6 inches. Based on updated hydrology and hydraulics modeling, there are no water depths greater than 2 feet at any structures when first floor elevation is taken into account for the 1% AEP event under the FWOPC, resulting in minimal (but not zero) flood damages. During more frequent events, inundation is expected to be even shallower, resulting in fewer damages compared to the 1% AEP event.

2.2 Problems and Opportunities

The overall problem is that the Iao Stream FCP is not functioning as intended and a design deficiency of the Federal project exists. There have been numerous floods on the Wailuku River since the early 1900s, many of which have inflicted heavy damage in terms of loss of life and property destruction. The most significant floods occurred in January 1916, November 1930, January 1948, December 1950, November 1961, and January 1971. In September 2016, an upper-level low pressure system moving over the state of Hawaii brought heavy rains, which resulted in significant debris and flood flows on the river. The resulting flood wave and debris flows caused significant channel changes and property damage upstream of the Iao Stream

FCP. Debris filled and overtopped the project's debris basin. Damage to the levees from erosion and scour occurred because of high velocity flows and debris movement. The United States Geological Survey (USGS) computed a peak streamflow of 10,900 cfs at the lower stream gage, USGS 16607000, using indirect methods. This gage was significantly damaged during the event. This is the highest peak streamflow recorded since the gage was installed in 1951. The 2016 event is referenced throughout this report as the most recent event perpetuating the design deficiency issues throughout the project.

As described in Section 1.4, high velocity flows within the steeply sloped channel have severely eroded key portions of the Iao Stream FCP levees and channel invert. Continued erosion caused unforeseen and extensive long-term OMRR&R costs for the NFS as well as emergency response costs to rehabilitate after damage occurs during flood events. In addition, there are actionable safety issues in the watershed resulting from the project entering a state of failure/non-performance. Failure/non-performance could occur if continued erosion or head cutting causes a levee to breach and fail.

The following sections describe problems in specific areas of the FCP.

2.2.1 Upper Concrete Channel

As the stream attempts to achieve dynamic equilibrium and a shallower slope in the natural reach, a significant head cut has formed just downstream of the upper concrete channel (RS 91+50). The drop is currently 6 to 8 feet and the boulder-concrete invert already experienced failure as a result of progressive undermining (Figure 2-1). As the lined channel slope is already very shallow (< 0.1%), the failure of the invert at this site is primarily caused by scour of the foundation material. Channel incision of the natural reach increases exposure and erosion of the foundation material. The sudden change in channel bed elevation creates a natural drop structure, causing turbulent (erosive) waters. As the foundation material of the lined channel is eroded by the turbulent waters, a toppling failure of the boulder-concrete invert follows. If left unaddressed, the entire channelized reach would eventually be compromised, and the concrete retaining walls could fail. An estimated timeline of damages and extent of repairs is summarized in Appendix A.

Figure 2-1. Existing Head Cut at the Upper Concrete Channel (August 2019)

2.2.2 Natural Reach: Levees A, B, C, D, and E

The 1995 DDR describes erosion problems along the entire natural reach, including more significant problems at Levees B, C, D, and E. Levees D and C (Figure 2-2) routinely experience bank failure and are likely to experience bank failure again in the next 50 years. Continuous erosion of the levee toe from smaller events is partially responsible for putting these levees at risk of failure from larger events. During the September 2016 flood event, Levee C and D experienced approximately 80% bank failure. This event was estimated to have a 2.5% AEP frequency. It was then projected that complete bank failure and a levee breach would occur during the 2% AEP flood event.

Figure 2-2. Undermining of Levee Toe and Levee C (left – October 2016)); Erosion at Levee D (right – September 2016)

2.2.3 Natural Reach: Revetment X

Within the vicinity of Revetment X, between RS 55+50 to 48+50, the meandering natural channel was straightened and narrowed with boulder concrete lining after project construction was completed due to damages sustained in the area immediately following construction in 1981. As a result of this constriction and reduced flow area, the velocities in the channel increased and began to undermine the lining on both the left and right banks. The dramatic channel incision and continuous undermining within the vicinity of Revetment X (Figure 2-3) is a constant challenge. Failure of Revetment X in its current state is inevitable due to continuous erosion in this area. Removal of the left bank segment would provide the river with more flexibility to meander, as needed, to achieve dynamic equilibrium. The high velocity flows that are a result of the channel constriction are likely to incise the channel an additional 10 feet within the next 50 years, requiring costly repairs by the NFS.

Figure 2-3. Revetment X, September 2016, Post-Flood

A summary of problems and opportunities for the EDR amendment are described below:

Problems

- The Iao Stream FCP is not functioning as intended and a design deficiency of the Federal project exists.
- Extremely high channel velocities and debris flows produce areas of significant channel scour and erosion of the channel invert and banks, increasing risk to community safety during an event.
- NFS OMRR&R requirements and emergency repair costs continue to increase as channel damage repeatedly occurs, resulting in increased frequency of repairs to mitigate for erosional effects.

Opportunities

- Identify nature-based solutions if opportunities exist.
- Improve community safety and resiliency.

2.3 Planning Objectives

Over the 50-year period of analysis (beginning in 2023), the objectives of the study are to:

- Reduce the risk to community safety during an event in the Iao Stream FCP for the 50-year period of analysis.
- Reduce channel instability, head cutting, and risk of bank failure due to high velocity flows and erosion in the Iao Stream FCP for the 50-year period of analysis.
- Reduce the long-term OMRR&R costs to the NFS that are beyond the original scope of OMRR&R, but necessary to maintain a minimally acceptable standard in the PL 84-99 Rehabilitation Program.

2.4 Planning Constraints

The constraints identified for the EDR Amendment are as follows:

- To the extent possible, minimize significant disturbance or modification to the existing, natural stream alignment.
- To the extent possible, avoid implementation of measures that would disturb the culturally significant Wailuku River and its importance to the Native Hawaiian Community.

3 Safety Considerations

Per Planning Bulletin (PB) 2019-04, risks to human life are a fundamental concept of all facets of FRM and must receive explicit consideration throughout the planning process. Factors that influence life loss include, but are not limited to, the depth and velocity of flooding, infrastructure performance, socioeconomic characteristics of the population, warning systems, evacuation plans, emergency response, and other preparedness measures. For the purposes of this study, a qualitative assessment of life safety risk and other community safety considerations was conducted to inform formulation and evaluation of alternatives. The qualitative approach to evaluation of safety risks was coordinated by the Honolulu District with the Pacific Ocean Division and Headquarters, USACE (the Vertical Team) with agreement to justify the recommended plan based on both economic benefits and qualitative safety considerations as outlined in Engineer Regulation (ER) 1165-2-119. Documentation of this concurrence is recorded in memorandums for records and subsequent internal correspondence with the Vertical Team. As a result of comprehensive alternative analysis, the recommended plan presented in later chapters of this report is both economically justified and improves resilience to the community safety risks summarized in this chapter.

3.1 Summary of Hazards and Consequences

There are actionable safety issues in the study area resulting from the project entering a state of failure or non-performance. Failure or non-performance could occur if continued erosion or head cutting causes a levee to breach and fail. The most critical locations where failure of a Federally constructed feature is likely to occur include:

1. The transition between the upper concrete channel to the natural reach near RS 91+50.
2. The right bank segment between Waiehu Beach Road and Imi Kala Street Bridge in the natural reach, including Levees A, B, C, and D.
3. The concrete channel constriction within the natural reach known as “Revetment X,” located between RS 59+50 and 48+50.

Without risk management, failure of one or more of the critical locations identified above would result in the following safety conditions:

1. Failure of the invert at the upper concrete channel creates a natural drop structure, causing turbulent (erosive) waters. As the foundation material of the lined channel is eroded by the turbulent waters, a toppling failure of the boulder-concrete invert follows. If left unaddressed, the entire channelized reach would eventually be compromised, and the concrete retaining walls could fail.

2. There is an increased risk of erosion upstream and downstream of Revetment X. This feature causes increased stream velocity and vertical erosion in the channel, which threaten the integrity of existing levees nearby.

3. During the 2% AEP event, inundation along the more developed right bank within the natural reach can occur following levee failure. While the levees in this area were repaired following the September 2016 flood event and risk of one-time failure is reduced, it is important to understand how flood risk is inherently present in the study area and evaluate the safety-related consequences of possible project failure in this reach. Under simulated levee failure scenarios, flood depths along this right bank residential area are shallow (less than 1 foot during the 2% AEP event) but increase with larger events.

4. During a 2% AEP event or larger, residents of the left (west) bank that need to access emergency services and/or evacuation destinations on the right (east) bank would be required to do so through inundated streets, that would cause some people to move from a condition of "safe" (i.e., low risk to life safety) to a condition of "chance" (i.e., higher risk to life safety) from a life safety perspective. They would also be required to evacuate via crossing a project that is in an active state of failure/non-performance. Their only other option would be to evacuate via Highway 340 in the direction of Waihee-Waiehu, perhaps through other areas that may be experiencing flooding. Figure 3-12 depicts egress routes in the study area.
5. During these events, emergency services from the right bank seeking to render aid would similarly be required to do so via crossing the project that is in an active state of failure/non-performance and would also be subjected to the potential of moving from "safe" to "chance" condition.
6. Due to the flashy nature of these events, it is likely that people will be caught in their vehicles, an obvious safety concern that would likely move people from "safe" to "chance" condition.
7. Emergency services would likely be disrupted for approximately two hours based on simulated inundation in the consequence area.

3.2 Performance History

There have been no fatalities since the 1916 flood, before the project was constructed. There was one rescue of a boy and his father. The boy was bodyboarding in the channel during the initial flows of a large flood event in the vicinity of Waiehu Beach Road Bridge. He was found on a large shoal near the outlet.

During the September 2016 flood event, multiple levees along the right bank of the natural reach eroded significantly. One levee experienced 80% bank failure at the bend near Levee C, with residential properties immediately adjacent to the near-breach site.

3.3 Population at Risk

The 2020 Maui County Multi-Hazard Mitigation Plan indicates a greater than likely probability (greater than 90% annual chance) of a flood event within the Wailuku-Kahului Community planning area, which includes Iao Valley and the Iao Stream FCP area. The plan cites the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Storm Database, which used historical data from 1971 to March 2020 to capture 137 flood events in Maui County. This data indicates an average of three flood events annually between 1971 and March 2020.

The extremely flashy nature of typical floods in the system provides little opportunity for flood warning and evacuation. Typically, there is only one hour between peak rainfall and peak flow in the river based on gaged data from past events. Regional Emergency Alert Systems warn of imminent flash flooding in the area. However, there is no site-specific flood warning system for the Wailuku River floodplain and only two stream gages on the river. Residents are generally unaware of whether they should shelter in place or attempt to evacuate, which can result in a delayed evacuation at the most inopportune time (during a breach).

Residents living immediately adjacent to the levee are at a much higher life safety risk. Those residents who live behind critical areas that previously experienced bank failure should consider early evacuation in response to a flood warning siren/alert. Others, such as those residents on the east side of Eha Street, may benefit instead from sheltering in place.

In addition, flood risk is not consistently recognized by the local community. Residents often recreate in the project (Figure 3-1) and bodyboard over the project's shallower drop structures during above-average flow events. A flood alert would also discourage trespassers who tend to take advantage of the initial low flows during a storm event to bodyboard in the channel.

Figure 3-1. Individual Creating a Recreational Pool in Wailuku River (formerly known as Iao Stream)

In addition to the residents who are familiar with the area, there are visitors to the Iao Valley who are unfamiliar with the area and are more susceptible to risk during an active event. The 2016 event impacted the Kepaniwai Heritage Gardens County Park, located in the upper watershed of Iao Valley, including severe damage to the visitor center, the visitor center parking lot, and the access road. If the peak occurred earlier in the day, the risk to visitors would have been much higher. Iao Valley averages about 1,800 visitors daily. Often, it will be raining and sunny at the same time and visitors are not deterred by the weather. The limited egress routes would have residents and visitors attempting to evacuate through inundated areas, such as along Eha Street, or evacuating by crossing a project that is in an active state of failure and non-performance via Waiehu Beach Road (Highway 340) in the direction of Waihee-Waiehu.

During the September 2016 (2.5% AEP) flood that led to extensive bank failure and other prior events, residents reported hearing large boulders moving in the river behind their property, a sign that residents may not evacuate even during high flow events that cause significant amounts of large material to be mobilized in the system. The peak of the September 2016 event occurred in the evening, around 1900 hours, when most residents were in their homes, and even possibly sleeping. A peak event occurring at nighttime increases safety risks, as most flood-related deaths occur either at night or when people become trapped in automobiles that stall while driving in areas that are flooded. While there are likely less cars on the road at night, the life safety risk of residents being caught unaware in their home while sleeping is greater. In addition, it is harder to gauge water depth at night, further increasing risk for residents attempting to evacuate. Regardless of the timing of a flood event, the greatest risk to life for the Iao Stream FCP occurs in situations where residents are caught on foot or in vehicles trying to evacuate in the high velocity flows, even though depths would generally be shallow.

3.3.1 Population in Project Area

This section gives a brief description of the population residing in the area protected by the levee (leveed area) as well as the surrounding city of Wailuku. The purpose of this section is to describe the population that may be at risk from flooding in the protected area as well as identify characteristics that may increase individual vulnerability during a flood event. Population data for Maui County is provided for comparison purposes. There are two data sources for the population data in this section, the U.S. Census Bureau, and the U.S Environmental Protection Agency (EPA) Environmental Justice (EJ) screening tool, which uses U.S. Census Bureau American Community Survey (ACS) data as its source. The EPA EJ screening tool was used to isolate Census data for the leveed area.

3.3.1.1 Population

There are approximately 3,600 people living in the leveed area and 17,400 people living in the city of Wailuku. Both the leveed area and Wailuku experienced population growth in recent years (2010 to 2018), with annual growth rates of 1.3% and 1.4% respectively. By comparison, Maui County grew at a rate of 0.7% annually during the same time period.

Table 3-1. Population Estimate and Trends in Project Area (2010, 2018)

Geographical Area	2010 Population Estimate	2018 Population Estimate	Population Percent Change (2010-2019)
Leveed Area	3,242	3,642	1.3%
Wailuku, HI	15,313	17,354	1.4%
Maui County	154,834	165,281	0.7%

Source: U.S. Bureau of the Census, 2010 Census (2010 Estimate for Wailuku and Maui); U.S. Bureau of the Census, American Community Survey (2018 Estimate for Wailuku and Maui); 2010 Census and 2018 American Community Survey accessed via EPA EJ Screen (Leveed Area)

3.3.1.2 Housing Units

There are approximately 1,343 households in the leveed area, which accounts for multi-family residences. Of those, approximately 55% are owner-occupied and 45% are renter-occupied. These households make up approximately 2% of the households within Maui County.

Table 3-2. Number of Households in Project Area (2018)

Area	Households	Owner Occupied	Renter Occupied
Leveed Area	1,343	741	602
Wailuku, HI	4,670	2,690	1,980
Maui County	54,274	32,685	21,589

Source: 2018 American Community Survey accessed via EPA EJ Screen

3.3.1.3 Age

Table 3-3 displays the distribution of population under the ages of five and over the age of 65 in the geographies of interest. During a potential evacuation situation, senior citizens and parents of young children can face unique challenges. In the leveed area, 8% of the population is below the age of five and 15% of the population is 65 or older, which is similar to the city and county. According to the EPA EJ screening tool, the leveed area is in the 73rd percentile when compared to the state and the 72nd percentile compared to the U.S. in terms of young children (ages 0-4). The leveed area is in the 39th percentile in the state and the 55th percentile in the U.S. in terms of individuals ages 65 and older. Though the population distribution in these key age groups is not notably different when compared to the county and even the nation, there is still a significant portion of the population in the leveed area that may face difficulties if immediate evacuation is required.

Table 3-3. Age Distribution in Project Area (2018)

	0-4 Years		65+ Years	
Area	Number of Persons	Percent of Population	Number of Persons	Percent of Population
Leveed Area	290	8%	540	15%
Wailuku, HI	915	7%	2,084	16%
Maui County	10,068	6%	27,860	17%

Source: 2018 American Community Survey accessed via EPA EJ Screen

3.3.1.4 Ethnicity

The 2020 Maui County Hazard Mitigation Plan references a 2012 survey by the Hawaii State Department of Health, Office of Health Status Monitoring identifying the diversity and ethnicity within Maui County. Survey results of Maui County population identified approximately: 27% identifies as Hawaiian, or part Hawaiian; 25% identifies as Caucasian; 23% identifies as mixed race, except Hawaiian; 23% identifies as Japanese, Chinese, Korean or Filipino, with Filipino being the largest demographic in this population segment; and less than 2% identifies as other. Accordingly, approximately 75% of the Maui County population is represented by Minority populations, as defined by EPA. Per the EPA EJ screening tool, 85% of the Wailuku Community residing within a 1-mile radius of the project area is represented by Minority or People of Color Populations.

3.3.1.5 Language

8% of the population in the leveed area speak English “less than very well,” compared to 9% in Wailuku and 10% in Maui. In terms of households, 5% are linguistically isolated in the leveed area and 4% in Wailuku, compared to 3% in the Maui County. The protected area is in the 66th percentile in the state and the 73rd percentile in the U.S. in terms of linguistically isolated population. Based on these estimates, the linguistically isolated population in the leveed area is significant. These families and individuals may have difficulty interpreting direction during a flood event causing them to react in an unsafe manner (e.g., evacuating when it is not safe to do so).

Table 3-4. Linguistic Isolation in Project Area (2018)

Area	Population 5+ that speak English "less than very well"		Linguistically Isolated Households	
	Number of Persons	*Percent of Population*	*Number of Households*	*Percent of Households*
Leveed Area	282	8%	70	5%
Wailuku, HI	1,082	9%	179	4%
Maui County	16,060	10%	1,838	3%

Source: 2018 American Community Survey accessed via EPA EJ Screen

3.3.1.6 Employment and Daytime Population Assumptions

Daytime population at risk within the leveed area can be estimated given the unemployment rates. Approximately 73% of the population (age 16 and older) in the leveed area and 70% of the population in Wailuku are in the labor force, compared to 67% in Maui, 62% in Hawaii, and 63% in the U.S. According to the ACS, the unemployment rate was 8% in the leveed area and 6% in Wailuku in 2018. Given that approximately 30% of the population ages 16 and older are either unemployed or not in the labor force and considering that 8% of the population is not yet school aged (i.e., less than 5 years old), it can be roughly estimated that 38% of the population in the leveed area is home during the day.

Table 3-5. Labor Force and Employment in the Project Area (2018)

Area	Population Ages 16+	In Labor Force	Unemployed	Not in Labor Force	Unemployment Rate
Leveed Area	2,931	2,132	161	799	8%
Wailuku, HI	10,121	7,050	395	3,071	6%
Maui County	132,234	88,279	3,901	43,955	4%
Hawaii	1,147,445	709,482	32,036	397,918	5%
United States	257,754,872	162,248,196	9,508,312	94,478,543	6%

Source: 2018 American Community Survey accessed via EPA EJ Screen (Note: Census unemployment rates differ from Bureau of Labor Statistics; U.S. and Hawaii Census unemployment rates are provided for comparison purposes)

3.3.1.7 Low Income and Poverty Rate

According to the 2020 Maui County Hazard Mitigation Plan, an estimated 10 percent of individuals and 6.6 percent of families within the planning area are living below the poverty line. Nearly 12 percent of those living in poverty are under 18 years of age. Poverty thresholds in Hawaii are about 15 percent higher than those for other U.S. states, therefore the prevalence of poverty in Hawaii may be understated. According to the EPA EJ screening tool, 27% of the Wailuku Community residing within a 1-mile radius of the project area population are characterized as, low income.

3.3.1.8 Commercial Structures

There are approximately 150 commercial structures within the protected area. Of those, the majority (approximately 55%) are warehouses, while 16% are office buildings, 14% are retail, 6% are restaurants, and the rest are other types of commercial buildings. There is not critical infrastructure or institutions within the protected area.

3.4 Hazard

This section describes the hazards that contribute to community safety concerns within the study area.

3.4.1 Upstream Reach

The authorized project includes a concrete lined channel in the upstream reach of the Wailuku River. However, the downstream end of the concrete channel does not include a buried toe or other erosion control features in this critical area of transition from a lined to unlined channel. As described in Section 2.2.1, a significant head cut has formed just downstream of the upper concrete channel (River Station 91+50). The drop is currently 6 to 8 feet and the boulder-concrete invert has already experienced failure due to progressive undermining.

Without correction to address this design deficiency, scouring and erosion will continue increasing the risk of upstream head cutting or under cutting of the concrete lined channel. The undermining and impacts of that could lead to single event failure and increased risk to the community downstream on both the left and right banks of the Wailuku River.

3.4.2 Natural Reach: Levees A, B, C, D, and E

The Corps' HEC Life Loss Estimation (LifeSim) 2.0 software allows users to evaluate the life loss and economic damages resulting from a single flood scenario. It explicitly models the warning and mobilization of people potentially exposed to the hazard and predicts the spatial distribution of fatalities within buildings or on road networks expected to be impacted by the hazard. While LifeSim 2.0 was not used to formally model or evaluate life loss associated with the Iao Stream FCP, multiple model concepts and parameters were used to qualitatively evaluate the safety risks associated with potential failure of various features of the FCP.

Two stability criteria from LifeSim 2.0 were used to evaluate safety risks within the Natural Reach. Stability criteria are the depth and velocity thresholds for structures or vehicles used to evaluate the threshold for building collapse or vehicles being swept away during a flood event. The vehicle and pedestrian stability criteria used in LifeSim 2.0 can be used to evaluate the risk of vehicles and pedestrians being swept away by floodwaters. These criteria were compiled using data from multiple sources (research findings). Low clearance vehicles (i.e., personal vehicles) are "most likely" to be at risk when depths exceed 3.94 ft, velocities exceed 14.76 ft/second, and the functional threshold (depth x velocity) exceeds 2.62 square ft per second (ft^2/s) (Figure 3-2).

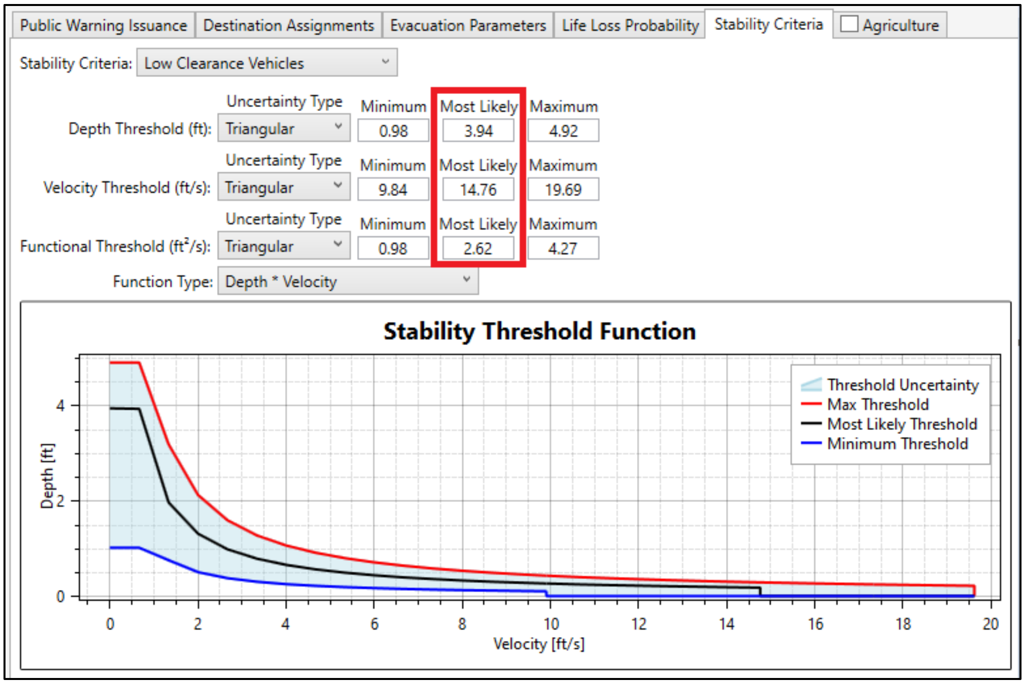

Figure 3-2. Stability Threshold Criteria for Low-Clearance Vehicles

High clearance vehicles (i.e., emergency vehicles) are "most likely" to be at risk when depths exceed 4.92 ft, velocities exceed 19.68 ft/s, and the functional threshold exceeds 3.94 ft^2/s (Figure 3-3).

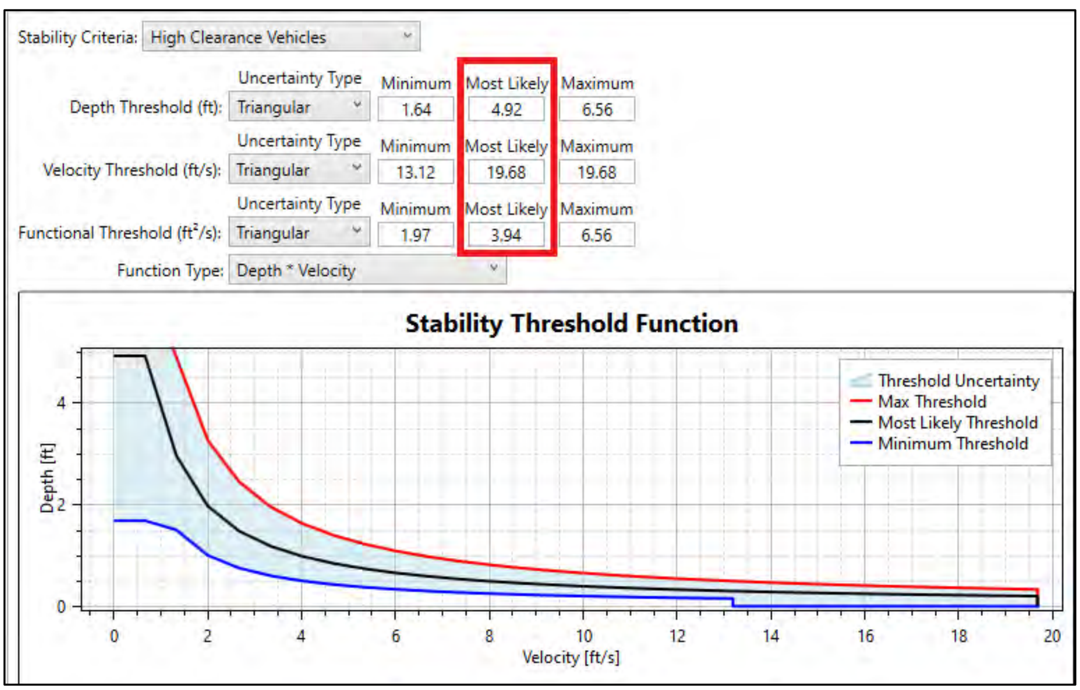

Figure 3-3. Stability Threshold Criteria for High-Clearance Vehicles

Pedestrians are "most likely" to be at risk when depths exceed 4 ft, velocities exceed 9.8 ft/s, and the functional threshold exceeds 6.46 ft^2/s (Figure 3-4).

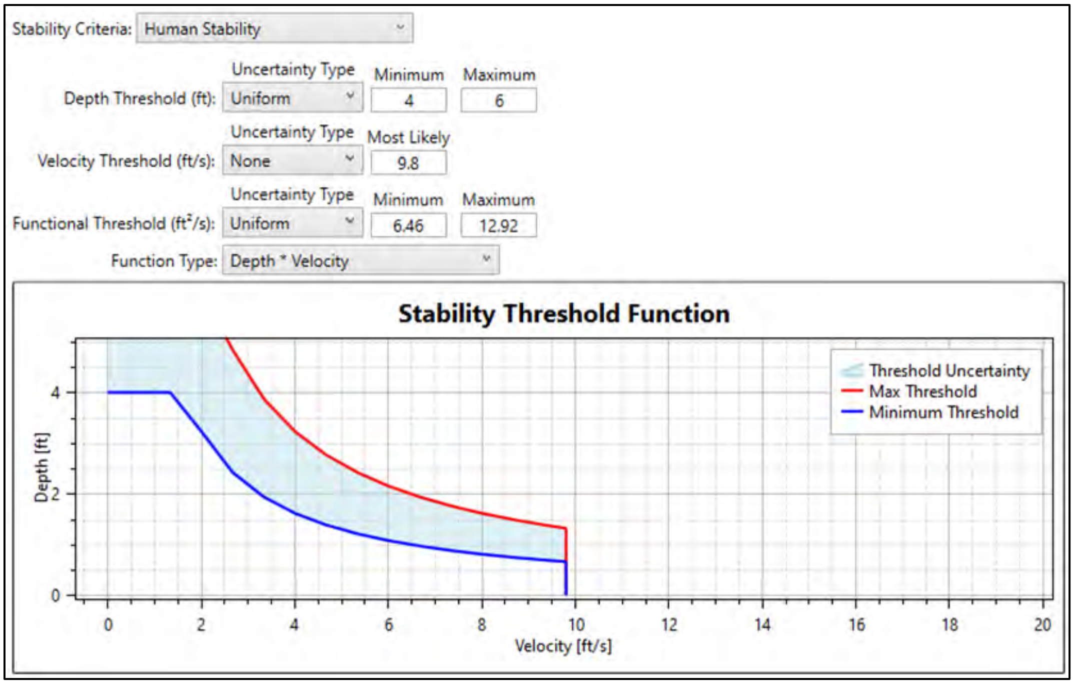

Figure 3-4. Stability Threshold Criteria for Pedestrians

3.4.3 Natural Reach: Revetment X

Revetment X within the natural reach of the Wailuku River was constructed to straighten this reach of the Wailuku River in an effort to reduce risk to the left and right banks. The left bank of this reach is identified as floodplain and remains undeveloped, the right bank in this reach is developed with residential community structures. By straightening the reach and constructing the revetment on both the left and right banks, flows and velocities were increased by removing the natural meandering of the river. As a result, an increased erosion issue along the revetment and a channel incising hazard has developed over time, having the opposite impact from its original purpose, and increasing risks to the community.

3.5 Consequence

This section summarizes the consequences of the hazards described above.

3.5.1 Upstream Reach

Without correction to address this design deficiency at the transition between the upstream lined channel and natural reach, scouring and erosion will continue increasing the risk of upstream head cutting or undercutting of the concrete lined channel. Failure to address the head cutting issue could lead to single event failure, resulting in extensive damage to the invert and threaten stability of nearby retaining walls. Failure of these >16 ft retaining walls would be catastrophic as adjacent homes would likely fall directly into the river. Ultimately, the consequences of this hazard would cause substantial risks to the community located immediately upstream and downstream of the scour-hole on both banks of the Wailuku River.

3.5.2 Natural Reach: Levees A, B, C, D, E

This section describes the consequences associated with right bank levee failure along the natural reach. A high-density residential area is located right behind Levees C and D (Figure

3-5). While the levees in this area were repaired following the September 2016 flood event and risk of one-time failure is reduced, it is important to understand flood risk that is inherently present in the study area. To support this analysis, the study team conducted a qualitative evaluation of the safety-related consequences of possible project failure.

As simulated, a breach at Levees C and D would lead to significant inundation of the right bank consequence area. The extent of inundation is shown in Figure 3-7. While some properties are inundated by shallow flooding (< 2 ft), most of the inundation was limited to the streets and open areas and continues as sheet flow until it reaches the ocean.

Figure 3-5. High-Density Residential Area Located Near Levees C and D

It would generally be expected that as water enters the leveed area, the velocities would be high (10 to 40 ft/s), but as it spreads out, it would slow down, rapidly causing shallow flooding (< 2 ft) to streets and low lying areas as it flows toward the ocean (Figure 3-6 and Figure 3-7). During the triggering event for a breach (2% AEP), typical and maximum depths in the right bank consequence area are about 1 and 2 ft; and typical and maximum velocities are 2 and 9 ft/s (Figure 3-8 and Figure 3-9). While these depths and velocities are not enough by themselves to stall vehicles and pedestrians, their combined effects (depth x velocity) exceeds the thresholds. During the 2% AEP event and larger, low-clearance vehicles, high-clearance vehicles, and pedestrians would likely become stalled or swept away. Functional threshold maps are provided as Figure 3-10 and Figure 3-11.

Figure 3-6. "Existing Condition" Depth Grid for 2% (1/50) AEP Flood

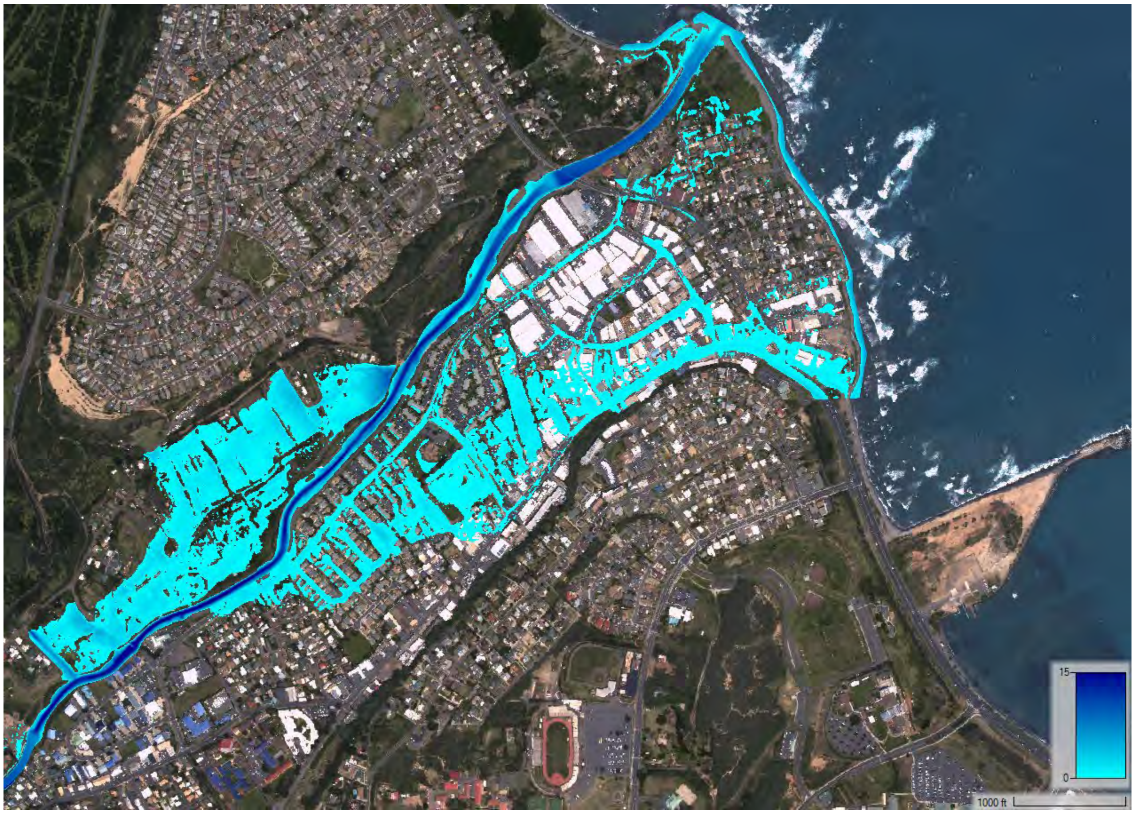

Figure 3-7. "Future Without Project Condition" (Breach Scenario) Depth Grid for 2% (1/50) AEP Flood

Functional threshold of low-clearance vehicles: 2.6 ft^2/s; high-clearance vehicles: 3.9 ft^2/s, and pedestrians: 6.5 to 12.9 ft^2/s.

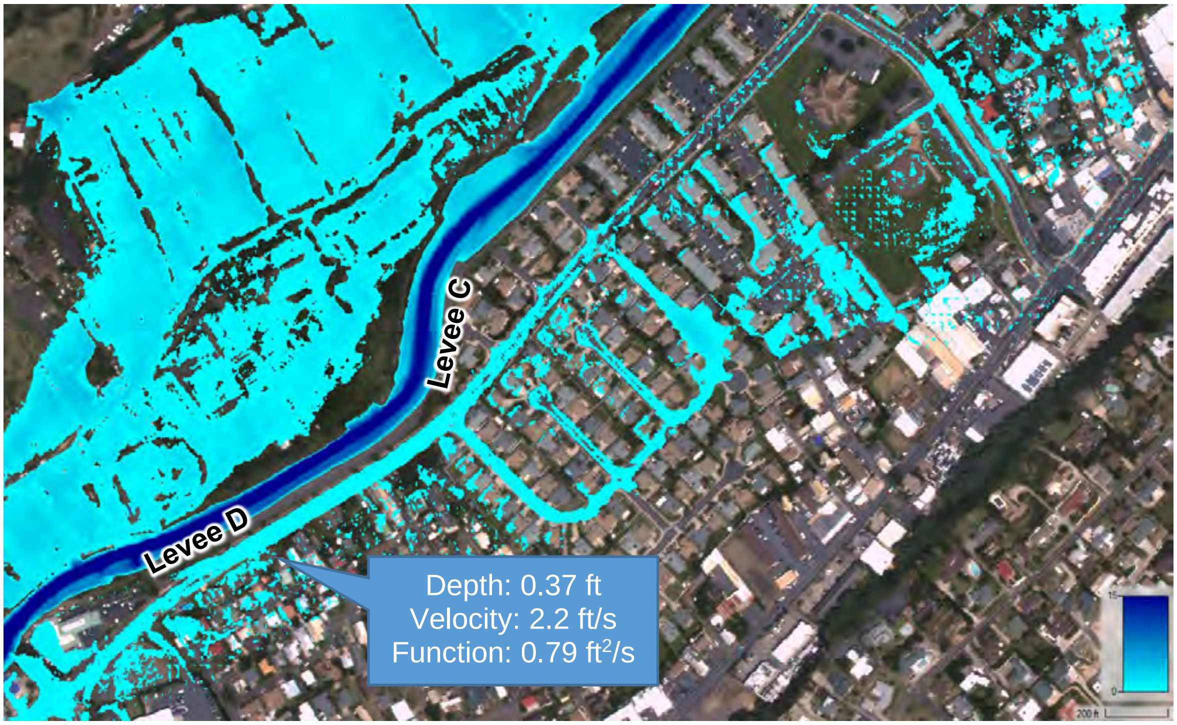

Figure 3-8. "Existing Condition" Depth Grid for 2% (1/50) AEP Flood near Levee C

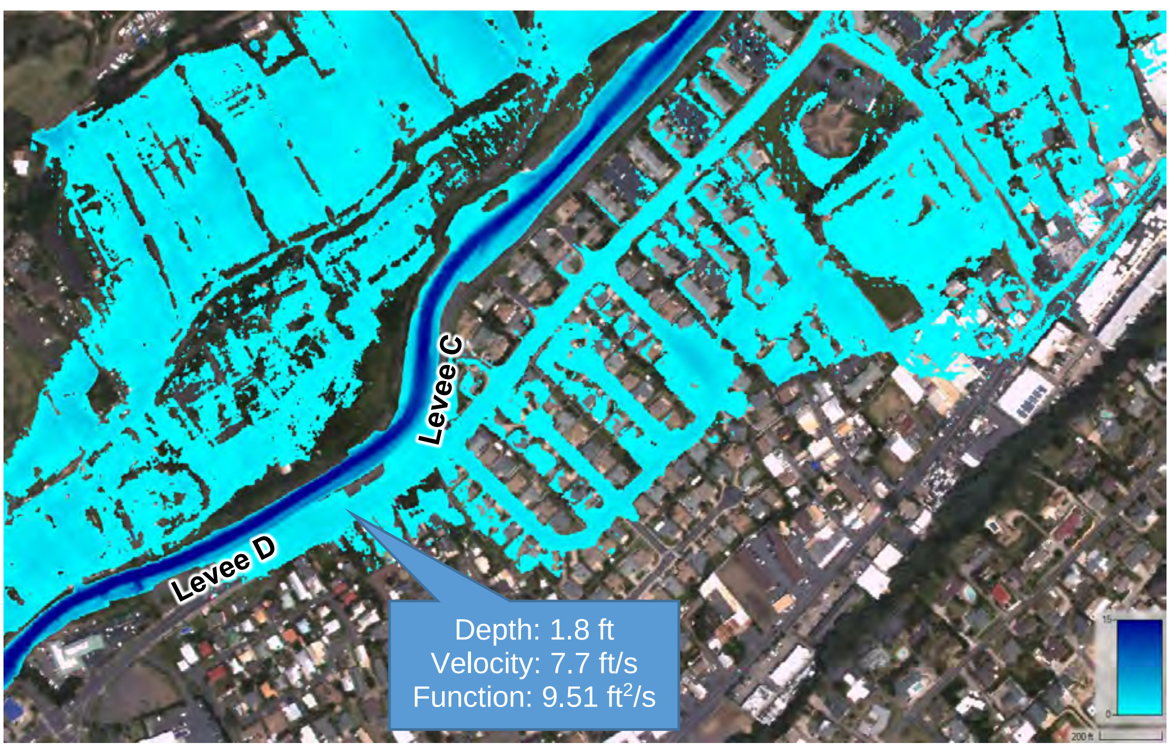

Figure 3-9. "Future Without Project Condition" (Breach Scenario) Depth Grid for 2% (1/50) AEP Flood near Levee C

Functional threshold of low-clearance vehicles: 2.6 ft²/s; high-clearance vehicles: 3.9 ft²/s, and pedestrians: 6.5 to 12.9 ft²/s.

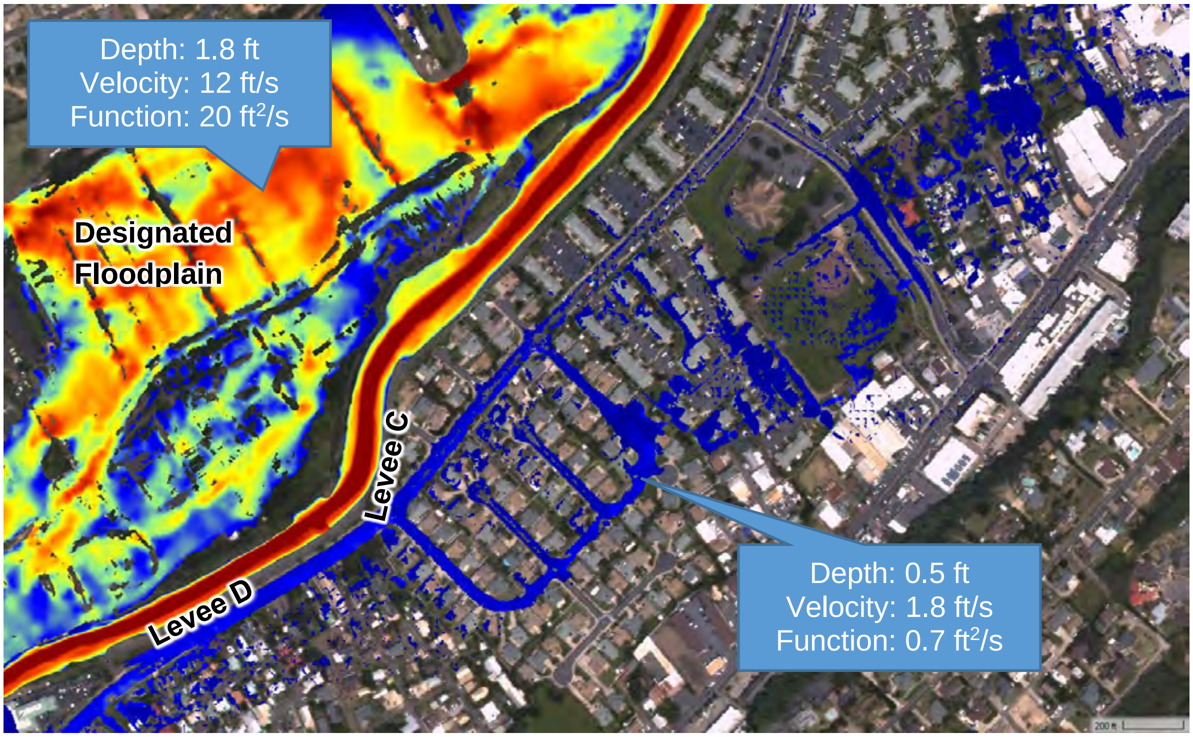

Figure 3-10. "Existing Condition" Velocity Grid for 2% (1/50) AEP Flood near Levee C

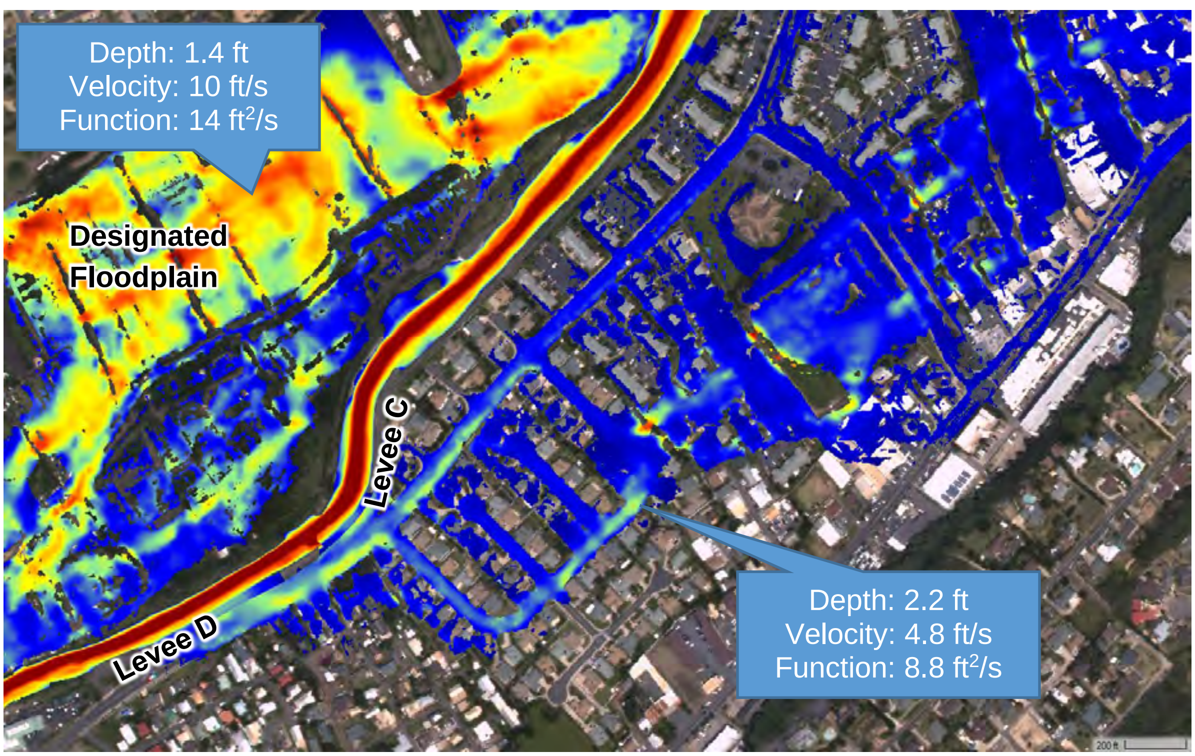

Figure 3-11. "Future Without Project Condition" (Breach Scenario) Velocity Grid for 2% (1/50) AEP Flood near Levee C

In addition to egress routes, Figure 3-12 identifies areas where low-clearance vehicles, high-clearance vehicles, and pedestrians would likely become overwhelmed by the flows in the floodplain based on the combined effects of depth and velocity (functional threshold). There are four primary egress routes out of the floodplain, identified as Routes A, B, C, and D. Limited egress routes would have residents attempting to evacuate through inundated areas that exceed the threshold for pedestrian and vehicle stability, such as along Eha Street (Route C) or Lower Main Street toward Kahului Beach Road (Route B). Some would also be required to evacuate by crossing a project that is in an active state of failure and non-performance via Waiehu Beach Road (Route A) in the direction of Waiehee-Waiehu. The greatest risk to life safety would be residents caught on foot or in vehicles trying to evacuate in the high velocity flows, even though depths would generally be shallow. Emergency responders would also be subjected to flows exceeding the stability threshold for their vehicles to traverse safely through the floodplain.

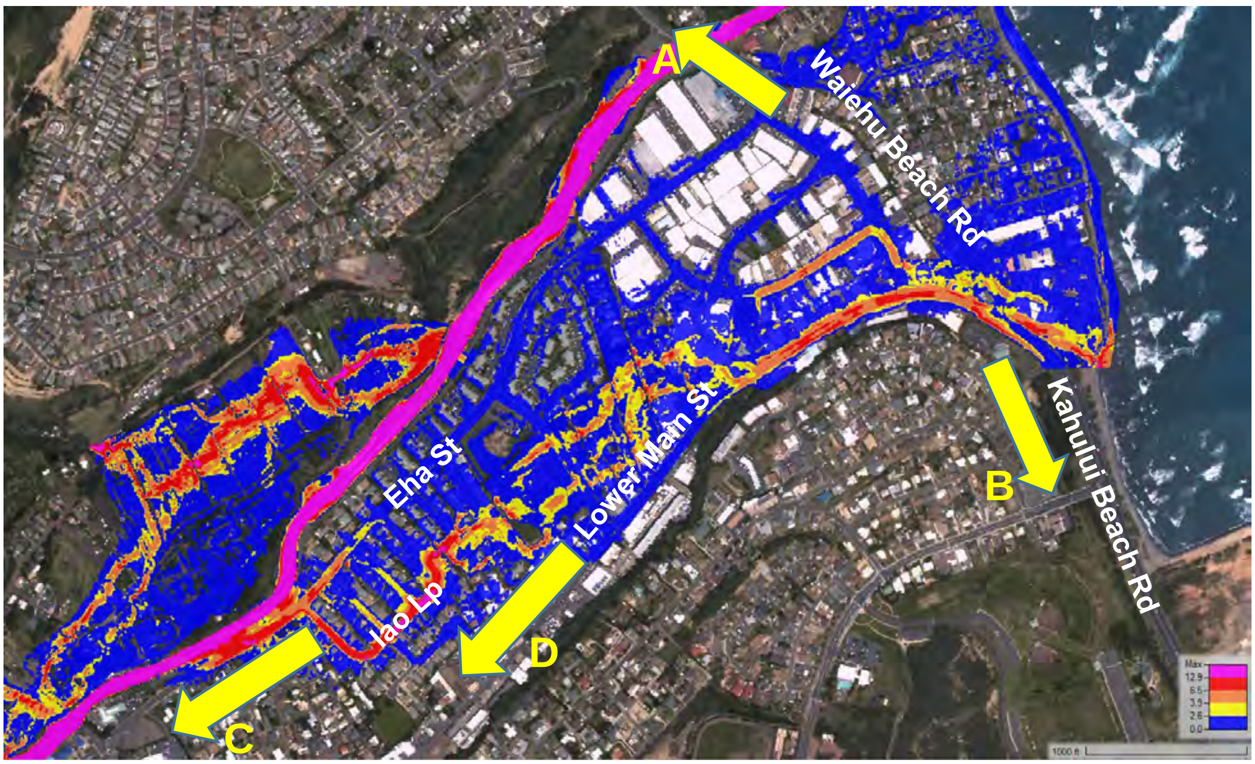

Figure 3-12. Functional Threshold Map for the 1% AEP (100-year) Flood, Future Without Project (Breach) Conditions and Egress Routes

Blue = below all thresholds (< 2.6 ft²/s); Yellow = above low-clearance vehicle threshold (2.6 – 3.8 ft²/s); Orange = above high-clearance vehicle threshold (3.9 – 6.4 ft²/s); Red = above the minimum pedestrian threshold (6.5 – 12.8 ft²/s); Pink = above the maximum pedestrian threshold (> 12.9 ft²/s)

Although flood water is largely constrained to roadways under these failure scenarios, there are still safety risks associated with road use during flood events in the study area. Various types of vehicles move through the area and would be disrupted for approximately two hours based on simulated inundation in the consequence area. According to local traffic count data from the Hawaii Department of Transportation from 2013 to 2016, key roadways in the study area experience relatively high magnitudes of traffic on potentially affected streets, leading to increased community safety concerns during flood events. Volume on Kahului Beach Road, a key transportation corridor in the study area as indicated by “B” on Figure 3-10, was estimated at approximately 40,000 vehicles in a 24-hour period and 1,500 to 1,700 vehicles per 2-hour morning and evening peak commuting periods. In addition, Lower Main Street and Eha Street are the primary routes for leaving the area during storm events, with traffic potentially diverting from Lower Main Street to Eha Street if Lower Main Street floods first. Lower Main Street and Eha Street traffic counts were approximately 14,000 and 3,300 vehicles, respectively, in a 24-hour period. Ultimately, although flood events primarily impact streets rather than structures, community safety risk on roadways is still prevalent within the study area.

3.5.3 Natural Reach: Revetment X

The dramatic channel incision and continuous undermining within the vicinity of Revetment X are a constant challenge. Failure of Revetment X in its current state is inevitable, which could cause flooding impacts to the right bank, similar to those described for Levee C or D failures summarized above.

4 Alternative Plans

An array of alternatives was formulated to specifically focus on addressing the design deficiency at critical locations of the Iao Stream FCP. Alternatives were designed to reduce velocity, shear stress, and erosion in the channel to meet the planning objectives of reducing the risk to community safety, channel instability, and the long-term OMRR&R costs for the NFS.

Per Engineer Regulation (ER) 1165-2-119, design deficiency improvements are required to make the project function as initially intended. Proposed corrective actions must meet several conditions as described in ER 1165-2-119 and presented in Section 4.7. As such, alternatives were not formulated to provide new or supplemental FRM benefits (e.g., reduction in inundation, damages, etc.). Multiple iterations of the planning process resulted in formulation, evaluation, and screening of various arrays of alternatives. Alternatives were evaluated based on economic considerations including a reduction in future OMRR&R expenditures, as well as a qualitative evaluation of community safety considerations. The approach to evaluation and justification of alternatives was coordinated with the Corps' Vertical Team, with agreement to justify the recommended plan based on both economic benefits and qualitative safety considerations as outlined in ER 1165-2-119. As a result of comprehensive alternative analysis, the recommended plan presented in this report is both economically justified and reduces community safety risks in the study area.

4.1 Management Measures and Screening

A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. A preliminary list of structural and non-structural management measures is included below.

Non-Structural Measures

- **Flood Warning Systems:** Alert the community or key officials of imminent hazardous flooding conditions; install stream gages.
- **Property Buyouts:** Acquire lands and structures either by purchase or through the powers of eminent domain.
- **Flood Proofing:** Seal structures from water damage by waterproofing walls and floors and installing floodgates at entry points.
- **Elevating Structures:** Lift the building from its foundation and raise it above the flood level.

Structural Measures

- **Detention Basins (surface and sub-surface):** Create surface and/or subsurface temporary storage facilities to collect flood flows during larger storm events; operate to manage storm flow.
- **Dams / reservoirs:** Create larger storage facilities than detention basins to collect and store flood flows during larger storm events; operate to manage storm flow.
- **Diversion / Bypass Structures:** Create diversion structures (weirs, etc.) to divert high flows to less densely populated areas.
- **Pump System:** Install pump system to pump peak flows out of streams.
- **Widen / Deepen / Channelize Stream Channel:** Widen or deepen stream channels to increase flow capacities.

- **Levees and Floodwalls:** Construct levees and floodwalls to reduce flood risk.
- **Grade Control Structure:** Install concrete or boulder-filled trenches at changes in slope to manage bed erosion.
- **Roller Compacted Concrete Lining:** Replace channel lining with roller compacted concrete to reduce erosion.
- **Ring Walls or Berms:** Construct small ring wall or berm around the exterior of a single structure or small group of structures.

4.1.1 Screening of Measures

Screening is the ongoing process of eliminating, based on planning criteria, those measures that will not be carried forward for consideration. Criteria are derived for the specific planning study, based on the planning objectives, constraints, and the opportunities and problems of the study/project area. The primary criteria used to evaluate measures is consideration of whether the measure meets the planning objectives and avoids constraints. A measure may “partially” meet planning objectives by meeting one or two objectives (Section 2.3) but not all three. The table below displays the measures screening outcomes.

Table 4-1. Measures and Objectives

Measure	Meets Planning Objectives	Avoids Planning Constraints
Flood Warning Systems	Partially	Yes
Property Buyouts	Partially	Yes
Flood Proofing	Partially	Yes
Elevating Structures	Partially	Yes
Detention Basins	Yes	Yes
Dams / Reservoirs	Yes	No
Diversion / Bypass Structures	Yes	Yes
Pump System	No	Yes
Widen / Deepen / Channelize	Yes	Yes
Levees and Floodwalls	Yes	Yes
Grade Control Structure	Yes	Yes
Roller Compacted Concrete Lining	Yes	Yes
Ring Walls or Berms	Partially	Yes

At this stage of the planning process, the pump system and dam/reservoir measures were screened out from further consideration. While a pump system may provide localized benefits, it does not resolve the significant scour and erosion problems of the existing project and would not improve community safety. A dam/reservoir does not avoid constraints related to the cultural significance and integrity of the Wailuku River system. As such, neither of these measures meets the purpose or need of the project.

Non-structural measures may not provide a holistic design deficiency solution (i.e., they do not meet all objectives) but were carried forward for evaluation as they would provide community safety benefits. Non-structural measures may be combined with structural measures or may be evaluated as a standalone alternative.

4.2 Initial Array of Alternatives

Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. An initial array of alternative plans was formulated through combinations of screened management measures. A description of the initial array is included below and presented in Table 4-2.

Table 4-2. Design Deficiency Alternatives

Alternatives	
	No Action
1	Install Fully-Lined Channel
2	Remove Revetment X (Left Bank)
3	Install Revetment Near Levee E
4	Remove Imi Kala Street Bridge
5	Create Sacrificial Berm
6	Install Pre-Formed Scour Hole
7	Modify Detention Basin
8	Drop Structures
9	Overflow Basin with Floodplain Reconnection
10	Deauthorize Project
11	Non-Structural Plan
12	Combination Plan

Alternative 1: Install Fully Lined Channel

A portion of the Iao Stream FCP is already lined. This alternative would create a fully lined trapezoidal channel for the remainder of the system (approximately 7,200 linear feet). A fully lined channel would significantly reduce the risk of erosion to the banks and levee toes.

Alternative 2: Remove Revetment X

Revetment X is located on both banks of the stream between Stations 59+50 to 48+50. In this area, the meandering natural channel was straightened and narrowed with boulder concrete lining. As a result, the channel was constricted and velocities increased, causing additional erosion in the area. There is an increased risk of erosion upstream and downstream if the revetment is left in place. A portion of Revetment X eroded by the September 2016 event was removed along the left bank (RS 55+50 to 48+50) as it was a safety concern. Removal of all of Revetment X along the left bank would essentially widen the channel, allowing flows to dissipate across a wider area and reduce velocity.

Alternative 3: Install Revetment Near Levee E

The area upstream of Levee E (right bank) is a high-risk area experiencing ongoing erosion. Constructing a new revetment upstream of Levee E would reduce erosion to properties along the adjacent bank.

Alternative 4: Remove Imi Kala Street Bridge

Imi Kala Street Bridge, with its two pier structures, acts as a structural bottle neck where the channel can be “clogged” with sediment, boulders, vegetation, and debris during larger flow events. Removing the bridge would allow the channel to be widened, removing an artificial constriction, and allowing for velocities to be reduced.

Alternative 5: Create Sacrificial Berm

This alternative includes placement of material on the right bank levee toe as a sacrificial berm that would provide a barrier between stream flows and the levee toe. The berm would begin upstream of the Imi Kala Street Bridge; the feature would be approximately 200 linear ft above Levee E and 1,400 linear ft along Levee D and C. The sacrificial berm would direct flows away from the right bank levee toe, reducing the risk of erosion of the levee toe in this area.

Alternative 6: Install Pre-Formed Scour Hole

At the downstream end of the upper concrete-lined channel (downstream from Market Street Bridge and the large drop structure), continuous erosion of the natural reach has created an unintended drop structure and scour hole. This alternative includes creating a pre-formed (designed) scour hole with limited placement of concrete revetment to reduce the risk of the existing concrete channel invert from being undermined by future erosion. This alternative also includes a single drop structure to help in reducing downstream erosion.

Alternative 7: Modify Detention Basin

Modify the detention basin to separate fine sediments from large boulders with the placement of an additional debris wall upstream. Large boulders will then be manually transported downstream to the sediment-starved system by the NFS as part of routine maintenance. A sediment budget should be created for the entire system to determine the appropriate amount of material to relocate. Fine-grained sediment material accumulated in the debris basin will be excavated and placed offsite, as needed, to maintain capacity. This alternative would also slow the rate of downstream incision.

Alternative 8: Drop Structures

Through occasional drops in the bed elevation, the system can maintain a relatively shallow slope throughout other parts of the reach. A shallower slope would reduce velocities and erosion along the channel. The approximate drop height required along the natural reach to maintain a stable slope is approximately 125 ft. This total height can be divided over several drop structures (e.g., 10 drop structures approximately 12.5 ft in height, etc.) This measure may be limited by “fixed points” in the system, such as bridge foundations, and would likely require some type of armoring in the channel for the drop structure to maintain its shape without additional head cutting.

Alternative 9: Overflow Basin with Floodplain Reconnection

This alternative would reconnect the channel with the floodplain by constructing a diversion weir perpendicular to and upstream of Levee E, allowing flows to move into an overflow area near the confluence of the Wailuku River and the tributary along Levee G. The overflow area would slow down flows, detain some of the water and move excess flow into the existing floodplain. Excess flows would return to the main channel at an outlet structure at the downstream end of the floodplain. This alternative would reduce the risk of incision, bank erosion, and levees overtopping along the main channel.

Alternative 10: Deauthorize Project

This alternative would include deauthorization of the flood control project. Congress would deauthorize the project in written Legislation and the Federal Government would no longer have jurisdictional, fiscal, or rehabilitation obligations associated with the Iao Stream FCP. The NFS would own and operate the Iao Stream FCP at its own discretion.

Alternative 11: Non-Structural Alternative

This alternative would include installation of stream gages or radar water level sensors on the river plus implementation of a flood warning system to assist with flood warning and evacuation planning. To establish a public warning system, the Corps will coordinate directly with the County of Maui Emergency Management Agency to establish a central base station or field station with necessary communications equipment (siren / beacon lights) and software at the County Emergency Management Offices. When rainfall or rising water levels reach set thresholds, the automated station will notify emergency personnel. Sirens can be automatically or remotely activated. In addition to the audible sirens, most public warning systems also often include visual flashing beacon lights to warn the community of the immediate hazard.

A threshold would need to be established based on discussions with emergency personnel and understanding of the specific equipment being installed and based on historical and simulated storms. A flood warning system could provide 1 to 2 hours of warning time. This type of flood warning would be most effective at warning pedestrians on foot in the immediate area to evacuate or seek shelter. This includes visitors at the State and County parks upstream, trespassers bodyboarding in the lined concrete channel downstream and homeless people who set up encampments downstream near the outlet or within the floodplain. In addition to pedestrians on foot, residents living near the river and levee system would become aware of their increased risk and could respond appropriately. There is a steep "rise to peak" in the hydrograph, but there could be earlier indicators that provide additional warning time (i.e., basing the threshold on rainfall intensity rather than the stream stage).

Alternative 12: Combination Plan

This alternative includes a combination of Alternatives 2, 6 and 11, as listed above.

4.3 Evaluation of Initial Array of Alternatives

The initial array of alternatives was qualitatively evaluated based on the following screening criteria: meets objectives, avoids constraints, rough order of magnitude costs, environmental impacts, technical viability, and sponsor support. The results of the screening are summarized in Table 4-3 below. Alternatives highlighted in green were carried forward into the final array as further described below.

Table 4-3. Evaluation of Initial Array

Alternative	Screening Results
Alternative 1 Install Fully Lined Channel	**Screened Out** *Cost prohibitive & not recommended in prior reports* *Does not avoid constraints* *Significant adverse environmental effects*
Alternative 2 Remove Revetment X	**Carried Forward**
Alternative 3 Install Revetment Near Levee E	**Screened Out** *Sponsor to implement locally* *Does not meet objectives (increases future O&M)*
Alternative 4 Remove Imi Kala Street Bridge	**Screened Out** *Not technically feasible*
Alternative 5 Create Sacrificial Berm	**Screened Out** *Does not meet objectives (increases future O&M)* *Not supported by sponsor*
Alternative 6 Install Pre-Formed Scour Hole	**Carried Forward**
Alternative 7 Modify Detention Basin	**Screened Out** *Cost prohibitive* *Does not meet objectives (increases future O&M)* *Adverse cultural resource impacts*
Alternative 8 Drop Structures	**Screened Out** *Cost prohibitive* *Does not meet objectives (increases future O&M)* *Not supported by sponsor* *Does not avoid constraints* *Significant adverse environmental effects*

Alternative	Screening Results
Alternative 9 Overflow Basin with Floodplain Reconnection	**Carried Forward**
Alternative 10 Deauthorize Project	**Screened Out** *Does not meet objectives*
Alternative 11 Non-Structural Alternative	**Carried Forward**
Alternative 12 Combination Plan	**Carried Forward**

Alternative 1, Install Fully Lined Channel, was screened out due to high costs and significant environmental concerns. The estimated cost for this alternative is approximately five times higher than other alternatives (i.e., conceptual construction cost is estimated to be approximately 5 million) and would have significant environmental impacts associated with fully lining the natural channel bed with concrete. This alternative was evaluated in prior study efforts and was screened out for similar reasons. While it would reduce erosion concerns and effectively convey flows, it is not likely to be economically justified and would likely require substantial mitigation.

Alternative 3, Install Revetment Near Levee E, was also screened out. Construction of a new revetment may provide scour protection in the immediate vicinity but could result in further erosion immediately upstream or downstream of the revetment. This alternative would also increase OMRR&R responsibilities for the sponsor. In addition, the NFS is evaluating opportunities to implement projects near this area already; so, this alternative will not be carried forward as a recommendation within this study.

Alternative 4, Remove Imi Kala Street Bridge, was screened out based on technical viability. Removal of this bridge would have multiple utility and traffic impacts and is not supported by the sponsor.

Alternative 5, Create Sacrificial Berm, was screened out because it does not meet project objectives and is not supported by the NFS. Creation of a sacrificial berm would be difficult and expensive to maintain, and the sponsor is not supportive of significantly increasing their OMRR&R responsibilities.

Alternative 7, Modify Detention Basin, was screened out based on high cost of construction of an upstream debris wall, as well as anticipated increased OMRR&R responsibilities under the FWOPC. If constructed, this alternative would require the NFS to move boulders from the detention basin to the unlined section of the channel, increasing OMRR&R costs in the future. Additionally, the Corps acknowledges, and heeds concerns expressed by the Native Hawaiian community regarding manipulation of Wailuku River rock/boulders or *pohaku*, a cultural resource. Upon development of a system-wide sediment budget, this alternative may be further evaluated by the NFS in the future.

Alternative 8, Drop Structures, was screened out for reasons similar to Alternative 1 (Install Fully Lined Channel). While this alternative may reduce erosion concerns, it is not likely to be economically justified due to high cost associated with construction of 10 large drop structures and would likely require substantial mitigation associated with lining and hardening the channel by installing drop structures.

Alternative 10, Deauthorize Project, does not meet study objectives. This alternative would remove Federal obligation to ensure the Iao Stream FCP provides flood risk reduction to the Wailuku community and would not obligate the Federal Government to rehabilitate current or future damaged structural components of the Iao Stream FCP. The NFS would operate and maintain the Iao Stream FCP at its own discretion.

4.4 Focused Array of Alternatives

Based on the evaluation of the initial array summarized above, the focused array of alternatives carried forward for additional analysis includes the following:

- No Action Alternative
- Alternative 2: Remove Revetment X
- Alternative 6: Install Pre-Formed Scour Hole
- Alternative 9: Overflow Basin with Floodplain Reconnection
- Alternative 11: Non-Structural Plan (Flood Warning System)
- Alternative 12: Combination Plan

4.5 Evaluation of Focused Array

Conceptual cost estimates were developed for each alternative included in the focused array. Cost estimates include real estate requirements, contingency, pre-construction, engineering and design, and construction management and are presented in Table 4-4.

Table 4-4. Cost Estimates for Focused Array of Alternatives

Alternative	Project First Cost FY21 Price Level	Carried Forward?
Alt 2: Remove Revetment X	$3.15 million	Yes
Alt 6: Install Pre-Formed Scour Hole	$2.99 million	Yes
Alt 9: Overflow Basin with Floodplain Reconnection	$60.68 million	No – Screened out; cost prohibitive
Alt 11: Non-Structural Plan (Flood Warning System)	$0.035 million	Yes
Alt 12: Combination Plan (Alt 2 + Alt 6 + Alt 11)	$5.43 million	Yes

Based on the cost estimates presented above, Alternative 9 was not carried forward for further evaluation. This alternative would be cost prohibitive to implement.

4.6 Final Array of Alternatives

Based on the evaluation summarized above, the final array of alternatives includes:

- No Action Alternative
- Alternative 2: Remove Revetment X
- Alternative 6: Install Pre-Formed Scour Hole
- Alternative 11: Non-Structural Plan (Flood Warning System)
- Alternative 12: Combination Plan (Alternative 2 + Alternative 6 + Alternative 11)

4.7 Evaluation and Comparison of Final Array of Alternatives

Per Engineer Regulation (ER) 1165-2-119, "*Works proposed to correct a design or construction deficiency may be recommended for accomplishment under existing project authority without further Congressional authorization if the proposed corrective action meets all of the following conditions:*

1. *It is required to make the project function as initially intended by the designer in a safe, viable, and reliable manner.*
2. *It is not required because of changed conditions.*
3. *It is generally limited to the existing project features.*
4. *It is justified by safety or economic considerations.*
5. *It is not required because of inadequate local maintenance."*

This section summarizes the economic and qualitative safety evaluation conducted for the final array of alternatives. Section 5.2 highlights eligibility of the recommended plan under the remaining criteria of ER 1165-2-119.

4.7.1 Benefits of Alternatives: Safety Considerations

As described in Section 2.4, there are actionable safety issues in the watershed resulting from the project entering a state of failure/non-performance. Failure/non-performance could occur if continued erosion or head cutting causes a levee to breach and fail, leading to significant safety concerns in the project area. As such, alternatives were qualitatively evaluated to determine the extent to which they address these and other safety considerations, including the hazards and consequences presented in Chapter 3.

Alternative 2: Remove Revetment X

The removal of Revetment X on the left bank provides the stream with more flexibility to adjust, as needed, to improve channel stability. Without being confined by the fixed revetment, the stream will be able to meander within more reasonable limits (reducing stream velocities) and form a more stable channel shape (one that likely floods the levee toe less frequently). While removing Revetment X would reduce the likelihood of right bank failure as the levee toe would be flooded less often and at lower velocities, nuisance flooding over the left bank during a storm event may occur; however, the impacted area is within a designated floodplain. This reduction of right bank flood risk is consistent across all AEP events with a greater delta in risk reduction benefits between the FWOPC and future with-project conditions (FWPC) during larger AEP events.

Alternative 6: Install Pre-Formed Scour Hole

The integrity of the upper concrete channel must be preserved by either continuous maintenance beyond what was initially anticipated, or the modification proposed under Alternative 6. Failure to address the head cutting issue located at the downstream end of the concrete channel would result in extensive damage to the invert and threaten the stability of the nearby retaining walls. Failure of these >16 ft retaining walls would be catastrophic as adjacent homes would likely fall directly into the river. The proposed modification improves the resiliency of the system. The likelihood of invert failure and catastrophic failure of the retaining walls would be significantly reduced (i.e., close to 90% reduction of risk of retaining wall failure). The reduction of risk is greater for larger AEP events. While the channel invert would be gradually undermined over time under the FWOPC, larger AEP events would accelerate undermining and create a larger scour hole, thereby increasing risk of failure. Based on a qualitative evaluation, the delta in risk reduction benefits between the FWOPC and FWPC is expected to be smaller during larger AEP events.

Alternative 11: Non-Structural Plan (Flood Warning System)

Warning of impending floods can save lives and prevent extensive property damage. Installation of a stream gage would improve community safety by increasing community and regional understanding of the potential for flooding as well as increased communication of imminent flood events. A stream gage can provide valuable data to inform flood warning and evacuation plans, which contribute to improving life safety and community resilience for a relatively small cost.

Due to the flashy nature of the system, an automated warning system is recommended for Wailuku River. To establish a public warning system, the Corps will coordinate directly with the County of Maui Emergency Management Agency to establish a central base station or field station with necessary communications equipment (siren / beacon lights) and software at the County Emergency Management Offices. When rainfall or rising water levels reach set thresholds, the automated station will notify emergency personnel. Sirens can be automatically or remotely activated. In addition to the audible sirens, most public warning systems also often include visual flashing beacon lights to warn the community of the immediate hazard.

The stream gage and flood warning system are expected to significantly reduce the potential for life loss by providing real-time data to improve warning times for evacuation. Another beneficial impact associated with implementation of the project is heightened awareness of the flood-related risks including both an increased understanding of the overall potential for flooding based on dissemination of project-related information, as well as increased communication of imminent flood events via improvements to real-time data gathering via the stream gage. This is expected to translate to increased levels of preparedness, thus improving community safety.

Alternative 12: Combination Plan

Implemented together, removal of Revetment X (Alternative 2), installation of the pre-formed scour hole (Alternative 6), and implementation of a flood warning system (Alternative 11) would be a more complete and effective solution to address safety across the project by reducing the risk of failure or non-performance at critical locations, in addition to improving community safety by addressing residual flood risks.

4.7.2 Economic Considerations: Reduction in OMRR&R

While the proposed alternatives are likely to be justified based on safety considerations, an approach to account for reduced OMRR&R benefits was identified and coordinated with the Vertical Team. Based on a preliminary analysis, outlays for the purposes of OMRR&R (considering non-Federal regular expenditures, non-Federal emergency expenditures, and Federal emergency expenditures) exceed the levels anticipated in the original OMRR&R agreements and manuals (adjusted for inflation) by 215% to 1100%. As such, an economic benefit exists in the form of a potential reduction in OMRR&R for the project.

Alternatives were evaluated using two OMRR&R-related considerations: reductions in future OMRR&R, and reductions in future emergency repairs. These benefit categories were evaluated using the 2016 Project Information Report (PIR) and OMRR&R records from the NFS.

Alternative 2: Remove Revetment X

Under the FWOPC, routine maintenance would involve periodic removal of the undermined revetment and application of shotcrete to the exposed bank, continuing the substantial OMRR&R outlays for the project. These types of activities are expected to cost approximately $150,000 every two years. In addition, emergency repairs at this site would continue in the future. For example, as part of the 2017 PL 84-99 rehabilitation, Revetment X was repaired from damages incurred by a 2.5% AEP flood event. Approximately $570,000 (100% Federal) was budgeted for the repair of both the left and right banks, which does not include other costs covered by the larger contract such as mobilization, site preparation, etc. As described in Appendix C, emergency repair costs under the FWOPC are estimated to be $100,000 every 10 years, $150,000 every 25 years, and $230,000 every 50 years.

Under the FWPC, minimal maintenance is anticipated and OMRR&R requirements for this alternative are anticipated to be $0. In addition, OMRR&R outlays would be reduced substantially as natural riverine processes would be allowed to occur in a less constrained channel. In addition, no emergency repairs to this feature are anticipated in the future as the proposed alternative involves the removal of the revetment. Finally, removal of Revetment X allows the stream to be flexible and attempt to reach channel stability through natural riverine processes. Increased stability would lessen channel incision and widening that currently threaten the right bank levees, thereby reducing risk to community safety during an event.

Overall, OMRR&R requirements and associated costs are cumulatively reduced under the FWPC.

Alternative 6: Install Pre-Formed Scour Hole

Under the FWOPC, routine maintenance would involve regular placement of loose riprap at the scoured site and periodic application of shotcrete. This type of OMRR&R activity is similar to what is performed regularly at Revetment X, which is estimated to be approximately $60,000 per year for routine maintenance. In addition, continuous head cutting would eventually lead to failure of the boulder concrete invert, requiring immediate repair. The work and level of effort would be similar to the repairs conducted at Levee A for the 2017 PL 84-99 rehabilitation, which involved restoring 400 linear ft of boulder-concrete toe that eroded from a 2.5% AEP flood event. As described in Appendix C, emergency repair costs under the FWOPC are estimated to be $250,000 every 10 years, $750,000 every 25 years, and $1.5 million every 50 years.

Under the FWPC, routine maintenance of the implemented alternative would be minimal. OMRR&R requirements are anticipated to be $5,000 annually and are limited to sealing cracks in the concrete and removing vegetation, as needed. In addition, minimal emergency repairs are anticipated for the 50-year project life once this alternative is implemented.

Overall, OMRR&R requirements and associated costs are cumulatively reduced under the FWPC.

Alternative 11: Non-Structural Plan (Flood Warning System)

Installation of a stream gage and implementation of a flood warning system would not have direct impacts to OMRR&R requirements of the existing structural aspects of the project and would not create a new OMRR&R burden on the NFS. OMRR&R requirements of the flood warning system would be minimal ($10,000 per year) and limited to annual inspections and testing.

Alternative 12: Combination Plan

Implemented together, removal of Revetment X, installation of the pre-formed scour hole, and installation of a flood warning system would lower OMRR&R requirements across the project. Removal of Revetment X and installation of the pre-formed scour hole reduce long-term OMRR&R and the flood warning system would have only a small OMRR&R requirement. Ultimately, the combination of all alternatives would result in a cumulative reduction in OMRR&R requirements for the project, with OMRR&R requirements decreasing from approximately $135,000 annually to $15,000 annually. This OMRR&R reduction does not account for significant cost savings associated with avoidance of emergency repairs or major rehabilitation of individual project features.

4.7.3 Economic Considerations: Flood Risk Management Benefits

While large-scale reduction in FWPC water surface elevations is not expected, alternatives were qualitatively evaluated based on an assessment of possible reductions in inundation based on the latest H&H model results.

Alternative 2: Remove Revetment X

Removal of Revetment X would result in lower water surface elevations as the channel capacity would increase (approximately 2-3 feet in the immediate area). Additionally, velocities would lower and as a result, flows would be less erosive (e.g., 13 ft/s vs 17 ft/s for the 0.2% AEP event). The risk to the right bank levees would be reduced. As such, implementation of this alternative would provide ancillary FRM benefits for the project.

Alternative 6: Install Pre-Formed Scour Hole

Qualitatively, there will be negligible impacts (i.e., little to no change) to the water surface elevations for the modification proposed by Alternative 6, install pre-formed scour hole, during normal flow and smaller frequency flood events. While there is a chance that a significant event, such as the 0.2% AEP flood, would cause extensive damage to the invert, it is still not likely to affect the flood profile significantly. Damages incurred over time would eventually lead to failure of the retaining walls, but this is unlikely to occur as we have assumed the NFS would make the periodic repairs necessary to prevent that. Implementation of Alternative 6 would minimize the requirement for those local, periodic repairs and associated costs.

Alternative 11: Non-Structural Plan (Flood Warning System)

Installation of a stream gage and a flood warning system would not directly impact water surface elevations or provide a reduction of inundation depth, extent, or duration.

Alternative 12: Combination Plan

Implemented together, removal of Revetment X, installation of the pre-formed scour hole, and flood warning system would have marginal incremental FRM benefits, plus reduction of community safety risk associated with flooding via implementation of the flood warning system.

4.8 Benefit-to-Cost Ratios for Structural Alternatives

Average annual equivalent (AAEQ) costs and benefits and the benefit to cost ratio (BCR) for each structural alternative included in the final array are displayed in **Table 4-5** below. Net benefits are based on reductions in future OMRR&R as summarized in Section 4.7.2 above. The table below shows that the BCR is approaching unity for Alternative 2 (Removal of Revetment X), greater than unity for Alternative 6 (Installation of Pre-Formed Scour Hole), and greater than unity for the combination of the two structural alternatives. The plan that maximizes net benefits is the plan that combines Alternative 2 and Alternative 6. A combination of removal of Revetment X and installation of the pre-formed scour hole maximizes net benefits and is economically justified to implement.

Table 4-5. Average Annual Equivalent Cost and Benefits and BCR of Alternative Plans

Alternative	AAEQ Benefits	AAEQ Costs	Net Benefits	BCR
Revetment X Removal (Alt. 2)	$95,900	$111,751	$(15,851)	0.86
Pre-Formed Scour Hole (Alt. 6)	$150,000	$105,933	$44,067	1.42
Combination (Alt 2 + Alt 6, Alt 11)	$245,900	$192,603	$53,297	1.28
Based on FY 2021 price level, discount rate of 2.5%				

It should be noted that AAEQ benefits, AAEQ costs, net benefits, and a BCR were not calculated for Alternative 11, Non-Structural Plan. This Alternative reduces residual flood risk in the study area and is justified based on the safety considerations described above. Short of lining the entire system with concrete, as described in earlier sections of this chapter, and subsequently screened out due to cost, environmental impacts, and community acceptability, addressing flood risk and community safety through non-structural management measures is an economically and environmentally acceptable recommendation.

4.9 Recommended Plan

Based on the evaluation and comparison of alternatives as described above, the recommended plan is Alternative 12, Combination Plan (Figure 5-3) that includes three recommendations: removal of Revetment X, installation of the pre-formed scour hole, and implementation of a flood warning system. This alternative is justified based on both safety and economic considerations.

5 Recommended Plan

This study was completed in partnership with the NFS. This section describes details of the recommended plan to correct the design deficiency at Iao Stream FCP and is supported by the County (Appendix G).

5.1 Description of the Recommended Plan

The recommended plan includes three features: removal of Revetment X, installation of a pre-formed scour hole, and implementation of a flood warning system. Descriptions of each feature are included below and presented in Figure 5-3.

Remove Revetment X

Revetment X is located on both banks of the stream between Stations 59+50 to 48+50. In this area, the meandering natural channel was straightened and narrowed with boulder concrete lining. As a result, the channel was constricted and velocities increased, causing additional erosion in the area. There is an increased risk of erosion upstream and downstream if the revetment is left in place. A portion of Revetment X (RS 55+50 to 48+50) eroded by the September 2016 event was removed because of safety concerns. Removal of the remaining portions of Revetment X would essentially widen the channel, allowing flows to dissipate across a wider area and reduce velocity. With the removal of the revetment, the stream will likely meander more in its attempt to lengthen the stream and achieve a shallower bed slope. It is possible it will "bend" into either the left or right bank, most likely increasing erosion on the unprotected left bank over the hardened right bank. However, possible erosion on the left bank is a lower risk compared to the right bank, as the left bank is an undeveloped designated floodplain. The residual risk of the stream meandering into either the left or right bank is also still preferable over current conditions, where the right bank levee toe is experiencing continuous high velocity flows for over greater than 700 linear ft.

Figure 5-1. Revetment X

Install Pre-Formed Scour Hole

At the downstream end of the upper concrete-lined channel, continuous erosion of the natural reach created an unintended drop structure and scour hole. This alternative includes creating a pre-formed (designed) scour hole with limited placement of concrete revetment to reduce the risk of the existing concrete channel invert being undermined by future erosion. This alternative also includes a single drop structure to help in reducing downstream erosion and risks to community safety.

Figure 5-2. Proposed Location of Pre-Formed Scour Hole

Stream Gage and Flood Warning System

Warning of impending floods can save lives and prevent extensive property damage. Installation of an automated flood warning system specifically for Wailuku River would improve community safety by increasing community and regional understanding of the potential for flooding as well as increase communication of imminent flood events. A flood warning gage can provide valuable data to inform flood warning and evacuation plans, which contribute to improving life safety and community resilience for a relatively small cost.

Due to the flashy nature of the system, an automated warning system is recommended for Wailuku River. To establish a public warning system, the Corps will coordinate directly with the County of Maui Emergency Management Agency to establish a central base station or field station with the necessary communications equipment (siren / beacon lights and software at the County Emergency Management Offices). When rainfall or rising water levels reach set thresholds, the automated station will notify emergency personnel. Sirens can be automatically or remotely activated. In addition to the audible sirens, most public warning systems also often include visual flashing beacon lights to warn the community of the immediate hazard.

The stream gage and flood warning system are expected to significantly reduce the potential for life loss by providing real-time data to improve warning times for evacuation. Another beneficial impact associated with implementation of the project is heightened awareness of the flood-related risks, including both an increased understanding of the overall potential for flooding based on dissemination of project-related information, as well as increased communication of imminent flood events via improvements to real-time data gathering via the stream gage. This is expected to translate to increased levels of preparedness, thus improving community safety.

This alternative proposes installation of a radar water level sensor on the downstream end of the Iao Valley Road Bridge deck. The water level sensor uses radar technology to provide a non-contact alternative to other level gauging methods such as submersible pressure transducers. This would minimize the risk of the gage becoming damaged during a high flow event (existing stream gages on the site, which are currently sited on the banks, have a history of being damaged by debris and large boulders). Placement of the gage on the Iao Valley Road Bridge would also provide better accessibility for periodic performance maintenance. The flood warning gage would also include a tipping bucket rain gage and integrated data logging system. Continuous real-time data on precipitation and water surface elevation can be sent to any computer and any control measures or emergency actions can be implemented immediately if parameter limits are exceeded.

As described in Section 4.2, a threshold would need to be established based on discussions with emergency personnel and better understanding of the specific equipment being installed, but based on historical and simulated storms, a flood warning system could provide 1 to 2 hours of warning time. This type of flood warning would be most effective at warning pedestrians on foot in the immediate area to evacuate or seek shelter.

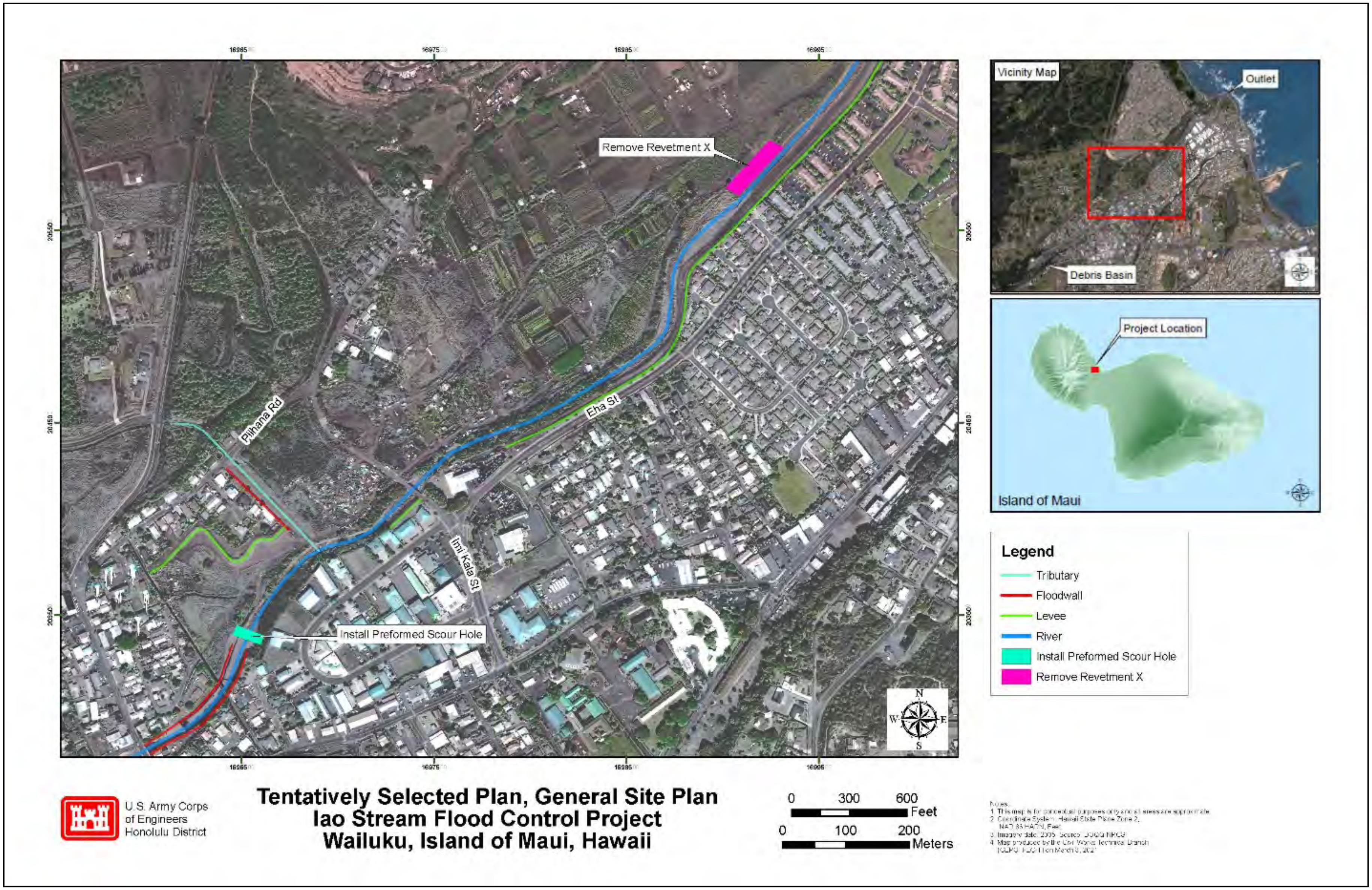

Figure 5-3. Recommended Plan

5.2 Design Deficiency Eligibility Criteria

Per ER 1165-2-119, works proposed to correct a design or construction deficiency may be recommended for accomplishment under existing project authority without further Congressional authorization if the proposed corrective action meets all of the following conditions:

1. It is required to make the project function as initially intended by the designer in a safe, viable, and reliable manner (e.g., pass the original design flow without failure). This does not mean the project must meet present day design standards. However, if current engineering analysis or actual physical distress indicates the project will failure, corrections may be considered a design or construction deficiency if the other criteria are met.
2. It is not required because of changed conditions.
3. It is generally limited to the existing project features. Remedial measures that require land acquisitions or new project structures must not change the scope or function of the authorized project.
4. It is justified by safety or economic considerations.
5. It is not required because of inadequate local maintenance. Local responsibilities for maintenance of local protection projects are stated in 33CFR208.10.

Although the Iao Stream FCP is sufficiently maintained by the NFS, erosion and streambed incision continue to be the underlying problems despite conditions not changing within the project. A DDR was completed in March 1995 and approved by the ASA(CW) in November 1995. Based on the original DDR, the project design at the time of construction was not deficient based upon knowledge of boulder/gravel streams. After project construction, further knowledge was acquired regarding these processes. Correction of the deficiency is required to prevent further damages and to stabilize the existing damaged structures. However, the design deficiency has yet to be addressed. Implementation of the recommended plan would allow the project to function as initially intended in a safe, viable, and reliable manner. The recommended plan includes features that are located within the existing footprint and the recommended plan is justified based on safety and economic considerations.

As summarized in Table 5-1 and the discussion following the table, the recommended plan meets all eligibility criteria to be implemented under the existing authority.

Table 5-1. ER 1165-2-119 Eligibility Criteria: Modification Under Existing Authority, Local Protection Projects

No.	Criteria	Criteria Met? Alternative 2: Remove Revetment X	Criteria Met? Alternative 6: Install Pre-Formed Scour Hole	Criteria Met? Alternative 11: Flood Warning System	Discussion
1	Required to make the project function as initially intended	Yes	Yes	Yes	Design deficiencies that have resulted in continuous erosion and streambed incision were originally identified and agreed to by the Acting ASA(CW) in 1995; alternatives address deficiencies.
2	It is not required because of changed conditions	Yes	Yes	Yes	See above. Erosion and streambed incision are longstanding problems.
3	Generally limited to existing project features	Yes	Yes	Yes	Alternatives lie within the footprint of the existing project.
4	It is justified by safety or economic considerations	Yes; primary justification related to safety considerations	Yes; primary justification related to safety considerations	Yes; primary justification related to safety considerations	Both alternatives are justified by both safety and economic considerations.
5	It is not required because of inadequate local maintenance	Yes	Yes	Yes	All project features have been sufficiently maintained by the local sponsor.

Removal of Revetment X

Revetment X is located on the left bank between Stations 48+50 and 55+50 of the existing project (in accordance with (IAW) ER 1165-2-119, Para 7.a(3), where the meandering natural channel was straightened and narrowed with boulder concrete lining. As a result of straightening, the channel was constricted and flow velocities increased, causing continuous erosion in the area. A portion of Revetment X was severely eroded during the September 2016 flood event, where the sediment behind the lining was washed away. This section was later removed due to safety concerns of the concrete slab remains with no support. Erosion and streambed incision continue to be the underlying problems, despite unchanged conditions within the project (IAW ER 1165-2-119, Para 7.a(2)). Although the project is sufficiently maintained by the NFS (IAW ER 1165-2-119, Para 7.a(5)), removal of the remaining portions of Revetment X would result in widening of the channel, reducing flow velocities and thereby, allow the project to function as intended (IAW ER 1165-2-119, Para 7.a(1)). In addition, removal is justified by safety concerns from the potential mass loss of the remaining concrete slab during future flooding events (IAW ER 1165-2-119, Para 7.a(4)).

Install Pre-Formed Scour Hole

Immediately downstream of the large drop structure and concrete-lined channel at Station 91+35, erosion created an unintended drop structure and scour hole within the project footprint

((IAW ER 1165-2-119, Para 7.a(3)). Despite the project being sufficiently maintained by the NFS ((IAW ER 1165-2-119, Para 7.a(5)), this section has continued to increase over time, both in area and depth, and is causing erosion beneath the lined invert upstream. Erosion of the unintended drop structure and scour hole continues to be a key problem, despite unchanged project conditions ((IAW ER 1165-2-119, Para 7.a(2)). This alternative includes creating a pre-formed/designed scour hole with limited placement of concrete revetment to reduce the risk of potential undermining and damage to the adjacent concrete-lined invert. Repairs would allow the project to perform as intended (IAW ER 1165-2-119, Para 7.a(1)). Work is also justified because safety concerns due to the potential undermining and damage during future flooding events (IAW ER 1165-2-119, Para 7.a(4)).

Flood Warning System

Despite the project being sufficiently maintained by the local sponsor ((IAW ER 1165-2-119, Para 7.a(5)) and despite conditions not changing within the project (IAW ER 1165-2-119, Para 7.a(2)), the extremely flashy nature of typical floods in the system provides little opportunity for flood warning and evacuation, there is no site-specific flood warning system for the Wailuku River. The flood warning system is limited to features within the project footprint ((IAW ER 1165-2-119, Para 7.a(3)) with supporting communications equipment and software located at the County Emergency Management Offices. The flood warning system is expected to significantly reduce the potential for life loss by providing real-time data to improve warning times for evacuation, allowing the project to function as intended (IAW ER 1165-2-119, Para 7.a(1)) while providing warning of impending floods to the community. Finally, installation of a flood warning system is justified based on safety considerations. Installation of an automated flood warning system specifically for Wailuku River would improve community safety by increasing community and regional understanding of the potential for flooding as well as increased communication of imminent flood events (IAW ER 1165-2-119, Para 7.a(4)).

5.3 Real Estate Considerations

Real estate requirements (Appendix E) are limited to temporary easements during construction only, e.g., for staging, as both structural features included in the recommended plan are located within the existing stream channel. No new land acquisitions are required. The estimated real estate cost associated with the recommended plan is approximately $7,800, including all recommended estates, incremental real estate costs, and administrative costs to be carried out by the NFS and Government. As the NFS will perform real estate acquisitions with contract support, the NFS is considered moderately capable at present to acquire and provide the LERRDs necessary for the proposed project.

5.4 Environmental Compliance

NEPA documentation including a Final EA and FONSI were included with the 2017 EDR and are incorporated by reference. Removal of Revetment X was previously evaluated under the 2017 EA as a component of the former “Alternative F”. There have been no changes to the scope of removal of Revetment X from the 2017 EA.

Alternative 6, Install pre-formed scour hole, is evaluated in this EDR Amendment and the accompanying SEA (see Appendix F). The pre-formed scour hole will be constructed within existing lined and unlined portions of the Iao FCP channel, which was previously and extensively modified to its current state and alignment. The Corps anticipates no more than minimal adverse environmental effects. The supplemental EA is included in Appendix F and addresses: 1) the no action alternative, 2) Alternative 2: Removal of Revetment X only, 3) Alternative 6: Install Pre-Formed Scour Hole, 4) Alternative 11: Non-Structural Plan (Flood

Warning System) and 5) Alternative 12: Alternatives 2, 6 and 11 combined (i.e., the preferred alternative). The Corps' evaluation of environmental effects of the proposed action, including coordination with Federal, State, and local agencies, Native Hawaiian organizations, and the public, in accordance with the NEPA is documented in the attached SEA (Appendix F).

Additional environmental compliance activities are summarized below:

- ENDANGERED SPECIES ACT. Pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended, the Corps determined that the recommended plan (Alternative 12) would have no effect on Federally listed species or their designated critical habitat. The Corps has satisfied statutory requirements for the proposed federal action under Section 7 of the ESA.
- FISH AND WILDLIFE COORDINATION ACT. Pursuant to the Fish and Wildlife Coordination Act (FWCA) of 1934, as amended (16 U.S.C. §§ 661–667e), the Corps consulted USFWS, NMFS and the State Department of Land and Natural Resources on the effect of removal of Revetment X on fish and wildlife resources as documented in the 2017 Final EA and a Planning Aid Letter dated April 22, 2014 from the USFWS. The repairs associated with installation of a pre-formed scour hole and the proposed non-structural public flood warning system do not require FWCA consultation. No further consultation with the Services is required for Alternative 12, combining the alternatives listed above. The Corps has satisfied statutory requirements for the proposed federal action under the FWCA.
- NATIONAL HISTORIC PRESERVATION ACT. Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the Corps has determined that the recommend plan (Alternative 12) would have no effect to historic sites and initiated consultation on August 26, 2021 with the State Historic Preservation Division (SHPD). In addition, to SHPD, the Corps has consulted the County Archaeologist and the following native Hawaiian Organizations to seek concurrence on its effect determination: Central Maui Hawaii Civic Club, Aha Moku Council, Hui O Na Wai Eha, and the Office of Hawaiian Affairs. SHPD concurred with USACE determination of "No Historic Properties Affected" by letter dated September 29, 2021 (Appendix F). The Corps has satisfied statutory requirements for the proposed federal action under Section 106 of the NHPA.
- CLEAN WATER ACT, SECTION 404. Pursuant to Section 404 of the Clean Water Act (CWA), the Corps evaluated the recommended plan (Alternative 12) and determined the following: 1) Alternatives 2 and 11, Remove Revetment X and Flood Warning System do not propose any discharge of fill material and does not require authorization under Section 404; and 2) Alternative 6, Install Pre-Formed Scour Hole proposes discharges regulated under Section 404, that meet the terms and conditions of Nationwide Permit (NWP) #3, Maintenance. The Corps adopts and incorporates by reference the 404(b)(1) analysis completed by USACE prior to issuance of the 2017 NWP #3.
- CLEAN WATER ACT, SECTION 401. Pursuant to Section 401 of the CWA, the Corps must obtain a water quality certification (WQC) from the State of Hawaii Department of Health, Clean Water Branch for any discharge into state waters. On September 7, 2021, the Corps requested from DOH to obtain a letter of confirmation acknowledging the Corps' coordination on this project with DOH, DOH's potential preliminary findings, if available, and acknowledgement of the Corps' plans to obtain a WQC in the design phase, prior to implementation of the project. The Corps received the letter of confirmation from DOH, dated September 9, 2021.

- COASTAL ZONE MANAGEMENT ACT. The Corps submitted its application, assessment form with substantiating documentation and request for federal consistency review to the State CZM Office on July 26, 2021. On September 14, 2021, the State CZM Office provided the Corps comments from their public review process to address. The Corps submitted to the State CZM Office the responses to those comment on September 24, 2021. The State CZM Office conditionally concurred with the Corps' federal consistency determination on September 28, 2021, requiring submission of additional information during the design phase and prior to construction. By email dated September 30, 2021, USACE accepted all conditions of the State conditional concurrence, satisfying the statutory requirements under Section 307 of the CZMA for the proposed action. USACE will continue to coordinate requested additional information with the State CZM Office in the design phase and prior to construction.

5.5 Cost Estimate and Economic Summary

The project first cost (Constant Dollar Cost at FY2021 price levels) of the recommended plan is $5.5 million. In accordance with the cost share provisions of Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213), the Federal share (65%) of the project first cost is estimated to be approximately $3.6 million and the non-Federal share (35%) is estimated to be approximately $2 million, which includes $7,800 in LERRDs. Table 5-2 and Table 5-3 provide the cost breakdown for project first cost and cost-share information. Detailed information on Project costs can be found in Appendix D.

Table 5-2. Project First Cost Summary

Construction Item Cost	Project First Cost (FY21 Price Level; $1000s)
Construction	$3,934
LERRDs	$8
Preconstruction Engineering & Design	$1,049
Construction Management	$524
Total First Cost ($1000s)	$5,515

Table 5-3. Estimated Project First Cost and Cost Share

Item	Project First Cost (FY21 Price Level; $1000s)	Federal Cost	Non-Federal Cost
Construction + Construction Management	$4,458	$2,898	$1,560
LERRDs (non-cash contribution)	$8	$0	$8
Subtotal	**$4,466**	**$2,903**	**$1,563**
Preconstruction Engineering and Design	$1,049	$682	$367
Total ($1000s)	**$5,515**	**$3,585**	**$1,930**

5.5.1 Operations and Maintenance

Minimal OMRR&R requirements are expected for the alternative. OMRR&R requirements are anticipated to be $15,000 annually and are limited to sealing cracks in the concrete and removing vegetation, as needed, as well as annual inspections and testing of the stream gage. An updated OMRR&R manual will be provided to the sponsor after project implementation.

5.6 Risk and Uncertainty

The study team used a risk-based strategy in its approach to formulating and evaluating alternatives.

5.6.1 Implementation Risk

The primary risk associated with this project is related to the sediment load for the system. The Iao Stream FCP is functioning in a highly active system with a substantial sediment load moving through the project, especially during high flow events. As such, there is a risk that higher than expected sediment loads may impact the effectiveness or sustainability of the recommended plan. To manage this risk, Honolulu District is working with the Corps' Regional Sediment Management Program Team to develop a sediment budget and load frequency curve for the project. This information will help inform final design of the recommended plan along with future NFS OMRR&R activities to manage sediment across the system.

5.6.2 Residual Risk

Residual risk is the risk remaining after implementation of a plan; that is, it is the difference in damages between the with- and without-project conditions. This section summarizes residual risk associated with the recommended plan.

While the proposed structural measures included in the recommended plan address critical areas of risk associated with the existing design deficiency, they do not provide a comprehensive reduction to all flood risk for the community, as flood events are expected to continue regardless of whether the design deficiency is fully addressed. Installation of the stream gage and implementation of the flood warning system would help address residual risks in those areas by increasing community and regional understanding of the potential for flooding, as well as increased communication of imminent flood events. A public warning system can provide valuable data to inform flood warning and evacuation plans, which contribute to improving life safety and community resilience for a relatively small cost.

There are also residual risks associated with implementation of the structural features included in the recommended plan. With removal of Revetment X, the stream will likely meander more in its attempt to lengthen the stream and achieve a shallower bed slope. It is possible it will "bend" into either the left or right bank, most likely increasing erosion on the unprotected left bank over the hardened right bank. However, this risk of increased erosion on the left bank is acceptable as the left bank is an undeveloped designated floodplain. The residual risk of the stream meandering into either the left or right bank is also still preferable over current conditions, where the right bank levee toe is experiencing continuous high velocity flows for over greater than 700 linear ft.

5.7 Response to 1995 ASA(CW) Design Deficiency Memorandum

This report is intended to respond to the Memorandum from the ASA(CW) to the Director of Civil Works, dated November 24, 1995. The memorandum identified two alternatives already evaluated by the Corps, a $5.5 million (FY 1995 price level) plan to reconstruct levee toes and a $15 million (FY 1995 price level) plan to line the entire channel with concrete. Per the subject memorandum, a project to correct the deficiency associated with the existing project will be considered approved subject to three conditions. Those conditions are outlined below, along with responses to each item:

1. Evaluate the $5.5 million alternative originally prepared by the Pacific Ocean Division and specifically identify the residual risks and the economic impacts and/or increased costs associated with those risks.

   Response: *The team formulated and evaluated dozens of different alternatives, starting with those identified in the past DDR and multiple EDRs, including the $5.5 million and $15 million alternatives described above. New alternatives were also formulated to support this EDR Amendment effort.*

2. Evaluate measures to avoid the residual risks and costs and verify that the recommended $15 million deficiency correction identified in the 1995 DDR is less costly than mitigating for the risks and costs associated with the $5.5 million alternative.

   Response: *The $15 million deficiency correction (lining the entire channel with concrete) was re-evaluated. Based on an updated cost estimate, this alternative is now expected to cost approximately $61 million and is cost prohibitive to implement.*

3. If the $15 million solution is the only acceptable solution, a value engineering study should be conducted with a goal of reducing the costs.

   Response: *The $15 million solution is not the only acceptable solution. A less-costly alternative is recommended for implementation. As such, a value engineering study of the $15 million alternative is not recommended. A value engineering study may be pursued during the design and implementation phase prior to implementation of the recommended plan.*

6 Recommendations

I have considered all significant aspects of this project, including environmental, social, and economic effects, and engineering feasibility. I recommend that the recommended plan for correcting the design deficiency at the Iao Stream FCP, as generally described in this report, be approved for implementation as a Federal project. This recommendation reflects the policies governing formulation of individual projects and the information available at this time. It does not necessarily reflect the program and budgeting priorities inherent in the local and state program or the formulation of a national civil works water resources program. Consequently, this recommendation may be changed at higher review levels of the executive branch outside the Honolulu District before it is used to support funding.

Eric S. Marshall, PE, PMP
Lieutenant Colonel, U.S. Army
District Engineer

7 References

HED, 1974. Flood Control and Allied Purposes, Iao Stream, Wailuku, Maui, Hawaii, Design Memorandum No. 1, Hydrology.

USACE, 1975. General Design Memorandum No. 2, General Design Memorandum, Phase I – Plan Formulation, Flood Control & Allied Purposes, Iao Stream, Wailuku, Maui, Hawaii. Report. Honolulu, HI.

USACE, 1976. General Design Memorandum, Phase II – Project Design, Flood Control & Allied Purposes, Iao Stream, Wailuku, Maui, Hawaii. Honolulu, HI.

USACE, 2000. Channel Stability Problems, Iao Stream, Maui, Hawaii.

USACE, 2008. Hydraulic Analysis of Iao Stream, Maui County, Hawaii Report. Honolulu, HI.

USACE, 2017. Final Environmental Assessment for Modification to the Iao Stream Food Control Project, Wailuku, Island of Maui, Hawaii.

USACE, 2017. Final Engineering Documentation Report. Iao Stream Flood Control Project, Wailuku, Maui, Hawaii.

USACE, 2017. Upper Wailuku River (Iao Stream) Flood Hazard Study. Wailuku, Maui, Hawaii.

USACE, 2019. Report on the 85th Meeting of the USACE Committee on River Engineering (Volume 1). Maui, Hawaii, 30 July – 2 August 2019.

Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

Engineering Documentation Report Amendment

Appendix A: Hydrology & Hydraulics

September 2021

US Army Corps of Engineers
Honolulu District

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1. Introduction

The purpose of this appendix is to provide additional information on 1) the hydrology and hydraulics of Wailuku River (formerly known as Iao Stream), Maui Hawaii and 2) the various mitigation measures and alternatives evaluated to address historic and continuous erosion issues observed along the river.

1.1. Project Objective

The objective of the current reevaluation study is to preserve the integrity of the existing project features, address known problem areas affected by channel instability, and to reduce channel instability due to erosion and high velocity flows in the lower reach of Wailuku River for the 50-year period of analysis.

1.2. Project Opportunities

The project opportunities are as follows:

a. Reduce levee toe erosion
b. Reduce bank erosion
c. Reduce property damages

1.3. Project Constraints

The project constraints are as follows:

a. Flood risk to the community is not increased by implemented measures
b. Minimize maintenance costs of remedial measures.
c. Avoid impacts to the aesthetics in this urban environment, especially the use of conventional concrete channelization.
d. Maintain opportunities for native fish passage within the channel by designing a low flow channel with a capacity between 5 and 10 cubic feet per second (ft^3/s). Minimize or avoid channel hardening or steep drop structures that may result in adverse impacts to fish habitats and passage and reduce groundwater recharge.

1.4. Previous Studies and Reports

1.4.1. 1974 – 1976 General Design Memorandums

There are two General Design Memorandum (GDM) documents for the Iao Stream Flood Control Project (FCP). "Design Memorandum No. 1" dated March 1974 covers the initial project hydrology studies, such as the development of the standard project flood (SPF), maximum probable floods, discharge frequency curves, and overflow areas (USACE, 1974). "Design Memorandum No. 2, Phase I and II" dated April 1975 and May 1976 presents the results of further studies for flood risk reduction and related water resources development for Wailuku River, Maui, Hawaii. It includes the various design considerations used to develop the project and final plans (USACE, 1975 and USACE, 1976). The channel improvements completed in 1981 included different flood risk reduction features from the mouth of the river to 13,500 feet upstream. Concisely, the highlights of the improvements are presented below in sequential order from the most upstream portion to the mouth.

- 800-ft debris basin designed to capture most of the watershed’s sediment load
- 1,100-ft boulder-concrete channel with several chutes and a vertical drop structure at the end
- 200-ft reinforced concrete channel
- 7,000-ft reach of the alluvial channel that includes levees on the right banks to protect the town of Wailuku
- 1,700-ft rectangular concrete-lined channel with a boulder-concrete bed and conventional reinforced concrete side slopes

Other studies completed by USACE for the Wailuku River basin are superseded by the GDMs. These reports include the “Report on Survey for Flood Control and Allied Purposes on Iao Stream, Wailuku, Maui, Hawaii,” dated 5 April 1966, and “Report on Survey for Flood Control, Iao Stream, Island of Maui, Hawaii,” dated 30 November 1959.

1.4.2. 1997 – 2000 Channel and Slope Stability Studies

In response to dramatic channel incision, bank erosion, and structural undermining observed along the natural reach of Wailuku River, several studies from 1997 to 2000 focused on assessing the channel stability problem and evaluating various alternatives to address the issue. These reports include a 1997 slope stability assessment, a 1997 value engineering report, a 2000 report on channel stability problems downstream, and a 2000 hydraulic design analysis of the various proposed alternatives. These reports did not analyze the watershed in its totality nor include any new hydrological information. None of the proposed alternatives have been implemented to date.

1.4.3. 2008 Hydraulic Analysis

In 2008, the USACE, Honolulu District conducted a hydraulic analysis for Wailuku River. The purpose of this analysis was to map the floodplain about 1-mile upstream of the debris basin.

1.4.4. 2011 Wailuku Flood Study

In 2011, the Honolulu District conducted a flood study in a nearby watershed located south of the current study area. Light Detection and Ranging (LiDAR) data was provided to the Honolulu District by the County of Maui in the form of .xyz files. While the studies and study areas are independent of each other, the 2011 study revealed an additional source of terrain data and provided initial insight into selected methods of hydrologic and hydraulic modeling in a similar watershed.

1.4.5. 2013 Engineering Documentation Report

In 2013, the Honolulu District completed an Engineering Documentation Report (EDR) and Environmental Assessment (EA) to provide engineering analysis and a preliminary design for modifications to the existing Iao Stream FCP. Under this EDR, six alternatives were evaluated, including the “No-Action” alternative, to prevent further streambed erosion, loss of life, and property damage during flood events. A less expensive, more environmentally sound design than what was previously proposed (Section 1.4.2) was sought. The final recommended plan, referred to in the report as “Alternative F,” proposes reconnecting the main channel with a previously designated floodplain on the left bank by constructing a concrete diversion wall in the main channel and lowering the left bank.

1.4.6. 2017 Upper Wailuku Flood Hazard Study

As a result of the damaging and significant flow experienced along Wailuku River, specifically in the Upper Wailuku region upstream of the existing Iao Stream FCP, a new flood hazard study was conducted by USACE. This study refines previous hydrology and extends the one-dimensional, steady flow hydraulic model created in 2008 (Section 1.4.3) to the Iao Valley State Park (further upstream), using the latest available elevation data.

1.4.7. 2019 USACE Committee on River Engineering

In 2019, the USACE Committee on River Engineering returned to Wailuku River to offer new insight on channel instability problems within the system and the previously proposed alternative to divert flows in the left bank floodplain. The recommendations from the Committee that are pertinent to this study are summarized below:

- Assess project performance under a wider range of conditions, other than the Standard Project Flood (SPF);
- Review the historical record to identify any trends in the flooding with respect to both peak flows and duration;
- The skew in the flood-frequency analysis seems high – determine if it is based on a mixed population dataset, where two large events have separate hydrologic drivers;
- Include the HMS flow results in the flood-frequency analyses, and re-evaluate with the results from the regression equations and Bulletin 17C;
- Remove the left bank of Revetment X and allow its foundation to erode;
- The Committee does not recommend development of a sediment transport model for this study – evaluating the change in shear stress by use of 2D modeling is more appropriate;
- Consider using permanent or sacrificial berms along the channel and throughout the lower un-channelized reach.
    - If the berms are designed to be sacrificial, they would need to be reconstructed following any major fold event. Initial construction and O&M costs would require evaluation to determine benefit/costs;
- Consider designing a preformed scour hole at the downstream end of the lined channel near station 90+00. The current drop is 6 to 8 feet and if this continues, the channelized reach will become compromised;
- With regards to flow diversions, there are two main concerns: 1) risk of sediment depositing downstream, and 2) potential scour in the diversion area. Evaluate this risk by assessing shear stresses in the hydraulic model;

- Continue to clean out shoals in the lower concrete-lined channel (from Waiehu Beach Rd to the ocean outlet);
- The steepness of the stream makes sills a cost prohibitive alternative;

Other recommendations made by the Committee specific to the project's debris basin and additional evaluation of the sediment within the system are being evaluated under a separate study under the Regional Sediment Management (RSM) Program.

2. Watershed Description

2.1. Location

The study area is located along Wailuku River (formerly named Iao Stream), between the ocean outlet and the federally constructed debris basin – approximately 13,900 feet (ft) upstream. Wailuku River is located within a drainage basin on the eastern slopes of the West Maui Mountains, near the north end of the isthmus connecting East and West Maui. The river drains the steep Iao Valley, meandering eastward to the Pacific Ocean, through the town of Wailuku. The existing project is located at the downstream end of the reach (Figure 2-1).

2.2. Topography

Maui, the second largest island in the state, is 48 miles long and 26 miles wide. The land area is 465,920 acres or 728 square miles. The island was formed through the merging of two volcanoes – the East Maui Volcano or Haleakala, and the West Maui Volcano. The island is divided into three main areas: West Maui, East Maui, and Central Maui (or the isthmus). West Maui is a deeply dissected volcano that rises to 5,788 feet at Puu Kukui. East Maui is dominated by the 10,025-foot Haleakala Volcano.

The study area is located in the watershed of the Wailuku River, which flows a distance of about 8 miles to the ocean down the northeast slope of the West Maui Mountains and across the isthmus. The isthmus that connects East and West Maui was created by a lava flow from Haleakala Volcano ponding against the older West Maui Volcano. About half the river length is in the West Maui Mountains with gradients of 2,000 feet per mile (38 percent). The lower half of the river is across the gently sloping isthmus on a gradient of 120 feet per mile (2.3 percent).

2.3. Geology and Soils

Iao Valley is an old caldera in the West Maui Mountains tapped by the Wailuku River and enlarged by erosion. The circular valley is deeply incised and was shaped by heavy rainfall runoff on comparably soft volcanic rock (basalt with varying amounts of olivine). Fast flowing streams carried the eroded material to the ocean and deposited a thick veneer of sedimentary deposits consisting of unconsolidated, stream-laid brown silt,

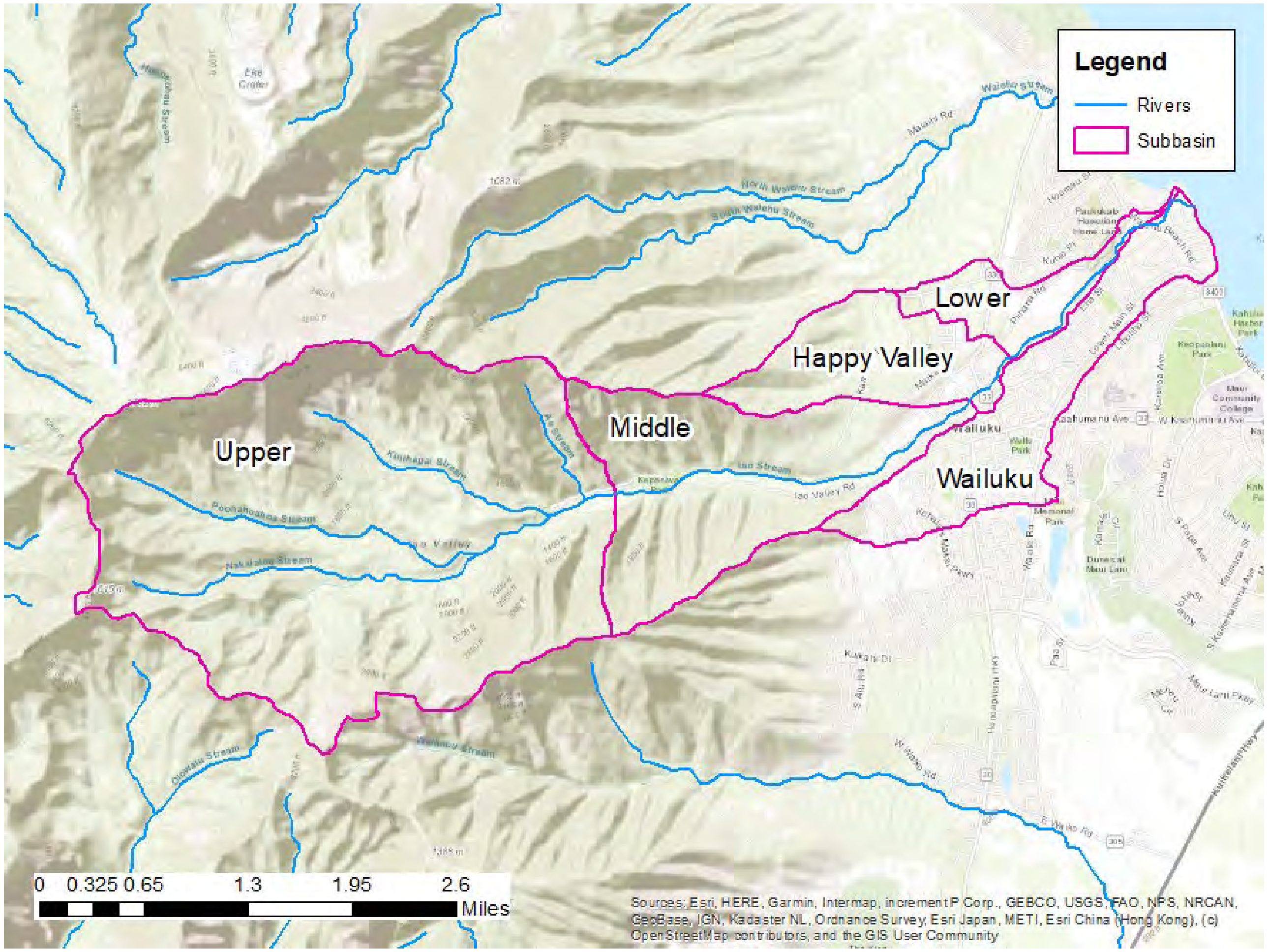


Figure 2-1: Subbasin Delineation and Identification

The "Wailuku" subbasin was delineated and included in this figure due to its very close proximity to Wailuku River, but it does not contribute flow to the river. Runoff flow from this subbasin generally flows northeast toward the ocean and away from the river.

Figure 2-2: Existing Project Features at the Iao Stream FCP

sand, and gravel. Toward the mountains, consolidated or partly consolidated fine-grained cream colored dunes composed calcareous sand, blown inland from ancient beach deposits, are found. The lower slopes of the mountains contain consolidated earthy deposits of mottled red-brown, deeply weathered, poorly sorted nearly impermeable and friable conglomerates that form conspicuous terraces. In the vicinity of Wailuku, the soil consists of clay, silt, and sand with varying amounts of gravel, cobbles, and boulders. The fine sandy silt is high in organic and is very productive (USACE, 1974).

2.4. Climate

Hawaii has a subtropical climate with temperatures that are mild and fairly uniform throughout the year. The mean annual temperature at Kahului, near Wailuku, is 73.2° Fahrenheit (F), with an average maximum of 81.9°F and average minimum of 64.5°F (Honolulu Weather Forecast Office, 2020). The

The climate of the Hawaiian Islands is characterized by a two-season year; a 5-month summer or dry season and a 7-month winter or wet season; mild and uniform temperatures, strikingly marked geographic differences in rainfall, generally humid conditions, and prevailing dominance of trade wind flow from the northeast. During the 5-month summer from May through September, trade winds prevail 80-95 percent of the time. During the 7-month winter from October through April, the prevalence of the trade winds decreases to 50-80 percent. Although the northeasterly trade winds produce most of the annual rainfall over the Hawaiian Islands, it is during the absence of these winds that the flood producing rainfall occurs. In particular, southerly winds bring moist warm air that creates “Kona” storms which produce the damaging floods in Hawaii. These storms usually occur during the winter months. The climate of the Iao Valley watershed is tropical with cooler and wetter areas at higher elevations in the belt of the northeasterly trade winds. The average monthly precipitation ranges from 3.35 inches in the wettest month (December) to 0.2 inches in the driest month (June) (U.S. Climate Data, 2017).

2.5. Channel Characteristics

The principal tributaries of the Wailuku River from most upstream to downstream are Nakalaloa Stream, Poohahoahoa Stream, Kinihapai Stream, and Ae Stream. With the exception of Ae Stream, these tributaries all merge with Wailuku River above the Iao Valley State Park. The Ae Stream tributary junction is between the Iao Valley State Park and the most upstream U.S. Geological Survey (USGS) streamflow gage (USGS Station 16604500). From the combined confluence of all these streams, the Wailuku River flows eastward through Wailuku to the Pacific Ocean.

Wailuku River can be described as four distinct reach segments:

1) The natural reach upstream of the federally constructed FCP;
2) The concrete-lined channel in the upper part of the FCP;
3) The middle section of the FCP that has a natural riverbed and some revetment along the right bank; and
4) The concrete-lined channel in the lower part of the FCP.

Only the second, third, and fourth reach segments are being evaluated in this study.

Table 2-1: Typical Channel Characteristics

Reach	Location	Type	Length (ft)	Bed Slope (%)	Shape	Bottom Width (ft)	Bank Slope	Bankfull Depth (ft)
1	Upstream of the FCP	Natural	12,300	4.8	Trapezoidal	40	4H:1V	9
2	Upper part of the FCP	Conc.	3,620	3.3	Trapezoidal Rectangular	80 50	1.5H:1V 0H:1V	4 7
3	Middle part of the FCP	Natural	6,870	2.4	Trapezoidal	35	1.5H:1V	8
4	Lower part of the FCP	Conc.	1,890	1.3	Rectangular	100	0H:1V	4

Photo 2-1: Looking upstream at Reach 1

Photo 2-2: Looking downstream at Reach 2

Photo 2-3: Looking downstream at Reach 3

Photo 2-4: Looking upstream at Reach 4

2.5.1. Historic Flood Events

Figure 2-2 shows annual peak flows for all recorded historic events at the stream flow gaging station along Wailuku River, near Market Street Bridge (USGS 16607000).

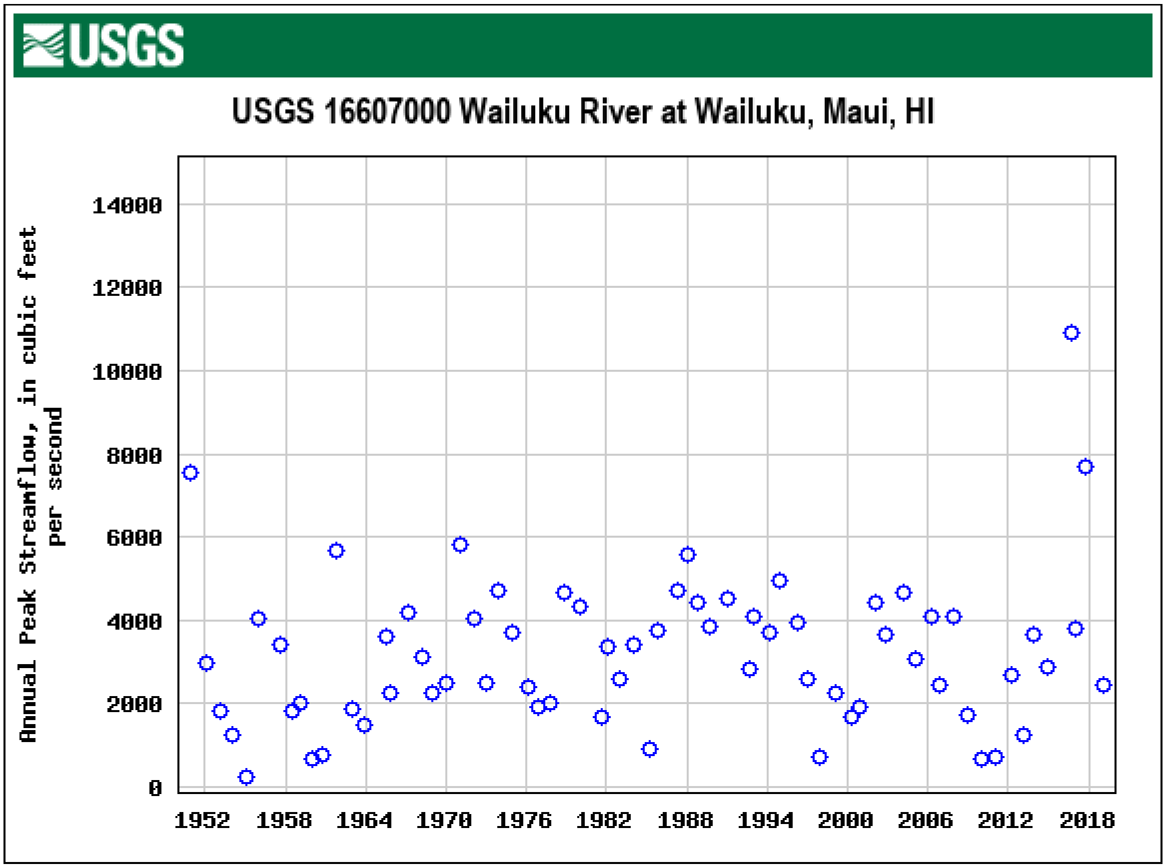


Figure 2-3: Peak stream flow at USGS 16607000

From Flood Insurance Study (FIS) 150003V001B, published by the Federal Emergency Management Agency (FEMA) in 2015:

> *There have been numerous floods on this stream since the early 1900s, many of which have inflicted heavy damage in terms of loss of life and property destruction. The most significant floods occurred in January 1916, November 1930, January 1948, December 1950, November 1961, and January 1971. Records for the years prior to 1903 are unavailable.*
>
> *The flood of 1916 was the worst flood to hit the area. Peak discharge was estimated to be 17,000 cfs at the Market Street bridge. Thirteen lives were lost, and 70 homes were demolished.*

The storm of December 1950 dumped 5 inches of rain in a 2-hour period, causing the stream to rise and overflow very rapidly. The discharge was estimated to be 7,550 cfs. Residences, commercial properties, crops, and other private property were damaged. This flood resulted in the loss of one life and $130,000 worth of damage.

The flood of November 1961 resulted in an estimated $95,000 in damage to homes, sugarcane fields, and public and commercial properties. This flood occurred after the county had constructed flood-control structures near the Market Street bridge between 1951 and 1955.

In January 1971, heavy rains resulted in flooding along the stream's right overbank. The discharge was estimated to be 5,280 cfs.

In addition to flooding in the immediate stream area, flooding from sheetflow is a problem. The areas near the intersection of Keanu Street and State Highway 30 and the Kahookele Street area across from Wailuku Elementary School are constant problems. Water is either pumped out or seeps into the ground.

In February 1965, the area bounded by Waiale Road, Kaahumanu Avenue, and Spreckels Ditch was flooded with several feet of water. Sheetflow through the downtown area and overflow from the ditch caused this flood.

Tsunami flooding occurred in May 1960, when waves of 15 feet were reported in this area, causing damage of nearly $750,000 (USACE, 1971; University of Hawaii, 1976; State of Hawaii, April 1973).

In September 2016, an upper level low pressure system moving over the state brought heavy rains, which resulted in significant debris and flood flows on the river. The resulting flood wave and debris flows caused significant channel changes and property damage upstream of the Iao Stream FCP. Debris completely filled and overtopped the project's debris basin. Damage to the levees from erosion and scour occurred as a result of high velocity flows and debris movement. The USGS computed a peak streamflow of 10,900 cfs at the lower stream gage, USGS 16607000, using indirect methods; this gage was significantly damaged during the event. This is the highest peak streamflow recorded since the gage was installed in 1951. Photos showing the resulting damages from this event are provided in Photo 2-5 through Photo 2-11.

A cold front storm in October 2017 resulted in a peak flow of 7,690 cfs at the lower stream gage, USGS 16607000. There were no reports of flooding or damages to the project.

Hurricane Lane (August 2018) and Tropical Storm Olivia (September 2018) were not particularly significant events for this watershed.

Photo 2-5: Large boulders were activated in the September 2016 flood, near Iao Valley Road Bridge

Photo 2-6: Geomorphic changes near Ua Place (September 2016)

Photo 2-7: Debris basin filled to capacity, Iao Stream FCP (September 2016)

Photo 2-8: Toe erosion along Levee E, post-flood (September 2016)

Photo 2-9: Looking downstream at Levee D's eroded bank, post-flood (September 2016)

Photo 2-10: Bank and revetment failure at Levee D/C, post-flood (September 2016)

Photo 2-11: Undermining at Revetment X (September 2016)

2.6. Future Condition of the Existing Project

In the next fifty years, the channel could incise as much as 20 feet in some locations from its original invert elevations in 1981[1]. While the nonfederal sponsor has been patching undermined revetment with shotcrete in the past, such extreme levels of incision would require a more significant action. The most critical locations where failure of a federally constructed feature is likely to occur are 1) where the upper concrete channel transitions to the natural reach near River Station (RS) 91+50, 2) the right bank segment between RS 75+00 and RS 60+00, better known as "Levee D" and "Levee C," and 3) the concrete channel constriction within the natural reach known as "Revetment X," located between RS 59+00 and 49+00.

Nonfederal areas not directly addressed by this study, but likely to fail in the next 50 years, include – but are not limited to – the unlined bank upstream of Levee E that continues to erode the foundation material of an adjacent property, and 2) the abandoned Imi Kala Street Bridge whose foundation would collapse with further channel incision. Addressing these issues directly is beyond the scope of this study and authorized project. However, there is an ongoing study by the County of Maui to evaluate alternatives to protect the eroded bank upstream of Levee E. While Imi Kala Street Bridge remains abandoned, it carries sewer and water lines to homes behind Levee G and likely would be replaced as part of future development – serving as a main road to a future subdivision area. There are no certain plans for replacement of the bridge currently, just occasional interest by developers.

2.6.1. Upper Concrete Channel

As the stream attempts to achieve dynamic equilibrium and a shallower slope in the natural reach, a significant head cut has formed just downstream of the upper concrete channel (RS 91+50). The drop is currently 6 to 8 feet and the boulder-concrete invert has already experienced failure as a result of progressive undermining (Photo 2-12). As the lined channel slope is already very shallow (< 0.1%), the failure of the invert at this site is primarily caused by scour of the foundation material. Channel incision of the natural reach increases the exposure of the foundation material. The sudden change in channel bed

[1] In the past 40 years, the channel has incised 8 feet = 0.2 ft/yr. In another 50 years, at the same rate, the channel could incise an additional 10 feet, for a total of 18 feet (rounded to 20 feet).

elevation creates a natural drop structure, causing turbulent (erosive) waters. As the foundation material of the lined channel is eroded by the turbulent waters, a toppling failure of the boulder-concrete invert follows (Figure 2-3). Conservatively, a plane of failure of 2H:1V was assumed (e.g. a change in bed elevation of 7 feet would compromise 14 feet of invert upstream). If left unaddressed, the entire channelized reach would eventually be compromised. An estimated timeline of damages and extent of repairs is summarized below in Table 2-2.

Photo 2-12: Existing head cut at the Iao Stream FCP, RS 91+50

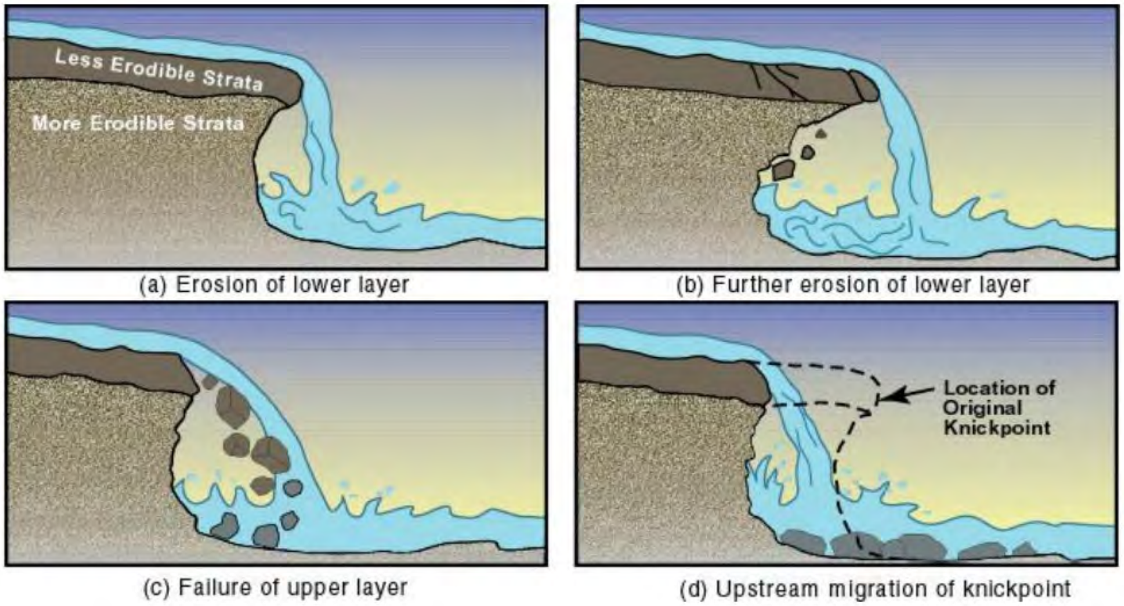


Figure Source: (Papanicolaou, Wilson, Dermisis, Thomas, & Elhakeem, 2008)

Figure 2-4: Knickpoint Migration (Progression of Failure)

Table 2-2: Life Cycle Analysis for the Upper Concrete Channel

Year	Condition	Action
0 (Present Day)	7-ft vertical drop; compromised channel invert (eroded foundation) up to 14 ft upstream	14 ft of channel invert repair
10	9-ft vertical drop; compromised channel invert (eroded foundation) up to 18 ft upstream	18 ft of channel invert repair
25	11-ft vertical drop; compromised channel invert (eroded foundation) up to 22 ft upstream	22 ft of channel invert repair
50	15-ft vertical drop; compromised channel invert (eroded foundation) up to 30 ft upstream	30 ft of channel invert repair

2.6.2. Levee D and C

Levees D and C have previously experienced bank failure and are likely to experience bank failure again in the next 50 years. Continuous erosion of the levee toe from smaller events is partially responsible for putting these levees at risk of failure from larger events; however, these smaller, infrequent events are not likely to result in bank failure by themselves over time as it is assumed the County of Maui will continue making repairs periodically and as needed.

Table 2-3: Life Cycle Analysis for Levee D and C

Year	Condition	Action
0 (Present Day)	Slightly undermined levee toe	Levee toe repair – application of shotcrete to the levee toe
10	20% bank failure and levee breach	Bank restoration – placement of fill and loose riprap; shotcrete application
25	50% bank failure and levee breach	
50	100% bank failure and levee breach	

Photo 2-13: Minor undermining of levee toe and Levee C

2.6.3. Revetment X

The dramatic channel incision and continuous undermining within the vicinity of Revetment X has been a constant challenge for the nonfederal sponsor to address. Failure of Revetment X in its current state is inevitable, and on the left bank – perhaps even desirable. Removal of the left bank segment would provide the river with more flexibility to meander, as needed, to achieve dynamic equilibrium. The high velocity flows that are a result of the channel constriction are likely to incise the channel an additional 10 feet within the next 50 years, requiring costly repairs by the nonfederal sponsor.

Table 2-4: Life Cycle Analysis for Levee D and C

Year	Condition	Action
0 (Present Day)	Slightly undermined revetment	Application of shotcrete at the toe, as needed
10	2 ft channel incision, undermining	Increased application of shotcrete at the toe
25	5 ft channel incision, bank failure	Bank restoration on the right bank
50	10 ft channel incision, bank failure	Bank restoration on the right bank; removal of severely undermined portions of revetment on the left bank

Photo 2-14: Revetment X, September 2016, Post-Flood

2.7. Levee Breach

During the September 2016 flood event (Section 2.5.1), Levee D and C experienced approximately 80% bank failure. This event was estimated to have a 2.5% (1/40) AEP frequency. It was then projected that complete bank failure and a levee breach would occur during the 2% (1/50) AEP flood event, as summarized in Table 2-5 and presented in Figure 2-4.

Table 2-5: Summary of Levee Breach Analysis

AEP	AEP	Failure (%)	Comment
0	0	0	There is no risk of bank failure without flood waters (0% AEP)
0.025	1/40	80	During the September 2016 flood, bank failure was approximately 80% at Levee C
0.02	1/50	100	Therefore, 100% bank failure is likely to occur during the 0.2% (1/50) AEP event.

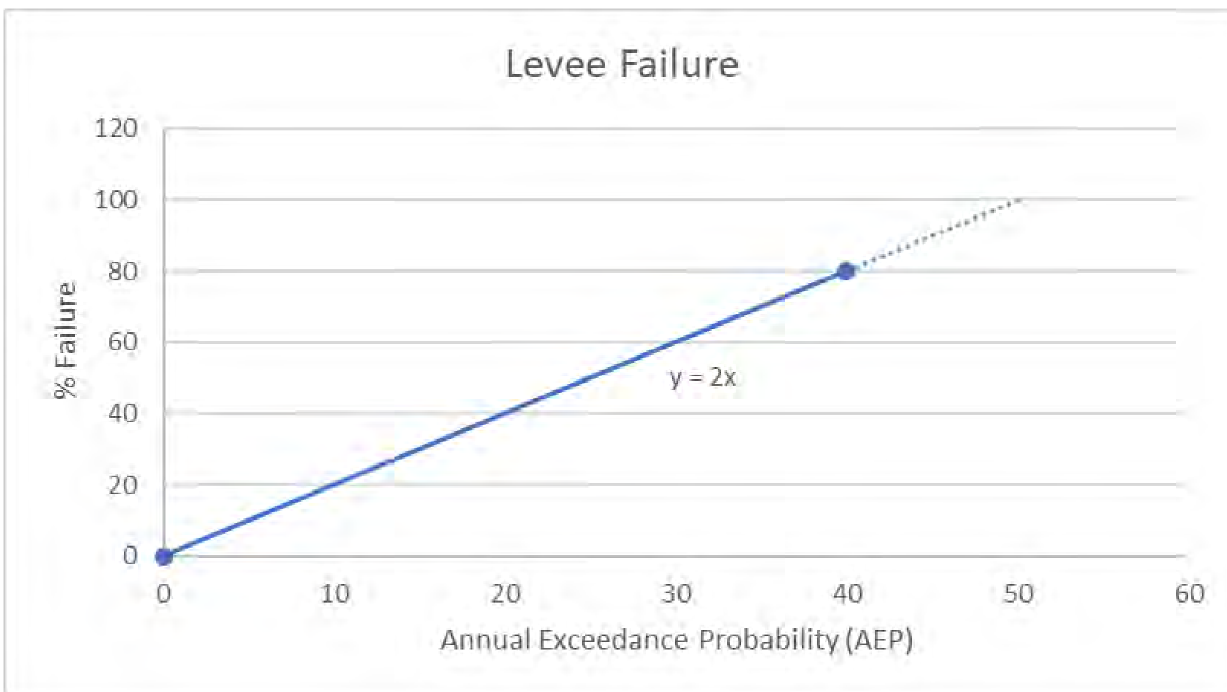


Figure 2-5: Levee Failure Curve

3. Geographic Information Systems Data

3.1. Datum and Projection

The datum and projection for this study is as follows:

Horizontal projection: State Plane Zone 2 (US Survey Feet)

Horizontal datum: NAD83 (PA11)

Vertical Datum: Local Tidal Datum – MSL

Tidal Epoch: 1983 – 2001

Geoid: 2012B

3.2. Elevation

The following sources of elevation data were used in this study:

Table 3-1: Elevation Data Type and Sources

Survey year	Agency	Data type	Location
2017	USACE	LiDAR	Upper Wailuku River
2013	USACE & JALBTCX	LiDAR	Lower Wailuku River
2011	County of Maui	LiDAR	Upper and Lower Wailuku River
2005	NOAA	IfSAR	Maui

Light Detection and Ranging (LiDAR) data were also collected by USACE and the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) in 2013. This data includes hydrograph and topographic data depicting elevations above and below the immediate coastal water [available at coast.noaa.gov/dataviewer]. The vertical height of the Topobathy LiDAR data set was in Local Mean Sea Level (LSML). The data set has a vertical accuracy of 0.1 m and a horizontal accuracy of 1 m. The selected projection is State Plane Zone 5102 Hawaii 2. Horizontal coordinates reference the North American Datum of 1983 (NAD83) in U.S. Feet. The vertical control datum is based on Hawaii GPS-derived orthometric height (ft). This projection coordinate was adopted for all the final shapefiles and other GIS features used in this project. The extent of this data is from the mouth of the stream to about 13,500 feet upstream.

In 2017, the USACE Engineering Research and Development (ERDC), Coastal and Hydraulics Laboratory (CHL) conducted a topographic LiDAR data collection along the Wailuku River from Iao Valley State Park to the federal debris basin, bank to bank. The vertical datum and horizontal coordinate system are the same as the 2013 LiDAR collected (LMSL and NAD83). The units are also in ft. The implied horizontal accuracy is +/- 10 ft; the implied vertical accuracy is +/- 0.2 ft.

Additionally, LiDAR data was provided by the County of Maui to the Honolulu District in the form of .xyz files in 2011.

Areas within the study area that were not covered by LIDAR were supplemented using Interferometric Synthetic Aperture Radar (IfSAR) data collected by the National Oceanic and Atmospheric Administration (NOAA)'s Office for Coastal Management (OCM) in 2005. This data, which was provided in the form of a Digital Terrain Model (DTM), has a vertical accuracy of 1 m and a horizontal accuracy of 2 m or better in areas of unobstructed flat ground. Horizontal coordinates reference NAD83 UTM Zone 4N in meters. The vertical coordinate system is the GRS80 Ellipsoid, which theoretically represents MSL and therefore was not adjusted.

3.3. Imagery

High resolution imagery used for background mapping of the study area is from the National Geospatial-Intelligence Agency and the USGS. World Imagery, provided by Esri, was used for larger scale background mapping, such as when it was necessary to show the entire island of Guam.

3.4. Land Cover and Land Use

A general land cover and land use raster was developed by OCM in 2005 based upon high resolution (1 to 5 meter) aerial and satellite imagery; a detailed land cover raster was developed in 2010. These rasters were used to compute the directly connected impervious areas for the rainfall-runoff model (Section 4.2) and to create the Manning's n layer in the hydraulic model, respectively.

4. Development of the Rainfall-Runoff Model

A rainfall-runoff model was developed using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS) software (version 4.7, 2020). This model was created to estimate discharge-frequency relationships at key points in the study area. The loss method used was the Initial and Constant method, which was determined by using initial conditions from soil information provided by the Hawaii Soil Atlas. The transform method was Clark's unit hydrograph method. Muskingum-Cunge routing was selected for the routing reach method. This method lends itself to circumstances where limited observed data is available.

4.1. Basin, subbasin and river delineation

GIS data were used to delineate the basin, subbasins and the river. The basin was divided into four subbasins based on three key locations in the watershed: 1) the USGS stream gage located at Kepaniwai Park (16604500), 2) the USGS stream gage located near Market Street Bridge (16607000), and 3) the confluence where an unnamed tributary joins Wailuku River near "Levee G." Drainage areas and centroid locations for each subbasin are provided in Table 4-1. The HEC-HMS model layout, which identifies the four subbasins and three key locations (junctions) is provided as Figure 4-1.

Table 4-1: Subbasin identification and information

Subbasin name	Drainage area (mi^2)	Centroid location	
		Latitude	Longitude
Upper	6.12	20.879013	-156.564577
Middle	2.00	20.883392	-156.528158
Happy Valley	0.891	20.894216	-156.514538
Lower	0.465	20.900246	-156.500362

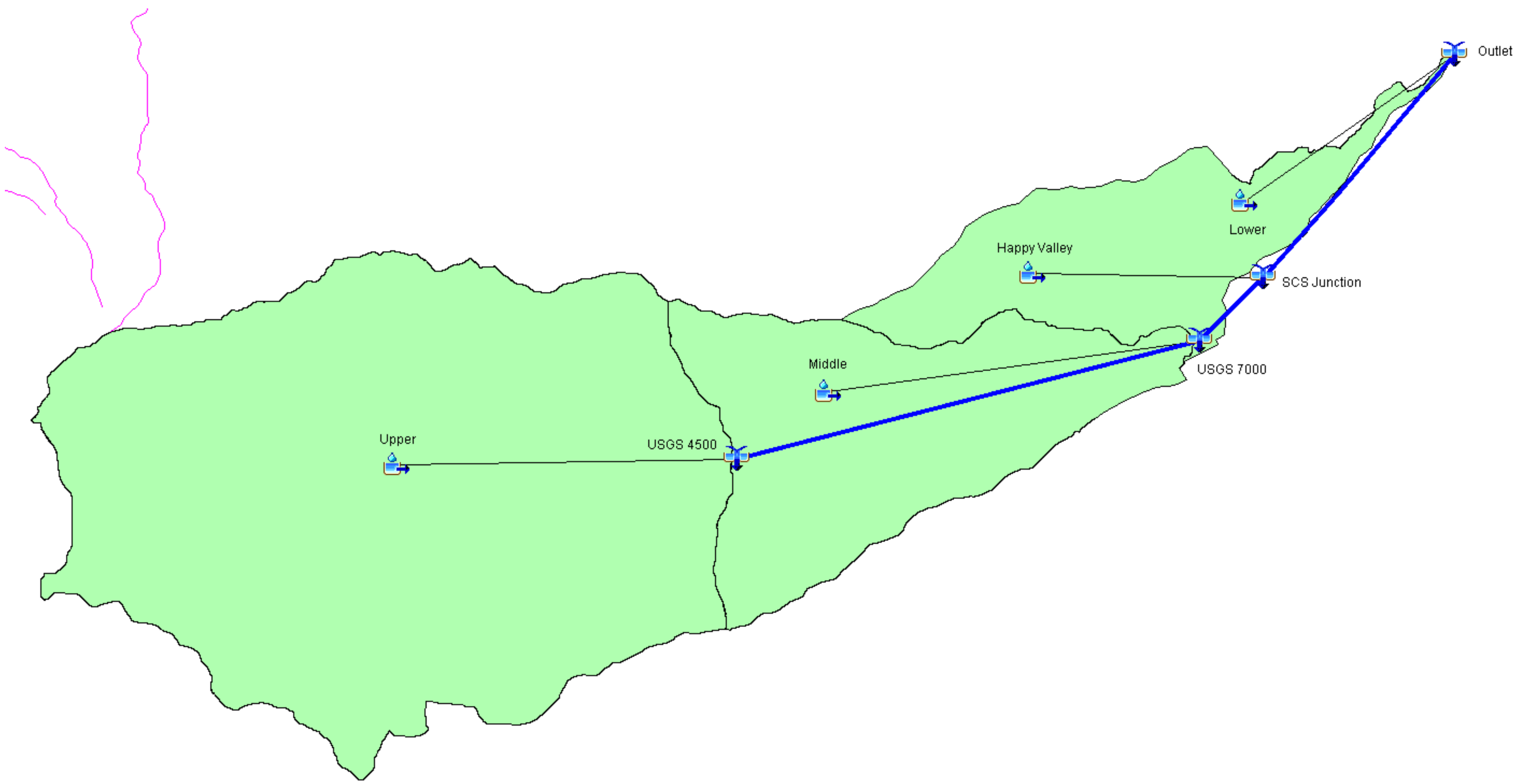


Figure 4-1: HEC-HMS Model Layout

4.2. Initial estimation for loss parameters

The initial and constant loss methods were applied to the model to account for precipitation loss due to infiltration. This approach uses three parameters: initial loss, constant rate, and percent impervious area. The initial loss, the amount of precipitation lost to the soil at the beginning of the rainfall event, depends on the saturation of the soil and varies for each event. 0.1 inches of precipitation was assumed to be the initial loss due to absorption of the soil.

The constant loss rates were determined using soil data from the Hawaiʻi Soil Data Atlas, an interactive and online tool for providing basic information about each soil type (University of Hawai'i, 2014). Each soil type had previously been classified by their saturated hydraulic conductivity (Ksat) as either slow (< 3 micrometers per second; µm/s), moderate (3 to 10 µm/s), fast (10 to 100 µm/s), or very fast (> 100 µm/s). Only fast and moderate soil types were found in the study area. A geospatial shapefile provided by the Hawaiʻi Soil Data Atlas was used to compute a weighted average Ksat for each subbasin, and then converted to the appropriate units – inches per hour (in/hr). Results are provided in Table 4-2.

Table 4-2: Initial constant loss rates

Subbasin	Saturated hydraulic conductivity, Ksat (µm/s)	Constant loss rate (in/hr)
Upper	28.0	3.97
Middle	23.7	3.36
Happy Valley	9.26	1.31
Lower	22.7	3.22

NRCS's Technical Release 55 (TR-55) identifies typical percentages of directly connected impervious areas (DCIA) for various land cover types. A land cover raster (Section 3.4) was used to compute the weighted average DCIA based on the various land cover classifications (Table 4-3) within each subbasin. Results are provided in Table 4-4.

Table 4-3: Directly connected impervious areas by land cover type

Land cover	Directly connected impervious area (%)
Developed, Open Space	< 20
Developed, Low Intensity	20 – 49
Developed, Medium Intensity	50 – 79
Developed, High Intensity	80 – 100

Table 4-4: Directly connected impervious areas for each subbasin

Subbasin	Directly connected impervious area (%)
Upper	0.04
Middle	3.33
Happy Valley	12.1
Lower	6.59

4.3. Initial estimation for transform parameters

The excess precipitation in each subbasin was transformed into surface runoff by applying the Clark Unit Hydrograph method in the hydrologic model. This method requires two input parameters for each subbasin: the time of concentration (t_c) and the storage coefficient (R). The time of concentration, or the time it takes for runoff to travel from the most distant point in the watershed to the outlet, was calculated in accordance to the TR-55 manual's guidance. The TR-55 method breaks the surface flow in the watershed into three flow regimes (NRCS, Conservation Engineering Division, 1986). As water travels along the longest flow path in the subbasin, it is transformed from sheet flow (see Table 4-5), to shallow concentrated flow (see Table 4-6), to open channel flow (see Table 4-7).

A time value is calculated for each flow regime. The time of concentration of a watershed is calculated by summing the travel time of flow through each of these flow regimes. GIS was used to determine the longest flow path, slope, and flow length of each subbasin. Representatives channel cross-sections were estimated from the LiDAR data (Section 3.2) and as-built drawings for the project. Additional data required for the

TR-55 method, such as the 2-yr, 24-hour rainfall, were entered based on precipitation frequency estimates published in NOAA's Precipitation Frequency Data Server (2017). The computed travel times for each subbasin are presented in Table 4-8.

Table 4-5: Sheet flow characteristics

Subbasin	Manning's *n*, overland	Sheet flow length (ft)	Land slope (ft/ft)	2-yr, 24-hr rainfall (in)	t_c, sheet (hrs)
Upper	0.16	130	0.292	9.40	0.042
Middle	0.10	145	0.245	5.84	0.043
Happy Valley	0.16	164	0.480	4.72	0.059
Lower	0.04	92	0.084	4.21	0.026

Table 4-6: Shallow flow characteristics

Subbasin name	Surface description	Shallow flow length (ft)	Watercourse slope (ft/ft)	Average velocity (ft/s)	t_c, shallow (hrs)
Upper	Unpaved	2,530	1.03	16.4	0.043
Middle	Unpaved	2,210	0.800	14.4	0.043
Happy Valley	Unpaved	983	0.671	13.2	0.021
Lower	Unpaved	7,230	0.059	3.92	0.512

Table 4-7: Channel flow characteristics

Subbasin	Cross sectional flow area (ft^2)	Wetted perimeter (ft)	Hydraulic radius (ft)	Channel slope (ft/ft)	Manning's *n*, channel	Velocity (ft/s)	Flow length (ft)	t_c, channel (hrs)
Upper	278	63.5	4.38	0.126	0.045	31.5	18,200	0.160
Middle (1)	112	47.5	2.35	0.393	0.050	33.5	3,190	0.026
Middle (2)	78.8	8.29	9.50	0.039	0.040	33.0	11,900	0.100
Happy Valley (1)	39.8	19.6	2.03	0.200	0.040	26.7	4,260	0.044
Happy Valley (2)	50.0	20.0	2.50	0.082	0.030	26.2	5,640	0.060
Lower	288	49.5	5.83	0.019	0.030	22.2	4,080	0.051

Table 4-8: Initial times of concentration, t_c

Subbasin	Time of concentration, t_c (hrs)
Upper	0.246
Middle	0.212
Happy Valley	0.184
Lower	0.590

The Clark Unit Hydrograph storage coefficient, R, accounts for storage in the watershed. This parameter was determined using a mathematical relationship between the longest flow path, drainage area, and time of concentration. An equation was adopted from the “Drainage Design Manual for Maricopa County” (Flood Control District of Maricopa County, 2013) for use in this study. While there may not be many similarities between Maricopa County and Maui County, this equation provides a consistent way to estimate a highly variable parameter. The estimates were adjusted during the hydrologic model calibration. The equation used is as follows:

$$R = 0.37T_c^{1.11}A^{-0.57}L^{0.80}$$

R: Storage coefficient

T_c: Time of concentration (hours)

A: Drainage area (square miles)

L: Length of flow path (miles)

The initial values for this parameter are summarized in Table 4-9.

Table 4-9: Initial storage coefficients

Subbasin Name	Area (mi^2)	Length of flow (mi)	Storage coefficient, R
Upper	6.12	3.94	0.083
Middle	2.00	3.30	0.116
Happy Valley	0.891	2.09	0.109
Lower	0.465	2.16	0.589

4.4. Subbasin Baseflow

The *recession* baseflow method was selected, which is appropriate for short-term, event-based simulations. Initial discharges were set for each calibration event based on the first flows in the observed record. The recession constant and ratio were determined during the calibration process to provide the best fit between the observed and simulated hydrographs.

4.5. Reach Routing and Loss Parameterization

Muskingum-Cunge routing was selected for the reach routing method because it is based on physical parameters such as channel shape, routing reach length, and surface roughness (Manning's *n* value). Muskingum-Cunge routing lends itself to circumstances where limited observed data is available. Routing reaches for each subbasin were determined based on landform slope and channel shape. A typical cross-section of either trapezoidal, rectangular, or triangular shape was entered based on the land surface representative of the reach. The reach length, slope, and cross sections were estimated using field estimates and the terrain model constructed from the LiDAR measurements. Channel loss within the reach was assumed to be negligible. The routing parameters for Wailuku River are presented in

Table 4-10 for the four reaches initially described in Section 2.5.

Table 4-10: Routing parameters for HEC-HMS reaches

Reach name	Channel Type	Length (ft)	Slope (ft/ft)	Manning's roughness coefficient, n		
				Left bank	Channel	Right bank
Reach 1	Natural	9700	0.042	0.065	0.045	0.065
Reach 2	Concrete	3,620	0.033	0.080	0.030	0.080
Reach 3	Natural	6,870	0.024	0.050	0.040	0.080
Reach 4	Concrete	1,890	0.013	0.080	0.030	0.080

Manning's roughness coefficients were based on knowledge of the constructed invert type, observations made in the field over multiple site visits, and photographs taken from various USACE personal over the years. Some photographs are provided in Section 2.5. While concrete channels typically have a roughness coefficient, *n*, of 0.013 to 0.015, most of the constructed invert is a rougher boulder-concrete that typically has some debris (loose cobbles, boulders). Therefore, 0.030 was selected as the roughness coefficient for the lined portion of the project. Conditions of the unlined portions were compared with described roughness conditions and corresponding roughness coefficients published by Ven Te Chow in 1959.

4.6. Model Calibration

Instantaneous (continuous) rainfall data from USGS 205327156351102 (-51102), instantaneous streamflow data from USGS 16604500, and peak streamflow data from USGS 16607000 were used to calibrate the hydrologic model.

4.6.1. Rainfall Data

Data was available at one USGS and four NOAA rain gages within or near the study area. These gages are listed in Table 4-11. with those providing instantaneous data in 15-minute intervals highlighted in yellow. The rainfall gage at Puu Kukui (USGS -51102) was ideally located near the top of the watershed; unfortunately, this site has very limited historical record for instantaneous data of only 16 years (2005 – 2021). The model was calibrated to five large events, which occurred in Water Year 2008, 2014, 2016, 2018, and 2021 (Section 2.5.1). Other rainfall gages located within or near the study area were not ideally located and did not have overlapping data with the station at Puu Kukui. Therefore, it was not possible to develop a synthetic hyetograph for other historical events that could be validated.

Table 4-11: USGS and NOAA rain gage stations

Agency	Site ID / Site Number	Site Name	Period of Record	Datum of gage (ft above LMSL)	Latitude	Longitude
USGS	2053271563 51102	380.0 Puu Kukui Rain Gage at alt 5,771 ft, Maui, HI	2005 – 2021	5,771	20°53’27”	-156°35’11”
NOAA	COOP: 512208	IAO NEEDLE 387.2, HI US	1965 – 1978	1,079	20°52’60”	-156°33’0”
NOAA	COOP: 519376	WAIKAPU 390, HI US	1916 – 2004	483	20°51’13”	-156°30’32”
NOAA	WUKH1	Wailuku (HI66)	1994 – 2008	Unknown	20°53’49” [1]	-156°30’47”[1]
[1]: location approximated based on aerial imagery						

Mountains in the upper watershed force the persistent northeasterly flow (tradewinds) to ascend upward and cool, leading to greater precipitation in the upper watershed. In calibrating the HEC-HMS model, the instantaneous rainfall record at USGS -51102 was used as input for the "Upper" subbasin and a reduced hyetograph of this same record was used for the "Middle" subbasin. The hyetograph was reduced approximately 35%. This number was determined based on the reduced amount of total rainfall estimated by NOAA for the 1% AEP, 24-hour storm at each centroid location of the Upper and Middle" subbasins: 23.7 and 15.5 inches, respectively (NOAA, 2017).

4.6.2. Streamflow Data

Two USGS stream gages are referenced for this project: USGS 1605600 and USGS 16607000 (Table 4-12). USGS 16604500 is located along Wailuku River near Kepaniwai Park. This gage records instantaneous streamflow data at 15-minute intervals for a period of record of approximately 27 years. The second gage, USGS 16607000 is located further downstream near the Market Street Bridge. This gage provides peak flow data, but not continuous streamflow data. Its period of record is 71 years.

Table 4-12: USGS stream gage stations near the study area

Site Number	Site Name	Data Type and Period of Record	Drainage Area (sq. mi.)	Latitude[1]	Longitude[1]
16604500	Wailuku River at Kepaniwai Park, Maui, HI	Peak Flow: 1983 – 2021 Instantaneous: 1994 – 2021	6.13	20°52’56.6”	156°32’21.4”
16607000	Wailuku River at Wailuku, Maui, HI	Peak Flow: 1950 – 2021	8.11	20°53’25.8”	156°30’17.7”

[1]: coordinates based on NAD83

4.6.3. Calibrated Parameters

For each of the four historic events that were used to calibrate the model, a specified hyetograph from a single rain gage was used to simulate the precipitation in the model. The hyetographs and calibrated hydrographs for each event are presented in Figure 4-2 through Figure 4-5.The final optimized parameters for the “Upper” subbasin, whose outlet corresponds with the streamflow gage near Kepaniwai Park (USGS 16604500), are presented in Table 4-13.

On September 13, 2016, USGS 16604500 was destroyed by the flood. USGS has indicated that the peak flow is likely higher than the final values recorded by this gage during that event. This was also taken into consideration during calibration of the model. A comparison of the simulated and observed peak discharges at this gage, and the percent difference, for all three events are presented in Table 4-21.

The Nash-Sutcliffe model efficiency (NSE) coefficient is used to assess the predictive power of hydrologic models. This number can range from -∞ to 1. Typically, an NSE between 0.75 to 1.00 is a very good fit, between 0.64 to 0.74 is a good fit, between 0.50 to 0.64 is a satisfactory fit and less than 0.50 is an unsatisfactory fit (Moriasi, et al., 2007). An efficiency of 1 corresponds to a perfect match of the simulated discharge to observed data. The NSE coefficients for each storm event at the two stream flow gages are also included in the tables that follow.

Percent Bias (PBIAS) has also been included as a secondary performance metric indicative of calibration. PBIAS measures the average tendency of the simulated data to be larger or smaller than their observed counterparts. The closer the percentage value is to zero (0%), the better the calibration is. Typically, a percent bias of less than 10% is very good, between 10 to 15% is good, and between 15 to 25% is fair (Moriasi, et al., 2007). Positive values indicate under-estimation bias, and negative values indicate over-estimation bias. The allowable bias in this study is +/- 35%.

Percent difference was used to compare the simulated and observed peak discharges at both stream gages. A percent difference of 5% or less was acceptable in this study.

Figure 4-2: Comparison of the simulated and observed hydrographs near USGS 16604500 for the December 2007 flood

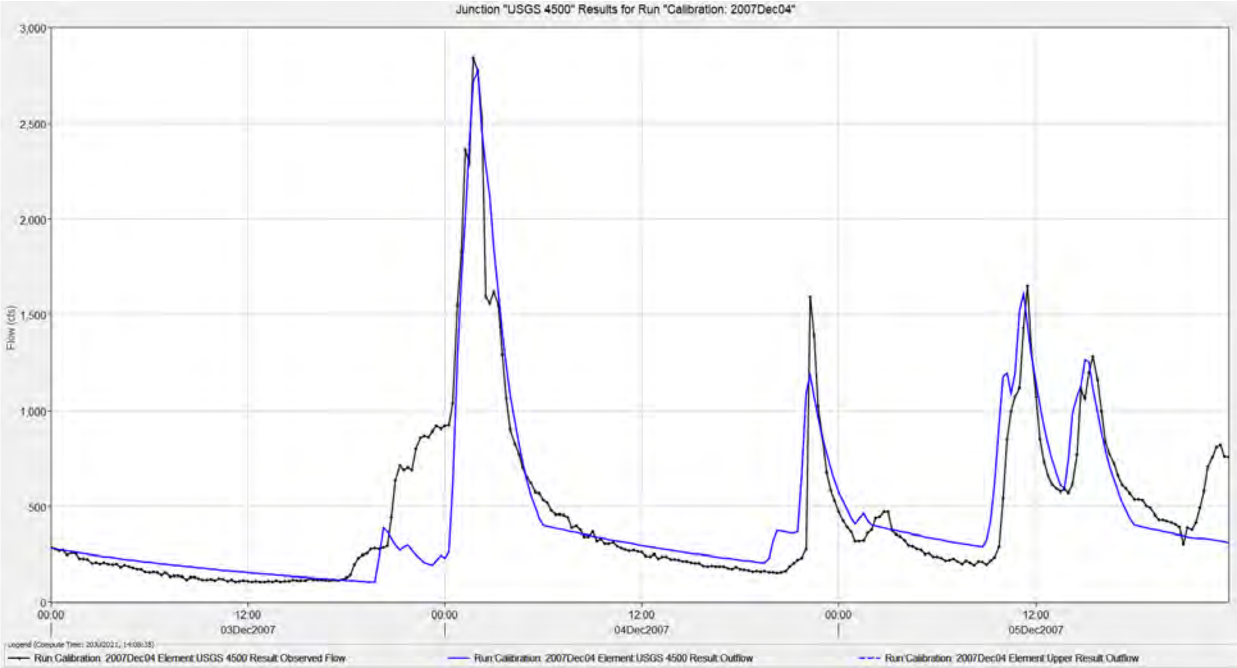


Table 4-13: Initial and optimized parameters at the "Upper" subbasin for the December 2007 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R	Nash-Sutcliffe	Percent Bias
Initial	0.1	3.97	0.246	0.083	--	--
2007 Dec	0.1	0.447	0.304	1.77	0.807	-4.71%
% change:	*0%*	*-88.7%*	*23.6%*	*2,033%*		

The baseflow parameters selected during calibration were 280 ft^3/s for the *initial discharge*, 0.209 for the *recession constant*, and 0.147 for the *ratio to peak*.

Both performance metrics (Nash-Sutcliffe and Percent Bias) indicate the model is well calibrated to the observed record at USGS 16604500. With the "Upper" subbasin parameters established, the "Middle" subbasin parameters were then adjusted to match the recorded flow at USGS 16607000. To meet this observed flow, the loss and transform parameters were initially adjusted by the same percent change as the upper parameters. The storage coefficient, R, was then adjusted further as the primary calibration variable.

Table 4-14: Initial and optimized parameters at the "Middle" subbasin for the December 2007 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R
Initial	0.1	3.36	0.212	0.116
2007 Dec	0.1	0.380	0.262	0.98
% change:	*0%*	*-88.7%*	*23.6%*	*745%*

The resulting percent difference between the observed and simulated hydrographs are both below 5%, as presented in Table 4-15, indicating the model is also well calibrated for this subbasin.

Table 4-15: Simulated peak discharges versus observed data for the December 2007 flood

USGS Gage	Simulated (ft^3/s)	Observed (ft^3/s)	Percentage difference (%)
16604500	2,810	2,840	1.06
16607000	4,099	4,100	0.024

Figure 4-3: Comparison of the simulated and observed hydrographs near USGS 16604500 for the November 2013 flood

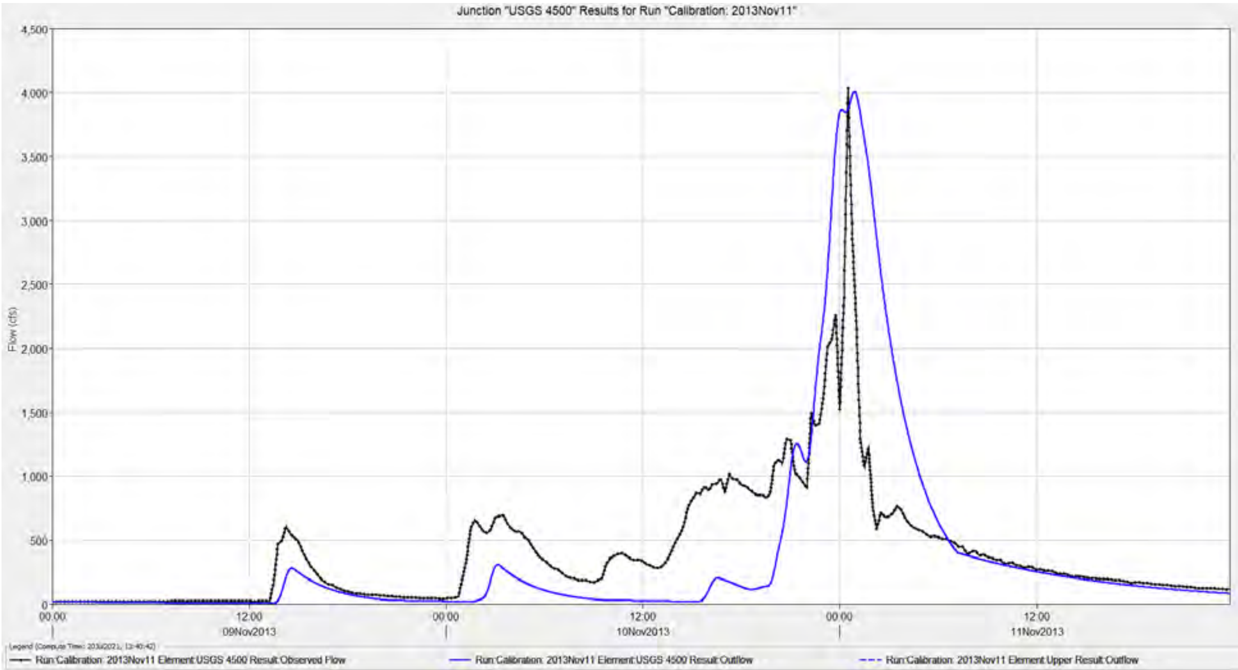


Table 4-16: Initial and optimized parameters at the "Upper" subbasin for the November 2013 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R	Nash-Sutcliffe	Percent Bias
Initial	0.1	3.97	0.246	0.083	--	--
2013 Nov	1.3	0.40	0.80	2.50	-0.150	-6.09%
% change:	*1200%*	*-89.9%*	*225%*	*2,912%*		

The baseflow parameters selected during calibration were 20 ft^3/s for the *initial discharge*, 0.1 for the *recession constant*, and 0.1 for the *ratio to peak*.

While the Percent Bias performance metric considers the calibration very good, the Nash-Sutcliffe efficiency is a less than satisfactory fit. Additionally, the upper gage (USGS 16607000) recorded a higher peak flow than the lower gage (USGS 16604500), which is not typical for this river system. The resulting percent difference between the observed and simulated peak flow at the lower gage was 29.4%, which is beyond what is allowed (Table 4-18). For these reasons, this calibration event was considered invalid and not used in determining the final dataset of optimized parameters.

Table 4-17: Initial and optimized parameters at the "Middle" subbasin for the December November 2013 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R
Initial	0.1	3.36	0.212	0.116
2007 Dec	1.3	0.4	0.862	5.171
% change:	*1200%*	*-88.1%*	*307%*	4,358%

Table 4-18: Simulated peak discharges versus observed data for the November 2013 flood

USGS Gage	Simulated (ft^3/s)	Observed (ft^3/s)	Percentage difference (%)
16604500	4,004	4,030	0.65
16607000	4,908.5	3,650	29.4

Figure 4-4: Comparison of the simulated and observed hydrographs near USGS 16604500 for the September 2016 flood

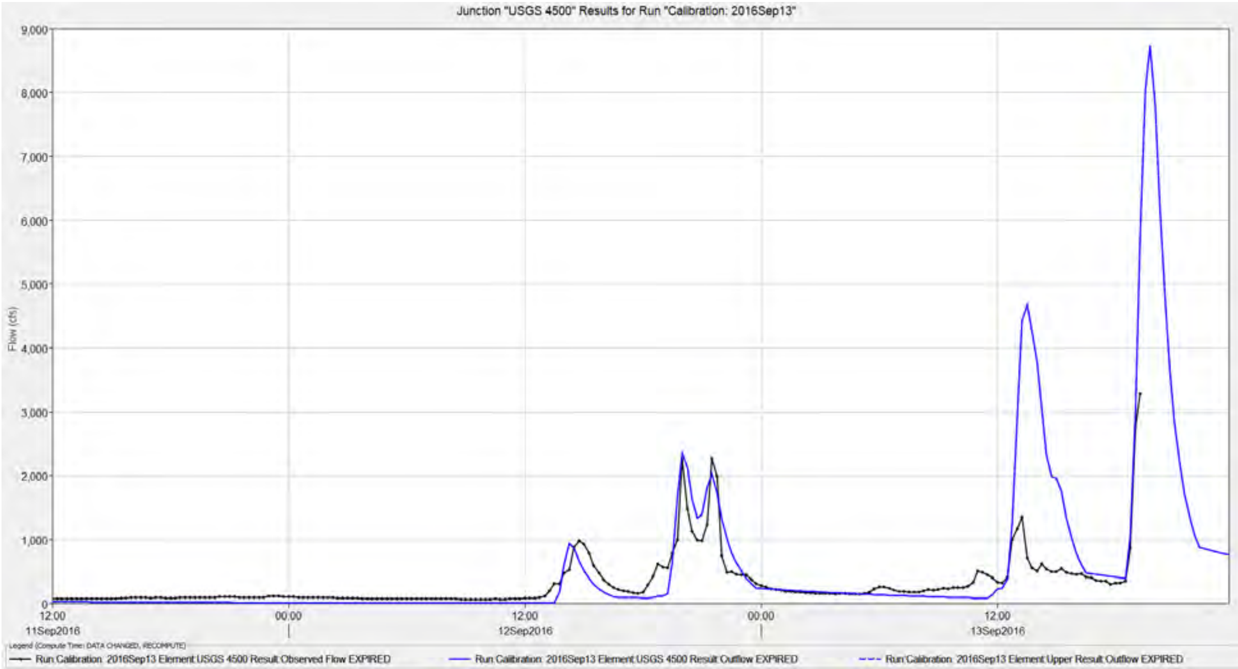


Table 4-19: Initial and optimized parameters at the "Upper" subbasin for the September 2016 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient R	Nash-Sutcliffe	Percent Bias
Initial	0.1	3.97	0.246	0.083	--	--
2016 Sep	1.2	0.5	0.50	0.90	-1.40	43.6%
% change:	*1100%*	*-87.4%*	*103%*	*984%*		

The baseflow parameters selected during calibration were 25 ft^3/s for the *initial discharge*, 0.9 for the *recession constant*, and 0.1 for the *ratio to peak*.

The performance metrics do not justify including this event. The Nash-Sutcliffe efficiency is beyond what is allowed at -1.40. The Percent Bias is also unacceptable at 43.6%. This is unfortunate because it is the largest event for this river system within the last 100 years. However, as the gage was destroyed, the observed record is incomplete. It was not possible to effectively calibrate with the limited dataset. Although this calibration event was not used to determine the final dataset of optimized parameters, additional information is provided regarding the optimized parameters for the “Middle” subbasin and the simulated peak flows at each gage.

With the “Upper” subbasin parameters established, the “Middle” subbasin parameters were then adjusted to match the estimated peak flow at USGS 16607000. To meet this flow, the loss and transform parameters were initially adjusted by the same percent change as the upper parameters. The storage coefficient, R, was then adjusted further as the primary calibration variable. The resulting hydrograph produces a peak flow at the lower gage (USGS 16607000) that is very similar to the peak flow estimated by USGS for this event (Table 4-21).

Table 4-20: Initial and optimized parameters at the “Middle” subbasin for the September 2016 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R
Initial	0.1	3.36	0.212	0.116
2007 Dec	0.1	0.423	0.430	1.80
% change:	*0%*	*-87.4%*	*103%*	*1,452%*

Table 4-21: Simulated peak discharges versus observed data for the September 2016 flood

USGS Gage	Simulated (ft^3/s)	Observed (ft^3/s)	Percentage difference (%)
16604500	8,950	4,220[1]	71.8
16607000	10,905	10,900[2]	0.046

[1]: the actual peak discharge was likely higher; stream gage destroyed during this event
[2]: estimated by USGS; stream gage destroyed during this event

Figure 4-5: Comparison of the simulated and observed hydrographs near USGS 16604500 for the October 2017 flood

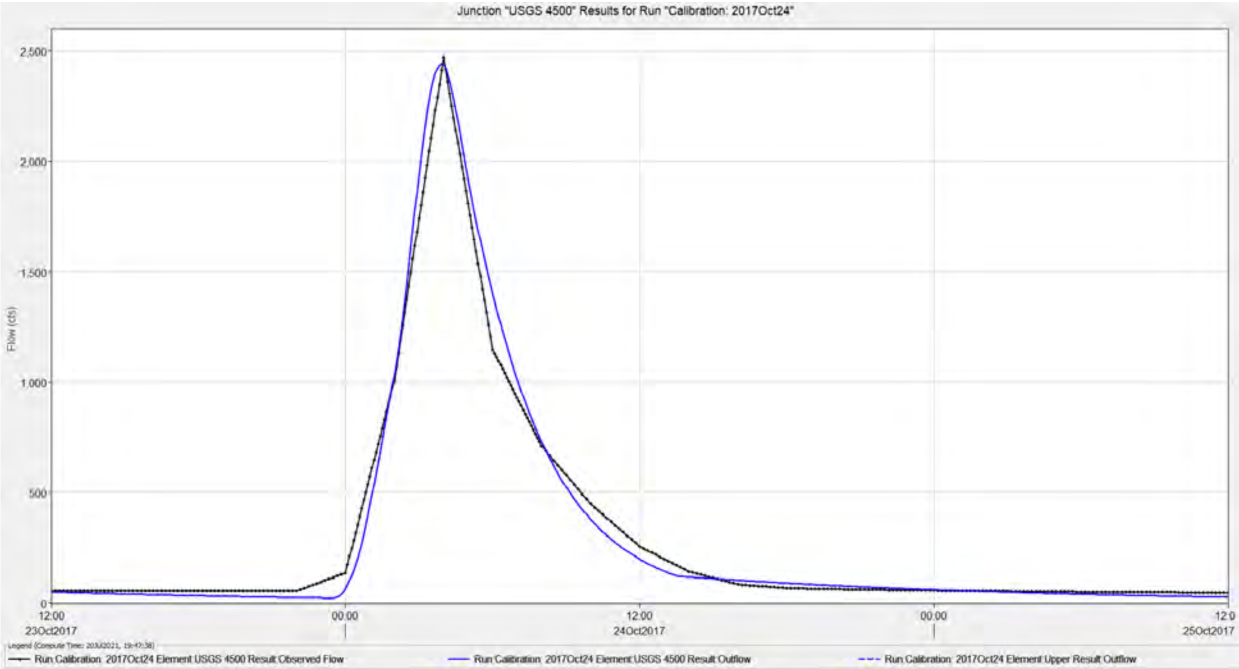


Table 4-22: Initial and optimized parameters at the “Upper” subbasin for the October 2017 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R	Nash-Sutcliffe	Percent Bias
Initial	0.1	3.97	0.246	0.083	--	--
2017 Oct	0.5	0.3	2.2	3.0	0.986	-1.00%
% change:	*400%*	*-200%*	*794%*	*3,515%*		

The baseflow parameters selected during calibration were 50 ft^3/s for the *initial discharge*, 0.2 for the *recession constant*, and 0.05 for the *ratio to peak*.

Both performance metrics (Nash-Sutcliffe and Percent Bias) indicate the model is well calibrated to the observed record at USGS 16604500. With the “Upper” subbasin parameters established, the “Middle” subbasin parameters were then adjusted to match the recorded flow at USGS 16607000. However, even with the loss and transform parameters optimized, the peak flow could not be met for this event.

Table 4-23: Initial and optimized parameters at the "Middle" subbasin for the October 2017 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R
Initial	0.1	3.36	0.212	0.116
2007 Dec	0.0	0.1	0.02	0.1
% change:	*-100%*	*-97.0%*	*-90.6%*	*-13.8%*

The resulting percent difference between the observed and simulated hydrographs are below 5% for the upper gage (USGS 16604500), as presented in Table 4-15, indicating the model is well calibrated for this subbasin. However, the lower subbasin was not able to meet the observed peak flow, with a percentage difference of 47.2% - well beyond the allowable limit. It is possible the rain gage (located at the uppermost point in the watershed) did not capture rainfall that fell in the lower part of the watershed, which is why the peak flow in the lower gage is unusually high. Due to lack of confidence in the rainfall data and the inability to effectively calibrate the lower gage, the optimized parameters for this calibration event were not used in determining the final calibrated dataset.

Table 4-24: Simulated peak discharges versus observed data for the October 2017 flood

USGS Gage	Simulated (ft^3/s)	Observed (ft^3/s)	Percentage difference (%)
16604500	2,440	2,470	0.121
16607000	3,191	7,690	47.2

Figure 4-6: Comparison of the simulated and observed hydrographs near USGS 16604500 for the January 2021 flood

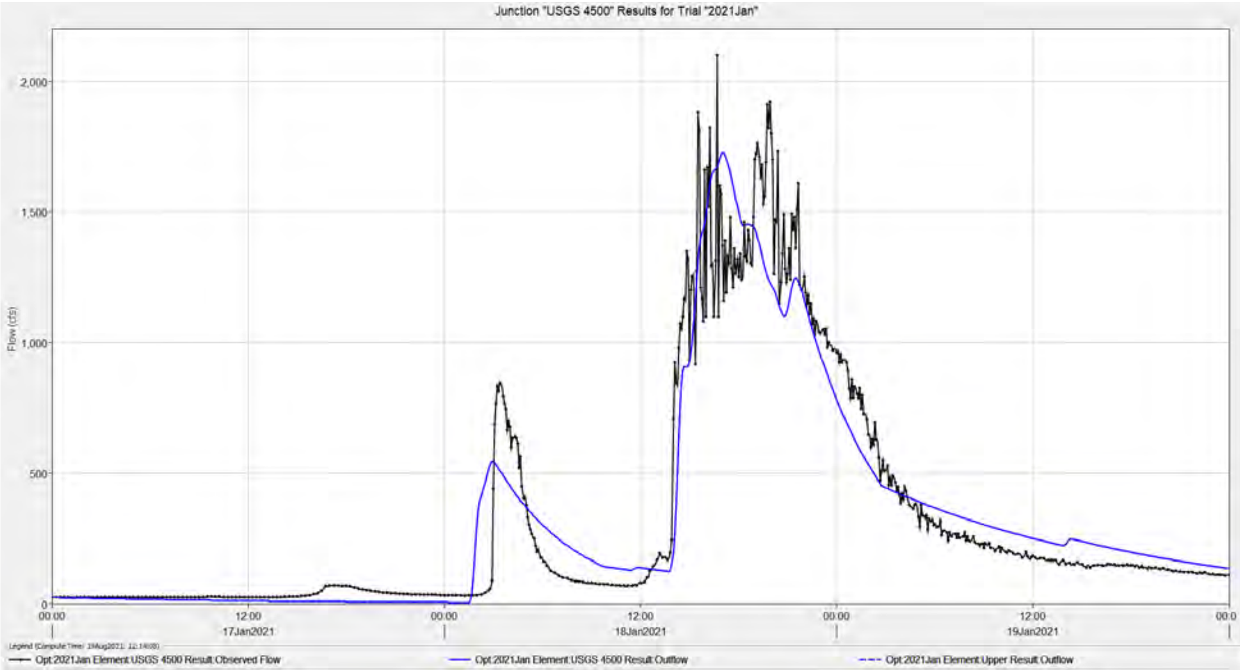


Table 4-25: Initial and optimized parameters at the "Upper" subbasin for the January 2021 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R	Nash-Sutcliffe	Percent Bias
Initial	0.1	3.97	0.246	0.083	--	--
2007 Dec	0.0	0.473	0.467	5.01	0.908	-0.10%
% change:	*400%*	*-88.1%*	*89.8%*	*5,936%*		

The baseflow parameters selected during calibration were 23.5 ft^3/s for the *initial discharge*, 0.209 for the *recession constant*, and 0.251 for the *ratio to peak*.

Both performance metrics (Nash-Sutcliffe and Percent Bias) indicate the model is well calibrated to the observed record at USGS 16604500. With the "Upper" subbasin parameters established, the "Middle" subbasin parameters were then adjusted to match the recorded flow at USGS 16607000. To meet this observed flow, the loss and transform parameters were set to minimum values.

Table 4-26: Initial and optimized parameters at the "Middle" subbasin for the January 2021 flood

Calibration status	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R
Initial	0.1	3.36	0.212	0.116
2007 Dec	0.0	0.100	0.212	0.1
% change:	*400%*	*-88.1%*	*0%*	*-13.8%*

The resulting percent difference between the observed and simulated peak flows for the upper gage (USGS 16604500) was 19.8%. While it was possible to calibrate the model to a more optimal percentage, it would not have been a good fit overall (the NSE and PBIAS metrics would have been unacceptable). Despite this difference between the peak flows, the model was still considered to be well calibrated based on the NSE and PBIAS performance metrics.

At the lower gage (USGS 16607000), the percent difference between the observed and simulated peak flows is similar (19.7%). The time of concentration was set to the computed value in lieu of reducing it further to an unrealistic time. All other parameters were set to minimum values.

The resulting percent difference between the observed and simulated hydrographs are both presented in Table 4-15.

Table 4-27: Simulated peak discharges versus observed data for the January 2021 flood

USGS Gage	Simulated (ft^3/s)	Observed (ft^3/s)	Percentage difference (%)
16604500	1721	2,100	19.8
16607000	3700	4,510	19.7

The results show that the model can simulate observed events within the allowable performance metrics for the December 2007 and January 2021 storm events. The optimized loss, transform, and baseflow parameters used to calibrate the “Upper” and “Middle” subbasins to these two events were averaged to determine the final parameter dataset.

For the “Happy Valley” and “Lower” subbasins, the estimated initial and constant loss remained the same as the “Middle” subbasin. Time of concentration was based on a flow length ratio with the “Middle” subbasin; the storage coefficient was based on a ratio of the drainage areas.

Table 4-28: Summary of initial and optimized parameters, "Upper" subbasin

Calibration status	Loss		Transform		Baseflow		
	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R	Initial Discharge (ft^3/s)	Recession Constant	Ratio to Peak
Initial	0.1	3.36	0.212	0.116	--	--	--
2007 Dec	0.1	0.447	0.304	1.77	280	0.209	0.147
2013 Nov	1.3	0.4	0.800	2.50	20	0.1	0.1
2016 Sep	1.2	0.5	0.500	0.900	25	0.9	0.1
2017 Oct	0.5	0.3	2.20	3.00	50	0.2	0.05
2021 Jan	0.0	0.473	0.467	5.01	23.5	0.209	0.251

Table 4-29: Summary of initial and optimized parameters, "Middle" subbasin

Calibration status	Loss		Transform		Baseflow		
	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hrs)	Storage coefficient, R	Initial Discharge (ft^3/s)	Recession Constant	Ratio to Peak
Initial	0.1	3.36	0.212	0.116	--	--	--
2007 Dec	0.1	0.38	0.262	0.98	280	0.209	0.147
2013 Nov	1.3	0.4	0.862	5.17	20	0.1	0.1
2016 Sep	0.1	0.423	0.430	1.80	25	0.9	0.1
2017 Oct	0.0	0.1	0.020	0.100	50	0.2	0.05
2021 Jan	0.0	0.1	0.212	0.100	23.5	0.209	0.251

Table 4-30: Final calibrated parameters for the HEC-HMS model

Subbasin name	Watershed Description		Loss		Transform		Baseflow		
	Area (mi^2)	Length of flow (mi)	Initial loss (in)	Constant loss (in/hr)	Time of concentration, T_c (hr)	Storage coefficient, R	Initial Discharge (ft^3/s)	Recession Constant	Ratio to Peak
Upper	6.12	3.94	0.05	0.46	0.386	3.39	152	0.209	0.199
Middle	2.00	3.30	0.05	0.24	0.237	0.54	152	0.209	0.199
Happy Valley	0.891	2.09	0.05	0.24	0.150	0.241	152	0.209	0.199
Lower	0.465	2.16	0.05	0.24	0.155	0.126	152	0.209	0.199

5. Flood Frequency Analysis

Methods for estimating the peak flow for the 50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% (1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, and 1/500) AEP flood events (8 profiles) include the following:

1. Rainfall-Runoff Model
2. Stream Gage Analysis
3. Regional Regression Equations
4. County Drainage Standards

Other peak flow estimates previously published (for reference):

1. 1976 GDM
2. 2015 FEMA FIS
3. 2017 Upper Wailuku River Flood Hazard Study

5.1. Rainfall-Runoff Model

The HEC-HMS model introduced in Section 4 was used to perform the rainfall-runoff computations for the 8 frequency events. Point precipitation data was obtained from the National Weather Service's (NWS) NOAA Atlas 14 Precipitation-Frequency Data Server (PFDS). This source presents the estimated total rainfall from recurrence intervals of 1 to 1000 years (100% to 0.1% annual exceedance probabilities) for various durations (5 minutes to 60 days) within or adjacent to the study area (NOAA, 2017). The location points used to extract PFDS data were the approximate centroid locations for each subbasin. The latitude and longitude for the centroid locations are included in Table 4-1. Annual maximum time series data was used. This rainfall data (Table 5-1 to

Table 5-4) was put into the calibrated HEC-HMS model (Section 4) to compute peak flow estimates for the 8 frequency flood events at each subbasin (Table 5-5) and four critical locations along the Wailuku River (Table 5-6).

Table 5-1: Point precipitation frequency estimates in inches, "Upper" subbasin

Duration	Annual Exceedance Probability (AEP)							
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500
5 min	0.864	1.18	1.40	1.69	1.91	2.14	2.38	2.72
15 min	1.61	2.20	2.61	3.14	3.55	3.98	4.43	5.07
1 hr	2.98	4.08	4.83	5.81	6.57	7.37	8.21	9.39
2 hrs	4.06	5.57	6.57	7.85	8.82	9.82	10.8	12.2
3 hrs	4.23	5.85	6.92	8.26	9.27	10.3	11.3	12.7
6 hrs	5.29	7.38	8.75	10.5	11.7	13.0	14.3	16.0
12 hrs	6.73	9.51	11.4	13.8	15.7	17.6	19.6	22.3
1 day	8.39	12.0	14.6	18.0	20.8	23.7	26.7	31.1

Table 5-2: Point precipitation frequency estimates in inches, "Middle" subbasin

Duration	Annual Exceedance Probability (AEP)							
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500
5 min	0.495	0.702	0.844	1.03	1.18	1.33	1.48	1.69
15 min	0.922	1.31	1.57	1.92	2.19	2.47	2.76	3.15
1 hr	1.71	2.42	2.91	3.56	4.05	4.57	5.10	5.83
2 hrs	2.36	3.34	4.00	4.86	5.50	6.16	6.83	7.74
3 hrs	2.65	3.78	4.54	5.51	6.24	6.99	7.74	8.76
6 hrs	3.33	4.80	5.79	7.05	8.01	8.97	9.95	11.3
12 hrs	4.16	6.06	7.37	9.10	10.4	11.8	13.2	15.2
1 day	5.16	7.60	9.33	11.7	13.5	15.5	17.6	20.5

Table 5-3: Point precipitation frequency estimates in inches, "Happy Valley" subbasin

Duration	Annual Exceedance Probability (AEP)							
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500
5 min	0.393	0.573	0.697	0.859	0.983	1.11	1.25	1.43
15 min	0.731	1.07	1.30	1.60	1.83	2.07	2.32	2.66
1 hr	1.35	1.98	2.40	2.96	3.39	3.84	4.30	4.93
2 hrs	1.88	2.74	3.31	4.06	4.62	5.20	5.78	6.56
3 hrs	2.12	3.11	3.78	4.64	5.28	5.93	6.59	7.48
6 hrs	2.66	3.94	4.80	5.91	6.75	7.60	8.44	9.59
12 hrs	3.32	4.97	6.11	7.61	8.76	9.95	11.2	12.8
1 day	4.13	6.25	7.74	9.75	11.3	13.0	14.7	17.2

Table 5-4: Point precipitation frequency estimates in inches, "Lower" subbasin

Duration	Annual Exceedance Probability (AEP)							
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500
5 min	0.347	0.512	0.628	0.777	0.893	1.01	1.14	1.30
15 min	0.646	0.954	1.17	1.45	1.66	1.89	2.12	2.43
1 hr	1.20	1.77	2.16	2.68	3.08	3.49	3.92	4.50
2 hrs	1.66	2.45	2.98	3.68	4.20	4.73	5.27	6.00
3 hrs	1.90	2.81	3.43	4.23	4.83	5.44	6.06	6.90
6 hrs	2.37	3.55	4.35	5.39	6.18	6.98	7.78	8.87
12 hrs	2.96	4.47	5.53	6.93	8.00	9.12	10.3	11.8
1 day	3.67	5.61	6.99	8.86	10.3	11.9	13.5	15.8

Table 5-5: Peak flow estimates for each subbasin

HEC-HMS Element					
Subbasin		Upper	Middle	Happy Valley	Lower
Peak Flow (ft^3/s)[1]					
Annual Exceedance Probability (AEP)	**1/500**	11,254	7,901	4,570	2,827
	1/200	9,694	6,903	3,984	2,469
	1/100	8,581	6,169	3,549	2,197
	1/50	7,505	5,452	3,132	1,935
	1/25	6,493	4,765	2,731	1,688
	1/10	5,133	3,819	2,186	1,349
	1/5	4,028	3,041	1,735	1,068
	1/2	2,458	1,884	1,067	664

Table 5-6: Peak flow estimates at critical locations along Wailuku River

HEC-HMS Element					
Junction		USGS 16604500	USGS 16607000	SCS Tributary	Outlet
Peak Flow (ft^3/s)[1]					
Annual Exceedance Probability (AEP)	**1/500**	11,254	17,378	19,923	21,084
	1/200	9,694	14,999	17,198	18,190
	1/100	8,581	13,284	15,228	16,124
	1/50	7,505	11,634	13,344	14,128
	1/25	6,493	10,086	11,566	12,239
	1/10	5,133	7,993	9,161	9,688
	1/5	4,028	6,298	7,217	7,630
	1/2	2,458	3,882	4,430	4,679

5.2. Stream Gage Analysis

5.2.1. Hydrologic Drivers

Nearly all of the recent peak flow events (1996 – present) of record at USGS 16607000 (Table 5-7) were described as either “Heavy Rain” or “Flash Flood” as categorized by the National Centers for Environmental Information (NCEI)’s Storm Events Database (NCEI, 2021), including the two largest events in 2016 and 2018 (10,900 ft^3/s and 7,690 ft^3/s, respectively). When comparing the hydrographs recorded at the nearby Puu Kukui rainfall gage (USGS -51102) for these two events and other annual peak flow events, there was no apparent distinction in the types of events that occurred. There is a low likelihood that the annual peak flow record represents a mixed population dataset. While the site does occasionally experience tropical storms and hurricanes, these did not seem to be a hydrologic driver for flooding at Wailuku River.

5.2.2. Bulletin 17C

A Bulletin 17C analysis offers the opportunity to also use intervals or thresholds to represent the magnitudes of flood peaks that might be known with less precision, such as historical flood data. For the Bulletin 17C analysis on USGS 16607000, peak discharges were included as point observations for the three historic floods (1916 – 17,000 ft^3/s; 1930 – 5,000 ft^3/s; 1948 – 5,000 ft^3/s). Additionally, thresholds were added to indicate all other floods that may have occurred between Water Years 1917 to 1930, 1932 to 1947, and 1949 to 1950 were less than 5,000 ft^3/s. This was based on the assumption that if an event larger than 5,000 ft^3/s had occurred, there would be similar evidence, e.g. newspaper accounts and personal testimonies, available as it was for the other floods of record that were 5,000 ft^3/s or greater. The 1974 General Design Memorandum for this project documented floods of 5,000 ft^3/s as a result of the November 1930 and January 1948 storms; and a flood of approximately 17,000 ft^3/s as a result of the January 1916 storm. For the Bulletin 17C analysis on USGS 16604500, a threshold was added to represent the September 2016 flood indicating flows were between the last recorded value of 4,220 ft^3/s and 10,000 ft^3/s.

The weighted skew option was used for both, which weighs the computed station skew with the generalized regional skew. A generalized skew value of -0.17 and mean-square error of 0.35 was used as estimated by USGS in 2010, specifically for the Maui area.

However, for the Bulletin 17C analysis on the upper gage (USGS 16604500), the difference between the station skew and regional skew was 0.602. Per the Bulletin 17C guidance, “If the regional and station skews differ by more than 0.5, a careful examination of the data and the flood-producing characteristics of the watershed should be made” (USGS, p. 25-26). Upon review of the general watershed characteristics within the region and moderate period of record for this stream gage (37 years), it was determined that a weighted skew option was still appropriate for this site. Table 5-7 and Table 5-10 contain the results from completing a Bulletin 17C analysis at the two gage locations.

Table 5-7: Peak flow estimates computed using Bulletin 17C methodology for USGS 16604500

Annual Exceedance Probability (AEP)	Computed Curve Flow in ft^3/s	Variance Log	Confidence Limits	
			0.05	0.95
1/500	9778.9	0.01126	17403.9	7127.2
1/200	8724.5	0.00825	14122.9	6619.1
1/100	7902.1	0.00636	11970.2	6171.8
1/50	7055.5	0.00482	10040.9	5660.6
1/25	6180.5	0.00361	8302.5	5072.4
1/10	4966.5	0.00252	6234.3	4162.1
1/5	3983.3	0.00205	4813.3	3362.3
1/2	2500.4	0.00209	2966.5	2057.7
Station Skew: -0.750 | Regional Skew: -0.170 | Weighted Skew: -0.422				

Table 5-8: Distribution Parameters for the Bulletin 17C Analysis on USGS 16607000

Parameter	Value
Mean	3.380
Standard Dev	0.258
Station Skew	-0.772
Regional Skew	-0.170
Weighted Skew	-0.426
Adopted Skew	-0.426
EMA Estimate of MSE (G at-site)	0.214
Grubbs-Beck Critical Value	1280.000

Table 5-9: Events Summary for the Bulletin 17C Analysis on USGS 16607000

Parameter	Value
Historic Events	0
High Outliers	0
Low Outliers and Zero Flows	5
Missing Flows	1
Systematic Events	34
Historic Period	35
Equivalent Record Length (years)	29.000

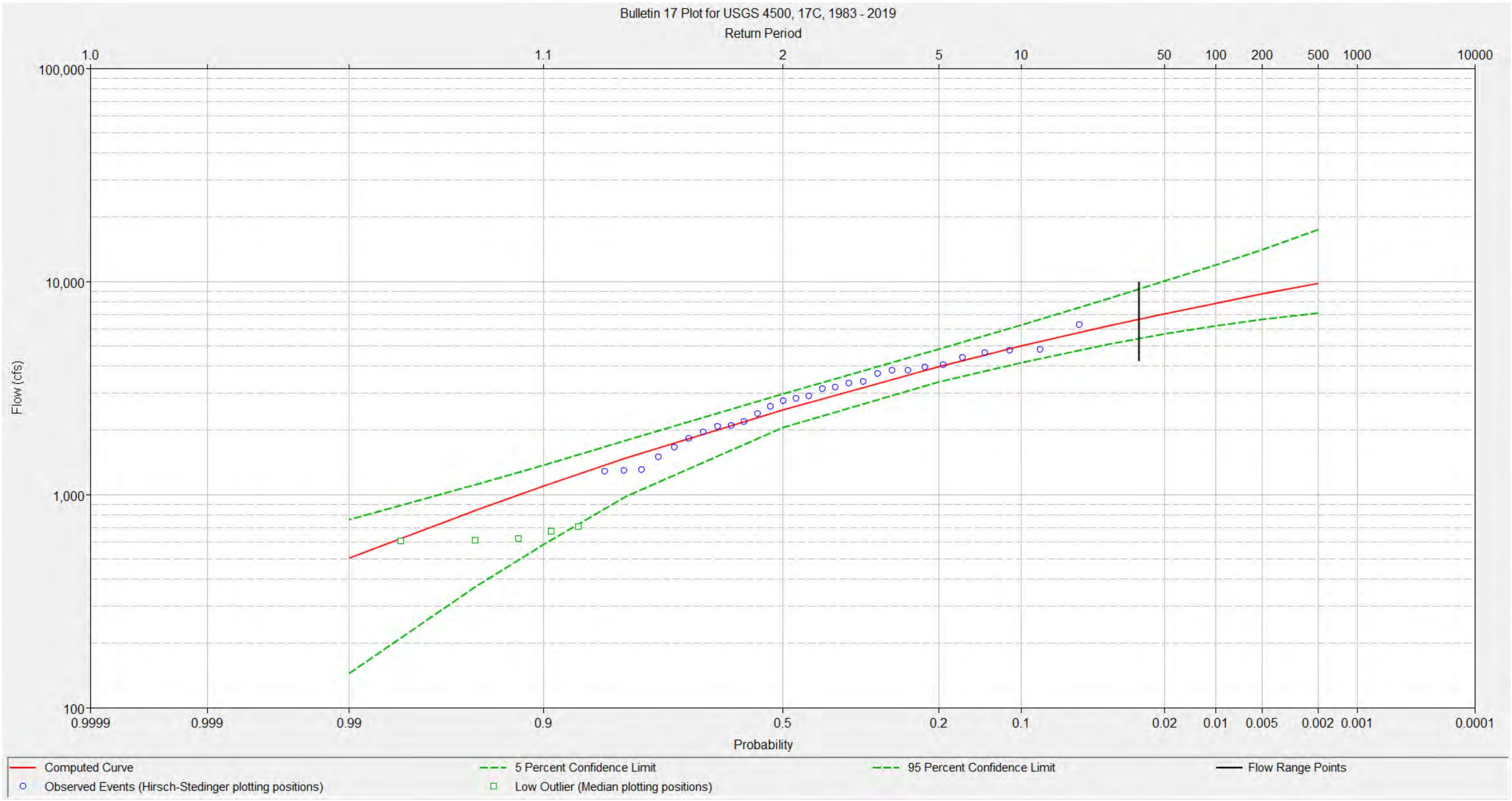


Figure 5-1: Bulletin 17C Plot for USGS 16604500

Table 5-10: Peak flow estimates computed using Bulletin 17C methodology for USGS 16607000

Annual Exceedance Probability (AEP)	Computed Curve Flow in ft^3/s	Variance Log	Confidence Limits	
			0.05	0.95
1/500	13,627	0.00811	22,253	10,527
1/200	11,498	0.00544	16,996	9,263
1/100	9,998	0.00387	13,767	8,294
1/50	8,587	0.00267	11,069	7,313
1/25	7,255	0.00180	8,825	6,315
1/10	5,595	0.00111	6,426	4,972
1/5	4,392	0.00086	4,922	3,934
1/2	2,773	0.00077	3,075	2,487
Station Skew: 0.123 | Regional Skew: -0.170 | Weighted Skew: 0.037				

Table 5-11: Distribution Parameters for the Bulletin 17C Analysis on USGS 16607000

Parameter	Value
Mean	3.444
Standard Dev	0.236
Station Skew	0.123
Regional Skew	-0.170
Weighted Skew	0.037
Adopted Skew	0.037
EMA Estimate of MSE (G at-site)	0.057
Grubbs-Beck Critical Value	1460.000

Table 5-12: Events Summary for the Bulletin 17C Analysis on USGS 16607000

Parameter	Value
Historic Events	3
High Outliers	0
Low Outliers and Zero Flows	9
Missing Flows	32
Systematic Events	69
Historic Period	104
Equivalent Record Length (years)	63.000

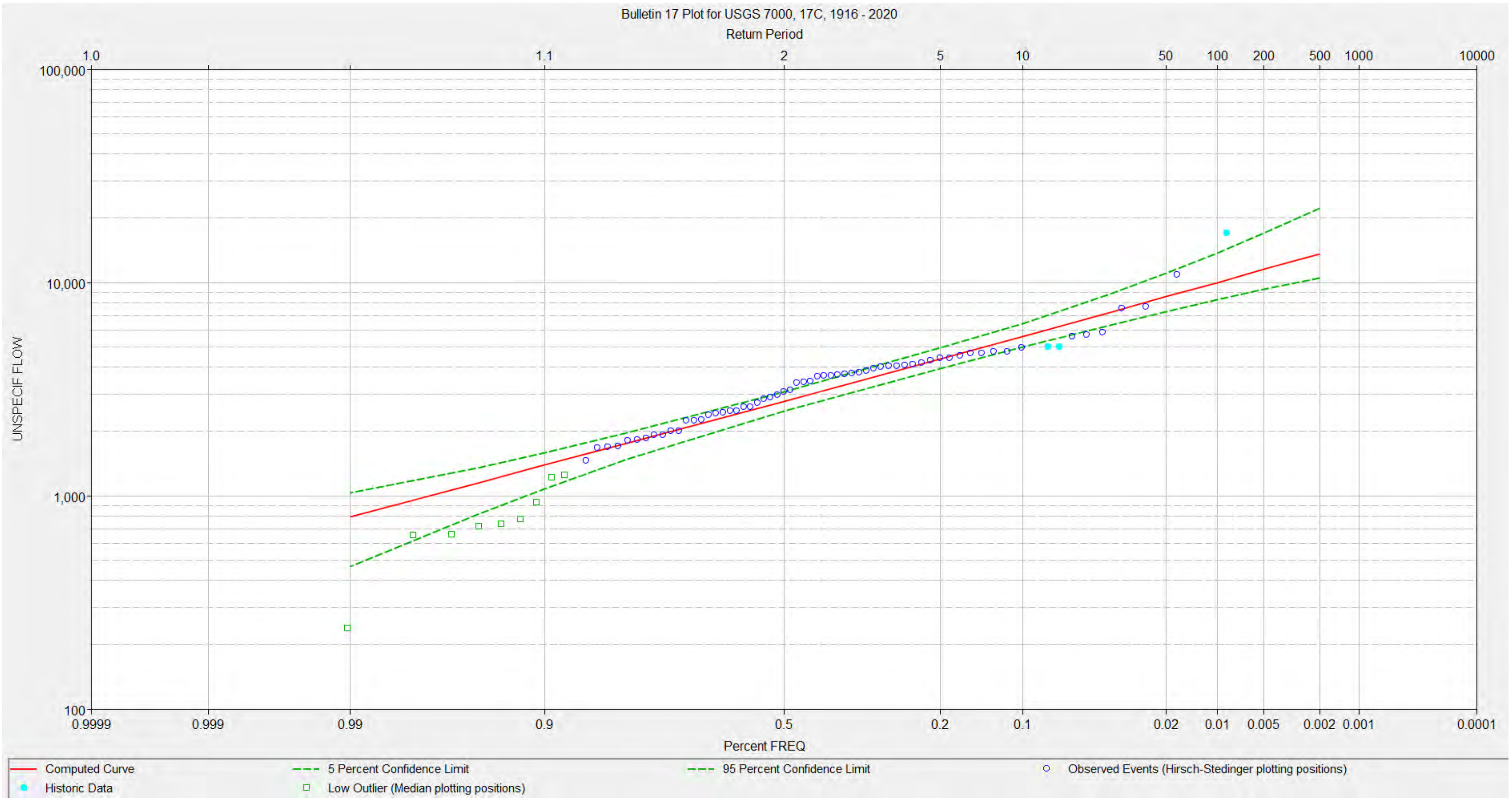


Figure 5-2: Bulletin 17C Plot for USGS 16607000

5.3. Regional Regression Equations

In 2010, the U.S. Geological Survey published *Flood Frequency Estimates for Streams on Kaua'i, O'ahu, Moloka'i, Maui, and Hawaii, State of Hawaii*, which includes regional regression equations for estimating peak flow for the 50%, 20%, 10%, 4%, 2%, 1%, and 0.2% (1/2, 1/5, 1/10, 1/25, 1/50, 1/100, and 1/500) AEP flood events (7 profiles). Wailuku River is located in the eastern-northwestern region of Maui, *Region 8*. The equations for this region are presented in .

Table 5-13: Regional Regression Equations for Peak-Discharge Estimates

Regression equation	Range of explanatory variables	Standard error of prediction, in percent	R^2	Standard model error, in percent
$Q_2=602.6(DA^{0.885})$	$0.09 \leq DA \leq 17.2$	93	0.64	90
$Q_5=1038(DA^{0.831})$	$0.09 \leq DA \leq 17.2$	70	0.71	68
$Q_{10}=1380(DA^{0.804})$	$0.09 \leq DA \leq 17.2$	66	0.72	64
$Q_{25}=1875(DA^{0.776})$	$0.09 \leq DA \leq 17.2$	65	0.72	63
$Q_{50}=2280(DA^{0.759})$	$0.09 \leq DA \leq 17.2$	67	0.71	65
$Q_{100}=2716(DA^{0.744})$	$0.09 \leq DA \leq 17.2$	70	0.69	67
$Q_{500}=3,828(DA^{0.717})$	$0.09 \leq DA \leq 17.2$	79	0.64	76
QT = peak discharge for T-year recurrence interval DA = drainage area, in square miles a < DA < b = the drainage area may be greater than or equal to a and less than or equal to b				

Results of using these equations to estimate peak flow at the two stream gages and at the mouth are presented in Table 5-14.

Table 5-14: Peak flow data for Wailuku River using regional regression equations

	USGS 16604500	**USGS 16607000**	**SCS Junction**	**Happy Valley**	**Outlet**
Drainage Area (mi^2)	6.12	8.11	9.01	0.891	9.47
AEP	**Peak Flow (ft^3/s)**				
1/500	14,000	17,200	18,514	3,520	19,200
1/100	10,450	12,900	13,939	2,500	14,500
1/50	9,020	11,200	12,094	2,090	12,600
1/25	7,650	9,520	10,324	1,710	10,700
1/10	5,920	7,430	8,081	1,260	8,410
1/5	4,680	5,910	6,450	943	6,720
1/2	2,990	3,940	4,217	544	4,410

[1]: rounded to three significant figures

5.4. County Drainage Standards

In 1995, the County of Maui adopted the “Rules for the Design of Storm Drainage Facilities in the County of Maui” to govern the design of storm drainage facilities in the County of Maui. For drainage areas greater than 100 acres (0.16 square miles) and all streams, the standard requires the use of the Natural Resources Conservation Service (NRCS) hydrograph method to compute peak flows and plot hydrographs. However, it also authorizes the use of the TR-55 method to be used in lieu of the NRCS hydrograph analysis. The TR-55 method was used to estimate the time of concentration when developing the hydrologic (HEC-HMS) model. In estimating runoff and peak discharges in small watersheds, the hydrologic model is expected to be a better representation of frequency-discharge relationship within each subbasin. Thus, this methodology of completing an NRCS or TR-55 tabular hydrograph analysis was not conducted.

5.5. Reference Flows

5.5.1. 1976 GDM

"General Design Memorandum No. 2, Phase I and Phase II," published by the U.S. Army Engineer District in 1976, includes the various design considerations used to develop the Iao Stream FCP and final plans (USACE, 1976). The discharge-frequency curve included in this General Design Memorandum was based on several large historical floods that preceded construction of the original project in 1981. Peak flow estimates are presented in Table 5-15.

Table 5-15: Peak flow data from the 1976 GDM by USACE

Location	Drainage area (mi^2)[1]	Peak flow (ft^3/s)[2]			
		1/10	1/50	1/100	1/500
Confluence	5.3	6,200	12,000	17,000	27,500
Debris Basin	7.7	7,300	15,000	19,000	35,000
USGS 16607000	8.11	6,800	15,300	19,700	30,000
Happy Valley Tributary	9.4	8,000	16,000	19,000	32,000
Mouth	10.1	8,500	17,000	20,000	33,000

[1]: drainage area values from USGS
[2]: rounded to three significant figures

5.5.2. 2015 FEMA FIS

In November 2015, the Federal Emergency Management Agency (FEMA) published Flood Insurance Study (FIS) 150003V001D for Maui County (FEMA, 2015). This FIS includes peak flow estimates for Wailuku River (Iao Stream) that were originally determined in 2009 and based on a regression equation created in 1981. The regression equation, created by USACE for estimating peak flows on the island of Maui, can be expressed as:

$Q_{100} = 142*(DA^{0.89})*(P_{2\text{-}24}{}^{1.24})$

where

Q_{100} =1/100 AEP discharge in cubic feet per second

DA = drainage area in square miles

$P_{2\text{-}24}$ = mean 50% AEP, 24-hour rainfall depth in inches

Peak flow estimates for Wailuku River (Iao Stream) were determined at only one location, the mouth, and are provided in Table 5-16.

Table 5-16: Peak flow data from the 2015 FIS by FEMA

Location	Drainage area (mi^2)	Peak flow (ft^3/s)			
		1/10	1/50	1/100	1/500
Mouth	10.1	6,100	11,000	13,800	20,600

5.5.3. 2017 Upper Wailuku River Flood Hazard Study

Peak flow values for the Wailuku River were determined in the 2017 Upper Wailuku River Flood Hazard Study. These values are based on different flow estimates computed using an HEC-HMS model, USGS regression equations, and a Bulletin 17C analysis. The adopted peak flow estimates for three subbasins of the Wailuku River watershed are presented in Table 5-17.

Table 5-17: Adopted peak flow values for the 2017 flood hazard study

HMS Element	Peak flow (ft^3/s)			
	10% AEP (1/10)	**2% AEP (1/50)**	**1% AEP (1/100)**	**0.2% AEP (1/500)**
Upper	6,026	8,467	9,557	12,085
Middle	1,253	2,381	2,934	4,524
Lower	893	1,343	1,542	2,032

Source: 2017 Upper Wailuku River Flood Hazard Study, Table 5-14, page 57

Unfortunately, this table and report did not include peak flow values at the stream gage location (USGS 7000), which represents the combined flow from the “Upper” and “Middle” subbasins. The HMS model created for this study did provide peak flow estimates at USGS 7000, and these numbers were scaled down by the same factor to account for the weighted values of the USGS regression equations and Bulletin 17C analyses, to determine peak flow estimates at the stream gage location. The results are presented in Table 5-18.

Table 5-18: Estimated peak flow at USGS 16607000 using a similar methodology

AEP	AEP	Q_{HMS}[1]	Scale Factor[2]	Q_{RAS}[3]
10%	1/10	10,067	0.72	7,248
2%	1/50	14,483	0.73	10,573
1%	1/100	16,443	0.74	12,168
0.2%	1/500	21,302	0.74	15,763

[1] Estimated peak flow computed by the HEC-HMS model
[2] Scale reduction factor, as presented in the 2017 Upper Wailuku River Flood Hazard Study, Table 5-13
[3] “Adopted” peak flow

5.6. Adopted Flows

All four methods used in this hydrologic analysis are valid methods of estimating peak flow. The resulting peak flows computed for one of the critical locations, USGS 16607000, are presented in Figure 5-3 as an example for visual comparison.

The final “adopted” peak flow values to carry forward in this study were determined by 1) taking an average of the peak flows estimated at USGS 16607000 by the HEC-HMS rainfall-runoff model, the Bulletin 17C stream gage analysis, and the 2010 USGS regional regression equations with equal weighting, 2) determining the percent reduction of these averaged values compared with the HEC-HMS peak flow estimates, and 3) applying this percent reduction to other peak flow estimates computed in HEC-HMS for each subbasin and critical location in the study area. Results of this flood frequency analysis are provided in Table 5-20 and Table 5-21. Flows are not expected to change significantly as a result of either climate change or urbanization.

Table 5-19: Peak flow estimates at USGS 16607000 by various methods

Method of Analysis						
		HMS	Bulletin 17C	Regression	Average	Percent Reduction
Peak Flow (ft^3/s)						
Annual Exceedance Probability (AEP)	**1/500**	17,378	13,627	17,169	16,058	7.60
	1/200	14,999	11,498	14,997[1]	13,831	7.78
	1/100	13,284	9,998	12,890	12,057	9.23
	1/50	11,634	8,587	11,166	10,462	10.1
	1/25	10,086	7,255	9,515	8,952	11.2
	1/10	7,993	5,595	7,426	7,005	12.4
	1/5	6,298	4,392	5,910	5,533	12.1
	1/2	3,882	2,773	3,842	3,449	9.87

[1]: interpolation

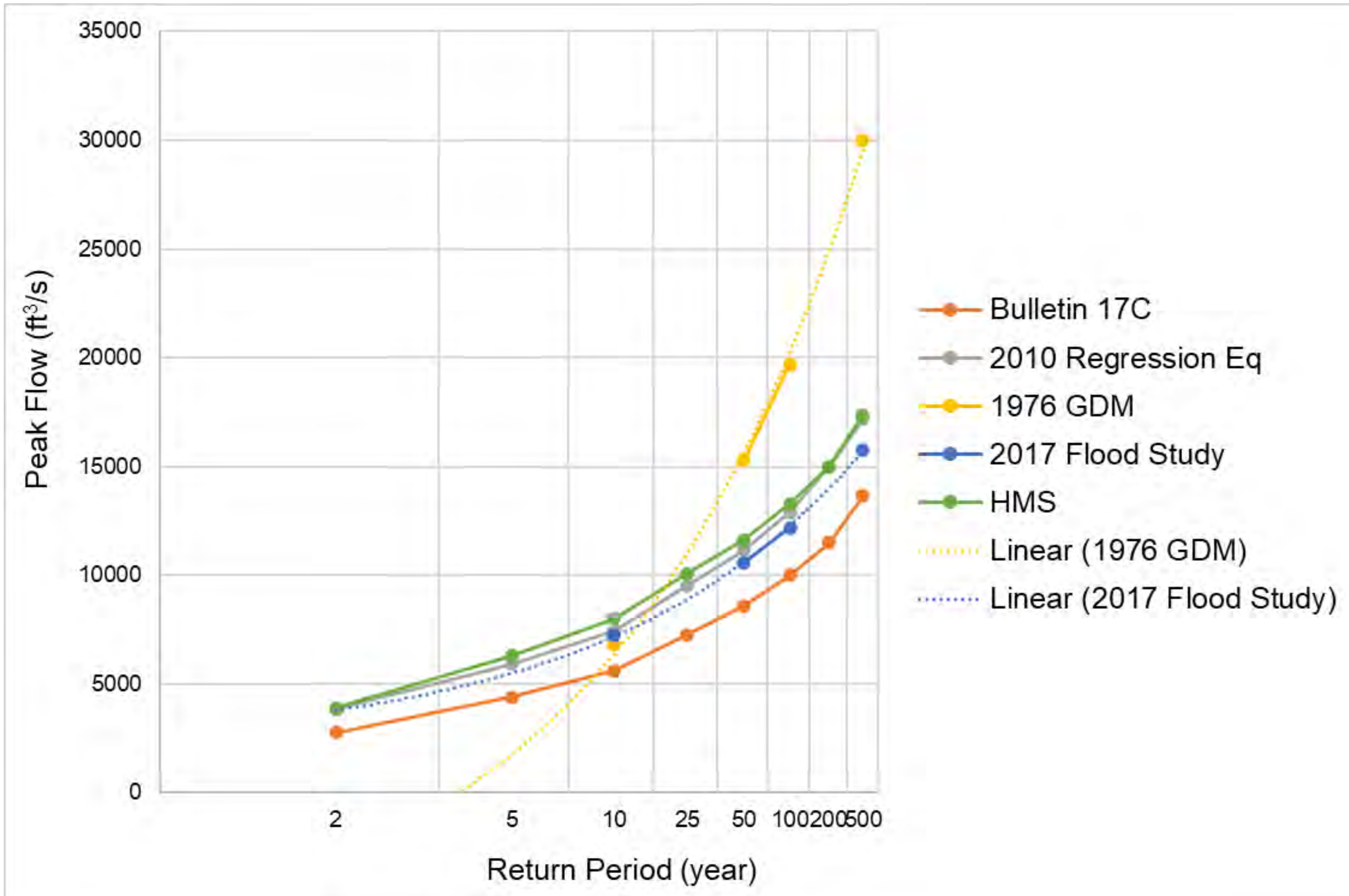


Figure 5-3: Computed peak flow estimates for Wailuku River at USGS 16607000

Table 5-20: Peak flow estimates contributed by each subbasin

HEC-HMS Element					
Subbasin		Upper	Middle	Happy Valley	Lower
Peak Flow (ft^3/s)[1]					
Annual Exceedance Probability (AEP)	**1/500**	10,400	7,300	4,220	2,610
	1/200	8,940	6,370	3,670	2,280
	1/100	7,790	5,600	3,220	1,990
	1/50	6,750	4,900	2,820	1,740
	1/25	5,760	4,230	2,420	1,500
	1/10	4,500	3,350	1,920	1,180
	1/5	3,540	2,670	1,520	938
	1/2	2,220	1,700	962	598

[1]: rounded to three significant figures

Table 5-21: Peak flow estimates at critical locations along Wailuku River

	HEC-HMS Element				
Junction		USGS 16604500	USGS 16607000	SCS Tributary	Outlet
		Peak Flow (ft^3/s)[1]			
Annual Exceedance Probability (AEP)	**1/500**	10,400	16,100	18,400	19,500
	1/200	8,940	13,800	15,900	16,800
	1/100	7,790	12,100	13,800	14,600
	1/50	6,750	10,500	12,000	12,700
	1/25	5,760	8,950	10,300	10,900
	1/10	4,500	7,010	8,030	8,490
	1/5	3,540	5,530	6,340	6,700
	1/2	2,220	3,500	3,990	4,220

[1]: rounded to three significant figures

5.7. Standard Project Flood

The 1976 GDM estimated the Standard Project Flood (SPF) to have peak flows ranging from 22,000 to 27,000 ft^3/s in the Wailuku River, with approximately 26,000 ft^3/s at the debris basin (Figure 5-5). Based on the flood frequency analysis completed for this study, it would be extremely rare for the system to experience this event. Based on the extended trendline created from the current flood frequency estimates, the projected AEP is expected to be less than 0.001% (1/100,000). This frequency is within a rough order of magnitude as there is less confidence in the probability of such a rare event.

This estimate was determined by plotting the adopted peak flows at USGS 16607000, the gage located just downstream of the debris basin, and using the equation generated by the trendline to project what frequency is needed to reach a peak flow of 27,500 ft^3/s. This also assumes there is little to no attenuation caused by the debris basin, which is supported by the hydraulic model performance.

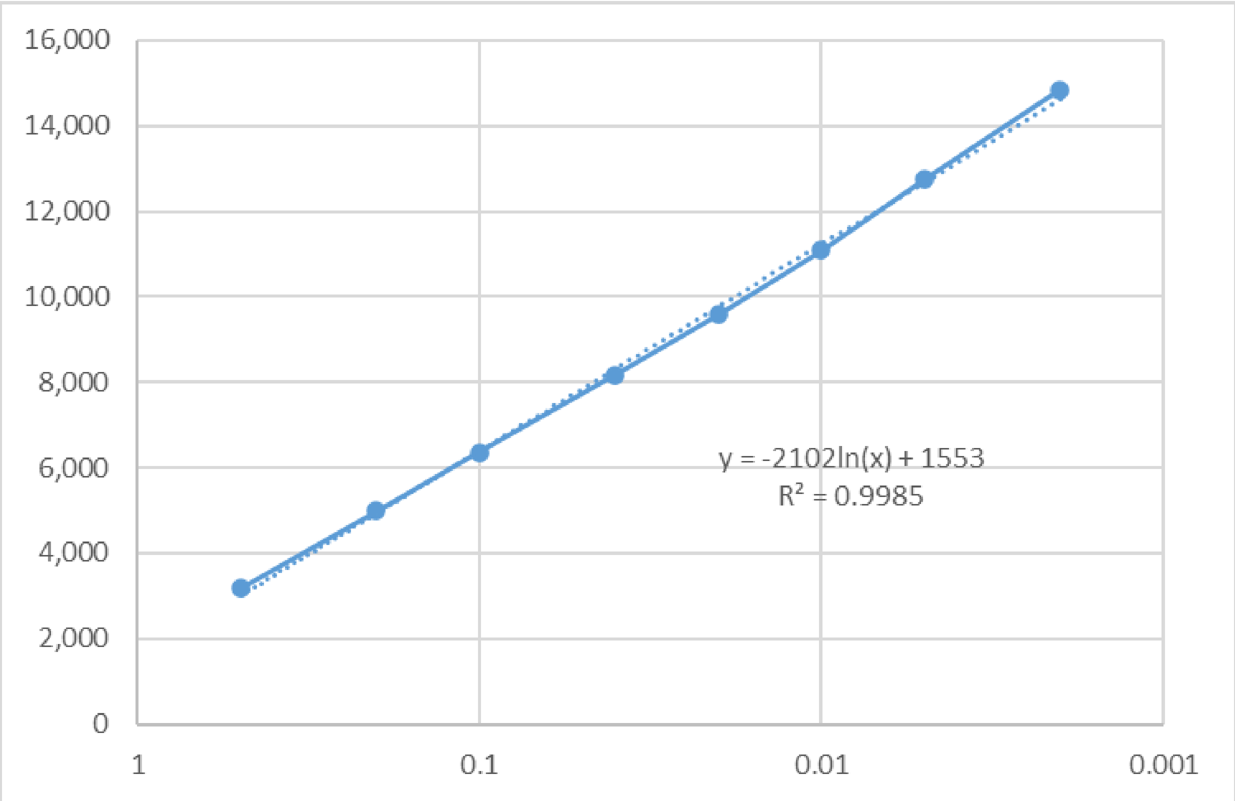


Figure 5-4: Adopted Flow Frequency Curve for USGS 16607000

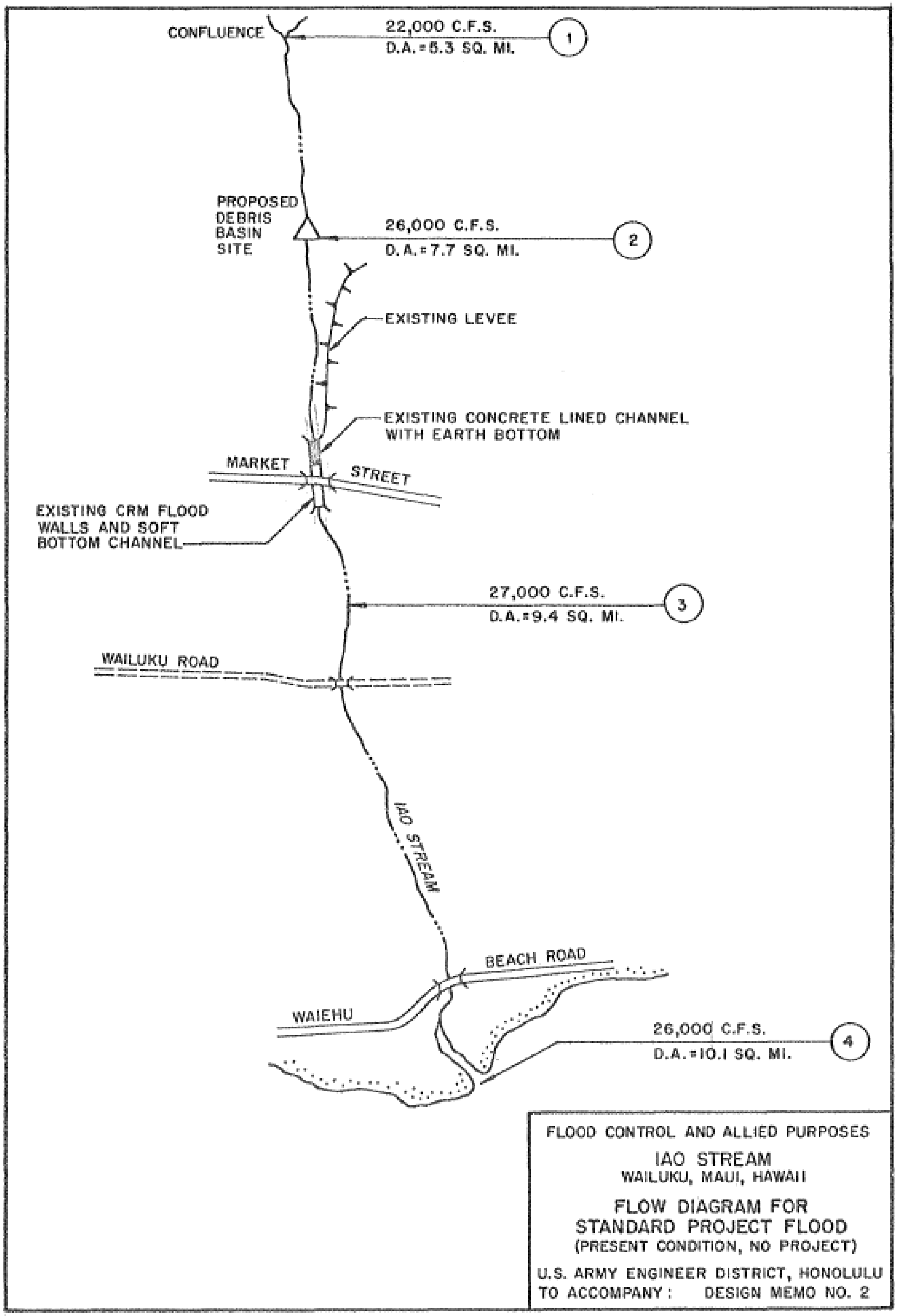


Figure 5-5: 1976 Standard Project Flood Peak Flow Estimates

5.8. Probable Maximum Flood

As the extremely rare SPF event is not a reasonable design flood to use anymore, the Probable Maximum Flood (PMF) was initially considered. However, after the PMP and PMF were very roughly estimated, the resulting peak flows from the PMF were significantly higher than the SPF and is also not a reasonable design flood to use in project design. This section summarizes how that determination was made.

5.8.1. Development of the PMP

The PMP is "theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given storm area at a particular geographical location at a certain time of the year" (USACE 1991). The PMP should be developed using the most recent applicable guidance provided by the National Weather Service (NWS), formerly known as the Weather Bureau. For the Hawaiian Islands, this is HMR 39.

As outlined in HMR 39, the derivation of a PMP estimate for a drainage basin requires the use of the appropriate 24-hour point values and duration-depth-area (DDA) curves. Figure 5-10 in HMR 39 shows generalized estimates of the 24-hour PMP across the island of Maui. For this study, a representative 24-hour PMP between of 50-. 46-, 45-, and 43-inches was used for the Upper, Middle, Happy Valley, and Lower subbasins, respectively. An isohyetal reduction pattern was not applied in this analysis – the PMP was applied uniformly across the entire drainage basin. Following the procedures outlined in HMR 39, 30-minute incremental PMP hydrographs were developed for each subbasin.

The temporal distribution of the 24-hour PMP was determined using the DDA curves presented in Figure 6-6 in HMR 39. This was done by plotting where each sub-basin area intersected with each duration curve to determine what percent of the 24-hour PMP was appropriate for each duration. The durations are 30-minute, 1-hour, 2-hours, and in 3-hourly increments until 24-hours. These percentages were then multiplied by the specific 24-hour PMP for each sub-basin to compute the total precipitation for each duration.

The 6-hour increments were arranged in a sequence identified as Storm Period "B" (HMR 39, Table 6-1), having the most intense rainfall occurring during the 3rd 6-hour duration, the 2nd most intense rainfall occurring during the 2nd 6-hour duration, the 3rd most intense rainfall occurring during the 4th 6-hour duration and the least intense rainfall occurring during the 1st 6-hour duration. This sequence was chosen because it represents the worst-case scenario in which the most intense rain occurs after the soil is saturated, and thus, initial losses can be ignored. The 3- and 6-hour increments of PMP and time distribution for the “Upper” sub-basin are shown in Table 5-22 as an example of the procedure.

Table 5-22: 3- and 6-Hour Incremental PMP for the “Upper” Sub-Basin

Duration (hours)	Percent of 24-hr PMP (%)	PMP Rainfall (in)	3-Hr Incremental PMP (in)	6-Hr Incremental PMP (in)	6-Hr Incremental PMP Arranged in Storm Sequence (in)	3-Hr Incremental PMP Arranged in Storm Sequence (in)
3	42.0	21.0	21.0			2.0
6	58.0	29.0	8.0	29.0	4.5	2.5
9	69.0	34.5	5.5			4.0
12	77.0	38.5	4.0	9.5	9.5	5.5
15	83.0	41.5	3.0			8.0
18	89.0	44.5	3.0	6.0	29.0	21.0
21	93.0	46.5	2.0			3.0
24	98.0	49.0	2.5	4.5	6.0	3.0

The largest 6-hour increment from the set was further subdivided into 30-minute increments to provide a better representation of the high intensities experienced during the PMP. The depth-duration relationship for each sub-basin was plotted in Microsoft Excel for the 1-, 2-, 3-, and 6-hour durations and used to predict the precipitation depths for the 4- and 5-hour durations. This was done by adding a trendline to the plot, which provided a cubic equation to represent the depth-duration relationship for that specific sub-basin. The plot for the “Upper” subbasin is shown in Figure 5-6 as an example.

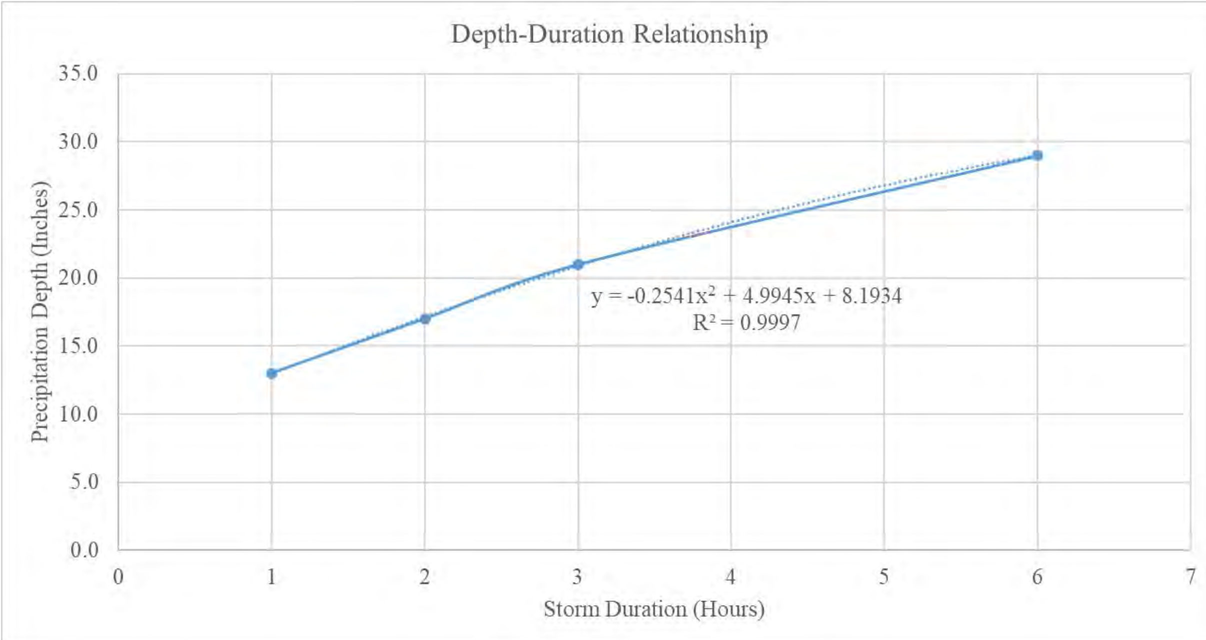


Figure 5-6: Depth-Duration Relationship for “Upper” Sub-Basin

The 30-minute increments were determined by calculating the difference and arranged in an alternating sequence, as demonstrated in Table 5-23.

Table 5-23: 30-Minute and 1-Hour Incremental PMP for the “Upper” Sub-Basin

Duration (hours)	PMP Rainfall (in)	30-Min Incremental PMP (in)	1-Hr Incremental PMP (in)	1-Hr Incremental PMP Arranged in Storm Sequence (in)	30-Min Incremental PMP Arranged in Storm Sequence (in)
0.5	9.5	9.5			1.3
1.0	12.9	3.4	12.9	2.7	1.4
1.5	15.1	2.2			1.8
2.0	17.2	2.1	4.2	3.7	1.9
2.5	19.1	1.9			3.4
3.0	20.9	1.8	3.7	12.9	9.5
3.5	22.6	1.7			2.2
4.0	24.1	1.5	3.2	4.2	2.1

Duration (hours)	PMP Rainfall (in)	30-Min Incrementa l PMP (in)	1-Hr Incremental PMP (in)	1-Hr Incremental PMP Arranged in Storm Sequence (in)	30-Min Incremental PMP Arranged in Storm Sequence (in)
4.5	25.5	1.4			1.7
5.0	26.8	1.3	2.7	3.2	1.5
5.5	28.0	1.2			1.2
6.0	29.0	1.0	2.2	2.2	1.0

Finally, the 3-hour and 30-minute incremental PMP values were used to create a composite hyetograph for each sub-basin. The 24-hour PMP temporal distribution for "Upper" is shown in Figure 5-7.

These hydrographs were put into the rainfall-runoff model to estimate peak flows along Wailuku River at critical locations during the Probable Maximum Flood and are presented in Table 5-24. The resulting peak flows are significantly higher than even the extremely rare SPF, with an AEP lower than 0.000002 (1/500,000) – an unrealistic target for project design.

Table 5-24: Probable Maximum Flood Peak Flow Estimates

HEC-HMS Element	Peak Flow (ft^3/s)[1]
Upper	25,800
Middle	8,800
Happy Valley	5,920
Lower	3,770
USGS 16604500	25,800
USGS 16607000	34,200
SCS Tributary	38,900
Outlet	41,200

[1]: rounded to three significant figures

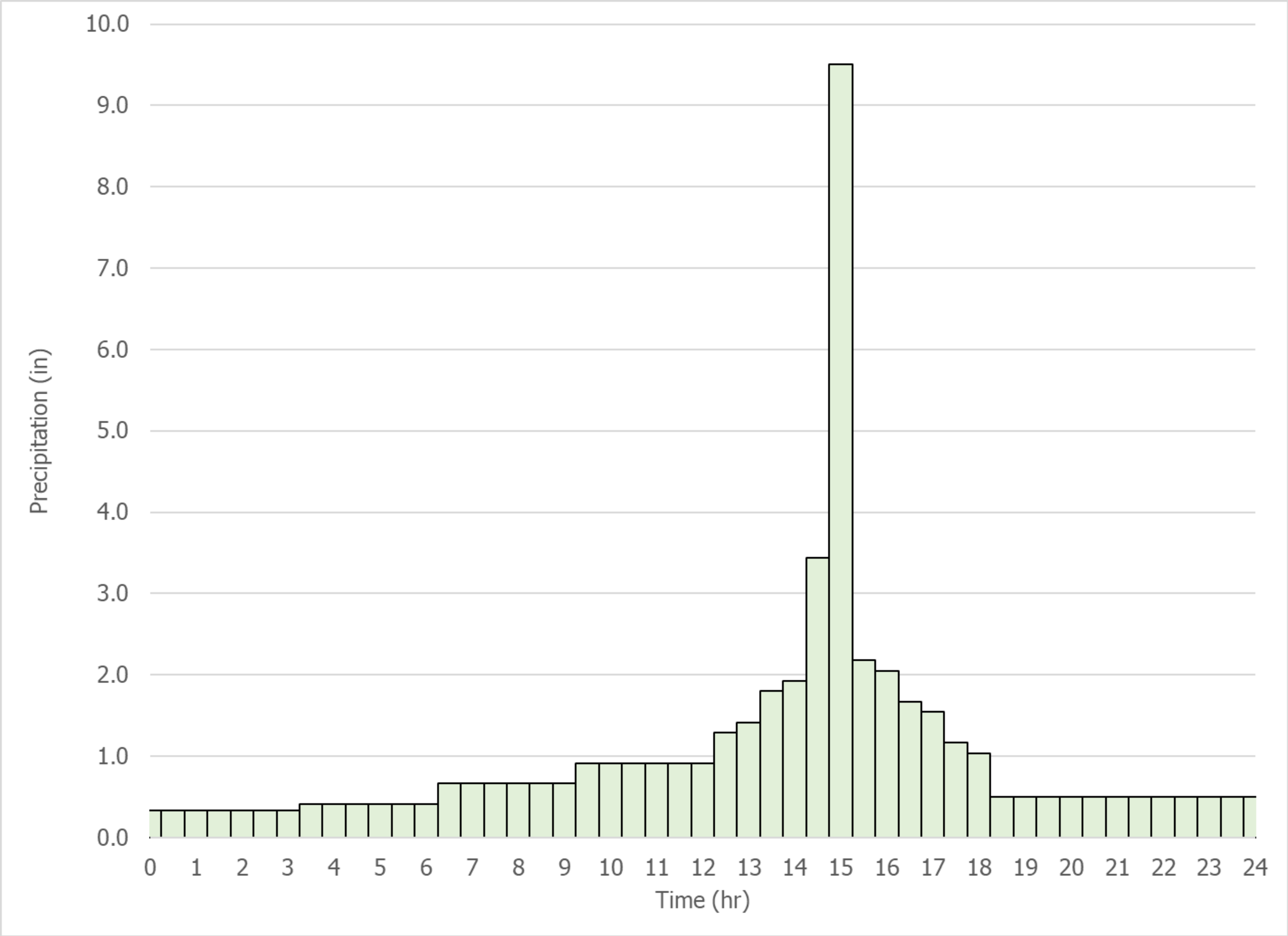


Figure 5-7: 24-Hour PMP Hyetograph for the “Upper” Sub-Basin

6. Climate Change

A qualitative analysis on climate and hydrology was conducted in accordance with Engineering and Construction Bulletin (ECB) 2018-14, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects*. A comprehensive literature review was completed to support this assessment, which included review of the following key resources:

1) *Volume II of the Fourth National Climate Assessment* (USGCRP, 2018);
2) *State Climate Summaries – Hawaii* (NOAA National Centers for Environmental Information, 2017);
3) The State of Hawaii's Climate Change Portal (Hawai'i Climate Change Mitigation and Adaptation Commission, 2021);
4) *Climate Change and Pacific Islands*: *Indicators and Impacts. Report for the 2012 Pacific Islands Regional Climate Assessment.* (Keener, Marra, Finucane, Spooner, & Smith, 2012); and
5) *Hawaii's Changing Climate* (Fletcher, 2010)

Regionally and within the study area, the following climate change indicators are relevant to this project:

- Rising air temperature;
- Rising sea surface temperature;
- Rising sea level;
- Less, but more intense rainfall;
- Declining base flow in streams; and
- Increased frequency of extreme events;

6.1. Rising Temperatures

The average annual air temperature in Hawaii has increased by about 2°F since 1950, but the warming has leveled off in the most recent two decades according to NCEI's State Climate Summaries (2017). Higher elevations are more likely to see a greater rate of temperature increase. Air temperature is heavily influenced by natural climate variability. The rate of temperature rise is also affected by future use (or reduction of) greenhouse gas emissions.

Sea surface temperatures are also rising, which increases the rate of coral bleaching and affects tropical cyclone formation.

6.2. El Niño-Southern Oscillation

Every 3 to 7 years, climate conditions over the Pacific Ocean basin change dramatically because of the El Niño-Southern Oscillation (ENSO). Strong ENSO years, such as 2015-2016, bring warmer sea surface temperatures, intense rains, and an increased risk of tropical cyclones (NOAA). The year 2015 was the most active hurricane season on record in the Central Pacific, with eight hurricanes and six additional tropical storms reported.

The strength of these ENSO-related patterns in the short term can make it difficult to detect the more gradual, long-term trends of climatic change. The effects of ENSO can be further magnified when it is in phase with longer periodic cycles such as the Pacific Decadal Oscillation and the Interdecadal Pacific Oscillation. It is unknown how the timing and intensity of ENSO will continue to change in the coming decades, but recent climate model results suggest a doubling in frequency of both El Niño and La Niña extremes in the 21st century as compared to the 20th century under scenarios with more warming (Keener, et al., 2018).

6.3. Rainfall

Annual rainfall averages have decreased throughout Hawaii over the last century, according to the Hawaii Rainfall Index (Chu & Chen, 2005). Less rainfall typically leads to a decline in groundwater and stream base flow.

6.3.1. Nonstationarity Analysis

To investigate whether a trend of changing peak annual flow is occurring, the Wailuku River gage records were tested using the Nonstationarity Detection Tool in accordance with ETL 1110-2-3. Two USGS streamflow gages (16604500 and 16607000) were used in this study, as previously introduced in Section 4.6.2, Streamflow Data.

The gage record for USGS 16604500, Wailuku River at Kepaniwai Park, includes peak annual stream flow from 1984 to 2019, which is a 35-year period of record. The gage captures a drainage area of 6.13 square miles and is located about 1.9 miles upstream from the project debris basin. The tool initially detected 10 nonstationarities where there was a statistically significant change to the average value of the data based only on the Bayesian method (Figure 6-1). This method identifies statistically significant changes in sample mean within a univariate, Gaussian dataset. Peak annual flow datasets rarely fit a Gaussian (normal) distribution and thus in most instances this method would be inappropriate to apply (USACE, 2019). Additionally, this method does not work well with short time series, or with small changes in magnitude. Therefore, the nonstationarities were disregarded. When the Bayesian Sensitivity was reduced from the default value of 0.5 to 0.3, 0 nonstationarities were detected. The average peak streamflow observed over the period of record is 2,667 ft^3/s with a standard deviation of 1,443 ft^3/s and a variance of 2,080,813 ft^3/s. Monotonic trend analysis of this period did not detect a statistically significant trend using the Mann-Kendall Test at a 0.05 level of significance (exact p-value of 0.307) or using the Spearman Rank Order Test at the 0.05 level of significance (exact p-value of 0.260). No trends were detected using parametrical statistical methods or Sens's Slope method. No nonstationarities or monotonic trends are detected within the streamflow record for USGS 16604500, Wailuku River at Kepaniwai Park.

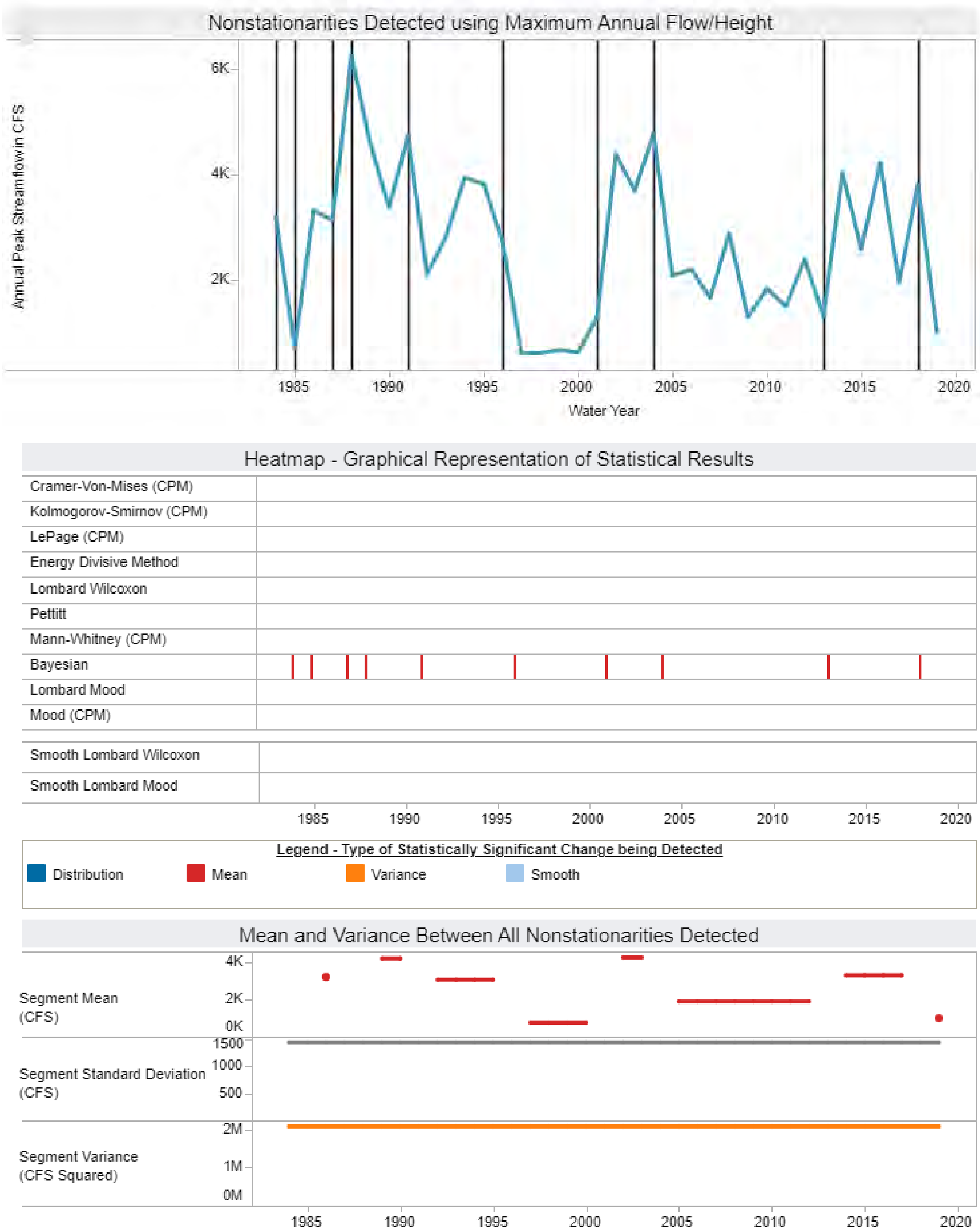


Figure 6-1: Nonstationarity Detector Charts – USGS 16604500

The gage record for USGS 16607000, Wailuku River at Wailuku, includes peak annual stream flow from 1951 to 2016, which is a 65-year period of record. The gage captures a drainage area of 8.11 square miles and is located about 0.4 miles downstream from the project debris basin. The tool detected one possible nonstationarity based on a change in distributional characteristics in 1986. However, this was supported by only one of the four distributional changepoint tests (lack of consensus). The average peak streamflow observed over the period of record is 3,149 ft^3/s with a standard deviation of 1,764 ft^3/s and a variance of 3,112,198 ft^3/s. Monotonic trend analysis of this period did not detect a statistically significant trend using the Mann-Kendall Test at a 0.05 level of significance (exact p-value of 0.429) or using the Spearman Rank Order Test at the 0.05 level of significance (exact p-value of 0.447). No trends were detected using parametrical statistical methods or Sens's Slope method. No nonstationarities or monotonic trends are detected within the streamflow record for USGS 16607000, Wailuku River at Wailuku River.

These two analyses indicate that no statistically significant changes in the basin hydrology have occurred during the period of record.

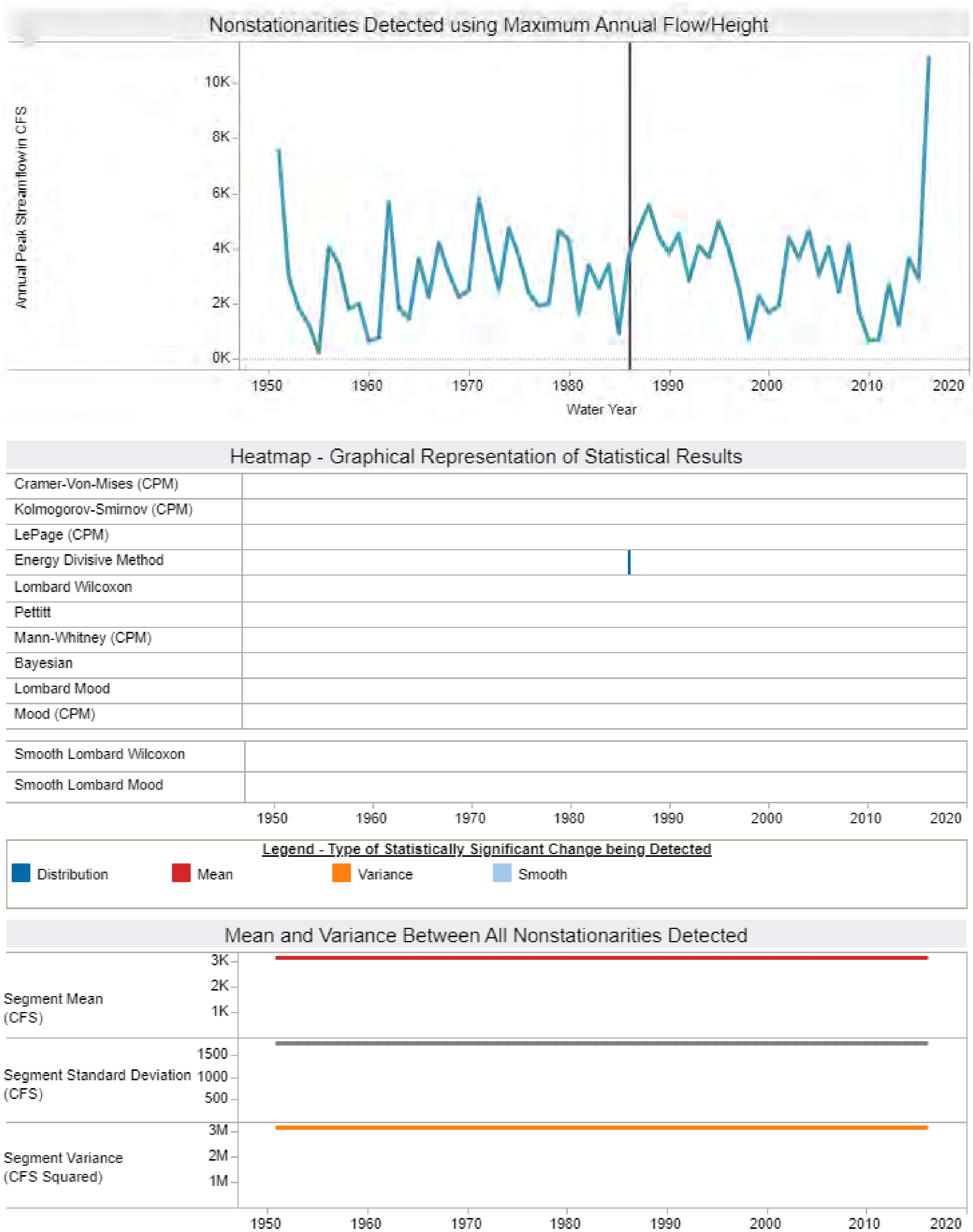


Figure 6-2: Nonstationarity Detector Charts – USGS 16607000

6.4. Sea Level Change

USACE requires that planning studies and engineering designs consider alternatives that are formulated and evaluated for the entire range of possible future rates of sea level change (SLC). Designs must be evaluated over the project life cycle and include evaluations for three scenarios of *low*, *intermediate*, and *high* sea level change.

According to Engineer Regulation (ER) 1100-2-8162 (USACE, 2019) and Engineer Pamphlet 1100-2-1 (USACE, 2019), the SLC *low* rate is the historic SLC. The *intermediate* and *high* rates are computed by:

- Estimating the *intermediate* rate of local mean sea level change using the modified National Research Council (NRC) Curve I, the NRC equations, and correcting for the local rate of vertical land movement (VLM).
- Estimating the *high* rate of local mean sea level change using the modified NRC Curve III, NRC equations, and correcting for the local rate of VLM. This *high* rate exceeds the upper bounds of the Intergovernmental Panel on Climate Change (IPCC) estimates from both 2001 and 2007 to accommodate the potential rapid loss of ice from Antarctica and Greenland.

The 1987 NRC described these three scenarios using the following equation:

$$\boldsymbol{E(t) = 0.0012t + bt^2} \qquad \text{Equation 1}$$

in which *t* represent years, starting in 1986, *b* is a constant, and *E(t)* is the eustatic sea level change, in meters, as a function of *t*. The NRC committee recommended, “projections be updated approximately every decade to incorporate additional data.” At the time the NRC report was prepared, the estimate of global mean sea-level (GMSL) change was approximately 1.2 mm/year. Using the current estimate of 1.7 mm/year for GMSL change, as presented by the IPCC, results in this equation being modified to be:

$$\boldsymbol{E(t) = 0.0017t + bt^2} \qquad \text{Equation 2}$$

The three scenarios proposed by the NRC result in global eustatic sea level rise values (by the year 2100) of 0.5 meters, 1.0 meters, and 1.5 meters. Adjusting the equation to include the historic GMSL change rate of 1.7 mm/year and the start date of 1992 (which corresponds to the midpoint of the current National Tidal Datum Epoch of 1983-2001), results in updated values for the variable b being equal to 2.71E-5 for modified NRC Curve I, 7.00E-5 for modified NRC Curve II, and 1.13E-4 for modified NRC Curve III.

Manipulating the equation to account for it being developed for eustatic sea level rise starting in 1992, while project will be constructed at some date after 1992, results in the following equation:

$$\boldsymbol{E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2^2 - t_1^2)} \qquad \text{Equation 3}$$

where t_1 is the time between the project's construction date and 1992 and t_2 is the time between a future date at which one wants an estimate for sea-level change and 1992 (or $t_2 = t_1$ + the number of years after construction). Using the three *b* scenarios required by ER 1100-2-8162 (United States Army Corps of Engineers, 2019) results in the following three GMSL rise scenarios depicted in Figure 6-3.

An analysis of the potential sea level rise was performed in the projected area. The gage at Kahului Harbor (NOAA ID: 1615680) was used for the analysis. This gage was established in 1946 and in its present location since 1989. It is located on the northwest corner of Pier #2 at Kahului Harbor, approximately 1.5 miles southeast of the Wailuku River outlet. This gage site was input into the USACE Sea Level Change Calculator (Version 2019.21). The result of the calculation indicates a relative sea level change of 5.15 feet was determined in the year 2100 at the *high* condition. For the *intermediate* condition, the change is 1.86 feet, and the *low* condition shows an increase of 0.82 feet. These values are relative to Local Mean Sea Level (LMSL) as the calculator states NAVD88 datum is not available for this station. The resulting sea level rise curve is shown in Figure 6-3.

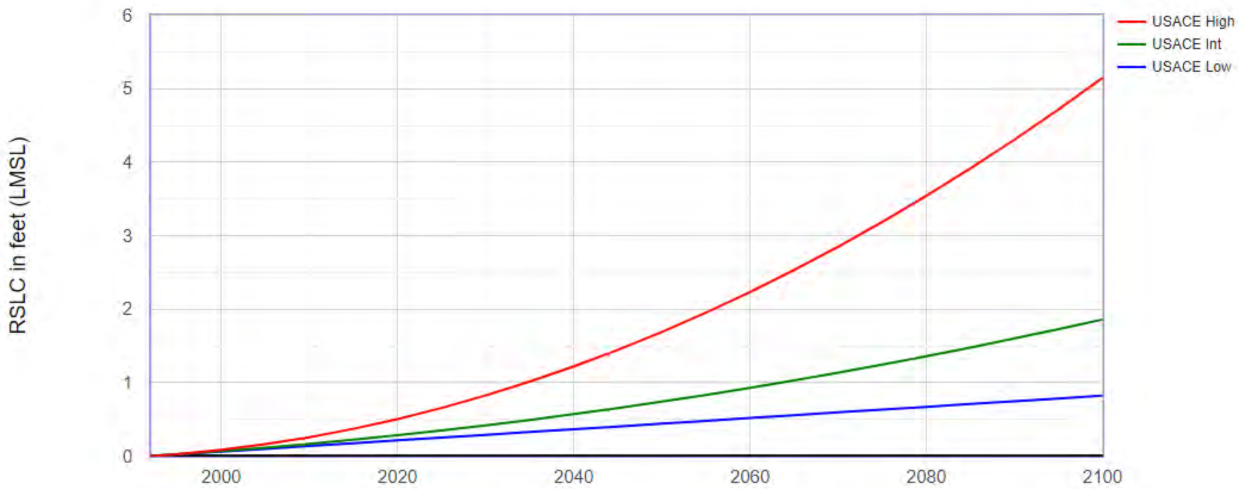


Figure 6-3: Estimated Relative Sea Level Change Projections – Gauge: 1615680, Kahului: Kahului Harbor, HI

The calculator also outputs a table showing the progression of sea level rise. This table was derived in 5 year increments and is shown below.

Table 6-1: Sea Level Rise by Year

Year	USACE		
	Low	***Intermediate***	***High***
1992	0.00	0.00	0.00
1995	0.02	0.02	0.03
2000	0.06	0.07	0.09
2005	0.10	0.11	0.16
2010	0.14	0.17	0.26
2015	0.18	0.22	0.37
2020	0.21	0.28	0.50
2025	0.25	0.35	0.66
2030	0.29	0.42	0.83
2035	0.33	0.49	1.01
2040	0.37	0.57	1.22
2045	0.40	0.65	1.45
2050	0.44	0.74	1.69
2055	0.48	0.83	1.95
2060	0.52	0.93	2.23
2065	0.56	1.03	2.53
2070	0.59	1.14	2.85
2075	0.63	1.24	3.19
2080	0.67	1.36	3.54
2085	0.71	1.48	3.91
2090	0.75	1.60	4.31
2095	0.78	1.73	4.72
2100	0.82	1.86	5.15

The calculator also provides extreme water levels expected across several datums. These datums and their respective values are shown in the table and figure below:

Table 6-2: Tidal Datums and Extreme Water Levels

Datum / EWL	**Reference Datum**	
	LMSL	***MLLW***
HAT	1.98 ft	3.09
MHHW	1.14 ft	2.25
MHW	0.78 ft	1.89
MSL	0.00 ft	1.11
MLW	-0.79 ft	0.32
MLLW	-1.11 ft	0
NAVD88	--	
EWL Type	NOAA GEV	
1/100 AEP	2.55 ft	3.66
1/50 AEP	2.50 ft	3.61
1/20 AEP	2.42 ft	3.53
1/10 AEP	2.35 ft	3.46
1/5 AEP	2.27 ft	3.38
½ AEP	2.11 ft	3.22
Yearly	1.78 ft	
Monthly	--	
From	1947	
To	2007	
Years of Record	60	

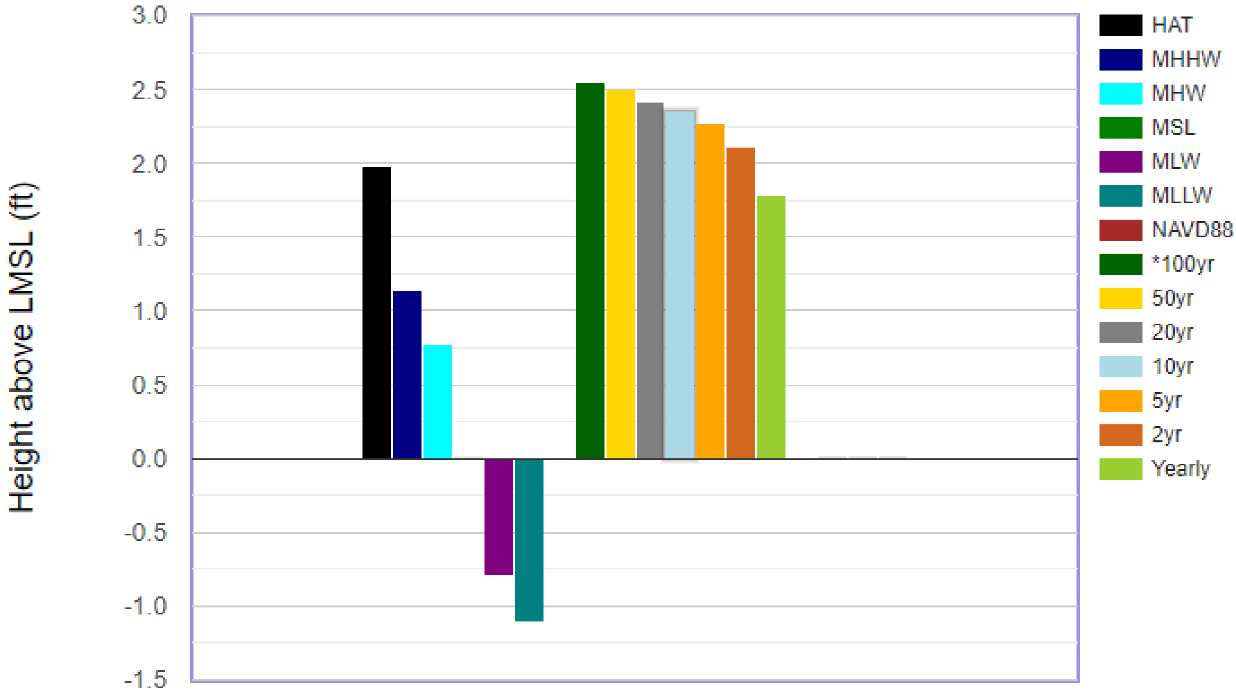


Figure 6-4: Tidal Datums and Extreme Water Levels

The highest tide level occurred in August 2017 and was 3.59 MLLW (2.47 MSL). Under *high* sea level rise conditions, this max tide level would be 8.37 MLLW (7.25 MSL) in 2100. The relative change in sea level from 2015 to 2100 is 4.78 feet. With regards to Wailuku River, this elevation is still very near to the ocean outlet with negligible impacts to existing or proposed project features.

7. Geomorphology and Sedimentology

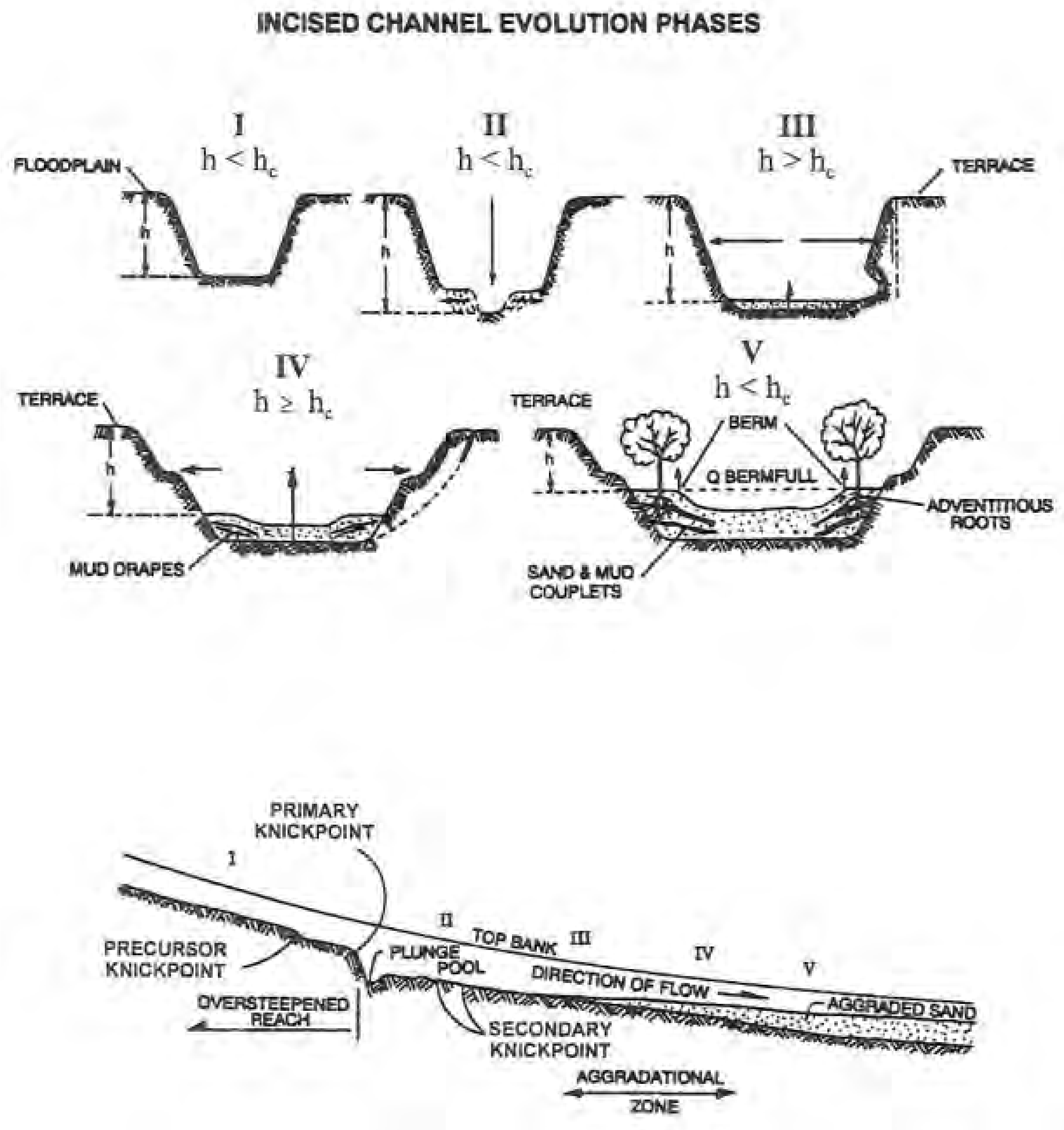
A stream maintains dynamic equilibrium (where it can maintain a stable shape over time without excessive erosion or sedimentation) when its natural flexibility and functional connection to the floodplain are preserved. However, Wailuku River's state of dynamic equilibrium has been interrupted and the river is limited in its ability to self-mend. Channelization of the upper reach has resulted in increased speed and erosive energy. Construction of the debris basin has resulted in low-sediment water flowing downstream, needing to be supplemented by sediment from the bed and banks. Placement of armored levees and bridges along the natural reach have limited the stream's ability to naturally meander. While these features have effectively reduced flood risk to the community and improved water quality downstream, it has also resulted in channel incision of unlined portions of the river.

7.1. Channel Evolution

The Channel Evolution Model (CEM) consists of five channel-reach types, which describe the evolutionary phases typically encountered in an incised channel (Figure 7-1). These reach types are labeled I through V and are assumed to occur consecutively in a downstream direction. The study reach was divided into sub-reaches based on the different geomorphological processes characteristic of the five channel-reach types of the CEM ().

Table 7-1: Channel Evolutionary Model Reach Segments in Wailuku River

Type	Phase	River Station	Description of Location
Type I	Stable	RS 127+00 to RS 91+50	Upper concrete channel
Type II	Incised	RS 91+50 to RS 79+29	Natural reach segment between the upper concrete channel and Imi Kala Street Bridge
Type III	Widening	RS 79+29 to RS 25+00	Natural reach segment between Imi Kala Street Bridge and Levee A
Type IV	Stabilizing	RS 25+00 to RS 4+00	Levee A and the lower concrete channel
Type V	Stable	RS 4+00 to RS 0+00	Outlet



Source: (Watson, Biedenharn, & Bledsoe, 2002)

Figure 7-1: Incised Channel Evolution Sequence

Type I reaches are located upstream of the actively degrading reach and have not yet experienced significant bed or bank instabilities. In Wailuku River, the upper concrete channel is considered Type I (Photo 7-1).

Photo 7-1: Type I Reach, Wailuku River

Immediately downstream of this reach segment, a Type II reach is encountered between the upper concrete channel and Imi Kala Street Bridge (Photo 7-2). The channel is actively degrading (the bed is lowering by erosion), but generally the banks are generally stable. There is one site along this reach segment that is at immediate risk of bank failure, however, the bank failure is more likely caused by the stream's intent to meander because of the tributary inflow rather than channel widening (a Type III characteristic).

Photo 7-2: Type II Reach, Wailuku River

Downstream of Imi Kala Street Bridge, a Type III reach begins, where the dominant process is channel widening. Extensive channel incision has led to very high banks with steep slopes, which will ultimately lead to bank failure. While there may be some areas of bed lowering still occurring, sediment deposition because of bank failure is more likely. Channel widening has also led to undermining of the boulder-concrete revetment along the right bank.

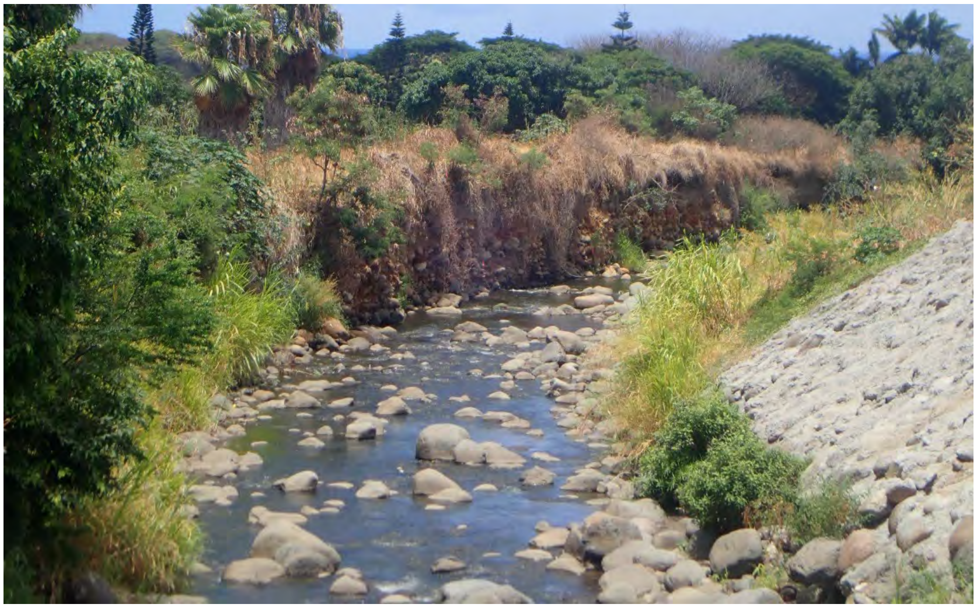


Photo 7-3: Type III Reach, Wailuku River

As the incised channel begins to return to a new state of dynamic equilibrium, Type IV reaches are characterized by the development of depositional features along margins of the over-widened channel. These depositional features, berms, represent the beginning of a new inner channel (Watson, Biedenharn, & Bledsoe, 2002). Bank instabilities and channel widening may continue, but at a much reduced rate. This seems to occur within the vicinity of Levee A (Photo 7-4).

Photo 7-4: Type IV Reach, Wailuku River

Finally, a state of dynamic equilibrium is achieved in a Type V reach, with a balance between sediment transport capacity and sediment supply. For Wailuku River, this is only achieved at the downstream end of the reach, near the outlet (Photo 7-5).

Photo 7-5: Type V Reach, Wailuku River

Identification of the evolutionary trends within the Wailuku River are critical to selecting appropriate rehabilitation measures that complement the morphologic phases.

7.2. Streambed and Bank Material

Iao Valley is a large “V”-shaped erosional valley that was deeply incised into the rocks that filled the original caldera of the West Maui Mountains. Wailuku River is the primary perennial drainage feature of Iao Valley. The portion of Wailuku River located within the project limits dissects the recent and older alluvial and fluvial deposits that comprise the gentle sloping terrain fronting the West Maui Mountains. The lower reaches of Wailuku River also dissect the lithified sand dunes that compose a portion of the windward Maui Isthmus. The boulder deposits encountered in the Wailuku River channel are of fluvial origin and have been transported from Iao Valley and adjoining lands by the activity of stream flow.

Photo 7-6 shows eroded *Levee D* with stratified deposits, following the September 2016 flood. Bank material is comprised of fluvial sediments, with evidence of multiple debris flows. Similar observations were made of the eroded left bank, with silty to clayey deposits of varying thickness (about 3 to 8 feet) overlaying boulders and cobbles.

Photo 7-6: Eroded Levee D and Channel Bed, Post September 2016 Flood

Photo 7-7: Eroded Left Bank (Designated Floodplain), Post September 2016 Flood

Bed material is segregated into two layers, with coarser particles overlying smaller gravels or sands beneath the surface. This overlying coarse layer is referred to as the armor layer and its presence indicates that the channel can transport more sediment than is available from upstream areas (finer sediment particles are washed away and the coarser ones are left on the river bed surface). This coarsening of the riverbed increases the surface roughness, *n*, and the amount of stress needed to move the bed material. Armoring is a natural phenomenon that reduces the risk of lateral channel scour and vertical incision. However, as observed during the September 2016 flood, even large boulders can be activated (moved) with enough stream power. The mean boulder size (D50) along the channel bed is approximately 1.0 ft (USACE, 1976).

7.2.1. Allowable Velocity

With reference to Engineer Manual 1110-2-1601, Plate B-29, the suggested maximum permissible mean channel velocity for Wailuku River is about **10.4 ft/s**. This was based on a mean particle size (D50) of 1 ft and specific stone weight of 135 lb/ft^3, under highly turbulent conditions (USACE, 1994). Additionally, the permissible velocity was increased 30%, reflective of high and infrequent discharges (extreme events).

Estimating the maximum permissible velocity allows for a quick comparison with hydraulic modeling results (Section 8.5) to determine when and where scour begins to occur.

7.2.2. Allowable Shear Stress

The *cohesive strength* of a material is the strength of bonding between the sediment particles and its ability to resist stress. Flowing water applies a *shear stress*, τ, on the bed and bank material. When the *shear stress* applied by the water is greater than the *cohesive strength* of the material, surface erosion and channel incision occur. The *critical shear stress*, τ_c, is the shear stress that is required to initiate surface erosion. Estimating this parameter allows for it to be used as a threshold in evaluating hydraulic modeling results (Section 8.5) or in the development of alternatives to reduce the risk of erosion (see Design Appendix).

7.2.2.1. Cohesion Strength Meter Test

In 2017, USACE requested assistance from USGS in performing a cohesive strength meter (CSM) test to estimate the cohesive strength of bank material at Revetment X (Photo 7-8). The test is performed by using a portable computer and water reservoir at the site, firing a jet of water at incrementally increasing pressure, and monitoring the amount of sediment suspended by using an infrared transmission meter. Cohesion values for initiation of bank erosion (90% transmission) between 0.2 – 0.5 kPa (4 – 10 lb/ft^2). After testing, sediment at each site were analyzed for particle size distribution. The soil texture ranged from loam to very gravelly sand loam. The average median particle size for the fine material in the bank matrix was 0.42 mm (0.017 in) (Stock, 2017). The USACE Committee on River Engineering did not think this data was reliable, however, given the type of sediments being tested on (boulders embedded in fine silt).

Photo 7-8: Cohesion Strength Meter "Jet" Testing at Revetment X

8. Development of the Hydraulic Model

A combined one-dimensional (1D) and two-dimensional (2D), unsteady flow hydraulic model was created for this study using the Hydrologic Engineering Center's River Analysis System (HEC-RAS) software (version 5.0.7, HEC, 2019).

8.1. Flow Data

Peak flow rates determined in the previous section (Table 5-20 and Table 5-21) were used to represent the amount of water in the system for the 50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% AEP (2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year) flood events (8 profiles).

8.1.1. Boundary Conditions

Boundary conditions are necessary to establish the starting water surface at the upstream and downstream ends of the channel system. A flow hydrograph was used to represent the amount of flow entering at the upstream end of the model (above the debris basin), from the SCS tributary (near *Levee G*), and as overland runoff entering the designated floodplain between *Levee G* and *Levee F*.

The downstream boundary condition at the ocean was set to a water surface elevation of 1.41 MSL (2.25 MLLW), representing the MHHW elevation of the ocean. For future scenarios (i.e. Future Without Project Conditions), the downstream boundary condition was set to a water surface elevation representing the MHHW with either *low*, *intermediate*, or *high* sea level change (SLC) conditions in the year 2100 (Section 6.4). Present day (2020) SLC estimates were subtracted from 2100 SLC estimates. These correspond to water surface elevations of 2.02 MSL (2.86 MLLW) for *low* conditions, 2.99 MSL (3.83 MLLW) for *intermediate* conditions, and 6.06 MSL (6.90 MLLW) for *high* conditions. Another downstream boundary condition using *normal depth* was added to represent flow that would continue along the southeast coast of Kahului that was beyond the study area.

8.1.2. Bulking

A bulking factor (BF) was initially applied to the peak flows previously presented in Table 5-5 and Table 5-6. The BF was computed for each event based on the estimated concentration of sediment in the flow (WEST Consultants, Inc., 2011):

$$BF = \frac{1}{1 - \frac{C_V}{100}}$$

where C_v is the concentration of sediment in percent volume.

While no sediment concentration data is available to reference, C_v was estimated for various frequency events based on each event's anticipated or observed flow characteristics (Table 8-1). The September 2016 flood, which was well documented, is estimated to have an approximate AEP of 0.025 (1/40). During this erosive event, surface waves (Photo 8-1) and marked settling of large cobbles and boulders were observed (Photo 8-2). This event was assumed to have a C_v of 40%. Other estimates and the corresponding BF are presented in Table 8-2. It was later determined, however, that increasing the Manning's roughness coefficient, *n*, for higher flow events was sufficient in replicating stages observed in past events (Section 8.3); bulking was not applied in the final model.

Photo 8-1: Mud flood, Imi Kala Street Bridge, September 2016 flood

Table 8-1: Mudflow Behavior as a Function of Sediment Concentration

	Sediment Concentration		**Flow Characteristics**
	by Volume	by Weight	Will not flow; failure by block sliding
Landslide	0.65 – 0.80	0.83 – 0.91	Block sliding failure with internal deformation during the slide; slow creep prior to failure
	0.55 – 0.65	0.76 – 0.83	Flow evident; slow creep sustained mudflow; plastic deformation under its own weight; cohesive; will not spread on level surface
Mudflow	0.48 – 0.55	0.72 – 0.76	Flow evident; slow creep sustained mudflow; plastic deformation under its own weight; cohesive; will not spread on level surface
	0.45 – 0.48	0.69 – 0.72	Flow spreading on level surface; cohesive flow; some mixing
Mud Flood	0.40 – 0.45	0.65 – 0.69	Flow mixes easily; shows fluid properties in deformation; spreads on horizontal surface but maintains an inclined fluid surface; large particle (boulder) settling; waves appear but dissipate rapidly
	0.35 – 0.40	0.59 – 0.65	Marked settling of gravels and cobbles; spreading nearly complete on horizontal surface; liquid surface with two fluid phases appears; waves travel on surface
	0.30 – 0.35	0.54 – 0.59	Separation of water on surface; waves travel easily; most sand and gravel has settled out and moves as bedload
	0.20 – 0.30	0.41 – 0.54	Distinct wave action; fluid surface; all particles resting on bed in quiescent fluid condition
Water Flood	< 0.20	< 0.41	Water flood with conventional suspended load and bedload

Photo 8-2: Large cobbles and boulders activated during September 2016 flood

Table 8-2: Sediment Concentration and Flow Characteristics for Various Frequency Events

AEP	AEP	Type	Sediment Concentration		Bulking Factor
			by Volume	by Weight	
≥ 0.002	≥ 1/500	Mud Flood	0.45	0.69	1.82
0.005	1/200		0.45	0.69	1.82
0.01	1/100		0.40	0.65	1.67
0.02	1/50		0.40	0.65	1.67
0.04	1/25		0.35	0.59	1.54
0.10	1/10		0.25	0.48	1.33
0.20	1/5	Water Flood	0.20	0.41	1.25
0.50	1/2		0.10	< 0.30	1.11

8.2. Geometry Data

RAS Mapper, a geospatial interface in the HEC-RAS software, was used to fully develop the geometric data required for the river hydraulics model. The projection was set to State Plane Zone 2 (US Survey Feet) with reference to the NAD83 (PA11) coordinate system. Elevation data presented in Section 3.2 was imported to create the terrain model. Several geometric layers required for the hydraulic model were digitized, some of which are described in Table 8-3 and Table 8-4. Generally, flow in the main channel was modeled in one dimension (1D) as the channel is well-defined and flow across the overbank areas were modeled in two dimensions (2D). A 2D model is usually preferred in urbanized areas or anywhere flow is expected to spread.

Table 8-3: GIS layers created for 1D hydraulic models

GIS Layer	Description
Stream	Stream centerlines are created to represent the river system schematic, associate individual cross-sections with designated river and reach names, compute stationing along the river, and compute reach lengths between cross-sections.
Cross Sections	Cross-section lines establish the location and extent for extracting station-elevation data from the terrain model for each cross-section. Cross-sections were drawn to represent typical conditions and key changes in the channel and floodplain geometry. In this study, the main channel is primarily represented by cross-sections and the floodplain areas are represented as 2D Flow Areas.
Bank Stations	Bank station points identify which part of the cross-section is the left overbank, main channel, and right overbank.
Flow Paths	Flow path centerlines define the center-of-mass of flow in the left overbank, channel, and right overbank areas. Flow path centerlines are used to compute the lengths between adjacent cross sections.
Bridges	Bridge centerlines establish the location and extent for extracting station-elevation data from the terrain model for describing the top-of-deck profile of the bridge or culvert. Additional information describing the bridges and culverts, such as road deck information and culvert dimensions, is also required.

GIS Layer	Description
Inline Structures	Inline structure centerlines define the location and extent of man-made and natural structures that act as inline dams and/or weirs (perpendicular to the river). They are also often used to represent significant vertical drops along the channel. Station-elevation data was extracted from the terrain model for the top of the inline structure.
Lateral Structures	Lateral structure centerlines define the location and extent of natural and man-made structures (such as levees) where water can flow out of the channel into overbank areas. Station-elevation data was extracted from the terrain model for the top of the lateral structure.

Table 8-4: GIS layers created for 2D hydraulic models

GIS layer	Description
2D Flow Areas	2D Flow Areas are created by constructing polygon areas representing the regions to be modelled.
Boundary Condition	A Boundary Condition (BC) line was added to identify the location for a specific flow condition on the boundary of a 2D Flow Area. In this study, a BC line was added to represent the flow coming from a tributary channel into the 2D Flow Area.
Breakline	Breaklines were sometimes used in 2D Flow Areas to align the computation cell faces along high ground and natural barriers that affect flow and direction (such as river banks).
SA/2D Area Connection	This internal connection feature can be used to represent embankment crests and major roads.

8.2.1. Cross-Section Orientation

Cross-section locations for the HEC-RAS model were determined by the channel slope, channel shape, and location of hydraulic structures (e.g. bridges, drop structures). Generally, cross-sections were oriented perpendicular to the flow of water. Intersecting cross-sections were bent or “doglegged” to preserve perpendicularity and ensure the overbank areas were not double-counted. Stationing begins with 0+00 at the ocean outlet to the northeast.

8.2.2. Cross-Section Spacing

The average spacing between cross sections along the Wailuku River is about 40 ft based on Samuels's equation:

$$L = \frac{0.15D}{S_o}$$

where,

L: Spacing of cross sections (m)

D: Bank fill depth (m)

S_o: Mean Channel Slope (m/m)

The bank fill slope ranges from 0.3 m to 1.5 m while the mean channel slope is between 0.02 and 0.03 m/m. Nonetheless, the spacing was adjusted, as needed, by moving, adding, or removing cross-sections along the reach. Cross sections that are too close or spaced too far apart can affect model stability.

8.2.3. Cross-Section Elevation Data

Elevation data presented in Section 3.2 was imported to create the terrain model. Cross section (XS) elevation profiles were extracted directly from the terrain model. Occasionally, adjustments were made to the bridge and cross section profiles to represent conditions observed in the field or depicted on record drawings. An example of the geometry layout created in RAS is provided as Figure 8-1. This figure shows the stream centerline in blue, cross-section cut lines in green, bank stations as small red dots, and bridge centerlines in grey.

Figure 8-1: HEC-RAS Geometry Layout

8.2.4. Manning’s Roughness Coefficient, *n*

Manning’s roughness coefficient, *n*, is an empirically derived coefficient that is dependent on several variables, such as vegetation, obstructions, and meandering when applied to open channels. At a minimum, the RAS model requires an *n* value for the left bank, main channel, and right bank areas of each cross section. This value was selected based on site characteristics observed in the field, aerial imagery, and land cover classifications based on the 2010 detailed land cover raster (Section 3.4).

Generally, the channel bed and banks can be described as either 1) a weedy reach with large cobbles and boulders characteristic of the debris basin (Photo 8-3), 2) a concrete float finish (Photo 8-3), 3) boulder-concrete revetment (Photo 8-4), or 4) loose cobbles and boulders characteristic of the natural reach segment (Photo 8-5). These segments were assigned a Manning’s *n* value based on a reference table of typical Manning’s *n* values for various channel types published by Chow in 1959. The values selected for this study are presented in Table 8-5 and very similar to the Manning’s *n* values used in the original design (0.014 for concrete; 0.030 for boulder-concrete; and 0.035 for grouted riprap). The boulder-concrete invert reach segment near the outlet has a slightly higher roughness coefficient as rock material and debris from the natural reach segment is often deposited here (Photo 8-6).

Significant changes to the channel were observed after the September 2016 flood (Photo 8-7 to Photo 8-10) and it became apparent that the default Manning’s *n* values selected would need to be adjusted for larger floods. During larger events, large stones are activated and carried downstream. In the natural reach segment, eroded banks contribute sediment and vegetative debris. Stream meandering increases, where possible. Engineering judgment was used to estimate higher roughness coefficients for the system during intermediate and high flow events, within reasonable limits. Higher than normal Manning’s *n* values (up to 0.07) were used in the HEC-RAS model to replicate volume increase due to the bulking during less frequent events. These values are also presented in Table 8-5.

Table 8-5: Manning's *n* Values Selected for the Channel

Reach Segment[1]	Channel Invert Type	Low (1/2, 1/5 AEP)	Intermediate (1/10, 1/25 AEP)	High ($\leq$ 1/50 AEP)
XS 14022 to XS 12725	Debris basin – large cobbles and boulders	0.050	0.050	0.050
XS 12660 to XS 10514	Boulder concrete invert	0.030	0.035	0.035
XS 10468 to XS 9741	Concrete float finish	0.015	0.020	0.020
XS 9701 to XS 9151	Boulder concrete invert	0.030	0.035	0.035
XS 9118 to XS 2361	Natural reach – cobbles and small boulders	0.033	0.050	0.070
XS 2308 to XS 5	Boulder concrete invert	0.033	0.040	0.045
[1]: Based on HEC-RAS Cross Section (XS), with some transition of Manning's *n* between segments for model stability				

Photo 8-3: Boulder Concrete Invert (0.030) and Debris Basin Invert (0.050) – Typical Low Flow Conditions

Photo 8-4: Concrete Float Finish Invert – Typical Low Flow Conditions (0.015)

Photo 8-5: Natural Reach Invert – Typical Low Flow Conditions (0.033)

Photo 8-6: Boulder Concrete Invert near Outlet – Typical Low Flow Conditions (0.035)

Photo 8-7: Debris Basin – Post High Flow Conditions

Photo 8-8: Debris Basin – Post High Flow Conditions

Photo 8-9: Natural Reach Invert – Post High Flow Conditions

Photo 8-10: Boulder Concrete Invert near Outlet – Post High Flow Conditions

2D flow and floodplain areas were determined by creating a Manning's *n* layer in RAS that relies upon the 2010 land cover raster and designated *n* values for each land cover classification.

Table 8-6: Designated Manning's *n* for 2D Flow Areas

Land Cover Classification	**Manning's *n***
Open water	0.04
Open space developed	0.04
Cultivated land	0.035
Grassland	0.035
Evergreen	0.16
Scrub shrub	0.1
Palustrine forested wetland	0.12
Palustrine scrub shrub wetland	0.1
Palustrine emergent wetland	0.07
Unconsolidated shore	0.04
Impervious surface	0.08
Bare land	0.025

8.2.5. Levees

Levee stations were used to confine flows to the channel for lower flow rates and represent natural barriers that would prevent water from entering the overbank before a certain elevation. The levee feature in HEC-RAS allows for this feature to be used to manipulate the model and to simulate an actual physical levee as expected.

8.2.6. Bridges

There are three bridges that cross Wailuku River downstream of the existing project's debris basin. A summary of the geometric features of these three bridges are provided in Table 8-7, as collected by field surveys, as-built plans, and national bridge inventory data. The Spreckels Ditch aqueduct was not included as a "bridge" in this version of the hydraulic model as it was previously found not to affect channel hydraulics significantly (water levels do not reach this feature, even during extreme events).

Table 8-7: HEC-RAS Bridge Information for Wailuku River

HEC-RAS Station	Name	Deck width (ft)	Deck thickness (ft)	Number of piers	Pier width (ft)	Bedrock material
9950	Market Street	38.1	3.75	0	n/a	Concrete
7929	Imi Kala Street	21.1	3.5	2	3-5	Natural
2000	Waiehu Beach Road	49.8	5	2	7	Concrete

Figure 8-2: Market Street Bridge, looking downstream

Figure 8-3: Imi Kala Street Bridge, looking downstream

Figure 8-4: Waiehu Beach Road Bridge, looking downstream

8.2.7. Inline structure

Inline structures were used to represent the headwall structure at the downstream end of the debris basin and at each drop structure (to improve model stability). The 5-ft wide openings in the headwall were represented as box culverts in the model.

Figure 8-5: Debris Basin Headwall

8.2.8. Drop Structures

Drop structures within the system were identified as either ogee or broad-crested and included in the model as an inline weir. A weir coefficient of 2.6 was used.

Photo 8-11: Ogee weir

Photo 8-12: Broad-Crested Weir

8.3. Model Calibration

The model was calibrated by simulating the September 2016 flood event – a recent and damaging flood event that generated the largest peak flow on record since the project was constructed in 1981.

Both USGS stream gages on Wailuku River were damaged by the event; however, the USGS estimated flows to be approximately 10,900 ft^3/s near USGS 16607000 (between the Debris Basin and Market Street Bridge). The hydraulic model showed a similar peak flow at this location during the event simulation.

Photographs provided by the County of Maui (Photo 8-13) show evidence of overtopping at Imi Kala Street Bridge, which resulted in minor street flooding in the right bank floodplain (and likely the left bank also, which is a designated floodplain). The limited extent of flooding into the right bank area likely indicates it was the result of wave action. These photos also show the types and amount of debris encountered during larger flood events (large branches and other woody vegetation). This condition was represented in the hydraulic model with 10-foot debris width at each pier to an elevation of 175 ft (approximately 10 feet high).

Photo 8-13: Imi Kala Street Bridge, facing the right bank, September 2016

During the post-flood inspection by USACE, debris lines – a high water mark indicator – were observed along the revetment at various locations:

1) At the bend between Levee D and C (where bank failure occurred): within a few feet from the levee crest (Photo 8-14);
2) Immediately downstream from Revetment X: 15 feet from the levee toe as measured along the sloped revetment towards the crest (Photo 8-15);

Photo 8-14: Debris Line near Levee D/C

Photo 8-15: Debris Line near Revetment X

When comparing this debris line with water surface elevations projected by the hydraulic model, however, the simulated water surface elevations were much lower (approximately 6 feet). To calibrate the model, Manning's *n* was increased along the natural reach from 0.033 to 0.070, understandably, to reflect the significant amount of debris and boulder material that were transported by the large flows along the steep reach. This raised the water surface elevation approximately 4 feet. Photo 8-16 shows the type of sediment material transported downstream to the previously cleared, concrete-lined invert near Waiehu Beach Road Bridge (downstream of the natural reach). It did not seem necessary to adjust the Manning's *n* coefficients along either the upstream or downstream concrete-lined channels as simulated water surface elevations were similar to observed elevations. These channels, which are much shallower than the natural reach, were initially set to a Manning's *n* that reflected its boulder-concrete invert (0.03 – 0.035) and left unchanged.

Photo 8-16: Near Waiehu Beach Road Bridge, Post-Flood, September 2016

The remaining difference between the simulated water surface elevations and observed debris lines (approx. 2 feet) is likely the result of superelevation (when the water surface elevation varies between the banks when the river bends) not accounted for in 1D modeling.

8.4. Model Sensitivity

A sensitivity analysis was performed on the hydraulic model by varying the values of Manning’s *n* to evaluate how water surface elevations were affected by this parameter. For this analysis, Manning’s *n* was multiplied by 1.2 in one simulation and 0.8 in another. The results of this analysis against the 1% AEP event show that the uncertainty in the water surface elevation due to the Manning’s *n* variation is about ±2.40 feet, with a standard deviation of 0.51 feet.

8.5. Future Without Project Conditions

The *Future Without Project* (FWOP) condition is based on the following conditions or assumptions: 1) sea level change in 2100 (Section 6.4), 2) channel incision continues to occur at the rate of 0.2 ft/yr (Section 2.6), 3) the project continues to be maintained by the nonfederal sponsor, the County of Maui, 4) emergency repairs and preventative maintenance projects are undertaken by the County of Maui within reasonable limits (to the extent done previously), 5) a single-event levee breach would likely occur during the 2% (1/50) AEP flood (Section 2.7).

To reflect FWOP conditions in the hydraulic model, the terrain was adjusted to reflect failure of the levees at critical points (Levee D and Levee C) for the 2% (1/50) AEP flood event and larger ones. This was based on past performance of the levee and a levee breach analysis (Section 2.7). Additionally, *high*, *intermediate*, and *low* sea level change (SLC) scenarios were included in the model runs for each frequency event.

9. Summary of Hydraulic Modeling Results

The results of this study make available the water surface profiles, flood elevations, and areal extent of the floodplain for the 50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% (1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, and 1/500) AEP flood events (8 profiles).

9.1. Existing Conditions

Overtopping is likely to first occur during the 4% (1/25) AEP event, over the left and right bank floodwalls downstream from Market Street Bridge, within the vicinity of the 20-ft vertical drop structure, RS 97+25 (Photo 9-1). The HEC-RAS flood profile at this location is provided as Figure 9-1. The momentum of the water moving over the drop structure during such a significant event may lessen the effects to splash and wave action for a period of about 1 hour for the 4% AEP event and about 2½ hours for the 0.2% AEP event. It is unknown if flooding issues occurred during the September 2016 event (2.5% AEP) at this location. It seems unlikely any significant flooding occurred as the event's damages were thoroughly documented by the media and did not identify this area, which was likely only subjected to very minor overtopping (splashes) or street flooding during the peak of the event. Residents should be interviewed in the future to verify conditions.

Photo 9-1: Looking upstream near RS 97+25, Iao Stream FCP

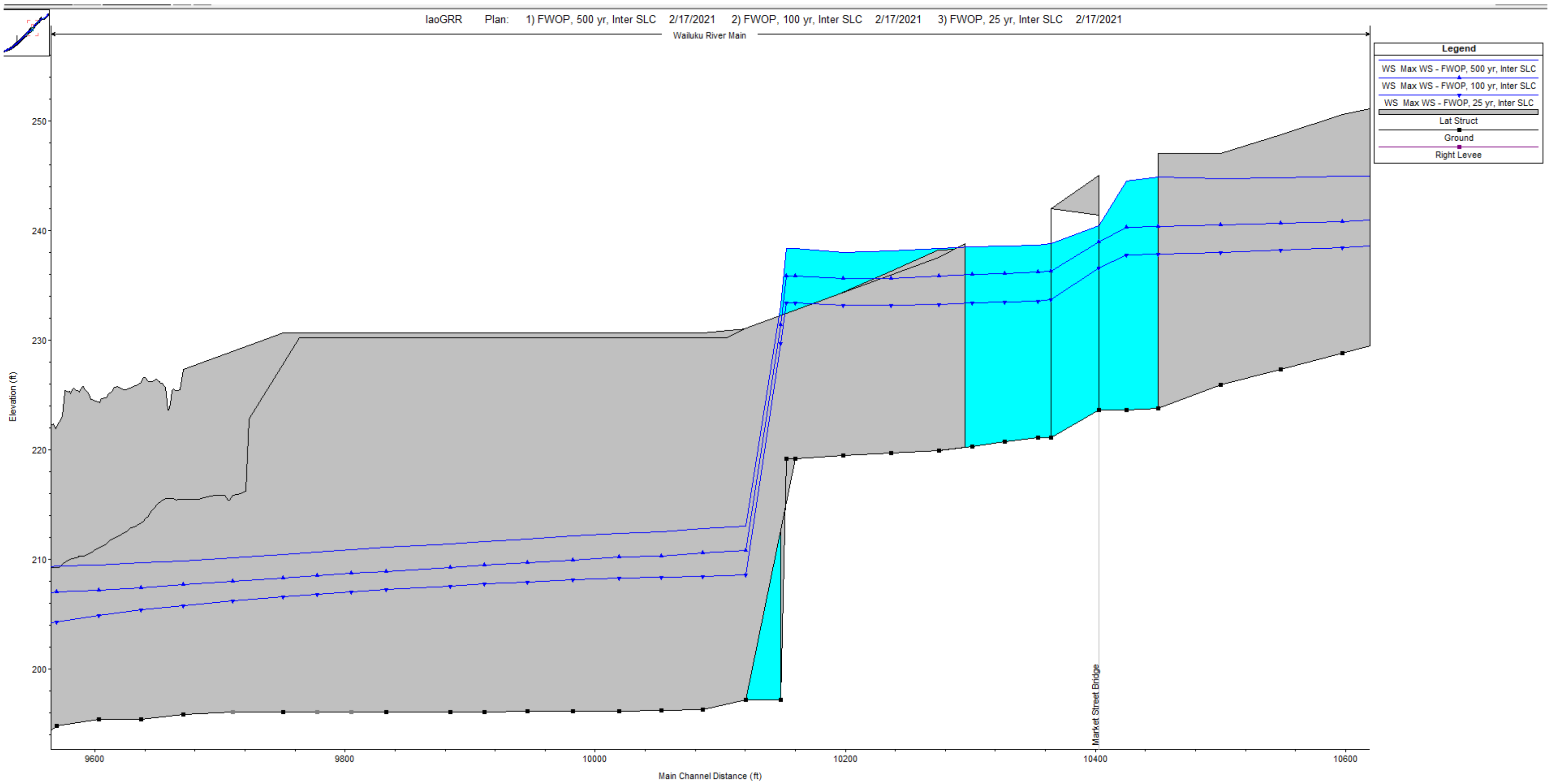


Figure 9-1: "Existing Conditions" Flood Profile for 0.04 AEP, 0.01 AEP, and 0.002 AEP near RS 97+25, Iao Stream FCP

Overtopping also occurs during the 2% (1/50) AEP at the drop structures along the upper concrete channel (Photo 9-2). Similar to the raised water surface elevation conditions at the drop structure near RS 97+25 (Figure 9-1), the raised elevation only occurs near the drop structure (Figure 9-2), and the momentum of the stream moving quickly down the channel may limit the actual amount of water that overtops the floodwall. Only the first three of the four drop structures in the upper channel indicate overtopping by the hydraulic model. The fourth, located just before Market Street Bridge and where the gage is located does not overtop during the 0.2% (1/500) AEP flood.

Photo 9-2: Looking upstream near RS 114+50, Iao Stream FCP

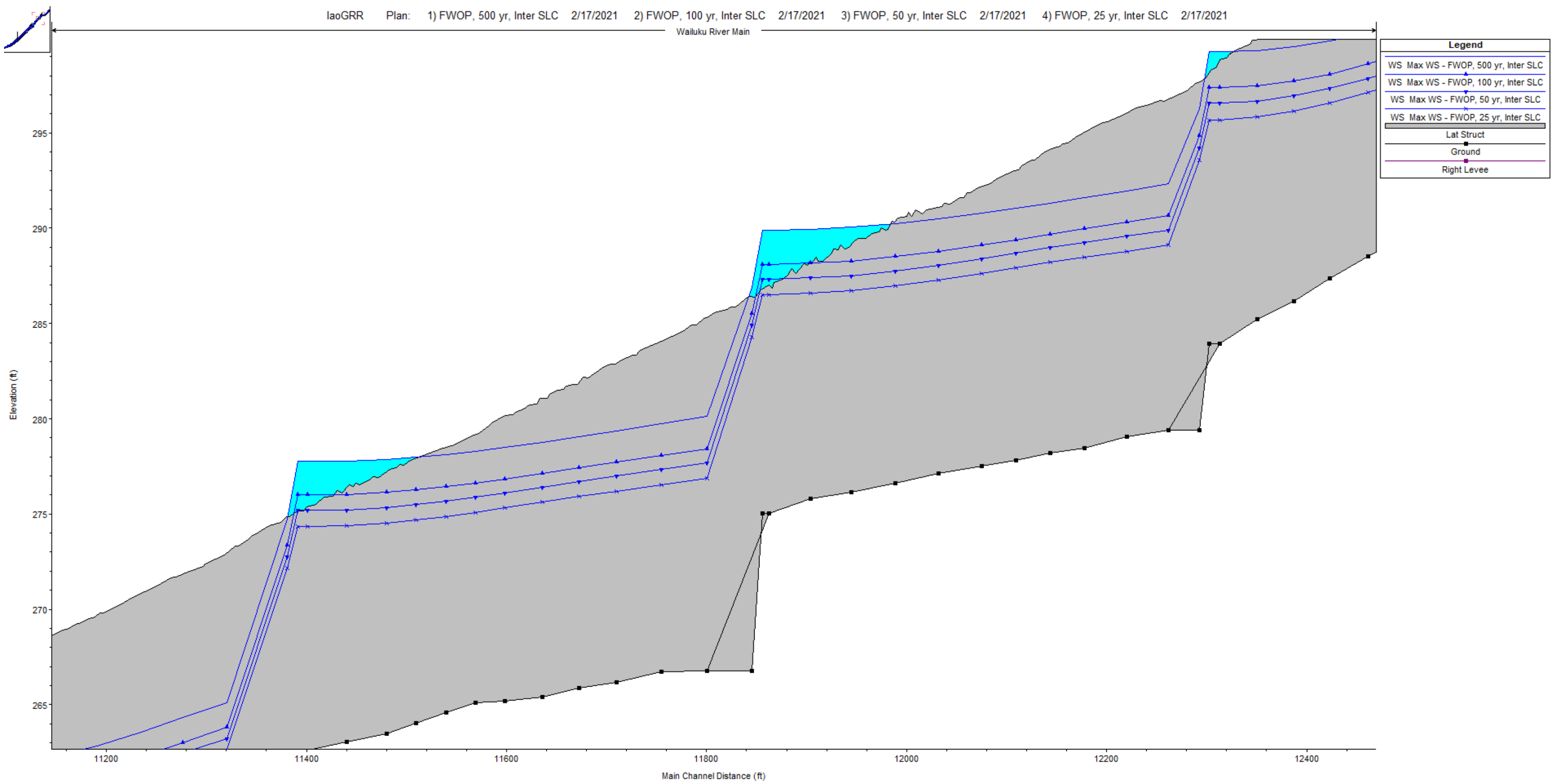


Figure 9-2: "Existing Conditions" Flood Profile for 0.04 AEP, 0.01 AEP, and 0.002 AEP near RS 97+25, Iao Stream FCP

Market Street Bridge does not overtop during the 0.2% (1/500) AEP flood. Imi Kala Street Bridge overtops during the 2% (1/50) AEP flood, but not the 4% (1/25) AEP flood. This is consistent with observations of limited overtopping and street flooding during the September 2016 (2.5% AEP; 1/40 AEP) flood (Section 8.3, Model Calibration). Waiehu Beach Road Bridge does not come close to overtopping for any event.

Typical and maximum conditions computed along the natural reach of Wailuku River and primary study area, from XS 8520 to XS 4274, are presented below. All values were rounded to three significant figures and computed in HEC-RAS. These values were determined by drawing a profile line along the natural reach in RAS Mapper and taking either the average or maximum value, as computed by HEC-RAS.

Table 9-1: Typical (averaged) conditions computed in RAS for the natural reach

Parameter		Annual Exceedance Probability (AEP)						
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500
Peak Flow (ft^3/s)	4,200	6,580	9,700	10,300	11,900	13,400	14,800	16,100
Water Depth (ft)	6.94	8.67	11.5	12.7	15.3	16.1	16.9	17.8
Velocity (ft/s)	24.6	24.6	20.5	22.1	18.4	19.1	19.7	20.2
Shear Stress (lb/ft^2)	0.23	0.56	1.81	2.88	6.40	8.14	9.99	12.4

Table 9-2: Maximum conditions computed in RAS for the natural reach

Parameter		Annual Exceedance Probability (AEP)						
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500
Peak Flow (ft^3/s)	4,350	6,880	16,200	11,000	12,800	14,600	16,600	19,000
Water Depth (ft)	11.8	14.4	16.3	18.1	19.9	21.4	23.7	25.1
Velocity (ft/s)	31.1	31.1	26.0	28.4	23.5	24.4	25.1	25.9
Shear Stress (lb/ft^2)	0.45	1.10	3.55	5.64	13.4	17.0	20.5	25.5

Velocities are slower for larger events due to increased roughness by sediment and debris contributions to the channel (Section 8.2.4).

Upper Concrete Channel: Inundation of the upper left bank (Figure 9-3) begins at the 2% (1/50) AEP flood. Even during the 0.2% (1/500) AEP flood, depths remain shallow (< 2 feet). Market Street Bridge does not overtop in the simulated 0.2% AEP flood. Velocities (Figure 9-4) in the floodplain at this location are greatest in the street adjacent to the floodwall (Kahawai Street) with speeds of 1-2 ft/s for the 1% AEP, 3 ft/s for the 0.5% AEP, and 4-5 ft/s for the 0.2% AEP.

Natural Reach: Inundation in the designated floodplain (Figure 9-5) begins with minor overflow near the tributary junction during the 50% (1/2) AEP flood to quite extensive coverage during the 0.2% (1/500) AEP flood. Typical depths in the floodplain remain shallow (< 2 feet), except at ineffective flow areas where high ground barriers can result in depths up to 10 feet. Inundation in the right bank consequence area remains very shallow (< 1 feet), even during the 0.2% AEP flood and typically follows the roads. Velocities in floodplain vary greatly, with some speeds reaching up to an erosive 13 ft/s near Levee F for the 0.2% AEP flood. In the right bank consequence area, however, velocities of flow that have overtopped existing project features are consistently smaller (< 2 ft/s). Although the scale differs, shear stress distribution seems to be consistent throughout all events. Higher shear stress was computed near the SCS tributary, Levee D, Levee C, and Revetment X (Figure 9-7 and Figure 9-8).

Lower Reach and Outlet: Residential structures near the outlet appear to become inundated just beyond the 1% (1/100) AEP flood as floodwaters wrap around the end of the floodwall into the consequence area. Flood depths remain shallow (< 2 ft), even for the 0.2% (1/500) AEP flood. Waiehu Beach Road Bridge is unlikely to overtop. Velocities of the inundated area are low (< 2 ft/s).

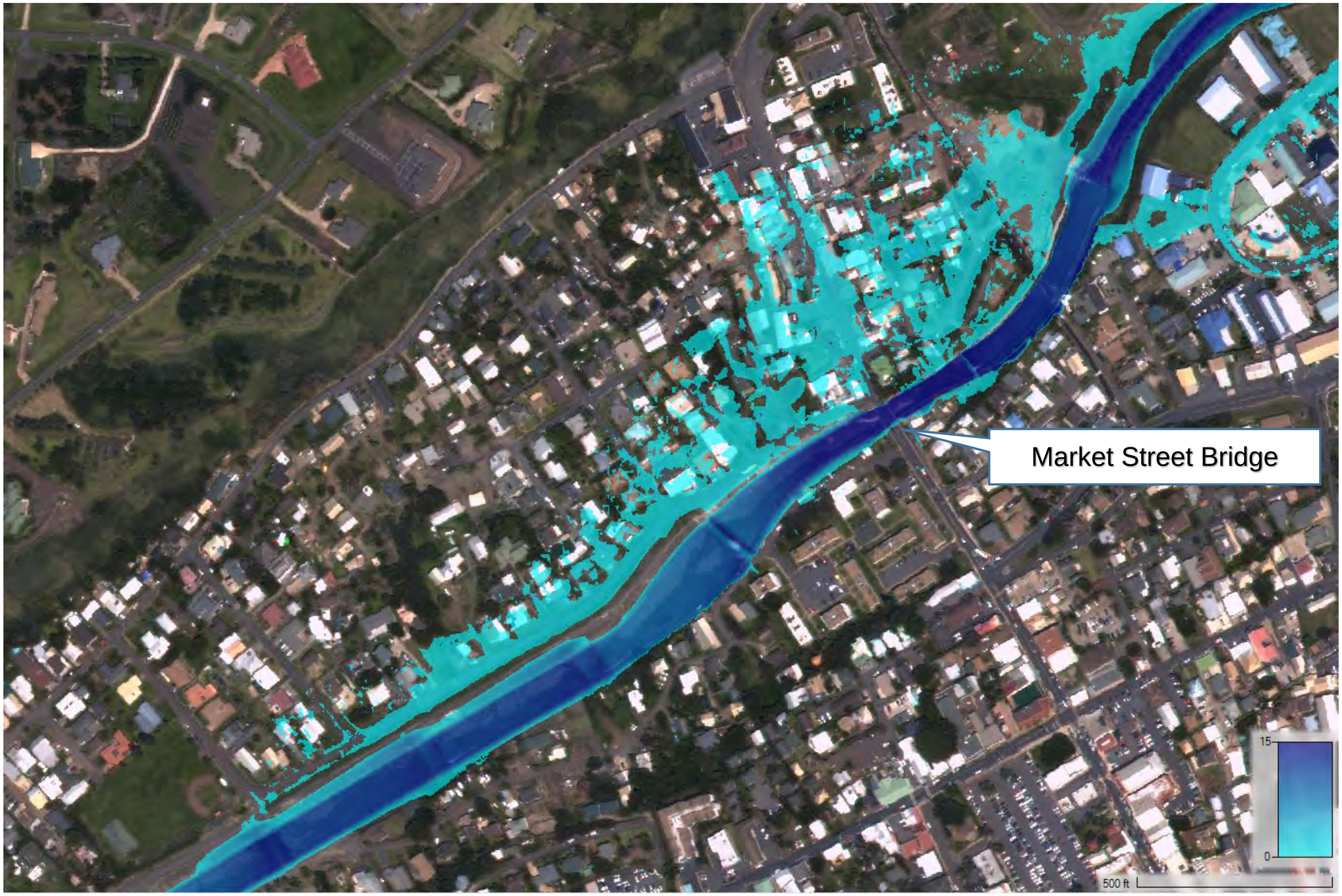


Figure 9-3: Maximum Depth "Existing Conditions" 0.2% AEP Flood, Upper Concrete Channel, Iao Stream FCP

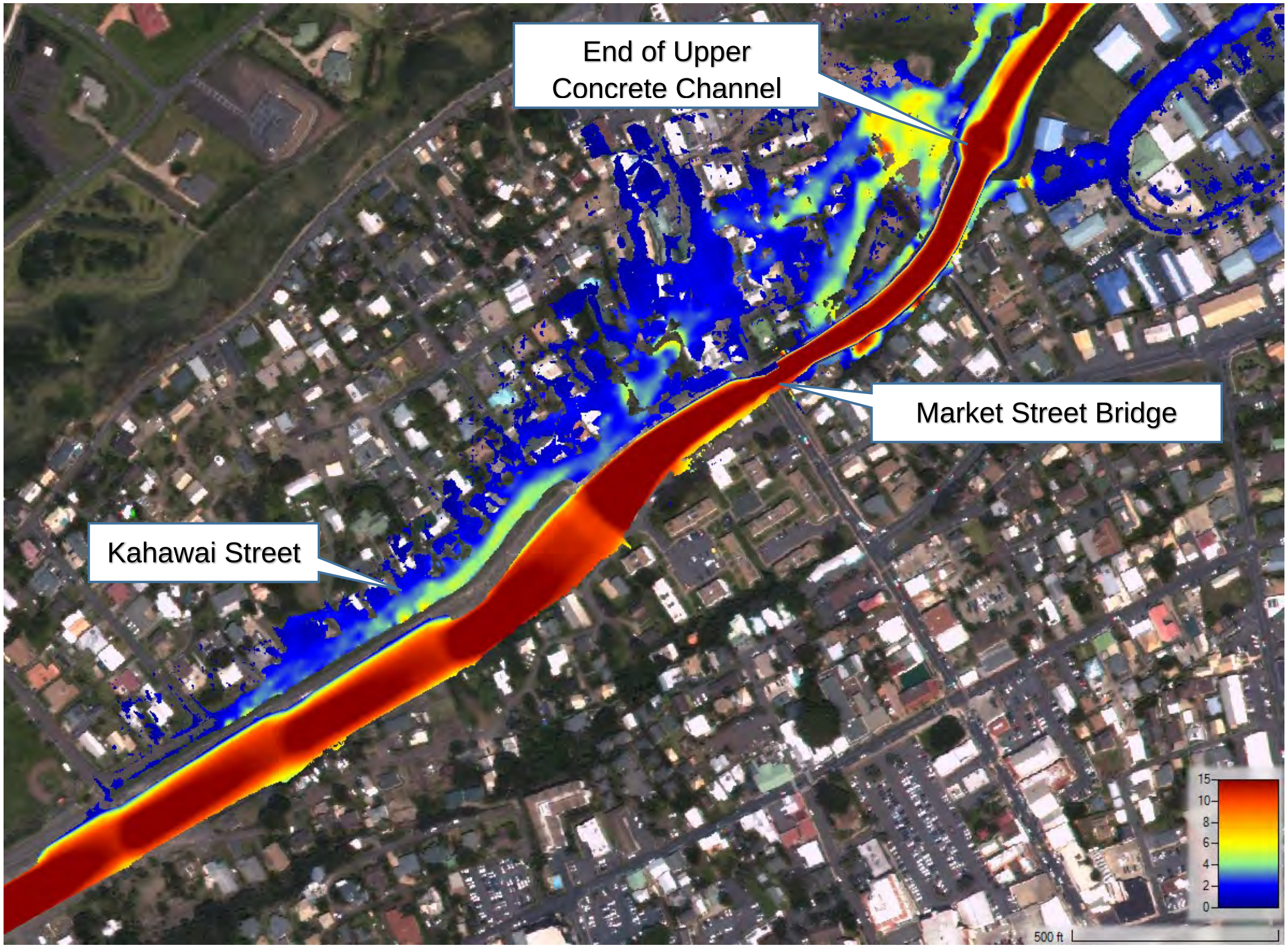


Figure 9-4: Maximum Velocity "Existing Conditions" 0.2% AEP Flood, Upper Concrete Channel, Iao Stream FCP

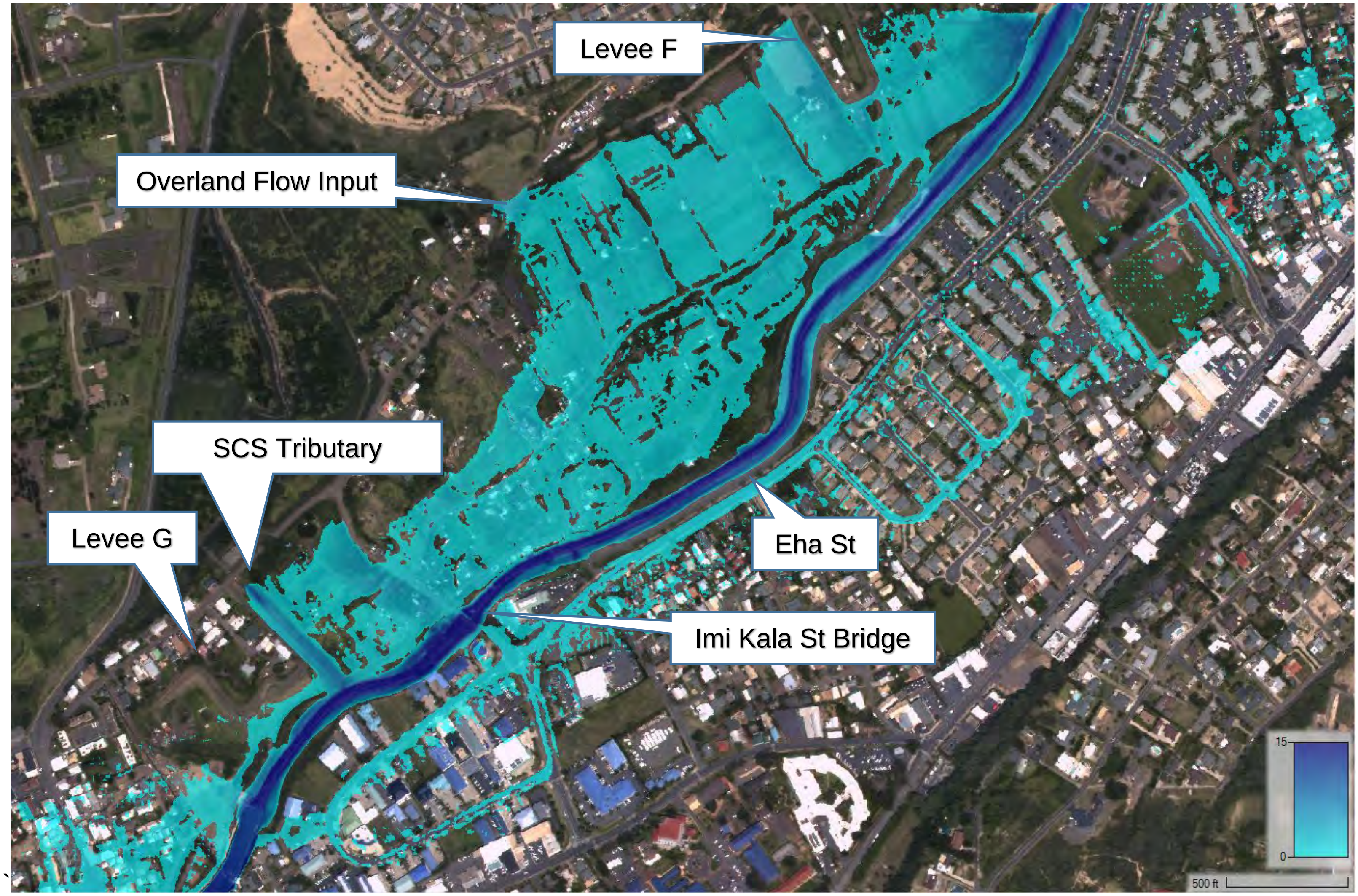


Figure 9-5: Maximum Depth, "Existing Conditions" 0.2% AEP Flood, Natural Reach Segment, Iao Stream FCP

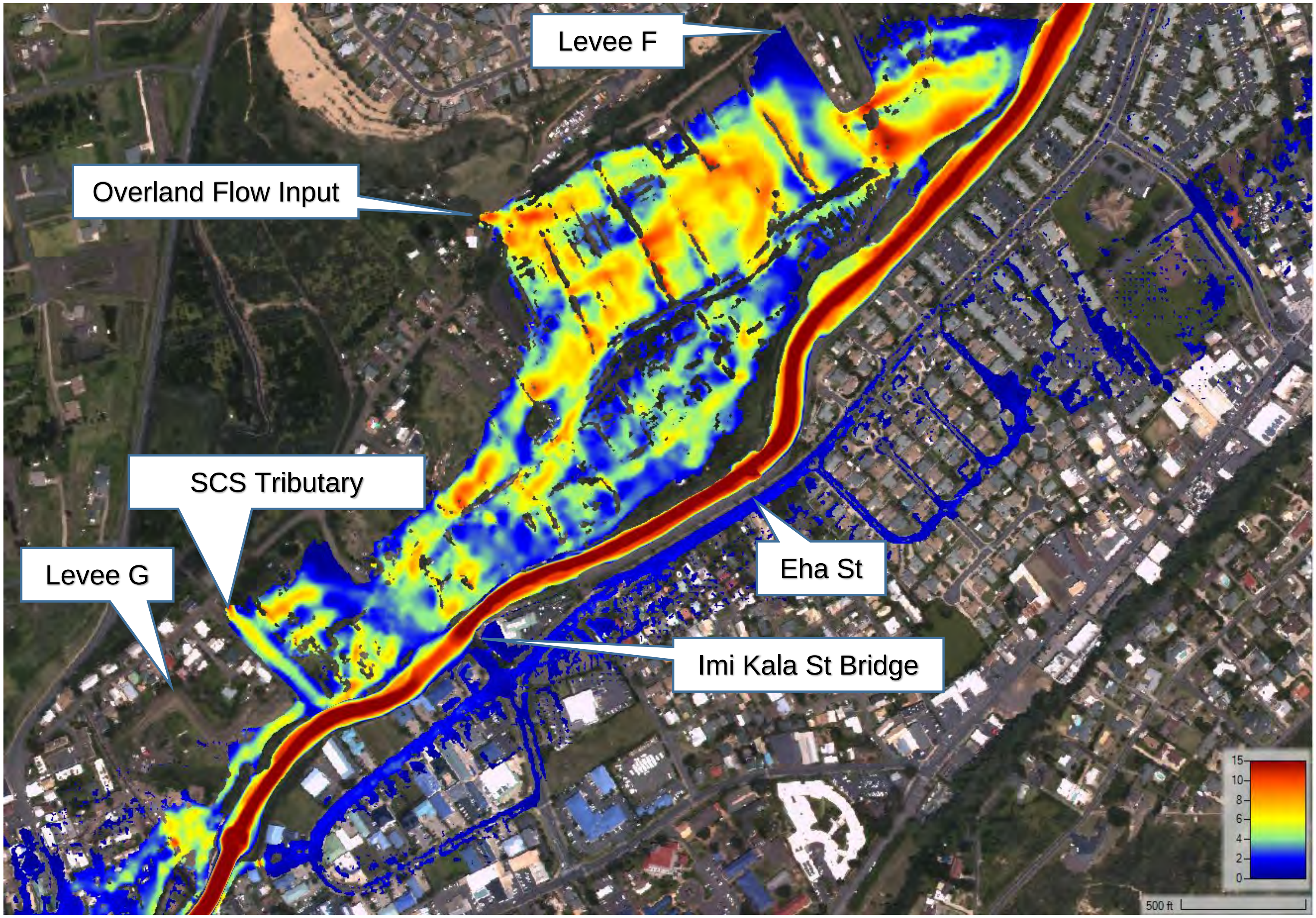


Figure 9-6: Maximum Velocity for the "Existing Conditions" 0.2% AEP Flood, Natural Reach, Iao Stream FCP

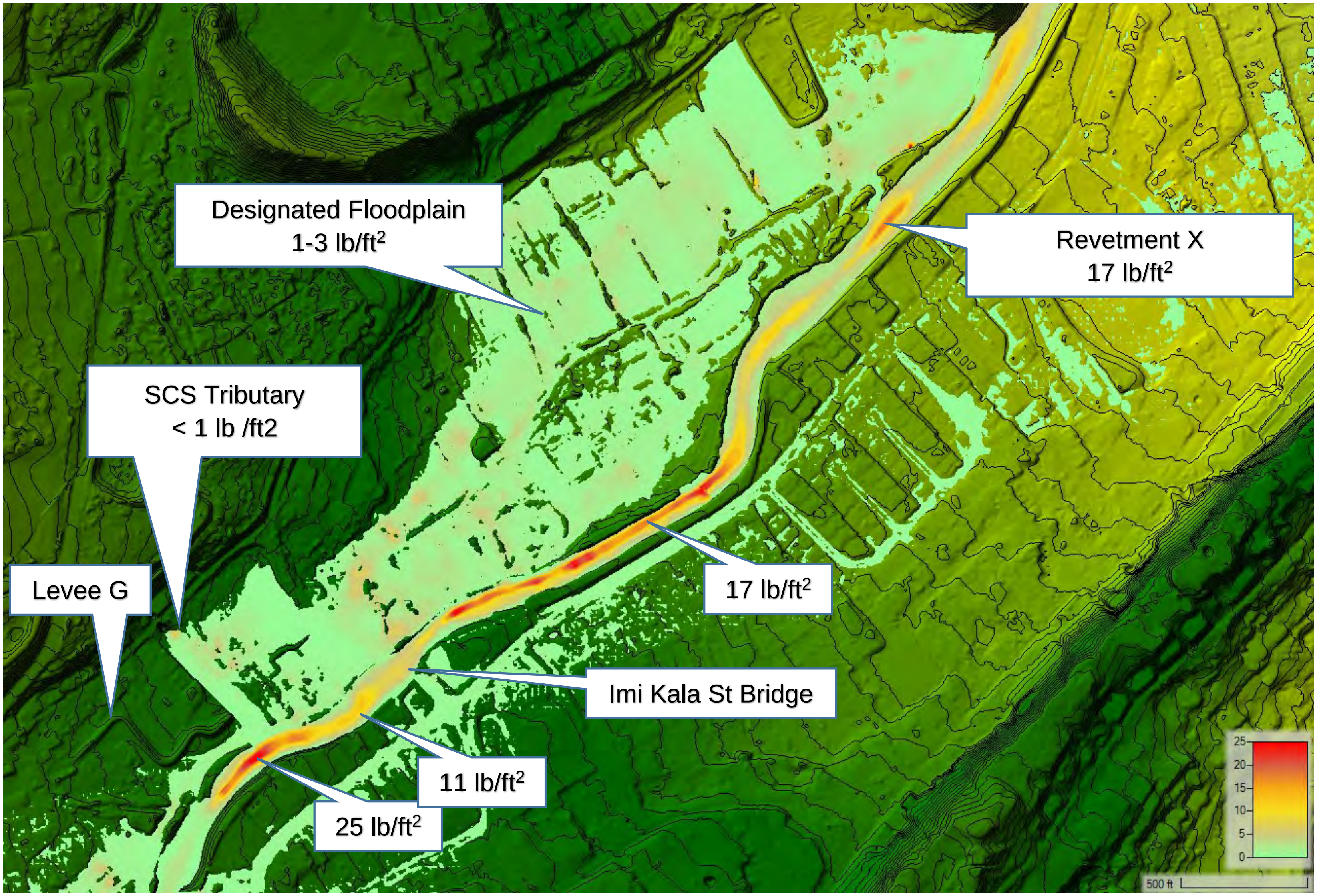


Figure 9-7: Shear Stress Distribution Map, “Existing Conditions” 0.2% AEP Flood, Upper Natural Reach

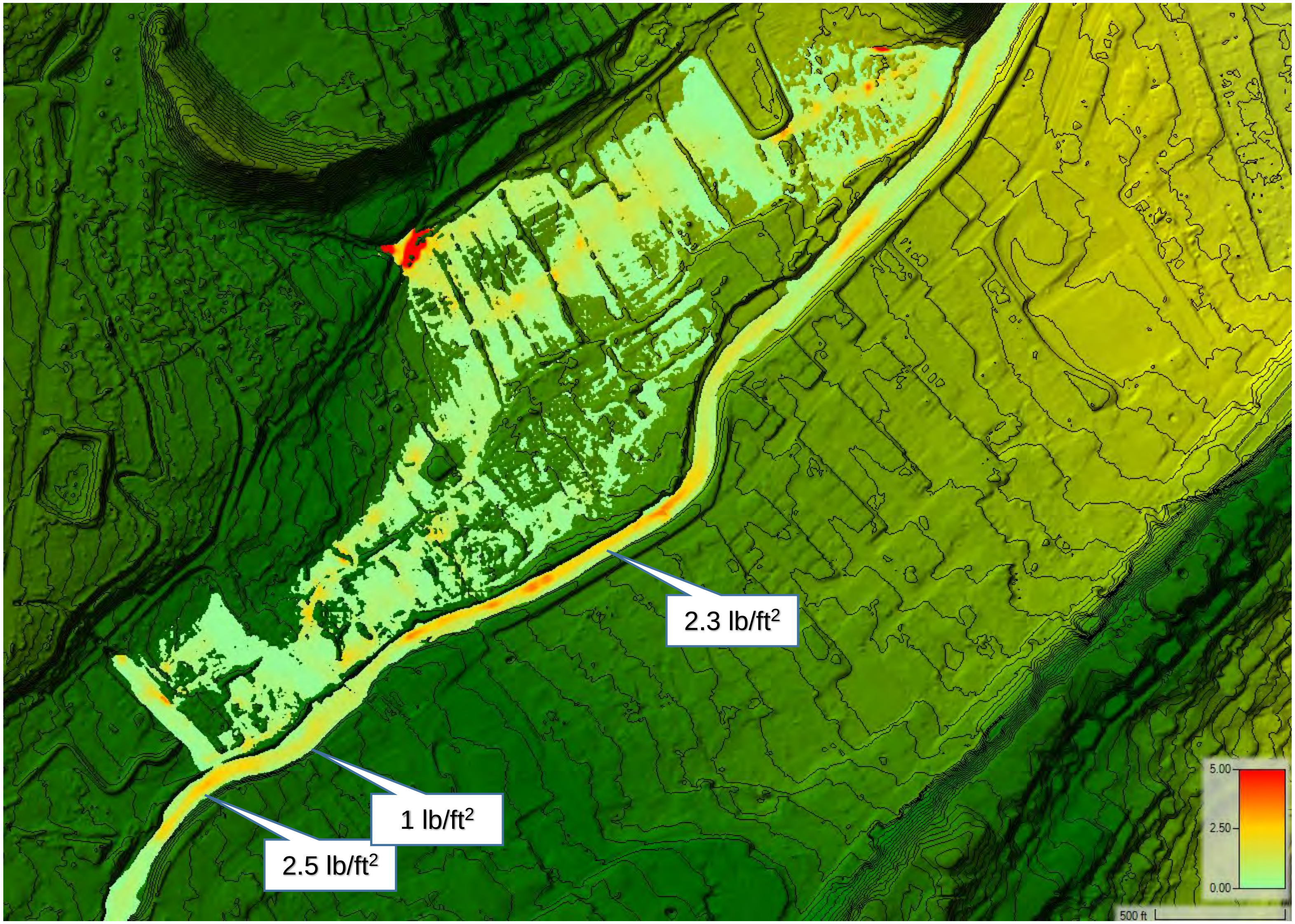


Figure 9-8: Shear Stress Distribution Map, "Existing Conditions" 10% AEP Flood, Upper Natural Reach

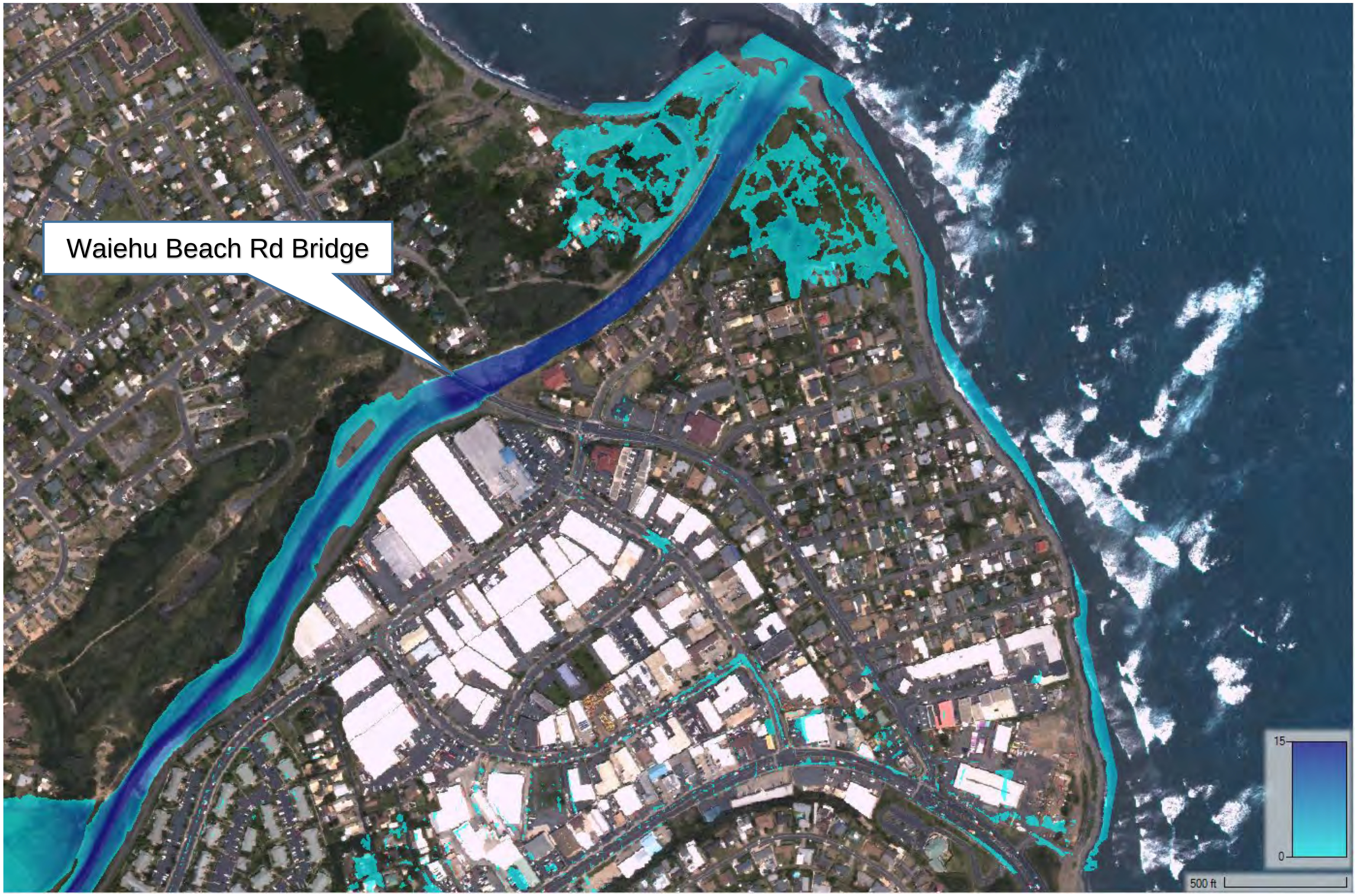


Figure 9-9: Maximum Depth for the “Existing Conditions” 0.2% AEP Flood, Lower Reach and Outlet, Iao Stream FCP

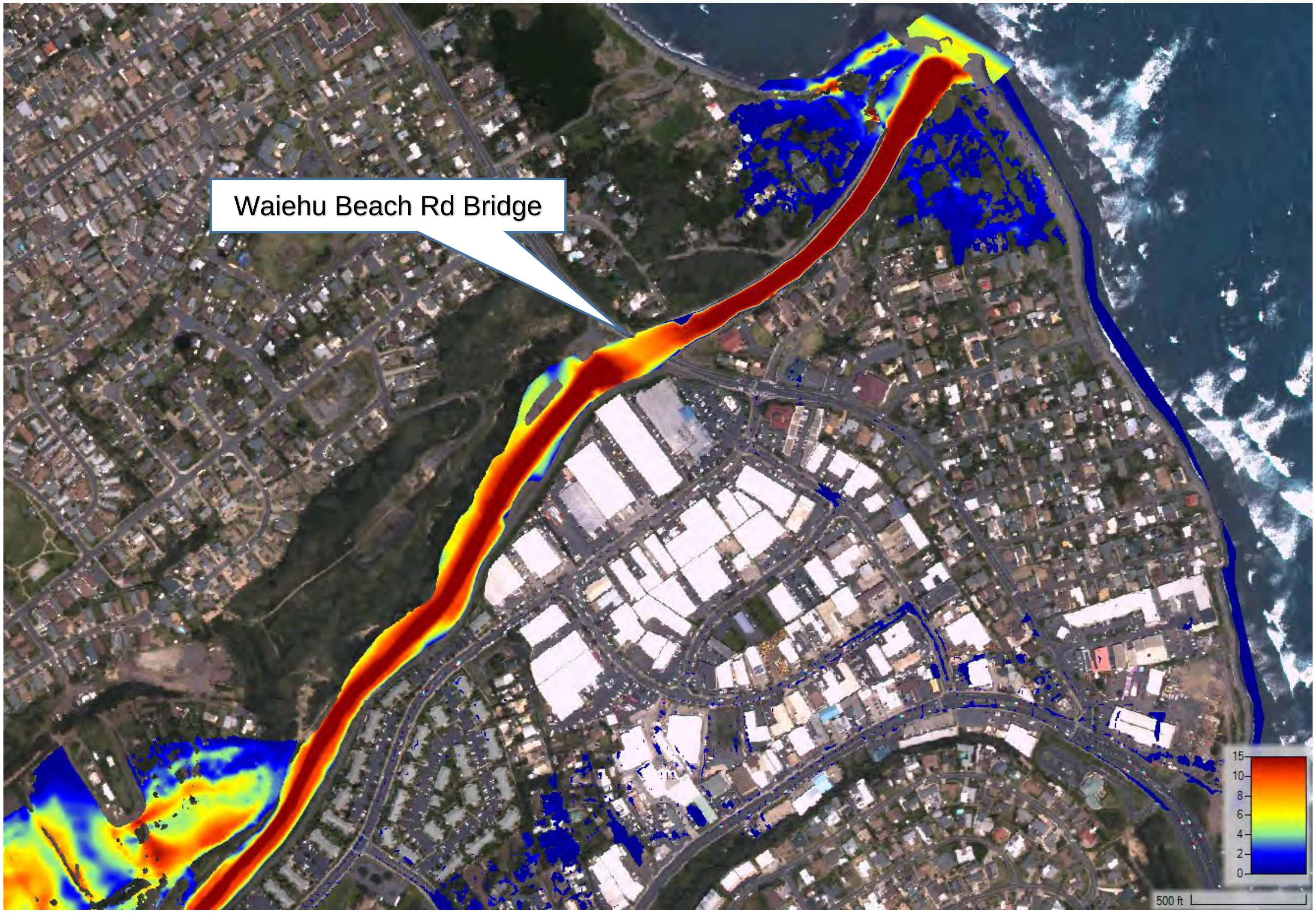


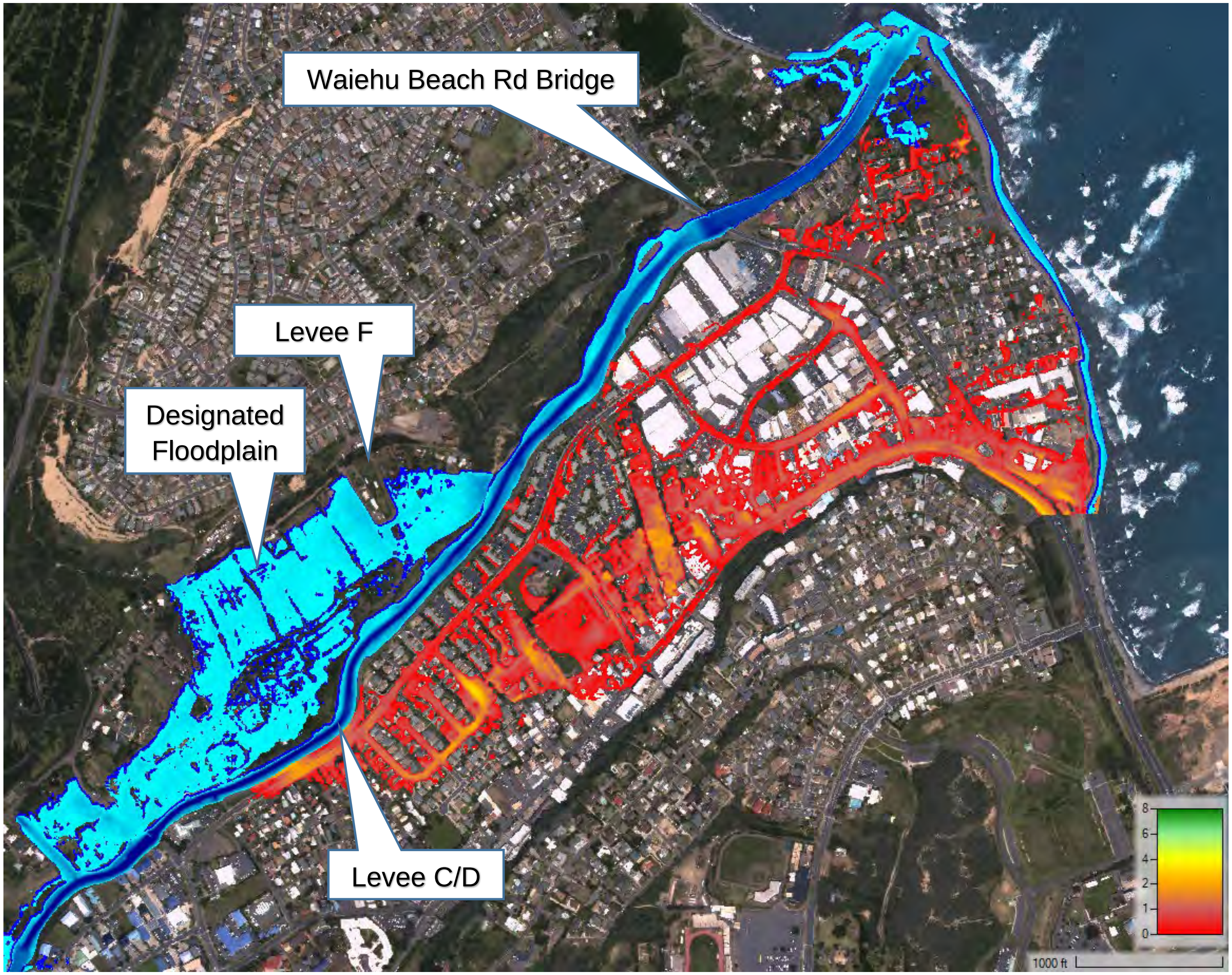
Figure 9-10: Maximum Velocity for the "Existing Conditions" 0.2% AEP Flood, Lower Reach and Outlet, Iao Stream FCP

9.2. Future Without Project Conditions

With the anticipated failure of Levees C and D during the 2% (1/50) AEP event, significant sheet flow inundates the right bank consequence area during this triggering event and larger ones (Figure 9-11). While the areal distribution is quite extensive, the flow remains quite shallow throughout most of the inundated area (< 2 ft depths) – even during the 0.2% (1/500) AEP flood (Figure 9-12).

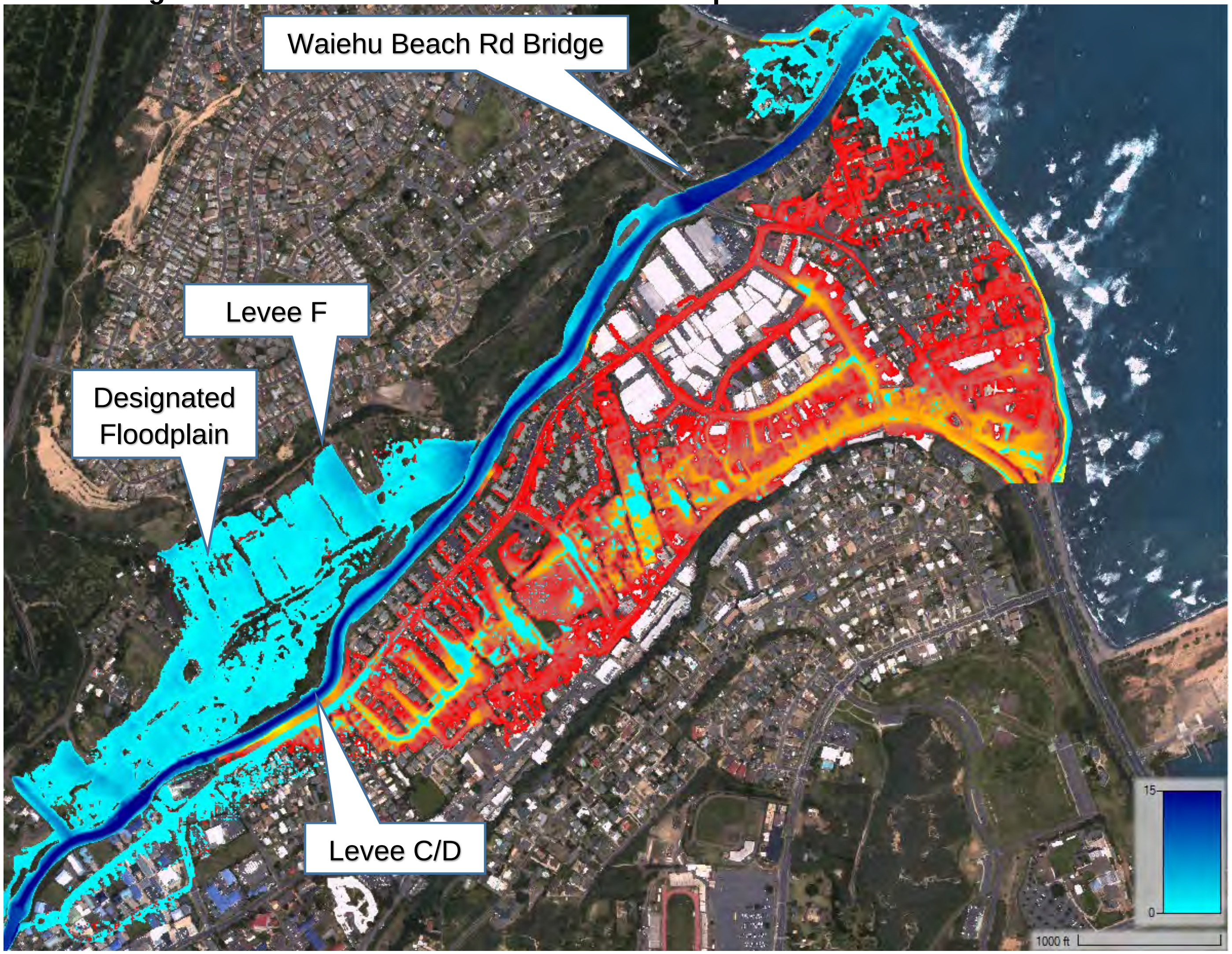
In the newly inundated area, approximately two-thirds of the flow appears to be slow moving (1-2 ft/s) and one-third of the flow appears to be a more concerning 4-5 ft/s during the 0.2% AEP flood (Figure 9-13). Flows near the breach site (Levee C and D) cause the greatest risk to life safety (Section 9.3).

Sea level change has a negligible impact to the Iao Stream FCP because of its steep channel slope. Changes in water surface elevation are limited to the very downstream end of the reach (Figure 9-14).



“Existing Condition” Depth Grid in Blue; “Future Without Project Condition” Depth Grid in Red

Figure 9-11: Areal Extent of Inundation Comparison for the 2% AEP Flood



"Existing Condition" Depth Grid in Blue; "Future Without Project Condition" Depth Grid in Red

Figure 9-12: Areal Extent of Inundation Comparison for the 0.2% AEP Flood

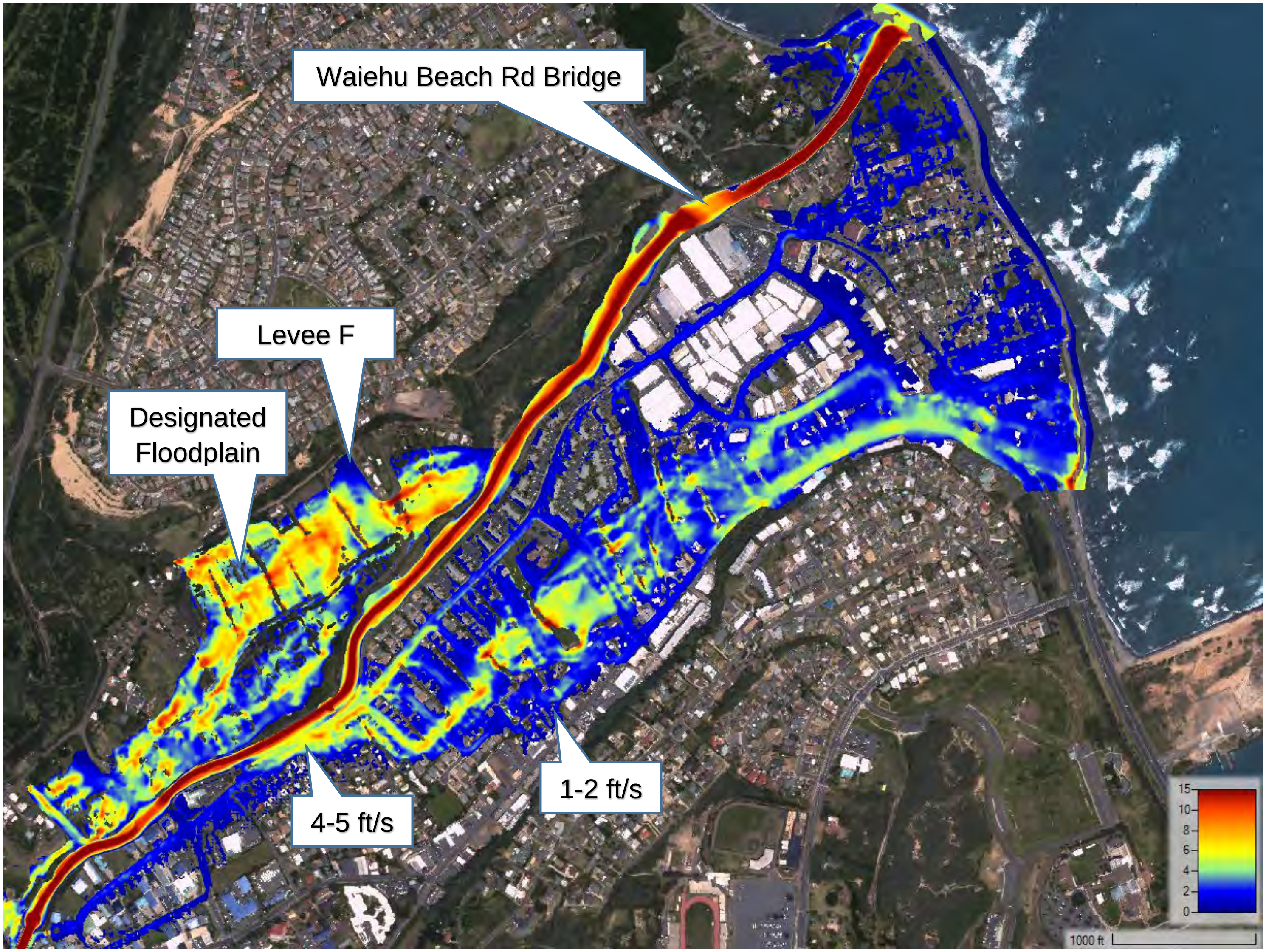


Figure 9-13: Velocity Map for "Future Without Project Conditions" during the 0.2% AEP Flood, Iao Stream FCP

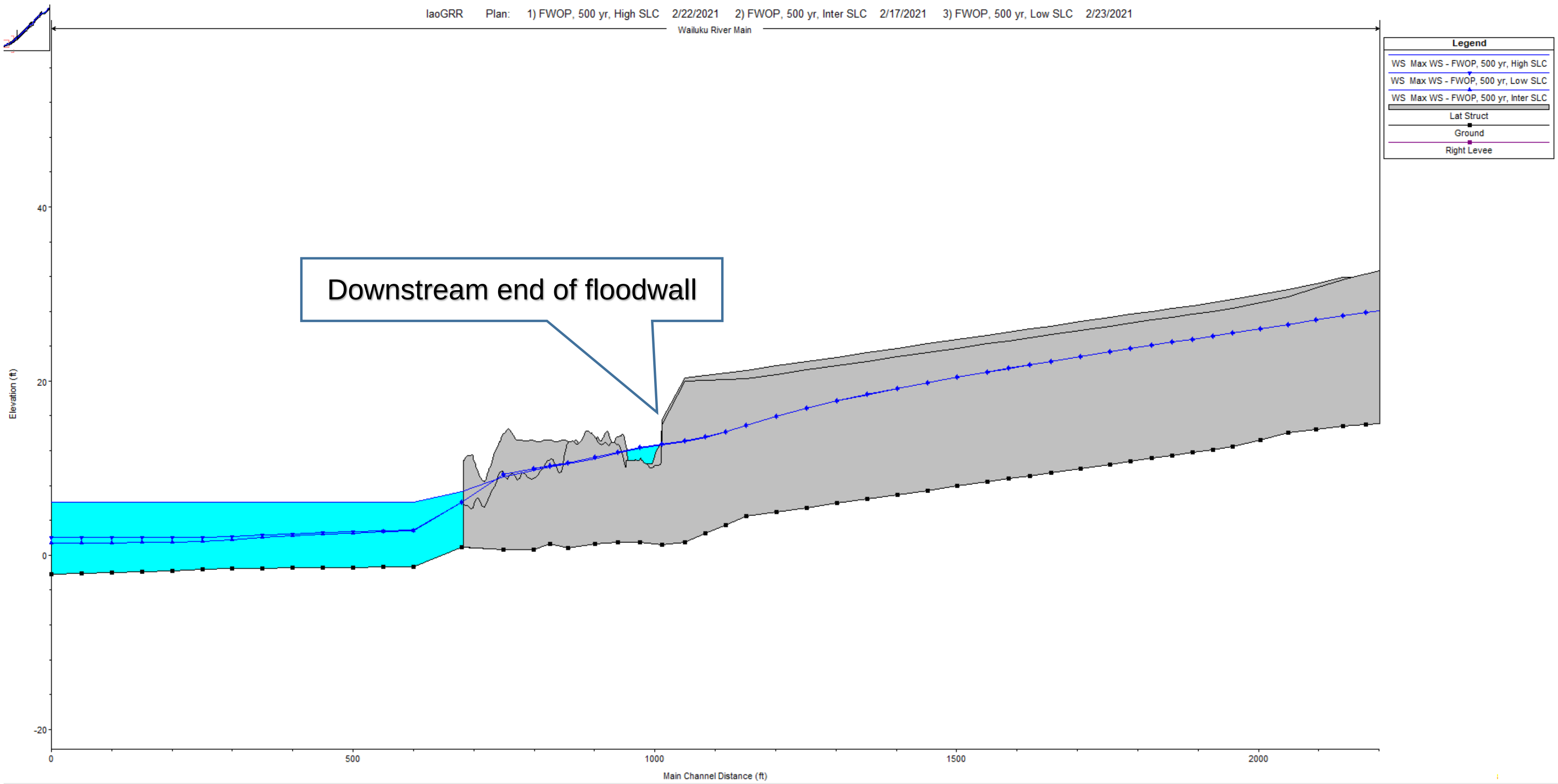


Figure 9-14: High, Intermediate, and Low Sea Level Change Effects for the 0.2% AEP Flood in 2100

9.3. Life Safety

The extremely flashy nature of typical floods in the system provides little opportunity for flood warning and evacuation. Typically, there is only 1 hour between peak rainfall and peak flow in the river, based on gaged data from past events. Regional Emergency Alert Systems warn of imminent flash flooding in the area. However, there is no site-specific flood warning system for Wailuku River. Residents are generally unaware of whether they should shelter in place or attempt to evacuate, perhaps resulting in a delayed evacuation at the most inopportune time (during a breach). Limited egress routes would have residents attempting to evacuate through inundated areas, such as along Eha Street. Some would also be required to evacuate by crossing a project that is in an active state of failure and non-performance via Waiehu Beach Road (Highway 340) in the direction of Waiehee-Waiehu.

During the September 2016 (2.5% AEP) flood, which led to extensive bank failure, one resident reported hearing the large boulders moving in the river behind her property. The peak of this event occurred in the evening, around 1900 hours, when most residents would be in their homes, and even possibly sleeping. The greatest risk to life safety would be residents caught on foot or in vehicles trying to evacuate in the high velocity flows, even though depths would generally be shallow. This would cause some people to move from a condition of “safe” to a condition of “chance” from a life safety perspective.

Overtopping of Imi Kala Street Bridge during the September 2016 flood resulted in shallow street flooding with no reported threats to life safety. Simulations of the event in the hydraulic model indicate flows were likely less than 2 ft deep and less than 2 ft/s. While there is still a chance of residents being caught in flows that have overtopped the banks and existing project features, breach failure of the levees is the critical threat to life safety for this project.

A breach failure of a levee is likely to occur during the 2% (1/50) AEP flood and larger events, specifically at Levees C and D. A high-density residential area is located right behind Levees C and D. The cause of this breach is due to a vulnerable levee toe and high velocity flows in the system. Despite the sponsor’s regular attempts to “seal” the levee toe, channel incision and meandering continues to leave the toe exposed. The high velocity flows that occur during a typical flood event erode the foundation material, ultimately leading to bank failure. It would generally be expected that as water enters the leveed area, the velocities would be high (10-40 ft/s), but as it spreads out it would slow down rapidly causing shallow flooding (< 2 ft) to streets and low lying areas as it flows towards the ocean. In the newly inundated area, approximately two-thirds of the flow appears to be slow moving (1-2 ft/s) and one-third of the flow appears to be a more concerning 4-5 ft/s during the 0.2% AEP flood (Figure 9-13). A breach of the levee would likely progress quickly due to the sandy silty nature of the embankment materials.

Given the flashy nature of the system, lack of egress routes available for evacuation, continuous threat of levee failure due to a vulnerable toe, and likely quick progression of the breach, there is a *possible* risk to life safety currently left unaddressed.

References

Chow, V. T. (1959). *Open-channel hydraulics.* New York: McGrawHill.

Chu, P.-S., & Chen, H. (2005). Interannual and Interdecadal Rainfall Variations in the Hawaiian Islands. *Journal of Climate*, 4796–4813. Retrieved from https://journals.ametsoc.org/view/journals/clim/18/22/jcli3578.1.xml

Fletcher, C. (2010). *Hawai'i's Changing Climate.* University of Hawai'i at Manoa. Retrieved from https://www.soest.hawaii.edu/coasts/publications/ClimateBrief_low.pdf

Hawai'i Climate Change Mitigation and Adaptation Commission. (2021). *Climate Change Portal*. (State of Hawaii) Retrieved from Hawaii.gov: https://climate.hawaii.gov/commission/

Honolulu Weather Forecast Office. (2020). *Observed Weather: Monthly Weather Summary (CLM)*. (National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Honolulu Weather Forecast Office) Retrieved from Weather.gov: https://w2.weather.gov/climate/index.php?wfo=hnl

Keener, V. W., Marra, J. J., Finucane, M. L., Spooner, D., & Smith, M. H. (2012). *Climate Change and Pacific Islands: Indicators and Impacts.* Washington, DC: Island Press.

Keener, V., Helweg, S., Asam, S., Balwani, S., Burkett, M., Fletcher, C., . . . Tribble, G. (2018). *Hawai'i and U.S.-Affiliated Pacific Islands.* Washington, DC, USA: U.S. Global Change Research Program. doi:10.7930/NCA4.2018.CH27

Kuehn, E. (2015, July). *Stream Bank Erosion Trends and Sediment Contributions in a Southwestern Missouri River.* Retrieved from Missouri State University: https://oewri.missouristate.edu/assets/OEWRI/Kuehn_Thesis_JR_bank_2015_FINAL.pdf

Minnesota Department of Natural Resources. (2010, January). *Resource Sheet 1: Streambank Erosion and Restoration.* Retrieved from Stream Habitat Program: https://files.dnr.state.mn.us/publications/waters/understanding_our_streams_and_rivers_resource_sheet_1.pdf

Moriasi, D. N., Arnold, J. G., Van Liew, M. W., Bingner, R. L., Harmel, R. D., & Veith, T. L. (2007). *Model evaluation guidelines for systematic quantification of accuracy in watershed simulations.*

NCEI. (2017). *State Climate Summaries Hawaii.* Retrieved from State Climate Summaries: https://statesummaries.ncics.org/chapter/hi/

NCEI. (2021, January 7). *Storm Events Database*. Retrieved from NOAA's National Centers for Environmental Information: https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=15%2CHAWAII

NOAA. (2017, April 21). *NOAA Atlas 14 Point Precipitation Freqeuncy Estimates*. (National Oceanic and Atmospheric Administration. National Weather Service. Hydrometeorological Design Studies Center) Retrieved from Precipitation Frequency Data Server (PFDS): https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_hi.html

NOAA. (n.d.). *Datums for 1615680, Kahului, Kahului Harbor HI*. Retrieved from Tides & Currents: https://tidesandcurrents.noaa.gov/datums.html?id=1615680

NOAA. (n.d.). *El Nino and its Impacts on Hawai'i.* Retrieved from National Weather Service: https://www.weather.gov/media/peac/one_pagers/El%20Nino%20Impacts%20on%20Hawaii.pdf

NOAA National Centers for Environmental Information. (2017). *State Climate Summaries HAWAII*. Retrieved from State Climate Summaries: https://statesummaries.ncics.org/chapter/hi/

NOAA. (n.d.). *Sea Level Trends*. Retrieved from Tides & Currents: https://tidesandcurrents.noaa.gov/sltrends/sltrends.html

Papanicolaou, A. T., Wilson, C. G., Dermisis, D. C., Thomas, J., & Elhakeem, M. (2008). *The Effects of Headcut and Knickpoint Propagation on Bridges in Iowa.* IIHR - Hydroscience & Engineering. Ames, IA: The University of Iowa. Retrieved from https://iowadot.gov/research/reports/Year/2008/fullreports/TR-541%20Final%20-%20T.%20Papanicolaou.pdf

Stock, J. (2017). *Bank cohesion testing to support USACE hydraulic modeling in West Maui, Hawaii.* Menlo Park, CA: U.S. Geological Survey.

U.S. Climate Data. (2020). *Climate Kahului - Hawaii*. Retrieved from U.S. Climate Data: https://www.usclimatedata.com/climate/kahului/hawaii/united-states/ushi0031

University of Hawai'i. (2014). Hawaii Soil Atlas. Hawaii, USA. Retrieved from https://gis.ctahr.hawaii.edu/SoilAtlas

USACE. (1976). *General Design Memorandum, Phase II - Project Design for Flood Control and Allied Purposes, Iao Stream, Maui, Hawaii.* Honolulu, Hawaii: Department of the Army, U.S. Army Engineer District.

USACE. (1994). *Hydraulic Design of Flood Control Channels.* Washington, DC: U.S. Army Corps of Engineers. Retrieved from https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1601.pdf

USACE. (2019). *Guidance for Detection of Nonstationarities in Annual Maximum Discharges.* Washington, DC: U.S. Army Corps of Engineers.

USACE. (2019). *Incorporating Sea Level Change in Civil Works Programs.* Washington, DC: U.S. Army Corps of Engineers. Retrieved from https://www.publications.usace.army.mil/

USACE. (2019). *Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation.* Washington, DC: U.S. Army Corps of Engineers. Retrieved from https://www.publications.usace.army.mil/

USACE. (n.d.). *Sea-Level Change Curve Calculator*. (U.S. Army Corps of Engineers) Retrieved from http://corpsmapu.usace.army.mil/rccinfo/slc/slcc_calc.html

USGCRP. (2018). Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. Washington, DC, USA. doi:10.7930/NCA4.2018

Watson, C. C., Biedenharn, D. S., & Bledsoe, B. P. (2002, February). Use of Incised Channel Evolution Models in Understanding Rehabilitation Alternatives. *Journal of the American Water Resources Association, 38*(1), 151-160. Retrieved from https://bledsoe.engr.uga.edu/wp-content/uploads/2017/11/Watson_et_al_2002_CEM.pdf

WEST Consultants, Inc. (2011). *Sediment / Debris Bulking Factors and Post-Fire Hydrology for Ventura County.* Draft Report, San Diego, CA. Retrieved from https://s29422.pcdn.co/wp-content/uploads/2019/11/BulkingFactorStudy-DraftCombinedReport5-15-11.pdf

Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

Engineering Documentation Report Amendment

Appendix B: Design

September 2021

US Army Corps of Engineers
Honolulu District

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1. Introduction

The authorized project is not functioning as intended and a design deficiency of the federal project exists. Extremely high channel velocities and debris flows produce areas of significant channel scour and erosion of the channel invert and banks. Non-federal sponsor O&M requirements and emergency repair costs continue to increase as channel scour continues, resulting in increased frequency of levee toe repairs, placement of riprap, etc. to mitigate for erosional effects. The purpose of this appendix is to provide additional information on the various mitigation measures and alternatives evaluated to address historic and continuous erosion issues observed along the river.

1.1. Project Objective

The objective of the current reevaluation study is to

1) Reduce channel instability due to erosion and high velocity flows in the lower reach of the Wailuku River for the 50-year period of analysis; and
2) Reduce the impacts of erosion and head cutting of the concrete-lined channel reaches of the Wailuku River for the 50-year period of analysis.

1.2. Project Opportunities

The project opportunities are as follows:

1) Reduce the frequency and cost of Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) to the Iao Stream FCP;
2) Reduce the frequency and cost of emergency repairs to the Iao Stream FCP;
3) Utilize the existing floodplain for nature-based solutions as applicable; and
4) Facilitate movement of native fish through the project area.

1.3. Project Constraints

The project constraints are as follows:

1) To the extent possible, minimize significant disturbance or modification to the existing natural stream alignment.
    a. To the extent possible, avoid implementation of measures that would disturb the culturally significant Wailuku River and its important to the Native Hawaiian community.

2. Management Measures

This section describes the various management measures that were initially considered and evaluated during the development of alternatives (Section 3). A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives. A preliminary list of structure and non-structural management measures is included below:

Non-Structural Measures

- **Flood Warning Systems:** Alert the community or key officials of imminent hazardous flooding conditions.
- **Property Buyouts:** Acquire lands and structures either by purchase or through the powers of eminent domain.
- **Flood Proofing:** Seal structures from water damage by waterproofing walls and floors and installing floodgates at entry points.
- **Elevating Structures:** Lift the building from its foundation and raise it above the flood level.

Structural Measures

- **Channel Hardening**: Replace channel lining with paved concrete or roller compacted concrete to reduce erosion.
- **Channel Widening:** Widening the existing channel through excavation to increase capacity and provide flexibility for the stream to meander.
- **Debris Basin Modification**: Modify the debris basin to allow more fine sediment to pass through.
- **Detention Basins (surface and sub-surface):** Create surface and/or subsurface temporary storage facilities to collect flood flows during larger storm events; operate to control storm flow.
- **Dams / reservoirs:** Create larger storage facilities than detention basins to collect and store flood flows during larger storm events; operate to control storm flow.
- **Diversion / Bypass Structures:** Create diversion structures (weirs, etc.) to divert high flows to less densely populated areas.

- **Pump System:** Install pump system to pump peak flows out of streams.
- **Levees and Floodwalls:** Construct levees and floodwalls to reduce flood risk.
- **Grade Control Structure:** Install concrete or boulder filled trenches at changes in slope to control bed erosion.

2.1. Channel Hardening

From an engineering perspective, channel hardening is one of the most effective ways at reducing the risk of channel incision and bank erosion. However, it typically comes with high costs and environmental impacts. Additionally, extensive channel hardening of Wailuku River is not likely to be received well by the public, based on previously expressed concerns by the community during public meetings.

Two types of channel hardening were the primary focus for consideration: traditional, reinforced concrete paving and roller compacted concrete (RCC). Three alternatives were developed that include this management measure: Alternatives C, E, and K.

2.1.1. Channel Terracing

Channel terracing and the use of RCC or grouted stone revetment was previously proposed by the USACE Committee on Channel Stabilization in 2000. The proposed design concept includes a partially armored bed at the existing slope. It features a semipervious center section armored with large derrick stone that would be sourced from the site. RCC terraces would tie into the existing armored levees (Figure 2-1). RCC was initially proposed as it is more aesthetically pleasing. This management measure improves the resiliency of the vulnerable levee bank toe and reduces the risk of channel incision, but is likely very costly, would require additional routine maintenance by the sponsor, and impacts the natural environment unfavorably.

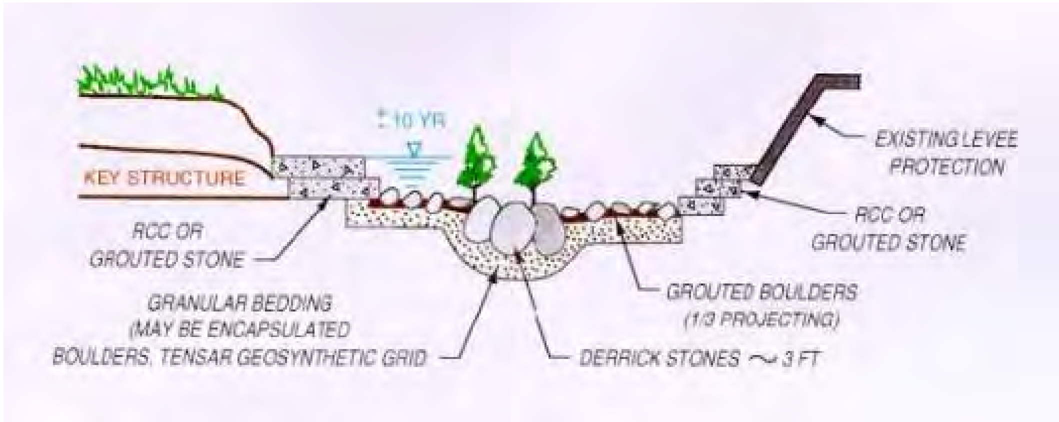


Figure 2-1: Channel Terracing Design Concept

2.1.2. Alternative Types of Revetment

Other types of lining that may be more favorable to the public and environment are not appropriate for the Wailuku River. Typical velocities along the natural reach of Wailuku River as simulated in HEC-RAS are presented in Table 2-1. Modeling results are discussed in detail in the Hydrology and Hydraulics Appendix

Table 2-1: Typical (averaged) conditions computed in RAS for the natural reach

Parameter		Annual Exceedance Probability (AEP)						
	1/2	1/5	1/10	1/25	1/50	1/100	1/200	1/500
Peak Flow (ft^3/s)	4,200	6,580	9,700	10,300	11,900	13,400	14,800	16,100
Water Depth (ft)	6.94	8.67	11.5	12.7	15.3	16.1	16.9	17.8
Velocity (ft/s)	24.6	24.6	20.5	22.1	18.4	19.1	19.7	20.2
Shear Stress (lb/ft^2)	0.23	0.56	1.81	2.88	6.40	8.14	9.99	12.4

Table 2-2 lists alternative types of lining that were removed from consideration as the velocities they are typically able to withstand before damage occurs is well below the typical velocities produced by the river.

Table 2-2: Types of Revetment Removed From Consideration

Type of revetment	Mean flow velocity, ft/s
Bioengineering	$\leq$ 3
Filled sacks	$\leq$ 5
Soil reinforcement system, gravel fill 14-22 mm	$\leq$ 5
Loose concrete blocks of weight less than 160 kg/m^2	$\leq$ 5
Precast concrete slabs	$\leq$ 5
Sand asphalt	$\leq$ 7
Soil reinforcement system, gravel fill 38 mm	$\leq$ 7
Loose concrete blocks of weight greater than 160 kg/m^2	$\leq$ 7
Hand pitched stone (loose riprap)	$\leq$ 7
Sack gabions	$\leq$ 8
Geomats with good grass cover	$\leq$ 8
Riprap, D_{50} = 600 mm (24 in)	$\leq$ 8
Soil reinforcement system - grassed	$\leq$ 13
Loose concrete blocks – grassed equivalent to > 100 mm thickness	$\leq$ 13
Cabled concrete blocks of weight greater than 250 kg/m^2	$\leq$ 15
Geomat with bitumen-bound gravel and good grass cover	$\leq$ 16
Piling[1]	$\leq$ 23

[1]: piling is not feasibly due to the rocky nature of the bed material

Careful consideration would be required of the following types of revetment as the design threshold nears the maximum velocities simulated for the 0.5% and 0.2% AEP (1/200 and 1/500- AEP) floods (22.6 and 23.4 ft/s, respectively). If these linings are used, they may not be able to withstand larger events.

Table 2-3: Types of Revetment With Limited Applicability

Box gabions	≤ 23
Soil reinforcement system – concrete filled	≤ 23
In-situ concrete	≤ 23
Flexible form mattress – concrete filled	≤ 23
Grouted stone	≤ 23
Cabled concrete blocks of weight greater than 250 kg/m^2	≤ 23
Open stone asphalt	≤ 23
Gabion mattress – 0.5 m thickness	≤ 23

2.2. Channel Widening

Widening the existing, natural reach will provide the stream with more flexibility to meander and increase the mean cross-sectional area (thereby reducing peak flow rates). This management measure is intended to address the continuous incision and lateral erosion experienced by the stream (i.e. up to the 50% AEP event) rather than improve the resiliency of existing infrastructure (e.g. levees) against extreme flood events. As presented in Table 2-1, typical velocities along the natural reach for the 50% AEP event are still an erosive 25 ft/s.

Velocity is not only affected by channel shape, but also the longitudinal slope of the channel. The effectiveness of the channel's ability to meander must also be taken under consideration for this alternative to also be effective. In following the *Manning equation*:

$$v = (\frac{1.49}{n})R^{2/3}\sqrt{S}$$

where:

v = velocity, ft/s

n = Manning roughness coefficient

R = the hydraulic radius, ft

S = the longitudinal slope of the channel, ft/ft

the channel slope that would limit velocities to 10.4 ft/s (Hydrology and Hydraulics Appendix, Section 8.3) during the 50% AEP event is 0.007 ft/ft (0.7%). This is based on a reach-averaged hydraulic radius of 4.7 ft and Manning roughness coefficient of 0.033.

To achieve this slope without artificial or natural drop structures, the channel would need to lengthen by approximately 18,300 ft (3.5 miles) by meandering: an unreasonable expectation that suggests this management measure is not likely feasible independently, although it may be paired with other measures such as grade control (drop) structures.

The effectiveness of this management measure is also somewhat localized: its effects downstream are limited, suggesting it needs to be implemented on either a large scale or at critical locations at higher risk of erosion. This management measure encourages keeping the channel in its natural state (unlined), whenever possible, to provide the stream with flexibility to adapt and meander, as needed.

2.3. Debris Basin Modification

Construction of the debris basin in 1981 was intended to prevent large boulders and debris from entering the lower reaches of the stream (USACE, 1976). However, it also reduces the amount of fine sediments that are carried downstream. While this is typically favorable to the environment in terms of improved water quality, a significant decrease in sediment supply can result in channel incision or bank erosion downstream. Sediment supply should equal sediment transport capacity. When the supply is limited, the system attempts to find alternative sources of sediment, such as from the channel bed and banks.

This management measure proposes modifying the existing debris basin to allow more sediment to pass through. However, the amount of sediment that should be released cannot be estimated appropriately at this time given the lack of historical records pertaining to sediment supply. To estimate the relationship between sediment load and bank erosion for a fluvial system, the quantity of eroded sediment and sediment loads must be known. Annual bank erosion rates can be calculated in several different ways. Common methods to measure bank erosion are erosion pins, aerial photograph analysis, successive digital elevation models, and repeat surveys, which all involve measuring the amount of bank sediment loss over a defined temporal scale (Kuehn, 2015). It is recommended that representative cross sections of Wailuku River be periodically surveyed (i.e. once every three years and after every major flood event) by the sponsor and any volume of sediment removed from either the channel or debris basin be diligently recorded.

As an interim measure, it may be possible for the sponsor to transport a conservative amount of sediment from the debris basin to the end of the upper concrete channel (where the natural reach begins) in an effort to re-supply the system manually. However, this manual “placement of fill” will certainly trigger environmental permitting requirements and may also be perceived unfavorably by the public.

2.4. Dams / Reservoirs

A dam or reservoir in the upper watershed would not be an effective management measure for reducing channel incision downstream. Typical velocities along the natural reach of Wailuku River (Table 2-1) demonstrates how erosive velocities occur even during less frequent events, such as the 50% AEP flood. Additionally, further reduction of the sediment supply as a result of the dam would likely increase channel incision and bank erosion downstream.

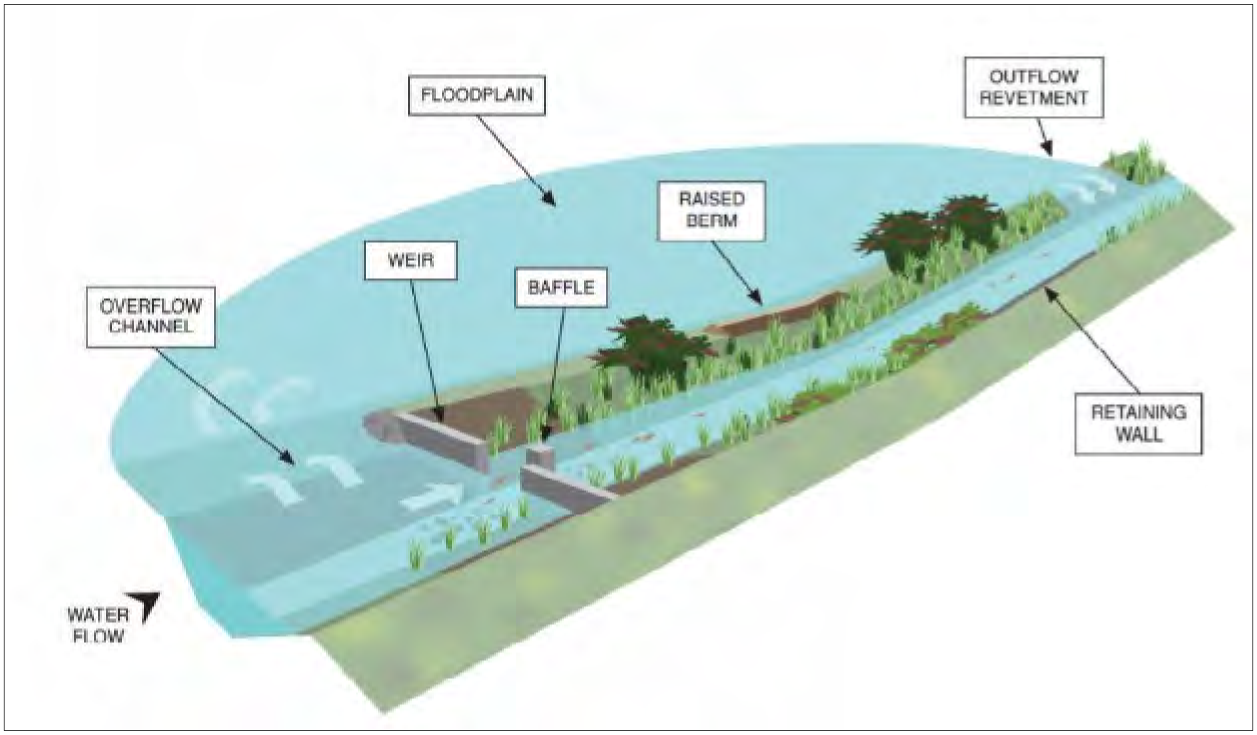
2.4.1. Detention Basin

On a smaller scale, an in-stream or offset detention basin may be effective in slowing down flow and corresponding velocities at critical locations. However, its effectiveness downstream is likely limited as the steepness of the channel bed slope would encourage waters to pick up speed again.

2.5. Diversion / Bypass Structures

Continuous incision over the years has significantly lowered channel bed elevations. There is currently no functional connection to the designated floodplain on the left bank. A diversion or bypass structure in the channel could divert high flows into the existing floodplain. This would be accomplished by either using several large pumps or by creating enough backwater so that floodwaters flow naturally into the left bank. The use of several large pumps is not preferred due to the cost of construction, increased maintenance that would be required by the sponsor, noise disturbance, and questionable feasibility.

Creating backwater conditions to divert flow comes with its own challenges regarding flood risk and fish passage. A large, concrete weir was previously proposed in the 2017 EDR, located just downstream of Imi Kala Street Bridge (*Alternative F*). This 18-ft high concrete diversion wall also included a 15-ft wide opening for fish passage, with the intention of limiting downstream flow to flows equivalent to the 10% AEP event. While this would reduce the amount of sediment taken from the banks during larger events, erosive flows still occur during smaller, less frequent events. Additionally, there is a large amount of uncertainty in diverting low-sediment water (as sediment was reduced by the debris basin) across the floodplain and potentially causing new erosion and sedimentation issues in either the floodplain or upon its return to the main channel.



2.6. Grade Control Structure

Grade control structures, also known as drop structures, can be effective in reducing channel erosion and preventing a head cut from migrating upstream. There are several existing drop structures that were constructed as part of the original FCP. One particular drop structure, located just downstream of Market Street Bridge at RS 97+24, was recently renovated in October 2019. A fiberglass fish ladder was installed on the face of the 22-foot vertical concrete drop structure to maintain flow continuity for the native o'opu (Photo 2-1).

Photo 2-1: Existing Drop Structure and Fish Ladder, Iao Stream FCP

Through occasional drops in the bed elevation, the system can maintain a relatively shallow slope throughout other parts of the reach. As presented in Section 2.2, the channel slope that would limit velocities to 10.4 ft/s (Hydrology and Hydraulics Appendix, Section 8.3) during the 50% AEP event is 0.007 ft/ft (0.7%). This would be the proposed slope, S_n. The existing bed slope, S_o is approximately 2.5% for a total reach length, L of approximately 6,870 ft. The total height required of the drop to maintain the proposed slope throughout the reach can be estimated by the following equation, with reference to Figure 2-2:

$$H = (S_O - S_n)L$$

The approximate drop height required along the natural reach, to maintain a slope of 0.7%, is 124 ft. This total height can be divided over several drop structures (i.e. 10 drop structures approximately 12.4 ft in height). It is also important to keep in mind *fixed points* throughout the natural reach, such as bridge piers and armored levees (Table 2-4), where there may be less flexibility in the design.

Photo 2-2: Existing grade control structure at the Iao Stream FCP

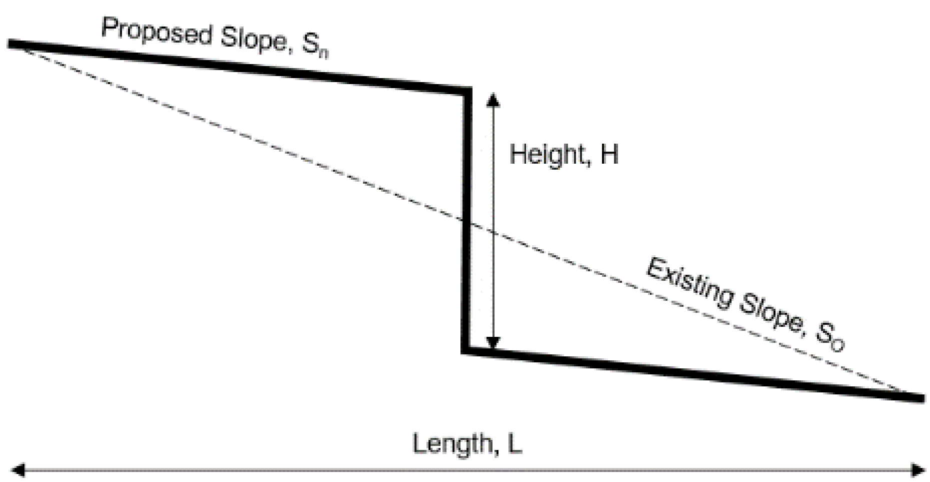


Figure 2-2: Illustration of Grade Control Structure Variables

Table 2-4: "Fixed" Elevations along Wailuku River

River Station	Description	Elevation (ft MSL)
91+50	Downstream end of upper concrete channel	199.0
79+29	Imi Kala Street Bridge	171.5
22+00	Upstream end of lower concrete channel	27.2

At the downstream end of the upper concrete channel, a natural drop structure (*head cut*) is already forming as the river attempts to balance between the constructed invert that has a relatively shallow slope and the steep, natural bed slope (Photo 2-3). This might provide one opportunity to implement a more intentional grade control feature.

Photo 2-3: Existing head cut at the Iao Stream FCP

3. Alternatives for Reducing Flood Risk

These larger-scale alternatives were developed early in the study and focus on preventing failure of the existing levees along the natural reach and thereby *reducing flood risk*. This could be done by improving the resiliency of the system through revetment, diverting or retaining a large portion of the flow, slowing down channel waters to reduce velocities, along with other concepts presented here.

3.1. Alternative A: No Action

This alternative is to not perform any modifications to the existing flood control project and reflects *future without project* conditions. Taking no action would likely result in the following:

- **Sudden bank failure of the unlined and armored levees.** Continued channel incision would threaten the stability of the unlined and armored levee banks and likely result in sudden bank failure, as observed during the September 2016 flood event (Photo 3-1). If this were to occur during a significant storm event, the displaced material could create an obstruction in the channel, increasing flood risk and uncertainty. A “sunny day” bank failure could result in lives lost if there are trespassers or maintenance personnel nearby at the time of failure.

Photo 3-1: Bank Revetment Failure at Levee C, September 2016

- **Failure of Revetment X**. Along the left bank of the natural reach, only a small section of the bank is lined with concrete revetment (Photo 3-2). Isolated sections of revetment are at greater risk of sudden failure as they can be undermined from several directions (e.g. along the upper slope edge, at the bank toe). As foundation material is washed out either gradually from small, continuous flow or suddenly by a significant flood, the slab will likely slide into the main channel, creating an obstruction.

Photo 3-2: Revetment X, September 2016, Post-Flood

- **Failure of the boulder concrete invert at the end of the upper concrete channel.** Head cutting at the end of the upper concrete channel (Photo 2-3) would continue, leading to failure of the boulder concrete invert. Eventually, this head cut would migrate upstream and threaten the existing flood walls.
- **Significant sediment deposit in the ocean.** Sediment removed from the channel bed and banks through natural processes would be transported to and deposited in the ocean. Sediment negatively affects water quality, fish habitat, and coral reefs.

3.2. Alternative B: Removal of Flood Control Improvements

This alternative includes removal of all concrete and man-made structures in Wailuku River, thereby returning the stream to its original and natural condition. Although this alternative does not meet project objectives from an engineering perspective, the public has previously expressed support for this alternative due to its environmental benefits and therefore, the alternative was kept as part of the screening process. With the removal of the concrete features and restoration of the natural stream, structures in the adjacent urbanized areas would be at significant risk of flooding and foundation issues caused by erosion and saturation of the soil during even moderate storm events. As part of this alternative, a flood warning system would be installed to warn residents of imminent flooding along Wailuku River. However, there would still be potential for loss of life and an increased flood risk to the urbanized areas. As an example of the threat, Photo 3-3 demonstrates how a single flood event (September 2016) resulted in severe bank erosion at the unimproved bank downstream of Imi Kala Street Bridge, Wailuku River.

Photo 3-3: Severe bank erosion at a previously unimproved site downstream of Imi Kala Street Bridge, Wailuku River during the September 2016 flood

3.3. Alternative C: RCC and Grouted Boulder Channel

Alternative C proposes improvements of roller compacted concrete (RCC) side slopes between River Station (RS) 22+00 and RS 98+13 (approximately 7,600 linear ft), a low flow boulder concrete channel within the RCC improvements, and stream realignment and widening between RS 76+02 and 85+30. The proposed stream realignment follows the alignment shown in Figure 3-6 for Alternative E. Channel side slopes would be lined with RCC up to the 10% (1/10) AEP flood elevation to protect the stream bank from erosion. Flood events greater than the 10% (1/10) AEP would also rely on the existing floodplain and levees. To minimize the impacts of adding a significant amount of revetment along the natural channel, the 15-20 ft wide low flow channel would be designed to replicate a more natural Hawaiian stream by embedding boulders in the concrete channel bottom. This would facilitate the movement of native fish through the modified channel area. Between RS 76+02 and 85+30, the channel would be realigned to the north to reduce impacts to existing structures along the right bank. Widening of the stream (Figure 3-2) would reduce water surface elevations in the channel and at the Imi Kala Street Bridge.

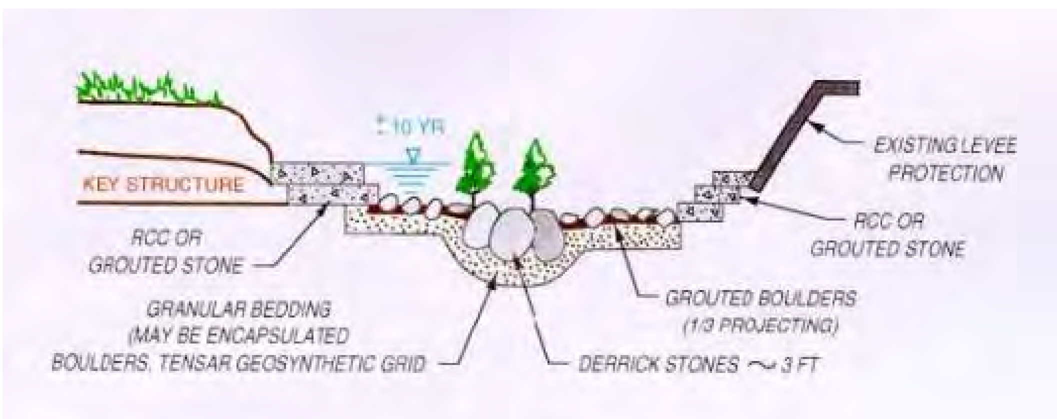


Figure 3-1: Channel Terracing – Design Concept

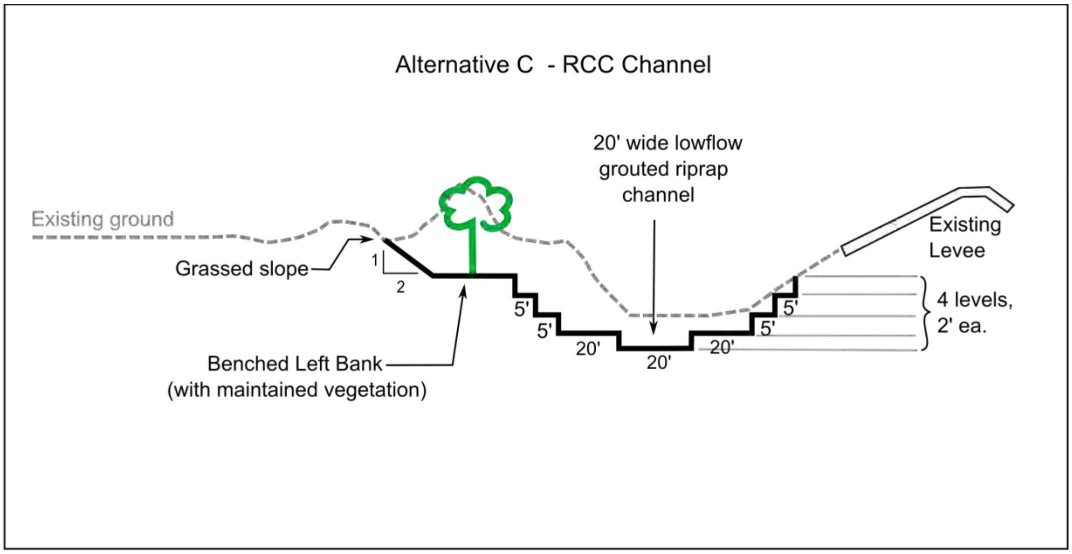


Figure 3-2: Channel Terracing – Typical Cross Section

3.4. Alternative D: Stilling and Sedimentation Basins

Alternative D uses grade control structures in conjunction with stilling basin areas to dissipate the high energy flows that are causing the erosion along the channel banks. Alternative D will incorporate four grade control structures and two large stilling basins between Imi Kala St bridge downstream to the high ground on the left bank (Figure 3-4). Alternative D includes the following modifications/features:

1) Grade Control Structures: Up to four large grade control structures and/or drop structures will be constructed to create milder slopes through the design reach. The proposed structures would provide an immediate bed elevation change of 15 feet (Figure 3-3). The milder bed slopes combined with the energy lost by the stream from flowing over the drop structures are designed to decrease velocities in the channel and mimic a more natural stream grade (< 1%).
2) Stilling Basins: The stilling basins (Figure 3-3) will widen the channel dramatically to help decrease velocities at the bottom of the drop structures. The stilling basins include energy dissipating design features such as baffle blocks, inverse grade, rip-rap, and a splash pool. The stilling basins will be designed to maintain a shallow pool during low flow events and will allow for ground water infiltration.
3) Channel Realignment: The existing erosion is largely due to the channel bends that focus the energy of the flow directly at the levee toe. The channel will be realigned in this area to focus the flow away from the levee toe (Figure 3-4).
4) Erosion Protection: Certain areas within the channel will need to be reinforced to protect against scour. The levee toe is a specific area of focus that will need to be protected. Possible protection measures include Roller Compacted Concrete (RCC), rip-rap, gabion baskets, etc. Some channel hardening may still be needed however; more natural solutions will be used whenever possible (Figure 3-5).
5) Benched Left Bank: The left bank of the channel will be benched to create more flood capacity in the channel. This allows room for the flow to spread out and the velocities to decrease. The benched left bank will also support natural

vegetation along the channel providing shade, erosion control and potentially public stream access.

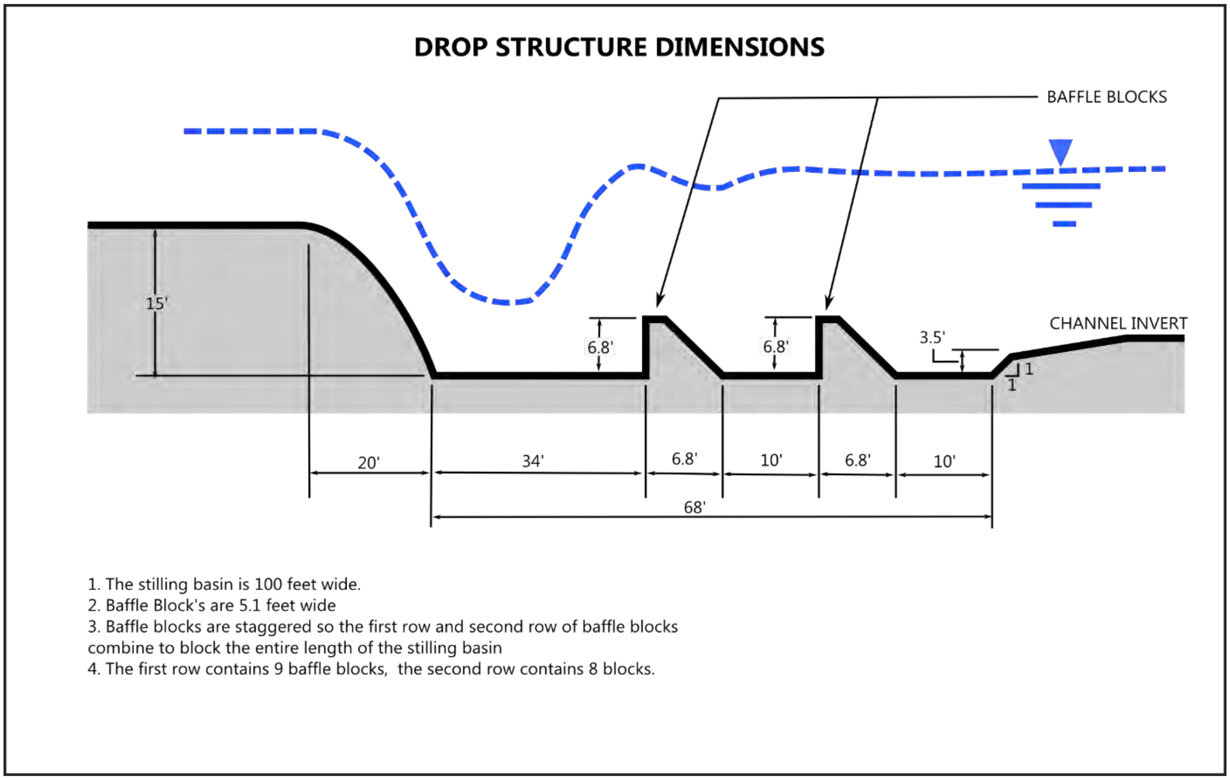


Figure 3-3: Drop Structure Dimensions for Alternative D and E

Figure 3-4: General Site Map for Alternative D

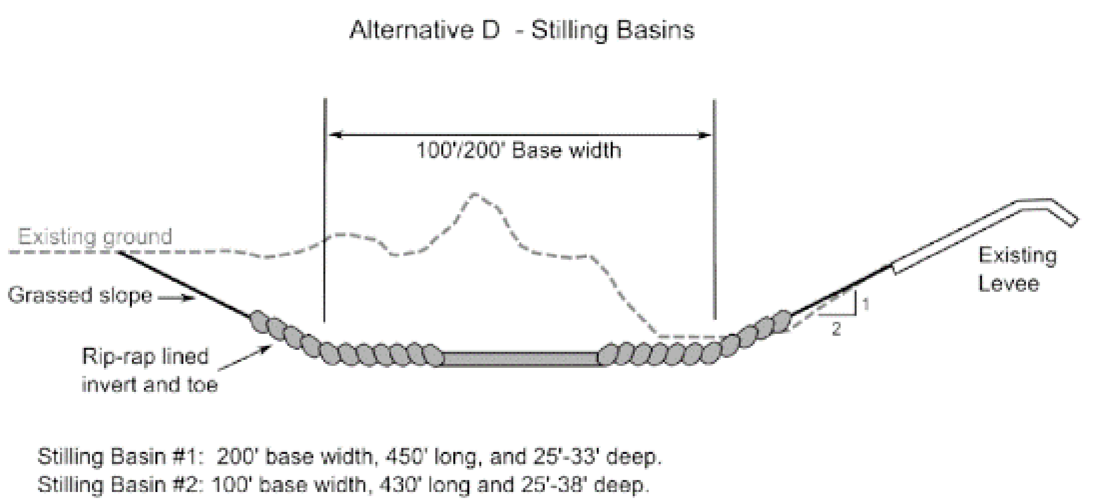


Figure 3-5: Typical Cross Section for Alternative D

3.5. Alternative E: RCC Channel with Grade Control Structures

Alternative E expands on Alternative C by adding grade control or drop structures to the channel to control stream velocities (Figure 3-6). Alternative E includes the following modifications/features.

1) Two Grade Control or Drop Structures in the form of a parabolic weir, and stilling basin with baffle blocks located near Stations 73+20 and 61+90. Typical cross-sections of these structures are shown in Figure 3-3.
2) Hydraulic improvements to the concrete channel between Stations 92+02 and 95+41. These improvements include baffle blocks and a weir within the existing concrete channel to more evenly distribute flow.
3) Roller compacted concrete (RCC) side slopes and a 20 ft wide boulder concrete low flow channel that would mainly follow the alignment of the existing stream between Stations 22+00 and 92+02 (approximately 7,000 feet long). The median base width range would vary between 40 to 60 feet.
4) Stream realignment and widening between Stations 76+02 and 85+30. The channel would be realigned to the north on the left bank to avoid existing structures to the right bank and be widened to reduce water surface profile at the Imi Kala Street Bridge.
5) Low Flow Boulder Concrete Channel within the RCC. The 20 ft wide low flow channel would use boulders embedded in concrete to replicate a more natural Hawaiian stream and facilitate the movement of native fish through the modified channel area. Structures such as rock groins, riffle pools, stream meander and grade control structures can create a habitat that is more suitable to riparian habitat.

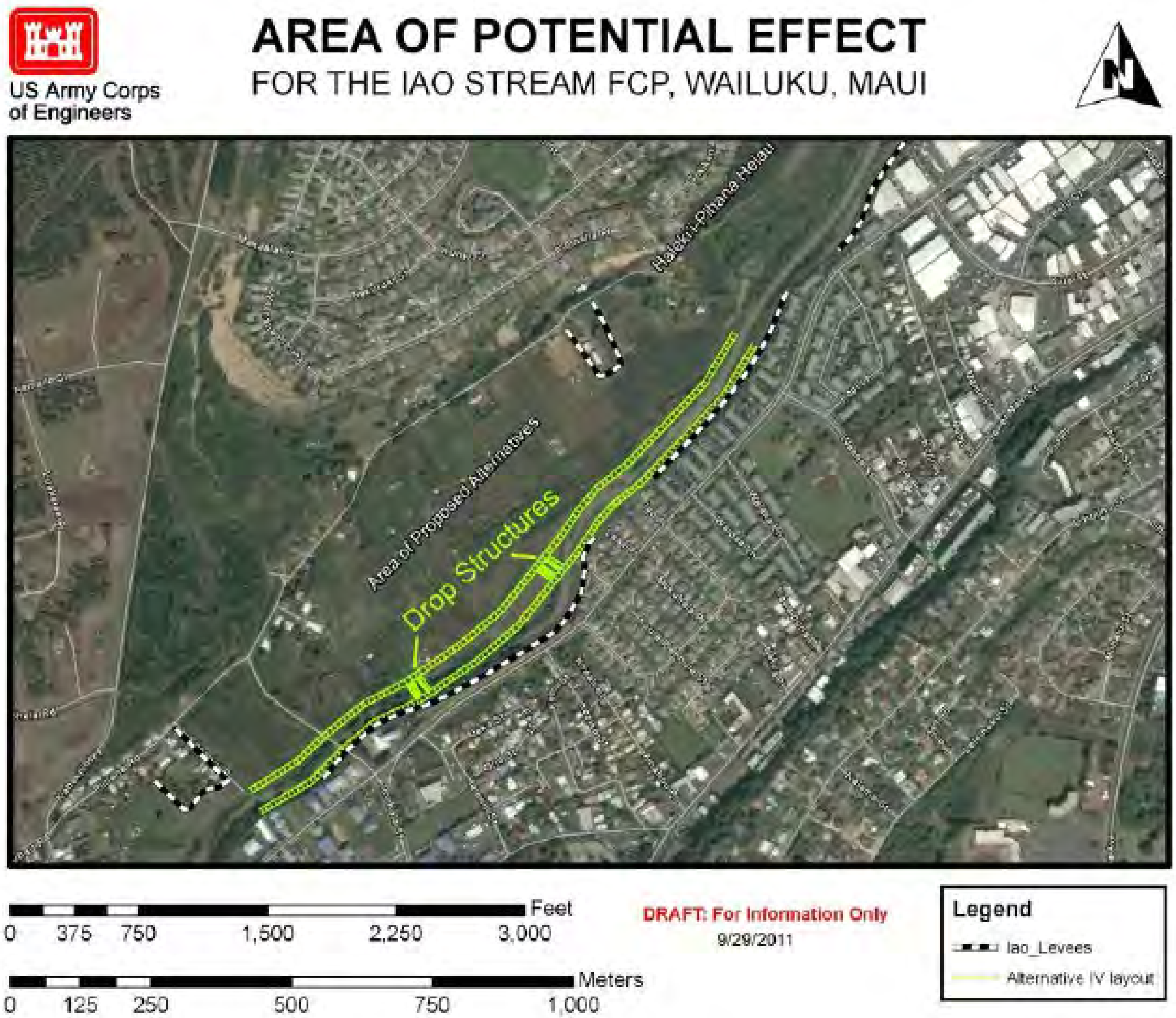


Figure 3-6: General Site Map for Alternative E

3.6. Alternative F: Floodplain Reconnection

Alternative F is intended to reconnect the main channel with the floodplain to reduce damaging flows along the main channel and right bank levees. The reconnection would be accomplished by lowering the left bank near Imi Kala Street Bridge, grading the overflow area to disperse flow into the floodplain, and constricting the main channel with a concrete diversion wall. A portion of the left bank would be raised further downstream to contain the overflow within the floodplain. Even further downstream, the left bank would be lowered to allow the return of the overflow into the main channel. Bank stabilization is also required upstream of the floodplain, along the right bank due to high stream velocities in this area. Existing revetment in the problem area will be entirely removed along the left bank. Along the right bank, the concrete toe berm will be replaced with a vertical retaining wall. A general site plan of this alternative is provided as Figure 3-7.

The original intent of this alternative was to limit peak flows in the main channel to the peak flow estimated for the 10% AEP flood event (8,440 cft^3/s). However, as presented in Table 2-1, the reach-average velocity for the 10% AEP flood event is approximately 21 ft/s and the allowable velocity is 10.4 fts (channel incision still occurs). Additionally, the HEC-RAS model shows the water surface elevations along the reach for this event are still above the vulnerable bank toe. This alternative only partially meets the project objective as continuous and gradual channel incision would still occur. Further details regarding this alternative can be found in the 2017 EDR published by USACE.

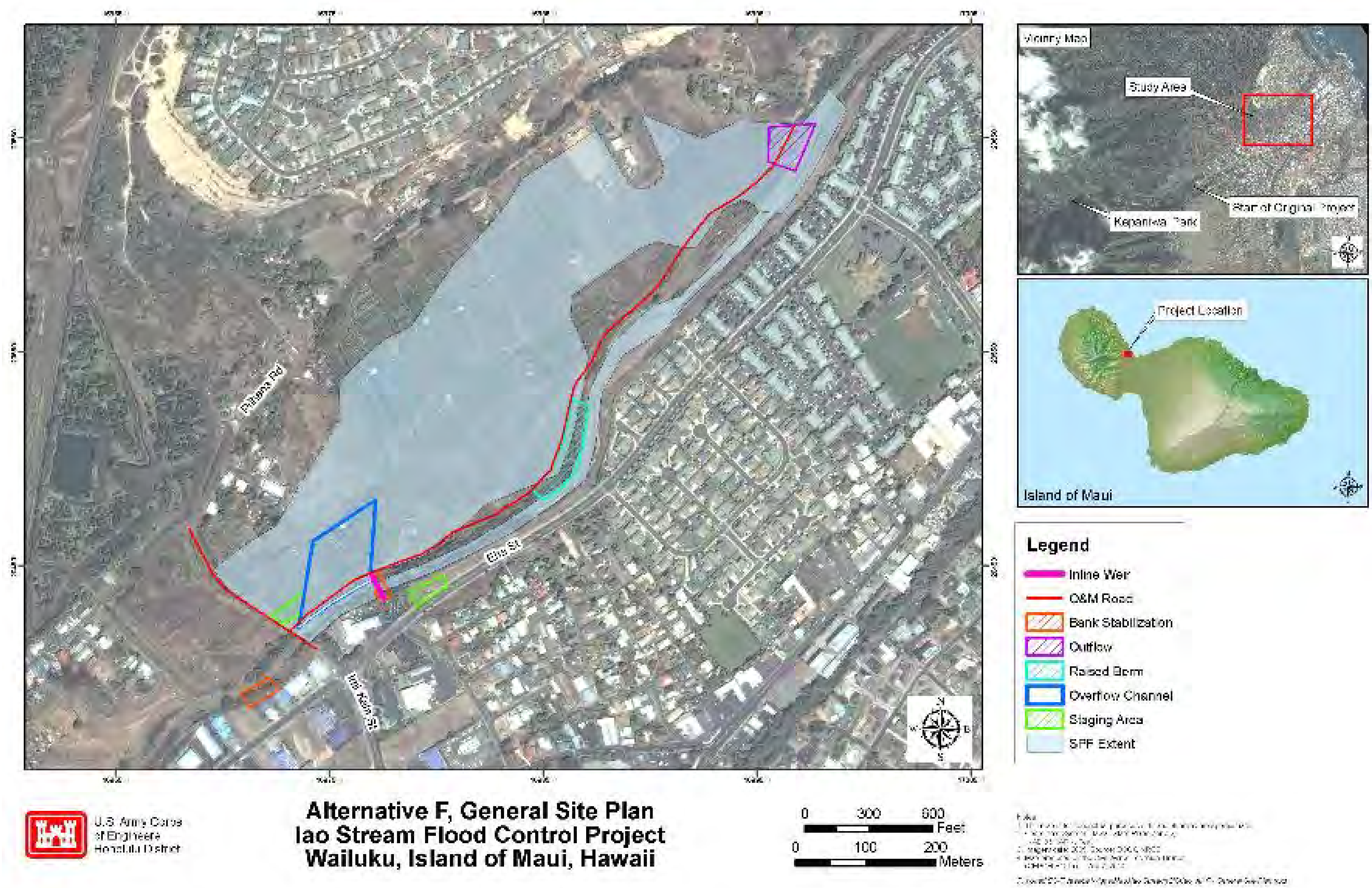


Figure 3-7: General Site Plan for Alternative F

3.7. Alternative G: Upstream Detention Basin / Dam

Alternative G includes construction of a detention basin or a large dam and reservoir near the headwaters of the Wailuku River and within the boundaries of the Iao Valley State Monument (approximately 3 miles upstream of the Iao Stream FCP project area). This area suffered substantial damage during the last significant flood in September 2016. Construction of an upstream dam or detention basin would maximize upstream attenuation of water during larger storm events and would allow controlled release of flows to downstream reaches. Considering the public's invested interest in Wailuku River and maintaining continuous flow from *mauka to makai* (from the mountains to the ocean), construction of a large detention basin or dam would be strongly opposed by the community. While this feature is not likely to have a significant impact regarding the reduction of channel incision and bank erosion along the lower reaches, it would be provide some flood risk reduction to the residential area above the project that was previously flooded in September 2016.

3.8. Alternative H: Non-Structural

Alternative H includes non-structural measures that can also function as a viable component of an integrated system of flood risk management in place of or in combination with structural measures. This alternative includes some combination of flood proofing, elevating or buying out selective structures, or constructing short ring walls around small groups of structures.

3.9. Alternative I: Overflow Basin with Floodplain Reconnection

Alternative I intends to preserve the integrity of the existing FCP features, address known problem areas affected by channel instability, and reduce flood risk. Similar to Alternative F, this alternative would reconnect the channel with the floodplain by constructing a diversion weir perpendicular to and upstream of Levee E, allowing flows to move into an overflow areas near the confluence of the Wailuku River and the tributary along Levee G. The overflow area would slow down flows and move them into the existing floodplain, and an outlet structure at the downstream end of the floodplain would return flows back into the main channel. This is explored in greater detail as Alternative 9 (Section 4.9).

3.10. Alternative J: Channel Terracing

Alternative J attempts to reduce velocities in the main channel by widening it, constructing a low flow channel, and terracing the banks into horizontal step-like structures. Construction of terraced banks on both sides of the channel would reduce velocity throughout the system, stabilize the slope, and control erosion. In addition, the channel would be widened (excavated) to slow down flows. This channel “terracing” alternative would dissipate the high energy flows that are causing the erosion along the channel banks.

4. Alternatives for Reducing Erosion

A new array of alternatives was developed that focuses on addressing erosion problems either comprehensively – throughout the entire natural reach system – or at critical locations of failure (site-specific). These alternatives were not formulated to provide flood risk management benefits. Benefits for these alternatives would be associated with reductions in future operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the channel.

4.1. Alternative 1: Concrete-Lined Channel

Based on the existing channel dimensions of the natural reach and simulated water levels for the 1% AEP flood event, Table 4-1 presents typical dimensions proposed for a trapezoidal, concrete channel to be constructed in this reach segment. The proposed channel is approximately 7,000 feet in length, has a boulder concrete invert, paved concrete slopes, and low flow channel. This type of lining (boulder concrete and paved concrete) would be able to withstand the higher velocities currently produced by the river and are typically easier to maintain.

Table 4-1: Typical Dimensions for Proposed Concrete Channel

Top width, ft	110
Bottom width, ft	95
Height, ft	15
Bank slopes	0.5H:1V
Thickness, in	12

4.2. Alternative 2: Remove Left Bank Revetment at Revetment X

This alternative recommends complete removal of all revetment on the left bank at *Revetment X*. This feature is shown in Photo 4-1 and described further in Table 4-2.

Photo 4-1: Looking downstream at the left bank of Revetment X

Table 4-2: Left Bank Revetment Characteristics

Revetment type	18” boulder concrete
Approximate River Station	RS 55+00 to RS 52+00
Approximate length	290 ft
Approximate height	7.9
Bank slope (horizontal to vertical)	2H:1V
Approximate surface area	3,530 ft^2

Revetment X was not included in the 1976 General Design Memorandum but is still considered to be part of the original project as it is detailed in the original as-built drawings. This feature is characterized by revetment placed on the left and right banks of Wailuku River, between *Levee B* and *Levee C*. Along the right bank, revetment ties into *Levee B* and *Levee C* to create a continuous armored slope. On the left bank, an isolated segment of revetment sits on the bank (approximately 200 ft long) adjacent to the designated floodplain and agricultural lands. It is believed the intent of this feature was to realign and straighten the stream at this location.

However, by armoring the left bank, some flexibility was taken away and the stream is only able to incise vertically (deepening the natural channel invert) instead of laterally (eroding the bank) at this location. Additionally, there is no flexibility in allowing the stream to correct itself, as needed, through meandering.

The existing left bank revetment is also at a higher risk of failure, requiring additional oversight and maintenance by the non-federal sponsor. Not only is the bank toe vulnerable, but the upstream slope edge is also at risk of being undermined. Removal of this left bank revetment would essentially widen the channel, allowing flows to dissipate across a wider area with lower velocities, and reduce the OMRR&R required by the sponsor.

Regarding construction methods, it was assumed that the existing revetment would be broken up by an excavator-mounted breaker, loaded into a dump truck, and disposed of off-site. Work would begin on the upstream end and continue downstream. Some seeding and mulching may be required to cover the bare soil to reduce the risk of rain-induced bank failure. However, the intention of this alternative is to provide the river with natural flexibility to erode, as needed and the foundation material is embedded with large cobbles already, as typical for this site. An existing dirt road within the left bank floodplain could be converted into a temporary access road for the dump truck by placing a gravel base. However, Imi Kala Street Bridge is not usable and access would continue along Piihana Road to reach the designated staging area (Figure 4-1).

The excavator would need to initially cross the stream, using the existing access ramp on the right bank off Eha Street. While some disturbance to the stream from this type of work is unavoidable, the contractor could minimize disturbance by beginning work upstream, working from the bank area rather than directly in the stream as much as possible (Figure 4-3), and setting up temporary sediment control practices (e.g. silt fence or filter sock) downstream.

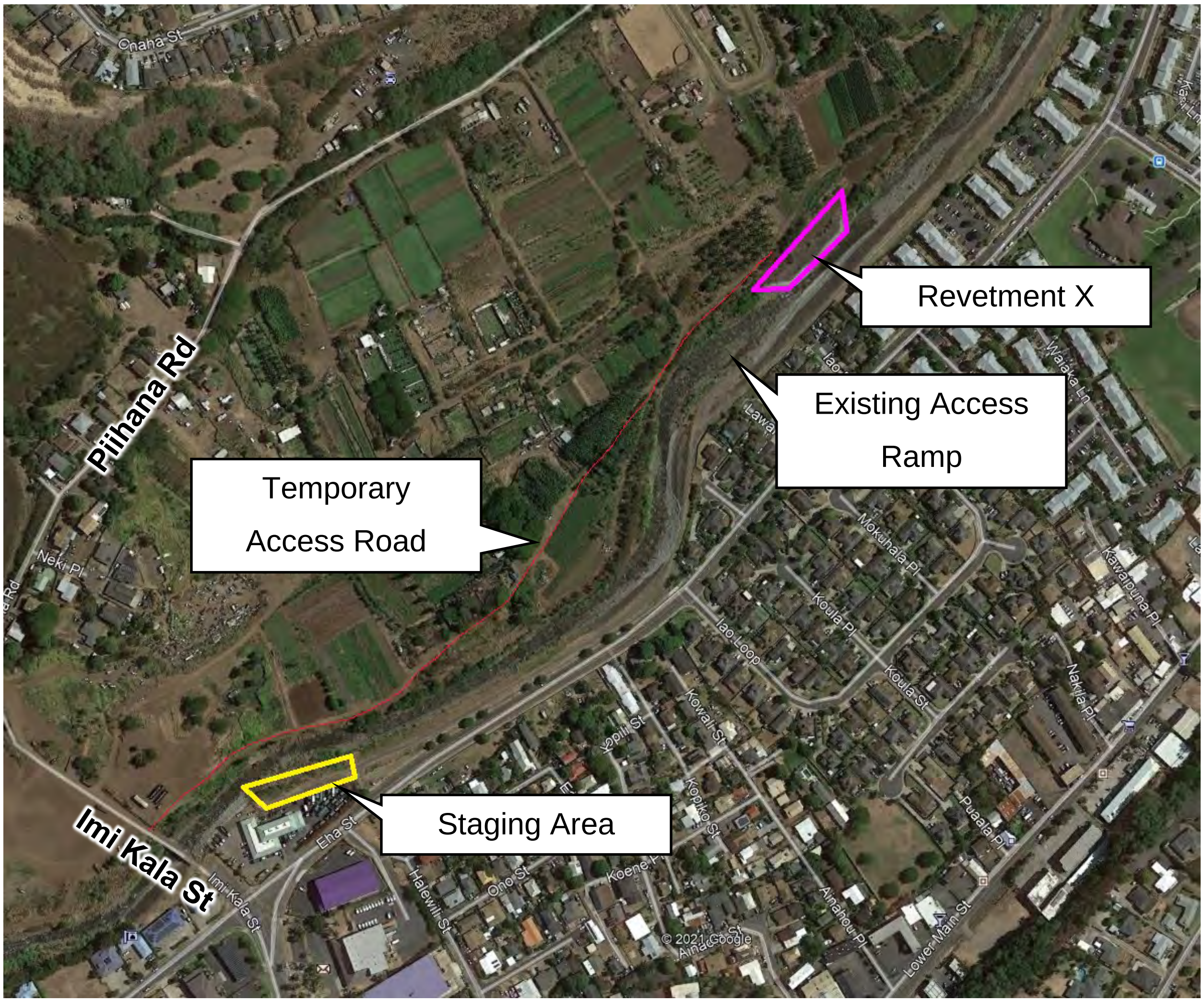


Figure 4-2. Site Plan for Revetment X Construction

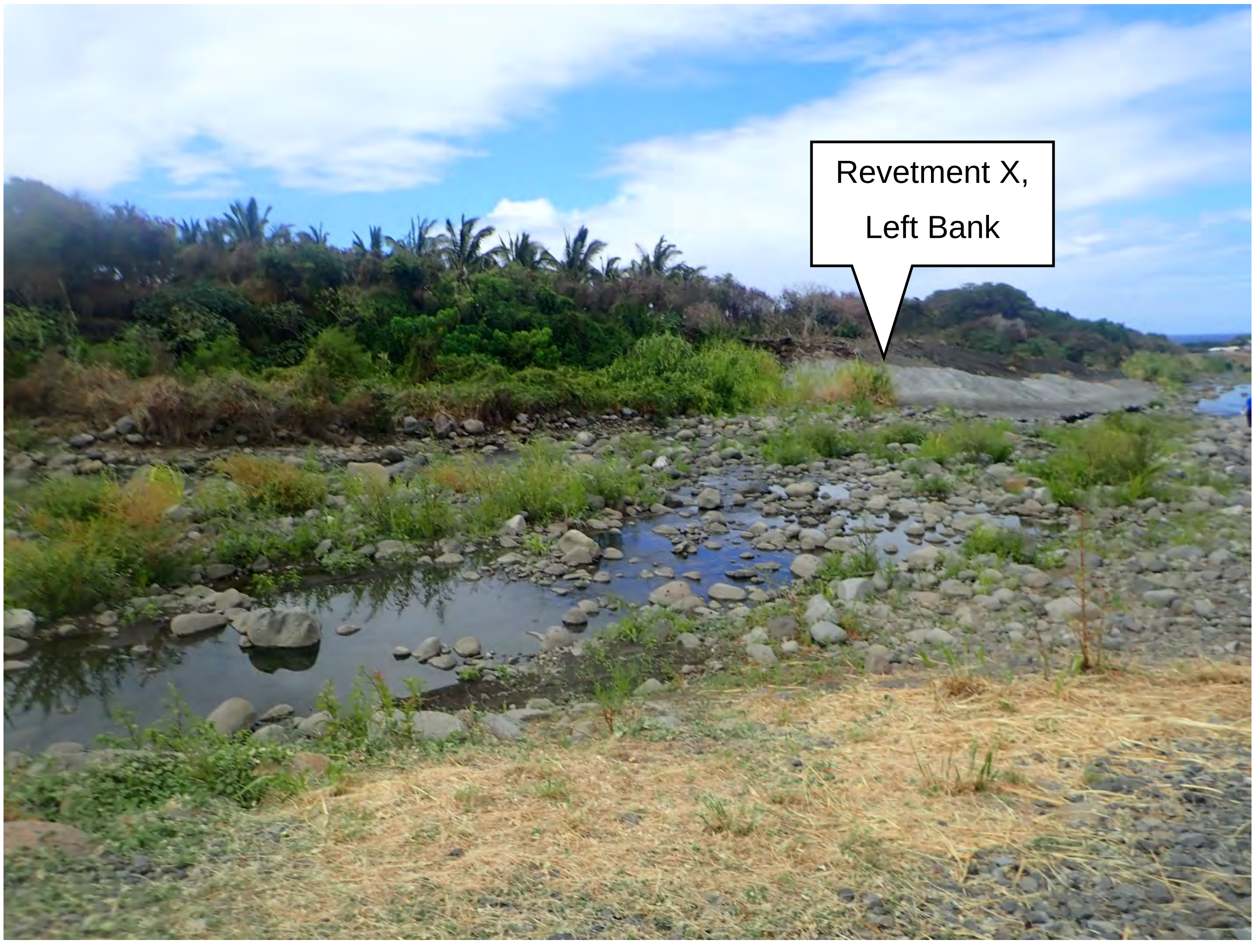


Figure 4-3. Looking across Wailuku River towards the left bank of Revetment X.

4.3. Alternative 3: Install Revetment near Levee E

The right bank area upstream of Levee E is a high-risk area experiencing ongoing erosion. Inflow from the SCS tributary pushes channel waters against the right bank at this location, which is unlined and protected only by vegetation (Photo 4-2). Property owners have previously expressed concern over the steep slopes which threaten the foundation of their properties, especially after the September 2016 flood event removed much of the vegetation.

Constructing a new revetment upstream of Levee E would reduce erosion to the bank and reduce the risk of the adjacent properties being lost. Typical flow velocities at this location are between 18 – 23 ft/s for the 1% AEP. Per Table 2-2 lists alternative types of lining that were removed from consideration as the velocities they are typically able to withstand before damage occurs is well below the typical velocities produced by the river.

Table 2-2, in-situ concrete (i.e. *shotcrete*) or a boulder concrete lining similar to *Levee E* would be able to withstand these typical velocities. Bank stabilization using shotcrete was previously proposed in the 2017 EDR under *Alternative F*. A typical detail of the proposed design is provided as Figure 4-4.

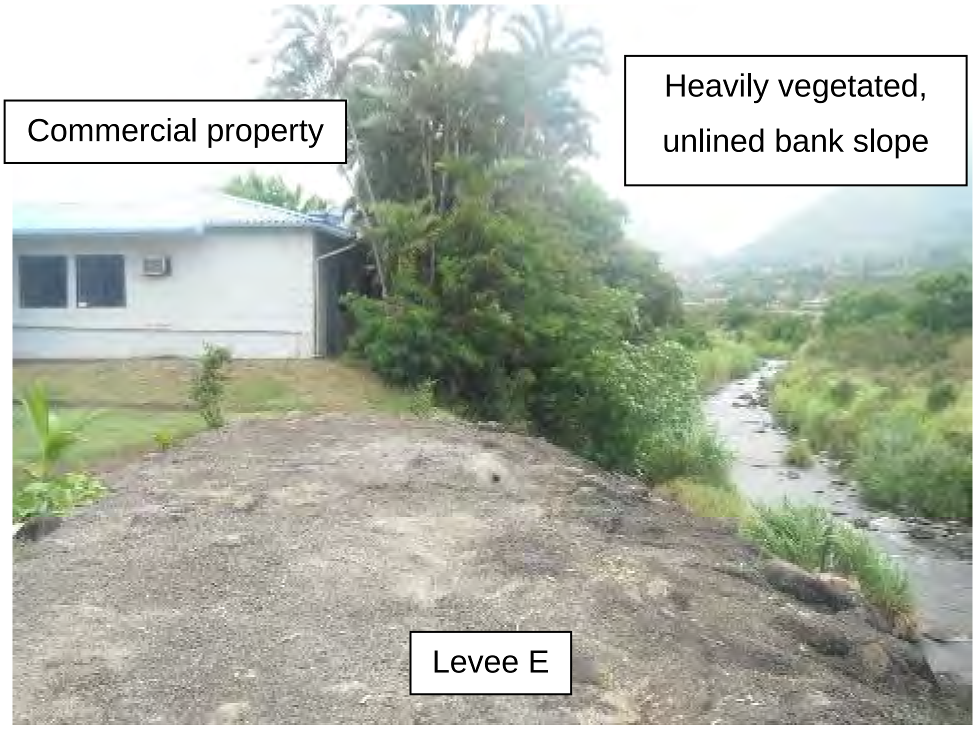


Photo 4-2: Looking upstream from Levee E, July 2016

Photo 4-3: Looking upstream from Levee E, September 2016

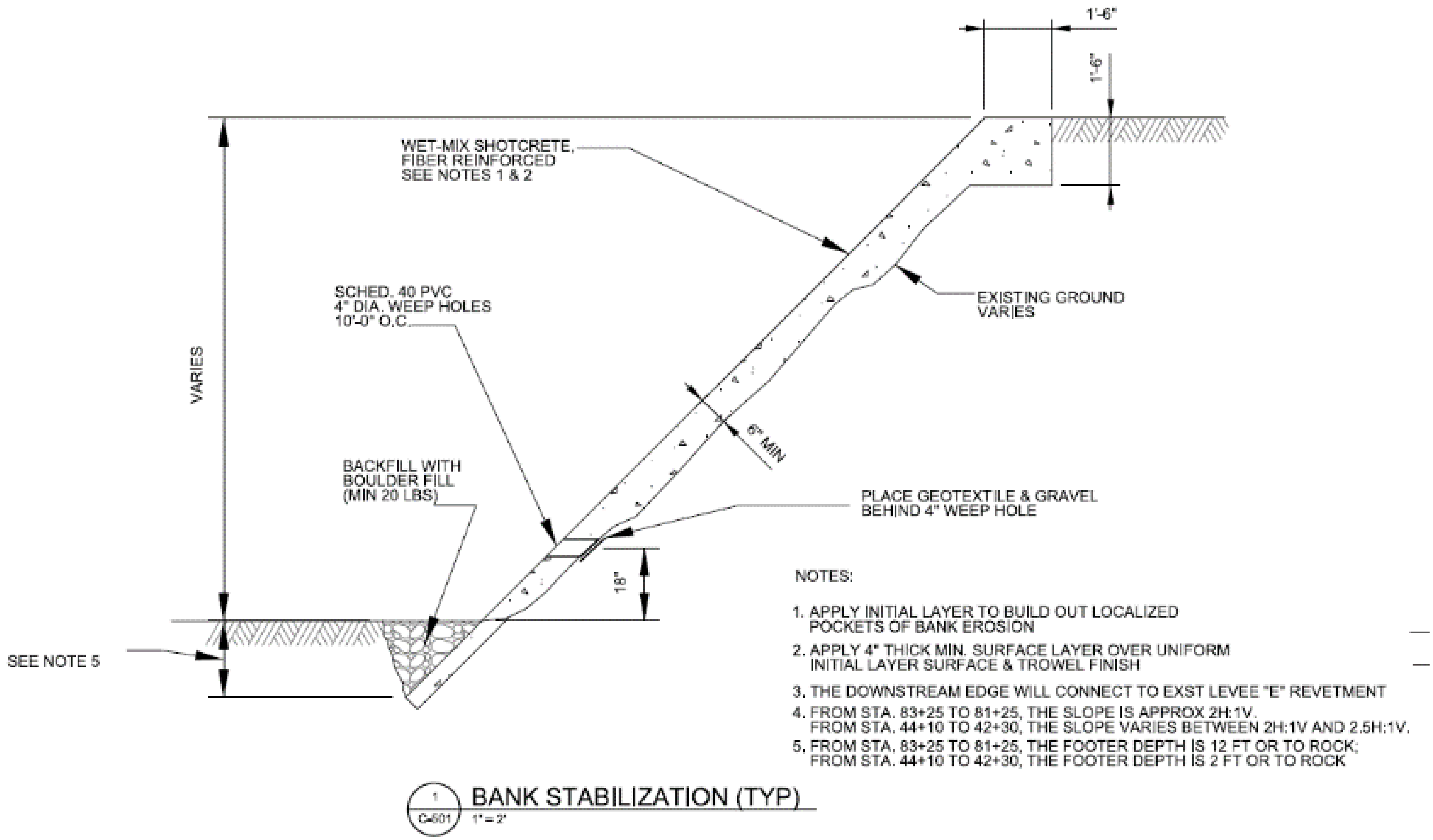


Figure 4-4: Typical Bank Stabilization Detail

4.4. Alternative 4: Remove Imi Kala Street Bridge

Imi Kala Street Bridge, formerly known as the Wailuku Sugar Mill Road Bridge, is located downstream from *Levee* E, at RS 79+29. It was constructed on two piers within the streambed, and has an 80-foot width (horizontal span) and 14-foot vertical clearance. There is also an existing 10-inch sewer line along the bridge deck which carries sewage from residential properties behind *Levee G* to the main sewer line; and a 36-inch water transmission line in a concrete jacket near the channel invert. The bridge is closed to vehicles and pedestrians, although trespassers and maintenance personnel occasionally pass through the rusted gate.

During significant flow events, various types of debris (e.g. logs, vegetation, boulders) are caught by the piers, resulting in higher water surface elevations and increased flood risk. As a routine maintenance activity, the non-federal sponsor removes debris regularly and after each major storm event.

The bridge also creates a fixed alignment that the stream must pass through. While removing the bridge would restore flexibility to the stream and its ability to meander, as needed, and reduce the likelihood of debris obstructions occurring at this location, utility line crossings need to be maintained. The existing sewer line cannot be lowered beneath the channel invert (approximate elevation 167 ft MSL), while still maintaining gravity flow to the main sewer line (approximate elevation 177 ft MSL). Replacing the existing bridge would be very costly.

Figure 4-5: Imi Kala Street Bridge, looking downstream

Figure 4-6: Debris obstruction at Imi Kala Street Bridge, September 2016 Flood

4.5. Alternative 5: Create a Sacrificial Berm

This alternative includes placement of material on the right bank levee toe as a sacrificial berm that would provide a limited amount of protection. The intent is for the sacrificial berm to be eroded first before high velocities flows undermine the armored levees. It is a temporary measure that would need to be periodically restored by the nonfederal sponsor.

The berm would begin upstream of Imi Kala Street Bridge; the feature would be approximately 200 linear feet above Levee E and 1,400 linear feet along Levee D and C. The berm would consist of random fill excavated from the left bank or material removed from the debris basin. Large stones in the random fill would make compaction difficult and leave the berm somewhat erodible. A compacted berm with more suitable fill was not selected for the recommended design because it would be more burdensome on the nonfederal sponsor to restore periodically and still be somewhat erodible (a greater effort for a questionable amount of increased protection). *Placement of fill* would likely trigger environmental permitting actions.

4.6. Alternative 6: Install Pre-Formed Scour Hole

At the downstream end of the upper concrete-lined channel (downstream from Market Street Bridge and the large drop structure), continuous erosion of the natural reach has created an unintended drop structure and scour hole (Photo 4-4). This alternative proposes improving the resiliency of this site with a pre-formed scour hole and drop structure feature.

Photo 4-4: Existing head cut at the Iao Stream FCP, RS 91+50

Following the equation and parameters presented previously in Section 2.6, the recommended vertical drop to maintain the proposed bed slope of 0.7% between the end of the concrete channel and Imi Kala Street Bridge is approximately 22 feet. Coincidentally, an existing 22-foot drop structure is located approximately 573 feet upstream. This feature received public criticism for its steep vertical drop design and was recently retrofitted with a fish ladder.

To facilitate fish passage in the proposed feature, a sloping drop apron with a buried key is recommended. The drop structure would tie into the existing boulder concrete invert at approximately 199 ft MSL at the upstream end. At a two horizontal to one vertical (2H:1V) slope, the invert would lower approximately 22 feet to elevation 177 ft MSL (Figure 4-7). The existing channel width (120 feet) would be maintained. Typical velocities at this location for the 0.2% AEP are about 15 ft/s, which allow for the use of either in-situ concrete (i.e. *shotcrete*) or a boulder concrete lining per Table 2-2. Velocities can reach up to 23 ft/s before being compromised. A 4-foot deep buried key would reduce the risk of head cutting. Future maintenance required by the nonfederal sponsor would be minimal (and less than current efforts to continuously repair the active head cut in Photo 4-4).

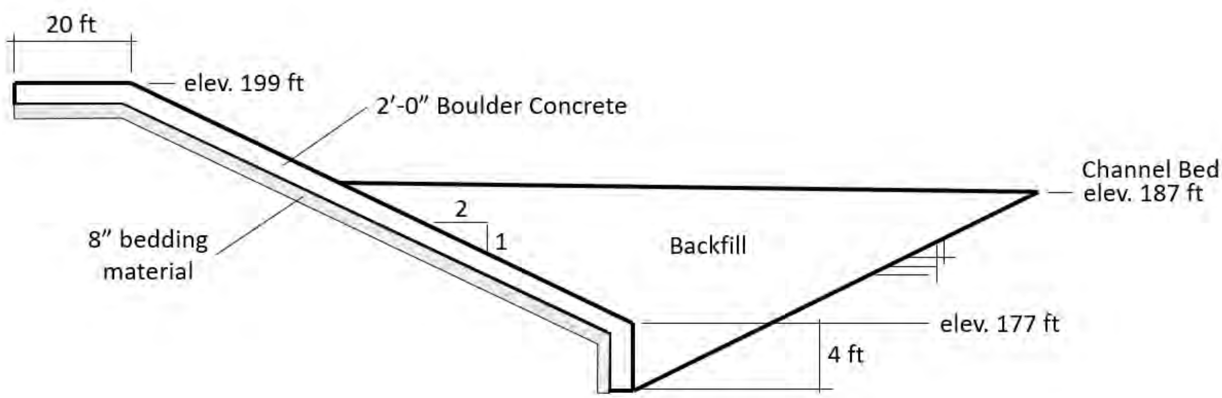


Figure 4-7: Cross-Section View of Proposed Pre-Formed Scour Hole

Regarding construction methods, the existing invert would be removed by use of an excavator-mounted breaker until undermining (loss of foundation material) is no longer observed. The area will be graded to the indicated elevations and slopes (Figure 4-7). An 8" thick gravel bedding will be placed over the surface. Large boulders (1.5 to 2.5 ft in diameter) would be placed on top of the bedding to form a loose revetment. These could be sourced on site (most likely) or provided by the County of Maui (boulders previously removed from this site and stored off-site). Concrete would then be poured/placed between the voids to create the fixed boulder-concrete revetment surface. The downstream end of the revetment would then be backfilled with on-site material to the elevation indicated in Figure 4-7.

Continuous flow in the stream should be preserved to the greatest extent possible. Flow diversion will be necessary to shift flows to one side of the stream while work is performed on the opposing side. Previous attempts at diverting flow by use of a 30-inch diameter HDPE pipe, anchored by sandbags were not successful. This method is not recommended. Use of natural in-stream materials (large boulders) or sandbags is preferable. It is also strongly suggested to schedule the work with consideration to native fish breeding and migration cycles.

The HEC-RAS hydraulic model was modified to reflect *future with-project* conditions where the pre-formed scour hole was installed, there has been intermediate sea level rise, and the downstream channel (between the pre-formed scour hole and Imi Kala Street Bridge has significantly incised through natural processes. The results of these modifications show velocities of 7 ft/s for the 0.5% AEP (1/2) AEP event and 12 ft/s for the 0.2% (1/500 AEP) events, respectively. For reference, typical velocities around this site for the 0.2% (1/500) AEP event were 15 ft/s under *existing conditions*.

All of these velocities are well below the maximum velocity recommended for a boulder concrete invert (*grouted stone* in Table 2-3): 23 ft/s. Additionally, this type of revetment has already been used elsewhere in the project, as part of the original construction in 1981, and has proven its ability to withstand velocities greater than 20 ft/s without failure.

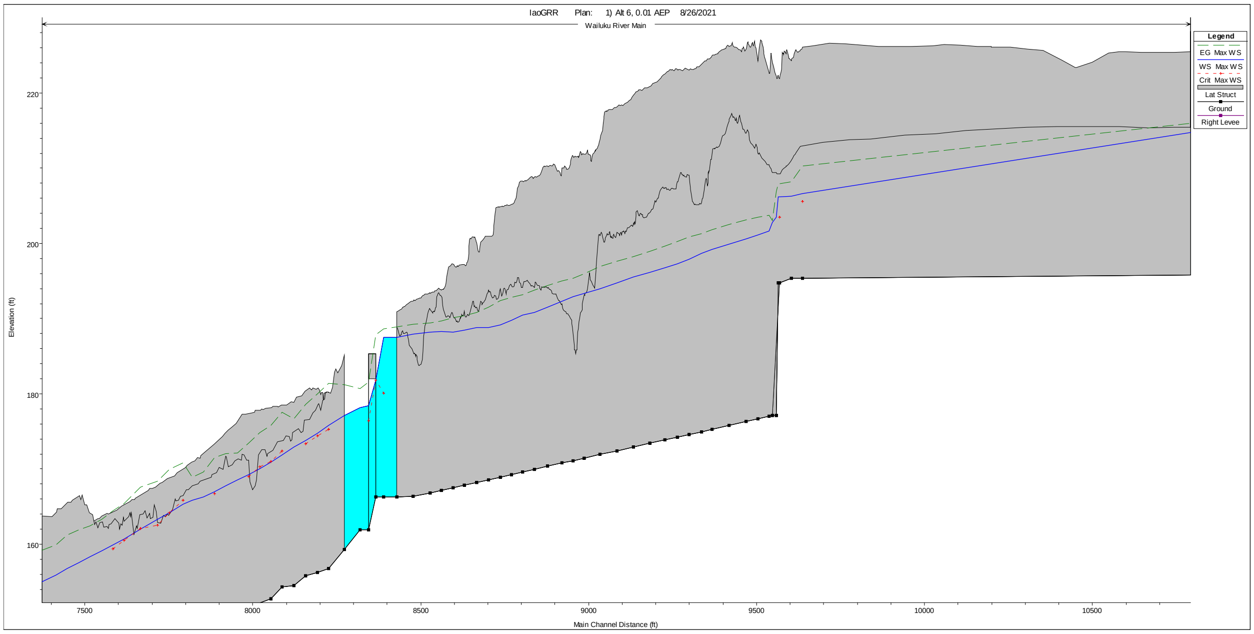


Figure 4-8: Water Surface Profile near Pre-Formed Scour Hole, Future With Project Conditions

4.7. Alternative 7: Modify Debris Basin

The intent behind this alternative was to modify the upstream debris basin in a way that it allowed preferential sediment (boulders and large cobbles) to pass through to the sediment-starved reach downstream, without damaging the upper concrete-lined channel. However, this objective proved difficult to conceptualize – especially since no sediment budget has been developed for the Wailuku River system yet.

Further development of this alternative was placed on hold, pending the outcome of a separate study under the Regional Sediment Management (RSM) Program to evaluate the debris basin, develop a sediment budget, and propose recommendations for reducing operation and maintenance (O&M) costs associated with maintaining the debris basin (and the need to regularly excavate large amounts of sediment).

Photo 4-5: Looking Upstream at the Debris Basin, Iao Stream FCP

4.8. Alternative 8: Drop Structures

As introduced in Section 2.6, drop structures can be effective in dissipating energy and limiting channel incision downstream. However, the approximate drop height required along the natural reach to maintain a stable slope of 0.7% is 124 ft. This total height would need to be divided over several drop structures (i.e. 10 drop structures approximately 12.4 ft in height) due to fixed elevation points throughout the natural reach (i.e. bridge foundations, levee toe elevations). Additionally, any drop structure would need a somewhat shallow slope to facilitate fish passage.

Due to the extreme flows and velocities produced by Wailuku River, each drop structure would need to be either tied into existing infrastructure or substantially constructed to reduce the risk of erosion around the structure itself. There are opportunities to construct a drop structure at the upstream and downstream ends of the natural reach, where it could tie into the upper and lower concrete channels. However, to construct a series of drop structures in the natural reach would ultimately lead to significant channelization of the natural reach – something costly and unfavorable. For this reason, this alternative was removed from serious consideration.

4.9. Alternative 9: Overflow Basin with Floodplain Reconnection

Alternative 9 proposes diverting some of the flow from the main channel into a newly constructed detention basin located within the designated floodplain. By reducing flows in the main channel, erosion and channel incision will also be reduced. A similar concept of diverting flows into the designated floodplain was previously proposed as Alternative F (Section 3.6). However, in that alternative, the diversion was located below Imi Kala Street Bridge. This alternative proposes the diversion take place upstream of the bridge.

4.9.1. Existing Infrastructure

There are two utility lines and a bridge within the proposed site for this alternative (Figure 4-9). The bridge – Imi Kala Street Bridge, is abandoned, but may one day be replaced and used as a main access road. It also supports a sewer line that begins behind Levee G as a 10-inch pipe, crosses the floodplain, scales down to an 8-inch cast iron pipe and crosses the bridge, then continues southeast toward Eha Street. The elevations of the utility line in the floodplain are not well known, but it is assumed to be near the surface. Near the channel invert, immediately upstream of Imi Kala Street Bridge, there is a 36-inch water line that crosses Wailuku River. From Piihana Road, it follows the dirt road across the floodplain towards Imi Kala Street Bridge.

Figure 4-9: Imi Kala Street Bridge, looking downstream

4.9.2. Methodology

The HEC-RAS geometry and terrain data was edited (Figure 4-10) to include a small, triangular detention basin near the junction between Wailuku River and the SCS tributary. The detention was about 10-feet deep and was shaped so that it did not intercept with existing utility lines. Additionally, a 25-ft high weir wall, similar to the one proposed for Alternative F, was placed just upstream of Imi Kala Street Bridge. The results of this analysis showed decreased flow and velocity within the main channel (meeting project objectives), and increased inundation and higher velocities in the floodplain.

Raising the dirt road that extends from Imi Kala Street Bridge to Piihana Road had undesirable effects: a significant increase of flooding to properties along the right bank as the water surface elevation rose to a very high stage, overtopping the weir and bank – similar to the results of Alternative F.

Raising the road, without the presence of the weir, however, had a negligible impact to flows and velocities in the main channel. The weir and diversion of flow into the floodplain, is a critical piece to the success of this alternative.

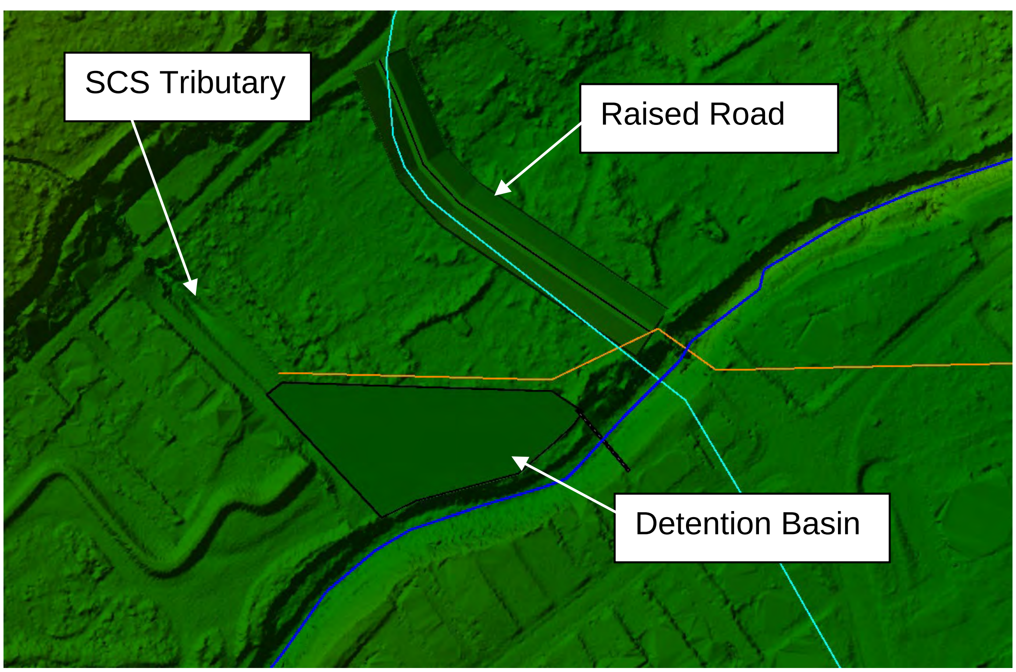


Figure 4-10: HEC-RAS Geometry, Alternative 9

4.9.3. Concrete Diversion Weir

The purpose of the concrete diversion weir is to redirect channel flow into the floodplain during large flood events, allowing no more than 7,670 cfs (10% annual chance exceedance probability) to continue in the natural channel, while still preserving fish passage under low flow conditions. To meet this objective, a 25-foot wall height was selected (the approximate height from the channel invert to the top of bank) with a 15-foot wide opening near the stream center. Shotcrete will be added to the downstream left and right banks for a distance of 36 ft; the upstream right bank will also have a shotcrete revetment for a distance of 24 ft.

Approximately 65 LF of the channel will be lined with either concrete or concrete-boulder fill, with an additional 18 LF of buried revetment (partially grouted riprap) at the downstream end. A single baffle block, with a height of 8 ft, will dissipate the flow that passes through the opening of the weir and further reduce the risk of erosion in the natural channel downstream.

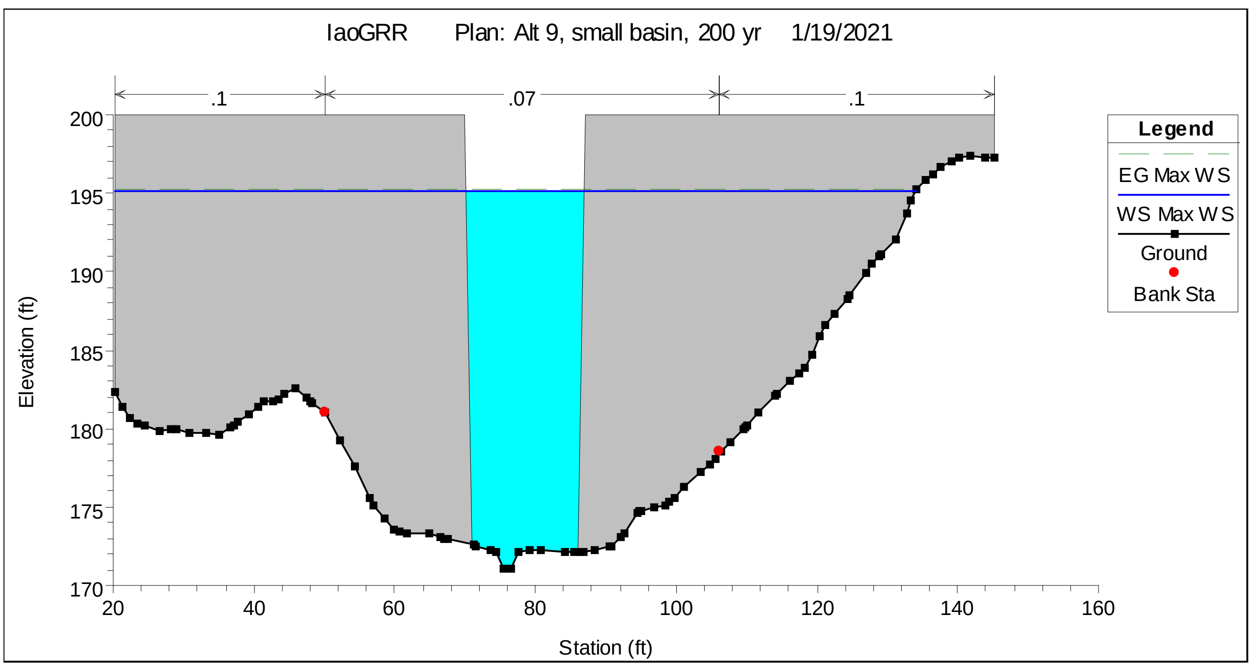


Figure 4-11: Inline Weir during the 0.5% (1/200) AEP Flood

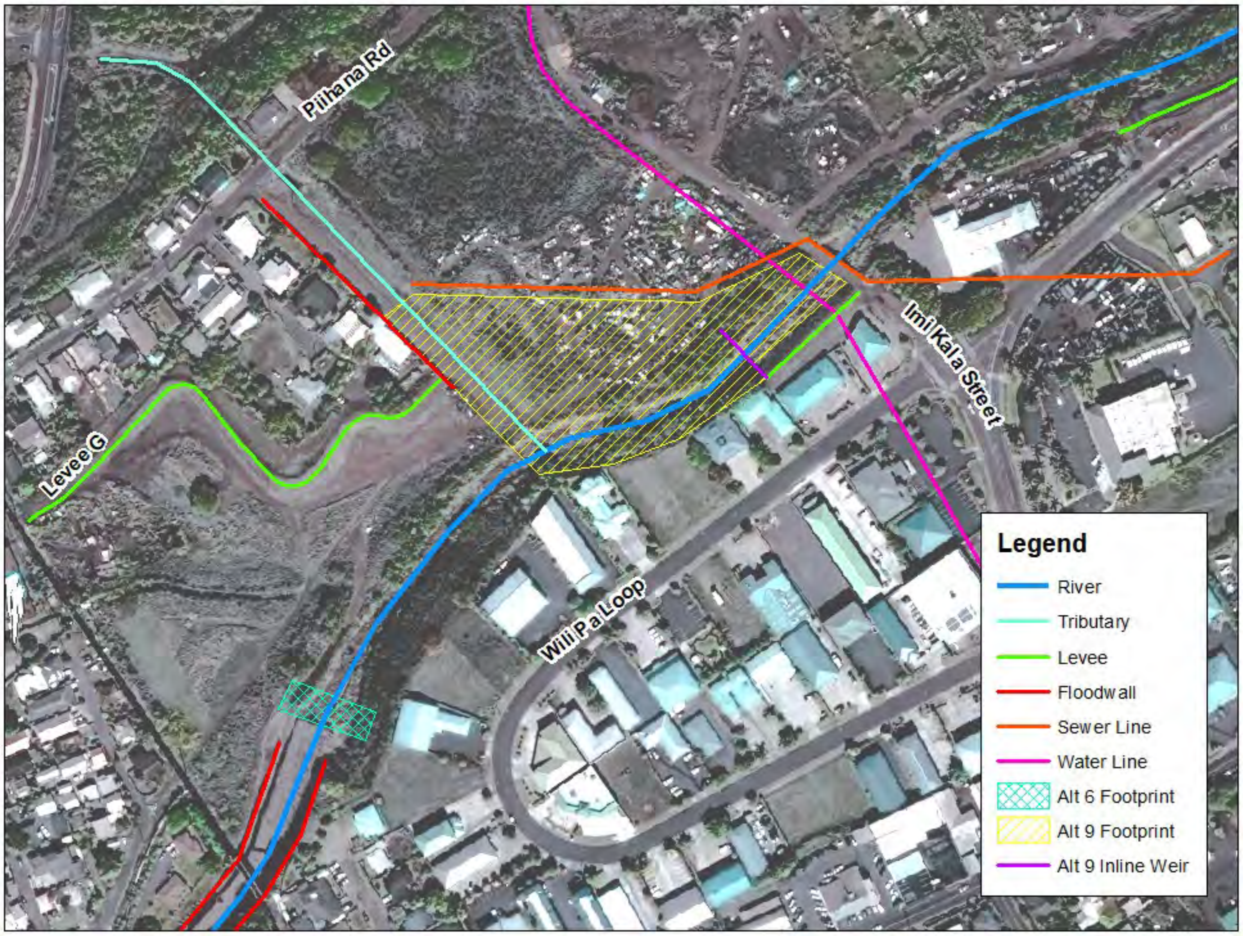


Figure 4-12: General Site Plan for Alternative 9

4.9.4. Results

The simulation of this alternative showed that diverting water into the floodplain reduced flow and velocity in the main channel significantly, meeting project objectives. The predicted maximum water depth near the concrete diversion weir is 24 feet. During the 0.5% (1/200) AEP flood, less than 5,500 cfs will continue downstream. Flows in the main channel would be limited to those typical of the 20% (1/5) AEP, significantly reducing the risk of erosion and channel incision in the main channel. Typical velocities during this event were reduced to 10-15 ft/s (previously 18 – 23 ft/s).

4.10. Alternative 10: Deauthorize Project

Deauthorizing the project does not meet the project objectives and would leave the nonfederal partner without resolution. It would likely result in similar consequences to those predicted for Alternative A: No Action (Section 3.1).

4.11. Alternative 11: Non-Structural Plan (Flood Warning System)

Warning of impending floods can save lives and prevent extensive property damage. Installation of an automated flood warning system specifically for Wailuku River would improve community safety by increasing community and regional understanding of the potential for flooding as well as increased communication of imminent flood events. A flood warning gage can provide valuable data to inform flood warning and evacuation plans, which contribute to improving life safety and community resilience for a relatively small cost.

Due to the flashy nature of the system, an automated warning system is recommended for Wailuku River. To establish a public warning system, a field station (for rain or water level monitoring), communications equipment (siren / beacon lights), and central base station equipment and software are required. When rainfall or rising water levels reach set thresholds, the automated station will notify emergency personnel. Sirens can be automatically or remotely activated. In addition to the audible sirens, most public warning systems also often include visual flashing beacon lights to warn the community of the immediate hazard.

The stream gage and flood warning system are expected to significantly reduce the potential for life loss by providing real-time data to improve warning times for evacuation. Another beneficial impact associated with implementation of the project is heightened awareness of the flood-related risks including both an increased understanding of the overall potential for flooding based on dissemination of project-related information as well as increased communication of imminent flood events via improvements real-time data gathering via the stream gage. This is expected to translate to increased levels of preparedness, thus improving community safety.

This alternative proposes installation of a radar water level sensor on the downstream end of the Iao Valley Road Bridge deck. The water level sensor uses radar technology to provide a non-contact alternative to other level gauging methods such as submersible pressure transducers. This would minimize the risk of the gage becoming damaged during a high flow event (existing stream gages on the site, which are currently sited on the banks, have a history of being damaged by debris and large boulders). Placement of the gage on the Iao Valley Road Bridge would also provide better accessibility for periodic performance maintenance. The flood warning gage would also include a tipping bucket rain gage and integrated data logging system. Continuous real-time data on precipitation and water surface elevation can be sent to any computer and any control measures or emergency actions can be implemented immediately if parameter limits are exceeded (Fondriest Environmental, Inc., 2021).

4.12. Alternative 12: Combination Plan

Alternative 12 proposes a combination of Alternatives 2, 6, and 11. Implemented together, removal of Revetment X, installation of the pre-formed scour hole, and implementation of a flood warning system would be a more complete and effective solution to address safety across the project by reducing the risk of failure or non-performance, plus improving community safety by addressing residual risks associated with flooding.

5. Climate Change

A qualitative analysis on climate and hydrology was conducted in accordance with Engineering and Construction Bulletin (ECB) 2018-14, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects*. A comprehensive literature review was completed to support this assessment, which included review of the following key resources:

1) *Volume II of the Fourth National Climate Assessment* (USGCRP, 2018);
2) *State Climate Summaries – Hawaii* (NOAA National Centers for Environmental Information, 2017);
3) The State of Hawaii's Climate Change Portal (Hawai'i Climate Change Mitigation and Adaptation Commission, 2021);
4) *Climate Change and Pacific Islands*: *Indicators and Impacts. Report for the 2012 Pacific Islands Regional Climate Assessment.* (Keener, Marra, Finucane, Spooner, & Smith, 2012); and
5) *Hawaii's Changing Climate* (Fletcher, 2010)

Regionally and within the study area, the following climate change indicators are relevant to this project:

- Rising air temperature;
- Rising sea surface temperature;
- Rising sea level;
- Less, but more intense rainfall;
- Declining base flow in streams; and
- Increased frequency of extreme events;

5.1. Rising Temperatures

The average annual air temperature in Hawaii has increased by about 2°F since 1950, but the warming has leveled off in the most recent two decades according to NCEI's State Climate Summaries (2017). Higher elevations are more likely to see a greater rate of temperature increase. Air temperature is heavily influenced by natural climate variability. The rate of temperature rise is also affected by future use (or reduction of) greenhouse gas emissions.

Sea surface temperatures are also rising, which increases the rate of coral bleaching and affects tropical cyclone formation.

5.2. El Niño-Southern Oscillation

Every 3 to 7 years, climate conditions over the Pacific Ocean basin change dramatically because of the El Niño-Southern Oscillation (ENSO). Strong ENSO years, such as 2015-2016, bring warmer sea surface temperatures, intense rains, and an increased risk of tropical cyclones (NOAA). The year 2015 was the most active hurricane season on record in the Central Pacific, with eight hurricanes and six additional tropical storms reported.

The strength of these ENSO-related patterns in the short term can make it difficult to detect the more gradual, long-term trends of climatic change. The effects of ENSO can be further magnified when it is in phase with longer periodic cycles such as the Pacific Decadal Oscillation and the Interdecadal Pacific Oscillation. It is unknown how the timing and intensity of ENSO will continue to change in the coming decades, but recent climate model results suggest a doubling in frequency of both El Niño and La Niña extremes in the 21st century as compared to the 20th century under scenarios with more warming (Keener, et al., 2018).

5.3. Rainfall

Annual rainfall averages have decreased throughout Hawaii over the last century, according to the Hawaii Rainfall Index (Chu & Chen, 2005). Less rainfall typically leads to a decline in groundwater and stream base flow.

5.3.1. Nonstationarity Analysis

To investigate whether a trend of changing peak annual flow is occurring, the Wailuku River gage records were tested using the Nonstationarity Detection Tool in accordance with ETL 1110-2-3. Two USGS streamflow gages (16604500 and 16607000) were used in this study, as previously introduced in the Hydrology and Hydraulics Appendix.

The gage record for USGS 16604500, Wailuku River at Kepaniwai Park, includes peak annual stream flow from 1984 to 2019, which is a 35-year period of record. The gage captures a drainage area of 6.13 square miles and is located about 1.9 miles upstream from the project debris basin. The tool initially detected 10 nonstationarities where there was a statistically significant change to the average value of the data based only on the Bayesian method (Figure 5-1). This method identifies statistically significant changes in sample mean within a univariate, Gaussian dataset. Peak annual flow datasets rarely fit a Gaussian (normal) distribution and thus in most instances this method would be inappropriate to apply (USACE, 2019). Additionally, this method does not work well with short time series, or with small changes in magnitude. Therefore, the nonstationarities were disregarded. When the Bayesian Sensitivity was reduced from the default value of 0.5 to 0.3, 0 nonstationarities were detected. The average peak streamflow observed over the period of record is 2,667 ft^3/s with a standard deviation of 1,443 ft^3/s and a variance of 2,080,813 ft^3/s. Monotonic trend analysis of this period did not detect a statistically significant trend using the Mann-Kendall Test at a 0.05 level of significance (exact p-value of 0.307) or using the Spearman Rank Order Test at the 0.05 level of significance (exact p-value of 0.260). No trends were detected using parametrical statistical methods or Sens's Slope method. No nonstationarities or monotonic trends are detected within the streamflow record for USGS 16604500, Wailuku River at Kepaniwai Park.

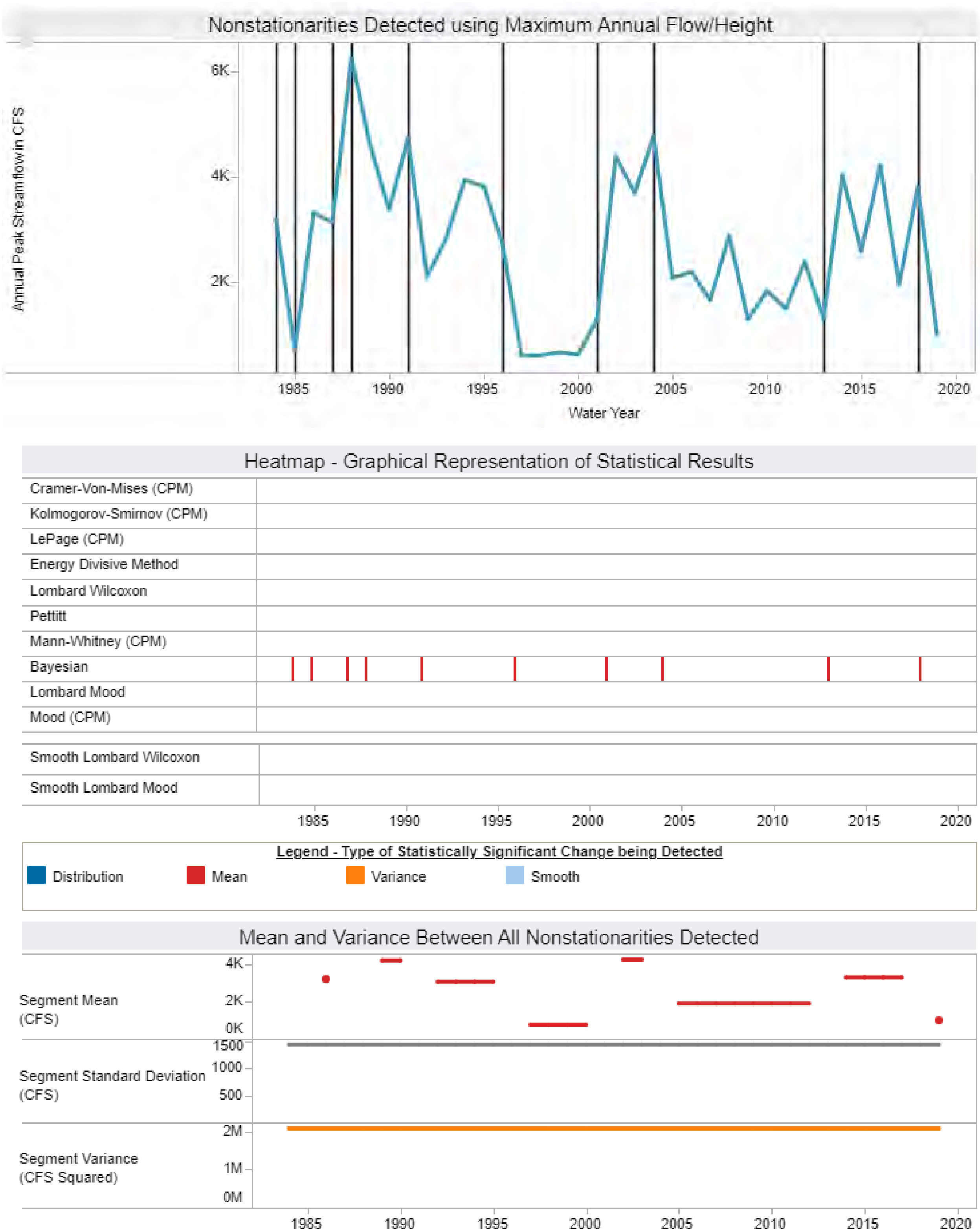


Figure 5-1: Nonstationarity Detector Charts – USGS 16604500

The gage record for USGS 16607000, Wailuku River at Wailuku, includes peak annual stream flow from 1951 to 2016, which is a 65-year period of record. The gage captures a drainage area of 8.11 square miles and is located about 0.4 miles downstream from the project debris basin. The tool detected one possible nonstationarity based on a change in distributional characteristics in 1986. However, this was supported by only one of the four distributional changepoint tests (lack of consensus). The average peak streamflow observed over the period of record is 3,149 ft^3/s with a standard deviation of 1,764 ft^3/s and a variance of 3,112,198 ft^3/s. Monotonic trend analysis of this period did not detect a statistically significant trend using the Mann-Kendall Test at a 0.05 level of significance (exact p-value of 0.429) or using the Spearman Rank Order Test at the 0.05 level of significance (exact p-value of 0.447). No trends were detected using parametrical statistical methods or Sens's Slope method. No nonstationarities or monotonic trends are detected within the streamflow record for USGS 16607000, Wailuku River at Wailuku River.

These two analyses indicate that no statistically significant changes in the basin hydrology have occurred during the period of record.

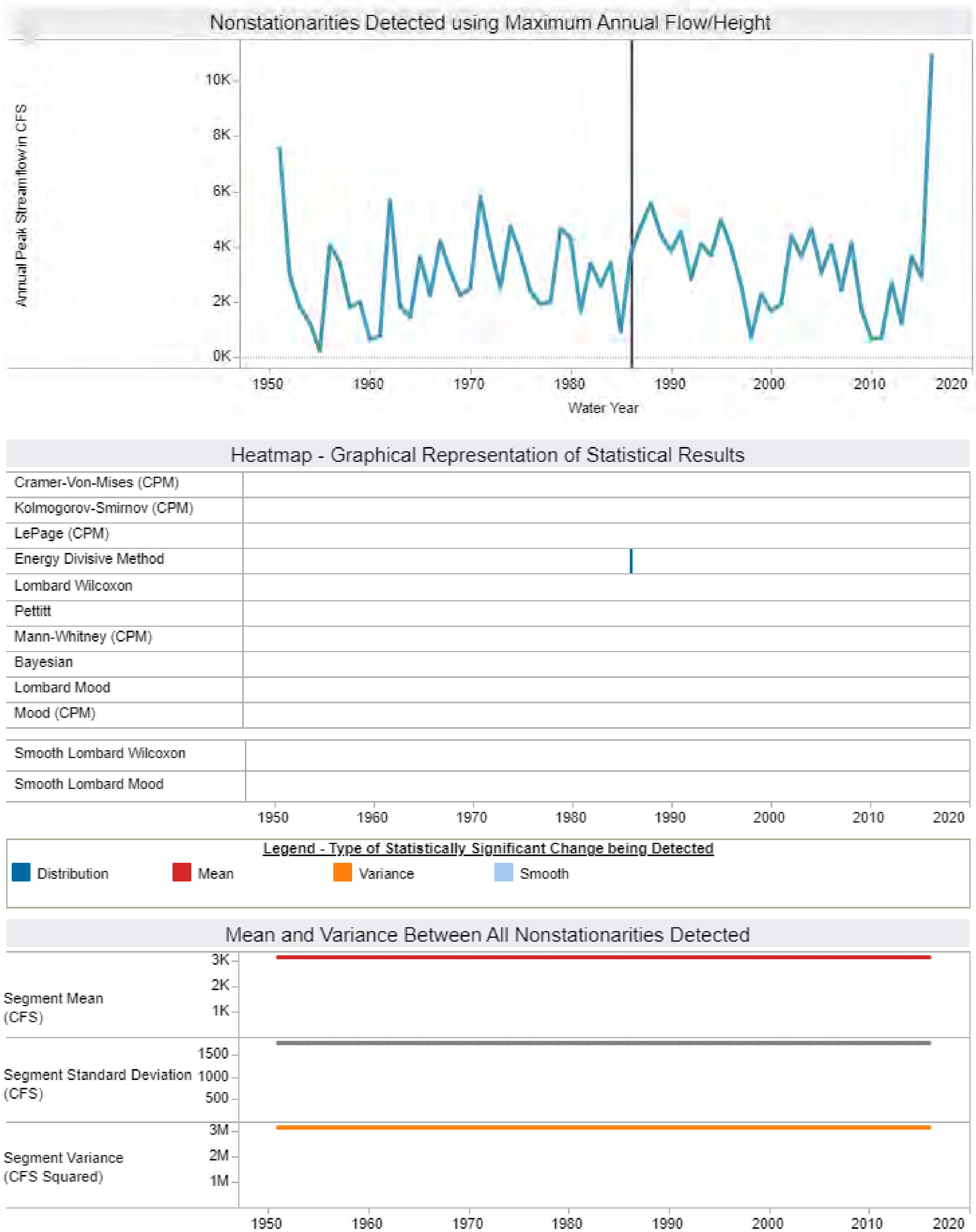


Figure 5-2: Nonstationarity Detector Charts – USGS 16607000

5.4. Sea Level Change

USACE requires that planning studies and engineering designs consider alternatives that are formulated and evaluated for the entire range of possible future rates of sea level change (SLC). Designs must be evaluated over the project life cycle and include evaluations for three scenarios of *low*, *intermediate*, and *high* sea level change.

According to Engineer Regulation (ER) 1100-2-8162 (USACE, 2019) and Engineer Pamphlet 1100-2-1 (USACE, 2019), the SLC *low* rate is the historic SLC. The *intermediate* and *high* rates are computed by:

- Estimating the *intermediate* rate of local mean sea level change using the modified National Research Council (NRC) Curve I, the NRC equations, and correcting for the local rate of vertical land movement (VLM).
- Estimating the *high* rate of local mean sea level change using the modified NRC Curve III, NRC equations, and correcting for the local rate of VLM. This *high* rate exceeds the upper bounds of the Intergovernmental Panel on Climate Change (IPCC) estimates from both 2001 and 2007 to accommodate the potential rapid loss of ice from Antarctica and Greenland.

The 1987 NRC described these three scenarios using the following equation:

$$\boldsymbol{E(t) = 0.0012t + bt^2} \qquad \text{Equation 1}$$

in which *t* represent years, starting in 1986, *b* is a constant, and *E(t)* is the eustatic sea level change, in meters, as a function of *t*. The NRC committee recommended, “projections be updated approximately every decade to incorporate additional data.” At the time the NRC report was prepared, the estimate of global mean sea-level (GMSL) change was approximately 1.2 mm/year. Using the current estimate of 1.7 mm/year for GMSL change, as presented by the IPCC, results in this equation being modified to be:

$$\boldsymbol{E(t) = 0.0017t + bt^2} \qquad \text{Equation 2}$$

The three scenarios proposed by the NRC result in global eustatic sea level rise values (by the year 2100) of 0.5 meters, 1.0 meters, and 1.5 meters. Adjusting the equation to include the historic GMSL change rate of 1.7 mm/year and the start date of 1992 (which corresponds to the midpoint of the current National Tidal Datum Epoch of 1983-2001), results in updated values for the variable b being equal to 2.71E-5 for modified NRC Curve I, 7.00E-5 for modified NRC Curve II, and 1.13E-4 for modified NRC Curve III.

Manipulating the equation to account for it being developed for eustatic sea level rise starting in 1992, while project will be constructed at some date after 1992, results in the following equation:

$$\boldsymbol{E(t_2) - E(t_1) = 0.0017(t_2 - t_1) + b(t_2{}^2 - t_1{}^2)} \qquad \text{Equation 3}$$

where t_1 is the time between the project's construction date and 1992 and t_2 is the time between a future date at which one wants an estimate for sea-level change and 1992 (or $t_2 = t_1$ + the number of years after construction). Using the three *b* scenarios required by ER 1100-2-8162 (United States Army Corps of Engineers, 2019) results in the following three GMSL rise scenarios depicted in Figure 5-3.

An analysis of the potential sea level rise was performed in the projected area. The gage at Kahului Harbor (NOAA ID: 1615680) was used for the analysis. This gage was established in 1946 and in its present location since 1989. It is located on the northwest corner of Pier #2 at Kahului Harbor, approximately 1.5 miles southeast of the Wailuku River outlet. This gage site was input into the USACE Sea Level Change Calculator (Version 2019.21). The result of the calculation indicates a relative sea level change of 5.15 feet was determined in the year 2100 at the *high* condition. For the *intermediate* condition, the change is 1.86 feet, and the *low* condition shows an increase of 0.82 feet. These values are relative to Local Mean Sea Level (LMSL) as the calculator states NAVD88 datum is not available for this station. The resulting sea level rise curve is shown in Figure 5-3.

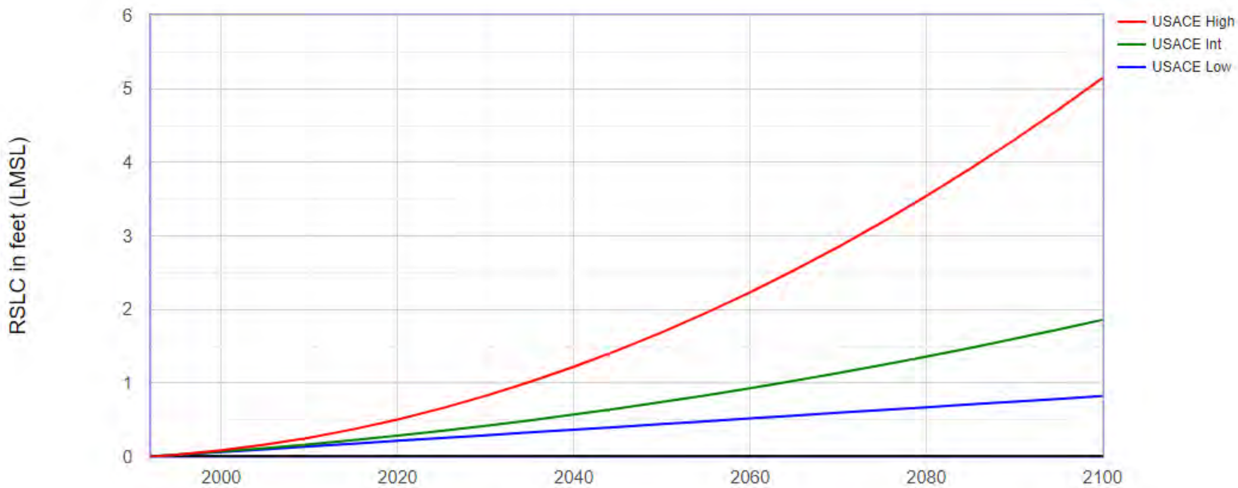


Figure 5-3: Estimated Relative Sea Level Change Projections – Gauge: 1615680, Kahului: Kahului Harbor, HI

The calculator also outputs a table showing the progression of sea level rise. This table was derived in 5 year increments and is shown below.

Table 5-1: Sea Level Rise by Year

Year	USACE		
	Low	***Intermediate***	***High***
1992	0.00	0.00	0.00
1995	0.02	0.02	0.03
2000	0.06	0.07	0.09
2005	0.10	0.11	0.16
2010	0.14	0.17	0.26
2015	0.18	0.22	0.37
2020	0.21	0.28	0.50
2025	0.25	0.35	0.66
2030	0.29	0.42	0.83
2035	0.33	0.49	1.01
2040	0.37	0.57	1.22
2045	0.40	0.65	1.45
2050	0.44	0.74	1.69
2055	0.48	0.83	1.95
2060	0.52	0.93	2.23
2065	0.56	1.03	2.53
2070	0.59	1.14	2.85
2075	0.63	1.24	3.19
2080	0.67	1.36	3.54
2085	0.71	1.48	3.91
2090	0.75	1.60	4.31
2095	0.78	1.73	4.72
2100	0.82	1.86	5.15

The calculator also provides extreme water levels expected across several datums. These datums and their respective values are shown in the table and figure below:

Table 5-2: Tidal Datums and Extreme Water Levels

Datum / EWL	Reference Datum	
	LMSL	***MLLW***
HAT	1.98 ft	3.09
MHHW	1.14 ft	2.25
MHW	0.78 ft	1.89
MSL	0.00 ft	1.11
MLW	-0.79 ft	0.32
MLLW	-1.11 ft	0
NAVD88	--	
EWL Type	NOAA GEV	
1/100 AEP	2.55 ft	3.66
1/50 AEP	2.50 ft	3.61
1/20 AEP	2.42 ft	3.53
1/10 AEP	2.35 ft	3.46
1/5 AEP	2.27 ft	3.38
1/2 AEP	2.11 ft	3.22
Yearly	1.78 ft	
Monthly	--	
From	1947	
To	2007	
Years of Record	60	

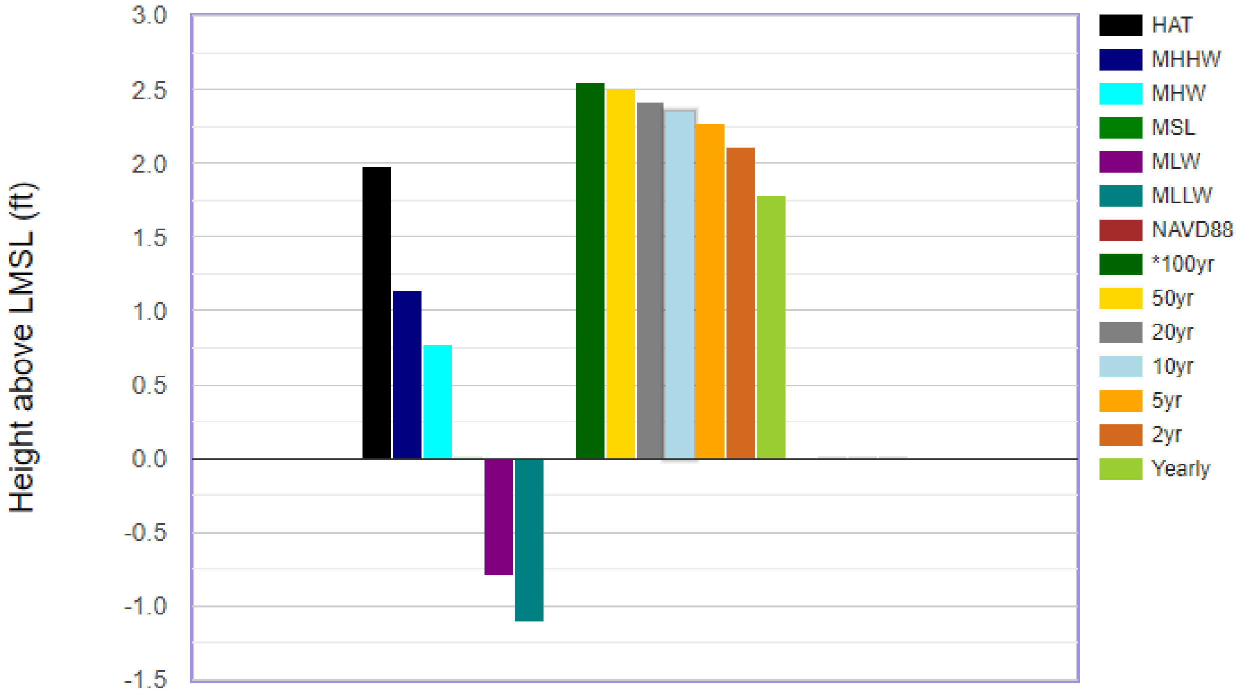


Figure 5-4: Tidal Datums and Extreme Water Levels

The highest tide level occurred in August 2017 and was 3.59 MLLW (2.47 MSL). Under *high* sea level rise conditions, this max tide level would be 8.37 MLLW (7.25 MSL) in 2100. The relative change in sea level from 2015 to 2100 is 4.78 feet. With regards to Wailuku River, this elevation is still very near to the ocean outlet with negligible impacts to existing or proposed project features.

5.5. Climate Risk Assessment

Engineering Construction Bulletin (ECB) 2018-14, *Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Work Studies, Designs and Projects* requires the evaluation of the risk climate change poses to the project features. A qualitative analysis on climate and hydrology was conducted in accordance with ECB 2018-14 and introduced in the Hydrology and Hydraulics Appendix, Section 6. Regionally and within the study area, the following climate change indicators are relevant to this project:

- Rising air temperature;
- Rising sea surface temperature;

- Rising sea level;
- Less, but more intense rainfall;
- Declining base flow in streams; and
- Increased frequency of extreme events;

The following table illustrates the features under consideration in this project and how they may be affected by climate change.

Table 5-3: Climate Change Risk

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
Concrete-Lined Channel	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency	Increased possibility of structural failure	Likely
Removal of Left Bank Revetment X	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency	Increased erosion on the left bank	Likely
Install Revetment near Levee E	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency	Increased possibility of structural failure	Likely
Sacrificial Berm	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency	Berm may erode more frequently and require more frequent rehabilitations	Highly Likely

Pre-Formed Scour Hole	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency	Increased possibility of structural failure	Likely
Modify Debris Basin	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency; increase in debris load	Debris basin fills up more frequently	Likely
Drop Structures	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency	Increased possibility of structural failure	Likely
Overflow Basin with Floodplain Reconnection	Increases in the frequency and magnitude of precipitation (storms are larger and occur more frequently)	Increases in flood discharge and frequency	Increased possibility of structural damage or erosion.	Likely

Although the effects of climate change on the project features is likely, the effect on project performance would be unlikely. In addition, the nonstationary detection tool did not detect a trend so there is a lack of evidence to reject the thought that the flow and frequency are stationary.

6. Safety Considerations

Per Planning Bulletin (PB) 2019-04, risks to human life are a fundamental concept of all facets of coastal storm risk management and must receive explicit consideration throughout the planning process. Factors that influence life loss include, but are not limited to, the depth and velocity of flooding, infrastructure performance, socioeconomic characteristics of the population, warning systems, evacuation plans, emergency response, and other preparedness measures. For the purposes of this study, a qualitative assessment of life safety risk and other community safety considerations was conducted to inform formulation and evaluation of alternatives. The qualitative approach to evaluation of safety risks was coordinated with the Corps' vertical chain, with agreement to justify the recommended plan based on both economic benefits as well as qualitative safety considerations as outlined in Engineer Regulation (ER) 1165-2-119. As a result of comprehensive alternative analysis, the recommended plan presented in later chapters of this report is both economically justified and also improves resilience to the community safety risks summarized in this chapter.

6.1. Summary of Hazards and Consequences

There are actionable safety issues in the study area resulting from the project entering a state of failure or non-performance. Failure or non-performance could occur if continued erosion or head cutting causes a levee to breach and fail. The most critical locations where failure of a federally constructed feature is likely to occur include:

1. The transition between the Upper Concrete Channel to the Natural Reach near RS 91+50.
2. The right bank segment between Waiehu Beach Road and Imi Kala Street Bridge in the Natural Reach, including Levees A, B, C, and D.
3. The concrete channel constriction within the Natural Reach known as "Revetment X," located between RS 59+50 and 48+50.

Without risk management, failure of one or more of the critical locations identified above would result in the following safety conditions, which warrant a design deficiency remedial action:

1. Failure of the invert at the Upper Concrete Channel creates a natural drop structure, causing turbulent (erosive) waters. As the foundation material of the

lined channel is eroded by the turbulent waters, a toppling failure of the boulder-concrete invert follows. If left unaddressed, the entire channelized reach would eventually be compromised, and the concrete retaining walls could fail.

2. There is an increased risk of erosion upstream and downstream of Revetment X. This feature causes increased stream velocity and vertical erosion in the channel, which threaten the integrity of existing levees nearby.
3. During the 2% AEP event, inundation along the more developed right bank within the natural reach can occur following levee failure. While the levees in this area were repaired following the September 2916 flood event and risk of one-time failure is reduced, it is important to understand how flood risk is inherently present in the study area and evaluate the safety-related consequences of possible project failure in this reach. Under simulated levee failure scenarios, flood depths along this right bank residential area are shallow (less than 1 foot) but increase with larger events.
4. During these events, residents of the left (west) bank that need to access emergency services and/or evacuation destinations on the right (east) bank would be required to do so through inundated streets, that would cause some people to move from a condition of “safe” (i.e., low risk to life safety) to a condition of “chance” (i.e., higher risk to life safety) from a life safety perspective. They would also be required to evacuate via crossing a project that is in an active state of failure/non-performance. Their only other option would be to evacuate via Highway 340 in the direction of Waihee-Waiehu, perhaps through other areas that may be experiencing flooding. Figure 6-9 depicts egress routes in the study area.
5. During these events, emergency services from the right bank seeking to render aid would similarly be required to do so via crossing the project that is in an active state of failure/non-performance and would also be subjected to the potential of moving from “safe” to “chance” condition.
6. Due to the flashy nature of these events, it is likely that people will be caught in their vehicles, an obvious safety concern that would likely move people from “safe” to “chance” condition.
7. Emergency services would likely be disrupted for approximately two hours based on simulated inundation in the consequence area.

6.2. Population at Risk

The 2020 Maui County Multi-Hazard Mitigation Plan indicates a greater than likely probability (greater than 90% annual chance) of a flood event within the Wailuku-Kahului Community planning area, which includes Iao Valley and the Iao Stream FCP area. The plan cites the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI) Storm Database which used historical data from 1971 to March 2020 to capture 137 flood events in Maui County. This data indicates an average of three flood events annually between 1971 and March 2020.

The extremely flashy nature of typical floods in the system provides little opportunity for flood warning and evacuation. Typically, there is only one hour between peak rainfall and peak flow in the river based on gaged data from past events. Regional Emergency Alert Systems warn of imminent flash flooding in the area. However, there is no site-specific flood warning system for the Wailuku River floodplain and only two stream gages on the river. Residents are generally unaware of whether they should shelter in place or attempt to evacuate, which can result in a delayed evacuation at the most inopportune time (during a breach).

In addition, flood risk is not consistently recognized by the local community. Local residents often recreate in the project (Figure 6-1) and bodyboard over the project's shallower drop structures during above-average flow events.

Figure 6-1. Individual Creating a Recreational Pool in Wailuku River (formerly known as Iao Stream)

In addition to the residents who are familiar with the area, there are visitors to the Iao Valley who are unfamiliar with the area and become more susceptible to risk during an active event. The 2016 event wreaked havoc on Kepaniwai Heritage Gardens County Park, located in the upper watershed of Iao Valley, including severe damage to the visitor center, the visitor center parking lot, and the access road. If the peak occurred earlier in the day, the risk to visitors would have been much higher. Iao Valley averages about 1,800 visitors daily. Often, it will be raining and sunny at the same time and visitors are not detracted by the weather when their time on the island is so short. The limited egress routes would have residents and visitors attempting to evacuate through inundated areas, such as along Eha Street, or evacuating by crossing a project that is in an active state of failure and non-performance via Waiehu Beach Road (Highway 340) in the direction of Waiehee-Waiehu.

During the September 2016 (2.5% AEP) flood that led to extensive bank failure and other prior events, residents reported hearing large boulders moving in the river behind her property, a sign that residents may not evacuate even during high flow events that cause significant amounts of large material to be mobilized in the system. The peak of the September 2016 event occurred in the evening, around 1900 hours, when most residents were in their homes, and even possibly sleeping. A peak event occurring at nighttime increases safety risks, as most flood-related deaths occur either at night or when people become trapped in automobiles that stall while driving in areas that are flooded. In addition, it is harder to gauge water depth at night, further increasing risk for residents attempting to evacuate. Regardless of time of a flood event, the greatest risk to life for the Iao Stream FCP occurs in situations where residents are caught on foot or in vehicles trying to evacuate in the high velocity flows, even though depths would generally be shallow.

6.2.1. Population in Project Area

This section gives a brief description of the population residing in the area protected by the levee (leveed area) as well as the surrounding city of Wailuku. Population data for Maui County is provided for comparison purposes. There are two data sources for the population data in this section, the U.S. Census Bureau and the Environmental Protection Agency (EPA) Environmental Justice (EJ) screening tool, which uses U.S. Census Bureau American Community Survey (ACS) data as its source. The EPA EJ Screen tool was used to isolate Census data for the leveed area.

6.2.1.1. Population

There are approximately 3,600 people living in the leveed area and 17,400 people living in the city of Wailuku. Both the leveed area and Wailuku have experienced population growth in recent years (2010 to 2018), with annual growth rates of 1.3% and 1.4% respectively. By comparison, the Maui County grew at a rate of 0.7% annually during the same time period.

Table 6-1. Population Estimate and Trends in Project Area (2010, 2018)

Geographical Area	2010 Population Estimate	2018 Population Estimate	Population Percent Change (2010-2019)
Leveed Area	3,242	3,642	1.3%
Wailuku, HI	15,313	17,354	1.4%
Maui County	154,834	165,281	0.7%

Source: U.S. Bureau of the Census, 2010 Census (2010 Estimate for Wailuku and Maui); U.S. Bureau of the Census, American Community Survey (2018 Estimate for Wailuku and Maui); 2010 Census and 2018 American Community Survey accessed via EPA EJ Screen (Leveed Area)

6.2.1.2. Housing Units

There are approximately 1,343 households in the leveed area, which accounts for multi-family residences. Of those approximately 55% are owner-occupied and 45% are renter-occupied. These households make up approximately 2% of the households within Maui County.

Table 6-2. Number of Households in Project Area (2018)

Area	Households	Owner Occupied	Renter Occupied
Leveed Area	1,343	741	602
Wailuku, HI	4,670	2,690	1,980
Maui County	54,274	32,685	21,589

Source: 2018 American Community Survey accessed via EPA EJ Screen

6.2.1.3. Age

In the leveed area, 8% of the population is below the age of 5 and 15% of the population is 65 or older, which is similar to the city and county. According to the EPA EJ Screen tool, the leveed area is in the 73rd percentile when compared to the state and the 72nd percentile compared to the U.S. in terms of young children (ages 0-4). The leveed area is in the 39th percentile in the state and the 55th percentile in the U.S. in terms of individuals ages 65 and older. Wailuku has a slightly greater percentage of the population that is 65 and older compared to the leveed area.

Table 6-3. Age Distribution in Project Area (2018)

	0-4 Years		65+ Years	
Area	*Number of Persons*	*Percent of Population*	*Number of Persons*	*Percent of Population*
Leveed Area	290	8%	540	15%
Wailuku, HI	915	7%	2,084	16%
Maui County	10,068	6%	27,860	17%

Source: 2018 American Community Survey accessed via EPA EJ Screen

6.2.1.4. Language

8% of the population in the leveed area speak English "less than very well," compared to 9% in Wailuku and 10% in Maui. In terms of households, 5% are linguistically isolated in the leveed area and 4% in Wailuku, compared to 3% in the Maui County. The protected area is in the 66^{th} percentile in the state and the 73^{rd} percentile in the U.S. in terms of linguistically isolated population.

Table 6-4. Linguistic Isolation in Project Area (2018)

	Population 5+ that speak English "less than very well"		Linguistically Isolated Households	
Area	*Number of Persons*	*Percent of Population*	*Number of Households*	*Percent of Households*
Leveed Area	282	8%	70	5%
Wailuku, HI	1,082	9%	179	4%
Maui County	16,060	10%	1,838	3%

Source: 2018 American Community Survey accessed via EPA EJ Screen

6.2.1.5. Employment

Approximately 73% of the population (age 16 and older) in the leveed area and 70% of the population in Wailuku are in the labor force, compared to 67% in Maui, 62% in Hawaii, and 63% in the U.S. According to the ACS, the unemployment rate was 8% in the leveed area and 6% in Wailuku in 2018.

Table 6-5. Labor Force and Employment in the Project Area (2018)

Area	Population Ages 16+	In Labor Force	Unemployed	Not in Labor Force	Unemployment Rate
Leveed Area	2,931	2,132	161	799	8%
Wailuku, HI	10,121	7,050	395	3,071	6%
Maui County	132,234	88,279	3,901	43,955	4%
Hawaii	1,147,445	709,482	32,036	397,918	5%
United States	257,754,872	162,248,196	9,508,312	94,478,543	6%

Source: 2018 American Community Survey accessed via EPA EJ Screen (Note: Census unemployment rates differ from Bureau of Labor Statistics; U.S. and Hawaii Census unemployment rates are provided for comparison purposes)

6.2.1.6. Commercial Structures

There are approximately 150 commercial structures within the protected area. Of those, the majority (approximately 55%) are warehouses, 16% are office buildings, 14% are retail, 6% are restaurants, and the rest are other types of commercial buildings. There is not critical infrastructure or institutions within the protected area.

6.3. Hazard

This section describes the hazards that contribute to community safety concerns within the study area.

6.3.1. Upstream Reach

The authorized project includes a concrete lined channel in the upstream reach of the Wailuku River. However, the downstream end of the concrete channel does not include a buried toe or other erosion control features in this critical area of transition from a lined to unlined channel. As described in Section 2.2.1, a significant head cut has formed just downstream of the upper concrete channel (River Station 91+50). The drop is currently 6 to 8 feet and the boulder-concrete invert has already experienced failure as a result of progressive undermining.

Without correction to address this design deficiency, scouring and erosion will continue increasing the risk of upstream headcutting or undercutting of the concrete lined channel. The undermining and impacts of which could lead to single event failure and increased risk to the community downstream on both the left and right banks of the Wailuku River.

6.3.2. Natural Reach: Levees A, B, C, D, and E

The Corps Hydrologic Engineering Center (HEC) Life Loss Estimation (LifSim) software allows users to evaluate the life loss and economic damages resulting from a single flood scenario. It explicitly models the warning and mobilization of people potentially exposed to the hazard and predicts the spatial distribution of fatalities within buildings or on road networks expected to be impacted by the hazard. While LifeSim was not used to formally model or evaluate life loss associated with the Iao Stream FCP, multiple model concepts and parameters were used to qualitatively evaluate the safety risks associated with potential failure of various features of the FCP.

Two stability criteria from LifeSim 2.0 were used to evaluate safety risks within the Natural Reach. Stability criteria are the depth and velocity thresholds for structures or vehicles used to evaluate the threshold for building collapse or vehicles being swept away during a flood event. The vehicle and pedestrian stability criteria used in LifeSim 2.0 can be used to evaluate the risk of vehicles and pedestrians being swept away by floodwaters. These criteria were compiled using data from multiple sources (research findings). Low clearance vehicles (i.e., personal vehicles) are “most likely” to be at risk when depths exceed 3.94 ft, velocities exceed 14.76 ft/second, and the functional threshold (depth x velocity) exceeds 2.62 square feet per second (ft^2/s) (Figure 6-2).

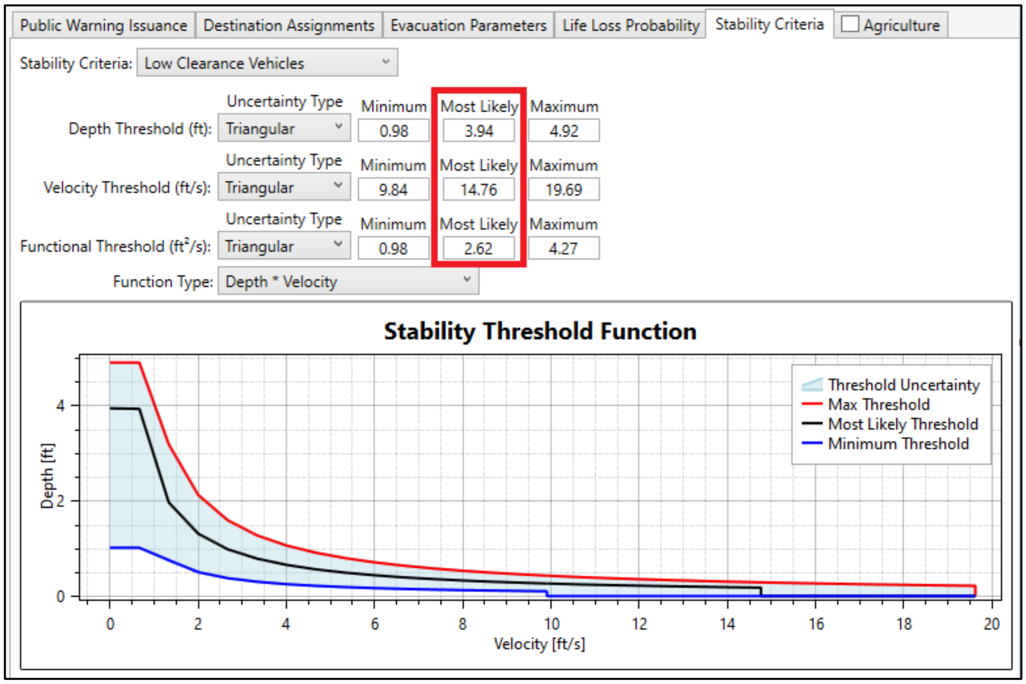


Figure 6-2. Stability Threshold Criteria for Low-Clearance Vehicles

High clearance vehicles (i.e. emergency vehicles) are “most likely” to be at risk when depths exceed 4.92 ft, velocities exceed 19.68 ft/s, and the functional threshold exceeds 3.94 ft^2/s (Figure 6-3).

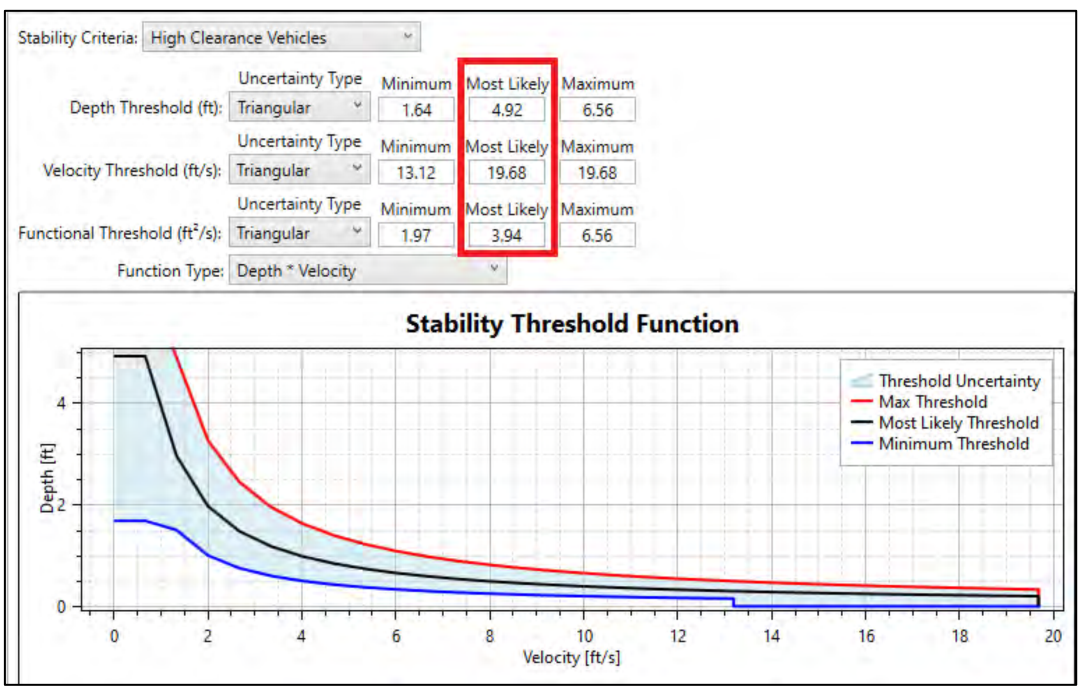


Figure 6-3. Stability Threshold Criteria for High-Clearance Vehicles

Pedestrians are "most likely" to be at risk when depths exceed 4 ft, velocities exceed 9.8 ft/s, and the functional threshold exceeds 6.46 ft^2/s (Figure 6-4).

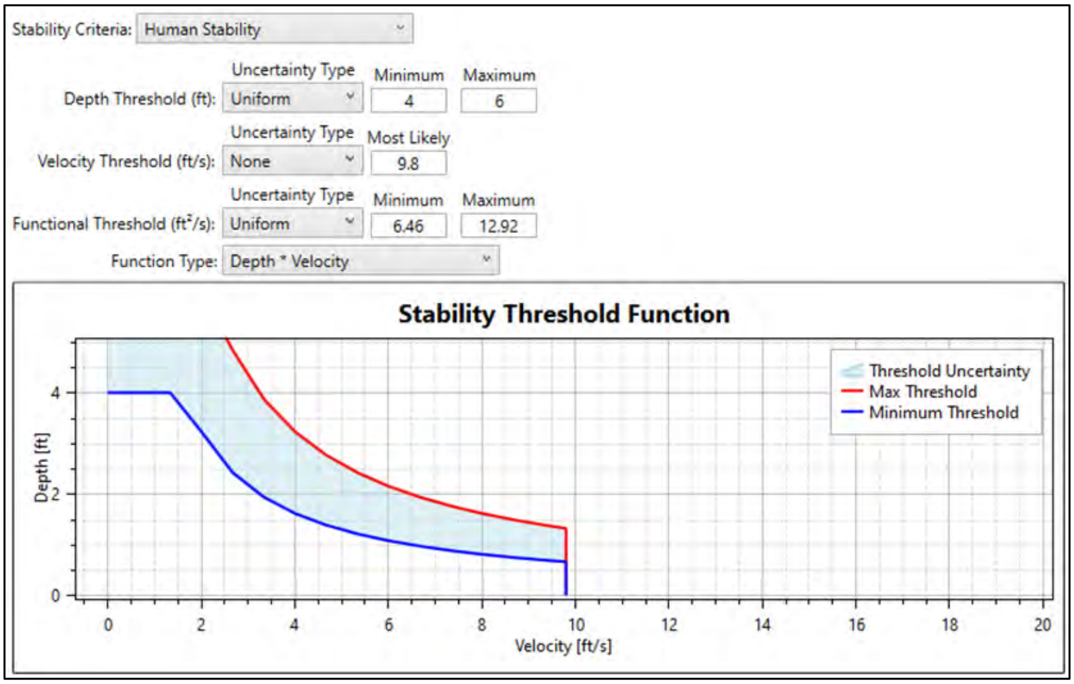


Figure 6-4. Stability Threshold Criteria for Pedestrians

6.3.3. Natural Reach: Revetment X

Revetment X within the Natural Reach of the Wailuku River was constructed to straighten this reach of the Wailuku River in an effort to reduce risk to the left and right banks. The left bank of this reach is identified as floodplain and remains undeveloped, the right bank in this reach is developed with residential community structures. By straightening the reach and constructing the revetment on both the left and right banks, flows and velocities were increased by removing the natural meandering of the river. As a result, an increased erosion issue along the revetment and a channel incising hazard has developed over time, having the opposite impact from its original purpose and increasing risks to the community.

6.4. Consequence

This section summarizes the consequences of the hazards described above.

6.4.1. Upstream Reach

Without correction to address this design deficiency at the transition between the upstream lined channel and natural reach, scouring and erosion will continue increasing the risk of upstream headcutting or undercutting of the concrete lined channel. Failure to address the headcutting issue could lead to single event failure, resulting in extensive damage to the invert and threaten stability of nearby retaining walls. Failure of these >16ft retaining walls would be catastrophic as adjacent homes would likely fall directly into the river. Ultimately, the consequences of this hazard would cause substantial risks to the community located immediately upstream and downstream of the scour-hole on both banks of the Wailuku River.

6.4.2. Natural Reach: Levees A, B, C, D, E

This section describes the consequences associated with right bank levee failure along the natural reach. A high-density residential area is located right behind Levees C and D (Figure 6-5). While the levees in this area were repaired following the September 2916 flood event and risk of one-time failure is reduced, it is important to understand flood risk that is inherently present in the study area. To support this analysis, the study team conducted a qualitative evaluation of the safety-related consequences of possible project failure.

As simulated, a breach at Levees C and D would lead to significant inundation of the right bank consequence area. The extent of inundation is shown in Figure 6-6. While some properties are inundated by shallow flooding (< 2 ft), most of the inundation was limited to the streets and open areas and continues as sheet flow until it reaches the ocean.

Figure 6-5. High-Density Residential Area Located Near Levees C and D

It would generally be expected that as water enters the leveed area, the velocities would be high (10 to 40 ft/s), but as it spreads out, it would slow down, rapidly causing shallow flooding (< 2 ft) to streets and low lying areas as it flows toward the ocean (Figure 6-6). During the triggering event for a breach (2% AEP), typical and maximum depths in the right bank consequence area are about 2 and 3.5 ft; and typical and maximum velocities are 1.5 and 8 ft/s (Figure 6-7). While these depths and velocities are not enough by themselves to stall vehicles and pedestrians, their combined effects (depth x velocity function) exceed the thresholds. During the 2% AEP event and larger, low-clearance vehicles, high-clearance vehicles, and pedestrians would likely become stalled or swept away. A functional threshold map is provided as Figure 6-8.

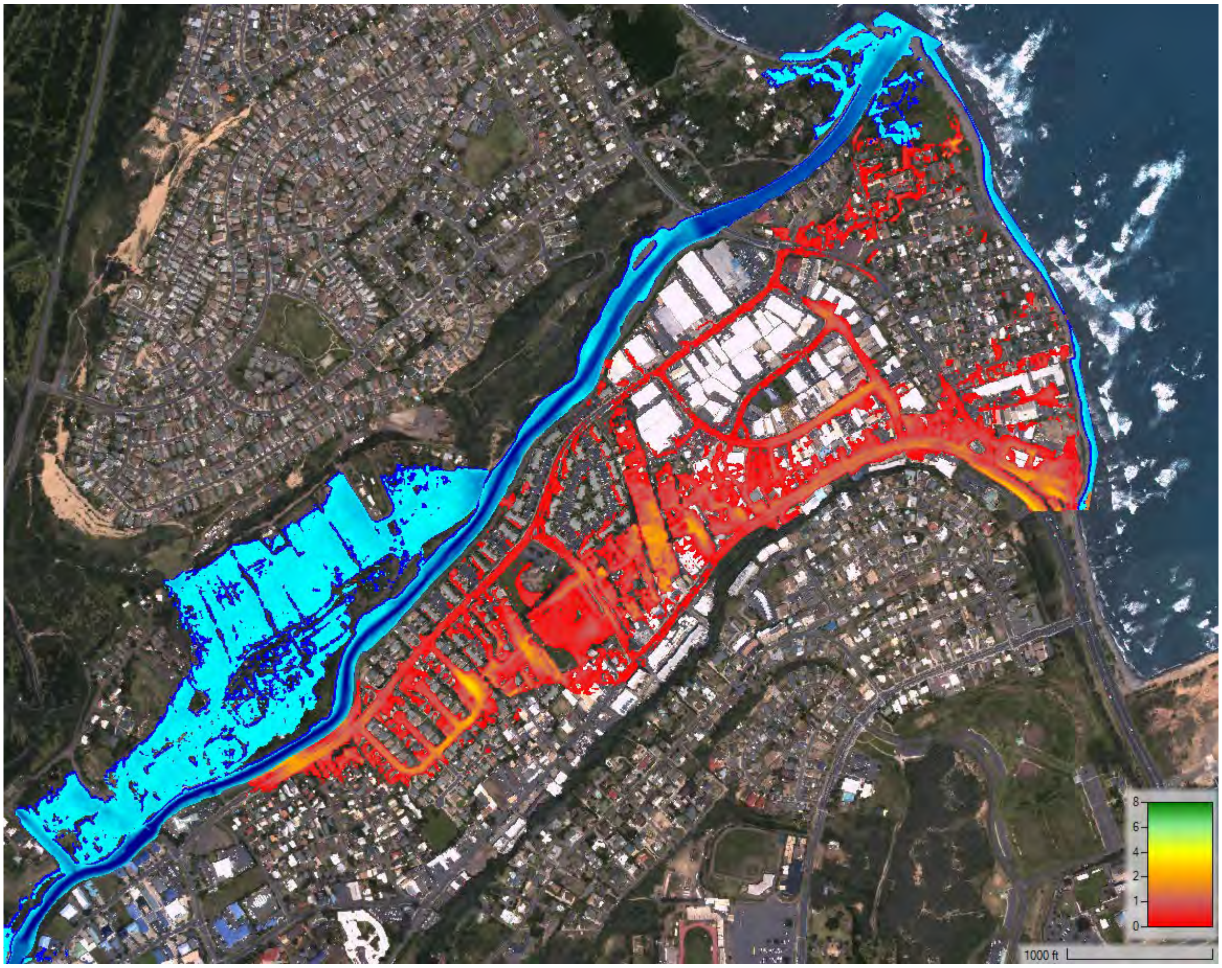


Figure 6-6. “Existing Condition” Depth Grid for 0.2% AEP Flood in Blue; “Future Without Project Condition” (Breach Scenario) Depth Grid in Red

Functional threshold of low-clearance vehicles: 2.6 ft^2/s; high-clearance vehicles: 3.9 ft^2/s, and pedestrians: 6.5 to 12.9 ft^2/s.

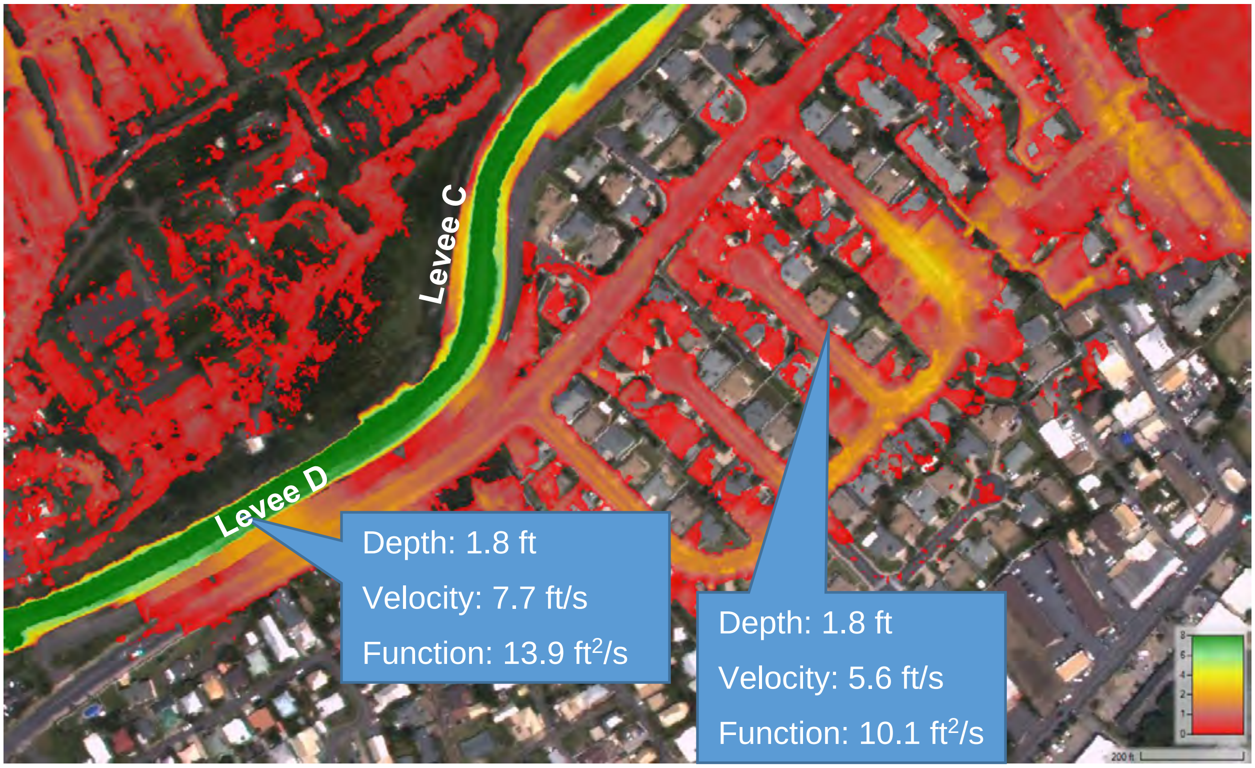


Figure 6-7. Depth Grid for the 0.2% AEP Flood, Future Without Project Conditions
Functional threshold of low-clearance vehicles: 2.6 ft^2/s; high-clearance vehicles: 3.9 ft^2/s, and pedestrians: 6.5 to 12.9 ft^2/s.

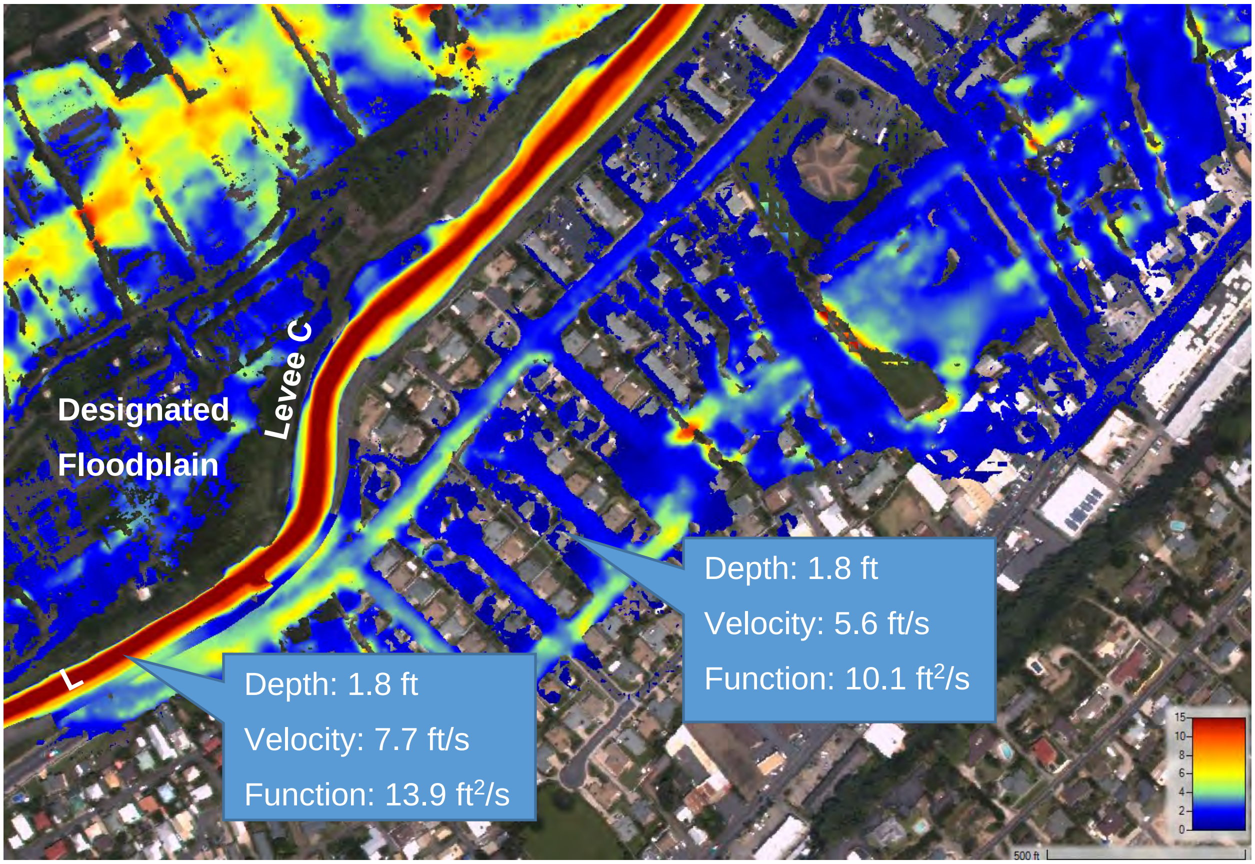


Figure 6-8. Velocity Map for the 0.2% AEP Flood, Future Without Project Conditions

Functional threshold of low-clearance vehicles: 2.6 ft^2/s; high-clearance vehicles: 3.9 ft^2/s, and pedestrians: 6.5 to 12.9 ft^2/s.

In addition to egress routes, Figure 6-9 identifies areas where low-clearance vehicles, high-clearance vehicles, and pedestrians would likely become overwhelmed by the flows in the floodplain based on the combined effects of depth and velocity (functional threshold). There are four primary egress routes out of the floodplain, identified as Routes A, B, C, and D. Limited egress routes would have residents attempting to evacuate through inundated areas that exceed the threshold for pedestrian and vehicle stability, such as along Eha Street (Route C) or Lower Main Street toward Kahului Beach Road (Route B). Some would also be required to evacuate by crossing a project that is in an active state of failure and non-performance via Waiehu Beach Road (Route A) in the direction of Waiehee-Waiehu. The greatest risk to life safety would be residents caught on foot or in vehicles trying to evacuate in the high velocity flows, even though depths would generally be shallow. Emergency responders would also be subjected to flows exceeding the stability threshold for their vehicles to traverse safely through the floodplain.

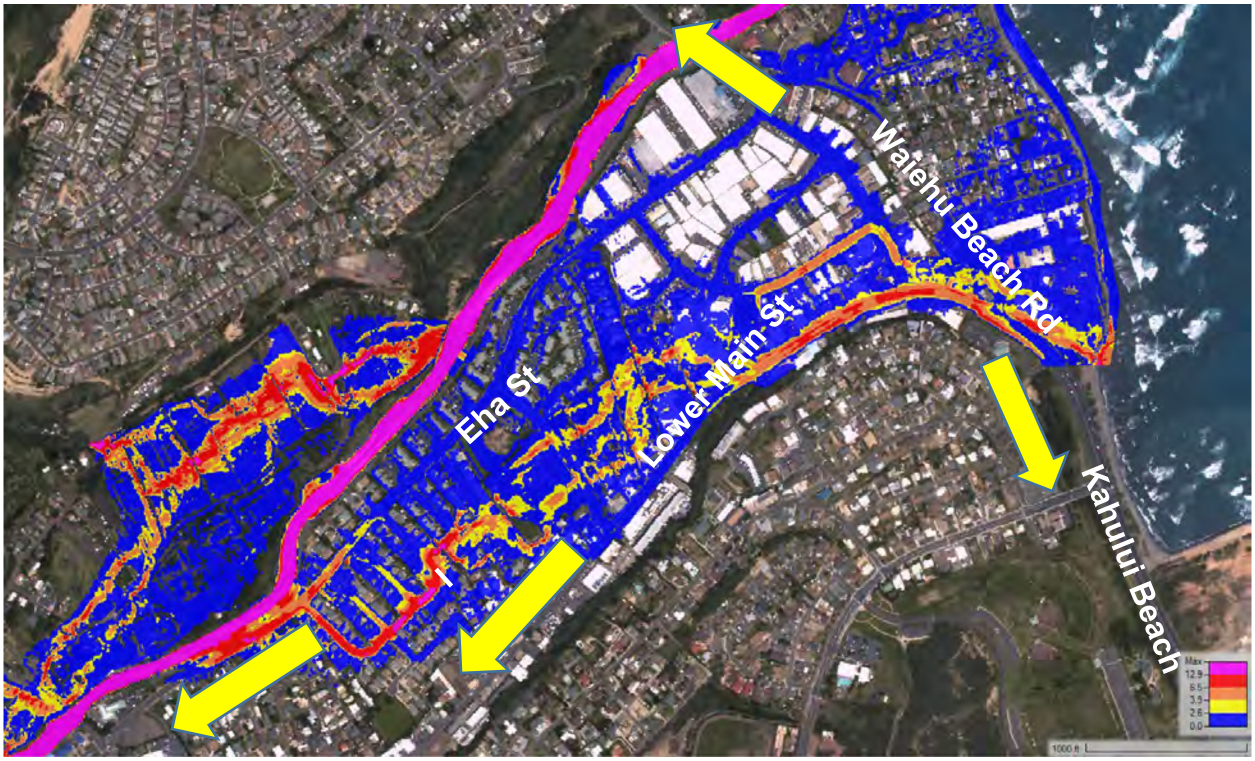


Figure 6-9. Functional Threshold Map for the 1% AEP (100-year) Flood, Future Without Project (Breach) Conditions and Egress Routes
Blue = below all thresholds (< 2.6 ft^2/s); Yellow = above low-clearance vehicle threshold (2.6 – 3.8 ft^2/s); Orange = above high-clearance vehicle threshold (3.9 – 6.4 ft^2/s); Red = above the minimum pedestrian threshold (6.5 – 12.8 ft^2/s); Pink = above the maximum pedestrian threshold (> 12.9 ft^2/s)

Although flood water is largely constrained to roadways under these failure scenarios, there are still safety risks associated with road use during flood events in the study area. Various types of vehicles move through the area and would be disrupted for approximately two hours based on simulated inundation in the consequence area. According to local traffic count data from the Hawaii Department of Transportation from 2013-2016, key roadways in the study area experience relatively high magnitudes of traffic on potentially affected streets, leading to increased community safety concerns during flood events. Volume on Kahului Beach Road, a key transportation corridor in the study area as indicated by “B” on Figure 3-10, was estimated at approximately 40,000 vehicles in a 24-hour period and 1,500-1,700 vehicles per 2-hour morning and evening peak commuting periods. In addition, Lower Main Street and Eha Street are the primary routes for leaving the area during storm events, with traffic potentially diverting from Lower Main Street to Eha Street if Lower Main Street floods first. Lower Main Street and Eha Street traffic counts were approximately 14,000 vehicles and 3,300 vehicles, respectively, in a 24-hour period. Ultimately, although flood events primarily impact streets rather than structures, community safety risk on roadways is still prevalent within the study area.

6.4.3. Natural Reach: Revetment X

The dramatic channel incision and continuous undermining within the vicinity of Revetment X has been a constant challenge. Failure of Revetment X in its current state is inevitable, which could cause flooding impacts the right bank, similar to those described for Levee C or D failure summarized above.

7. References

Chu, P.-S., & Chen, H. (2005). Interannual and Interdecadal Rainfall Variations in the Hawaiian Islands. *Journal of Climate*, 4796–4813. Retrieved from https://journals.ametsoc.org/view/journals/clim/18/22/jcli3578.1.xml

Fletcher, C. (2010). *Hawai'i's Changing Climate.* University of Hawai'i at Manoa. Retrieved from https://www.soest.hawaii.edu/coasts/publications/ClimateBrief_low.pdf

Hawai'i Climate Change Mitigation and Adaptation Commission. (2021). *Climate Change Portal*. (State of Hawaii) Retrieved from Hawaii.gov: https://climate.hawaii.gov/commission/

Honolulu Weather Forecast Office. (2020). *Observed Weather: Monthly Weather Summary (CLM)*. (National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS), Honolulu Weather Forecast Office) Retrieved from Weather.gov: https://w2.weather.gov/climate/index.php?wfo=hnl

Keener, V. W., Marra, J. J., Finucane, M. L., Spooner, D., & Smith, M. H. (2012). *Climate Change and Pacific Islands: Indicators and Impacts.* Washington, DC: Island Press.

Keener, V., Helweg, S., Asam, S., Balwani, S., Burkett, M., Fletcher, C., . . . Tribble, G. (2018). *Hawai'i and U.S.-Affiliated Pacific Islands.* Washington, DC, USA: U.S. Global Change Research Program. doi:10.7930/NCA4.2018.CH27

Kuehn, E. (2015, July). *Stream Bank Erosion Trends and Sediment Contributions in a Southwestern Missouri River.* Retrieved from Missouri State University: https://oewri.missouristate.edu/assets/OEWRI/Kuehn_Thesis_JR_bank_2015_FINAL.pdf

Minnesota Department of Natural Resources. (2010, January). *Resource Sheet 1: Streambank Erosion and Restoration.* Retrieved from Stream Habitat Program: https://files.dnr.state.mn.us/publications/waters/understanding_our_streams_and_rivers_resource_sheet_1.pdf

Moriasi, D. N., Arnold, J. G., Van Liew, M. W., Bingner, R. L., Harmel, R. D., & Veith, T. L. (2007). *Model evaluation guidelines for systematic quantification of accuracy in watershed simulations.*

NCEI. (2017). *State Climate Summaries Hawaii.* Retrieved from State Climate Summaries: https://statesummaries.ncics.org/chapter/hi/

NOAA. (2017, April 21). *NOAA Atlas 14 Point Precipitation Freqeuncy Estimates*. (National Oceanic and Atmospheric Administration. National Weather Service. Hydrometeorological Design Studies Center) Retrieved from Precipitation Frequency Data Server (PFDS): https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_hi.html

NOAA. (n.d.). *Datums for 1615680, Kahului, Kahului Harbor HI*. Retrieved from Tides & Currents: https://tidesandcurrents.noaa.gov/datums.html?id=1615680

NOAA. (n.d.). *El Nino and its Impacts on Hawai'i.* Retrieved from National Weather Service: https://www.weather.gov/media/peac/one_pagers/El%20Nino%20Impacts%20on%20Hawaii.pdf

NOAA National Centers for Environmental Information. (2017). *State Climate Summaries HAWAII*. Retrieved from State Climate Summaries: https://statesummaries.ncics.org/chapter/hi/

NOAA. (n.d.). *Sea Level Trends*. Retrieved from Tides & Currents: https://tidesandcurrents.noaa.gov/sltrends/sltrends.html

Stock, J. (2017). *Bank cohesion testing to support USACE hydraulic modeling in West Maui, Hawaii.* Menlo Park, CA: U.S. Geological Survey.

U.S. Climate Data. (2020). *Climate Kahului - Hawaii*. Retrieved from U.S. Climate Data: https://www.usclimatedata.com/climate/kahului/hawaii/united-states/ushi0031

University of Hawai'i. (2014). Hawaii Soil Atlas. Hawaii, USA. Retrieved from https://gis.ctahr.hawaii.edu/SoilAtlas

USACE. (1976). *General Design Memorandum, Phase II - Project Design for Flood Control and Allied Purposes, Iao Stream, Maui, Hawaii.* Honolulu, Hawaii: Department of the Army, U.S. Army Engineer District.

USACE. (1994). *Hydraulic Design of Flood Control Channels.* Washington, DC: U.S. Army Corps of Engineers. Retrieved from https://www.publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1601.pdf

USACE. (2019). *Guidance for Detection of Nonstationarities in Annual Maximum Discharges.* Washington, DC: U.S. Army Corps of Engineers.

USACE. (2019). *Incorporating Sea Level Change in Civil Works Programs.* Washington, DC: U.S. Army Corps of Engineers. Retrieved from https://www.publications.usace.army.mil/

USACE. (2019). *Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation.* Washington, DC: U.S. Army Corps of Engineers. Retrieved from https://www.publications.usace.army.mil/

USACE. (n.d.). *Sea-Level Change Curve Calculator*. (U.S. Army Corps of Engineers) Retrieved from http://corpsmapu.usace.army.mil/rccinfo/slc/slcc_calc.html

USGCRP. (2018). Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. Washington, DC, USA. doi:10.7930/NCA4.2018

Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

Engineering Documentation Report Amendment

Appendix C: Economics

September 2021

US Army Corps of Engineers®
Honolulu District

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Table of Contents

1. Introduction

1.1 Purpose of the Appendix.

The economic analysis completed for the Iao Stream Flood Control Project Engineering Documentation Report (EDR) Amendment will be detailed in this appendix. Originally, the scope of the economic analysis was for a General Reevaluation Report (GRR) and was based on updating the economic analysis from the recently completed 2017 EDR for this project. However, updated, 2D Hydraulic and Hydrologic (H&H) modeling completed for the GRR indicated that the economic benefits (quantified as flood damages prevented) were relatively minor compared to the 1D modeling results for the 2017 EDR.

Given the changes to the H&H analysis, the purpose of this appendix is as follows:

1. Provide background on the economic analysis completed for the 2017 EDR, including the project’s consequence area (i.e., damageable structures in the floodplain). The benefits resulting from this analysis are based on outdated H&H modeling and are therefore no longer relevant. They are provided in Section 2.1 for information purposes only.
2. Convey the potential flood damage reduction benefits of the project.
3. Describe the extent to which current Operations, Maintenance, Repair, Replacement & Rehabilitation (OMRR&R) expenditures exceed original outlays.
4. Quantify the potential benefits (in terms of OMRR&R reductions) of implementing an alternative plan.

1.2 Project Area.

The project is located in Wailuku, Maui, Hawaii. According to the latest FY14 survey of the area, there are 690 structures in the floodplain. The project area is broken down to eight reaches, displayed in Figure 1-1 and described briefly in Table 1-1. Not identified in this figure is an area on the left bank of the stream that is a designated floodplain. This area can be seen in the inundation mapping shown in Figure 2-1 and Figure 2-2.

Table 1-1. Streams and Reaches Included Iao Stream Study Area

Reach Name	Description	Beginning Station
Levee A Up	Residential	1.324 (Right Bank)
Levee A Low	Residential	1.089 (Right Bank)
Levee B Up	Residential	0.933 (Right Bank)
Levee B Low	Residential	0.746 (Right Bank)
Levee C&D Up	Commercial & Residential	0.524 (Right Bank)

Reach Name	Description	Beginning Station
Levee C&D Low	Commercial & Residential	0.330 (Right Bank)
Lower A	Commercial & Residential	0.180 (Left & Right Bank)
Lower B	Commercial & Residential	0.030 (Left & Right Bank)

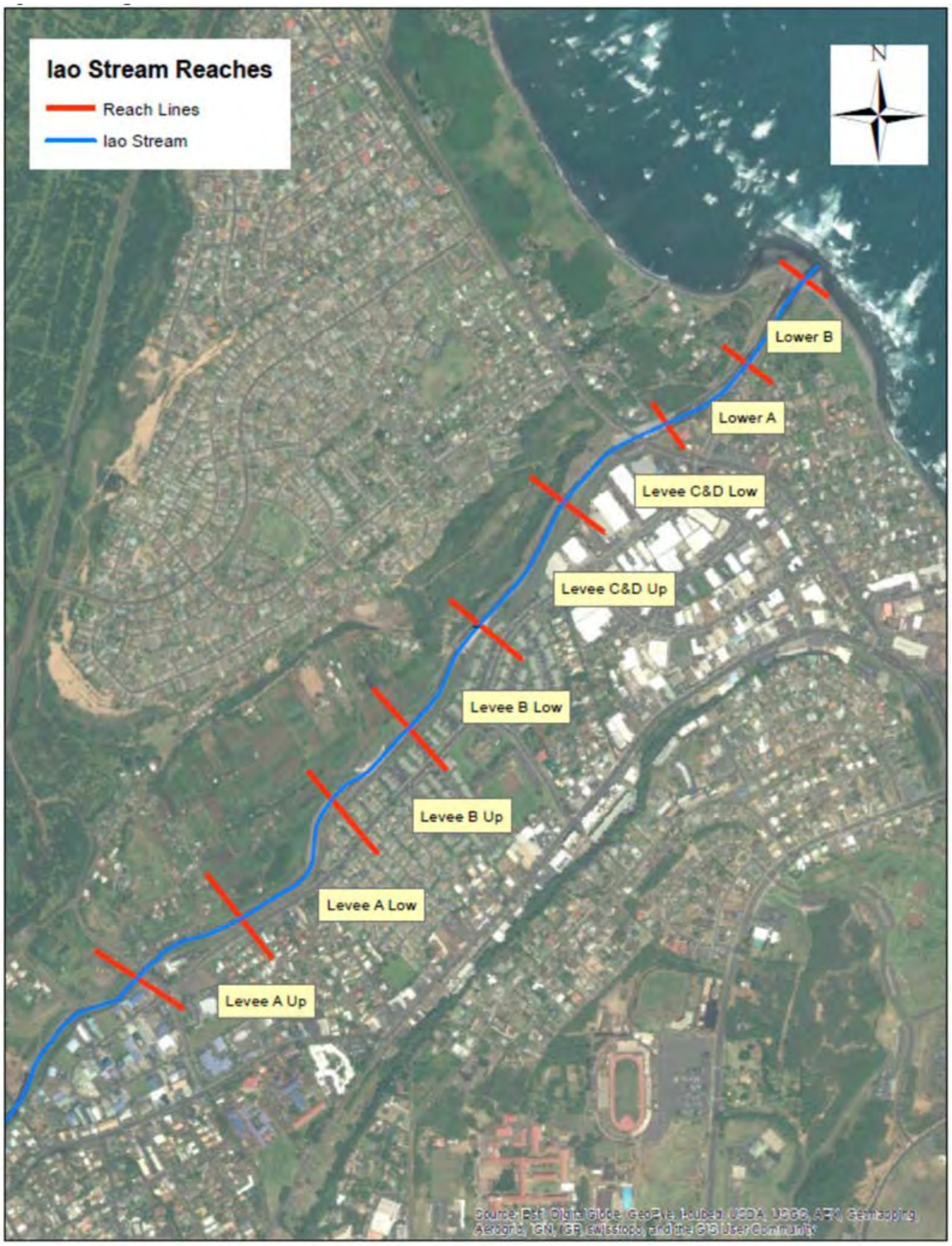

Figure 1-1. Map of Iao Stream Reaches

2 Economic Evaluation Procedures, Assumptions, & Methods

As stated previously, the scope of the economic analysis for the GRR included updating the benefits associated with each formulated alternative using the structure file and methodology utilized for the 2017 EDR. This section will discuss the inputs and methodology used for the 2017 EDR and updates to the economics of the Iao Stream Flood Control project since updated H&H modeling was completed in December 2020.

2.1 Economic Analysis for 2017 EDR

Methodology, Inputs, and assumptions used in the 2017 EDR are recapped in this section. The benefits resulting from this analysis are based on outdated H&H modeling and are therefore no longer relevant. They are provided in Section 2.1 for information purposes only.

2.1.1 Methodology:

- Flood damages and costs considered in the economic analysis included flood damages to residential and nonresidential structures and contents.
- Other, less significant damages and other National Economic Development (NED) benefit categories, such as reducing flood damages to automobiles, utilities, roadways and landscaping features were not evaluated.
- Inundation damages were computed by combining an inventory of structures in the floodplain with the anticipated extent and effects of the flooding from various storms in the without-project alternative and with-project alternatives. Flooding associated with the 50%, 20%, 10%, 4%, 2%, 1%, 0.5%, and 0.2% annual exceedance probability (AEP) events were estimated using the Corps of Engineers' HEC-RAS computer software.
- The economic justification of an alternative was determined by comparing the Expected Annual Benefits (EAB) to the Expected Annual Costs (EAC). The costs were based on an October 2016 price level, a period of 50 years, and were annualized to an annual equivalent cost using the FY2017 Federal Discount of 2.875 percent.

2.1.2 Hydraulic and Hydrologic Modeling

- Completed in USACE Hydrologic Engineering Center River Analysis System (HEC-RAS) steady flow model.

2.1.3 Structure Inventory

- Composed of all residential, commercial, and public buildings in the 0.2% AEP floodplain.
- Structures were identified by the use of a geographical information system (GIS) map with layers for county tax map key (TMK) parcels, the 0.2% AEP floodplain, an aerial survey topographic map with 5-foot contour lines, and aerial photographs of the project area.
- There are no structures used in the damage calculations that were built after the passing of Section 308, Water Resource Development Act of 1990, and are in

non-compliance with the requirement that the first-floor elevation be above the 1% AEP flood. This is due to no structures in the floodplain being applicable to Section 308.

- Both residential and commercial areas of the floodplain are fully built out, with little room available for construction of new structures without demolishing of existing structures. This study, therefore, assumes that no significant changes will occur to the structure inventories or other assets on which damage categories are based, and that future conditions will be the same as present conditions for the purposes of calculating damages or costs.
- The river station of each structure was calculated using a GIS map showing the location of structures and the floodplain cross sections with their associated river stations. The GIS measurement tool was used to interpolate the approximate river station for each structure using the river stations assigned to the nearest upstream and downstream cross sections.

2.1.4 First Floor Elevations

To identify the structures to include in the study, GIS floodplain maps marked with Tax Map Keys (TMKs) were used. The ground elevations for each structure identified from the maps were obtained through an aerial survey topographic map with 5-foot contour lines. In addition, some of the first floor elevations used in the structure file were carried forward from earlier studies of the area when actual surveyed elevations were recorded. A windshield survey was then performed to get additional data on the structure inventory, such as first floor elevations (FFE) and unique structure characteristics. For any additional inquiries, Google Earth was used. FFE, as defined by surveyors, is the lowest point of the lowest, non-basement floor.

In general, foundation types in the area are a mix of slab and pier. The majority of the structures (approximately 75%) are slab foundations with an assumed 6” FFE. Those structures closer to the coast are generally build with pier foundations with a FFE of 3-4’. Approximately 25% of the structures, mostly residential, have the elevated pier foundations.

2.1.5 Structure and Content Values

Residential and nonresidential structure values are based on FY2014 property tax assessed values. According to “Procedural Guidelines for Estimating Residential and Business Structure Value for Use in Flood Damage Estimations (USACE, 1995),” tax assessment data can be used as a proxy for depreciated replacement value when the assessment (1) has been performed recently, (2) gives consideration to effective age, remaining life, etc., (3) assesses land and improvements separately, and (4) when the economic depreciation is negligible. It was confirmed that all these stipulations were true after a team of USACE economists performed a windshield survey of the entire inventory of floodplain structures in March 2012. The latest TMK values were cross-checked against Marshall and Swift software, before deciding on the most reasonably accurate value to use to represent the depreciated replacement cost of all the structures in the floodplain. The Marshall and Swift cross-check included randomly sampling structures in the floodplain, inputting the structure's characteristics into the software, and determining whether or not the difference in tax assessed values and depreciated values were marginal. In the majority of cases, they were.

The minimum, maximum, and average structure values from the 2017 EDR are presented in Table 2-1 below to provide context for individual structure values within the study area.

Table 2-1. Average Structure Value in Study Area

Type	Structure Value		
	Minimum	**Maximum**	**Average**
Commercial	$13,400	$7,507,300	$551,635
Residential	$1,400	$1,878,900	$257,721

Note: 2014 Property Tax Values (taken from 2017 EDR structure file)

Content values for nonresidential structures were estimated using content value to structure value ratios from past USACE New Orleans District flood studies (USACE, 2006).

2.1.6 Reach Characteristics

The study area encompasses downstream of Imi Kala St and is separated into eight reaches. The majority of the structures in the area are primarily residential; however, commercial structures start to become more prevalent as the stream approaches the ocean. Overall, there are a total of 690 structures within the structure file for the 2017 EDR.

Of the 147 nonresidential structures, 146 structures are commercial properties. The majority of the commercial structures are warehouses, retail businesses, and offices, and they are mainly located in reaches Levee C&D Up and Levee C&D Low.

Values for the structures from the 2017 EDR are displayed in Table 2-2.

Table 2-2. Structure Inventory and values (FY 2017)

Reach	# of Structures in Reach	Structures by Type			Structure Values ($)	Content Values ($)
		Residential	**Commercial**	**Public**		
Levee A Up	18	17	1	0	2,402,000	2,226,000
Levee A Low	160	151	9	0	25,281,000	23,216,000
Levee B Up	111	103	8	0	36,717,000	34,105,000
Levee B Low	51	41	9	1	42,075,000	38,216,000
Levee C&D Up	95	56	39	0	41,739,000	34,609,000
Levee C&D Low	67	6	61	0	45,093,000	32,483,000
Lower A	125	107	18	0	29,402,000	24,829,000
Lower B	63	62	1	0	12,391,000	11,525,000
TOTAL	**690**	**543**	**146**	**1**	**$235,100,000**	**$201,209,000**

2.1.7 Depth-Damage Functions

The functions used for the 2017 EDR are as follows:

- Single Family Residential (SFR): Economic Guidance Memorandum 04-01, "Generic Depth-Damage Relationships for Residential Structures with Basements (USACE, 2003). Structure and contents damage curves for one-story residences without basements were used for the majority of residential structures.
- Residential Contents: Generic depth-damage curves supplied by Institute of Water Resources (USACE, 2003).
- Commercial/Public: New Orleans District depth-damage functions were used for commercial structures and contents (USACE, 2006).

2.1.8 Damage Calculations

• Hydrologic Engineering Center Flood Damage Analysis (HEC-FDA) software, version 1.4.1 was used to calculate Expected Annual Damages (EAD) for the 2017 EDR.

2.1.9 Without-Project Conditions

In the 2017 EDR, the eight reaches started to accumulate damages around the 1% AEP and greater events. Table 2-3 TABLE 1-1summarizes the aggregated without-project single event damages for all reaches. The damages presented in this table are from 1D H&H modeling (2017) and do not convey the latest H&H modeling and expected damages.

Table 2-3. 2017 EDR Without-Project Single-Event Aggregated Total Damages Summary

Iao Stream: Structure Inventory & Dollar Damages per Event Summary ($000)								
Aggregated Total Damages Summary								
Frequency	**50%**	**20%**	**10%**	**4%**	**2%**	**1%**	**0.5%**	**0.2%**
$Damages	0	0	0	0	0	8,151	10,530	16,721
#Residential	0	0	0	0	0	118	157	231
$Damages	0	0	0	0	0	7,003	9,488	14,235
#Commercial	0	0	0	0	0	20	23	33
$Damages	0	0	0	0	0	0	0	0
#Public	0	0	0	0	0	0	0	0

Table 2-4 summarizes the without-project expected annual damages, which are the potential benefits when flood damages are reduced in the with-project condition.

Table 2-4. 2017 EDR Without Project Benefits Summary ($000)

	Without Project EAD
Residential structures and contents	$1,502.49
Commercial structures and contents	$449.90
Total	**$1,952.39**

2.2 Economic Analysis Updates for GRR and EDR Amendment

With the conversion of H&H modeling to a HEC-RAS 2D model (and other factors involving H&H inputs that can be found in the H&H appendix), water surface elevations changed considerably from the H&H modeling used for the 2017 EDR. Economic damages that would result from the inundation represented in the new H&H modeling (January 2020) are less extensive than previously observed.

In the economic modeling for used for the 2017 EDR, damages began at the 1% AEP event. The old (2017) modeling resulted in 138 structures experiencing damages, the majority at depths ranging from 1.5 to 10 feet. In the 0.5% AEP event, 180 structures experienced damages, the majority at depths ranging from 2 to 11 feet. In the 0.2% AEP event, 264 structures experienced damages, the majority of which were between 3 and 12 feet.

For this study, the “existing condition” assumes that the levee in its current condition is in place. The future without-project (FWOP) condition assumes failure of Levees C and D occurs during the 2% AEP (50-year) event. (Note: Fragility curves have not been developed to support the analysis). The levee failure would trigger significant sheet flow in the right bank consequence area. Although the aerial extent of the flows is significant, the water depths remain relatively shallow in the consequence area, particularly at structures, and even more so when first floor elevation is considered.

In the most recent (2020) H&H modeling, the depth and extent of flooding within the consequence area is similar among the 2%, 1%, 0.5%, and 0.2% AEP flood events.

The inundation maps for the 2% AEP event is displayed in Figure 2-1 with the existing condition inundation mapped in blue and the FWOP in red/orange. The designated floodplain is on the left bank and is present in both scenarios.

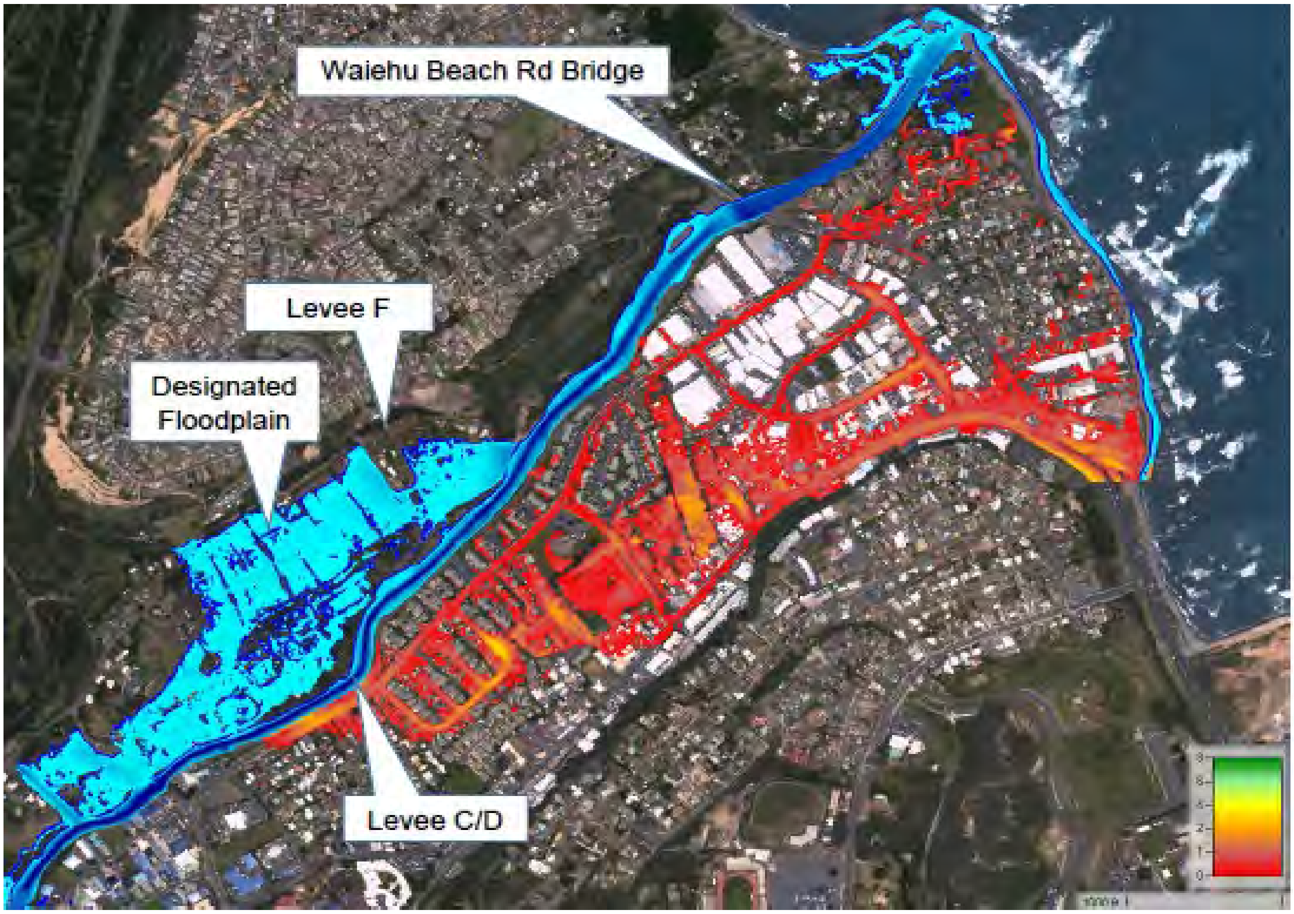

Figure 2-1. Existing (Blue) and FWOP (Red) Inundation Map for 2% AEP (50-Year) Flood

Figure 2-2 displays the inundation mapping for the 0.2% AEP existing condition (blue) and FWOP condition (red/orange). Again, the designated flood plain (left bank) is utilized in both conditions.

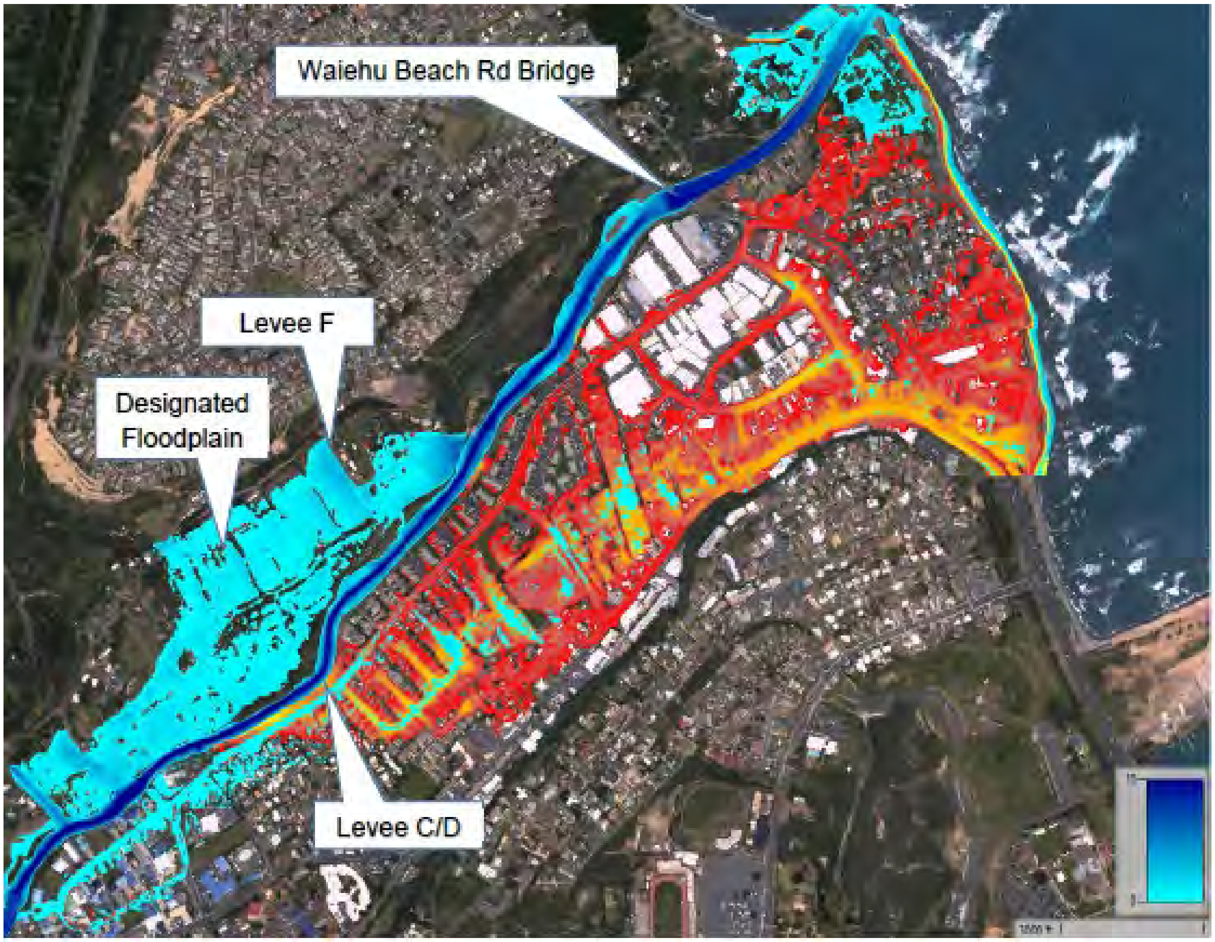

Figure 2-2. Existing (Blue) and FWOP (Red) Inundation Map for 0.2% AEP (500-Year) Flood

Because inundation is similar between the 2% to the 0.2% AEP event, a review of water depths at structures was completed for the 1% AEP event to determine the extent of flooding impacts likely under the FWOPC.

Water depths were determined by comparing water surface elevations based on depth grids and finished floor elevations. Finished floor elevations were determined by using ground elevations pulled from terrain files using ArcMap and Google earth to establish finished floor height. When finished floor heights could not be determined from Google Earth, a 6” FFE was assumed. The count of structures impacted by a range of water depths modeled by H&H are displayed in Table 2-5 below. In the 1% AEP event, there are no water depths greater than 2 feet at any structures when first floor elevation is taken into account.

Table 2-5. Structure Inundation Count 1% AEP (100-Year) Event

Water Depth	# of Structures Impacted in 1% AEP Event	
	With FFE	Without FFE
> 0	92	171
> 0.5'	38	96
> 1'	10	47
> 2	0	0

Though not extensive, damage to homes and commercial buildings can occur from inundation as shallow as 6 inches. Based on the information presented above, it is assumed that a future with-project condition (FWPC) where levee failure occurred at a less frequent event (or not at all) would result in some degree of NED benefits in the form of flood damages prevented. These NED benefits were not quantified, because it was determined that benefits would be relatively negligible and would not be adequate to justify an alternative that would significantly impact water surface elevations.

3 Maintenance and Repair Costs

As referenced in section 1.1, one of the economic concerns stemming from the design deficiency is the amount of OMRR&R that has been required to maintain this project. The purpose of this section is to demonstrate that, due to the design deficiency, the amount of OMRR&R the sponsor is regularly paying far exceeds levels anticipated in the original Operations and Maintenance (O&M) agreements and manuals. Table 3-1 lays out original O&M estimates as well as current OMRR&R estimates (annualized using 2.5% interest rate). The amount of O&M costs the non-Federal sponsor (County of Maui) has expended in recent years has fluctuated. As such, average and estimated O&M values are used in this section and may not match numbers in Section 4.

Based on a preliminary analysis, outlays for the purposes of OMRR&R exceed anticipated levels by approximately 215%-1100% (adjusted for inflation). The anticipated amounts of O&M differ depending on whether the 1967 Feasibility Report (FR) or the 1975 General Design Memorandum (GDM) are referenced. For information purposes, both the FR and the GDM costs are displayed in the table below. Also displayed are those anticipated O&M costs indexed to October 2021 dollars.

The average amount spent on O&M by the county between 2016 and 2018 was $390,000. It is anticipated that the annual O&M going forward in the FWOPC will be between $450,000 and $600,000. Hence, the table below uses an annual cost of $390,000 for the lower bound and $500,000 for the upper bound to estimate the extent to which the sponsor’s OMRR&R expenditures exceed original estimates.

Table 3-1. Anticipated Versus Actual OMRR&R

	$390,000 Annual O&M Average	$500,000 Annual O&M Estimate	$500,000 Annual O&M + P.L. 84-99 Repairs
1967 FR	$ 14,500	$ 14,500	$ 14,500
2021 Indexing	$ 123,441	$ 123,441	$ 123,441
Current O&M:	$ 390,000	$ 500,000	$ 1,097,322
Difference:	$ 266,559	$ 376,559	$ 973,882
% Difference:	**216%**	**305%**	**789%**
1975 GDM	$ 21,400	$ 21,400	$ 21,400
2021 Indexing	$ 100,791	$ 100,791	$ 100,791
Current O&M:	$ 390,000	$ 500,000	$ 1,097,322
Difference:	$ 289,209	$ 399,209	$ 996,532
% Difference:	**287%**	**396%**	**989%**

Given the figures above, an economic benefit exists in the form of a potential reduction in OMRR&R for the project. The next section will describe how alternatives were evaluated using two O&M-related considerations: reductions in future OMRR&R; and reductions in future emergency repairs.

4 OMRR&R Savings Benefits

Three alternatives were carried forward to address the design deficiency in the channel, and these alternatives are intended to reduce velocity, shear stress, and erosion in the channel. Alternatives were not formulated to provide flood risk management benefits (e.g., reduction in inundation, damages, etc.). In the absence of substantial flood damage reduction benefits, as described in Section 2.2, potential Operations and Maintenance (O&M) reductions and repair cost savings that may result from a levee repair or improvement were evaluated as a source of benefits associated with a with-project condition. For each alternative, FWPC benefits were estimated by the project delivery team (PDT) using existing and historic OMRR&R cost expenditures.

4.1 Alternative Plans

The alternatives that were carried forward are a) Removal of Revetment X (Alternative 2), b) Installation of a Pre-formed Scour Hole (Alternative 6), and c) a combination of Alternatives 2 and 6. These alternatives are described below and summarized in Table 4-1. The project first cost estimates were provided by cost engineering. The benefit values were determined by the PDT using existing and historic OMRR&R expenditure data. A recent (2016) flood event resulted in a Project Information Report (PIR) and emergency repairs under P.L. 84-99 in 2017. These recent repair costs as well as empirical O&M costs from the County of Maui were used to estimate the values in the Benefits Summary column below (i.e., probable OMRR&R savings under a FWPC). Additional information on how these values were developed is provided in sections 4.1.1 and 4.1.2

Table 4-1. Alternative Plan Overview

Alternative	Description	Project First Cost	Benefits Summary
Remove Revetment X (Alternative 2)	• Essentially widens the channel, allowing flows to dissipate across a wider area and reduce velocity • Eliminates need for future maintenance and repair of the revetment	$3,150,000	• Assumes $100,000 in future repair savings every 10 years; $150,000 every 25 years; and $230,000 every 50 years • Reduces routine OMRR&R by $150,000 every other year
Install Pre-Formed Scour Hole (Alternative 6)	• Creates a designed scour hole to reduce the risk (and associated repair cost) of the existing channel invert from being undermined by future erosion.	$2,986,000	• Assumes $250,000 in repair savings every 10 years; $750,000 every 25 years; and $1.5M every 50 years • Reduces routine OMRR&R by $55,000/year
Combination (Alternative 2 + Alternative 6)	• Combination of the two above alternatives	$5,429,000	• Annualized benefits of each plan were added together

4.1.1 Removal of Revetment X

The first alternative carried forward is the removal of Revetment X. Anticipated future with- and without-project O&M and major rehabilitation is described in this section.

<u>Future Without Project (FWOP) Cost – Routine O&M: $150,000 every 2 years</u>

Routine maintenance that would continue without the implemented alternative would involve periodic removal of undermined revetment and application of shotcrete to the exposed bank. The County of Maui previously estimated this effort to be $60,000 when maintenance was performed annually and when the channel was typically dry. With the return of continuous streamflow, the County is likely to perform this work less often (once every two to three years instead of annually). However, the scope of work may be larger due to extended period of flow eroding the exposed banks and the new requirements to apply for permitting and divert flow away from the area where work is being performed.

Future Without Project (FWOP) Cost – Major Rehabilitation: $100,000 every 10 years; $150,000 every 25 years; $230,000 every 50 years

As part of the 2017 PL84-99 Rehabilitation, Revetment X was repaired from damages incurred by a 2.5% (40-year) flood event. $566,530 was budgeted for the repair of both the left and right banks, which does not include other costs covered by the larger contract such as mobilization, site preparation, etc. Assuming one third of this cost was for the left bank only, with a 10% increase for mobilization and site prep, and another 10% increase for a larger flood event (2.5% AEP vs 2% AEP), the total estimated cost of repair for the left bank from a 2% AEP (50-year) flood would be about $230,000. For damages incurred by the 10% AEP (10-year) and 4% AEP (25-year), estimated rehabilitation costs would be $100,000 and $150,000, respectively.

Future With Project (FWP) Cost – Routine O&M: **$0**

No routine maintenance is anticipated following the removal of the left bank revetment. The sponsor should let natural riverine processes take the lead on making necessary adjustments within the river, assuming remaining project features are not threatened.

Future With-Project (FWP) Cost – Major Rehabilitation: **$0**

No major rehabilitation is anticipated in the future as the proposed alternative involves the removal of revetment.

4.1.2 Pre-formed Scour Hole

The second alternative (currently “Alternative 6”) is the construction of a pre-formed (designed) scour hole at the downstream end of the upper concrete channel. Anticipated future with- and without-project O&M and major rehabilitation is described in this section.

Future Without Project (FWOP) Cost – Routine O&M: **$60,0000 annually**

Routine maintenance that would be required without the implemented alternative would be regular placement of loose riprap at the scoured site and periodic application of shotcrete. The stones from the channel banks can be used for this work. Placement of the rocks in a stream that has continuous flow would require permitting. While no specific estimate for this work was provided by the County, the type of work is similar to what is performed at Revetment X.

Future Without Project (FWOP) Cost – Major Rehabilitation: **$250,000 every 10 years; $750,000 every 25 years; $1.5M every 50 years**

Continuous headcutting would eventually lead to failure of the boulder concrete invert, requiring immediate repair. The work and level of effort for smaller frequency events (e.g., 10% AEP) would be similar to the repairs needed at Levee A for the 2017 PL84-99 Rehabilitation, which involved restoring 400 LF of boulder-concrete toe that had eroded. For larger frequency events (e.g., the 2% AEP), a more extensive repair to the boulder concrete invert would likely be required. In 2018, approximately 550 LF of boulder concrete invert was replaced from damages incurred at the Hahaione Stream FCP. The total project cost estimated for rehabilitation of Hahaione Stream FCP was $2.7M, which also included bank stabilization work. Given the similar nature of work, $1.5M was estimated for repair of the boulder-concrete invert at the Iao Stream FCP. For damages incurred by the 10% AEP (10-year) and 4% AEP (25-year), estimated rehabilitation costs would be $250,000 and $750,000, respectively.

<u>Future With-Project (FWP) Cost – Routine O&M</u>: **$5,000 every year**

Routine maintenance of the implemented alternative would be minimal. The work would primarily involve sealing cracks in the concrete and removing vegetation, as needed.

<u>Future With-Project (FWP) Cost – Major Rehabilitation</u>: **$0**

The proposed alternative was designed with a 50-year project life. No major rehabilitation is anticipated in that time period.

4.1.3 Average Annual Benefits Calculations

Expected annual savings were calculated for each alternative based on savings that would occur in any given year if repairs from all exceedance probabilities and magnitudes were spread out equally over time. Table 4-2 and Table 4-3 display the expected annual repair savings for each alternative. These repair savings estimates are based on assumptions described in Section 4.1 above and do not include routine OMRR&R. For this analysis, repair savings were capped at the 2% AEP event and assumed to be the same for less frequent events.

Table 4-2. Revetment X Expected Annual Benefits

Recurrence Interval - Year	Probability	Single Event Savings	Recurrence Interval	Damage Interval	Expected Annual Repair Savings
0	0	0			
			0.5	0	$0
2	0.5	$0			
			0.3	0	$0
5	0.2	$0			
			0.1	50,000	$5,000
10	0.1	$100,000			
			0.06	125,000	$7,500
25	0.04	$150,000			
			0.02	190,000	$3,800
50	0.02	$230,000			
			0.01	230,000	$2,300
100	0.01	$230,000			

Recurrence Interval - Year	Probability	Single Event Savings	Recurrence Interval	Damage Interval	Expected Annual Repair Savings
			0.006	230,000	$1,380
250	0.004	$230,000			
			0.002	230,000	$460
500	0.002	$230,000			
			0.002	230,000	$460
0	0	$230,000			
					$20,900

Table 4-3. Pre-Formed Scour Hole Expected Annual Benefits

Recurrence Interval - Year	Probability	Single Event Savings	Recurrence Interval	Damage Interval	Expected Annual Repair Savings
0	0	0			
			0.5	0	$0
2	0.5	$0			
			0.3	0	$0
5	0.2	$0			
			0.1	125,000	$12,500
10	0.1	$250,000			
			0.06	500,000	$30,000
25	0.04	$750,000			
			0.02	1,125,000	$22,500
50	0.02	$1,500,000			
			0.01	1,500,000	$15,000
100	0.01	$1,500,000			
			0.006	1,500,000	$9,000
250	0.004	$1,500,000			
			0.002	1,500,000	$3,000
500	0.002	$1,500,000			
			0.002	1,500,000	$3,000
0	0	$1,500,000			
					$95,000

The annual routine OMRR&R savings were added to the expected annual repair savings to obtain a total expected annual savings. The breakdown of each benefit category and the total average annual benefits by alternative are displayed in Table 4-4.

Table 4-4. Expected Annual Savings by Alternative

Alternative	Expected Annual Repair Savings	Expected Annual Routine OMRR&R Savings	Total Expected Annual Savings
Revetment X Removal (Alt. 2)	$20,900	$75,000	$95,900
Pre-Formed Scour Hole (Alt. 6)	$95,000	$55,000	$150,000
Combination (Alt 2 + Alt 6)	$115,900	$130,000	$245,900

4.2 Cost of Alternative Plans

A project first cost was estimated by cost engineering for each alternative. Average annual costs are displayed in Table 4-5 below. These costs were calculated based on the total project first costs plus interest during construction (based on an assumed 6-month construction duration).

Table 4-5. Cost Summary of Alternative Plans

	Revetment X Removal (Alt. 2)	Pre-Formed Scour Hole (Alt. 6)	Combination (Alt 6 + Alt 12)
Project First Cost	$3,150,000	$2,986,000	$5,429,000
Interest During Construction	$19,526	$18,510	$33,654
Total Investment Cost	$3,169,526	$3,004,510	$5,462,654
Average Annual Cost	$111,751	$105,933	$192,603
Based on FY 2021 price level, discount rate of 2.5%			

4.3 Benefit to Cost Ratios

Average annual equivalent (AAEQ) costs and benefits and the benefit to cost ratio (BCR) for each alternative are displayed in Table 4-6 below. The design deficiency repair will be justified on resolving safety concerns. Therefore, the BCRs of these alternatives are not paramount. However, the table below shows that the BCR is approaching unity for Revetment X (Alternative 2), greater than unity for the pre-formed scour hole (Alternative 6), and greater than unity for the combination of the two alternatives. Although Revetment X is not economically justified as a separable element, it should be noted that there are other benefits of removing Revetment X that are not quantified as average annual benefits. Removal of the left bank of Revetment X allows the stream to be flexible and attempt to reach channel stability through natural riverine processes. Increased stability would lessen channel incision and widening that currently threaten the right bank levees.

Table 4-6. Average Annual Equivalent Cost and Benefits and BCR of Alternative Plans

Alternative	AAEQ Benefits	AAEQ Costs	Net Benefits	BCR
Revetment X Removal (Alt. 2)	$95,900	$111,751	$(15,851)	0.86
Pre-Formed Scour Hole (Alt. 6)	$150,000	$105,933	$44,067	1.42
Combination (Alt 2 + Alt 6)	$245,900	$192,603	$53,297	1.28
Based on FY 2021 price level, discount rate of 2.5%				

4.4 Conclusion

This appendix established that there are economic benefits in addition to the safety benefits of implementing the proposed alternatives to address the project's design deficiency. As stated previously, economic justification of the proposed alternatives are not paramount. The justification to fix the design deficiency for Iao Stream is based on the safety concerns of a levee failure and subsequent sheet flow in a populated area during somewhat-frequent flood events. However, in addition to the safety benefits, economic benefits can be realized in the following areas: 1) flood damage reduction benefits where flooding results from a levee failure, 2) reductions to regular and recurring O&M expenditures from the non-Federal sponsor, and 3) reduction or elimination of emergency repair costs for the non-Federal sponsor as well as the Federal government. These benefits are ancillary to addressing safety concerns, but were described, estimated, and/or quantified in this appendix to show the potential monetary benefits of fixing the project.

Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

Engineering Documentation Report Amendment

Appendix D: Cost Engineering

September 2021

US Army Corps of Engineers®
Honolulu District

WALLA WALLA COST ENGINEERING
MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 102968

POH – Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

The Iao Stream Flood Control Project, as presented by Honolulu District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of August 23, 2021, the Cost MCX certifies the estimated total project cost:

FY21 Project First Cost: $5,515,000
Fully Funded Amount: $5,870,000

Cost Certification assumes Efficient Implementation (Funding). It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through the period of Federal Participation.

2021.08.23
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Michael P. Jacobs, PE, CCE
Chief, Cost Engineering MCX
Walla Walla District

**** TOTAL PROJECT COST SUMMARY ****

PROJECT: Iao Stream Flood Control Project - Alt12: Combination of Alt2, Alt6, and Flood Warning System
PROJECT NO: P2 #102968
LOCATION: Wailuku, Island of Maui, Hawaii

DISTRICT: Honolulu District
POC: CHIEF, COST ENGINEERING, Alex M. Tseng
PREPARED: 7/20/2021

This Estimate reflects the scope and schedule in report; GRR Feb2021

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2021; Effective Price Level Date: 1 OCT 20									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: **1-Oct-20** ($K)	**TOTAL FIRST COST** ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*		*K*	*L*	*M*	*N*	*O*
08	ROADS, RAILROADS & BRIDGES	$372	$130	35.0%	$503	0.0%	$372	$130	$503	$0	$503	6.6%	$397	$139	$536
15	FLOODWAY CONTROL & DIVERSION STRU	$2,406	$842	35.0%	$3,248	0.0%	$2,406	$842	$3,248	$0	$3,248	6.6%	$2,565	$898	$3,463
18	CULTURAL RESOURCE PRESERVATION	$101	$35	35.0%	$136	0.0%	$101	$35	$136	$0	$136	6.6%	$108	$38	$145
19	BUILDINGS, GROUNDS & UTILITIES	$35	$12	35.0%	$47	0.0%	$35	$12	$47	$0	$47	-2.2%	$34	$12	$46
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$2,914	$1,020		$3,934	0.0%	$2,914	$1,020	$3,934	$0	$3,934	6.5%	$3,104	$1,086	$4,190
01	LANDS AND DAMAGES	$6	$2	25.0%	$8	0.0%	$6	$2	$8	$0	$8	0.7%	$6	$2	$8
30	PLANNING, ENGINEERING & DESIGN	$889	$160	18.0%	$1,049	0.0%	$889	$160	$1,049	$0	$1,049	5.5%	$938	$169	$1,107
31	CONSTRUCTION MANAGEMENT	$423	$101	24.0%	$524	0.0%	$423	$101	$524	$0	$524	7.9%	$456	$109	$565
	PROJECT COST TOTALS:	$4,232	$1,283	30.3%	$5,515		$4,232	$1,283	**$5,515**	$0	**$5,515**	6.4%	$4,504	$1,366	$5,870

ESTIMATED TOTAL PROJECT COST: **$5,870**

______________________ **CHIEF, COST ENGINEERING, Alex M. Tseng**

______________________ **PROJECT MANAGER, Nani Shimabuku**

______________________ **CHIEF, REAL ESTATE, Carrie-Ann C**

______________________ **CHIEF, PLANNING, Michael Wong**

______________________ **CHIEF, ENGINEERING, Todd C. Barnes**

______________________ **CHIEF, OPERATIONS, Phat Phung**

______________________ **CHIEF, CONSTRUCTION, Phat Phung**

______________________ **CHIEF, CONTRACTING, ACTING, Jason Moy**

______________________ **CHIEF, PM-PB, Kathleen De Guzman**

______________________ **CHIEF, DPM, Michael Wong**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: Iao Stream Flood Control Project - Alt12: Combination of Alt2, Alt6, and Flood Warning System
LOCATION: Wailuku, Island of Maui, Hawaii
This Estimate reflects the scope and schedule in report; GRR Feb2021

DISTRICT: Honolulu District
POC: CHIEF, COST ENGINEERING, Alex M. Tseng

PREPARED: 7/20/2021

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			1-Feb-21 / 1-Oct-20	Program Year (Budget EC): / Effective Price Level Date:			2021 / 1 OCT 20					
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
08	ROADS, RAILROADS & BRIDGES	$372	$130	35.0%	$503	0.0%	$372	$130	$503	2023Q2	6.6%	$397	$139	$536
15	FLOODWAY CONTROL & DIVERSION STRU	$2,406	$842	35.0%	$3,248	0.0%	$2,406	$842	$3,248	2023Q2	6.6%	$2,565	$898	$3,463
18	CULTURAL RESOURCE PRESERVATION	$101	$35	35.0%	$136	0.0%	$101	$35	$136	2023Q2	6.6%	$108	$38	$145
19	BUILDINGS, GROUNDS & UTILITIES	$35	$12	35.0%	$47	0.0%	$35	$12	$47	2020Q2	-2.2%	$34	$12	$46
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$2,914	$1,020	35.0%	**$3,934**		$2,914	$1,020	$3,934			$3,104	$1,086	$4,190
01	LANDS AND DAMAGES	$6	$2	25.0%	$8	0.0%	$6	$2	$8	2021Q2	0.7%	$6	$2	$8
30	PLANNING, ENGINEERING & DESIGN													
2.5%	Project Management	$73	$13	18.0%	$86	0.0%	$73	$13	$86	2022Q2	5.0%	$76	$14	$90
1.0%	Planning & Environmental Compliance	$29	$5	18.0%	$34	0.0%	$29	$5	$34	2022Q2	5.0%	$31	$6	$36
15.0%	Engineering & Design	$437	$79	18.0%	$516	0.0%	$437	$79	$516	2022Q2	5.0%	$459	$83	$541
1.0%	Reviews, ATRs, IEPRs, VE	$29	$5	18.0%	$34	0.0%	$29	$5	$34	2022Q2	5.0%	$31	$6	$36
1.0%	Life Cycle Updates (cost, schedule, risks)	$29	$5	18.0%	$34	0.0%	$29	$5	$34	2022Q2	5.0%	$31	$6	$36
1.0%	Contracting & Reprographics	$29	$5	18.0%	$34	0.0%	$29	$5	$34	2022Q2	5.0%	$31	$6	$36
3.0%	Engineering During Construction	$87	$16	18.0%	$103	0.0%	$87	$16	$103	2023Q1	7.9%	$94	$17	$111
2.0%	Planning During Construction	$58	$10	18.0%	$69	0.0%	$58	$10	$69	2023Q1	7.9%	$63	$11	$74
3.0%	Adaptive Management & Monitoring	$87	$16	18.0%	$103	0.0%	$87	$16	$103	2022Q3	5.9%	$93	$17	$109
1.0%	Project Operations	$29	$5	18.0%	$34	0.0%	$29	$5	$34	2022Q2	5.0%	$31	$6	$36
31	CONSTRUCTION MANAGEMENT													
10.0%	Construction Management	$291	$70	24.0%	$361	0.0%	$291	$70	$361	2023Q1	7.9%	$314	$75	$390
2.0%	Project Operation:	$58	$14	24.0%	$72	0.0%	$58	$14	$72	2023Q1	7.9%	$63	$15	$78
2.5%	Project Management	$73	$17	24.0%	$90	0.0%	$73	$17	$90	2023Q1	7.9%	$79	$19	$97
	CONTRACT COST TOTALS:	$4,232	$1,283		$5,515		$4,232	$1,283	**$5,515**			$4,504	$1,366	**$5,870**

COST APPENDIX FOR IAO STREAM FLOOD RISK MANAGEMENT PROJECT, ENGINEERING DOCUMENTATION REPORT, ISLAND OF MAUI (Rev 20 July 2021)

1. Project Description:

a. The Iao Stream Flood Control Project (FCP), Kahului, Maui, Hawaii was completed in October 1981 by the U.S. Army Corps of Engineers (Corps). Since its completion in 1981, numerous storm events of high velocity flows within the steeply sloped channel have severely eroded key portions of its levees and channel invert, particularly the right bank levee toe. Repairs to the levees have proven costly and ineffective.

   The Corps is authorized to implement flood damage reduction improvements to Wailuku River (formerly named Iao Stream) that meet or exceed the Standard Project Flood (SPF) requirements to protect the existing Wailuku community on the Island of Maui in Hawaii. The Corps is authorized to implement flood damage reduction improvements to Wailuku River that meet or exceed the Standard Project Flood (SPF) requirements to protect the existing Wailuku community on the Island of Maui in Hawaii. The selected alternative presented in this General Reevaluation Report (GRR) will prevent further streambed erosion, loss of life, and property damage during flood events.

b. The Non-Federal Sponsor is the County of Maui, Department of Public Works.

c. On September 2019 an IPR was completed (Version 1.0) by cost engineering to update the 2016 EDR report costs with the previous preferred alternative consisting of an excavated and grassed overflow on the left bank (existing floodplain), concrete overflow weir structure, baffle blocks, boulder concrete and concrete pad within the channel, shotcrete on the banks near the weir structure, repair of the right bank with shotcrete, raised berm/ bank stabilization on the left bank, access road, removal of existing concrete lining on the left and right bank, new retaining wall on the right bank, grouted riprap transition to return the overflow water to the stream, and bank stabilization on the right bank. Updates to the previous 2016 EDR included a Stilling Basin, deletion of the right bank overflow channel near station 77+00, deletion of existing concrete lining right bank near station 50+55, deletion of concrete retaining wall right bank near station 51+00, diversion of water modifications, and updates to the project schedule. The October 2019 IPR construction cost was $12.8M with a TPCS of $31.4M. The cost update also received a tentative approval from Walla Walla.

d. Then in October of 2019 the alternatives were evaluated separately per PDT (Version 2.0). The alternatives were narrowed down to 3 items: Stilling Basin Scour Pit ($2.9M construction/ $9.5M TPCS); RB Levee E ($1.5M construction/ $6.9M TPCS); LB Revetment X ($1.6M construction/ $7M TPCS).

e. Then in December of 2019 the PDT requested to revisit the cost of a previously ruled out alternative, 7,200LF trapezoidal concrete channel. Costs were obtained from a previous report and escalated based on labor and equipment cost changes over time (Version 3.0). This alternative cost was $25M for construction with an approximate

$55M TPCS. Alongside this alternative another alternative required excavation work along LB upstream Imi Kala Bridge at a TPCS of $13.2M to provide for a wider channel conveyance area and the deletion of Imi Kala Bridge. However the bridge could not be deleted without an exorbitant (likely a sewer pump station requiring County maintenance) cost from an existing gravity sewer line servicing an entire community along the right bank side.

f. Next in January 2020 the PDT came up with a sacrificial berm alternative at a construction cost of $4.5M and a TPCS of $16M rough order of magnitude (Version 4.0).

g. Finally in February 2021 the PDT came up with four alternatives (Version 5.0). The TPCS costs for these four alternatives did not include previous PED costs of $3.687M from other past versions per discussion with PM. Alt2 is LB Revetment X demolition, which is like the October 2019 under version 2 for an ECC of $1.7M and a TPCS cost of $3.338M. Alt 6 is a Pre-Formed Scour Hole, which is like the Stilling Basin Scour Pit in October 2019 under version 2 with some modifications per H&H for an ECC of $1.6M and a TPCS cost of $3.18M. Alt9 is Overflow Basin Open Channel Weir Baffle Structure which consisted of concrete open channel and concrete storage basin with various concrete flood water retaining walls for an ECC of $30M and a TPCS cost of $68.3M. Alt12 is a combination of Alt2 and Alt6 for an ECC of $2.9M and a TPCS cost of $5.8M.

h. The PDT in May 2021 decided to include nonstructural measures involving a flood warning system for Iao. Based on emails from PM and previous coordination with the USGS on other projects, an approximate cost from the USGS to install a stream gage flood warning system is about $35k initial cost with $16k annual maintenance costs. This initial first cost of the flood warning system was included in the MII estimate and associated TPCS assumed to be completed by the USGS. The flood warning system cost was added to Alt12 per PM. Alt 12 ECC is still about $2.9M and TPCS is about $5.9M with the added stream gage flood warning system.

2. **Basis of Estimate**:

This estimate is based on the EDR Report, May 2015, Effective Price Level is 4 Aug 16 (FY16, 1 Oct 15) price leveled to Oct 2020.

3. **Estimated Design and Construction Schedule**:

The construction schedule various for the various alternative and projects listed. Each alternative and schedule was evaluated and used as part of the TPCS.

a. Typical construction crew consisting of several laborers, two equipment operators, an excavator, and a loader (1 shift) working 8 hr/day and X 5 day weeks.

b. An overall Production Efficiency Rate of 90% which is based on anticipated project difficulty, method of construction, labor availability, supervision, job conditions, weather and expected delays.

c. CONSTRUCTION WINDOWS /OVERTIME: This estimate contains no provisions for overtime to complete the project.

4. Quantities

The updated EDR alternative is considered at a Class 3 Estimate Level. Quantities for this level of design were calculated from 10- 60% quality of project definition. Quantity calculations were aided by the use of Microstation, Google Earth, and Excel software. Major cost items were obtained from quotes from suppliers. Other alternatives beyond Version 1.0 were Class 3 to Class 5 ROM type estimates based on limited design information.

5. Acquisition Plan

a. The estimate is based on a single contract being awarded to the Prime Contractor with multiple sub-contractors. The acquisition strategy is assumed as Full and Open Invitation for Bid. The prime contractor will be responsible for oversight of the contract the rest of the work is assumed performed by subcontractors.

b. Sub-Contracting: the subcontractors are broken out as (as required for various alternatives/ Versions):

1) Sitework
2) Concrete/Masonry
3) Hauling
4) Testing
5) Survey
6) Archeologist
7) Shotcrete
8) Reinforcing
9) Landscape

6. Project Construction

a. Mobilization, Demobilization & Preparatory Work Assumptions for the TSP Estimate:

- The Prime Contractor and sub-contractors are assumed from the Island of Maui.

This does not exclude contractors from other locations during the solicitation process.

- Equipment for Mobilization at Standby Cost with hauling of the equipment by subcontractor.

- Hauling by local subcontractor on island to transport the equipment with the site work labor assisting with loading/unloading the equipment.

- Some of the sitework contractor’s equipment is mobilized by regularly scheduled inter- island barge from Honolulu to Kahului and trucked to the jobsite.

- Contractor will supply temporary facilities. The cost includes shared office trailer for the Prime Contractor and Government. The electricity will be supplemented by diesel generator. Temporary utilities.

b. Surveys: Assume site pre-construction survey and layout, survey during construction and installation of three benchmarks (as required by similar projects).

c. Disposal of debris and excavated materials will be to the Maui Demolition and Construction Landfill located in Maalaea, Island of Maui, approximately 6 miles or 0.5 hr r/t.

d. Best Management Practices (BMP) include use of silt fences, Concrete structure is assumed constructed in halves by temporarily diverting the stream to one side of the channel. While one side is constructed, the other side can be used for stream flow.

e. <u>Features & discussion:</u>

   1) <u>SITE ACCESS</u>: Access is to the site is from Imi Kala Street or Piihana Road. Two staging areas are assumed. One on the right bank (near Eha Street and Imi Kala) and one on the left bank of the channel near the Imi Kala Bridge.

   2) <u>BORROW AREAS:</u>

   There are no borrow areas. Imported topsoil is assumed from a commercial source. Excavated materials is assumed to be screened for rocks/boulders and soil, tested, and re-used in the project area as much as practicable. Excess material will be tested prior to disposal to the on-island landfill.

3) CONSTRUCTION METHODOLOGY:

Construction methodology is industry standard. Special equipment is not required for this project.

4) UNUSUAL CONDITIONS (Soil, Water, Weather):

It is assumed there are no unusual conditions. The construction schedule cost includes provision for anticipated weather delays.

5) UNIQUE TECHNIQUES OF CONSTRUCTION:

None

6) EQUIPMENT AND LABOR AVAILABILITY & DISTANCE TRAVELED:

The estimate assumes equipment and labor is readily available on the Island of Maui and in the State of Hawaii. The project site is located in Wailuku, Island of Maui, approximately 5 miles away from Kahului Airport.

7) ENVIRONMENTAL CONCERNS:

The estimate includes cost for water quality monitoring and reporting.

8) CULTURAL CONCERNS:

There is possibility of cultural deposits or burials found during ground disturbance during construction. Further investigations will be performed in the PED phase. The TSP estimate includes archeological monitoring which includes the estimated cost for data monitoring, and preservation.

7. Contingencies by Feature or Sub-Feature

Abbreviated Cost Risk Analysis (ACRA) was prepared for selected plan. The ACRA for the viable alternative(s) was not prepared since the results of the design analysis concluded that only one alternative was feasible. This alternative was further refined for the TSP estimate. The purpose of ACRA is to determine the contingency for each account. The results are included in this appendix. The PDT developed the risk register and ratings for each feature of costs. Various disciplines (Engineering, Construction, Designer and Project Manager) provided input into the risk register and a consensus among the participants determined the risk rating in order to refine the contingencies for the TSP.

Civil Works Break Down Structure	Contingency for the Selected Alternative
01 Lands and Damages	25.0%
08 Roads (Access/Maint Road)	35.0%
15 Floodway Control & Diversion Structures	35.0%
18 Cultural Resource Preservation	35.0%
19 Buildings, Grounds & Utilities	35.0%
30 Planning, Engrg & Design	18%
31 Construction Management	24.0%

High contingencies were due concern over the diversion of in-stream water, especially during flash flood situations. The estimate assumed using native material to create a berm to temporarily divert part of the stream for construction within the stream area. Water was restored in the stream in 2014. Therefore, the stream is not normally dry when the estimate was initially prepared. Another contingency of concern was potential for fuel price fluctuations under a Biden administration versus a Trump administration. This project relies heavily on equipment machinery for earthwork. Other risks to the project are an undefined Acquisition Strategy. This will be further determined as the designs are finalized and a Market Survey or Research is performed by Contracting. Construction contract markups could increase if the project is solicited as Small Business. These contingencies were based on the EDR report updated alternative Version 1.0 and revised and/or applied to other ROM type alternatives Version 2.0 to 5.0.

8. Cost Estimate

a. EFFECTIVE DATES FOR LABOR, EQUIPMENT, MATERIAL PRICING

1) The construction cost estimate was developed using MCASES 2nd Generation estimating software in accordance with ER 1110-2-1302, Civil Works Cost Engineering; UFC 3-740-05, Handbook: Construction Cost Estimating. The construction cost estimate was prepared using MII Version 4.4.1, 2016 English Cost Book, and Equipment Library (Region 10), 2016.

2) The labor rates used is from Davis Bacon Wage Rates for the General Decision Number Bulletin 497 dated February 2020 for the State of Hawaii for Building, Heavy (Heavy and Dredging), Highway and Residential Construction Types for all counties in Hawaii Statewide.

3) The base estimate has been updated with the following fuel prices: $3.44 /gal for off-road diesel, $4.15 /gal for on-road diesel and $3.56 /gal for gasoline for Kahului, Island of Maui, State of Hawaii. The estimated has been updated with

current quoted material prices, production rates and specialty equipment costs.

b. Labor and Equipment Productivity: No overtime hours are anticipated. The estimate includes an overall Production Index of 90% which is based on anticipated project difficulty, method of construction, labor availability, supervision, job conditions, weather and expected delays.

c. Project Markups

Escalation: Escalation has been calculated within the Total Project Cost Summary Sheet. Price levels have been escalated from the effective price levels of the construction cost estimate of 1 Oct 2020 to the midpoint of construction. The appropriate escalation cost factors were obtained from EM 1110-2-1304 Civil works Construction Cost Index System.

d. Functional Costs: Functional costs associated with this work:

1) 01 - Lands and Damages: This account covers costs of Lands and Damages for Construction. The Real Estate Cost was obtained from the Real Estate Planning Report (REPR) updated in 2019 and updated in 2021.

2) 08 – Roads: This account covers the construction hauling /O&M maintenance road.

3) 15- Floodway & Control: This covers the cost for channel improvements such as demolition of existing LB existing boulder concrete lining and construction of a pre-formed scour hole boulder apron concrete lining.

4) 18 – Cultural Preservation: This covers the cost of identification of cultural artifacts of inadvertent finds during construction, data analysis & reporting. This cost was provided using historical costs from our in-house Archeologist.

5) 19 – Buildings, Grounds & Utilities: This was the added stream gage flood warning system in May 2021 per the PDT to be completed by the USGS.

6) 30 – Planning, Engineering and Design (PED): This account covers Planning and Environmental Costs, Engineering & Design, Technical Reviews, Internal Technical Review, Value Engineering, Contracting and Reprographic. It is assumed the design, geotechnical, and topographic survey will be conducted by AE. This cost was obtained from the Project Manager.

7) 31 - Construction Management (CM): This account covers the cost of government construction management during the construction. This includes project oversight (Construction and Project Management). The cost for this account used a historical amount of construction due to the project site located on another island (Maui). Travel to the site for construction management requires flying from Honolulu to Kahului, Maui with the frequency

determined by the Government Field Office.

e. Total Project Cost Summary

The Total Project Cost Summary Sheet (TPCS) includes the construction costs from the MCASES estimate, project markups, as well as costs for Lands and Damages, Planning, Engineering & Design, and Construction Management. The costs were summarized in an earlier paragraph for the various versions.

---- End of Project Notes ----

Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

Engineering Documentation Report Amendment

Appendix E: Real Estate Plan

September 2021

US Army Corps of Engineers
Honolulu District

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Real Estate Plan

Iao Stream Flood Control Project
Modification
Section 203 of the Flood Control Act of 1968
Public Law (PL) 90-483 in accordance with the recommendations of the Chief of Engineers in House Document Number 151, 90th Congress

August 2021

Prepared for:
U.S. Army Corps of Engineers, Honolulu District

Prepared by:

HALLMAN.YVONNE.N.1409805538 Digitally signed by HALLMAN.YVONNE.N.1409805538 Date: 2021.08.27 09:20:44 -07'00'

27 August 2021

Yvonne Hallman
Realty Specialist
USACE South Pacific Border District

Date

Reviewed by:

LABESTE.ERICA.A.1286957435 Digitally signed by LABESTE.ERICA.A.1286957435 Date: 2021.08.27 10:20:34 -10'00'

27 August 2021

Erica Labeste
Chief, Real Estate Branch
USACE Honolulu District

Date

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FIGURES

ATTACHMENTS

1. EXECUTIVE SUMMARY

The Iao Stream Flood Control Project (Project) is located in Wailuku, Island of Maui, State of Hawaii, and was authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483). The Iao Stream FCP completed in October 1981 by the U.S. Army Corps of Engineers (Corps) and consists of a debris basin located 2.5 miles upstream of the stream mouth, a 3,500-foot lined channel downstream from the debris basin, and levees along the left and right banks of the stream.

Since its completion in 1981, numerous storm events of high-velocity flow within the steeply sloped channel have severely eroded key portions of its levees and channel invert, particularly the right bank levee toe, which is experiencing significant undercutting. Scour depths have extended to a maximum of 6-10 feet below the existing boulder concrete slope lining and repairs to the levees have proven costly and ineffective. A Design Deficiency Report was completed in March 1995 and approved by the Acting Assistant Secretary of the Army for Civil Works (ASA(CW)) in November 1995. The original solution to address the design deficiency was to line the channel in order to preserve the integrity of the flood control project. However, that solution was not implemented, and a number of additional alternatives have been formulated and evaluated since 1995.

The Recommended Plan includes the following features: removal of Revetment X, installation of a pre-formed scour hole, and installation of a stream gauge on the river, a temporary access road, and a staging area. The total Project cost of the recommended plan is $5.5 million at the FY21 price level and 2.5% discount rate. The recommended plan is justified based on both safety and economic considerations, with substantial improvements to community safety and long-term reductions in Operation, Maintenance, Repair, Rehabilitation, and Replacement requirements for the non-federal sponsor.

No compensatory mitigation is proposed for the Recommended Plan as no loss of wetlands or other special aquatic sites, no significant adverse effects to protected species, and no significant impacts to commercially important species or protected marine mammals are anticipated to occur based on the analyses presented in the Environmental Assessment attached to this document.

The Real Estate Plan (REP) is generally prepared as an appendix to the Feasibility Report to support the acquisition requirements of the recommended plan. The REP presents the real estate requirements, proposes the acquisition strategy, develops a cost estimate for real estate acquisition, and incorporates an internal technical review.

The NFS for the proposed amended Project is the County of Maui, Department of Public Works. The County of Maui owns the site of the original flood control project and some areas for current project features. The NFS is responsible for all lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRDs) required for the Project.

Anticipated acquisitions for the proposed amendment to the Project include a one-year temporary roadway easements consisting of approximately 0.85 acres. These 0.85 acres lie in four parcels involving three private owners. The County of Maui maintains ownership over remaining portions of the Project LERRDs, including the removal site of Revetment X (0.35 acres), scour hole (0.20 acres), portions of the construction roadway (0.05 acres), and staging area (0.19 acres).

The estimated real estate cost associated with the Recommended Plan is approximately $7,800, which includes an estimate of $600 for NFS-owned LERRDs which was not credited in the original project and $7,200 for LERRDs that the NFS is responsible to acquire. The real estate cost estimate comprises all recommended estates, incremental real estate costs, and administrative costs to be carried out by the NFS and Government. The NFS is considered moderately capable at present to acquire and provide the LERRDs necessary for the proposed Project. Any interest in land provided as an item of local cooperation for a previous Federal project is not eligible for credit.

2. AUTHORITY AND PURPOSE

The Iao Stream Flood Control Project (Project) was authorized for construction by the U.S. Army Corps of Engineers on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 in accordance with the recommendations of the Chief of Engineers in House Document Number 151, 90th Congress. The original project, which consisted of enlarging, straightening, and stabilizing the channel and constructing levees, walls, and a debris basin, was completed in October 1981. Details about the authorized project are included in Section 1.3.

The purpose of the Iao Stream Flood Control Project Amendment is to address and correct the existing design deficiency along the Wailuku River in the town of Wailuku, Island of Maui, Hawaii.

An Environmental Assessment (EA) for the Project was completed in July 2017. Pursuant to the National Environmental Policy Act (NEPA) and the Hawaii Environmental Policy Act (HEPA), the EA determined that the proposed action of modification of the Project would not result in significant adverse impacts on the environment. A Finding of No Significant Impact (FONSI) for the Project was issued in July 2017.

In June 2021, the USACE Engineering Documentation Report was completed to describe engineering design work, which includes removal of Revetment X, installation of a pre-formed scour hole, and installation of a stream gauge on the river. The total Project cost of the recommended plan is $5.5 million at the FY21 price level and 2.5% discount rate. The recommended plan is justified based on both safety and economic considerations, with substantial improvements to community safety and long-term reductions in Operation, Maintenance, Repair, Rehabilitation and Replacement requirements for the non-federal sponsor.

Generally, the Real Estate Plan (REP) is prepared by the USACE Honolulu District (District) as an appendix to the Feasibility Report. The REP presents the real estate requirements, proposes the acquisition strategy, develops a cost estimate for real estate acquisition, and incorporates an internal technical review. USACE Mapping determines private tract ownerships and acreages to prepare exhibits to the REP. USACE Appraisal prepares (or contracts for) and approves a cost estimate or gross appraisal, as needed for acquisitions. USACE Environmental provides applicable compliance memoranda and/or documentation in accordance with NEPA. HEPA, National Historic Preservation Act (NHPA), and USACE Hazardous, Toxic, and Radioactive Waste (HTRW) policy.

Project real estate requirements include a review of NFS-owned parcels as well as recommended roadway easements to be carried out by the NFS. LERRDs recommendations are requirements that the Government has determined the NFS must meet for the construction, operation, and maintenance of the Project. If LERRDs are required, USACE Real Estate coordinates with the NFS and provides the NFS with a partner packet outlining the sponsor's responsibilities and notice informing the NFS of the risks of early acquisition.

The information contained herein is tentative for planning purposes only. Final real property acquisition acreages, limitations, and cost estimates are subject to change even after approval of a final Feasibility Report.

3. PROJECT DESCRIPTION AND LOCATION

The Iao Stream FCP is located along the Wailuku River (formerly named Iao Stream) in the town of Wailuku on the northeast coast of the Island of Maui, State of Hawaii (Figure 1: Maui Map, Figure 2: Aerial Location Map, Figure 3: Iao Stream Project Feature Map). The Wailuku River is located within a drainage basin on the eastern slopes of the West Maui Mountains, near the north end of the isthmus connecting East and West Maui. The river is approximately 8 miles long and drains the steep Iao Valley, meandering eastward to the Pacific Ocean through the town of Wailuku. The Project is located in the lower reach of the Wailuku River, extending approximately 2.5 miles upstream of the river mouth. The area of concern is primarily within a 1.1-mile reach upstream of the Waiehu Beach Road.

The Wailuku River can be described as four distinct reach segments:

1. The natural reach upstream of the federally constructed FCP;
2. The concrete-lined channel in the upper part of the FCP;
3. The middle section of the FCP has a natural riverbed and some revetment along the right bank; and
4. The concrete-lined channel in the lower part of the FCP.

The existing flood control project was designed to provide protection against the Standard Project Flood (SPF) which, under project conditions, would have a discharge of 26,000 cubic feet per second (cfs) at the upper limits of the project at the debris basin and 26,500 cfs at the mouth of Wailuku River. The floodplain between the channel improvements incorporates the 1,500 cfs discharge from the Happy Valley Flood Prevention Project for a total discharge of 27,500 cfs (USACE, 1976).

The completed flood control project consists of a debris basin located 2.5 miles upstream from the stream mouth, channel improvements extending 3,500 feet (ft) downstream from the debris basin, levees along the right bank, levees, and floodplain management along the left bank for 6,950 ft of natural stream; and stream realignment with channel improvements for a reach of 1,730 ft that extends to the downstream limit of the Project located near the shoreline.

Project levees “A,” “B,” “C,” “D,” and “E” are intermittently situated upon the right bank of the stream; levees “F” and “G” are located on the left bank. On the left bank, downstream of the concrete channel, is an area zoned for floodplain management. It is primarily used for agricultural purposes. The natural stream bed consists of boulders and scrub brush. The bed ranges in width from 40 to 60 ft and has an average slope of 2.6 percent.

Recommended Plan

According to the Engineering Documentation Report, the selected amended Project includes the following features:

1. Removal of Revetment X
2. Pre-Formed Scour Hole and Stream Gauge
3. Access Road
4. Staging Area

Structures in the Area

There are no structures in the area.

Staging Areas

The County of Maui owns the land needed for staging.

Borrow Sites

No borrow sites are required.

Site Access

It will be necessary to acquire a temporary roadway easement for access to construct the Project.

Ownership by Project Feature
The following table summarizes the area, owner, and real estate interests by Project feature.

Feature	Tax Map Key (TMK)	Approximate Area (Acres)	Owner	Zoning/ Property Class	Minimum Interest Required	Interest To Acquire
1. Remove Revetment X	3-4-030:888	0.35	Public	AG-1 (Agricultural)	Temporary Work Area Easement	None
2. Pre-Formed Scour Hole	3-4-030:888	0.20	Public	AG-1 (Agricultural)	Flood Protection Levee Easement (perpetual)	None
3. Access Road	3-4-031:001	0.45	Private	AG-1 (Agricultural)	Temporary Roadway Easement	Roadway Easement (1 yr)
	3-4-032:002	0.02	Private	AG-1 (Agricultural)		Roadway Easement (1 yr)
	3-4-032:001	0.29	Private	AG-1 (Agricultural)		Roadway Easement (1 yr)
	3-4-032:062	0.09	Private	Residential		Roadway Easement (1 yr)
	3-4-030-:888	0.05	Public	AG-1 (Agricultural)		None
4. Staging Area	3-4-030-:888	0.19	Public	AG-1 (Agricultural)	Temporary Work Area Easement	None

See also Figures 3 to 7: Iao Stream Project Feature Map and Detail Maps.

4. SPONSOR'S REAL ESTATE INTERESTS

The NFS for the proposed Project is the County of Maui. The District will coordinate with the County of Maui DPW. Based on a review of maps from the County of Maui Tax Assessor's Office, the County of Maui owned TMK 3-4-030:888. Therefore, no acquisitions are anticipated for the following Project features:

1. Remove Revetment X: minimum interest is a temporary work area easement (0.35 acres);
2. Pre-Formed Scour Hole: minimum interest is a perpetual flood protection levee easement (0.20 acres);
3. Portions of the access road: minimum interest is a temporary roadway easement (0.05 acres);
4. Staging Area: minimum interest is a temporary work area easement (0.19 acres).

5. ESTATES TO ACQUIRE

The NFS will provide all LERRDs required for the construction, operation, and maintenance of the Project. The NFS is instructed to acquire the minimum real estate interest necessary for the Project. LERRDs to be acquired for the Project are one-year roadway easements totaling 0.85 acres. The roadway easements are required in TMKs 3-4-031:001, 3-4-032:002, 3-4-032:001, 3-4-032:062, which are owned by three private landowners.

<u>Roadway Easement Standard Estate</u>
A (perpetual [exclusive] [non-exclusive]and assignable) (temporary) easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____, _____ and _____) for the location, construction, operation, maintenance, alteration replacement of (a) road(s) and appurtenances thereto; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving, however, to the owners, their heirs and assigns, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in Schedule B); subject, however, to existing easements for public roads and highways, public utilities, railroads and
pipelines.

6. FEDERAL PROJECTS/OWNERSHIP

This Project is an amendment to the Iao Stream Flood Control Project to correct deficiencies; therefore, the County of Maui owns the property required for the original project. Additionally, there are no Federally owned lands within the LERRDs required for the Project. Any interest in land provided as an item of local cooperation for a previous Federal project is not eligible for credit.

7. NAVIGATION SERVITUDE

Iao Stream is not considered navigable, and therefore, Navigation Servitude doctrine does not apply to the Project.

8. MAPS

Maps are intended as a preliminary tool to illustrate the proposed Project area, LERRDs to be acquired, and lands within the navigation servitude. Detailed maps will be provided prior to the Notice to Acquire (NTA) notification to the NFS. (See Figures 3-7)

9. INDUCED FLOODING

It is not anticipated that the proposed Project would cause any induced flooding.

10. BASELINE COST ESTIMATE FOR REAL ESTATE

The cost estimate for all project LERRDs is estimated at $7,800, which includes an estimate of $600 for NFS-owned LERRDs which was not credited in the original project and $7,200 for LERRDs that the NFS is responsible to acquire.

Item	Size (Acres)	NFS-Owned	To Acquire
Temporary Roadway Easement (1 yr)	0.85		$2,200
Temporary Roadway Easement (1 yr)	0.05	$10	
Temporary Work Area Easement (1 yr)	0.54	$80	
Perpetual Flood Protection Levee Easement	0.20	$400	
Improvements	--		$0
Hazard Removals	--		$0
Mineral Rights	--		$0
Damages	--		$0
Facility/Utility Relocations	--		$0
Uniform Relocation Assistance	--		$0
Incremental Real Estate Costs	--	$100	$600
Incidental Acquisition Costs: NFS	--		$2,400
Incidental Acquisition Costs: Government	--		$2,000
Subtotal		**$600**	**$7,200**
TOTAL			**$7,800**

The values for the baseline cost estimate were obtained from a Land Cost Estimate Report prepared by USACE, Northwestern Division, effective July 14, 2021. Incremental real estate costs are estimated at 25% of total real estate acquisition costs for risk-based contingencies. Additionally, incidental acquisition costs are estimated for NFS title work, appraisals, review of appraisals, coordination meetings, review of documents, legal support, and other costs that are incidental to Project LERRDs as well as Government costs for staff monitoring and reviewing and approving LERRDs.

11. PUBLIC LAW 91-646 RELOCATION BENEFITS

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, PL 91-646, as amended, commonly called the Uniform Act, is the primary law for acquisition and relocation activities on Federal or federally assisted projects and programs. The NFS is required to follow the guidance of PL 91-646.

No displacement of towns or persons will occur, and there will be neither habitable nor commercial structures affected as a result of this Project. The Project is not eligible for the provisions of PL 91-646 related to relocation expenses.

12. MINERALS/TIMBER/CROP ACTIVITY

There are no known surface or subsurface minerals that would impact the Project.

Additionally, no known timber or crops will be permanently affected by the Project. Although the borrow area is located in farmland, restoration is planned to include grass or hydroseed to match the surrounding agricultural area.

13. ASSESSMENT OF SPONSOR'S ACQUISITION CAPABILITY

The NFS is considered moderately capable at present to acquire and provide the LERRDs necessary for the Project. The NFS has the financial capability and authority to hold title. However, the NFS will use contract support to perform necessary LERRDs efforts, such as survey, appraisal, title work, negotiation, closing, and eminent domain. The NFS has been advised of P.L. 91-646 requirements for documenting expenses for credit purposes.

An Assessment of the NFS's Real Estate Acquisition Capability will be conducted jointly with the NFS. A Sponsor's Acquisition Capability Assessment is included in Attachment 1.

14. ZONING

All lands required for the Project features are zoned as follows: agricultural (three parcels) and residential (one parcel) and are being used for those purposes. No construction of structures is proposed in the Project area. Therefore, no zoning change in lieu of acquisition is anticipated.

15. ACQUISITION MILESTONES

The following preliminary schedule estimates ten (10) months for NFS LERRDs planning and acquisition. The planned timeline below will be mutually agreed upon by USACE Real Estate, Project Management, and the NFS.

The NFS's preliminary acquisition planning is estimated at four (4) months as follows:

Survey/Map/Title Legal Description	60 Days
Appraisal	60 Days

The NFS's LERRD acquisition is estimated at six (6) months as follows:

Documentation	60 Days
Negotiation	60 Days
Payment	30 Days
LERRD Certification	30 Days

16. PUBLIC FACILITY OR UTILITY RELOCATIONS

No public facility or utility relocations will be required.

17. ENVIRONMENTAL IMPACTS

Potential environmental impacts resulting from the proposed Project were considered, including investigation under NEPA/HEPA, HTRW Policy, National Historic Preservation Act, Clean Water Act, Endangered Species Act, Coastal Zone Management Act, and Clean Air Act.

National Environmental Policy Act (NEPA) and Hawaii Environmental Policy Act (HEPA)
The NEPA (40 CFR 1500 et seq.) requires that environmental consequences and project alternatives be considered before a decision is made to implement a federal project. The NEPA established the requirements for an Environmental Impact Statement for projects potentially having significant environmental impacts and an Environmental Assessment for projects with no significant environmental impacts.

In accordance with NEPA and USACE regulations and policies, the EA determined that the Proposed Action would not result in significant adverse impacts on either the manmade or natural environment. A Finding of No Significant Impact (FONSI) was published in November 2017.

Hazardous, Toxic, and Radioactive Waste Policy
According to the EA, HTRW is not anticipated in the Project area. Based on a review of Envirofacts and Environmental Health Warehouse databases, there are no listed hazardous materials sites or existing hazardous material contamination present in the Project site and vicinity. Envirofacts is a single point of access to select U.S. Environmental Protection Agency data about environmental activities in the United States. Available topics include air, waste, facility, land, toxic releases, compliance, water, and radiation. The DOH, Solid & Hazardous Waste Branch, Underground Storage Tank Section operates the Environmental Health Warehouse database and Map Viewer, which provides the location of underground storage tanks, leaking underground storage tanks, hazardous material generators and transporters, and additional locational information for permitted facilities.

National Historic Preservation Act
Federal agencies are required under Section 106 of the National Historic Preservation Act of 1966 (NHPA, 54 USC Chapter 3001 et seq.), as amended, to “take into account the effects of their undertakings on historic properties” and consider alternatives “to avoid, minimize, or mitigate the undertaking’s adverse effects on historic properties.” In accordance with Section 106 of the NHPA, the USACE has consulted with the Hawaii SHPO, the Office of Hawaiian Affairs, and other appropriate consulting parties.

Implementation of the Proposed Action would have less than significant short-term impacts on historic and cultural resources within the Project area during the construction period. Archaeological and cultural resources have been encountered in ʻĪao Valley during prior investigations, but at this time no such resources are known to exist within the Project area.

Other Environmental Compliance
Additionally, USACE has considered and investigated potential environmental impacts in accordance with the Clean Air Act, Clean Water Act, Coastal Zone Management Act, and Endangered Species Act.

18. LANDOWNER CONCERNS

No landowner concerns are anticipated at this time. The NFS has a preexisting relationship with the surrounding private landowners for the previous Project features.

19. NOTIFICATION TO SPONSOR

The NFS, the County of Maui DPW, are involved in the planning process. The NFS was provided a Local Sponsor Toolkit and advised of the risks of acquiring LERRDs before the execution of the PPA. A Sample Letter Advising Against Early Acquisition is included in Attachment 2.

Additionally, once the LERRDs are finalized, a Notice to Acquire Letter will be transmitted to the NFS. The Notice to Acquire Letter serves as the formal instruction for the NFS to acquire the real estate interests needed for the Project. A Sample Notice to Acquire Letter is included in Attachment 3.

20. OTHER RELEVANT REAL ESTATE ISSUES

There are no other known relevant real estate issues in the proposed Project area.

Figure 1: Maui Map

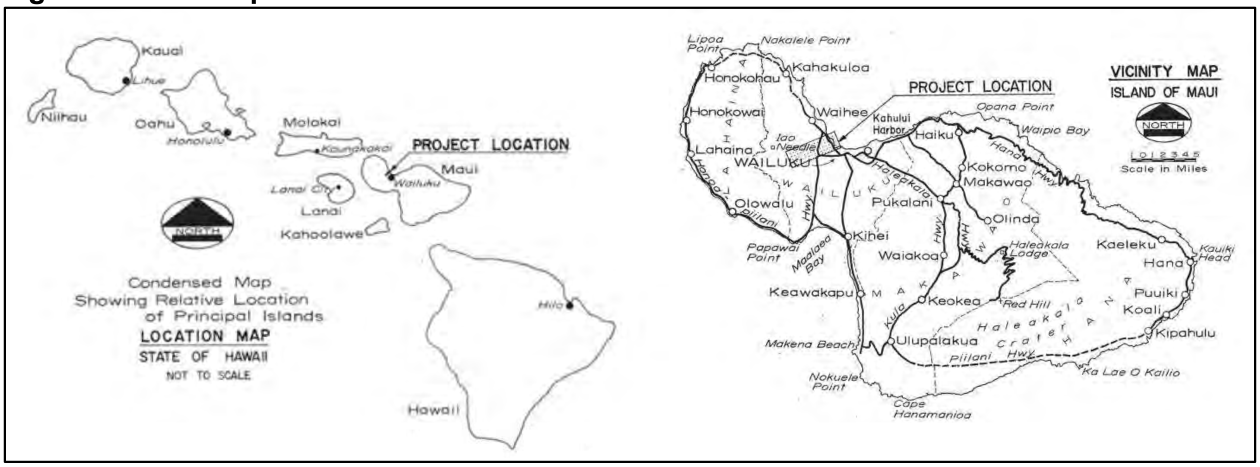


Figure 2: Aerial Location Map

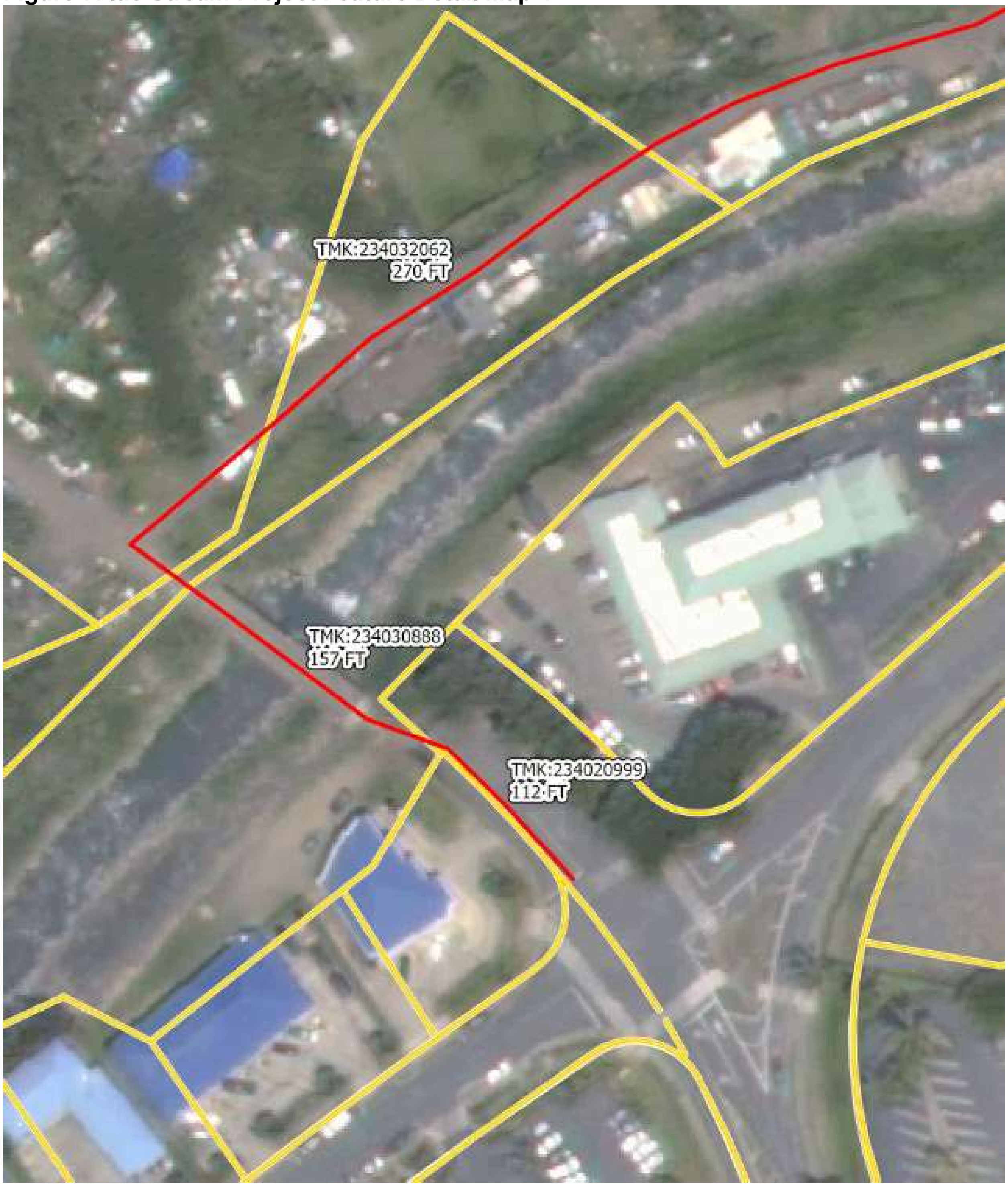
Figure 3: Iao Stream Project Feature Map

Figure 4: Iao Stream Project Feature Detail Map 1

Figure 5: Iao Stream Project Feature Detail Map 2

Figure 6: Iao Stream Project Feature Detail Map 3

Figure 7: Iao Stream Project Feature Detail Map 4



Attachment 1: Assessment of NFS's Real Estate Acquisition Capability

Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability

Project: Iao Stream Flood Control Project
Project Authority: authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483)
Non-Federal Sponsor: County of Maui, Department of Public Works
200 S High Street, Wailuku, Hawaii 96793
(808) 270-7845, public.works@co.maui.hi.us

Legal Authority	**Yes**	**No**
1. Does the NFS have legal authority to acquire and hold title to real property for project purposes? (Hawaii Revised Statutes, Chp. 46)	✓	
2. Does the NFS have the power of eminent domain for the project (Hawaii Revised Statutes, Chp. 101)	✓	
3. Does the NFS have "quick-take" authority for this project?		✓
4. Are there any lands/interests in land required for the project that are located outside the NFS's authority boundary?		✓
5. Are any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn?		✓
6. Will the NFS's in-house staff require training to become familiar with the real estate requirements of Federal projects, such as PL 91-646, as amended?		✓
7. If #6 is yes, has a reasonable plan been developed to provide training?		NA

Willingness to Participate	**Yes**	**No**
8. Has the NFS stated its general willingness to participate in the project and its understanding of the general scope and role?	✓	
9. Is the NFS agreeable to signing a Project Partnership Agreement and supplying funding as stipulated in the agreement?	✓	
10. Was the NFS provided the Local Sponsor Toolkit? 05/17/21	✓	

Acquisition Experience and Capability	**Yes**	**No**
11. Taking into consideration the project schedule and complexity, does the NFS have the capability, with in-house staffing or contract support, to provide the necessary services, including surveying, appraisal, title, negotiation, condemnation, closing, and relocation assistance, as required for the project? *Schedule does not include condemnation proceedings, if necessary.	✓	
12. Is the NFS's projected in-house staffing level sufficient considering its workload?	✓	
13. Can the NFS obtain contractor support, if required, in a timely manner?	✓	
14. Is the NFS's staff located within reasonable proximity to the project site?	✓	
15. Will the NFS likely request USACE assistance in acquiring real estate?		✓

Schedule Capability	**Yes**	**No**
16. Has the NFS approved the tentative project real estate schedule and indicated its willingness and ability to utilize its financial, acquisition, and condemnation capabilities to provide the necessary project LERRDs in accordance with the proposed project schedule so the Government can advertise and award a construction contract as required by overall project schedules and funding limitations? The anticipated NFS real estate acquisition timeframe for the project is ten (10) months. *Schedule does not include condemnation proceedings, if necessary. **NFS Initials:**	✓	

LERRD Crediting	**Yes**	**No**
17. Has the NFS indicating its understanding of LERRD credits and its capability and willingness to gather the necessary information to submit LERRD credits within six (6) months after possession of all real estate and completion of relocations so the project can be financially settled? **NFS Initials:**	✓	

Past Action and Coordination	**Yes**	**No**
1. Has the NFS performed satisfactorily on other USACE projects?	✓	
2. Has the assessment been coordinated with NFS?	✓	
3. Does the NFS concur with the assessment? (provide explanation if no)	✓	

With regard to the project, the NFS is anticipated to be:	**Select One**
Fully Capable: previous experience; financial capability; authority to hold title; in-house staff can perform necessary services (survey, appraisal, title, negotiation, closing, relocation assistance, condemnation) as required by the LERRDs.	
Moderately Capable: financial capability; authority to hold title; can perform, with contract support, necessary services (survey, appraisal, title, negotiation, closing, relocation assistance, condemnation) as required by the LERRDs.	✓
Marginally Capable: financial capability; authority to hold title; will rely on approved contractors to provide necessary services (survey, appraisal, title, negotiation, closing, relocation assistance, condemnation) as required by the LERRDs.	
Insufficiently Capable (provide explanation): financial capability; will rely on another entity to hold title; will rely on approved contractors to provide necessary services (survey, appraisal, title, negotiation, closing, relocation assistance, condemnation) as required by the LERRDs.	

USACE Prepared by:	**NFS Reviewed by:**
MURRAY.TIFFANY.MARIE.1384979013 Digitally signed by MURRAY.TIFFANY.MARIE.1384979013 Date: 2021.08.04 15:40:11 -10'00'	
Tiffany Murray Realty Specialist USACE Honolulu District	Rowena Dagdag-Andaya Director of Public Works County of Maui
Date: August 4, 2021	Date: AUG 0 4 2021

USACE Approved by:	
Considering the capability of the NFS and the ancillary support to be provided by contract services, it is my opinion that the risks associated with LERRDs acquisition and closeout of the project have been properly identified and mitigated.	
LABESTE.ERICA.A.1286957435 Digitally signed by LABESTE.ERICA.A.1286957435 Date: 2021.08.05 16:03:14 -10'00'	
Erica Labeste Chief, Real Estate Branch U.S. Army Corps of Engineers Honolulu District	Date: August 5, 2021

Attachment 2: Letter Advising Against Early Acquisition

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

August 5, 2021

Real Estate Division

SUBJECT: Iao Stream Flood Control Project Amendment, County of Maui, Department of Works Department, Risks of Early Acquisition

Rowena Dagdag-Andaya
Director of Public Works
County of Maui, Department of Works Department
200 S High Street
Wailuku, Hawaii 96793

Dear Ms. Dagdag-Andaya:

Reference is made to the Iao Stream Flood Control Project Amendment, as authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483). The County of Maui, Department of Public Works, as the non-Federal Sponsor, is responsible for ensuring that it possesses the authority to acquire and holds title for all real property required for the proposed project. The non-Federal sponsor shall provide one hundred percent (100%) of the lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRDs) as well as the operation, maintenance, and repair required by the project.

The United States Army Corps of Engineers (USACE), Honolulu District, advises your office that there are risks associated with the acquisition of LERRDs prior to the execution of a Project Partnership Agreement (PPA) or Local Cooperation Agreement (LCA). The County of Maui will assume full and sole responsibility for any and all costs and liabilities arising out of premature acquisition. Project risks generally include, but are not limited to:

a. Congress may not appropriate funds to construct the proposed project;

b. The proposed project may otherwise not be funded or approved for construction;

c. A PPA/LCA mutually agreed to by the non-Federal sponsor and the Government may not be executed;

d. The non-Federal Sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations, including liability arising out of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended;

e. The non-Federal Sponsor may acquire interest or estates that are later determined by the Government to be inappropriate, inefficient, or otherwise no required for the project;

f. The non-Federal Sponsor may initially acquire insufficient or excessive real property acreage, which could result in additional negotiations and or/benefit payments under Public Law 91-646 or additional payment of fair market value to affected landowners;

g. The non-Federal Sponsor may incur costs or expenses in connection with its decision to acquire LERRDs in advance of the executed PPA/LCA and the Government's Notice to Acquire (NTA).

If you have questions, please contact the USACE Honolulu District, Real Estate Branch, at (808) 835-4055.

Sincerely,

LABESTE.ERICA.
A.1286957435

Digitally signed by
LABESTE.ERICA.A.1286957435
Date: 2021.08.05 16:07:23 -10'00'

Erica Labeste
Chief, Real Estate Branch
U.S. Army Corps of Engineers
Honolulu District

Attachment 3: Sample Notice to Acquire Letter

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

August 26, 2021

Real Estate Division

SUBJECT: Iao Stream Flood Control Project, County of Maui Department of Public Works, Notice to Acquire

Kristi Ono
Maui County Public Works Department
200 S High Street
Wailuku, Hawaii 96793

Dear Ms. Ono:

This letter serves as your Notice to Acquire the real estate interests needed from the County of Maui for the Iao Stream Flood Control Project, as authorized by Section 203 of the Flood Control Act of 1968 (Public Law 90-483). Enclosed are the final Authorization for Entry for Construction, Attorney's Certificate of Authority, and project real estate drawings. Also enclosed is the standard language to be used for the Roadway Easement conveyance documents between the County of Maui, as the non-Federal Sponsor, and private landowners.

In accordance with the Project Partnership Agreement (PPA) dated xx, the County of Maui is responsible for xx. As required by the PPA, the Government has determined the Roadway Easements as shown on the real estate drawings are required for project implementation. The PPA also requires the County of Maui to comply with the Uniform Relocations and Assistance and Real Property Acquisition Policies Act. 42 U.S.C. § 4601, et. seq., and the Uniformed Regulations, 49 C.F.R. part 24. More information can be found at http://www.fhwa.dot.gov/realestate/realprop.

After acquisition of the required real estate interests, the County of Maui shall complete and sign the Authorization for Entry for Construction and Attorney's Certificate of Authority. Please return the original signed authorization documents to the Corps of Engineers, Honolulu District Real Estate Branch, by mail to the address contained in the letterhead. In addition, the County of Maui shall provide copies of all conveyance documents for required real estate acquisitions (Roadway Easements) to the Corps of Engineers. The Corps of Engineers requires the conveyance documents prior to advertising a construction contract. Copies of conveyance documents may be scanned and submitted electronically to the contact person below.

If you have any questions, please contact Yvonne Hallman, Realty Specialist, at (602) 671-5494 or Yvonne.n.hallman@usace.army.mil.

Sincerely,

Erica Labeste
Chief, Real Estate Branch
U.S. Army Corps of Engineers
Honolulu District

Enclosures

References

U.S. Army Corps of Engineers, Honolulu District, Iao Stream Flood Control Project, *Engineering Documentation Report Amendment,* June 2021.

U.S. Army Corps of Engineers, Honolulu District, *Final Environmental Assessment for Modification to the Iao Stream Flood Control Project,* July 2017, and *Finding of No Significant Impact,* July 2017.

Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

Engineering Documentation Report Amendment

Appendix F: Final Supplemental Environmental Assessment

September 2021

US Army Corps of Engineers
Honolulu District

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US Army Corps of Engineers®
Honolulu District

FINAL
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
MODIFICATION TO THE
IAO STREAM FLOOD CONTROL PROJECT
WAILUKU RIVER, WAILUKU, MAUI, HAWAII

September 2021

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

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ACRONYMS AND ABBREVIATIONS

AECOS	AECOS, Inc.
AIS	Archaeological Inventory Survey
AMP	Archaeological Monitoring Plan
APE	Area of Potential Effect
BMP	Best Management Practice
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
CH_4	Methane
CIA	Cultural Impact Assessment
CO	Carbon Monoxide
CO_2	Carbon Dioxide
County	County of Maui
CWA	Clean Water Act
CWRM	Commission on Water Resource Management
CY	Cubic Yard(S)
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DAR	Division of Aquatic Resources, State of Hawaii
dB(A)	Decibel (A-weighted scale)
DBEDT	Department of Business, Economic Development and Tourism
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
DOH	Department of Health, State of Hawaii
EA	Environmental Assessment
EDR	Engineering Documentation Report
EDRA	Engineering Documentation Report Amendment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency, United States
ER	Engineering Regulation
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
fps	Feet Per Second
ft	Feet
FWCA	Fish and Wildlife Coordination Act
FY	Fiscal Year
GHG	Greenhouse Gas
HAR	Hawaii Administrative Rules
HRS	Hawaii Revised Statutes
IIFS	Interim Instream Flow Standard
MBTA	Migratory Bird Treaty Act

mgd	Million Gallons Per Day
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO	Nitrous Oxide
NO2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
O3	Ozone
O&M	Operation And Maintenance
OEQC	State of Hawaii Office of Environmental Quality Control
OHA	Office of Hawaiian Affairs
OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
PAL	Planning Aid Letter
PDT	Project Delivery Team
PL	Public Law
RS	River Station
SCS	Scientific Consulting Services, Inc.
SCS/CRMS	Scientific Consultant Services/Cultural Resource Management Services
SHPD	State Historic Preservation Division
SHPO	State of Hawaii Historic Preservation Office
SHWS	State Hazardous Waste Site
SIHP	State Inventory of Historic Places
SPF	Standard Project Flood
SPS	Standard Project Storm
TMDL	Total Daily Maximum Load
TMK	Tax Map Key
USACE	United States Army Corps of Engineers
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WQC	Water Quality Certification
WRDA	Water Resources Development Act

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SECTION 1 - INTRODUCTION

The U.S. Army Corps of Engineers (USACE) Honolulu District is developing solutions to address identified design deficiency of the Iao Stream Flood Control Project. USACE Formulation of solutions are documented in an Engineering Documentation Report (EDR) finalized by USACE in 2017, with continued development in 2021 as documented in an amendment to the 2017 EDR. This Environmental Assessment (EA) is a supplement to the USACE 2017 Final EA that was completed in association with the 2017 EDR.

This supplemental EA (SEA) was prepared in accordance with the Council on Environmental Quality (CEQ) *National Environmental Policy Act (NEPA) Implementation Regulations,* Title 40 Code of Federal Regulations (CFR), Part 1500-1508, dated September 2020, and Engineer Regulation (ER) 200-2-2, *Procedures for Implementing NEPA*. The 2017 Final EA evaluated several alternatives to address ongoing flood hazards caused by design deficiencies and long-term damage to the existing flood control structures and included a description of the proposed action and alternatives, a description of the affected environment and evaluation of environmental effects, details compliance with environmental laws, regulations, plans and policies, listed agencies consulted and/or coordinated, preparers and references and concluded in a finding of no significant impact (FONSI).

This SEA documents USACE evaluation of potential environmental impacts that may exist as a result of implementing the action proposed (Section 2) under the 2021 EDR Amendment (EDRA). Information derived from the 2017 Final EA was used as a basis for the SEA analysis and is denoted as such throughout this document.

1.1 Project Authorization

The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and as recommended by the Chief of Engineers in House Document Number 151, 90th Congress. USACE completed construction of the original project in October 1981. The project consisted of enlarging, straightening, and stabilizing the channel and constructing levees, walls, and a debris basin. Structural details about the authorized project are included in Section 1.2.2. The non-federal sponsor (NFS) is the County of Maui (County), represented by the Department of Public Works. The NFS is responsible for operation and maintenance of the Iao Stream FCP in accordance with the Local Cooperation Agreement between the NFS and USACE.

1.2 Background

1.2.1 Location

The Iao Stream FCP is located along the Wailuku River (formerly named Iao Stream) in the town of Wailuku on the northeast coast of the island of Maui, Hawaii (Figure 1-1). The Wailuku River is located within a drainage basin on the eastern slopes of the West Maui Mountains, near the north end of the isthmus connecting East and West Maui. The river is approximately 8 miles long and drains the steep Iao Valley, meandering eastward to the Pacific Ocean, through the town of Wailuku. The Iao Stream FCP is located in the lower reach of Wailuku River, extending approximately 2.5 miles upstream of the river mouth (Figure 1-2). The area of concern is primarily within a reach approximately 1.5-miles long upstream of Waiehu Beach Road. The Wailuku River can be described as four distinct reach segments:

1. Natural Upstream Reach;
2. Upper Concrete Channel;
3. Natural Reach; and
4. Lower Reach and Outlet.

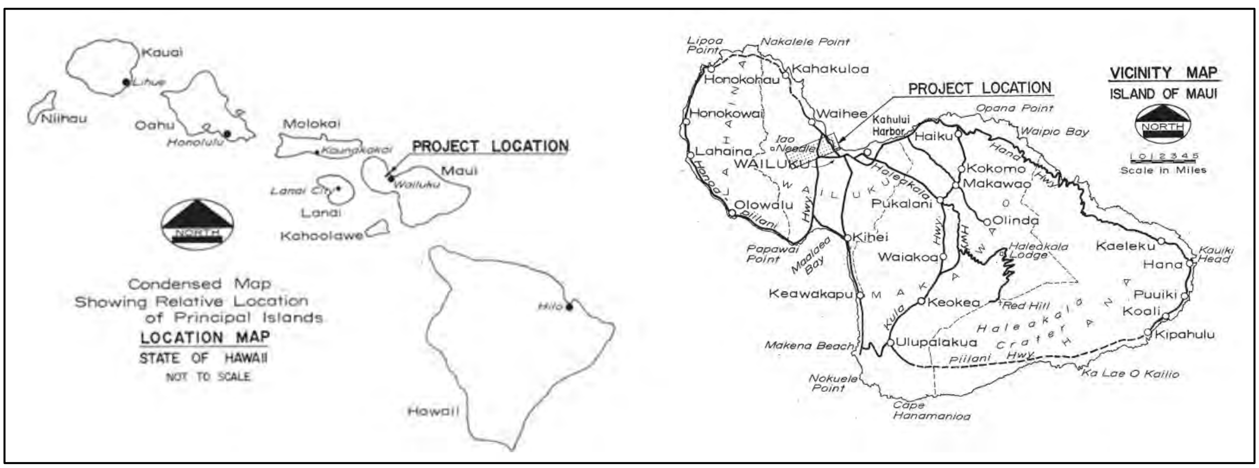

Figure 1-1. Location Map

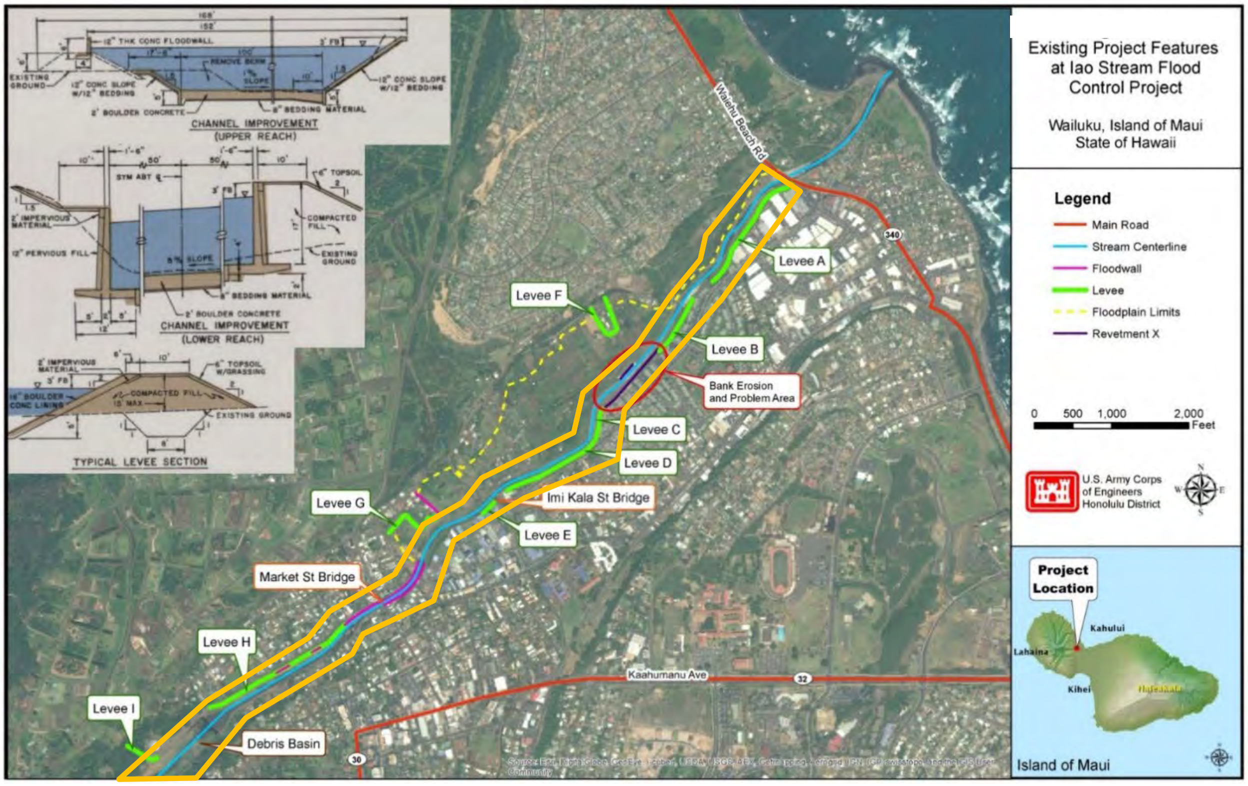

Figure 1-2. Project Area showing Existing Authorized Features. Analysis area in solid yellow.

1.2.2 Description of the Authorized Project

The existing FCP was designed to provide a protection against the Standard Project Flood (SPF) which, under project conditions, would have a discharge of 26,000 cubic feet per second (cfs) at the upper limits of the project at the debris basin and 26,500 cfs at the mouth of Wailuku River. The floodplain between the channel improvements incorporates the 1,500 cfs discharge from the Happy Valley Flood Prevention Project for a total discharge of 27,500 cfs (USACE, 1976).

The completed project (Figure 1-2) consists of the following features included in each of the four reach segments described above:

1. *Natural Upstream Reach:* There are no Federally authorized project features included in this reach.
2. *Upper Concrete Channel***:** The Federal project begins within this segment. A debris basin is located at the upstream end of the Federal project, approximately 2.5 miles upstream from the stream mouth. The debris basin is intended to prevent large boulders and debris from entering the lower reaches of the stream.
3. *Natural Reach***:** Project features in this reach include channel improvements extending 3,500 feet (ft) downstream from the debris basin, levees along the right bank[1], and levees and a designated floodplain along the left bank for 6,950 ft of natural stream channel.
   Project levees "A," "B," "C," "D," and "E" are intermittently situated upon the right bank of the stream; levees "F" and "G" are located on the left bank.
   This reach also includes Revetment X on both banks of the river between levees "C" and "B". Within the vicinity of Revetment X, the meandering natural channel was straightened and narrowed with boulder concrete lining as part of the original project.
   Finally, an area zoned for floodplain management is designated on the left bank within this reach. It is primarily used for agricultural purposes. The natural stream bed consists of boulders and scrub brush. The bed ranges in width from 40 to 60 ft and has an average slope of 2.6 percent.
4. *Lower Reach and Outlet***:** Features include stream realignment with channel improvements for a reach of 1,730 ft that extends to the downstream limit of the project located near the shoreline.

1.2.3 Proposed Action Background

The Iao Stream FCP was authorized for construction by the Flood Control Act of 1968 and was implemented after USACE completed an Environmental Impact Statement (EIS) with identified mitigation measures following approval of the EIS' Record of Decision (USACE, 1975). During the construction phase in January 1980, a flood occurred that caused extensive erosion of the sacrificial berm and undermined portions of the completed levees. To address this damage, the streamside slope of the levees was extended with a concrete riprap slope lining into the streambed. Considered to be a state-of-the-art design at the time, the toe of the cutoff walls was embedded 5 ft in depth.

Shortly after project completion, stream flows caused erosion of the stream bottom along an approximately 7,000-ft reach between the concrete channel and Waiehu Beach Road. The project levee was undermined with scour depths extending to a maximum of 6 ft below the existing boulder concrete slope lining. In July 1982, USACE Honolulu District requested approval of corrective work to extend the boulder concrete slope protection from the damaged portion to a minimum of 5 ft below the eroded stream bottom. The

[1] Left bank refers to the left bank of Wailuku River when looking downstream. Right bank refers to the right bank when looking downstream.

Office of the Chief of Engineers granted approval for this work in January 1983. The corrective work was completed in November 1983 under the Productive Employment Appropriation Act of 1983 and authorized under Section 205 of the Flood Control Act of 1948, PL 80-858, as amended. The stream channel has since eroded as much as 6 to 8 ft below the 1983 repair. USACE subsequently decided to conduct a reconnaissance study pursuant to ER 1165-2-119 (paragraph 7a) to investigate solutions to the recurring problems that are slowly undermining areas of the levee.

A Design Deficiency Report (DDR) was completed in March 1995 and approved by the acting Assistant Secretary of the Army for Civil Works (ASA(CW)) in November 1995. The DDR concluded insufficient levee toe protection and excessive erosion within the Iao Stream FCP led to the design deficiency. It recommended that lining the unlined portions of the channel would resolve the design deficiency at Iao Stream FCP. However, additional analysis demonstrated the identified solution was not feasible due to excessive costs and potentially significant environmental impacts. For these reasons, the Corps decided not to implement the DDR recommendation, leaving the design deficiency unaddressed.

Since 1995, several iterations of EDR development have been conducted to investigate multiple alternatives to address the design deficiency. The Corps thoroughly evaluated the overall function of the FCP as it relates to the design deficiency and has analyzed numerous alternatives throughout the study process. In 2017, a Final EDR was completed by the Corps. Under the 2017 EDR, six alternatives were evaluated to address the design deficiency. A less expensive, more environmentally acceptable design was identified through the EDR process, including recommendation of a comprehensive plan, "*Alternative F*" to reconnect the floodplain and provide a more holistic response to the design deficiency based on the engineering data available.

Alternative F proposed new features not included in the original authorized project that were deemed to beyond the authority of the current authorized project. Accordingly, the Corps was directed to complete a General Reevaluation Report (GRR) as the mechanism to receive Congressional authorization on a project with new flood risk management (FRM) features.

The GRR was initiated in October 2018 through execution of a Feasibility Cost Share Agreement between the Corps and the NFS. Contrary to conclusions drawn under the 2017 EDR, updated modeling and engineering analysis indicated that the previously recommended plan was no longer technically feasible. Alternative F, as designed, induced additional flood risks to the community and lacked cost-effective means to engineer the alternative to achieve the desired benefits of reduced flood risk. Rather than terminate the study and efforts, the project delivery team evaluated alternatives to solely address the design deficiency.

The study team evaluated alternatives with the objective to address the design deficiency justified based on safety and economic considerations. The final recommendations are presented in this EDR Amendment to the 2017 EDR. While recommendations since 1995 have changed in both scope and cost, the design deficiency remained the same - insufficient levee toe protection and excessive erosion of the flood control project. The final array of alternatives is presented below in Section 2.1. Alternatives eliminated from further consideration are presented in Section 2.2. Evaluation of environmental effects is presented in Section 3.

1.2.4 NEPA History

The 2017 Final EA (USACE) accompanied the 2017 EDR (USACE) was released in July 2017 and analyzed the following two alternatives to satisfy the project's purpose and need: 1) No Action, and 2) Alternative F (Preferred Alternative). The No Action alternative proposed no further action at the Federal project. Alternative F consisted of features intended to reconnect the mainstream channel to its floodplain to reduce damaging flows along the main channel and right bank levees. Alternative F also included bank stabilization along the right bank upstream of the proposed overflow channel and downstream of the outflow return location to prevent further erosion in these areas. In addition, an existing revetment (Revetment X) would be removed and either restored or replaced along both the left (RS 55+50 to 51+90) and right (RS 55+10 to 50+25) banks. The 2017 Final EA concluded in a Finding of No Significant Impact.

1.3 Purpose and Need

High velocity flows within the steeply sloped channel of the Wailuku River severely eroded key portions of the Iao Stream FCP and resulted in undermining of the existing levees in several locations along the stream. High stream flows resulted in downcutting (i.e., downward/vertical erosion) of the natural streambed and erosion of the levees along the right bank of the river. Several residential and commercial structures along the right bank are in danger of being undercut if streambank erosion continues as demonstrated by the extensive damages to the right bank caused by the September 2016 storm event. The September 2016 storm event also revealed the vulnerability of the heiau erosion, located along the lower reach of the left bank.

The purpose of the proposed action is to address ongoing flood hazards and community safety risks caused by design deficiencies and long-term damage to the existing FRM structures suffered during repeated floods since their original construction in 1981. The proposed action is necessary to make the project function as initially authorized by Congress in a safe, viable, and reliable manner. Ultimately, the purpose of the proposed action is to correct the design deficiency of insufficient levee toe protection and excessive erosion within the Iao Stream FCP.

1.4 Public Involvement and Agency Coordination

Prior Engagement. To summarize previous public involvement and agency coordination, public participation included opportunities for public review and comment on previous NEPA documents, including the 2015 draft EA as described in 2017 final EA. The 2015 draft EA was released for a 30-day comment period from June 23 to July 23, 2015. As part of that draft EA public review period, 64 parties were coordinated with directly, and comments from 23 parties were received and addressed as part of the 2017 Final EA analysis. The 2017 Final EA is available for reference online at: https://www.poh.usace.army.mil/Missions/Civil-Works/Civil-Works-Projects/Iao-Stream/

Current Engagement. Building upon the previous public involvement and coordination efforts, the proposed action solicited public input and reengaged with resources agencies. On April 19, 2021, USACE hosted a coordination meeting with Department of Health (DOH), State of Hawaii Office of Planning, and the U.S. Fish and Wildlife Service (USFWS) regarding Clean Water Act (CWA) Section 401, Coastal Zone Management Act (CZMA), Endangered Species Act (ESA), and Fish and Wildlife Coordination Act (FWCA) compliance. The purpose of the meeting was to update previously consulted Federal and state agencies with substantive prior involvement on the current status of the project, presenting the currently proposed action and highlighting changes from the 2017 project.

During this meeting, USFWS referred to prior FWCA coordination on the 2017 project and communicated its concern regarding fish passage for anadromous species and shared lessons learned from other projects involving fish passage. USFWS appeared supportive of the USACE proposed use of boulder-lined concrete that creates rugosity and pooling, as opposed to impermeable, homogenous concrete lining as a means to promote fish passage through the FCP. DOH appeared supportive of USACE's intent to request a letter of confirmation and pursuit of a Section 401 Water Quality Certification during the design phase when sufficient information is available to complete the State's application. The State Office of Planning made reference to the prior CZM Federal Consistency review on the 2017 project and advised USACE of the need to submit a request for any new project components that were not previously reviewed. Continued coordination with these agencies has occurred since the April 19th meeting. Additionally, USACE has begun coordination with the State Historic Preservation Division (SHPD) regarding the Section 106 process.

A Public Notice informing the public of the USACE's intent to prepare a supplemental EA was published to USACE Honolulu District website on May 17, 2021 for a 30-day public comment period for this proposed action soliciting scoping comments (Appendix A). Two virtual public informational meetings were held on May 22 and 29, 2021. No comments were received in response to the public notice or at the virtual meetings during or after the public meetings. Subsequently, USACE proceeded with drafting the supplemental EA for the proposed action.

In accordance with ER 200-2-2, the draft SEA was released for a 30-day public comment period from August 12 to September 13, 2021. The draft SEA and Public Notice informing the public of availability of documents for review and inviting participation at virtual public information meetings (Appendix A) were published to the Honolulu District website. The County assisted USACE in providing additional public notification via the County website and local news media. Three virtual public informational meetings hosted by USACE regarding the release of the draft SEA and EDR amendment were held on August 18, 21, and 26, 2021. Each meeting was held on a different day of the week and time of day, allowing for more public accessibility. The August 26, 2021 public information meeting was recorded and posted to the Iao Stream FCP website for future reference. During the public comment period, one verbal comment was submitted via telephone call, two comment letters were submitted via email and USACE engaged in open discussion and commentary at the virtual meetings. USACE considered and responded to all substantive comments. The comments reflected diverse stakeholders and opinions and ranged from comments on the alternatives to the methods of analysis. Appendix A – Public Involvement under Response to Public Comments section documents and summarizes public comments received and USACE responses.

SECTION 2 - ALTERNATIVES

USACE formulated an array of alternatives focusing specifically on addressing the design deficiency at Iao Stream FCP. Alternatives were designed to reduce velocity, shear stress, and erosion in the channel in order to meet planning objectives of reducing the risk to community safety, reducing channel instability, and reducing the long-term Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) costs for the NFS. Alternatives were not formulated to provide FRM benefits (e.g., reduction in inundation, damages, etc.). Multiple iterations of the planning process resulted in formulation, evaluation, and screening of various arrays of management measures and alternatives, resulting in the final array of alternatives. The final array of alternatives described in Section 2.1 were carried forward for further consideration because they were determined to be technically and economically feasible and meet the purpose and need (Section 1.3).

2.1 Final Array of Alternatives

The final array of alternatives analyzed in this SEA includes:

- No Action Alternative;
- Alternative 2: Remove Revetment X;
- Alternative 6: Install Pre-Formed Scour Hole;
- Alternative 11: Non-Structural Plan (Flood Warning System); and,
- Alternative 12: Combination Plan (Alternative 2 + Alternative 6 + Alternative 11).

The final array of alternatives is described below and shown in Figure 2-1.

Alternatives considered by USACE in the EDR that were eliminated from further consideration are listed in Table 2-1.

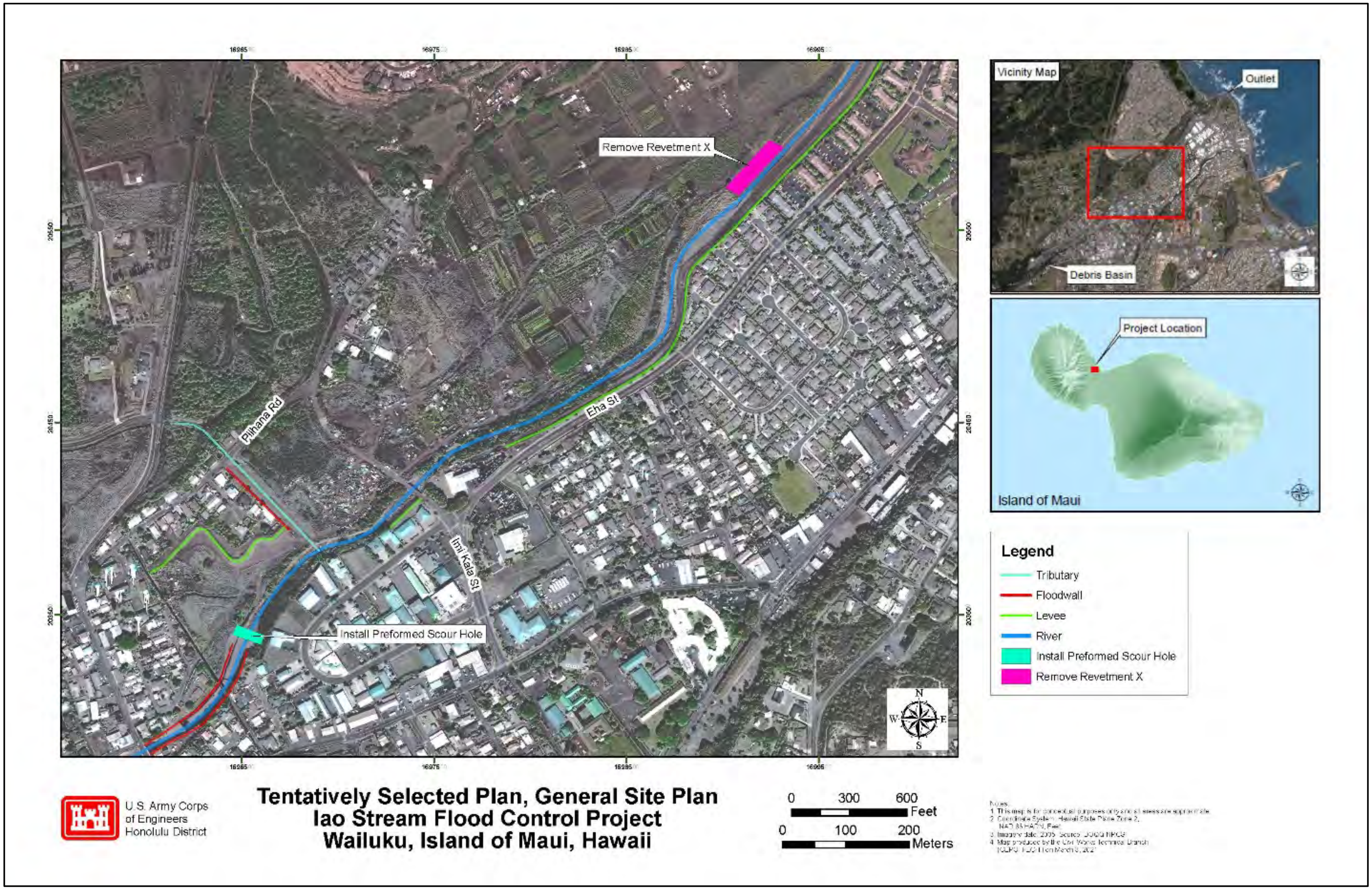

Figure 2-1. Preferred Alternative

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2.1.1 No Action

Under the No Action Alternative, USACE would not implement any action or rehabilitation to address the design deficiencies and long-term damage of the Iao Stream FCP. Future flooding of Wailuku River would continue to result in undermining of the existing levees. High flows would further the downcutting of the natural streambed and erosion of the base of the levees along the right bank . Failure or non-performance of the Iao Stream FCP could occur if continued erosion or head cutting continues, resulting in increased risk to community safety.

The No Action Alternative does not meet the purpose and need to address the design deficiency at the Iao Stream FCP. However, it is presented as required by NEPA to set the baseline from which to compare all other alternatives.

2.1.2 Alternative 2: Remove Revetment X

Revetment X is located on both banks of the stream between RS 55+50 to 48+50. In this area, the meandering natural channel was straightened and narrowed with boulder concrete lining of the banks, thereby constricting flow, increasing velocities and causing undermining of the lining on both the left and right banks. The existing channel bottom is a natural channel bottom, particularly susceptible to downcutting.

A portion of Revetment X was damaged by the September 2016 event. USACE subsequently repaired the damaged sections under the Public Law 84-99 Rehabilitation and Inspection Program. The 2016 Repairs included repair and reinforcement of the right bank lining and toe and removal of immediate hazards along the left bank to address safety concerns.

Alternative 2 would remove approximately 200 feet of the remaining portion of Revetment X along the left bank, widening the channel, allowing flows to dissipate across a wider area, and reducing velocity (Figure 2-2). No further stabilization or hardening of the left bank revetment is proposed. No maintenance is anticipated. No action is proposed along the right bank.

Figure 2-2. Revetment X, Photo taken from Right Bank, facing Left Bank and Upstream

With the removal of the revetment, USACE anticipates the Wailuku River would likely meander more in its attempt to lengthen the stream and achieve a shallower bed slope and possibly "bending" towards either the left or right bank. Removing the left bank revetment could increase erosion on the unprotected left bank, rather than the hardened right bank, allowing the stream to flow onto an undeveloped designated floodplain during high water events. USACE anticipates Removal of Revetment X will provide the river with more flexibility to meander, as needed, to achieve dynamic equilibrium. Post-removal, USACE will stabilize the exposed bank with vegetation and excess river rock, consistent with adjacent natural bank slopes upstream and downstream of Revetment X (Figure 2-3).

Figure 2-3. Photo taken upstream of Revetment X, facing Downstream

Note that the currently proposed action at the left bank of Revetment X (in addition to other previously proposed actions) was previously evaluated in the 2017 Final EA as a component of the recommended plan, "Alternative F". Under Alternative 2, USACE carries forward the removal of the hardened portion of the left bank slope. Substantively, Alternative 2 is the same as was proposed under the 2017 Alternative F, for the removal of Revetment X, left bank, noting that the conceptual level of design currently proposed will be further fine-tuned in design phase to reflect current site conditions. Required interagency coordination and public involvement was completed under the 2017 final EA and USACE concluded a finding of no significant impact. USACE assessment of the anticipated environmental effects of Alternative 2 is predominately documented in the 2017 final EA with relevant updates to supplement past evaluation in Section 3 of this final SEA. The currently proposed action, herein described, is essentially identical to the description of the same proposed action in the 2017 final EA (Figure 2-4).

Figure 2-4. Alternative F (2017) Comparison to Alternative 2 (2021) Remove Revetment X Footprint

2.1.3 Alternative 6: Install Pre-Formed Scour Hole

In this reach of the Iao Stream FCP, located downstream of Market Street Bridge and vertical drop structure, the transition from the upstream concrete channel bottom with cobble and boulders grouted in place as shown Figure 2-5, also known as boulder concrete lined invert, to the downstream unlined channel has eroded and is undermining the structural stability of the FCP (Figure 2-5). Under Alternative 6, USACE would excavate the eroded channel invert and construct a “pre-formed scour hole” i.e., engineered stabilization of the scoured invert consisting of a boulder-concrete sloped toe with buried key and backfilled with natural material consistent with the existing channel bottom (see concept drawing at Figure 2-6). This alternative would address existing erosion and prevent future, imminent erosion, thereby reducing downstream erosion and risk to community safety. OMRR&R requirements are anticipated to include sealing cracks in the concrete and removing vegetation, as needed.

Figure 2-5. Proposed Location of Pre-Formed Scour Hole

Details regarding construction means, methods and sequencing, best management practices and staging and access requirements is currently unavailable, pending authorization to fund this proposed action and proceed to the design phase, wherein construction detailing will become available. The Iao Stream FCP was constructed with maintenance accessways intended to facilitate maintenance repair to and within the channel. USACE assumes use of existing maintenance accessways to complete the proposed action.

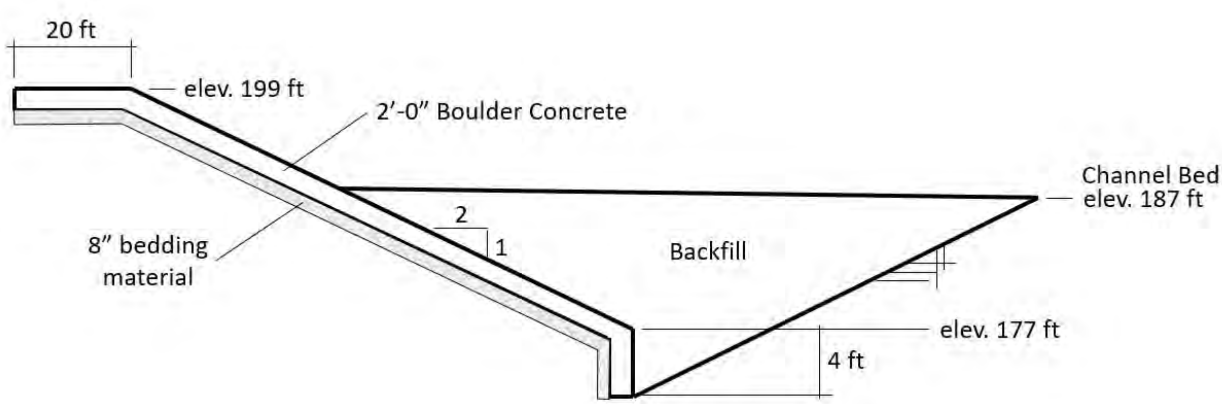

Figure 2-6. Cross-Section View of Proposed Pre-Formed Scour Hole Concept

2.1.4 Alternative 11: Non-Structural Plan (Flood Warning System)

Warning of impending floods can save lives and prevent extensive property damage. Installation of a stream gage would improve community safety by increasing community and regional understanding of the potential for flooding as well as increased communication of imminent flood events. A stream gage can provide valuable data to inform flood warning and evacuation plans, which contribute to improving life safety and community resilience for a relatively small cost.

Due to the flashy nature of the system, an automated warning system is recommended for Wailuku River. To establish a public warning system, USACE would coordinate directly with the County of Maui Emergency Management Agency to establish a central base station or field station with necessary communications equipment (siren / beacon lights), and software at the County Emergency Management Offices. No new construction is proposed. When rainfall or rising water levels reach set thresholds, the automated station will notify emergency personnel. Sirens can be automatically or remotely activated. In addition to the audible sirens, most public warning systems also often include visual flashing beacon lights to warn the community of the immediate hazard. OMRR&R requirements of the flood warning system would be annual inspections and testing.

The stream gage and flood warning system are expected to significantly reduce the potential for life loss by providing real-time data to improve warning times for evacuation. Another beneficial impact associated with implementation of the project is heightened awareness of the flood-related risks including both an increased understanding of the overall potential for flooding based on dissemination of project-related information as well as increased communication of imminent flood events via improvements real-time data gathering via the stream gage. This is expected to translate to increased levels of preparedness, thus improving community safety.

2.1.5 Alternative 12: Combination Plan (Preferred Alternative)

Alternative 12 would be a combination of Alternatives 2, 6, and 11. Alternatives 2 and 6 are discrete rehabilitation actions to address ongoing design deficiencies. These two alternatives are hydraulically independent of each other. Alternative 11 is a non-structural alternative that proposes a public warning system. OMRR&R requirements are anticipated to be sealing cracks in the concrete and removing vegetation, as needed, at the pre-formed scour hole as well as annual inspections and testing of the flood warning system.

Table 2-1 provides construction details for each of the elements in Alternative 12 – Combination Plan, known at this time. Design and construction details will be further refined during the design phase of this project which may begin in 2022, pending approval and funding. These construction details would also be applicable for each of the other alternatives.

Table 2-1: Preferred Alternative Construction Details

Element	Description
Revetment Removal	Removal of a 290 ft long portion of the revetment along the left bank between RS 55+50 to 48+50 and temporary stabilization of exposed earth embankment to be consistent with upstream and downstream bank slope conditions.
Pre-formed Scour Hole	At a two horizontal to one vertical (2H:1V) slope, the invert would lower approximately 22 feet, starting within the boulder-concrete lined channel at approximately 199 feet Mean Sea Level (MSL) and ending within the unlined channel at elevation 177 feet MSL. The slope from 199 feet MSL to 187 feet MSL will be exposed to form the channel invert. The slope from 187 feet MSL to 177 feet MSL will be buried and consistent with the unlined channel invert at this reach of the FCP. The existing channel width (120 feet) would be maintained. Approximately 120 linear feet of streambed would be impacted during construction.
Stream Gage or Other Climate Gage	Install stream gage or other climate gage as part of a public flood warning system at either Iao Valley Road Bridge or at the existing USGS gage between the Iao Stream FCP debris basin and the Market Street Bridge.
Staging/Site Access	Use of existing maintenance accessways built into the Iao Stream FCP.
Best management practices (BMPs) to be included during construction	Industry standard BMPs will be required during construction that address and/or avoid and minimize impacts to the following resources: water quality, historic and cultural resources including inadvertent discovery, fish and wildlife, invasive species, and hazardous waste. This list is not comprehensive since the design is at a conceptual level. BMP requirements will be further defined during the design phase in coordination with the NFS and local community stakeholders as part of the plans and specifications.
Types of construction equipment to be used	Excavator, front-end loader, and dump trucks.
Location of disposal of debris and excavated materials	Any excess excavated material (other than natural river rock) or construction debris and waste will be tested and disposedof at an approved upland disposal site in accordance with applicable federal, state and local regulations. No river rock will be removed from the Wailuku River system.
Construction duration	Approximately 10 months. Likely to be completed during daytime hours and incorporating any construction windows to be identified in the design phase.
O&M	Sealing cracks in the concrete and removing vegetation, as needed, at the pre-formed scour hole. Also includes annual inspections and testing of the stream gage. O&M will be completed by the NFS in accordance with the Local Cooperation Agreement for the Iao Stream FCP.

2.2 Alternatives Considered but Eliminated from Further Analysis

An array of alternatives was formulated to specifically focus on addressing the design deficiency at Iao Stream FCP, in particular the scoured channel at Revetment X and the toe scour at the transition from lined channel to unlined channel downstream of the Market Street Bridge. As part of the NEPA process, all potential alternatives must be evaluated. For alternatives to be considered reasonable, they must be affordable, implementable, meet the project purpose and need, and meet the established alternative selection criteria including meets objectives, avoids constraints, rough order of magnitude cost, environmental impacts, technical viability, and sponsor support. Generally, the alternatives listed below did not meet the purpose and need described at Section 1.3, above.

Alternatives developed during plan formulation and considered under the current EDR (EDR Section 4), but that USACE eliminated from further consideration are described in Table 2-2.

Table 2-2. Alternatives Considered but Eliminated

Alternative	Screening Results
Alternative 1 Install Fully Lined Channel	**Screened Out** *Cost prohibitive & not recommended in prior reports* *Does not avoid constraints* *Significant adverse environmental effects* *Does not meet purpose and need*
Alternative 3 Install Revetment Near Levee E	**Screened Out** *Sponsor to implement locally; increases future O&M* *Does not meet objectives* *Does not meet purpose and need*
Alternative 4 Remove Imi Kala Street Bridge	**Screened Out** *Not technically feasible* *Does not meet purpose and need*
Alternative 5 Create Sacrificial Berm	**Screened Out** *Not supported by sponsor; increases future O&M* *Does not meet purpose and need*
Alternative 7 Modify Detention Basin	**Screened Out** *Cost prohibitive* *Increases future O&M* *Adverse effects to cultural resources* *Does not meet purpose and need*
Alternative 8 Drop Structures	**Screened Out** *Cost prohibitive* *Not supported by sponsor; increases future O&M* *Does not avoid constraints* *Significant adverse environmental effects* *Does not meet purpose and need*
Alternative 9 Overflow Basin with Floodplain Reconnection	**Screened out** *Cost prohibitive* *Does not meet purpose and need*
Alternative 10 Deauthorize Project	**Screened Out** *Does not meet objectives* *Does not meet purpose and need*

SECTION 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

The environmental, social, and economic setting of the project site and the probable impacts of the final alternatives (No Action Alternative, Alternative 2, Alternative 6, Alternative 11 and Alternative 12 (Preferred Alternative)) are described in this section of the EA. Impacts may apply to the full range of natural, aesthetic, historic, cultural, and economic resources.

Impacts are described in relation to their significance. The CEQ regulations require analysis of the potentially affected environment and degree of the impacts of the action when determining the significance of an effect on a resource (40 C.F.R. § 1501.3(b)). Potentially affected environment means considering the extent of the effect such as in a national, regional, or local setting (40 C.F.R. § 1501.3(b)(1)). Several types of impacts should be considered, when considering the degree of the impacts as described below (40 C.F.R. § 1501.3(b)(2)). Impacts are described as either *beneficial* or *adverse*. Beneficial impacts result in a positive change in the condition of the resource when compared to the No Action Alternative. Adverse impacts result in a negative change in the condition of the resource when compared to the No Action Alternative. Impacts are also described in terms of duration. *Temporary* or *short-term impacts* would not persist for the duration of the management action or would only occur for a limited time after implementation of the action such as construction-related impacts (or both). *Long-term effects* would be permanent or continuous over the period of analysis of 50 years.

The 2017 Final EA for the Modification to the Iao Stream FCP is supplemented with this SEA (40 C.F.R. § 1502.9). Alternative F of the 2017 Final EA included and analyzed the removal of the revetment along the left bank, which in this SEA is called Alternative 2 – Remove Revetment X. The 2017 Final EA is incorporated by reference as part of this SEA, as appropriate, in accordance with 40 C.F.R. § 1501.12 and Environmental Regulation 200-2-2, *Procedures for Implementing NEPA*. The discrete rehabilitation at Alternative 6 and the non-structural Alternative 11, combined with the removal of Revetment X (formerly a component of Alternative F) would result in similar or lesser impacts as was evaluated in the 2017 Final EA and concluded in a Finding of No Significant Impact. The proposed Alternatives 2, 6, 11, and 12 would include similar type actions including construction within the existing FCP and in the same geographic location as the 2017 Alternative F. Although, Alternatives 2, 6, 11, and 12's proposed actions would be smaller in scale and footprint as compared to the 2017 Alternative F and therefore, is not reasonably expected to result in greater impacts than described in the 2017 Final EA. The following evaluation regards the currently proposed Alternatives 2, 6 and 11 both individually and in combination, as Alternative 12, to supplement the evaluation completed in the 2017 Final EA.

The resources identified in Table 3-1 were evaluated in the 2017 Final EA against the 2017 recommended plan, Alternative F. USACE determined that the alternatives would have no to negligible impacts to the following resources: geological resources; climate, air quality, and greenhouse gases; noise; land use, visual aesthetics; recreation resources; socioeconomics; public infrastructure and utilities; traffic and circulation; and solid and hazardous material and waste, as detailed in Table 3-1, and are not evaluated further in this Final SEA.

Table 3-1. Environmental Resources Not Evaluated Further

Environmental Resource	Explanation
Geological Resources: Geological resources typically consist of surface and subsurface materials and their inherent properties	During construction, all the proposed action alternatives would involve minimal ground disturbance within the existing, constructed footprint of a federal FCP. Geological resources temporarily and minimally disturbed during construction of Alternative 6 will be stabilized upon completion to prevent further and future erosion. No more than minimal temporary impacts to geological resources, if any, are anticipated for installation of the stream gage proposed under Alternative 11. Alternative 12 may result in negligible short-term impacts with no anticipated long-term impacts to geological resources.
Climate, Air Quality, Greenhouse Gases (GHGs): Climate is defined as long-term atmospheric patterns that characterize a region or location. Air quality at a given location is a function of several factors, including the quantity and type of pollutants emitted locally and regionally, as well as the dispersion rates of these pollutants. GHGs occur both naturally and anthropogenically (man-made) and include: water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (NO), and ozone (O_3).	Temporary minimal increase in fugitive dust and vehicle emissions during construction activities of Alternative 6 and the combined Alternative 12 would occur resulting in short-term negligible impacts. No long-term impacts would occur once construction is completed. Alternative 11 proposes no construction activities and would have no impact to climate or air quality.
Noise: Noise is generally defined as unwanted sound.	With any of the proposed action alternatives, short-term construction related negligible impacts would occur over an estimated construction period of ten (10) months, likely during daytime hours throughout the duration of construction. The proposed action alternatives do not propose any atypical or noise-generating operations or activities of significance. The setting is dominated by vehicular and residential noise as well as natural noise emitted from the perennially flowing Wailuku River. No long-term noise impacts are expected. Alternative 11 proposes a flood warning system that would notify the public of impending flood conditions and may involve generating a sound for notification purposes only. The anticipated noise generated would seldom occur and otherwise would generate no unwarranted sound.

Land Use: Land use is the human use of land.	The proposed action alternatives are sited wholly within the boundaries of the federal Iao Stream FCP, owned and maintained by the NFS. None of the proposed action alternatives would permanently change or alter current or future land use designations or characteristics. USACE has identified all land necessary to achieve the preferred alternative and all interests that needs to be acquired by the NFS to achieve the preferred alternative e.g. temporary roadway easement adjacent to the FCP will need to be acquired to facilitate construction. During the design phase the boundaries of all land necessary (and to be acquired) to achieve the preferred alternative will be further refined. Acquisition of the temporary roadway easement would be consistent with local land use ordinances and returned to its pre-construction state.
Visual Aesthetics: Visual resources are defined as the natural and manufactured features that comprise the aesthetic qualities of an area.	The proposed action alternatives would have negligible short-term impacts to visual and aesthetic resources, occurring only during construction with the introduction of machinery, equipment and construction activities. Once construction is completed, the proposed action alternatives would be consistent with other structural elements of the FCP and are designed to blend into the existing highly modified riverine environment. The proposed action alternatives would not introduce any visual obstructions or other discernibly different aesthetic qualities in and around the FCP. Alternative 11 may propose a stream or other climate gage in the vicinity of the Wailuku River. The physical dimensions of the gage would be no more than minimal and would have a negligible effect on visual aesthetics. There are no visual resources such as parks, conservation areas or other areas of recreational, ecological, scenic, or aesthetic importance in the project area.
Recreational Resources: Recreation is comprised of terrestrial- and water-based activities associated with the local population or visitors to the island	The proposed alternatives would not affect recreational resources during construction or after completion since public access to the existing federal flood control system is prohibited due to pre-existing safety concerns. While some USACE projects provide recreational resources and access, this federal FCP does not. In addition, the project site is not adjacent to any public recreational areas.
Socioeconomics: Socioeconomics are defined as the basic attributes and resources associated with the human environment, particularly population and economic activity.	With the implementation of any of the proposed action alternatives, short-term negligible beneficial impact to the local economy may occur by creating temporary employment opportunities and materials spending during the construction phase of the project. The proposed action alternatives involving discrete action to address the design deficiency of the federal FCP and a non-structural flood warning system

	would not result in temporary or permanent adverse impacts to regional socioeconomics.
Public Infrastructure and Utilities: Public infrastructure and utilities comprise functional services provided to a facility by public agencies or by a facility to the community.	The proposed action alternatives would not affect any public infrastructure or utilities because no public infrastructure or utilities are located within the project area.
Traffic and Circulation: Traffic and circulation refer to the movement of vehicles throughout a road or highway network.	The proposed action alternatives would have negligible short-term construction-related impacts to traffic resulting from additional vehicle trips to and from the project site by construction workers and haul trucks. USACE anticipates use of existing maintenance accessways designated for such purpose, thereby eliminating potential impacts to local traffic and circulation from staging and access necessary for construction. Upon completion, any of the proposed action alternatives are not expected to generate any additional traffic and would have no long-term impacts on traffic or parking.
Solid and Hazardous Material and Waste: Solid Materials are substances that do not have strong physical properties of ignitability, corrosivity, reactivity, or toxicity. Solid Wastes are solid materials that do not pose substantial present or potential hazard to human health or to the environment. Hazardous materials are defined as substances with strong physical properties of ignitability, corrosivity, reactivity, or toxicity, which may cause an increase in mortality, serious irreversible illness, incapacitating irreversible illness, or pose a substantial threat to human health or to the environment. Hazardous wastes are defined as any solid, liquid, contained gaseous, or semisolid waste, or any combination of wastes that pose a substantial present or potential hazard to human health or to the environment.	The proposed action alternatives would result in no to negligible impacts to solid and hazardous material and waste. Minimal solid waste would be generated during construction of any of the proposed action alternatives and would be disposed of at an appropriate disposal location in accordance with local and federal laws and regulations. There could be the potential of petroleum spillage associated with construction vehicles and equipment; however, all Best Management Practices best suited to avoid or minimize such risk would be implemented. Within the project area, there are no known environmental risk sites according to Federal and State databases as stated in the 2017 Final EA.
Relationship to Short-Term Uses and Long-Term Productivity (on all resources)	Long term productivity would not be impacted.

Irreversible and Irretrievable Commitment of Resources (on all resources)	Fuel, materials, and manpower are the only resources of the proposed actions considered irreversible or irretrievable.
Relationship to Land Use Plans and Master Plans	The Project would not change or conflict with any land use or master plan.

3.1 WATER RESOURCES

Definition of Resource

Water resources analyzed in this study encompass surface water, groundwater, floodplains, and wetlands. Surface water resources include lakes, rivers, and streams and are important for a variety of reasons including ecological, economic, recreational, aesthetic, and human health. Groundwater comprises subsurface water resources and is an essential resource in many areas as it is used for potable water, agricultural irrigation, and industrial applications. Floodplains are belts of low, level ground present on one or both sides of a stream channel and are subject to either periodic or infrequent inundation by floodwater. USACE defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

3.1.1 Existing Conditions

To summarize Section 3.4.3 of the 2017 Final EA, the project site is located on the Iao aquifer system of the Wailuku aquifer sector and the Wailuku River flows eastward through the Iao Valley, discharging into Kahului Bay. Wailuku River is about 12,000 ft in length from the sediment basin to the outlet into Kahului Bay, and about 30% is lined with existing concrete channels. The remaining portions of the stream are an alluvial channel where the stabilization problems occur. Currently, there is continuous flow of water through the proposed project area.

In accordance with 33 CFR 328.3(a)(5), the Wailuku River of the Iao Stream FCP with terminal discharge in the Pacific Ocean is a tributary to a navigable water and meets the definition of a water of the U.S. subject to the regulatory jurisdiction of the Clean Water Act. The Wailuku River at this location features perennial flow.

As identified an inland waterbody, Wailuku River including the project site is listed on the State of Hawaii DOH list of impaired waters in Category 3 and 5 for turbidity and trash (DOH, 2020). In addition, the Total Daily Maximum Load (TMDL) Priority list has Wailuku River listed as low (DOH, 2020). Downstream of the project area, Kahului Bay, a marine water, is listed on the DOH list of impaired waters in Category 2, 3, and 5 noting NO_3 and NO_2 with a TMDL Priority of low (DOH, 2020). According to Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, the project area is located within Regulatory Floodway (FEMA, 2009a; FEMA, 2009b). According to the

U.S. Fish and Wildlife Service (USFWS) *National Wetlands Inventory*, the project sites for Alternatives 2, 6, and 12 occur near areas designated as a freshwater emergent wetland (Figure 3-1), further classified as palustrine (i.e., nontidal wetlands dominated by emergent), and persistent (i.e., vegetation remains standing at least until the beginning of the next growing system) (2021a).

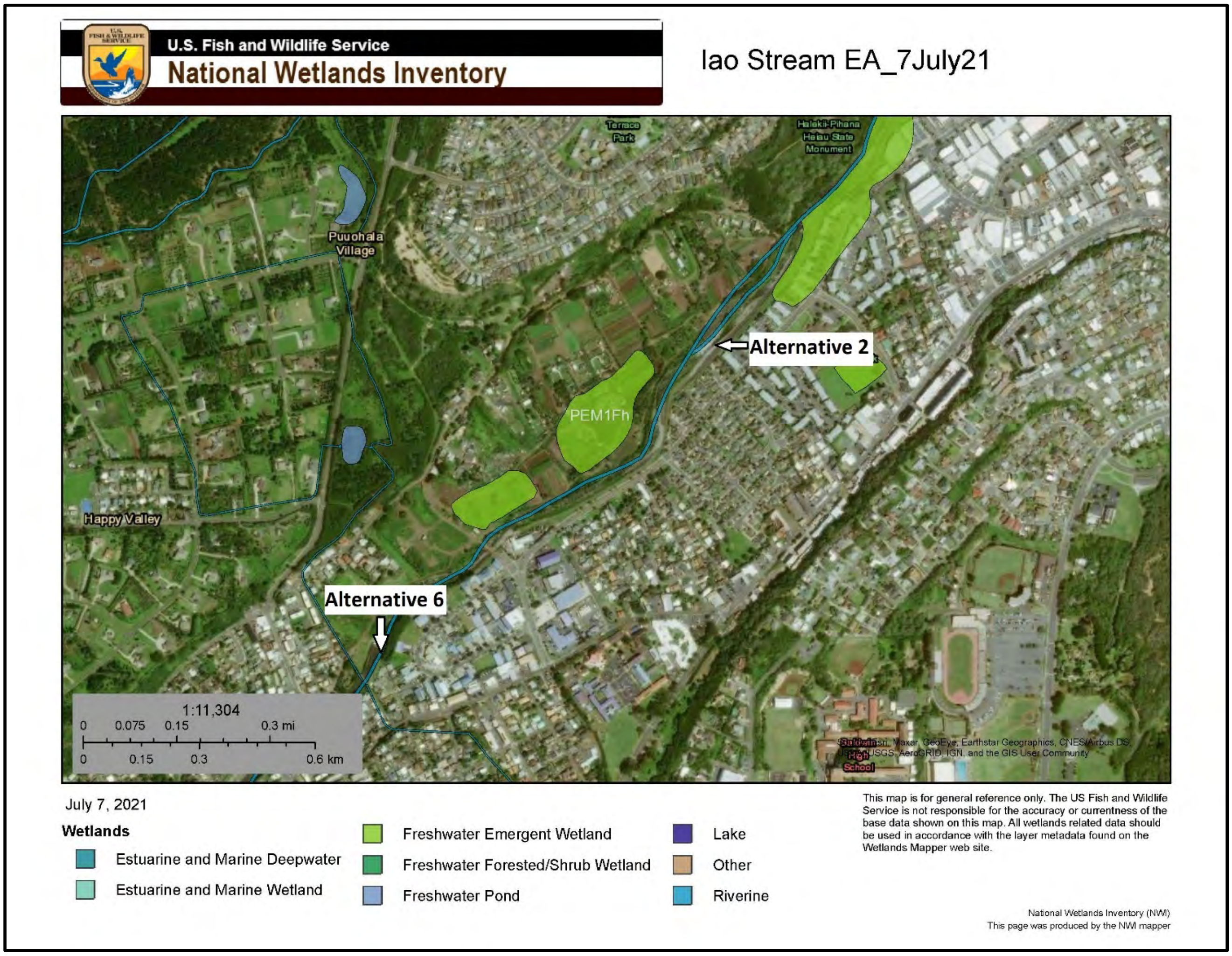

Figure 3-1. NWI Wetland in Project Area

<u>Approach to Analysis</u>

Impacts to water quality under the proposed alternative(s) were considered significant if the proposed alternative(s) would cause functional or chemical change to groundwater resources; or create significant sedimentation, pollution/runoff into surface water bodies, including any significant water body flow alteration. Impacts would be considered significant if they resulted in alteration, or incongruent development of a floodplain or wetland area. Significant impacts would occur if the proposed alternative(s) would result in non-compliance with applicable regulations and policies relating to water resources.

3.1.2 Environmental Consequences

3.1.2.1 No Action Alternative

Under the No Action Alternative, no action alternatives would be implemented and there would be continued impacts to the water quality of Wailuku River as well as nearshore waters in Kahului Bay due to continued erosion of the stream bank and channel during storm events that deposits terrigenous sediments, organic matter and other pollutants into these surface waters. Since there would be no reduction in volume of sediment deposited into stream waters, there would be no improvement to water quality in the affected aquatic environment.

3.1.2.2 Alternative 2: Remove Revetment X

Alternative 2 is expected to result in similar or less impacts to groundwater, surface water, floodplain, and wetlands as Alternative F as described in Section 3.4 Water Resources of the 2017 Final EA and incorporated by reference in this SEA. The removal of the Revetment X left bank would not result in anticipated impacts to groundwater due to the estimated depth to groundwater. Less than significant impacts to surface water would occur to slightly altered stream flow during and after construction by allowing access to the floodplain on the left bank with the removal of the revetment. In addition, a slight increase in turbidity would occur during construction; however, BMPs would be implemented to ensure that state water quality standards would be met. Alternative 2 does not propose constructed stabilization via structured reinforcement of the left bank post-removal, and instead proposes natural stabilization which may result in short-term erosion of the natural bank, until a natural homeostasis is reached. Alternative 2 would not alter the existing floodplain and would be implemented to reduce flood risk within Iao Valley. No impacts to wetlands would occur since there are no wetlands occur with the footprint of Alternative 2.

3.1.2.3 Alternative 6: Install Pre-formed Scour Hole

Impacts of Alternative 6 are similar as the impacts described in Alternative 2, anticipating short-term adverse effects during construction that will be avoided and minimized to the greatest extent practicable via application of appropriate BMPs such as sediment-erosion control measures. Long-term adverse impacts are not expected. Rather, implementation of Alternative 2 would decrease sedimentation from erosion, benefitting receiving surface waters through improved water quality.

3.1.2.4 Alternative 11: Non-structural Plan (Flood Warning System)

Alternative 11 proposes no new construction. Any stream or climate gage would be affixed to existing structures within the Iao Stream FCP and Wailuku River and any field or control center would be established in an existing building. Accordingly, Alternative 11 would have no effect on historic or cultural resources.

3.1.2.5 Alternative 12: Combination Plan (Preferred Alternative)

Impacts of the Preferred Alternative are similar to the impacts described in Alternatives 2, 6 and 11.

3.2 BIOLOGICAL RESOURCES

Definition of Resource

Biological resources include native or naturalized plants and animals and the habitats in which they occur. Sensitive biological resources are defined as those plants and animal species listed as threatened or endangered, or proposed as such, by USFWS, NMFS, the State of Hawaii Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), or Division of Aquatic Resources (DAR).

3.2.1 Existing Conditions

A more detailed description of the existing conditions at the project area can be found in the 2017 Final EA, Section 3.5 Biological Resources and is incorporated by reference. Below is a brief summary of Section 3.5 of the 2017 Final EA.

Terrestrial Flora

Riparian and terrestrial vegetation in and around the project area can be characterized as coastal dry forest and consists of at least nine plants species: Bermuda grass (*Cynodon*), bristly foxtail (*Setaria verticillata* L.), finger grass (*Chloris* L.), *kiawe* (*Prosopis pallida*), klu (*Acacia farnesiana* L.), lantana or *lakana* (*Lantana camara* L.), *koa haole* (*Leucaena leucocephala*), sand bur (*Cenchrus* L.; endemic), and natal red top (*Rhynchely trum repens* Wild.). Many of the plant species found in the project area are non-native species and most are common weedy species that have established in highly disturbed banks and sand/mud bars that form in the concrete channel.

Terrestrial Wildlife Species

Common terrestrial wildlife species observed in the vicinity of the project area include introduced species such as cats, mice, rats, and mongoose. Game animals such as wild goats, pigs, and deer have been reported to occur in the forest reserve area, a mile upstream of the project site. Typical bird species in the general project area include barr doves, lace necked doves, pheasants, Franklin partridge, Kentucky cardinal, house finch, house sparrow, mockingbird, and mynah.

Aquatic Species

Native and indigenous freshwater gobies such as *Lentipes concolor*, *Sicyopterus stimpsoni*, and *Awaous guamensis* were observed in Wailuku River (USACE, 2017). Typical estuarine fishes such as mullet (*Mugil cephalus*), aholehole (*Kuhlia xenura*), kupipi (*Abudefduf sordidus*), and dusky frillgoby (*Bathygobius fuscus*) inhabit the estuarine reach located downstream of the project area. Two endemic amphidromous mollusks, hihiwai (*Neritina granosa*) and hapawai (*Neritina vespertina*), also inhabit the estuarine reach of the stream. During the 2016 survey, numerous *oopu nakea* (*Awaous stamineus*) were observed in the FRM channel. Mr. Skippy Hau of the DLNR-DAR attended the August 26, 2021 public information meeting and described presence of invasive guppies and sword tails, and endemic hihiwai, oopu alamoo (*Lentipes concolor*) and opae.

Marine Species

The Revised Draft FWCA report (USFWS, 2006) noted the presence of coral reefs in the coastal ecosystem adjacent to the mouth of Wailuku River. The near shore coastal environment in Kahului Bay is also noted to support sport fisheries for jacks (*Carangidae*) including *Caranx melampygus* and *C. ignobilis* (called *omilu* or *ulua* as adults and *papio* as juveniles); *Selar crumenopthalmus* (called *akule* as adults and *halalu* as juveniles); and goatfish *(Mullidae*) such as *Mullodichthys vanicolensis* (called *weke* as adults and *oama* as juveniles).

Threatened & Endangered Species

As documented in the 2017 Final EA, no threatened or endangered species were observed within the project area (USACE, 2017). The project area is absent of designated critical habitat or any ESA-listed species. Based on the geographic location of the Iao Stream FCP, the following USFWS listed species could occur or be affected by certain activities in this location (USFWS, IPAC, 2021b):

- Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), endangered;
- Band-rumped Storm-petrel (*Oceanodroma castro*), endangered;
- Hawaiian Duck, Koloa, (*Anas wyvilliana*), endangered;
- Hawaiian Coot, (*Fulica americana alai*), endangered; and,
- Hawaiian Stilt (*Himantopus mexicanus knudseni*), endangered.

While marine species under NMFS jurisdiction are known to occur upwards of 1-mile upstream from the stream mouth, Iao Stream FCP downstream of the project area features drop structures that marine listed species could not traverse and therefore would not occur in the project area.

The stream channel at both Alternative 2 and 6 project areas are vegetated with non-native shrubs and grasses opportunistically growing in the boulder-lined channel bed and banks. No suitable habitat for endangered bat roosting and nesting (i.e., trees greater than 15-ft height) is present. Suitable waterfowl nesting and breeding habitat (i.e., permanent aquatic habitat featuring vegetated wetlands and mudflats) is also absent.

<u>Approach to Analysis</u>

Determination of the significance of potential impacts to biological resources is based on: 1) the importance (i.e., legal, commercial, recreation, ecological, or scientific) of the resource; 2) the proportion of the resource that would be affected relative to its occurrence in the region; 3) the sensitivity of the resource to proposed activities; and 4) the duration of ecological ramifications.

Impacts to biological resources are significant if species or habitats of concern are adversely affected over relatively large areas, or if disturbances cause reductions in population size or distribution. Potential physical impacts such as habitat loss, noise, and impacts to water quality were evaluated to assess potential impacts to biological resources.

3.2.2 Environmental Consequences

3.2.2.1 No Action Alternative

Under the No Action Alternative, none of the action alternatives would be implemented. There would be continued impacts to aquatic resources within the Federal FCP and the downstream marine ecosystem caused by sediment runoff originating from erosion of the adjacent and upstream stream banks during storm events. Biological resources within the marine habitat within the vicinity of the stream mouth would continue to be impacted from sedimentation suspended in runoff waters.

3.2.2.2 Alternative 2: Remove Revetment X

Alternative 2 is expected to result in similar or less impacts to biological resources within the project area during and after the construction of Alternative F as described in Section 3.5 Biological Resources of the 2017 Final EA and incorporated by reference in this SEA. To summarize, removal of the revetment would result in less than significant short-term impacts on biological resources within the project area during the construction period. Displaced terrestrial flora and fauna would be expected to return to the project area following completion of construction activities. In addition, during construction, applicable BMPs would be utilized to avoid and minimize impacts to biological resources. No long-term impacts to the existing biological resources within and in the vicinity of the project area are expected to occur. Since no threatened or endangered species, their designated critical habitat, or habitat suitable to support listed species occurs in the project vicinity, Alternative 2 would not affect any ESA species or their designated critical habitat. See Section 4 for documentation of ESA compliance.

3.2.2.3 Alternative 6: Install Pre-formed Scour Hole

Based on the discrete scope, implementation of appropriate BMPs, and location of the proposed design deficiency work, impacts of Alternative 6 are similar as the impacts described above for Alternative 2. In addition, implementation of Alternative 6 would decrease sedimentation of surface waters from erosion, resulting in beneficial impact to riverine aquatic species and downstream marine species in nearshore waters of Kahului Bay.

3.2.2.4 Alternative 11: Non-structural Plan (Flood Warning System)

Alternative 11 proposes no new construction and accordingly would have no effect on biological resources.

3.2.2.5 Alternative 12: Combination Plan (Preferred Alternative)

Impacts of the Preferred Alternative are similar to the impacts described in Alternatives 2, 6 and 11.

3.3 HISTORIC AND CULTURAL RESOURCES

Definition of Resource

Cultural resources represent and document activities, accomplishments, and traditions of previous civilizations, and link current and former inhabitants of an area. Depending on their conditions and historic uses, these resources may provide insight to living conditions in previous civilizations and may retain cultural and religious significance to modern groups.

Archaeological resources comprise areas where prehistoric or historic activity measurably altered the earth or deposits of physical remains (e.g., arrowheads, bottles). Architectural resources include standing buildings, districts, bridges, dams, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for inclusion in the National Register of Historic Places (NRHP), an inventory of culturally significant resources identified in the U.S.; however, more recent structures, such as Cold War-era resources, may warrant protection if they have the potential to gain significance in the future. Traditional cultural resources can include archaeological resources, structures, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Hawaiians or other groups consider essential for the persistence of traditional culture.

Regulatory Setting

Several Federal laws and regulations were established to manage cultural resources, including the National Historic Preservation Act (NHPA) of 1966, the Archaeological and Historic Preservation Act (1974), and the Archaeological Resource Protection Act (1979). In order for a cultural resource to be considered significant, it must meet one or more of the following criteria for inclusion on the NRHP:

"The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and: (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives or persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history" (CFR, Title 36, Part 60:4; 2004).

The DLNR State Historic Preservation Division (SHPD) works to preserve and sustain historical and cultural resources through three branches: History and Culture, Archaeology, and Architecture. The SHPD maintains the statewide inventory of Historic Properties and reviews development projects in order to lessen the effects of change on Hawai'i's historical and cultural assets. Administrative rules pertaining to historic preservation in Hawaii can be found in Hawaii Administrative Rules (HAR) Chapters 197-198, 275-284, and 300. Statutes pertaining to historic preservation in Hawai'i are found in Hawaii Revised Statutes (HRS) Chapter 6E.

Traditional cultural practices acknowledged in the State of Hawaii include rights of access and gathering. Traditional gathering rights have been codified in HRS 1-1 and 7-1, Article 12-7 of the Constitution of the State of Hawaii and affirmed in various legal decisions. In order to exercise traditional gathering rights in the State of Hawai'i, an individual must establish the following: he/she must qualify as "native Hawaiian"; he/she must establish that their claimed right is protected as a customary or traditional native Hawaiian practice; AND he/she must prove that the exercise of that right will occur on undeveloped or "less than fully developed property" (SOEST, 2021).

Articles IX and XII of the State Constitution of Hawaii (Chapter 343, HRS) require government agencies to promote and preserve cultural beliefs, practices, and resources of native Hawaiian and other ethnic groups. The "Guidelines for Assessing Cultural Impacts," adopted by the Environmental Council of the State of Hawaii (1997), identifies the protocol for conducting cultural assessments.

3.3.1 Existing Conditions

Regional and Local History

The 2017 Final EA, Section 3.2 Historical and Cultural Resources, provides detailed description of existing historic and cultural resources. A summary of that description is provided herein. During the pre-Contact and early post-Contact periods, Iao Valley and the greater Wailuku area was a political and ceremonial center (USACE, 2017). Land Commission Awards granted in the mid-nineteenth century in lower Iao Valley indicate a substantial population was once present in the area and that the land was agriculturally very important.

Background research on land use history indicates that the project area contained *loi* (taro) patches during the pre-Contact and early historic periods. Over a century of sugarcane farming in the area impacted remnant evidence of traditional *loi* and associated pre-Contact or early historic sites. The potential for encountering human burials or habitation sites is considered low due to previous disturbance by sugarcane agriculture, in addition to natural events that altered the landscape, such as the flood of 1916. Potential for other pre-contact or early historic features associated with traditional agriculture is also considered low. However, if such features are extant in subsurface layers, they may be evidenced by stone and earthen terraces, alignments, walls, and *auwai*. Associated artifacts may include lithic artifacts such as basalt cores, adzes, flakes, or poi pounders.

Based on historic information, the project area may contain evidence of temporary, small scale habitations associated with *loi* or sugarcane fields. Evidence of traditional camps may be lithic artifacts (adzes, flakes, etc.), faunal remains, and charcoal associated with imu (traditional underground oven). Historic period camp sites may additionally include historic artifacts (metal, ceramic, and glass assemblages).

<u>Archaeology</u>

Numerous archaeological investigations have been conducted in Iao Valley. Previous work includes archaeological assessments, archaeological surface survey, archaeological inventory survey, archaeological subsurface testing, and archaeological monitoring (USACE, 2017). A few of these projects were carried out within or near the current project area. The following list itemizes projects conducted in the immediate vicinity of the project area and the survey results. A detailed summary of each project and description of the survey results is provided in the 2017 Final EA.

- In 1998, Scientific Consulting Services, Inc. (SCS) conducted an Archaeological reconnaissance surveys with subsurface testing, for the Iao Stream FCP. The reconnaissance surveys revealed only one site, (State Inventory of Historic Places) SIHP No. 50-50-04-475 located in the vicinity, but outside of the current USACE area of potential effect (APE).
- An archaeological inventory survey (AIS) was carried out in 2004 by SCS for the proposed Imi Kala Street and Neki Place Extensions (USACE, 2017). The AIS revealed SIHP No. 50-50-04-1508, 50-50-04-5564, 50-50-04-5565 and 50-50-04-5566, all located in the vicinity, but outside of the current USACE APE. No other traditional archaeological sites or features were identified.
- An AIS was conducted by Pacific Consulting Services, Inc. in May 2014. The subsurface survey revealed no SIHP sites within the current USACE APE.
- An oral history survey was conducted in November of 2003 by Social Research Pacific, Inc., to obtain information regarding properties of cultural and historical significance and incorporated in a Cultural Impact Assessment (CIA) in accordance with National Park Service guidance (USACE, 2017). Based on the research and interviews incorporated into the CIA, there are no known traditional cultural properties within the current USACE APE, and traditional land uses of the project area have been discontinued.

<u>Section 106 Coordination and Consultation</u>

USACE has pursued several undertakings at the Iao Stream FCP. A detailed history of past Section 106 consultations is provided in the 2017 Final EA. USACE consulted SHPD and the following Native Hawaiian Organizations: 1) the Central Maui Hawaiian Civic Club, 2) Hui Malama I Na Kupuna O Hawaii Nei, and 3) the Office of Hawaiian

Affairs in December 2016 as documented in the 2017 Final EA. USACE Section 106 consultation related to the currently proposed undertaking and since the 2017 Final EA is based on the environmental consequences documented below and requiring USACE to consult with the SHPD and other consulting parties. By letter dated August 26, 2021 USACE initiated Section 106 consultation with SHPD the County of Maui Archaeologist and the following NHOs: 1) the Central Maui Hawaiian Civic Club, 2) Aha Moku Council, 3) Hui O Na Wai Eha, and 4) the Office of Hawaiian Affairs, seeking concurrence on the USACE's "No Historic Properties Affected" determination pursuant to pursuant to 36 CFR 800.4(d)(1).

USACE received concurrence from the SHPD by letter dated September 29, 2021 on its effect determination, satisfying the USACE statutory requirement under Section 106 of the NHPA. No other consulting party provided response within 30 days of the USACE request for Section 106 consultation. Hui O Na Wai Eha attended the August 26, 2021 public information meeting and provided comment to the draft SEA by letter dated September 5, 2021. Evaluation of comments from Hui O Na Wai Eha have been incorporated into this final SEA in Appendix A.

<u>Historic/Cultural Resources</u>

A total of 31 properties and historic districts are listed on the National Register of Historic Places (NRHP) for Maui County. Of the 31 listed properties, two (Iao Theater and Waialae Bridge) are located outside of, but within 0.5 miles of the APE.

A total of 64 properties and historic districts are listed on the Hawaii Register of Historic Places for Maui County. Three (Iao Theater, Waialae Bridge and Naniloa Drive Overpass Bridge) of the 64 properties are located outside of, but within 0.5 miles of the APE.

3.3.2 Environmental Consequences

3.3.2.1 No Action Alternative

Under the No Action Alternative, USACE would not pursue any undertaking. Further deterioration of structural elements of the Iao Stream FCP are anticipated. USACE would propose future undertaking(s) to address structural damage(s) on an as-needed basis and to maintain the authorized level of flood protection for the Wailuku community. Future undertaking(s) would necessitate future consultation(s) pursuant to Section 106.

3.3.2.2 Alternative 2: Remove Revetment X

Revetment X is a constructed component of the Iao Stream FCP and is located in the middle of the dynamic Iao Stream, where presence of any cultural resource remains is highly unexpected. The historic natural stream was artificially straightened and constricted to its current alignment by USACE. Any subsurface historic or cultural resources are expected to have been impacted at that time, if they existed. Any cultural resource remnants contained in its entirety within the stream bed in its past or current alignment would have been washed away by stream flows including flooding events through the years. No cultural item is expected to withstand the constant barrage from such high velocity/energy flows. Hence, no cultural resources are expected to exist within the APE or be impacted by this alternative.

A detailed discussion regarding impacts to historic and cultural resources from the former “Alternative F” was previously documented in the 2017 Final EA. USACE concluded that Alternative F would not affect historic properties. The proposed Alternative 2, a component of the former Alternative F, is expected to similarly have no effect on historic or cultural resources.

3.3.2.3 Alternative 6: Install Pre-formed Scour Hole

The undertaking proposed under Alternative 6 is similar in nature to the undertaking proposed under Alternative 2, involving actions to address design deficiencies at existing structural elements of the Iao Stream FCP. Proposed actions to the lined and unlined portions of the channel bed at its transition in the Iao Stream FCP would encounter previously, extensively modified subgrade during excavation occurring wholly within the stream channel. Similar to Alterative 2, the presence of any cultural remains in the stream channel is highly unlikely. The proposed reinforcement of the stream bed would be predominately subgrade, with a buried toe, and the surface work would not introduce new visual elements that would change substantively from the existing condition. The proposed impacts to the stream bed are to be consistent with the upstream lined stream bed. USACE anticipates no cultural or historic properties to occur within or be affected by the proposed undertaking. Alternative 6 would have no impact on historic or cultural resources.

3.3.2.4 Alternative 11: Non-structural Plan (Flood Warning System)

Alternative 11 proposes no new construction. Any stream or climate gage would be affixed to existing structures within the Iao Stream FCP and Wailuku River, and any field or control center would be established in an existing building. Accordingly, Alternative 11 would not have the potential to cause effect on historic or cultural resources.

3.3.2.5 Alternative 12: Combination Plan (Preferred Alternative)

Alternative 12 consists of a combination of Alternatives 2, 6 and 11, above. Note the undertakings at Alternative 2, 6 and 11 are hydraulically and geographically disjointed. Similar to Alternatives 2, 6, and 11 individually, USACE anticipates the preferred Alternative 12 (undertaking) would have no impact on historic or cultural resources.

3.4 Other Actions

Per 40 CFR 1508.1(g), effects or impacts are changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives, including those effects that occur at the same time and place as the proposed action or alternatives and may include effects that are later in time or farther removed in distance from the proposed action or alternatives.

Past Actions

Construction of the original Iao Stream FCP was completed in 1981. The constructed FCP has successfully prevented an estimated $51 million in flood damages (as of 2021). However, since completion, several large storm events caused structural damage and highlighted structural vulnerabilities requiring various repair and reinforcement actions as described in Section 1.2.3 and subsequently changing the stream dynamic. Numerous activities occurred within the streambed during the past 30 years, including ongoing upstream water diversion for agricultural uses, changes in the streambed dynamic due to natural processes, and upstream watershed use/development. Rapid expansion of urban development, particularly within the lower watershed, as well as agricultural expansion throughout the watershed have most likely caused extensive changes in the current dynamic of the Iao stream as compared to conditions at the time of the original construction of the FRM structures.

Present Actions

To the knowledge of USACE, no major public infrastructure or development projects are presently occurring within proximity to the project area. There are various small private residential construction and renovation projects ongoing within the surrounding residential, commercial, and agricultural parcels. These projects are subject to Maui County zoning and permitting regulations, including the Maui County Rules for the Design of Storm Water Treatment Best Management Practices (Maui County, 2021a). As a result, these projects would not represent significant incremental impacts that would contribute to significant cumulative impacts.

Reasonably Foreseeable Future Actions

The proposed action involves rehabilitation and modification of existing FCP structural components intended to address current erosion and reduce future OMRR&R beyond the anticipated maintenance activities normally pursued by the NFS under the Local Cooperation Agreement. No additional concrete channel lining (i.e., hardening) or change in the alignment of the stream is proposed under the USACE proposed action; therefore, no changes to the dynamics of Wailuku River, in addition to those caused by the construction of flood control structures in the past, are anticipated. While the proposed action is not expected to cause deterioration of stream functions or structural components of the Federal FCP, it can be reasonably presumed that other large storms or natural events may occur that could affect stream dynamics and/or damage structural components of the FCP that would require structural repair or modification either by the County under normal OMRR&R or by USACE to restore project function. No such future repairs by USACE are identified at this time; however, structural repairs in response to changes in stream dynamics or structural damage is reasonably foreseeable.

Maui County is concurrently and independently pursuing two proposed projects in the vicinity of the project area that USACE considers reasonably foreseeable future actions. Both projects are addressing bank erosion along the Wailuku River within the Iao Stream FCP and currently going through the Hawaii Revised Statutes Chapter 343 process with the public release of draft environmental assessments; however, no Federal, State, or local permits have been obtained to date. Pursuant to USACE statutory authority at 33 USC 408, USACE must review and approve the County's proposed modifications to the Iao Stream FCP to ensure the proposed modifications will not be injurious to the public interest or impair its usefulness.

The County's Iao Stream Levee 27 Repair project proposes an approximately 240 ft long repair to the right bank of the Wailuku River, located downstream of Imi Kala Street bridge and upstream of the Iao Stream FCP Levee 27. This proposed project would be approximately 1,290 ft downstream of Alternative 6 and approximately 2,390 ft upstream of Alternative 2. The County completed emergency repairs to this section of the Wailuku River right bank in response to a heavy precipitation event in September 2016. To reinforce the bank protection, the County proposes to remove and grade the existing concrete boulder fill slope, extending the grouted rip rap slope subgrade and reinforcing the toe of the slope with dumped rip rap. The proposal would reinforce existing hardened structures. According to the County's Draft EA, construction would occur in the spring of 2022 during the dry season, taking 6-8 months to complete (Maui County, 2021b).

The Wailuku Bank Stabilization project is the County's other proposed project (Maui County, 2021c) that involves excavation, regrading, and reinforcement of the right bank of and within the Wailuku River near the Wailuku Millyard light industrial subdivision. This proposed project would be approximately 830 ft downstream of Alternative 6 and approximately 2,880 ft upstream of Alternative 2. The right bank slope at this location has eroded. To address current erosion and prevent further imminent bank failure, the County proposes to harden the right bank slope with grouted riprap. In addition, large boulders would be placed at the toe of the lined slope and a boulder filled concrete key will be excavated and installed to protect the constructed toe.

Both County projects and USACE's proposed modifications to the existing Iao Stream FCP have preliminarily concluded less than significant impacts pursuant to HRS Chapter 343 and NEPA, respectively. Likewise, the three projects are expected to result in less than significant impacts when considered in combination. Each of the three proposed modifications addresses discrete erosion damage and would restore structural function within each discrete location. In other words, the three concurrent actions are independent: the success of any one modification will not determine the success or continued pursuit of the others. All three actions would result in relatively similar short-term construction related impacts designed to provide long-term structural rehabilitation and would, most likely, be constructed in a staggered timeframe with Iao Stream Levee 27 Repair in 2022, Wailuku Bank Stabilization in 2023, at the earliest, followed by the proposed action, pending Federal approval and funding. USACE expects that standard BMPs would be required and implemented by all three projects to avoid and minimize any impacts to environmental resources of the Wailuku River and surrounding area.

SECTION 4 - COMPLIANCE WITH APPLICABLE ENVIRONMENTAL LAWS AND REGULATIONS

4.1 National Environmental Policy Act

The NEPA (42 U.S.C. §4321 et seq.) commits Federal agencies to considering, documenting, and publicly disclosing the environmental effects of their actions. This SEA, prepared July 2021 is intended to achieve NEPA compliance for the proposed project. As required by NEPA, this SEA describes existing environmental conditions at the project area, the proposed action and alternatives, potential environmental impacts of the proposed project, and measures to minimize environmental impacts. Before preparing the draft SEA, USACE posted a Public Notice for a 30-day public review period, May 17 to June 23, 2021, soliciting initial comments on the proposed action alternatives. The 30-day public comment period, August 12 to September 13, 2021 on the draft SEA provided disclosure of the environmental effects of the alternatives to the public and solicits comments for USACE consideration and incorporation into the final SEA.

4.2 Endangered Species Act

The ESA established a national program for the conservation of threatened and endangered fish, wildlife and plants and the habitat upon which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the USFWS and NMFS, the Services, as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their critical habitats. Section 7(c) of the ESA and the Federal regulations on endangered species coordination (50 CFR §402.12) require that Federal agencies prepare biological assessments of the potential effects of major actions on listed species and critical habitat. USFWS has jurisdiction over endangered and threatened terrestrial flora, fauna, and birds in the State of Hawaii. The National Oceanic and Atmospheric Administration (NOAA), through the NMFS, has jurisdiction over marine mammals, turtles (while in water), fish, and coral species.

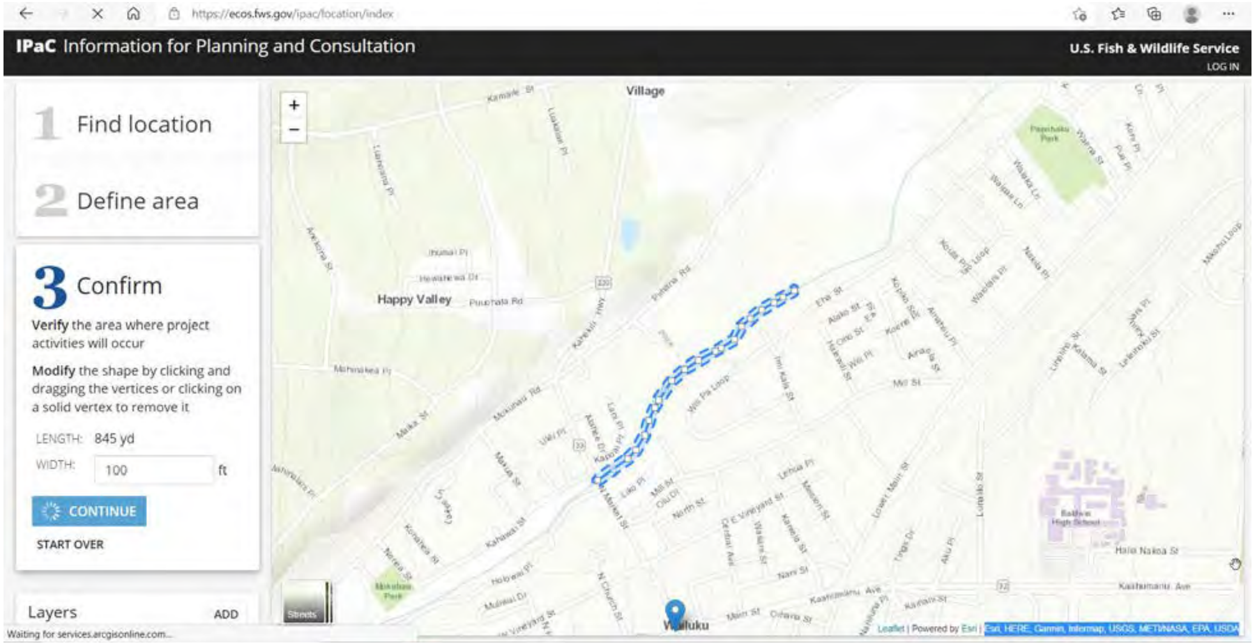

Figure 4-1 ESA Action Area

The Preferred Alternative proposes discrete actions to address design deficiencies at existing structures within the confines of the Iao Stream FCP. The ESA Action area includes the stream channel from top of bank to top of bank and along the length of the proposed work at Alternatives 2 and 6 and proximal existing maintenance accessways. The downstream end of the ESA Action area is approximately 1 mile inland of the shoreline. Based on the geographic location of the ESA Action area, the following listed species could either occur or be affected by certain activities in this location (USFWS, IPAC, 2021b):

- Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), endangered;
- Band-rumped Storm-petrel (*Oceanodroma castro*), endangered;
- Hawaiian Duck, Koloa, (*Anas wyvilliana*), endangered;
- Hawaiian Coot, (*Fulica americana alai*), endangered; and,
- Hawaiian Stilt (*Himantopus mexicanus knudseni*), endangered.

These species are within USFWS jurisdiction. The ESA action area is absent of listed marine species under NMFS jurisdiction. Designated critical habitat and Federally listed species are not present in the ESA Action Area.

The stream channel at both Alternatives 2 and 6 project areas are vegetated with non-native shrubs and grasses opportunistically growing in the boulder-lined channel bed and banks. No suitable habitat for endangered bat roosting and nesting (i.e., trees greater than 15-ft height) is present. Suitable waterfowl nesting and breeding habitat (i.e., permanent aquatic habitat, including vegetated wetlands and mudflats) is also absent. USACE anticipates the contractor would complete the work during daytime hours, not requiring artificial lighting.

Since no threatened or endangered species, their designated critical habitat, or habitat suitable to support listed species occurs in the project vicinity, Alternative 2 would have no effect on any ESA species or their designated critical habitat within the ESA Action Area. USACE has concluded a no effect determination for the proposed action; consultation with the Services under Section 7 of the ESA is not required and USACE has met its statutory requirement under the ESA for the proposed Federal action.

4.3 National Historic Preservation Act

The NHPA of 1966 as amended directs Federal agencies to assume responsibility for all cultural resources under their jurisdiction. Section 106 of NHPA requires agencies to consider the potential effect of their actions on properties that are listed, or are eligible for listing, on the NRHP. The NHPA implementing regulations, 36 CFR Part 800, requires that the Federal agency consult with the State Historic Preservation Officer (SHPO), Tribes and interested parties to ensure that all historic properties are adequately identified, evaluated and considered in planning for proposed undertakings.

The undertaking consists of a combination of Alternatives 2, 6, and 11 to the existing Iao Stream FCP: a) removal of existing revetment X left bank; b) installation of the pre-formed scour hole within the existing Iao Stream FCP; and c) a flood warning system. The actions in Alternative 2 and 6 would be performed entirely within the existing channel flow confines and both locations will comprise the APE for the project. Because of the constant stream flow, it is very unlikely that any cultural resources will be present in either APE. Alternative 11 proposes no new construction.

USACE determined the proposed undertaking would have no effect to historic properties and cultural resources and requested concurrence from the State Historic Preservation Division (SHPD) on its No Historic Properties Affected determination made pursuant to 36 CFR 800.4(d)(1) by letter dated August 26, 2021. USACE anticipates minor refinement during the design phase. Should the refinements proposed in the design phase modify either or both the undertaking and the APE, then USACE will evaluate the modification to determine if Section 106 consultation is warranted.

USACE received concurrence from the SHPD by letter dated September 29, 2021 on its No Historic Properties Affected determination, satisfying the USACE statutory requirement under Section 106 of the NHPA (Appendix E). No other consulting party provided response within 30 days of the USACE request for Section 106 consultation.

4.4 Clean Water Act

The Clean Water Act (CWA) of 1972 establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Section 401 of the Federal Clean Water Act requires that any Federal activity that may result in a discharge of dredged or fill material to waters of the U.S. must first receive a water quality certification from the state in which the activity would occur. Discharge of pollutants into surface waters of the U.S. are controlled under the National Pollutant Discharge Elimination System (NPDES) program, pursuant to

Section 402 of the Clean Water Act. Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into waters of the United States.

Section 401. Under Section 401 of the CWA, an activity involving a discharge into waters of the U.S. authorized by a Federal permit or license, or construction actions being undertaken by a Federal action must receive a water quality certification (WQC) from the affected certifying agency or tribe. The issuance of a certification means that the activity will comply with the water quality standards and any established effluent limitations of the certifying agency or tribe. Thus, fill activities that are not exempt from Section 404 require Section 401 certification from the state, EPA, or a 401 certification-authorized tribe.

For projects in the State of Hawaii, DOH is the certifying agency. Since the proposed project may generate discharges to State waters during construction of the Federal action, a Section 401 WQC would be required prior to the start of construction. The feasibility level of conceptual design is inadequate to identify and describe all proposed discharges with sufficient detail to apply for and obtain a Section 401 WQC at this point. USACE proposes to apply for and obtain a Section 401 WQC from the DOH during the environmental permitting process of the Pre-construction, Engineering, and Design Phase. The conditions of any future Section 401 WQC issued for the proposed action would become specifications of any construction contract.

On April 19, 2021, USACE hosted a coordination meeting with DOH, State of Hawaii Office of Planning, and USFWS regarding Section 401, CZMA, ESA and FWCA compliance. On September 7, 2021, USACE requested from DOH a letter of confirmation acknowledging USACE's coordination on this project with DOH, DOH's potential preliminary findings, if available, and acknowledgement of USACE's plans to obtain a WQC at a later date, prior to implementation of the project. USACE received the letter of confirmation from DOH, dated September 9, 2021 (Appendix C).

Section 402. Discharge of pollutants into surface waters of the U.S. are controlled under the NPDES program, pursuant to Section 402 of the Clean Water Act. This program is administered by the DOH under HAR Title 11, Chapter 55 Water Pollution Control (October 29, 1992). This chapter requires submission of a NPDES application or a Notice of Intent (NOI) for NPDES General Permit coverage, for discharges of regulated pollutants, or for substantially altering the quality of any discharge, or for substantially increasing the quantity of discharge. The NPDES program requires construction site operators to obtain coverage under a NPDES permit for clearing, grading, and excavating activities that disturb an area of 1 acre or more to prevent any discharges associated with construction activities from entering the stream. The preferred alternative may involve cumulative disturbance to an area greater than 1 acre, requiring USACE to obtain a NPDES permit from DOH prior to the start of construction activities. The NPDES permit application process would be initiated during the design phase of the project when sufficient information regarding construction sequence, means and methods, etc. is available.

Section 404. Components of the preferred alternative would involve activities that could result in the discharge of fill and/or dredged material into waters of the U.S. as regulated under Section 404 of the CWA and subject to the provisions of Section 404 (b)(1) of the CWA. The Honolulu District Civil and Public Works Branch discussed the preferred alternative with the Regulatory Branch and determined the following: 1) Alternative 2, Remove Revetment X does not propose any discharge of fill material and does not require authorization under Section 404, 2) Alternative 6, Install Pre-Formed Scour Hole proposes discharges beyond the original fill footprint that are regulated under Section 404, and 3) Alternative 11, the non-structural flood warning system does not propose any discharges regulated under Section 404.

Alternative 6 involves installation of a pre-formed scour hole that would rehabilitate the transition from the existing lined channel invert to unlined channel invert by removal of the existing grade, excavation and construction of a buried toe with restoration of the lined channel invert would result in the discharge of fill material into the Wailuku River within and greater than the original fill footprint necessary to bring the structure to current engineering standards. The proposed discharges meet the terms and conditions of Nationwide Permit (NWP) #3, Maintenance, for repair, rehabilitation, or replacement of any previously authorized, currently serviceable structure or fill including minor deviations in the structure's configuration or filled area to meet current construction codes. The public comment period of this SEA and the District Commander signing the FONSI satisfies the pre-construction notification condition for NWP #3. In addition, all applicable general and regional conditions regarding construction and BMPs necessary to ensure compliance with NWP #3 will be incorporated into the contract specifications to be implemented by the construction contractor. USACE has reviewed the 404(b)(1) analysis completed in association with the issuance the Regulatory Program's NWPs in 2017 and expiring in 2022 and determined the proposed discharges meeting the terms and conditions of NWP#3 are consistent with the subject 404(b)(1) analysis. Accordingly, USACE references the analysis completed in 2017 for NWP#3 as documentation of the 404(b)(1) analysis for the proposed action.

Construction detail is limited in this phase of the planning process. The determinations regarding Section 404 above are based on information known at this time. Additional construction detail formulated in the design and construction phase will be evaluated at that time to identify any additional regulated discharges and ensure compliance of those discharges with the CWA.

4.5 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972, as amended (16 U.S.C. 1451 et seq.), is administered in Hawaii by the State Office of Planning, CZM Office. Pursuant to Section 307 of the CZMA, Federal agency activities that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone (also referred to as coastal uses or resources and coastal effects) must be consistent to the maximum extent practicable with the enforceable policies of a State's Federally approved coastal management program.

The entire State of Hawaii is generally regarded as located within the coastal zone. The CZM program objectives and policies are to provide coastal recreational opportunities; preserve and protect historic, scenic and coastal ecosystem resources; provide economic uses; reduce coastal hazards; improve public awareness in coastal zone management; and manage development within the coastal zone.

USACE previously determined that Alternative 2, Removal of Revetment X, is consistent to the maximum extent practicable with the State CZM program policies and objectives as a component of Alternative F of the 2017 Final EA and received Federal consistency concurrence from the State CZM Office by letter dated June 2, 2017.

USACE has determined that Alternative 6, Install Pre-formed Scour Hole, of the Preferred Alternative, also is consistent to the maximum extent practicable with the State CZM program policies and objectives. USACE submitted its application, assessment form with substantiating documentation and request for Federal consistency review to the State CZM Office on July 26, 2021. On September 14, 2021, the State CZM Office provided USACE comments from their public review process to address. USACE submitted to the State CZM Office responses to those comment on September 24, 2021. The State CZM Office conditionally concurred with USACE's Federal consistency determination on September 28, 2021, requiring submission of additional information during the design phase and prior to construction. By email dated September 30, 2021, USACE accepted all conditions of the State conditional concurrence, satisfying the statutory requirements under Section 307 of the CZMA for the proposed action. USACE will continue to coordinate requested additional information with the State CZM Office in the design phase and prior to construction.

4.6 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC 703-712) makes it illegal for anyone to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof except under the terms of a valid permit issued pursuant to Federal regulations. The migratory bird species protected by the Act are listed in 50 CFR 10.13. Since the preferred alternative would only include limited short-term disturbance of the affected environment during the construction period, and since close coordination with the USFWS would assure that the preferred alternative would not result in significant impacts to any migratory bird habitat, the preferred alternative would comply with the provisions of the MBTA.

4.7 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) of 1934, as amended (16 U.S.C. §§ 661–667e), provides authority for USFWS and NMFS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other development project features. It requires Federal agencies that construct, license, or permit water resource development projects to consult with the USFWS, NMFS, and state resource agencies regarding the impacts on fish and wildlife resources and measures to mitigate these impacts when waters of any stream or other body of water are “proposed . . . to be impounded, diverted . . . or . . . otherwise controlled or modified . . .”

USACE will not pursue further coordination with the services on Alternative 12, which combines the actions under Alternatives 2, 6 and 11 based on the following FWCA coordination history: A Planning Aid Letter was issued dated April 22, 2014 for Alternative F of the 2017 Final EA, which includes Alternative 2 of this SEA and can be found in Appendix F of the 2017 Final EA, documenting Alternative 2 compliance with the FWCA. With regard to Alternative 6 of the Preferred Alternative, USACE proposes discrete actions (e.g., maintenance of structural components of an existing Federal project); therefore, in accordance with the USFWS’ Water Resources Development under the Fish and Wildlife Coordination Act dated November 2004, FWCA is not applicable. No FWCA coordination is required for Alternative 6. Alternative 11 does not propose to control or modify a body of water. Likewise, FWCA is not applicable; no FWCA coordination is required for Alternative 11.

4.8 Magnuson-Stevens Fishery Conservation and Management Act

Section 305(b)(2)of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) mandates that federal agencies prepare an essential fish habitat (EFH) assessment to inform consultation with NOAA Fisheries regarding any of their actions authorized, funded, or undertaken that may adversely affect EFH. The Preferred Alternative is located within Wailuku River waters and stream bank; approximately 1.0 and 1.7 miles upstream from the river mouth. Even though EFH is located downstream from the project site at the mouth river and extending out into the ocean, no EFH within or adjacent to the proposed project area occurs. No adverse effects on EFH are expected as a result of implementing the preferred alternative since the project site would approximately one mile upstream and during construction, standard BMPs would be implemented to comply with State Water Quality standards. Therefore, EFH consultation is not required.

4.9 Farmland Protection Policy Act

The purpose of the Farmland Protection Policy Act (FPPA) (7 U.S.C. 4201 et seq., implementing regulations 7 CFR Part 658, of the Agriculture and Food Act of 1981, as amended) “is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland tononagricultural uses, and to assure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with State, unit of local government, and private programs and policies to protect farmland." The preferred alternative does not include any activities, including new construction or acquisition of undeveloped land, which could potentially convert one land use to another. Land use within the affected area would remain unchanged; therefore, the preferred alternative is in compliance with the FPPA.

4.10 Executive Order 11988 – Floodplain Management

This EO requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

The preferred alternative consists of removing a damaged revetment and installing pre-formed scour hole to correct a design deficiency. These actions would address existing erosion and prevent future, imminent erosion, thereby reducing downstream erosion and risk to community safety. In addition, these actions would not change the current land use and would not likely induce development. Therefore, the preferred alternative would be in compliance with EO 11988.

4.11 Executive Order 11990 – Protection of Wetlands

EO 11990 states that each Federal agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for: 1) acquiring, managing, and disposing of Federal lands and facilities; 2) providing Federally undertaken, financed, or assisted construction and improvements; and 3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. According to the USFWS National Wetlands Inventory accessed on June 21, 2021, no wetlands are present at the project site; however, potential pockets of wetlands are present between Alternatives 2 and 6. This SEA assesses impacts on wetlands in Section 3.2 and has determined the impacts would be negligible.

4.12 Executive Order 12898 – Environmental Justice (EJ) in Minority Populations and Low-Income Populations

EO 12898 states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health orenvironmental impacts of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Northern Mariana Islands."

An evaluation of the Wailuku Community population and demographics is provided in Section 3.3.1 of the EDRA and is incorporated by reference. According to the EPA EJ

Screening Tool, 85% of the Wailuku Community residing within a 1-mile radius of the review area is represented by minority populations, 27% is represented by low-income population. The Wailuku Community ranks within the 53rd and 66th percentile in the state for minority populations and low-income populations, respectively.

USACE maintains the conclusion of the 2017 Final EA evaluation of EO 12898 that no impacts would be expected due to demographics of the project area which do not comprise disproportionately high concentrations of minority or low-income populations. Such conclusions remain applicable to all components of the preferred Alternative 12, both individually and in combination. The preferred alternative would address design deficiencies to an existing FRM project that would not result in any unacceptable human health or environmental impacts to either the general population at large or specifically to minority populations or low-income populations of the Wailuku Community.

4.13 Executive Order 13045 – Protection of Children from Environmental Health and Safety Risks

EO 13045 applies to economically significant rules under EO 12866 that concern an environmental health or safety risk that EPA has reason to believe may disproportionately affect children. Environmental health risks or safety risks refer to risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest (such as the air we breathe, the food we eat, the water we drink or use for recreation, the soil we live on, and the products we use or are exposed to). During the construction period of the Preferred Alternative, access to the construction site would be restricted to the general public as a safety measure. Further, no locations of concentration of children (e.g., schools, playgrounds, daycare centers) are located near the project area; therefore, the preferred alternative is not expected to disproportionately affect the health and safety of children.

4.14 Executive Order 13089 – Protection of Coral Reefs

EO 13089 states that "all Federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) use their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund or carry out will not degrade the conditions of such ecosystems."

The preferred alternative consists of removing a damaged revetment and installing pre-formed scour hole and a stream gage. These actions would reduce the risk of further erosion, potentially improving water quality. Improved water clarity and reduced sedimentation would have positive impacts on the coral species as well as the marine invertebrate species supported by the coral reef.

There would be no projected significant impacts to coral reef ecosystems under the Preferred Alternative since the construction activities would adhere to applicable BMPs and regulations, such as the CWA. Therefore, since the preferred alternative may enhance the conditions of coral reef ecosystems, its implementation would be compliant with EO 13089.

SECTION 5 - REFERENCES

State of Hawaii Department of Health (DOH), 2020. 2020 State of Hawaii Water Quality Monitoring and Assessment Report: Integrated Report to the U.S. Environmental Protection Agency and the U.S. Congress Pursuant to §303(D) and §305(B), Clean Water Act (P.L. 97-117). July 30, 2020.

Federal Emergency Management Agency (FEMA), 2009a. Flood Insurance Rate Map No. 1500030383E. Maui County, Hawaii. Accessed July 7, 2021. <https://msc.fema.gov >

FEMA, 2009b. Flood Insurance Rate Map No. 1500030391E. Maui County, Hawaii. Accessed July 7, 2021. https://msc.fema.gov

Maui County, 2021a. Maui County Rules for the Design of Storm Water Treatment Best Management Practices. Accessed August 2021.

Maui County, 2021b. Draft Environmental Assessment for the Iao Stream Levee 27 Repair, Wailuku, Island of Maui, Hawaii. August 2021. Accessed at: http://oeqc2.doh.hawaii.gov/Doc_Library/2021-08-08-MA-DEA-Iao-Stream-Levee-27-Repair.pdf

Maui County, 2021c. Draft Environmental Assessment for the Wailuku Bank Stabilization, Wailuku, Maui, Hawaii. June 2021. Accessed at: http://oeqc2.doh.hawaii.gov/Doc_Library/2021-07-08-MA-DEA-Wailuku-River-Bank-Stabilization-Project.pdf

School of Ocean and Earth Science and Technology (SOEST), 2021. Traditional Gathering Rights. Accessed July 2021. <http://seagrant.soest.hawaii.edu/traditional-gathering-rights>

US Army Corps of Engineers (USACE), 1975. Final Environmental Statement, Flood Control and Allied Purposes, Iao Stream, Maui, Hawaii. April.

USACE, 1976. Design Memorandum No. 2, General Design Memorandum, Phase II – Project Design, Flood Control & Allied Purposes, Iao Stream, Wailuku, Maui, Hawaii.

USACE, 2017. Final Environmental Assessment for the Modification to the Iao Stream Flood Control Project, Iao Stream, Wailuku, Maui, Hawaii.

USFWS, 2006. Revised Draft Fish and Wildlife Coordination Act Report for the Iao Stream Flood Control Project, Maui, Hawaii. U.S. Department of the Interior. November. Prepared for U.S. Army Corps of Engineers, Pacific Ocean Division, Honolulu Engineering District.

USFWS, 2021a. National Wetlands Inventory. Accessed July 7, 2021. <http://www.fws.gov/wetlands/Data/Mapper.html>

USFWS, 2021b. IPaC Information for Planning and Consultation Website. Accessed July 21, 2021. < IPaC: Getting Started - Draw on Map (fws.gov)>

SECTION 6 - APPENDICES

Appendix A – Public Involvement

Appendix B – Finding of No Significant Impact

Appendix C – Clean Water Act

Appendix D – Coastal Zone Management Act

Appendix E – Historic & Cultural Resources

Appendix A

Public Involvement

- Public Notice of Preparation of an Environmental Assessment, May 17, 2021

- Public Notice of Availability of Draft Engineering Documentation Report and Draft Environmental Assessment for Review, August 12, 2021

- Responses to Public Comments

- Comment Letters

    - County of Maui (Mayor and Planning Department)
    - Hui o Nā Wai ‘Ehā

Public Notice of Preparation of an Environmental Assessment, May 17, 2021

US Army Corps of Engineers
Honolulu District
BUILDING STRONG®

Public Notice of Preparation of an Environmental Assessment

Civil and Public Works Branch
Building 230
Fort Shafter, Hawaii 96858-5440

Public Notice Date: May 17, 2021
Expiration Date: 30 days
Corps Project: **Iao Stream Flood Control Project**

Interested parties are hereby notified that the Honolulu District, U.S. Army Corps of Engineers (Corps) is preparing a Supplemental Environmental Assessment (EA) to assess the significance of the potential impacts of the proposed action on the quality of the human environment in accordance with the Council on Environmental Quality's National Environmental Policy Act (NEPA) Implementing Regulations at 40 CFR Parts 1500 to1508, as amended, and the Corps' NEPA regulations at 33 CFR 230. The Corps has preliminarily determined that the proposed action is not likely to result in significant impacts on the human environment and an Environmental Impact Statement will not be prepared.

With this notice, the Corps seeks to involve the public as it prepares the draft EA for proposed repairs to an existing federal project, as a matter of due diligence. In addition, and in accordance with 33 CFR 230, the Corps will again seek public involvement and solicit comment on the completed draft Supplemental EA in July 2021. The Corps will consider comments received during the public comment period for the draft Supplemental EA in making a determination on a finding of no significant impact. Concurrent to involving the public, the Corps will pursue interagency coordination on the proposed action.

ACTION AGENCY: Ms. Rhiannon Kucharski, Chief, Civil and Public Works Branch, Honolulu District, U.S. Army Corps of Engineers, Building 230, Fort Shafter, Hawaii 96858-5440

LOCATION: River Station (RS) 55+50 to 48+50 and RS 91+50, Iao Stream Flood Control Project, Wailuku River, Wailuku, Island of Maui, Hawaii (Center coordinates: 20.899867N, -156.494564W and 20.893229N, -156.502358W, respectively.) See map attached to this notice.

DESCRIPTION OF THE FEDERAL PROJECT: The Iao Stream Flood Control Project (FCP) is located within the Wailuku River (formerly Iao Stream) in Wailuku, Hawaii and was authorized in 1968 at a cost of $1.68 million. Construction of the project was completed in October 1981 and consists of a debris basin located 2.5 miles upstream of the stream mouth, a 3,500 feet (ft) long lined channel downstream from the debris basin, and levees along the left and right banks. The Iao Stream FCP was turned over to the County of Maui as the Non-Federal Sponsor, to operate and maintain.

DESCRIPTION OF THE PROPOSED ACTION: The Corps proposes discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel, to improve public safety and reduce future maintenance requirements for the County of Maui, Department of Public Works. River Station (RS) 55+50 to 48+50 requires removal of the existing left bank revetment, "Revetment X", to allow the Wailuku River to meander and naturally slow velocities. Further upstream, at RS 91+50, construction of a "pre-formed scour hole" is required to rehabilitate the channel invert. See figures attached to this notice.

<u>Removal of Revetment X</u>. In this reach of the Iao Stream FCP, the natural channel was straightened and narrowed with boulder-concrete (grouted riprap) lining of the banks and a buried toe, to provide the congressionally authorized level of flood protection. The bed of the channel remains unlined.

Under the proposed action, the Corps will remove approximately 200 linear feet of the reinforced left bank of Revetment X, widening the channel to within the lateral limits of the FCP and reducing streamflow velocity. Further stabilization of the left bank is not proposed. No action is proposed along the right bank.

Note that the proposed action at Revetment X (in addition to other previously proposed actions) was previously evaluated in 2017 under the Corps' EA, including required interagency coordination and public involvement, and concluding in a finding of no significant impact. The currently proposed action, herein described, is identical to the description of the same proposed action in the 2017 EA (See Alternative F). The EA for the proposed action will supplement the 2017 EA. The 2017 EA is available for reference online at: https://poh.usace.army.mil/Missions/Civil-Works/Civil-Works-Projects/Iao-Stream/.

<u>Pre-formed scour hole</u>. In this reach of the Iao Stream FCP, located downstream of Market Street Bridge and vertical drop structure, the transition from the upstream boulder concrete lined invert to the downstream unlined channel has eroded and undermines the structural stability of the FCP at this location. Under the proposed action, the Corps will excavate the eroded channel invert and construct a "pre-formed scour hole" i.e. engineered stabilization of the scoured invert consisting of a boulder-concrete sloped toe with buried key using material consistent with the existing channel. The proposed channel invert rehabilitation will repair existing erosion and prevent future, imminent erosion.

Detail regarding construction means, methods and sequencing, best management practices and staging and access requirements is currently unavailable, pending authorization to fund the repairs and proceed to the design phase, wherein construction detailing will become available. The Iao Stream FCP was constructed with maintenance accessways intended to facilitate maintenance repair to and within the channel. The Corps assumes use of existing maintenance accessways to complete the proposed repairs.

ALTERNATIVES: The reasonable alternatives under consideration by the Corps at this time include the following: 1) No Action, 2) Removal of Revetment X only, 3) Pre-formed scour hole only, and 4) the Proposed Action, as described above.

AUTHORITY(S): The Iao Stream FCP was authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483). No further congressional authorization is required for the proposed action.

COMMENT AND REVIEW PERIOD: The Corps is soliciting initial comments from the general public, Federal, State and local agencies and officials, and other interested parties in order to consider and evaluate the impacts of the proposed action on the human environment. Any comments received will be considered. Only those comments received during the designated comment and review period will be considered by the Corps in preparation of the draft EA. All comments received will become a part of the administrative record.

Written comment on this public notice must be submitted via conventional mail or electronic mail (e-mail).

Comments sent by conventional mail should include your name, return mailing address, phone number, and reference to "Iao Stream Flood Control Project" and be sent to:

U.S. Army Corps of Engineers, Honolulu District
Civil and Public Works Branch (CEPOH-PPC)
Attn: Jessie Paahana
Building 230
Fort Shafter, Hawaii 96858-5440

Comments sent by e-mail may be sent to: CEPOH-Planning@usasce.army.mil. If using email, you must include reference to "Iao Stream Flood Control Project" in the subject heading of the email along with your name, mailing address and phone number. In order to be accepted, e-mail comments must originate from the author's e-mail account.

To be accepted, all comments, whether transmitted by conventional mail or e-mail, must be received by our office within **30 days** of the date of this notice.

VIRTUAL PUBLIC INFORMATION EVENT: The public is invited to attend a virtual information event hosted by the Corps on either of the following dates:

May 22, 2021 at 9:00am – 10:00am HST, and
May 29, 2021 at 9:00am – 10:00am HST.
The Corps will present the proposed action, accept public comment and answer questions to the best of our ability during this event. The same information will be presented at both meetings.

Access Information:
Join online webinar via Cisco WebEx platform at https://usace1.webex.com/meet/jessie.k.paahana.
Access via this platform is interactive and includes both visual and audio transmittal.

Join by phone, toll free at 1 (844) 800-2712. Access code: 199 533 9315.
Access via this platform is not interactive and includes audio transmittal only.

This event coincides with the comment and review period; comments received at this event will be considered in the preparation of the draft EA and will become a part of the administrative record. Comments submitted in response to, but not at this event, must follow the submittal procedures described above for written comments.

This public notice is issued by the Chief, Civil and Public Works Branch.

Attachment

U.S. Army Corps of Engineers Honolulu District

Tentatively Selected Plan, General Site Plan
Iao Stream Flood Control Project
Wailuku, Island of Maui, Hawaii

0 300 600 Feet
0 100 200 Meters

Notes:
1. This map is for conceptual purposes only and all areas are approximate
2. Coordinate System: Hawaii State Plane Zone 2, NAD 83 HARN, Feet
3. Imagery date: 2005, Source: DOQQ NRCS
4. Map produced by the Civil Works Technical Branch (CEPOH-EC-T) on March 8, 2021

Public Notice of Availability of Draft Engineering Documentation Report and Draft Environmental Assessment for Review, August 12, 2021

US Army Corps of Engineers
Honolulu District
BUILDING STRONG®

Public Notice
of Availability of Draft Engineering Documentation Report and Draft Environmental Assessment for Review

Civil and Public Works Branch
Building 230
Fort Shafter, Hawaii 96858-5440

Public Notice Date: August 12, 2021
Expiration Date: September 13, 2021 (32 days)
Corps Project: **Iao Stream Flood Control Project**

Interested parties are hereby notified that the Honolulu District, U.S. Army Corps of Engineers (Corps) has prepared a draft Environmental Assessment (EA) to assess the significance of the potential impacts of the proposed action on the quality of the human environment in accordance with the Council on Environmental Quality's National Environmental Policy Act Implementing Regulations at 40 CFR Parts 1500 to 1508, as amended. In addition, the Corps has prepared a draft Engineering Documentation Report (EDR) Amendment to evaluate and recommend repairs required to address a design deficiency at an existing federal project. With this notice, the Corps seeks to involve the public and solicit feedback on the proposed repairs to an existing federal project in accordance with 33 CFR 230. Concurrent to involving the public, the Corps will pursue interagency coordination of the proposed action.

ACTION AGENCY: Ms. Rhiannon Kucharski, Chief, Civil and Public Works Branch, Honolulu District, U.S. Army Corps of Engineers, Building 230, Fort Shafter, Hawaii 96858-5440

LOCATION: River Station (RS) 55+50 to 48+50 and RS 91+50, Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui, Hawaii (Center coordinates: 20.899867N, -156.494564W and 20.893229N, -156.502358W, respectively.) Tax Map Keys 234030888 and 234031001.

DESCRIPTION OF THE FEDERAL PROJECT: The Iao Stream FCP is located within the Wailuku River (formerly Iao Stream) in Wailuku, Hawaii and was authorized in 1968 at a cost of $1.68 million. Construction of the project was completed in October 1981 and consists of a debris basin located 2.5 miles upstream of the stream mouth, a 3,500 feet (ft) long lined channel downstream from the debris basin, and levees along the left and right banks (See Figure 1, Attachment 1). The Iao Stream FCP was turned over to the County of Maui as the Non-Federal Sponsor, to operate and maintain.

Extremely high channel velocities and debris flows produce significant scour and erosion of the channel invert and banks, increasing risk to community safety during a flood event. The County of Maui's maintenance requirements and emergency repair costs continue to increase beyond what was originally anticipated, as channel damage repeatedly occurs, resulting in increased frequency of repairs to mitigate for erosional effects. The Corps has concluded that the Iao Stream FCP is not functioning as intended and a design deficiency of the Federal project exists. Addressing design deficiency of a Corps project is the Corps' responsibility to ensure continued flood risk reduction for the Wailuku community.

DESCRIPTION OF THE PROPOSED ACTION: The Corps proposes discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel, to restore public safety and reduce future maintenance requirements for the County of Maui, Department of Public Works. Additionally, the Corps proposes to install a stream or other climate gage as part of a public flood warning system. These three components comprise the Corps' preferred alternative.

River Station (RS) 55+50 to 48+50 requires removal of the existing left bank revetment, "Revetment X", to allow the Wailuku River to meander and naturally slow velocities. Further upstream, at RS 91+50, construction of a pre-formed scour hole is required to repair structural damage and prevent further erosion. The Corps is considering two different locations for the stream gage within the Iao Stream FCP. Additional detail regarding the Corps' recommend plan is described in the draft EA and draft EDR Amendment.

Detail regarding construction means, methods and sequencing, best management practices and staging and access requirements is currently unavailable, pending authorization to fund the repairs and proceed to the design phase, wherein construction detailing will become available. The Iao Stream FCP was constructed with maintenance accessways intended to facilitate maintenance repair to and within the channel. The Corps assumes use of existing maintenance accessways to complete the proposed repairs.

ALTERNATIVES: Several iterations of alternatives were evaluated to address the design deficiency. Details regarding eliminated alternatives are described in the draft EA and draft EDR Amendment. The final array of alternatives being considered by the Corps includes the following: 1) No Action, 2) Removal of Revetment X only (Alternative 2), 3) Pre-Formed Scour Hole only (Alternative 6), 4) Non Structural Plan (Flood Warning System), and 5) the Preferred alternative (Combination Alternative 2, Alternative 6 and Alternative 11), as described above.

NEPA COMPLIANCE: In 2017 the Corps proposed several measures that comprised the recommended plan to address design deficiency of the Iao Stream Flood Control

Project. The Corps documented compliance with NEPA and evaluation of environmental effects of the 2017 recommended plan in a final EA and FONSI dated July 2017. Based on updated modelling, the Corps modified its approach to addressing the design deficiency and the only component carried forward to the currently proposed action for final consideration was the removal of Revetment X under Alternative 2. This action was a component of the recommended plan or Alternative F.

The currently proposed action includes Alternative 2 (formerly a component of Alternative F) and Alternatives 6 and 11, not previously evaluated for environmental effects. The purpose of the subject draft EA is to document the Corps' evaluation of environmental effects anticipated to result from implementation of Alternatives 6 and 11 and supplements the Corps' past evaluation in the 2017 final EA with updated information, where relevant. The current draft supplemental EA notates where the data or evaluation remains consistent with the Corps' 2017 final EA and where new or updated information is presented.

OTHER ENVIRONMENTAL COMPLIANCE:

ENDANGERED SPECIES ACT

Pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended, the U.S. Army Corps of Engineers determined that the recommended plan would have no effect on federally listed species or their designated critical habitat. The Corps has satisfied statutory requirements for the proposed federal action under Section 7 of the ESA.

NATIONAL HISTORIC PRESERVATION ACT

INCOMPLETE Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that the recommend plan would have no effect on historic properties including cultural resources. USACE consulted the State Historic Preservation Division and interested Native Hawaiian Organizations to seek concurrence on this determination. *INCOMPLETE, PENDING CONSULTATION*

CLEAN WATER ACT SECTION 404(B)(1) COMPLIANCE

INCOMPLETE, PENDING USACE EVALUATION

CLEAN WATER ACT SECTION 401 COMPLIANCE:

INCOMPLETE, PENDING STATE REVIEW. A water quality certification pursuant to section 401 of the Clean Water Act will be obtained from the State of Hawaii Department of Health, Clean Water Branch prior to construction.

COASTAL ZONE MANAGEMENT ACT COMPLIANCE:

INCOMPLETE, PENDING STATE REVIEW. A determination of consistency with the Hawaii Coastal Zone Management (CZM) program pursuant to the Coastal Zone Management Act of 1972 will be obtained from the State CZM Office prior to construction.

AUTHORITY(S): The Iao Stream FCP was authorized under Section 203 of the Flood Control Act of 1968 (Public Law 90-483). Per Engineering Regulation (ER) 1165-2-119, Water Resources Policies and Authorities - Modifications to Completed Projects, works proposed to correct a design or construction deficiency may be recommended for accomplishment under existing project authority without further Congressional authorization. The Corps has determined the proposed repairs meet the eligibility criteria at ER 1165-2-119. No further congressional authorization is required.

The Corps will comply with all applicable environmental regulations at and in accordance with the procedures prescribed at ER 1105-2-100, Appendix C: Environmental Evaluation and Compliance.

EVALUATION FACTORS: Works proposed to correct a design or construction deficiency may be recommended for accomplishment if the proposed corrective action is required to make the project function as initially intended, is not required because of changed conditions, is generally limited to existing project features, is justified by safety or economic considerations, and is not required because of inadequate local maintenance.

The decision whether to pursue the proposed action or any of the final array of alternatives, including the no action alternative, will be made pursuant to the evaluation factors summarized above. That decision will reflect the national concern for both protection and utilization of important resources. The benefits, which reasonably may be expected to accrue from the proposal, must be balanced against its reasonably foreseeable detriments.

PUBLIC HEARING: Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider the proposed action. Requests for public hearings must state clearly and concisely, the reasons and rationale for holding a public hearing. The District Engineer will then decide whether a hearing should be held.

COMMENT AND REVIEW PERIOD: The Corps is soliciting comments on the draft supplemental EA and draft EDR Amendment from the general public, Federal, State and local agencies and officials, and other interested parties in order to consider and evaluate the impacts of the proposed action on the human environment. Any comments received will be acknowledged. Only those comments received during the designated comment and review period will be considered by the Corps in preparation of any final NEPA document. All comments received will become a part of the administrative record.

The draft EA and draft EDR Amendment are available for public review, and the 2017 final EA and 2017 EDR are available for reference on the Honolulu District website at https://poh.usace.army.mil/Missions/Civil-Works/Civil-Works-Projects/Iao-Stream/

Comments on this public notice must be made in writing and submitted via conventional mail or electronic mail (e-mail).

Comments sent by conventional mail should include your name, return mailing address, phone number, and reference to “Iao Stream Flood Control Project” and be sent to:

U.S. Army Corps of Engineers, Honolulu District
Civil and Public Works Branch (CEPOH-PPC)
Attn: Jessie Paahana
Building 230
Fort Shafter, Hawaii 96858-5440

Comments sent by e-mail may be sent to CEPOH-Planning@usasce.army.mil. If using email, you must include reference to “Iao Stream Flood Control Project” in the subject heading of the email along with your name, mailing address and phone number. In order to be accepted, e-mail comments must originate from the author’s e-mail account.

All comments, whether transmitted by conventional mail or e-mail, must be received by our office by 5:00 p.m. Hawaii Standard Time on **September 13, 2021**.

VIRTUAL PUBLIC INFORMATION EVENT: The public is invited to attend a virtual information event hosted by the Corps on either of the following dates:

Wednesday, August 18, 2021 at 12:00PM - 1:00PM HST, and
Saturday, August 21, 2021 at 9:00AM - 10:00AM HST.

The Corps will present the proposed action, accept public comment and answer questions to the best of our ability during this event. The same information will be presented at both meetings.

Access Information:

Join online webinar via Cisco WebEx at https://usace1.webex.com/meet/jessie.k.paahana. Access via this platform is interactive and includes both visual and audio transmittal.

Join by phone, toll free at 1 (844) 800-2712. Access code: 199 533 9315.
Access via this platform is not interactive and includes audio transmittal only.

This event coincides with the comment and review period; comments received at this event will be considered in the preparation of the draft EA and draft EDR Amendment and will become a part of the administrative record. Comments submitted in response to, but not at this event, must follow the submittal procedures described above for written comments.

This public notice is issued by the Chief, Civil and Public Works Branch.

Attachment

Response to Public Comments

Summary of Public Comments
Iao Stream Flood Control Project Modifications
Wailuku River, Wailuku, Maui, Hawaiʻi
Draft Supplemental EA Public Review Period: August 21, 2021 - September 13, 2021

Name/Affiliation	Date/Source	Comment	USACE Response
Public Meeting Attendees: Erin Derrington – County of Maui Planning Department, Hokuao Pellegrino – Hui o Na Wai Eha, Skippy Hau – State Division of Aquatic Resources	8/26/21 Public Information Meeting via Oral Communication	In summary, commentors -requested clarification regarding the previously proposed Alternative F in comparison to the currently proposed Removal of Revetment X, a component of the former Alternative F, -opposed any alternative that hardens natural areas of Wailuku River, -recommended expanded stakeholder engagement to address concerns regarding native anadromous fish species such as life cycle information to inform construction windows, ensuring continuous flow to facilitate fish passage and accommodating cultural practices such as harvesting for consumption, -recommended further coordination with resource agencies and community members to develop BMPs that incorporate lessons learned such as requiring retrieval of construction materials washed downstream by storm events, -requested continued engagement with Hui O Na Wai Eha as a community organization that is often queried for up-to-date information to relay project information to the community,	-Clarification regarding rationale for down scoping the proposed action from the former Alternative F to the currently proposed preferred alternative that carried forward a single component of the former Alternative F and proposed one additional structural modification and non-structural component to comprise the proposed action was provided at the meeting. Additional clarification regarding the differences and similarities between the previous and current proposed action was also discussed at the meeting. Where appropriate within the final supplemental Environmental Assessment (EA), additional clarification, as noted above, was incorporated. -USACE acknowledged that new proposals for new hardening is not supported by the community at large. USACE reiterated that no new hardening is proposed under the preferred alternative, with the exception of Alternative 6 that expands the current fill footprint to bring the project up to current engineering and construction standards. -USACE took note of information shared by State Division of Aquatic Resources and Hui o Na Wai Eha regarding anadromous fish species and other aquatic biota. USACE will continue to engage local stakeholders and resource agencies for information regarding aquatic biota to develop and incorporate best management practices into the design phase. -USACE will continue to engage local stakeholders and resource agencies for information regarding construction best management practices to incorporate into the design phase. -USACE acknowledges this request, and will add Hui o Na Wai Eha to the project stakeholder list for engagement on this and future projects.

		-requested direct coordination with the County Emergency Management Department to identify existing public flood warning system to inform necessary improvements, and -requested sharing of hydrologic/hydraulic and sediment modelling data to inform community planning decisions.	-USACE Will coordinate further development of Alternative 11 with the County Emergency Management Department and community stakeholders to identify opportunities to improve and/or expand upon the existing public flood warning system. -USACE modelling efforts are partially complete and partially ongoing. USACE will continue to share the modelling results with the non-federal sponsor who may distribute the information and incorporate into future planning decisions.
John Duey Public Citizen Adjacent Landowner	9/1/21 Voicemail and Follow-Up Phone Call	Change name of project from "Iao Stream Flood Control Project" (FCP) to "Wailuku River FCP". Waterway name was formally restored in November 2015 to Wailuku River. Continued use by USACE of term Iao Stream FCP causes confusion and challenges ongoing efforts to get community and local government to use the restored name: Wailuku River.	Congress authorized federal funding to construct the flood control project with the name "Iao Stream Flood Control Project" [in 1968] prior to restoration of the waterway's legal name. While Honolulu District acknowledges the name change and deliberately refers to the project location as "Wailuku River" in all project documents, Congress has not formally received request to change the name of the federal project. The Honolulu District will look into Mr. Duey's request to correct the name of the Iao Stream Flood Control Project to the Wailuku River Flood Control Project. Any request to formally change the federal project name will be made independent of the proposed action.
		Opposes any new hardening	USACE described the components of the proposed action to Mr. Duey and highlighted that no new hardening was proposed. USACE explained that Removal of Revetment X proposes to remove hardening and restoral natural bank and Install Pre-Formed Scour Hole would construct engineered toe to address current and prevent further erosion of channel lining. Minimal expansion of fill footprint is necessary to reinforce existing channel lining and prevent imminent erosion consistent with current engineering standards. Public warning system is non-structural and proposes no new hardening. Mr. Duey responded positively to USACE description of the proposed action.
		Commentor requests notification of any future meetings concerning this project	USACE informed Mr. Duey that there are no more planned public meetings concerning the currently proposed action. However, as requested, the Honolulu District will add Mr. Duey to the project stakeholder list for future engagement.
County of Maui Planning	9/13/21 Letter transmitted via email	USACE should consider revising this Environment Assessment and Federal Consistency Determination request in order to: -clarify the current project scope and discussion of direct, indirect, and cumulative impacts including complementary project components or reasonably foreseeable future projects; - demonstrate alignment with existing plans and policies;	- The current environmental assessment is intended to supplement the analysis documented in the 2017 EA, document evaluation of the current project scope and has been updated with additional information regarding alternatives analysis, resource information, agency coordination, public engagement and relevant impact analyses in accordance with the September 14, 2020 NEPA rule. - This NEPA environmental assessment documents the federal action and compliance with federal laws and regulations. Additionally, the Corps completed the State of Hawaii Office of Planning CZM Federal Consistency

			Assessment Form to document the Corps' analysis of consistency with the State Coastal Zone Management Plan and concluding that the proposed modifications to the Iao Stream FCP are consistent with the enforceable State's policies and objectives.
		-improve impacts analysis with clear definitions of significance and commitments to mitigation measures; and	-The Corps has completed an evaluation of environmental effects that is commensurate to a rehabilitation project. The Corps' analysis is documented in its Environmental Assessment. The Corps conducted all required analyses and evaluations pursuant to all applicable federal laws including, but not limited to the Endangered Species Act, the Fish and Wildlife Coordination Act, the National Environmental Policy Act, the Coastal Zone Management Act and Clean Water Act. The individual and combined conclusion of all of those analyses is consistent with anticipated conclusions of a rehabilitation project of this scope and scale. Pursuant to each of these analyses, no extraordinary circumstances or potentially significant impacts were identified. The Corps will incorporate standard industry best management practices intended to avoid and/or minimize adverse impacts to natural and cultural resources, incorporating comments and recommendations received to date and which will be developed with greater detail in the design phase and prior to construction. The Corps' commitment to these best management measures will be incorporated into any contract as specifications.
		-expand public engagement and information sharing efforts.	-Based on the Corps' knowledge of the community, its stakeholders and general concern for activity in the Wailuku River watershed the Corps approach to public engagement expanded upon the Corps' NEPA implementation regulations in the following ways (as documented in Section 1.4 of the Environmental Assessment): 1) the Corps issued a public notice to notify the public and solicit comments on the Corps' intent to prepare an environmental assessment for the proposed action, and 2) hosted two public informational meetings during that review period, in addition, 3) the draft supplemental EA and Engineering Design Report Amendment was released for public review and comment and 4) the Corps hosted three public informational meetings during the draft EA review period. The Corps will continue to engage the local sponsor, the County of Maui, and other community stakeholders to promote information sharing through the design phase and into construction.
Hokuao Pellegrino, President Hui O Na Wai Eha (Hui) Native Hawaiian Organization	9/5/21 Letter Received 9/13/21 via email	Hui opposes any proposal to cement, harden, cover over, channelize and/or further modify the natural riverbed of Wailuku River. Hui acknowledges the proposed action does not propose new hardening but wants to make this concern a part of the public record.	As acknowledged by the Hui, no new hardening is proposed.

		Hui requests archaeological monitor on-site during construction due to known pre-western and historic resources in the location of the project. It is important to protect historic and cultural resources	USACE will continue to coordinate this project, in particular the construction specifications with the USACE archaeologist to determine whether an on-site archeological monitor is warranted based on the USACE evaluation of effects to historic properties including cultural resources pursuant to Section 106 of the National Historic Preservation Act. If warranted, such a requirement will be codified in the contract specifications. Contract specifications regarding inadvertent finds are standard conditions of any USACE construction contract.
		Hui requests USACE coordinate this project with the State of Hawaii Department of Land and Natural Resources Division of Aquatic Resources to identify any management measures, e.g., construction work windows, etc. to conserve and protect native aquatic biota and their habitat. In-water construction has the potential to adversely affect native biota, so care should be taken to insure the species' survival.	USACE will coordinate with the local sponsor, DLNR-DAR and any other subject matter expert with information necessary to assist the Corps in developing best management practices to avoid and minimize to the greatest extent practicable adverse effects to fish and wildlife resources, including native aquatic biota and their habitat. At a meeting on April 19, 2021, the U.S. Fish and Wildlife Service discussed the need to incorporate into the design passage for anadromous fish species known to occur in Wailuku River. At the August 27, 2021 public informational meeting concerning the draft supplemental environmental assessment review, "Skippy" Hau, DLNR-DAR attended and indicated availability to coordinate with USACE on native biota and habitat. USACE will continue to develop in greater detail best management practices to be incorporated into the proposed action that consider conservation of fish and wildlife resources in the design phase, prior to construction.
		Hui opposes any request by USACE to the Commission on Water Resources Management at the State to alter or otherwise reduce Instream Flow Standards for any period of time during this project to ensure continuous mauka to makai stream flow.	USACE does not propose or anticipate the need to propose temporarily halting or otherwise reducing instream flow standards. As construction details are further developed, USACE will ensure this concern is considered in the design phase.
		Hui wants to see USACE propose BMPs that go above and beyond to ensure protection of natural and cultural resources in and below the project area.	USACE will develop in greater detail the design plans and contract specifications, which include BMPs that avoid and/minimize natural and cultural resources to the greatest extent practicable and consistent with industry standard during the design phase, prior to construction. USACE will ensure contract specifications are developed to incorporate lessons learned from past malpractice involving in-water work and downstream impacts in Wailuku River.
		Hui requests to be apprised of the project timeline as the project progresses, and in particular of construction start. Hui is looked to by the community to inform the community of ongoing projects. Ensuring the Hui is informed will help to ensure the greater Wailuku community is informed.	USACE acknowledges this request, and the Honolulu District will add Hui o Na Wai Eha to the project stakeholder list for engagement on this and future projects.

Comment Letters

MICHAEL P. VICTORINO
Mayor

SANDY K. BAZ
Managing Director

OFFICE OF THE MAYOR

COUNTY OF MAUI
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793
www.mauicounty.gov

September 28, 2021

LTC Eric S. Marshall, PE, PMP
District Engineer
U.S. Army Engineer District
Honolulu District
Building 230
Fort Shafter, Hawaii 96858

LTC Eric S. Marshall:

SUBJECT: IAO STREAM FLOOD CONTROL PROJECT

The County of Maui ("County") has partnered with the U.S. Army Corps of Engineers Honolulu District ("Corps") to address an identified design deficiency and develop the recommended plan in the EDR Amendment Report for the Iao Stream Flood Control Project ("FCP"), Maui, Hawaii. The County concurs with the recommended plan that includes removal of Revetment X, installation of a pre-formed scour hole, and implementation of a flood warning system.

Staff from both Maui County Departments of Planning and Public Works will coordinate directly with the Corps to ensure consistency with local plans and policies integral to the development of this project's design. We appreciate the due diligence being applied to maximize project features that support the reduced risks to the community as well as reducing the operations and maintenance burden the County has been forced to endure as a result of the identified design deficiency.

It is our understanding that the County will be responsible for the acquisition of property necessary to implement the project, in compliance with federal and local laws. Use of the property would include but not be limited to the following: temporary and permanent easements, rights of way for construction, rights of entry, and staging areas. It is also our understanding that depending on the final cost share allocation, costs associated with real estate acquisition, including nominal administration fees can be credited back to the Sponsor, namely the County of Maui, during construction. The exact amounts will be determined during design in a final real estate plan and notice to acquire.

Finally, we understand that the County will continue to be responsible for operations and maintenance of the project into perpetuity and such obligations will be outlined in the partnership agreement executed in the next phase. We understand that this letter of support in no way obligates the Corps or the County to financial or legal commitments.

For further information please contact Rowena M. Dagdag-Andaya, Director of the Department of Public Works for the County of Maui at (808) 270-7845.

Sincerely,

Michael P Victorino

MICHAEL P. VICTORINO
Mayor, County of Maui

cc: Rhiannon Kucharski, U.S. Army Corp of Engineers
Michele McLean, Department of Planning
Rowena M. Dagdag-Andaya, Department of Public Works

MICHAEL P. VICTORINO
Mayor

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DEPARTMENT OF PLANNING
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September 13, 2021

John Nakagawa
Hawaii Coastal Zone Management Program
Transmitted via email: *john.d.nakagawa@hawaii.gov*

U.S. Army Corps of Engineers, Honolulu District
Civil and Public Works Branch (CEPOH-PPC)
Attn: Jessie Paahana
Building 230
Fort Shafter, Hawaii 96858-5440
Transmitted via email:
CEPOH-Planning@usasce.army.mil
Jessie.K.Paahana@usace.army.mil

Dear Mr. Nakagawa and Ms. Paahana:

SUBJECT: COMMENTS ON FEDERAL CONSISTENCY AND DRAFT ENVIRONMENTAL ASSESSMENT FOR MODIFICATION TO THE IAO STREAM [SIC] FLOOD CONTROL PROJECT (RFC 2021/0139 CZMA FEDERAL CONSISTENCY REVIEW)

The Maui County Department of Planning (Department) is in receipt of your July 27, 2021 email requesting comments regarding the state Office of Planning and Sustainable Development's (OP) pending Federal Consistency Review under the Coastal Zone Management Act (CZMA) and transmission of the Draft Environmental Assessment (DEA) for the Proposed Iao Stream [sic] Flood Control Project (FCP). Thank you for this opportunity to comment on this DEA and its consistency with coastal zone management regulations and policies from the perspective of the Department, and for the comment extension you provided when additional materials including the amended Engineering Documentation Report (EDR) and revised DEA were made available on August 17, 2021.

As detailed in OP's transmittal, the proposed action pertains to proposed repairs and alterations to the Wailuki River / Iao Stream [sic] Flood Control Project (FCP) by the U.S. Army Corps of Engineers (USACE). This DEA proposes to implement combined alternatives that reflect engineered solutions to address localized erosion that is occurring at the transition between the lined stream channel and the unlined stream channel upstream of the Market Street Bridge.

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USACE has proposed the installation of a pre-formed scour hole, i.e., an engineered stabilization of the scoured invert consisting of a boulder-concrete sloped toe with buried key and backfilling with natural material consistent with the existing channel bottom to repair existing erosion and prevent future "imminent erosion" thereby reducing downstream erosion and risk to community safety. This project will also include the installation of a public flood warning system at either the Iao Valley Road Bridge or at the existing USGS gage between the Iao Stream [sic] FCP debris basin and the Market Street Bridge. OP's transmission indicates this improvement will occur at TMK (2) 3-4-30-888. That lot is owned and operated by the County of Maui and is zoned "Agricultural" and "Open Space".

As it is currently written, it is unclear how the proposed project alternative and reasonably foreseeable related actions will not result in potentially significant impacts to sensitive environmental systems including coastal resources of concern. Specifically, the Department has concerns with the approach and content reflected in this DEA and federal consistency determination request, and suggests revisions to ensure consistency with CZMA enforceable policies, National Environmental Policy Act (NEPA), and Hawaii's Environmental Policy Act (HRS 343). Specifically, it is suggested that to improve project outcomes, reflect enhanced consistency with the letter and spirit of CZMA enforceable policies and NEPA itself, and to facilitate improved understanding and review by agencies and the public, USACE should consider revising this Environment Assessment and Federal Consistency Determination request in order to:

(1) clarify the current project scope and discussion of direct, indirect, and cumulative impacts including complementary project components or reasonably foreseeable future projects;

(2) demonstrate alignment with existing plans and policies;

(3) improve impacts analysis with clear definitions of significance and commitments to mitigation measures; and

(4) expand public engagement and information sharing efforts.

The Department provides these additional comments for further consideration:

1. **Clarification of project purpose and scope in relationship to all related proposed stream improvements would support project review and anticipated "no effects" determination.**

The July 2017 Final Environment Assessment for Modification to the Iao Stream [sic] Flood Control Project (2017 FEA) outlined that the purpose and need for that undertaking was to "address ongoing flood hazards caused by design deficiencies and long-term damage to the existing flood control structures suffered during repeated floods since their original construction in 1981 and to provide the authorized level of reduced flood risk to the town of Wailuku" (2017

FEA, pg. 1-15). The stated purpose and need of the 2021 Draft EA is to "correct the design deficiency" (2021 DEA, pg. 8). It would be helpful if revisions to the current DEA clarify whether or not the proposed project will provide the same level of flood risk reduction to the town of Wailuku as the preferred alternative identified in the 2017 FEA. The analysis that follows in the 2021 DEA includes what appears to be regulatory or appropriations-specific jargon that is difficult to interpret. If the purpose and need has changed and a less comprehensive management measure is more prudent than the previously proposed approach, further plain English clarification in the DEA would provide important context for the analysis that follows in the revised 2021 environmental assessment.

The Revised 2021 DEA incorporates by reference the environmental analysis of the USACE's 2017 FEA. The 2017 FEA assessed numerous alternatives that are not detailed in the 2021 EA and identified "Alternative F – Floodplain Reconnection" as the preferred alternative. As described in great detail in the 2017 FEA, "Alternative F" includes removing "Revetment X" in addition to comprehensive ecological restoration efforts that would reconnect the main channel with the existing floodplain on the left bank of the Wailuku River and revegetate the floodplain to reduce damaging flows along the main channel and right bank levees. The 2017 Final EA described "Alternative F" as a design that "incorporates public and agency concerns regarding biological resources in the stream, including input provided by USFWS regarding biological function of the stream" and "also incorporates designs that minimize channel hardening within the stream, which in turn minimizes potential impacts to groundwater recharge" (FEA, 2-8). That design aimed to replicate natural hydrological patters of an alluvial floodplain to the extent practicable, including proposed reconnection to the floodplain on the left bank of the stream in addition to vegetation that together were anticipated to reduce erosion and associated sedimentation in the main channel, resulting in water quality improvements to downstream areas including Kahului Bay (Id.). Through the selection of Alternative F the 2017 FEA addressed numerous concerns raised by stakeholders regarding water quality at Wailuku River and the receiving waters of Kahului Bay, impacts of proposed channelization in relation to the natural streambed and adjacent floodplain, as well as encouragement to support stream restoration for ecological and cultural resources including "spiritual values" of this stream system.

The USACE's Revised 2021 DEA and EDR reflect a significantly limited project scope compared to the 2017 FEA's Preferred Alternative F. This proposal reflects a combination of proposed alternatives as follows: Alternative 2, removal of "Revetment X"; Alternative 6, installation of pre-formed scour hole; and Alternative 11, the installation of a stream gage and warning system that would install a new gage at one of two locations and link to a field station or control center to be established in an existing building. The removal of "Revetment X" outlined in Alternative 2 in this DEA appears to be a limited component of the previously identified preferred alternative, "Alternative F" from the 2017 FEA.

As it is currently written it is unclear how the proposed project components will achieve comprehensive sustainable management goals for this flood-prone stream system, or how the determination to install discrete engineered solutions rather than the preferred intervention identified in the 2017 FEA "Alternative F – Floodplain Reconnection" was made. The DEA states that the USACE Honolulu District was directed to complete a General Reevaluation Report (GRR) as the mechanism to receive Congressional authorization on a project with new flood management features; that the GRR was initiated in October 2018 by execution of a Feasibility Cost Share between USACE and the County, and that "updated modeling and engineering data found the previously recommend plan was no longer economically justified" (2021 DEA, pg. 7). As such, "USACE has reformulated alternatives with the objective to address the design deficiency justified based on safety and economic considerations" in this proposal. It would seem including additional narrative regarding changes to the modeling and engineering data referenced here and attaching the referenced GRR and associated benefit cost analysis modeling would be appropriate to provide further context and support for this reformulation of alternatives. Additional analysis of why environmental and cultural project elements were de-scoped and what non-USACE funding mechanisms might have been considered to further support the comprehensive flood management goals reflected in the engineered and nature-based solutions proposed in the 2017 FEA would be beneficial in the revised EA narrative as well. A simplified clarification of the purpose, extent, and motivation of the change in preferred alternatives and a table summarizing these changes would be appropriate to support alternatives analysis and substantiate the revised purpose of the modified project proposal.

The EDR that was made available on August 17, 2021 does provide some discussion of project history and includes limited benefit cost analysis of structural alternatives, but does not appear to include analysis of the previously developed "nonstructural measures" included in "Alternative F" in the 2017 FEA. In EDR Section 4.3 alternatives that were discussed in the 2017 FEA were listed and interventions that were "cost prohibitive", "not feasible", or "not recommended in prior reports" were screened out. As described in section 4.5, "Alternative 9 – Overflow Basin and Floodplain Reconnection" that appears to be similar to the previously assessed but more extensive "Revetment X" removal was screened out due to the assessed cost of $60.68 million being "cost prohibitive" (see 2021 EDR, pg. 32). However, no cost assumptions were detailed, and because this proposed project seems smaller in scale than the total project costs estimated for Alternative F in the 2017 FEA which reported a first project cost of $18.64 million (2017 EDR, pg. 87). That project was also assessed to yield a positive benefit cost ratio of 2.46, suggesting considerable net benefits despite the relatively higher project cost of "Alternative F" compared to 2021 DEA "Alternatives 6 and 12" which would have a first project cost of $5.429 million and a benefit cost ratio of 1.11 (2021 EDR, pg. 16). The limited discussion of alternatives that follows notes that "Alternative 9" envisioned construction of a concrete diversion weir to redirect channel flow below the Ima Kala Street Bridge as opposed to the 2017 “Alternative F” approach which would have focused diversion and floodplain reconnection efforts at an upstream location. Clarification of why an alternate site was identified and assessed for flood protection in a proposal that nearly tripled the initial assessed project cost is necessary in the alternatives analysis provided in the body of the 2021 DEA.

Further clarification of potential impacts of the currently proposed alternative area are also needed, as removal of “Revetment X” and additional hardening of the “scour hole” were not analyzed previously. Specifically, although the revised DEA incorporates the 2017 FEA by reference (2021 DEA, pg. 19), it does not appear that the effects of the removal of Revetment X without the supporting ecological restoration described in the 2017 FEA have been fully detailed in this DEA. Because the Revetment X removal component of “Alternative F” was not assessed as a stand-alone measure, it is not possible to rely on environmental effects analysis from the comprehensive intervention assessed in the 2017 FEA. Without supporting models and analysis it is unclear if additional sedimentation, erosion, and flooding may occur due to the removal of only this component without associated floodplain restoration and structural improvements, or if is the intention of USACE that the entirety of Alternative F be implemented in the future in order to stabilize the floodplain that would be exposed with the removal of the current structure. Without discussion of changes to impacts due to the limited implementation of the previously identified preferred alternative, or inclusion of referenced “updated studies” which appear to be ongoing, it is not clear how the proposed implementation of this DEA’s preferred alternative is consistent with and ecologically similar to the analysis provided in the 2017 FEA. It is also unclear how these components are “hydrologically independent of each other” (2021 DEA, pg. 16), particularly when they are occurring in close proximity to each other and other proposed improvements to flood control structures and the river bank within the same project area. Clarification of the project scope that is proposed for implementation, revisions to potential impacts assessed in the 2017 FEA, and discussion of reasonably foreseeable complementary projects and likely impacts based on referenced and publicly available “updated studies” are necessary to result in an adequate analysis of significance of potential impacts.

Similarly, discussion of climate impacts would benefit from more robust analysis to support analysis of the significance of project impacts and consistency with planning policies to implement sustainable and climate adaptive resource management interventions. The DEA notes limited data does not reflect significant changes in flow trends despite projections that high intensity rainfall events are likely to increase. The engineering report provided in Table 5-3 (2021 EDR Design Appendix at pg. 58-59) outlines a list of features or measures and anticipated hazard, harm, and likelihood of impact. Table 5.3 indicates that the “Removal of Left Bank Revetment X” is “likely” to cause “increases in flood discharge and frequency” (EDR Design Appendix, pg. 58) and the “Pre-formed Scour Hole” is also “likely” to cause “increased possibility of structural failure" (EDR Design Appendix, pg. 59) due to increases in the frequency and magnitude of precipitation. The two lines of analysis that follow state:

> Although the effects of climate change on the project features is likely, the effect on project performance would be unlikely. In addition, the nonstationary detection tool did not detect a trend so there is a lack of evidence to reject the thought that the flow and frequency are stationary. (Id.).

It is not clear how the conclusion that likely climate-driven effects to the project would not affect project performance is supported nor how the lack of a detected trend using a relatively limited data-set reflects best available science and projections. Particularly in light of the discussion of expected climate impacts included in the preceding section that acknowledge that the strength of El Niño-Southern Oscillation related patterns in the short term can make it difficult to detect the more gradual, long-term trends of climatic change (EDR Design Appendix, pg. 47), it would seem additional precautionary modeling and analysis would be beneficial to ensure the longevity and cost effectiveness of the proposed preferred alternative. With daily peak flow being reintroduced to the Wailuku River combined with indicators suggesting that long-term climate impacts are likely to include more extreme rainfall and thus flood events, additional discussion of likely climate impacts to the proposed project and resulting flood management implications would result in more robust analysis of potentially significant risks and necessary risk reduction opportunities in the environmental assessment.

As such, it seems this project proposal and supporting analysis would be more consistent with requirements of NEPA, CZMA, HRS 343, and other relevant state and local regulations and plans if the assessment were revised to clarify the limitations of the current project scope compared to the previously discussed 2017 FEA preferred alternative. Where the proposed activities are significantly different, or where new data is available, that information should be clearly indicated and included to support the 2021 environmental analysis, which appears different enough from the 2017 FEA that incorporation of that FEA by reference is not appropriate. While it is understood that regulations and NEPA guidance from the Council of Environmental Quality support incorporation by reference of prior environmental assessments, clear summaries of such information and relevant changes in the supplemental environmental analysis is necessary to provide adequate understanding of the project elements being proposed by this action and therefore the review of this project proposal. Given the substantial differences between the 2017 FEA and the 2021 DEA, a stand-alone EA that duplicates relevant sections of the prior publication may be easier to navigate and would clarify the differences in the two sets of environmental analysis documents.

2. **Environmental analysis would benefit from discussion of alignment with relevant plans, policies, and regulations.**

As reflected in Chapter 4 of the 2017 FEA, there are numerous regulatory requirements as well as planning considerations that aim to ensure implementation of projects that result in improved outcomes for environmental resources, the built environment, and our communities as a whole. Although the 2017 FEA does provide some discussion and analysis of planning policies and specific components of the proposed action that would address these policies, such discussion is limited to state level plans. The 2021 DEA does not provide such assessment. In addition to being within the coastal zone, the proposed project is in Maui County, on Maui Island, and within the area covered by the Wailuku-Kahului Community Plan. Consistency with relevant county, island, and district-level plans should be detailed. Analysis should include discussion of how the proposed project will reflect best management practices and preserve or enhance functions of the stream system that align with planning objectives and policies for open space, natural resources, and cultural resources at state, county, and local levels as well as with relevant functional plans. This includes the Hawaii State Planning Act, Hawaii State Environmental Policy, Maui County Plan, Maui Island Plan, and Wailuku-Kahului Community Plan, with consideration of some of the following components:

> ***Hawaii State Planning Act HRS §226.*** The 2017 FEA discusses consideration of objectives and policies for the physical environment in HRS 226 sections 11 and 13. Analysis in this DEA would be improved if it directly included such analysis and also assessed §226-12, historic resources, particularly with consideration of historic and cultural uses and use values. Additional analysis relevant to §226-104 goals for open space and enhanced shoreline access, relevant here due to the area's state and county-level land use designations as well as district planning that identifies the area as a "protected area" and future trail corridor, §226-108, which outlines sustainability guidelines, and §226-109 which emphasizes the importance of climate change adaptation planning, is critical to demonstrating consistency with relevant state and county-level resource management policies.
>
> Larger flood control and risk reduction planning efforts for the Wailuku River, concurrent and cumulative flood management efforts should be discussed together in the context of relevant planning objectives, rather than identifying "hydrologically distinct" flood control components and limiting the associated analysis. Sustainable resource management analysis should be supported by project-specific models in the context of the larger watershed and stream system. The DEA notes that in addition to addressing flood risk reduction this project aims to reduce erosion and allow for less sediment to be directly transported within the stream and to the nearshore marine environment, and states that

improved water clarity and reduced sedimentation would have positive impacts on the aquatic environment. While it is understood additional studies are ongoing, supporting documentation and monitoring plans that will likely result from water quality certification requirements would further substantiate such statements. As such, the revised, supplemental, or final EA should provide system-wide and project-specific modeling data and resulting analysis that reflects comprehensive management efforts and the relationship of the proposed action to furthering economically and ecologically sustainable management interventions for the Wailuku River. Furthermore, emphasis on how this project will support comprehensive ecosystem level management efforts and ensure cost effective management interventions are implemented and maintained for the life of the proposed built structure would be relevant to this discussion, and would further be supported by cost benefit analysis including discussion of alternatives assessed in the 2017 USACE FEA as well as related and concurrent project proposals.

Similarly, discussion of climate change impacts and adaptation opportunities should reflect comprehensive assessment and management efforts that align with state, county, and district-level policies and objectives. HRS §226-109 provides guidelines that encourage the preservation and restoration of natural landscape features, which includes streams, floodplains, and wetlands, that have the inherent capacity to avoid, minimize, or mitigate the impacts of climate change. Discussion of how this and related comprehensive management projects are furthering preservation and restoration goals may demonstrate additional consistency with this priority guideline. Furthermore, it is noted that current design specifications aim to address the 100-year flood event. Given that recent climate assessments indicate storm events and flood extents are likely to become more intense as climate impacts increase, some discussion of costs and benefits of planning for a larger flood event such as the 500-year recurrence interval that was observed in 2016 will further support robust analysis of cost-effective alternatives that would result in sustainable management measures to protect people as well as the built and natural environment in the face of a changing climate.

Hawaiʻi State Land Use Law. This project involves use of lands within the Agricultural and Urban State Land Use Districts. Although the 2017 FEA included floodplain connection and restoration components that would hydrologically reconnect the adjacent "prime" agricultural lands to this culturally and historically significant water source, these project components have been descoped from the 2021 DEA. It does not appear the costs and benefits of "no action" compared to the previously selected preferred alternative that included the enhancement to existing and reasonably foreseeable future agricultural activities was considered in the cost-benefit analysis that led to the current proposal. While the cost of the 2017 FEA preferred alternative was higher, it appears that proposal was more consistent with resource management goals relevant to agricultural and open space land uses. Discussion of how this proposal alternative has considered and addressed these priority uses would reflect efforts to ensure that this proposal action is as consistent as practicable with relevant resource management goals at the state level.

Maui County General Plan. The Maui County General Plan is a long-term, comprehensive guide for the physical, economic, environmental development and cultural identity of the county. Analysis of relevant goals, objectives, policies, and implementation actions should be reflected in the environmental assessment. This includes but is not limited to elements of the Maui Countywide Policy Plan (2010), Maui Island Plan (December, 2012), and the Wailuku-Kahului Community Plan (2002).

The Maui Countywide Policy Plan (2030 General Plan) is guided by the vision that Maui County will be an innovative model of sustainable island living, that Maui County will be a leader in the creation of self-sufficient communities and environmentally sound economic development and land stewardship, and "that which makes Maui County unique in the world will be preserved, celebrated, and protected for generations to come." This vision is framed by core principles that include commitments to excellence in stewardship and the natural environment and cultural resources, engagement and empowerment of Maui County residents, sustainability principles, and "thoughtful, island-appropriate innovation". It is within this context that Section III of the 2030 General Plan outlines key strategies and Section IV details goals, objectives, and policies. Discussion of relevant sections as they relate to ongoing comprehensive flood management, watershed and water flow restoration, and other complementary and reasonably foreseeable projects that aim to achieve multiple use values within this high value preservation area should be included in the planning consistency analysis provided in the revised environmental assessment for this project.

Relevant components of the Maui Island Plan include goals to ensure watershed and coastal zone management are integrated to protect the island's critical marine resources because these systems are hydrologically connected, as well as a directed growth plan that identifies this area of the Wailuku River as preserved protected area. Long-range goals for this area include reestablishing traditional access from the upper stretches of the Wailuku River to the shoreline. Analysis of these planning goals and objectives including discussion of past and present scoping and alternatives analysis that reflects alignment with these plans would demonstrate consistency with state coastal resources management policies and local planning actions. Such analysis would also highlight efforts to achieve the purpose and need of this project in the comprehensive watershed management planning context envisioned in the "Directed Growth Plan" detailed in Chapter 8. Relevant guiding land use

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principles including #5 “protect open space and working agricultural landscapes” and #6 “protect environmentally sensitive lands and natural resources” should be discussed further.

Please include consistency details regarding the Maui Island Plan’s policy 2.4.3.c, to “promote innovative environmental-planning methods and site-planning standards that preserve and re-establish indigenous flora and fauna habitat, to preserve and restore connected habitat coordinators, and open space”. Given the emphasis the Maui Island Plan places on encouraging enhancement of open spaces to serve multiple use objectives that include providing educational and recreational opportunities as well as supporting and enhancing ecological functions, additional discussion and assessment of costs and benefits of acquiring the vacant lots and commercial properties threatened by the Iao Stream / Wailuku River adjacent to the project area may support a more robust discussion of site interventions that could expand long-term ecological and social benefits that are more consistent with environmental as well as socio-economic planning goals. Further discussion of the numerous benefits and potential impacts or avoided impacts achieved by this project and reasonably foreseeable related projects would further demonstrate consistency with important state, regional, and local planning objectives.

Similarly, the 2002 Wailuku-Kahului Community Plan, which designates the Wailuku River as “Open Space”, includes the following objectives and policies that would warrant further discussion in the FEA:

- ENVIRONMENT - Objectives and Policies No. 3. – “Protect shoreline wetland resources and flood plain areas as valuable natural systems and open space resources. These natural systems are important for flood control, as habitat area for wildlife, and for various forms of recreation. Future development actions should emphasize flood prevention and protection of the natural landscape”.

- CULTURAL RESOURCES – Objectives and Policies No. 4, 5, & 8 – “Ensure that the proposed projects are compatible with neighboring historic, cultural, and archaeological sites or districts. Such projects should be reviewed by the Cultural Resources Commission, where appropriate”; “Require development projects to identify all cultural resources located within the project area as part of initial project studies. Further, require that all proposed activity include recommendations to mitigate potential adverse impacts on cultural resources” and “Preserve and restore historic roads, paths, and water systems as cultural resources, and support public access.”

- URBAN DESIGN - Objectives and Policies No. 5 – "Integrate stream channels and gulches into the region's open space system for purposes of safety, open space relief, greenways for public use and visual separation. Drainage channels and siltation basins should not be used for building sites, but rather for public open space. Drainage channel rights-of-way and easements may also be used for pedestrian and bikeway facilities."

- RECREATION – Objectives and Policies No. 15 – "Establish a linear park, with bicycle and pedestrian facilities where practical, from the Paukukalo oceanfront along 'Iao Stream to Kepaniwai Park."

- LAND USE – Objectives and Policies No. 5 – "Encourage traditional Hawaiian agriculture, such as taro cultivation, within the agricultural district, in areas which have been historically associated with this cultural practice."

- DRAINAGE - Objectives and Policies No. 5 – "Encourage the incorporation of drainageways, setbacks, and flood protection areas into greenways consisting of open space, pedestrian way and bikeway networks."

- PLANNING STANDARDS – CULTURAL RESOURCES – "Require development projects to identify significant cultural resources located within the project area as part of initial project studies. Further require that all proposed activity include recommendations to mitigate potential adverse impacts on cultural resources."

In summary, discussion of planning policies and state and local laws should be expanded. This project proposal would reflect improved analysis and enhanced consistency with relevant enforceable policies discussed in the CZMA application with the inclusion of discussion of project components and best management practices that will be implemented to further achieve these and other relevant regional goals, objectives, and policies. The Wailuku-Kahului Plan also identifies "'Iao Stream", "taro lo'i in 'Iao Valley" and "habitation and burial sites along Lower Main Street corridor" as Wahi Pana (Significant Traditional Places) that are listed in the State inventory of Historic Places and on file with the State and National Registers of Historic Places (see Wailuku-Kahului Plan, pg. 17-18, 2002). This proposal and supporting environmental analysis would be more consistent with HRS 343 and supporting regulations, plans, and policies if these cultural and natural resources of significance were acknowledged and potential positive or negative effects are discussed relevant to requirements and planning goals in the supporting documentation. This analysis is necessary for compliance with HRS 343, and should be considered to support this federal consistency determination request.

Relevant local requirements and functional planning considerations and best management practices should also be identified as considerations and addressed. Particularly relevant to the Department's review of this proposed project, the Maui County Code Section 19.62.100 states that the "Director shall not issue or recommend issuance of any permit or approval involving modification, construction, lining, or alteration of any drainage facility, river, or stream unless such modification, construction, lining, or alteration does not reduce the capacity of the drainage facility, river, or stream, or adversely affect any downstream or adjacent property". This environmental assessment fails to establish that the proposed action will not adversely affect any downstream or adjacent property. Inclusion of modeled extents of the pre-action and post-action flooding anticipated for the 100-year storm event would be helpful, as would discussion of currently assessed alternatives in the context of ongoing flood management efforts underway with DPW. To reflect compliance with NEPA requirements and substantiate an anticipated FONSI, consideration of direct and cumulative impacts including potential spillover effects that are reviewed to be addressed under CZMA should be included the revised narrative. Supporting documentation that describes how hydrogeomorphic impacts of the revised project have been assessed, avoided, minimized, and mitigated if necessary should be clearly summarized and provided in appendices. Revised sediment studies and hydrological models that reflect current conditions and assess the impacts of proposed improvements would provide enhanced support for this critical management consideration. Lacking these components, a conditional CZMA concurrence should establish a timeline and process to facilitate development of these documents with ample time for coordinated local agency and community engagement and review.

To further demonstrate consistency with state, regional, and local plans, please also include specific discussion and analysis of whether proposed hardening at Parcel 888 would constitute conversion of "open space" and "agricultural" land and address that issue further as needed in assessment of consistency with plans and potential impacts regarding the Hawai'i State Plan and the Maui Island Plan. Specifically, please review and consider revising the assessment provided regarding the Hawai'i State Plan Chapter 226's policy 7-10, which seeks to "assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs", policy 23-4, which aims to "promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring their inherent values are preserved", guideline 104(b)(2) which prioritizes land use that makes available "marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district" and guideline 104(b)(13) to "protect and enhance Hawaii's shoreline, open spaces, and scenic resources". Such analysis could be provided in a supporting chapter or appendix in the revised or supplemental EA to demonstrate consideration and incorporation of critical planning principles and consistency with land use and development requirements.

3. **CZMA Assessment and EA would be more consistent and reflect improved analysis if clear definitions of significance and commitments to mitigation measures were detailed and supported by additional documentation.**

The supporting CZMA Federal Consistency Application (CZMA Application) provided by USACE provides several statements and conclusions that require substantiation through inclusion of additional information and analysis, including reference to the planning goals and policies outlined above. As detailed further here, the CZMA Application would provide a sufficiently persuasive showing of consistency by expanding on details relevant to historic resources, scenic and open space resources, coastal ecosystems, economic resources, coastal hazards, development, public participation, and marine resources.

Regarding historic resources, the CZMA Application indicates that the project site has previously been surveyed for historic or archaeological resources, and acknowledges the cultural significance of river rock or "pohaku", but indicates that the site is not within or adjacent to a Hawaiian fishpond or settlement area. However, as noted previously, the Wailuku River and the surrounding area are identified in the Wailuku-Kahului plan as Wahi Pana (Significant Traditional Places) that are listed in the State inventory of Historic Places and on file with the State and National Registers of Historic Places. The CZMA Assessment for Cultural Resources restates the intent for Revetment X removal but does not appear to address the other proposed project components such as the installation of the pre-formed scour hole or emergency warning system that are under review here. As such, the CZMA Application and supporting DEA would reflect improved consistency with local, regional, and state plans and policies if the significance of these resources and potential impacts to these resources – both positive and negative – as well as efforts to avoid and mitigate negative impacts through best management practices that *will* be implemented (rather than "may be implemented") were identified and discussed further in the CZMA Application and revised Supplemental or Final Environmental Assessment.

In discussing consistency with "scenic and open space resources", the CZMA Application notes that the "proposed action would have negligible long-term impacts to visual and aesthetic resources within the stream channel and no impact on coastal scenic or open space resources." The analysis that follows is limited to the scour hole construction. It would seem appropriate to also describe the location and potential positive and/or negative impacts of the new "stream or other climate gage as part of a public flood warning system" in the CZMA Application and supporting environmental assessment. The DEA indicates two locations for the gage are being considered but does not appear to select a preferred alternative, limiting the ability of reviewers to further comment on a proposed location. To support further analysis it would be helpful to discuss both sites further if no preferred location can be identified. As discussed in the August 26, 2021 public hearing, coordination with local emergency management systems is critical for the success of an expanded early warning system and public participation and information sharing opportunities should be leveraged. It is also noted that the implementation of the removal of Revetment X and other flood reconnection project components may result in benefits to open space resources – as well as other significant coastal resources and relevant plans and policies – that could potentially also be referenced and discussed further in the revised EA and revised CZMA Application if necessary to demonstrate consistency with local, regional, and state plans and regulatory requirements.

Discussing impacts to coastal ecosystems, the CZMA Application notes that the proposed action does involve dredge and fill activities that will involve some form of discharge or placement of material in the water, require earthwork, grading, clearing, or grubbing, within a perennial stream. The form indicates the project site does not provide habitat for endangered species or plants, birds, or mammals, however, this analysis does not appear to include discussion of state listed species of concern or environmentally sensitive habitats. Discussion of potential impacts to native fish (o'opu), shrimp (opae), and snails (hihiwai) as well as potential impacts of hardening to the riffle and pool segments of the stream is lacking in the CZMA Application, supporting DEA, and 2017 FEIS that is incorporated by reference. Coordination on project design and timing with the state Department of Land and Natural Resources' Division of Aquatic Resources as well as other engaged stakeholders such as Hui o Na Wai 'Eha, a group working to restore and protect Central Maui streams and rivers including Wailuku River, would ensure improved consistency with local species and habitat management efforts and reduce potential significant impacts to coastal ecosystems and resources of concern.

Regarding "coastal hazards", the project is identified as within a flood hazard area. The supporting discussion notes that the "proposed action would not involve structures or buildings that are subject to development requirements for flood prone areas and would not be related to prevention of coastal flooding from inland projects." However, no support for this analysis is provided. Given that additional scouring will likely increase flow velocity and may contribute to downstream scour, flooding, and associated water quality impacts, additional discussion of impacts of proposed hardening would be beneficial. Similarly, potential positive and negative impacts specific to the removal of "Revetment X" without supporting floodplain reconnection and restoration activities that were previously envisioned should be further detailed in a supplemental CZMA Assessment and federal consistency determination request and in the FEA.

Relevant to "managing development", the CZMA Application states that the proposed action conforms to state and county land use designations as "Agricultural". Parcel 888 is identified as "Prime Agricultural Land" by the Department of Agriculture's Agricultural Lands of Importance to the State of Hawaii (ALISH) classification system and "Agricultural" land by Maui County Zoning, and is identified as "Open Space" in the Wailuku-Kahului Community Plan. The ALISH "prime" classification indicates agricultural lands that have soil quality, growing season, and moisture supply needed to produce sustained crop yields economically, and management of prime agricultural land is addressed in supporting plans and policies. The CZMA Application also indicates that the public has been informed of the proposed action, a conclusion that is addressed further in the following section. A revised EA or a condition of a CZMA concurrence should reflect commitments to outlining and demonstrating alignment of this project with relevant plans and policies.

When detailing "public participation", the CZMA Application notes that a Public Notice for Environmental Assessments was published on May 17, 2021 for a 30-day public comment period and that two virtual public meetings were held on May 22 and 29, 2021 with no comments received. It would be helpful if the FEA detailed where meeting notices were published. Lacking that, it appears that the notice included in "Appendix A – Public Involvement" reflects the notice that was posted on the USACE website. It is not reasonable to expect the average citizen to regularly visit the USACE website to see if public notices are published. In the future it is suggested that USACE work with local partners to initiate early stakeholder meetings including notifying individuals residing or owning property in areas of flooding effect and post notices at proposed project sites and in the local paper to improve public engagement moving forward. The inclusion of a listserv option on the USACE website that would enable stakeholders to sign up and receive notifications when new public comment opportunities or materials are posted may also be helpful and improve public participation in important resource management planning and decision-making procedures as NEPA, CZMA, and other state and local policies envision.

Although it is understood that USACE has held the requisite public meetings, limited participation and lack of responsiveness to questions raised at the recent public meeting do suggest that improved communication and coordination would support enhanced public awareness, engagement, and understanding of this proposal. At the public meeting held on August 26, 2021, representatives from the USACE indicated that additional sediment and hydrological models were underway but are not currently available. Best management practices that may be implemented were also discussed and the three non-USACE attendees at the meeting – two of whom were county employees – were told standard BMPs would be shared to support review and comment. As of September 9, 2021, this supplemental information has not yet been provided. Lack of commitment to specific BMP implementation makes it impracticable for agencies and members of the public alike to understand what potentially significant impacts will be mitigated through BMPs or what BMPs specifically will be implemented. Without inclusion of referenced information that is not yet available for public review and lacking specific mitigation commitments, conclusions that this project will not result in significant impacts are not sufficiently justified.

The small community turn-out at public meetings is also concerning, particularly given the past comments and extensive engagement that occurred relevant to the 2017 FEA. It is understood dissemination of meeting information is especially challenging in the days of the COVID19 pandemic, however, posting notice on the USACE website alone to announce meetings scheduled at lunchtime, dinnertime, or a Saturday morning may not reflect best practices in community engagement. To ensure community awareness of and public engagement in scheduled meetings for proposed actions, it is encouraged that notice be coordinated in advance with local media outlets so it can be posted in the newspaper, on county websites, and perhaps even on printed notices in the surrounding area. In the future it may be worth considering open forums that provide for more than a one-hour window that may conflict with typical mealtimes. Particularly given the cultural and environmental sensitivity of the Wailuku River, documentation of engagement efforts with relevant agencies and stakeholders would further demonstrate consistency with the CZMA objective to "stimulate public awareness, education, and participation in coastal management" and supporting policies of this federal consistency objective.

In summary, it is recommended that the supplemental or revised EA clearly identify and discuss current direct, indirect, and cumulative impacts. This analysis should be supported by additional information regarding modification of past planning efforts, currently proposed projects that would be implemented at this site, and the relationship of this proposed improvement with other reasonably foreseeable projects. Data-driven discussion of reasonably foreseeable direct, indirect, and cumulative effects of these activities should be detailed and the narrative should indicate how identified impacts of concern including potential impacts to stream processes and water quality were analyzed. Analysis of impacts across resource categories should include consideration of future climate impacts and increased in-stream flow, and clear discussion of how potentially significant impacts were identified avoided, minimized, and mitigated. With these revisions, such revisions are necessary for the DEA to be consistent with the requirements of NEPA and HRS 343 and to provide an adequate basis for assessment of the significance of potential impacts of the proposed preferred alternative.

4. **Ensure consistency and participation through ongoing coordination with state and local agencies and community stakeholders through ongoing engagement.**

The draft EA reviewed by the Department did not include details "regarding construction means, methods and sequencing, best management practices, and staging and access requirements" which were not provided and classified as "currently unavailable" as the project is pending authorization to fund repairs and proceed to the design phase. While environmental compliance will be ensured through permitting and approval processes including Clean Water Act Section 401 and 404(B)(1), as well as Section 106 of the National Historic Preservation Act. However, revisions to the supplemental EA or reflected in the FEA would be necessary to achieve consistency with NEPA and HRS 343, and to reflect meaningful public engagement. This includes providing details of best management practices that will actually be implemented and documenting stakeholder outreach and engagement efforts and responses to feedback. To further demonstrate ongoing coordination and consistency with relevant plans and policies, and considering the cultural and ecological sensitivity of the project area, USACE should work with Maui County Department of Public Works to coordinate additional community meetings regarding this and other complementary projects being proposed to address design deficiencies and improve outcomes of the Iao Stream [sic] Flood Control Project. Additional discussion with community members regarding management priorities and changes to instream flow may be prudent and timely given the recent June 28, 2021 Decision and Order from the Commission on Water Resources Management relevant to restoring flow and surface water rights. Given that USACE has ongoing sediment transport and hydrological studies for the Wailuku River underway, incorporating that information into a revised or FEA or into a full draft environmental impact statement may be worth considering further to ensure impacts are fully assessed and alternatives are well vetted and supported by relevant stakeholders. Given the tremendous federal appropriations being allocated to supporting nature-based solutions to reduce flood risks while providing benefits to ecosystem services, if cost alone was the driving motivation to descope the 2017 FEA preferred alternative, perhaps alterative funding mechanisms could be discussed further and pursued in order to achieve the significantly higher benefit cost ratio identified for "Alternative F".

To further reflect consideration of best available data and address community concerns raised at public meetings and comments documented in the 2017 FEA, the Department requests that additional sources of information on water quality as well as freshwater and reef ecosystem health be included in the baseline assessment in the revised or final EA. Rather than deferring to pending water quality certification permits or waiver requests to demonstrate the project will not result in significant impacts to water quality and stream systems, the Department recommends expanded discussion of current water quality measurements available from the Hawaii Department of Health (DOH) as well as incorporation of habitat observations and management recommendations which include construction timing and flow diversion considerations from the Department of Land and

Natural Resources' Division of Fish and Wildlife. Additional discussion and analysis would be helpful to support conclusions that short- and potential long-term water quality changes that may result from this project and associated projects will not result in significant impacts to these high value environmentally sensitive areas. To further establish baseline conditions to support your revised models and analysis, please consider incorporating current data from the 2020 State of Hawaii Water Quality Monitoring and Assessment Report, available at https://health.hawaii.gov/cwb/files/2020/06/DRAFT-202-303d-305b.pdf.

To support public participation, understanding, and engage in ongoing efforts to gather and share robust data on this significant stream system, the Department suggests that USACE and the project sponsor consider developing water quality and benthic monitoring plans for this and related flood management projects in coordination with the University of Hawaii and/or locally-based expert groups during and after implementation of proposed project improvements. Previous flood control and riparian restoration projects have been criticized for a perceived lack of independent or impartial monitoring. There is an opportunity to draw upon a wealth of locally based expertise from groups such as the Hui o Na Wai 'Eha, the Nature Conservancy, local land trusts and cultural groups, and other engaged stakeholders who are active in this area. It may even be possible for these groups to be engaged in the implementation of the pre- and post-construction monitoring, as well as to support comprehensive management efforts to achieve ecosystem and socio-economic benefits for the surrounding Wailuku community. Such outreach and engagement would further reflect meaningful commitments to ensuring public participation and information sharing that are also important resource management goals at federal, state, and local levels.

In conclusion, as it is currently written, it is unclear how the proposed project alternative and reasonably foreseeable related actions will not result in potentially significant impacts to sensitive environmental systems including coastal resources of concern. It is also unclear how this proposed alternative will not be significantly impacted by climate change and increased flood events that the analysis in the Design Appendix of the 2021 EDR indicated were "likely". As such it is not evident how the identified preferred solution will sustainably and cost effectively achieve the stated project purpose and align with federal, state, county, and district-level management objectives. It is suggested that a revised or supplemental analysis include robust discussion of the logic behind the selection of the 2021 proposal alternative rather than the 2017 alternative, including cost assumptions and analysis of total economic valuation of benefits of these approaches. Inclusion of robust modeling that reflects anticipated changes in in-stream flow and accounts for extreme flood events such as the 2016 "500-year return interval" disaster event is further recommended to demonstrate this considerable undertaking is indeed the most cost-effective and beneficial project to protect people, property, and the environment. If such analysis cannot be included in a revised or supplemental environmental assessment, it would seem to be appropriate and more consistent with NEPA and HRS 343 to pursue a full environmental impact

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CURRENT DIVISION (808) 270-8205 / LONG RANGE DIVISION (808) 270-7214 / ZONING DIVISION (808) 270-7253

statement to provide sufficient level of detailed analysis to demonstrate that this project proposal will not result in significant impacts to the Iao Stream / Wailuku River system and will achieve the desired level of sustainable, cost-efficient flood risk mitigation for the Wailuku community and the people of Maui County.

As such, the Department requests substantive revisions and is not supportive of the anticipated FONSI as the DEA is currently written. The Department encourages OP to include conditions that reflect the need to incorporate consideration of ongoing proposed projects that DPW has previously shared with USACE, discussion of complementary planning and project implementation efforts, and best available data and projections regarding this and reasonably foreseeable related projects into a supplemental or revised environmental analysis or commit to conducting an environmental impact statement to allow for additional coordination, review, and public comment before project construction moves forward.

Thank you for your consideration of these comments and for this opportunity to comment on this Draft Environmental Assessment and Federal Consistency Determination. The Department looks forward to the inclusion of additional project details in the Final Environmental Assessment. Should you need clarification on the above comments or would like to discuss further, please contact Coastal Resources Planner Erin Derrington at erin.derrington@co.maui.hi.us or (808) 270-5537.

Sincerely,

for MICHELE MCLEAN, AICP
Planning Director

xc: Clayton I. Yoshida, AICP, Planning Program Administrator (PDF)
Jeffrey P. Dack, Current Planning Supervisor (PDF)
Erin Derrington, Coastal Resources Planner (PDF)
Diego Sanchez-Gomez, ZEAD Floodplain Administrator (PDF)
Tara Miller Owens, U.H. Sea Grant Extension Program (PDF)
Wesley Crile, U.H. Sea Grant Extension Program (PDF)
Sam Lemmo, Department of Land and Natural Resources-Office of Conservation and Coastal Lands (PDF)
U.S. Army Corps of Engineers, Honolulu District, Civil and Public Works Branch (CEPOH-PPC), Attn Jessie Paahana (Letter, PDF)
Project File

MCM:CIY:JPD:EMD

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Hui 0 Nā Wai ‘Ehā

Ola i ka wai WWW.HUIONAWAIEHA.ORG

September 5, 2021

Re: Army Corps of Engineers ‘Īao Flood Control Project Modifications – Wailuku River

Aloha e Kākou,

On behalf of the Board of Hui o Nā Wai ‘Ehā, including myself Hōkūao Pellegrino as Board President, we would like to extend our gratitude to you for allowing us to comment on the ‘Īao Flood Control Project Modifications – Wailuku River. As mentioned during your presentation in August, our organization takes all projects that involve our streams very seriously, especially if they are intended to alter, divert, modify stream flow or impact natural and cultural resources. Please accept our testimony based on the background information you provided. We would like to request the right to further expand and or even change our comments as more details are provided to us through the review and permitting process.

Although this project may be small in size compared to many other projects we review and provide comments on, we have experienced firsthand in recent years after the massive 2016 flood in Wailuku River, that even small projects can have serious consequences and impacts to our native and culture resources. In fact, a project literally feet away and just mauka from the proposed project on October 25, 2017, there was a major incident in which over fifteen massive 3 foot by 20 foot black corrugated pipe got washed down the river and ended up in the ocean and reef system, many of which could never be recovered. We were able to document the entire issue and to our disappointment, even with BMP’s in place, it completely failed and caused irreparable damage to our ocean resources. The contractor, project team and company tasked with that project were from the mainland and knew very little to nothing about the characteristics and nature of our streams, especially around flash flooding events. Therefore, it is imperative that we request to be kept in the loop throughout the duration of the project, especially knowing that we are the eyes and ears on the ground with the Nā Wai ‘Ehā and Wailuku community members. The Nā Wai ‘Ehā and Wailuku community is very sensitive when it comes to seeing machines and other materials in our rivers and lot of times, they look to the Hui for answers and immediate responses to things that are out of the ordinary happening in our rivers and streams.

Hui o Nā Wai ‘Ehā (501c3) · 213 West Waikō Road, Wailuku, Maui, Hawaii 96793
(808) 430-4534 · Huionawai4@gmail.com · www.huionawaieha.org ·

The Mission of Hui o Nā Wai ‘Ehā is to advocate for the restoration and stewardship of mauka to makai streamflow in Waikapū, Wailuku, Waiehu, Waihe‘e Streams (Nā Wai ‘Ehā), to protect cultural and natural resources pertaining to traditional and customary practices of Native Hawaiian kuleana kalo farmers and to engage the Maui community in water resource management education outreach programs.

Please see the numbered points below regarding concerns that we have.

1. Hui o Nā Wai ʻEhā opposes any work that is meant to cement, harden, cover over, channelize, and/or further modify the natural riverbed of Wailuku River. While we understand this won't be occurring on this particular project, we need to state that loud and clear because there have been numerous attempts by other governing agencies to further channelize the lower reaches of the Wailuku River. There are well-known and documented historical springs (Kawaiola) downstream from this proposed project that irrigate the pre-western wetlands/fishpond and loʻi kalo of Kaʻehu O Ka Moi, which are known as both naturally and culturally protected resources. Research has made it clear that former channelization work in the Wailuku River beginning in the 1960s has severely and negatively impacted the springs and other important water/cultural resources in the lower reaches of the Wailuku River. As more details come out for this project, we would like to take the opportunity to further review exact locations of the embankment stabilization work.

2. Hui o Nā Wai ʻEha requests that there be an archaeological monitor on-site due to the known pre-western and historic resources of Wailuku River in the location of the project. Following the massive 2016 flood in Wailuku, the proposed project area that is being discussed had numerous plantation era relics become exposed such as train tracks, train engine and car wheels and other things. The Wailuku Sugar Mill was located in the neighboring vicinity and the area close to the river was used as a dumping site. There may likely be other cultural layers beneath and/or adjacent to the proposed work area and therefore, we would request a monitoring plan in place as well as having an archaeologist on site to ensure that area is protected. The Pihanakalani and Hale Kiʻi Heiau are not that much farther downstream and it is important that all areas in and around the project area are protected, especially relating to Native Hawaiian cultural resources.

3. Hui o Nā Wai ʻEhā requests that the project contractors notify DLNR Aquatics Division about this project and to have an aquatic biologist conduct a native biota survey. This study is to better understand periods of native aquatic species spawning as well as upstream migration. A Project like this will likely require equipment in the stream as well of the possibility of making the stream turbid in the lower reaches when work commences. This most definitely has the potential to cause irreparable damage to native aquatic species habitat and survivability. Our organization has fought and advocated for over two decades to re-establish native aquatic habitats and since the Interim Instream Flow Standards were established in 2014 for Wailuku River, we have seen new and healthy native aquatic species recruitment occurring on a regular basis. If DAR is unable to

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conduct this task, Hui asks that the County of Maui hire someone to conduct research on this.

4. Hui o Nā Wai ʻEhā opposes any request by the Army Corps of Engineers and Contractors to request CWRM to temporarily halt or alter Instream Flow Standards for any length of time that this project is being executed on. This is to ensure that mauka to makai flow is continual and natural flows undisturbed. This also includes any diversions of natural stream flows away from the project area. In, 2019, CWRM built a ʻOʻopu Ladder with the intent of protecting native species, however in the construction of this ladder, thousands of ʻoʻopu, ʻōpae and hīhīwai species were killed off because Wailuku Water Co. was allowed to "shut off" off the river via their diversion. Hui o Nā Wai ʻEhā condemned these acts of "playing god" by turning on and off rivers and would like to make this crystal clear that we do not support any and all attempts to reduce stream flow prior, during and/or following whatever work is conducted.

5. Hui o Nā Wai ʻEhā would like to see the BMP's for this project go above and beyond, especially knowing there may likely be heavy machinery, equipment and material in the riverbed. Paying close attention to daily whether guides. Knowing weather patterns as wells as the characteristics of the river will be super important not just for the safety of the crew but also the protection of our natural and cultural resources below the project area. (i.e. washing down of materials/equipment into the ocean and reef system).

6. Communication is key and the Hui requests that we be notified about the progression of the planning and entitlement process however, even more so, is when the project starts. We need to know details as to ensure when the community reaches out to us with concerns, we will be able to address their concerns. If and when plans for this project are approved, we request that we are notified on the exact scope of work, timeline, planed dates for work and communication plan.

Our streams and rivers deserve the utmost respect, protection and enforcement, a kuleana we don't take light. Mahalo nui for your time and ability to provide comments on this reject. Should you have any questions, please don't hesitate to reach out.

Me ka haʻahaʻa,

Hōkūao Pellegrino

Hōkūao Pellegrino
(President)

Appendix B

Finding of No Significant Impact

- Finding of No Significant Impact, September 30, 2021

FINDING OF NO SIGNIFICANT IMPACT

Modification to the Iao Stream Flood Control Project
Wailuku River, Wailuku, Island of Maui, Hawaii

The USACE, Honolulu District has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The amended Engineering Documentation Report (EDR) and Supplemental Environmental Assessment (SEA) dated 30 September 2021, for the Modification to the Iao Stream Flood Control Project addresses design deficiency and flood risk reduction opportunities for the Wailuku community. The final recommendation is contained in both the Final EDR and SEA.

The Final EDR and SEA, incorporated herein by reference, evaluated various alternatives that would address design deficiency and reduce flood risk in the Wailuku community. The recommended plan is the National Economic Development (NED) Plan and includes:

- Removal of approximately 290 feet of the remaining portion of Revetment X along the left back,
- Excavation of the eroded channel invert and construction of a pre-formed scour hole, and
- Installation of a stream gage or other climate gage as part of a public flood warning system.

In addition to a “no action” plan, four alternatives were evaluated.[1] The alternatives are included in Section 2 of the SEA:

- No Action Alternative
- Alternative 2: Remove Revetment X
- Alternative 6: Install Pre-Formed Scour Hole
- Alternative 11: Non-Structural Plan (Public Flood Warning System)
- Alternative 12: Combination Plan: Alternative 2 + Alternative 6 + Alternative 11 (Recommended Plan)

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the recommended plan are listed in Table 1:

[1] **40 CFR 1505.2(b) requires a summary of the alternatives considered.**

Table 1: Summary of Potential Effects of the Recommended Plan

	Insignificant effects	Insignificant effects as a result of mitigation*	Resource unaffected by action
Aquatic resources/wetlands	☒	☐	☐
Fish and wildlife habitat	☒	☐	☐
Threatened/Endangered species/critical habitat	☐	☐	☒
Historic properties	☐	☐	☒
Other cultural resources	☐	☐	☒
Floodplains	☐	☐	☒
Land use	☐	☐	☒
Noise	☐	☐	☒
Public infrastructure	☐	☐	☒
Socio-economics	☐	☐	☒
Environmental justice	☐	☐	☒
Geological Resources	☐	☐	☒
Recreational Resources	☐	☐	☒
Solid and Hazardous Waste	☐	☐	☒
Visual Aesthetics	☐	☐	☒
Water quality	☒	☐	☐
Climate, Air Quality, Greenhouse Gases	☐	☐	☒
Traffic and Circulation	☐	☐	☒

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the EDR and EA will be implemented, if appropriate, to minimize impacts.[2] Standard BMPs will be implemented throughout the duration of construction to avoid and minimize adverse impacts to natural resources. For example, silt fencing and other sediment erosion control measures to prevent inadvertent discharges to surface waters.

No compensatory mitigation is required as part of the recommended plan.

Public review of the draft SEA and FONSI was completed on 13 September 2021. All comments submitted during the public review period were responded to in the Final SEA and FONSI.

[2] 40 CFR 1505.2(C) all practicable means to avoid and minimize environmental harm are adopted.

OTHER ENVIRONMENTAL AND CULTURAL COMPLIANCE REQUIREMENTS:

ENDANGERED SPECIES ACT

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, USACE determined that the recommended plan will have no effect on federally listed species or their designated critical habitat.

NATIONAL HISTORIC PRESERVATION ACT

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that the recommended plan would have no effect on historic properties including cultural resources. The State Historic Preservation Division concurred with the determination on 29 September 2021**.**

CLEAN WATER ACT SECTION 404(B)(1) COMPLIANCE

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the recommended plan has been found to be compliant with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Section 7 of the USACE Final Decision Document for the 2017 Nationwide Permit (NWP) #3, Maintenance dated 21 December 2016 as referenced in Section 4.4 of the Final SEA. All applicable general and regional conditions of NWP #3 will be incorporated as specification of any construction contract.

CLEAN WATER ACT SECTION 401 COMPLIANCE:

401 WQC TO BE OBTAINED IN THE DESIGN PHASE.

A water quality certification pursuant to section 401 of the Clean Water Act will be obtained from the State of Hawaii Department of Health, Clean Water Branch prior to construction. In a letter of confirmation dated 9 September 2021, the State acknowledged USACE's coordination on this project, stated it had no preliminary issues with the USACE moving forward with further designs of this project and seeking Section 401 WQC from the State prior to construction. All conditions of any water quality certification obtained will be implemented in order to minimize adverse impacts to water quality.

COASTAL ZONE MANAGEMENT ACT COMPLIANCE (CZMA):

CZMA CONSISTENCY CONDITIONAL CONCURRENCE OBTAINED.

The State of Hawaii Coastal Zone Management (CZM) Office issued concurrence on the USACE determination of consistency with the State CZM program pursuant to the Coastal Zone Management Act of 1972 by letter dated 28 September 2021, including conditions necessary to be implemented in the design phase to ensure consistency . All conditions of the consistency determination shall be implemented as stated in the

State's conditional concurrence in order to minimize adverse impacts to the coastal zone.

FINDING:

Technical, environmental, and economic criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives; coordination with appropriate agencies and officials have been completed.[3] Based on this report, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the recommended plan would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.[4]

30 SEP 21

Date

Eric S. Marshall
Lieutenant Colonel, Corps of Engineers
District Commander

[3] 40 CFR 1505.2(B) requires identification of relevant factors including any essential to national policy which were balanced in the agency decision.

[4] 40 CFR 1508.13 stated the FONSI shall include an EA or a summary of it and shall note any other environmental documents related to it. If an assessment is included, the FONSI need not repeat any of the discussion in the assessment but may incorporate by reference.

Appendix C

Clean Water Act

- Section 401 Letter of Confirmation, September 9, 2021
- Request for Letter of Confirmation, September 7, 2021

Clean Water Act Section 401
Letter of Confirmation

DAVID Y. IGE
GOVERNOR OF HAWAII

ELIZABETH A. CHAR, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

09010CEC.21

September 9, 2021

Ms. Rhiannon L. Kucharski
Civil and Public Works Branch
Department of the Army
U.S. Army Corps of Engineers, Honolulu District
Fort Shafter, Hawaii 96858-5440

Dear Ms. Kucharski:

Subject: Iao Stream Flood Control Project Conceptual Design April 19, 2021 Coordination Meeting

Reference is made to your letter transmitted in the September 7, 2021 e-mail from Ms. Jessie Paahana, Environmental Coordinator, of your staff. The Department of Health (DOH), Clean Water Branch (CWB) confirms attending the subject coordination meeting with the U.S. Army Corps of Engineers (USACE), Civil and Public Works Branch.

Pursuant to Clean Water Act (CWA), Section 401 (33 USC § 1341), the USACE must obtain a Section 401 Water Quality Certification (WQC) from the DOH-CWB for the proposed discharge. The DOH-CWB acknowledges that the details of the planning level of conceptual design are inadequate to identify and describe the proposed discharges with sufficient detail to apply for and obtain a Section 401 WQC from the DOH-CWB. Although insufficient detail exists at the planning stage for USACE to apply and obtain a Section 401 WQC from the DOH-CWB, the DOH-CWB has no preliminary issues, based on information available at this time, with the USACE moving forward with further designs of this project. We acknowledge that USACE will seek a Section 401 WQC from the DOH-CWB when sufficient detail is available. A Section 401 WQC must be obtained prior to construction.

If you have any questions, please contact Mr. Edward Chen of the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Alec Wong

ALEC WONG, P.E., CHIEF
Clean Water Branch

c: Ms. Lorayne Shimabuku, USACE [via e-mail Lorayne.P.Shimabuku@usace.army.mil only]
Ms. Jessie Paahana, USACE [via e-mail Jessie.K.Paahana@usace.army.mil only]

Clean Water Act Section 401
Request for a Letter of Confirmation

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

September 7, 2021

Civil and Public Works Branch
Programs and Project Management Division

Mr. Alec Wong
Clean Water Branch
Environmental Management Division
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Wong:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is pursuing discrete structural repairs to address a design deficiency at the Iao Stream Flood Control Project (FCP) in Wailuku, Island of Maui, Hawaii. The Iao Stream FCP was authorized for construction by Congress in 1968 under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 in accordance with the recommendations of the Chief of Engineers in House Document Number 151 of the 90th Congress. Construction of the project by the Corps was completed in 1981 and consisted of enlarging, straightening, and stabilizing the channel as well as constructing levees, walls, and a debris basin. The non-Federal sponsor is the County of Maui.

The Corps met with your agency on April 19, 2021, to present the project details and to discuss potential discharges into waters of the U.S. subject to the Clean Water Act regulation (see enclosed presentation). In accordance with Section 401 of the Clean Water Act (33 USC § 1341), the Corps must obtain certification from the State of Hawaii Department of Health (DOH), Clean Water Branch that any proposed discharges will comply with the applicable provisions of the Clean Water Act. However, as discussed at our meeting, the details of the planning level, conceptual design are inadequate to identify and describe all proposed discharges with sufficient detail to apply for and obtain a Section 401 Water Quality Certification from the DOH. The Corps will seek water quality certification from your agency when sufficient detail is available, during the environmental permitting process of the Design Phase. The Corps seeks written confirmation acknowledging the Corps' coordination on this project with your agency, your agency's potential preliminary findings, if available, and acknowledgement of the Corps' plans to obtain a water quality certification at a later date, prior to implementation of the project.

We request your written confirmation within 30 days of the date of this letter. As this study progresses, we will continue to keep your agency apprised of any changes, as appropriate. Should you have any questions or comments, please contact the Project Manager, Ms. Lorayne (Nani) Shimabuku, at (808) 835-4030 or via email at Lorayne.P.Shimabuku@usace.army.mil or the Environmental Coordinator, Ms. Jessie Paahana, at (808) 835-40423 or via email at Jessie.K.Paahana@usace.army.mil. Thank you for your attention to this matter.

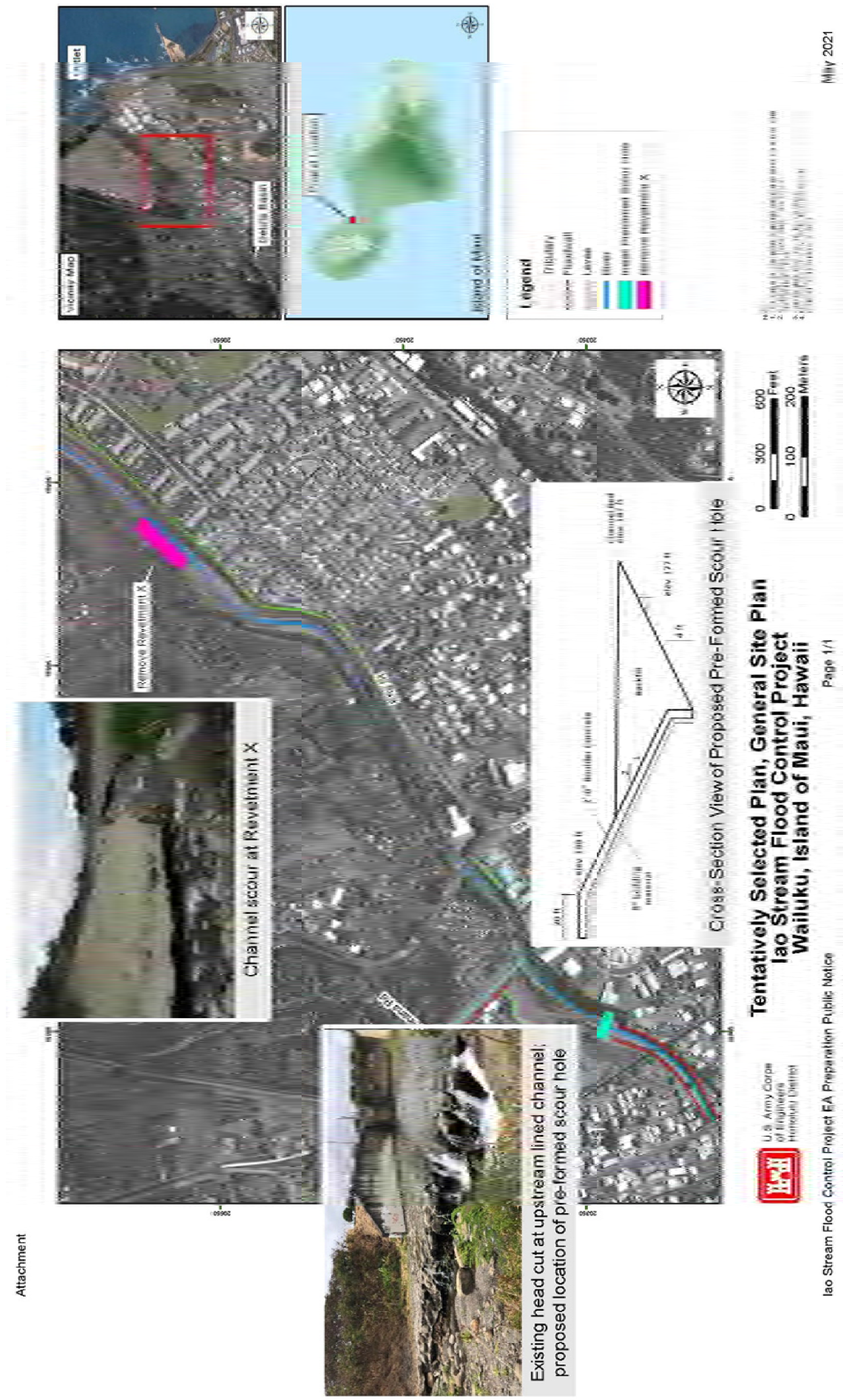
Sincerely,

R. Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosure

Enclosure: Proposed Action Drawing



Appendix D

Coastal Zone Management Act

- CZM Conditional Concurrence, September 28, 2021
- Request for Federal Consistency Review, July 27, 2021
- CZM Correspondence

Coastal Zone Management Act
Conditional Concurrence

STATE OF HAWAII
OFFICE OF PLANNING
& SUSTAINABLE DEVELOPMENT

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

DAVID Y. IGE
GOVERNOR

MARY ALICE EVANS
DIRECTOR

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: https://planning.hawaii.gov/

Coastal Zone Management Program

Environmental Review Program

Land Use Commission

Land Use Division

Special Plans Branch

State Transit-Oriented Development

Statewide Geographic Information System

Statewide Sustainability Program

DTS202107281449NA

September 28, 2021

Ms. Jessie K. Paahana
U.S. Army Corps of Engineers, Honolulu District
Civil and Public Works Branch
Building 230
Fort Shafter, Hawaii 96858-5440
jessie.k.paahana@usace.army.mil

Dear Ms. Paahana:

Subject: Coastal Zone Management Act Federal Consistency Review for Iao Stream Flood Control Project Modifications and Repairs, Wailuku, Maui

The Hawaii Coastal Zone Management (CZM) Program has reviewed the U.S. Army Corps of Engineers, Honolulu District, Coastal Zone Management Act (CZMA) consistency determination for the Iao Stream Flood Control Project (FCP) modifications and repairs, Wailuku, Maui (proposed activity), that was received on July 27, 2021. This federal consistency review covers the Corps of Engineers Alternative 12: Combination Plan (a combination of Alternative 2, Alternative 6, and Alternative 11), which is identified as the "Preferred Alternative" in the Draft Supplemental Environmental Assessment (DSEA), July 2021, and includes the following:

- Alternative 2 - Remove Revetment X. Remove approximately 200 feet of the remaining portion of Revetment X along the left bank, widening the channel, allowing flows to dissipate across a wider area, and reducing velocity. Further stabilization of the left bank revetment is not proposed. No action is proposed along the right bank.

- Alternative 6 - Install Pre-Formed Scour Hole. Excavate the eroded channel invert and construct a "pre-formed scour hole," i.e., engineered stabilization of the scoured invert consisting of a boulder-concrete sloped toe with buried key and backfilled with natural material consistent with the existing channel bottom (concept drawing shown as Figure 2-6, DSEA, p. 16). This alternative would repair existing erosion and prevent future, imminent erosion, thereby reducing downstream erosion and risk to community safety.

- Alternative 11 - Non-Structural Plan (Flood Warning System). Install a stream gage or other climate gage as part of a public flood warning system at either Iao Valley Road Bridge or at the existing USGS gage between the Iao Stream FCP debris basin and the Market Street Bridge. Installation of a stream gage would improve community safety by increasing community and regional understanding of the potential for flooding as well as increased communication of imminent flood events. USACE will coordinate directly with the County of Maui Emergency Management Agency to establish a central base station or field station with necessary communications equipment (siren / beacon lights), and software at the County Emergency Management Offices.

The Hawaii CZM Program published a public notice in the State Environmental Review Program publication, "The Environmental Notice," on August 8, 2021, with the public review and comment period concluding on August 23, 2021. A revised supplemental public notice that included the federal consistency supplemental coordination for Revetment X, was published on August 23, 2021, with the public review and comment period concluding on September 7, 2021. Revetment X was previously reviewed for federal consistency as part of the former Alternative F, that was issued conditional concurrence on June 2, 2017, and was reviewed currently for supplemental coordination because it is the only feature of Alternative F that is being moved forward. During the CZM public notice period no public comments or inquiries were received. Consultation requests were sent to the Division of Aquatic Resources (DAR) and the County of Maui Planning Department (Maui Planning) on July 27, 2021. No comments were received from DAR. Comments from Maui Planning, dated September 13, 2021, were received on September 14, 2021. The Hawaii CZM Program identified Maui Planning comments that were deemed necessary for the CZMA federal consistency review, and along with questions from the CZM Program were referred to the Corps of Engineers on September 14, 2021 for responses. Responses to the comments and questions were received from the Corps of Engineers on September 27, 2021.

We conditionally 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 activity shall be carried out as represented in the CZMA federal consistency determination and all supporting materials and information provided to the Hawaii CZM Program. Any changes to the proposed activity shall be submitted to the Hawaii CZM Program for review and approval. Changes to the proposed activity 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 activity 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. To mitigate potential adverse effects to water quality, to ensure continuous in-stream flow, and to allow for passage of native aquatic biota, e.g., fish (oopu), shrimp (opae), and snails

(hihiwai), best management practices (BMP) shall be designed and implemented as represented in the consistency determination, CZM assessment form, and supporting information - DSEA July 2021; Final EA July 2017; Engineering Documentation Report Amendment August 2021; and Corps of Engineers responses to questions and comments, received on September 20 and 27, 2021. When the BMP plan(s) has/have been finalized by the Corps of Engineers, the County of Maui Department of Public Works, and/or their contractor(s), the BMP plan(s) shall be submitted to the Hawaii CZM Program. Because the BMP plan(s) has/have not yet been fully developed, supplemental coordination and review of the BMP plan(s) by the Hawaii CZM Program may be required in accordance with 15 CFR § 930.46. This condition is necessary to ensure consistency with Hawaii CZM Program federally approved enforceable policy HRS Chapter 205A Coastal Zone Management, Section 205A-2 Coastal Ecosystems.

3. The proposed activity shall be conducted in compliance with State of Hawaii water quality standards and requirements as specified in Hawaii Administrative Rules (HAR) Chapter 11-54 Water Quality Standards, including obtaining a Section 401 Water Quality Certification (WQC) from the State Department of Health (DOH). The commitment to obtain a WQC was represented in the U.S. Army Corps of Engineers letter to DOH on September 7, 2021 and confirmed by DOH that a WQC is required (letter September 9, 2021). This condition is necessary to ensure consistency with Hawaii CZM Program federally approved enforceable policies HRS Chapter 342D Water Pollution, and HAR Chapter 11-54.

4. The proposed activity shall be conducted in compliance with the State Historic Preservation Division (SHPD) requirements resulting from the consultation under HRS Chapter 6E Historic Preservation / Section 106 National Historic Preservation Act that was initiated by the Corps of Engineers on August 27, 2021. This condition is necessary to ensure consistency with Hawaii CZM Program federally approved enforceable policy HRS Chapter 6E.

5. A Stream Channel Alteration Permit (SCAP) shall be obtained by the County of Maui Department of Public Works, as the non-federal sponsor for the proposed activity, if the State Department of Land and Natural Resources, Commission on Water Resources Management, determines that a SCAP is required for alterations to the bed and banks of the Iao Stream FCP. This condition is necessary to ensure consistency with Hawaii CZM Program federally approved enforceable policies HRS Chapter 174C State Water Code, and Hawaii Administrative Rules (HAR) Chapter 13-169 Protection of Instream Uses of Water.

6. In response to the Maui Planning comments that “documentation that describes how hydrogeomorphic impacts of the revised project have been assessed, avoided, minimized, and mitigated if necessary should be clearly summarized and provided in appendices” and “revised sediment studies and hydrological models that reflect current conditions and assess the impacts of proposed improvements would provide enhanced support for this critical

management consideration," (County of Maui Planning Department letter September 13, 2021, page 12, paragraph 1), the Corps of Engineers stated (response to CZM Program received September 27, 2021):

> "As the study moves into the design phase, the proposed design would be further refined and more detail regarding the design plan and specification would be developed. The Corps, in partnership with the County of Maui, will continue to engage the local sponsor and local stakeholders to ensure consideration and incorporation of local requirements and planning considerations. In the absence of this information at this planning stage, the Corps acknowledges that concurrence may be conditional, pending receipt of this requested information."

As represented by the Corps of Engineers response above, when the proposed design is refined and details of the design plan are available, along with information on the hydrogeomorphic impacts, sediment studies, and hydrological models that reflect current conditions and assess the impacts of proposed improvements, the information shall be provided to the Hawaii CZM Program for review. If the final design is deemed by the CZM Program as significantly and/or substantially different from the proposed activity that was reviewed by this consistency review at the planning stage, then additional federal consistency review may be required in accordance with condition no. 1, above.

7. Future activities occurring within the Iao Stream (Wailuku River) FCP, whether new, modifications, or repairs, conducted by the Corps of Engineers and/or the County of Maui that are subject to CZMA federal consistency review, may be required by the Hawaii CZM Program to provide an analysis of the cumulative and/or additive effects to coastal resources and uses as information necessary to evaluate consistency with CZM enforceable policies. This condition is necessary to ensure consistency with Hawaii CZM Program federally approved enforceable policy HRS Chapter 205A Coastal Zone Management.

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. The U.S. Army Corps of Engineers, Honolulu District shall notify the Hawaii CZM Program if the conditions are not acceptable in accordance with 15 CFR § 930.4(a)(2). Otherwise, acceptance of the conditions shall be presumed at the end of the 90-day federal consistency notification period on October 25, 2021. In accordance with 15 CFR § 930.41(c), final federal agency action shall not be taken sooner than October 25, 2021, unless the Corps of Engineers notifies the Hawaii CZM Program that the conditions of concurrence are acceptable, thereby confirming this concurrence and closing the federal consistency notification period on the date of receipt of the Corps acceptance of the conditions.

This CZM consistency conditional concurrence does not represent an endorsement of the proposed activity nor does it convey approval with any 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 contact John Nakagawa of our CZM Program at john.d.nakagawa@hawaii.gov or (808) 587-2878.

Sincerely,

Mary Alice Evans

Mary Alice Evans
Director

cc: Darryl Lum, DOH Clean Water Branch (by email)
State Historic Preservation Division (by email)
DLNR, Division of Aquatic Resources (by email)
Commission on Water Resource Management (by email)
Erin Derrington, County of Maui Planning Department (by email)
County of Maui Department of Public Works (by email)

Coastal Zone Management Act

Request for Federal Consistency Review

From: Nakagawa, John D
To: Paahana, Jessie A CIV USARMY CEPOH (USA)
Subject: [Non-DoD Source] Re: CZM Federal Consistency Review for Iao Stream Flood Control Project Install Pre-Formed Scour Hole
Date: Tuesday, July 27, 2021 2:26:12 PM

Jessie:

The U.S. Army Corps of Engineers CZMA federal consistency determination for the Iao Stream FCP installation of pre-formed scour hole, removal of Revetment X, and installation of a public flood warning system, has been received and accepted for review. The start date for the 60-day CZM review is July 28, 2021, the end date is September 27, 2021. If it is necessary to use the 15-day extension for the CZM review period, then we will inform you. The public notice for the CZM review will be published in the State Environmental Review Program publication, "The Environmental Notice," on August 8, 2021, with the public review and comment period ending on August 23, 2021. If any comments or questions are received from the public or reviewing state and county agencies, they will be referred to you for responses to the CZM Program.

Also, please provide copies of the letters to the Department of Health Clean Water Branch and the State Historic Preservation Division when they are finalized.

Thank you.

John Nakagawa
Hawaii Coastal Zone Management Program

From: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Sent: Tuesday, July 27, 2021 7:54 AM
To: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Subject: [EXTERNAL] RE: CZM Federal Consistency Review for Iao Stream Flood Control Project Install Pre-Formed Scour Hole

Mahalo, John!

From: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Sent: Tuesday, July 27, 2021 7:45 AM
To: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Subject: [Non-DoD Source] Re: CZM Federal Consistency Review for Iao Stream Flood Control Project Install Pre-Formed Scour Hole

Jessie:

All documents received. I will review for completeness and then confirm with you, or get back with questions.

John Nakagawa
Hawaii Coastal Zone Management Program

From: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Sent: Tuesday, July 27, 2021 1:01 AM
To: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Subject: [EXTERNAL] RE: CZM Federal Consistency Review for Iao Stream Flood Control Project Install Pre-Formed Scour Hole

I fumbled this one and received some last minute input for the Section 106 for these repairs. If it is at all possible to expedite CZM review or shoot for less than 75 days, it would be greatly appreciated. We are trying to tie up all loose ends by beginning to mid September. Note this is an addendum just for the added repair. Previously consulted repair at Revetment X received a CZM concurrence (attached). The 2017 EA can be accessed online here: https://www.poh.usace.army.mil/Portals/10/docs/Civil%20Works/Iao%20Stream%20Final%20EA_July2017.pdf Previously referred to as Alternative F, the preferred alternative in 2017.

From: Paahana, Jessie A CIV USARMY CEPOH (USA)
Sent: Monday, July 26, 2021 10:56 PM
To: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Subject: CZM Federal Consistency Review for Iao Stream Flood Control Project Install Pre-Formed Scour Hole
Importance: High

Aloha, John:

As discussed at our coordination meeting with DOH and USFWS on April 19, 2021, the Honolulu District, United States Army Corps of Engineers (Corps) is proposing to address design deficiencies of the Iao Stream Flood Control Project (FCP) in Wailuku, Island of Maui, Hawaii. Specifically, the Corps is proposing to install a pre-formed scour hole to address localized erosion at the transition between the lined stream channel and unlined stream channel upstream of the Market Street Bridge. Pursuant to Section 307 of the Coastal Zone Management Act (16 USC § 1456), the Corps understands that the proposed repairs constitute a development project that may affect coastal uses and/or resources and accordingly is subject to review by your office, to ensure consistency with the State of Hawaii Coastal Zone Management (CZM) Program.

Background. The proposed installation of a pre-formed scour hole is a component of the Corps' proposed action, in addition to the removal of revetment X and installation of a public flood warning system. Collectively, the proposed action is termed, "Alternative 12". Under the current proposal, the pre-formed scour hole is termed, "Alternative 6" and the removal of revetment X is termed, "Alternative 2". Note that Alternative 2 was previously proposed by the Corps in 2017, and at the time, was a component of Alternative F, the previously preferred alternative. In response to additional modelling, the only component of the 2017 preferred alternative that has been carried forward under the currently proposed action is the removal of revetment X.

In 2017, the Corps requested review by the Hawaii CZM Office and received a Consistency Concurrence Determination. The Corps has identified no change to the scope or assessment of removal of revetment X between the previously proposed Alternative F and the currently proposed Alternative 2. Accordingly, the Corps seeks confirmation from the Hawaii CZM Office that the prior consistency concurrence remains valid for that portion of the currently proposed action. Alternative 6, install pre-formed scour hole, is a recent proposal and has not yet been formally reviewed by the Hawaii CZM Office. The proposed repairs under Alternative 6 are to repair and reinforce the existing channel bed lining prevent further and future imminent erosion and undermining of the functioning of the Iao Stream FCP. All repairs will occur within the lateral limits of the Iao Stream FCP. The proposed reinforcement involves construction of a buried toe. Upon completion, the minimum reach necessary to repair the transition from a lined channel to an unlined channel will be consistent with the upstream lined channel. The proposed lining 1) will not be discernibly different from the existing upstream channel lining, 2) will not introduce any new vertical visual element above the existing channel bed, and 3) will not demonstrably modify stream flow dynamics upstream or downstream.

Environmental Compliance. For your information, the Corps has determined the proposed installation of a pre-formed scour hold will have no effect on listed species, therefore consultation with USFWS is not required. The maintenance repairs do not trigger the need to consult under the Fish and Wildlife Coordination Act. The project area is absent of Essential Fish Habitat and will not cause adverse effects to EFH and therefore consultation with NMFS is not required. Consultation will be initiated with SHPD and interested parties for the Corps' preliminary determination that the undertaking will not affect historic properties in August 2021. The Corps will seek a letter of confirmation from DOH on the Corps' intent to apply for and obtain a Section 401 WQC during the design phase when sufficient project-specific information exists to submit a complete application. Pursuant to NEPA, the Corps has prepared an Environmental Assessment to supplement the 2017 final EA for the previously proposed repairs at Iao Stream FCP. Relevant updates and evaluation of the proposed installation of a pre-formed scour hole is documented in the draft EA that will begin public review for comment in August 2021. To prepare drafting the draft EA, the Corps posted a Public Notice on May 17, 2021 notifying the public of the Corps' intent to prepare an EA and to solicit feedback on the proposed repair. In addition the Corps hosted two public informational meetings on May 22 and May 29, 2021. No comment was received during the 30-day comment period. The draft EA will be circulated for 30 days. Comments received will be incorporated into any final NEPA document.

Determination. The Corps has reviewed the Hawaii CZM Program objectives and policies at Hawaii Revised Statutes, Chapter 205A and determined that based on the maintenance nature of the activity and the resulting minor, non-adverse, anticipated impacts to coastal uses and resources, the proposed project is consistent, to the maximum extent practicable, with the State's CZM Program. The Corps seeks your concurrence on this determination.

Transmitted with this letter is the Corps' Hawaii CZM Program Federal Consistency Application

(Enclosure 1), Hawaii CZM Program Federal Consistency Assessment Form (Enclosure 2), draft EA (not released) (Enclosure 3), draft Section 106 consultation letter (Enclosure 4), and the draft DOH letter of confirmation request (Enclosure 5).

Should you have any questions or comments, please contact Ms. Jessie Paahana, Environmental Coordinator of my Civil and Public Works Branch, at (808) 835-4042 or via email at jessie.k.paahana@usace.army.mil. Thank you for your cooperation.

Mahalo,

Jessie

Jessie Paahana
Environmental Coordinator
Honolulu District, U.S. Army Corps of Engineers Programs and Project Management Division, Civil and Public Works Branch Building 230, [CEPOH-PPC] Fort Shafter, Hawaii 96858-5440

P: 808-835-4042
E: Jessie.k.paahana@usace.army.mil

Hawaii CZM Program
Coastal Zone Management

www.hawaii.gov/dbedt/czm

APPLICATION FOR CZM FEDERAL CONSISTENCY REVIEW

Project/Activity Title or Description: Install Pre-Formed Scour Hole at Iao Stream Flood Control Project

Location: Iao Stream Flood Control Project, Upstream of Market Street Bridge, Wailuku

Island: Maui

Tax Map Key: 234030888

Applicant or Agency	**Agent or Representative for Applicant**
U.S. Army Corps of Engineers, Civil & Public Works	
Name of Applicant or Agency	Agent or Representative for Applicant
Building 230	
Mailing Address	Mailing Address
Fort Shafter/HI/96858-5440	
City / State / Zip Code	City / State / Zip Code
808-835-4042	
Phone	Phone
jessie.k.paahana@usace.army.mil	
E-mail Address	E-mail Address

CZM Consistency Determination or Certification

✓ Check the applicable type of federal action below and sign.

☑ 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 27 July 2021

☐ Federal Permit or License

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 ______________

☐ Federal Grants and Assistance

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 ______________

Mail Application To: Office of Planning, State of Hawaii, P.O. Box 2359, Honolulu, Hawaii 96804

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 recreational 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, fishponds, and sand 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) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources.
   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 lagoons, artificial beaches, and artificial reefs for surfing and fishing.
   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, and county authorities; and crediting such dedication against the requirements of Hawaii Revised Statutes, section 46-6.

RECREATIONAL RESOURCES (continued)

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

		Yes	No
1.	Will the proposed action occur in or adjacent to a dedicated public right-of-way, e.g., public beach access, hiking trail, shared-use path?	☐	☑
2.	Will the proposed action affect public access to and along the shoreline?	☐	☑
3.	Does the project site abut the shoreline?	☐	☑
4.	Is the project site on or adjacent to a sandy beach?	☐	☑
5.	Is the project site in or adjacent to a state or county park?	☐	☑
6.	Is the project site in or adjacent to a water body such as a stream, river, pond, lake, or ocean?	☑	☐
7.	Will the proposed action occur in or affect an ocean recreation area, swimming area, surf site, fishing area, or boating area?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

The objective of the proposed action is to address design deficiencies in the Iao Stream Flood Control Project (FCP) to provide the community with flood risk management therefore, providing coastal recreational opportunities accessible to the public would be out of the scope of the proposed project. All activities will occur within the lateral limits of the existing FCP that is owned and operated by the County and that restricts public access for safety reasons. No recreational areas including any state or county parks are located in the project area.

The Iao Stream FCP, at present, consists of an in-stream boulde/debris basin approximately 2.5miles upstream from the shoreline and a series of segments of lined and unlined portions of the stream channel down to its terminus approximately 700 feet upstream of the shoreline. The proposed action involves discrete repairs at two separate locations requiring construction activities within the lateral limits (top of bank to top of bank) of the Wailuku River of the Iao Stream FCP, approximately 1.7 miles upstream from the coastline (at the closest location) and does not involve work at or along the coastline; thus, would not have any significant impacts on or hinder public access to shoreline parks or other recreational facilities located along the coastline or recreational use of coastal waters such as fishing or surfing.

BMPs would be implemented during construction (e.g., silt fencing, tarping/covering exposed and stockpiled soils, vegetation, etc.) of the proposed action to minimize/eliminate stormwater flow from the proposed construction site and any associated degradation of water quality of surface waters or coastal waters within the vicinity of the proposed project area.

HISTORIC RESOURCES

Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric 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.
3) Support state goals for protection, restoration, interpretation, and display of historic resources.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Is the project site within a designated historic or cultural district?	☐	✔
2. Is the project site listed on or nominated to the Hawaii or National Register of Historic Places?	☐	✔
3. Has the project site been surveyed for historic or archaeological resources?	✔	☐
4. Does the project parcel include undeveloped land which has not been surveyed by an archaeologist?	☐	✔
5. Is the project site within or adjacent to a Hawaiian fishpond or historic settlement area?	☐	✔

Discussion: (If more space is needed, attach a separate sheet.)

The proposed action to repair structural elements of and within the Iao Stream FCP does not involve work on or in undeveloped lands. The footprint of the Iao FCP was surveyed prior to construction, as documented in the EIS prior to the 1981 construction. In 2017 USACE contracted surveyors in the Alternative 2, Removal of Revetment X area because at the time, USACE previously proposed work in the floodplain adjacent to the Iao Stream FCP at this location. However, the scope of the undertaking has been reduced and no longer extends beyond/outside of the Iao Stream FCP and instead focuses only on within channel repairs to existing structural elements. Section 3.6 of the 2017 EA describes existing historic and cultural resources in the surrounding area, beyond the Iao Stream FCP and outside of the Area of Potential Effects. The current APE encompasses the lateral limits of the Iao Stream FCP at the discrete repair areas and is absent of historic properties. USACE understands the expressed cultural significance of the river rock or "pohaku" by the Native Hawaiian community and will include a specification in any future contract for this work to prohibit removal of pohaku from the Wailuku River system. Additionally, the proposed action will not divert or otherwise permanently modify stream flow. The intent of Removal of Revetment X is to restore natural meanders into the Iao Stream FCP by removing structural constriction of the Wailuku River.

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) Ensure 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.
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, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Will the proposed action alter any natural landforms or existing public views to and along the shoreline?	☐	☑
2. Does the proposed action involve the construction of a multi-story structure?	☐	☑
3. Is the project site located on or adjacent to an undeveloped parcel, including a beach or oceanfront land?	☐	☑
4. Does the proposed action involve the construction of a structure visible between the nearest coastal roadway and the shoreline?	☐	☑
5. Will the proposed action involve constructing or placing a structure in waters seaward of the shoreline?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

The proposed action would have negligible long-term impacts to visual and aesthetic resources within the stream channel and no impact on coastal scenic or open space resources. All construction work is proposed within the lateral limits of the Iao Stream FCP with no proposed new structural elements that would introduce visual projections above or beyond the top of bank. Once construction is completed, the pre-formed scour hole installed in the Wailuku River would blend into the existing highly modified riverine environment and would not contrast with the mix of residential, urban, and agricultural aesthetic of the project area. Undeveloped and agricultural parcels located within the designated floodplain would maintain their current agricultural/open space aesthetic.

COASTAL ECOSYSTEMS

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

Policies:

1) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources.
2) Improve the technical basis for natural resource management.
3) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance.
4) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land water uses, recognizing competing water needs.
5) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Does the proposed action involve dredge or fill activities?	✔	☐
2. Is the project site within the Special Management Area (SMA) or the Shoreline Setback Area?	☐	✔
3. Is the project site within the State Conservation District?	☐	✔
4. Will the proposed action involve some form of discharge or placement of material into a body of water or wetland?	✔	☐
5. Will the proposed action require earthwork, grading, clearing, or grubbing?	✔	☐
6. Will the proposed action include the construction of waste treatment facilities, such as injection wells, discharge pipes, or septic systems?	☐	✔
7. Is an intermittent or perennial stream located on or adjacent to the project parcel?	✔	☐
8. Does the project site provide habitat for endangered species of plants, birds, or mammals?	☐	✔
9. Is any such habitat located in close proximity to the project site?	☐	✔

COASTAL ECOSYSTEMS (continued)

	Yes	No
10. Is a wetland located on the project site or parcel?	☐	☑
11. Is the project site situated in or abutting a Natural Area Reserve, a Marine Life Conservation District, or an estuary?	☐	☑
12. Will the proposed action occur on or in close proximity to a reef or coral colonies?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

The project area is an extensively modified stream channel. The project area is located at two discrete locations in the mid-section of the Iao Stream FCP. Continuous erosion of the natural reach has created an unintended drop structure and scour hole. The installation of the pre-formed scour hole would reduce the risk of further erosion, potentially improving water quality. Improved water clarity and reduced sedimentation would have positive impacts on the coral species, marine invertebrate species supported by the coral reef, and other benthic habitat.

The proposed action would include in channel excavation, burying of a reinforced toe and placement of boulder concrete i.e. grouted rip rap to in and to stabilize the channel. This work in the channel could result in potential discharge of fill and/or dredge material into an aquatic ecosystem. BMPs would be implemented during construction of the proposed action (e.g., silt fencing, tarping/covering exposed and stockpiled soils, etc.) to minimize/eliminate prevent runoff from entering stream waters during construction activities. The USACE would monitor the in-water work area to ensure appropriate BMPs designed to isolate and contain the in-water work area are working as intended to preventing water quality degradation downstream and maintaining state water quality standards.

The proposed action would be completed in accordance with State and Federal regulations, including Section 404 (b)(1) of the CWA, which would establish and implement mechanisms to minimize any significant impacts to water quality in the Wailuku River channel and Kahului Bay. In addition, a CWA Section 401 WQC and a NPDES permit would be obtained prior to construction activities to establish and implement mechanisms intended to prevent potential discharge of pollutants to state waters. With the implementation of BMPs and by adhering to applicable state and federal regulations, there would be no significant impacts to the water quality of coastal waters within the vicinity of the proposed project area during construction. USACE met with DOH on April 19, 2020 to discuss the USACE plan to apply for and obtain a 401 WQC during the design phase when adequate information detailing construction means/methods/sequencing is available. USACE will submit an official request confirming the discussion of the aforementioned meeting and the USACE plan for 401 compliance.

According to the USFWS National Wetlands Inventory accessed on June 21, 2021, no wetlands are present at the project site; however, potential pockets of wetlands are present downstream of the project area. Work practices during construction activities would be modified as needed to avoid and/or minimize any impacts to any identified wetlands beyond the Iao Stream FCP.

ECONOMIC USES

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

Policies:

1) Concentrate coastal development in appropriate areas.
2) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as 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.
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) Use of presently designated locations is not feasible;
   b) Adverse environmental effects are minimized; and
   c) The development is important to the State's economy.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Does the proposed action involve a harbor or port?	☐	✔
2. Is the proposed action a visitor industry facility or a visitor industry related activity?	☐	✔
3. Does the project site include agricultural lands or lands designated for such use?	✔	☐
4. Does the proposed action relate to commercial fishing or seafood production?	☐	✔
5. Is the proposed action related to energy production or transmission?	☐	✔
6. Is the proposed action related to seabed mining?	☐	✔

Discussion: (If more space is needed, attach a separate sheet.)

The objective of the proposed action is to provide flood risk management for the community of Wailuku by reducing the risk to community safety during a flood event and reducing channel instability, head cutting, and risk of bank failure.
The project area is designated as Agricultural according to the State LUC district classifications. The proposed action would not result in permanent change of the current land use within and adjacent to the proposed project area.
The proposed action is not directly or indirectly related to energy production, transmission or seabed mining.

COASTAL HAZARDS

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

Policies:

1) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards.
2) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards.
3) Ensure that developments comply with requirements of the Federal Flood Insurance Program.
4) Prevent coastal flooding from inland projects.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Is the project site on or abutting a sandy beach?	☐	☑
2. If "Yes" to question no. 1, has the project parcel or adjoining shoreline areas experienced erosion?	☐	☐
3. Is the project site within a potential tsunami inundation area? Refer to tsunami evacuation maps at http://www.scd.hawaii.gov	☐	☑
4. Is the project site within a flood hazard area according to a FEMA Flood Insurance Rate Map (https://msc.fema.gov)?	☑	☐
5. Is the project site within a subsidence hazard area?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

The project site is not on or abutting a sandy beach, nor within a potential tsunami inundation area. The proposed action is intended to address design deficiencies of an existing federal FCP to restore flood risk reduction benefit/function and reduce hazard to life and property from stream flooding. According to FEMA Flood Insurance Rate Map accessed on June 20, 2021, the project area is located within Regulatory Floodway. The proposed action would not involve structures or buildings that are subject to development requirements for flood prone areas and would not be related to prevention of coastal flooding from inland projects.

MANAGING DEVELOPMENT

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

Policies:

1) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development.
2) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements.
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 public to facilitate public participation in the planning and review process.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. List the permits or approvals required for the proposed action and provide the status of each in the Discussion section below.		
2. Does the proposed action conform with state and county land use designations for the site?	✔	☐
3. Has the public been notified of the proposed action?	✔	☐
4. Has an environmental impact statement or environmental assessment been prepared for the proposed action?	✔	☐

Discussion: (If more space is needed, attach a separate sheet.)

For environmental compliance the Corps as a federal action agency is subject to the following federal laws and regulations (See Draft EA Chapter 4):
-Endangered Species Act consultation (not required; no effect to ESA listed species)
-National Historic Preservation Act consultation (in progress; seeking concurrence on No Effect determination)
-Coastal Zone Management Federal Consistency review (in progress)
-Section 401 Water Quality Certification (will be obtained during Pre-Construction Engineering & Design phase of the project; seeking letter of confirmation from DOH-CWB)
-Section 402 Clean Water Act National Pollutant Discharge Elimination System permit (will be obtained prior to construction, if applicable)

The proposed action conforms to state and county land use designations as Agricultural.

A Public Notice for the preparation of an Environmental Assessments was published on May 17, 2021 for a 30-day public comment period for this proposed action. soliciting initial public comments Two virtual public informational meetings were held on May 22 and 29, 2021. No comments were received during this comment period. No request for a public hearing has been received. In addition, the draft Environmental Assessment will be released later this summer for a public comment period.

PUBLIC PARTICIPATION

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

Policies:

1) Promote public involvement in coastal zone management processes.
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 issues, developments, and government activities.
3) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Has information about the proposed action been disseminated to the public?	✔	☐
2. Has the public been provided an opportunity to comment on the proposed action?	✔	☐
3. Has or will a public hearing or public informational meeting be held?	✔	☐

Discussion: (If more space is needed, attach a separate sheet.)

A Public Notice for the preparation of an Environmental Assessments was published on May 17, 2021 for a 30-day public comment period for this proposed action. soliciting initial public comments Two virtual public informational meetings were held on May 22 and 29, 2021. No comments were received during this comment period. No request for a public hearing has been received. In addition, the draft Environmental Assessment will be released later this summer for a public comment period.

BEACH PROTECTION

Objective: Protect beaches for public use and recreation.

Policies:

1) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and 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.
3) Minimize the construction of public erosion-protection structures seaward of the shoreline.
4) Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor.
5) Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Will the proposed action occur on or adjacent to a beach?	☐	☑
2. Is the proposed action located within the shoreline setback area?	☐	☑
3. Will the proposed action affect natural shoreline processes?	☐	☑
4. Will the proposed action affect recreational activities?	☐	☑
5. Will the proposed action affect public access to and along the shoreline?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

The proposed action will not occur on or adjacent to a beach, is not located within the shoreline setback area, and will not affect either recreational activities or public access to and along adjacent shorelines. The project area is a high modified channel. Currently, the project site is located at the downstream end of the concrete-lined channel where continuous erosion of the natural reach has created an unintended drop structure and scour hole. The installation of the pre-formed scour hole would reduce the risk of further erosion.

MARINE RESOURCES

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

1) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial.
2) Coordinate the management of marine and coastal resources and activities 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 to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources.
6) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Check either Yes or No for each of the following questions, and provide an explanation or information for Yes responses in the Discussion section:

	Yes	No
1. Will the proposed action involve the use or development of marine or coastal resources?	☐	☑
2. Will the proposed action affect the use or development of marine or coastal resources?	☐	☑
3. Does the proposed action involve research of ocean processes or resources?	☐	☑

Discussion: (If more space is needed, attach a separate sheet.)

The proposed action of installing a pre-formed scour hole in the Wailuku River would not involve the use or development of marine or coastal resources. Improved water clarity and reduced sedimentation as a result of the proposed action is expected to have positive impacts on the coral species as well as the marine invertebrate species supported by the coral reef found in the immediate vicinity of the mouth of Wailuku River.

The proposed action does not involve research of ocean processes or resources.

US Army Corps of Engineers®
Honolulu District

DRAFT ENVIRONMENTAL ASSESSMENT FOR MODIFICATION TO THE IAO STREAM FLOOD CONTROL PROJECT WAILUKU, ISLAND OF MAUI, HAWAII

July 2021

, 2021

Civil and Public Works Branch
Programs and Project Management Division

Alan S. Downer, Ph.D.
Administrator
State Historic Preservation Division
Hawaii State Department of Land and Natural Resources
601 Kamokila Boulevard, Suite 555
Kapolei, Hawaii 96707

Dear Dr. Downer:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has been investigating solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui, Hawaii, Tax Map Keys: 234030888 and 234031001, . The Iao Stream FCP was authorized for construction by Congress in 1968 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 foot long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). The Iao Stream FCP was turned over to the County of Maui, the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperating Agreement.

The Corps is currently preparing a Supplemental Environmental Assessment (SEA) to assess the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The repairs consist of a). removal of the existing Revetment X left bank to allow the Wailuku River to meander and naturally slow velocities and b) installation of a pre-formed scour hole to prevent further and future erosion (Figure 2, Enclosure 1).

This project is a federally funded action or “undertaking” and, as such, is subject to federal laws and regulations, including the National Historic Preservation Act (NHPA) of 1966 (54 USC § 306108) and implementing regulations, 36 CFR Part 800. Section 106 of the NHPA mandates consultation with your office to ensure historic properties are protected during execution of the undertaking. The purpose of this letter is to initiate Section 106 consultation with your office for the undertaking as described below, and seek your concurrence on the Area of Potential Effect and the Corps’ determination of effect.

The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative 'F' in 2017(see Figure 3, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with your office and the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of 'no adverse effect on historic property" (Enclosure 2). To date, neither your office nor any of the consulted NHOs have officially responded to the Corps' letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a "pre-formed scour hole" (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and the Corps' currently proposed undertaking. Note each of these three components are hydraulically independent and geographically discrete.

The APE for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps has adjusted the APE for the currently proposed undertaking to two separate polygons that bound the area wherein the Corps anticipates potential for direct and indirect effects at Alternative 2 and Alternative 6. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. The Corps seeks concurrence on the APE for the undertaking as depicted in Figure 4 and 5, Enclosure 1.

Based on a review of past reports and surveys in and around the Iao Stream FCP, including an Archaeological Inventory Survey and Cultural Impact Assessment completed for the Corps' previously proposed undertaking (USACE, 2017), the APE for Alternatives 2 and 6 are absent of historic properties listed on the National and State Registers of Historic Places and is absent of traditional cultural properties or cultural practices. Through past consultation with SHPD, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties'.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps has preliminarily determined that the undertaking involving removal of existing left bank Revetment X and construction of pre-formed scour hole, will have 'no effect on historic properties'. In compliance with Section 106 of NHPA and implementing regulations 36 CFR Part 800, the Corps seeks your concurrence on this preliminary determination. The Corps is concurrently consulting with the aforementioned NHOs on the currently proposed undertaking. Primary contact for this undertaking as it relates to Section 106 consultation is Mr. Kanalei Shun, Archaeologist, Tel: (808) 835-4097, and e-mail: Kanalei.Shun@usace.army.mil.

Sincerely,

Jennifer Moore, PMP
Deputy District Engineer for
Programs and Project Management

Enclosures

Civil and Public Works Branch
Programs and Project Management Division

Mr. Alec Wong
Clean Water Branch
Environmental Management Division
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Wong:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is pursuing discrete structural repairs to address design deficiency at the Iao Stream Flood Control Project (FCP) in Wailuku, Island of Maui, Hawaii. The Iao Stream FCP was authorized for construction by Congress in 1968 under the under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 in accordance with the recommendations of the Chief of Engineers in House Document Number 151, 90th Congress. Construction of the project by the Corps was completed in 1981 and consisted of enlarging, straightening, and stabilizing the channel and constructing levees, walls, and a debris basin. The non-federal sponsor is the County of Maui.

The Corps met with your agency on April 19, 2021, to present the project details and to discuss potential discharges into waters of the U.S. subject to Clean Water Act regulation. In accordance with Section 401 of the Clean Water Act (33 USC § 1341), the Corps must obtain certification from the State of Hawaii Department of Health (DOH), Clean Water Branch that any proposed discharges will comply with the applicable provisions of the Clean Water Act. However, as discussed at our meeting, the details of the planning level of conceptual design is inadequate to identify and describe all proposed discharges with sufficient detail to apply for and obtain a Section 401 Water Quality Certification from the DOH. The Corps will seek water quality certification from your agency when sufficient detail is available, during the environmental permitting process of the Design and Construction Phase. The Corps seeks written confirmation acknowledging the Corps' coordination on this project with your agency, your agency's potential preliminary findings, if available, and acknowledgement of the Corps' plans to obtain a water quality certification at a later date, prior to implementation of the project.

We request your written confirmation within 30 days of the date of this letter. As this study progresses, we will continue to keep your agency apprised of any changes, as

appropriate. Should you have any questions or comments, please contact the study project manager, Ms. Lorayne (Nani) Shimabuku of my Civil and Public Works Branch, at
(808) 835-4030 or via email at Lorayne.P.Shimabuku@usace.army.mil. Thank you for your cooperation.

Sincerely,

Jennifer Moore, PMP
Deputy District Engineer for
Programs and Project Management

Coastal Zone Management Act Correspondence

From:	Paahana, Jessie A CIV USARMY CEPOH (USA)
To:	Nakagawa, John D
Cc:	Shimabuku, Lorayne P CIV USARMY CEPOH (USA); Herzog, Jeffrey A CIV USARMY CEPOH (USA); Hadley, Hannah F CIV USARMY CENWW (USA); Mendes, Debra L; Nihipali, Justine W; Barcina, Keelan MK
Subject:	RE: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs
Date:	Tuesday, September 28, 2021 3:18:33 PM

Acknowledged and understood. Mahalo John!

From: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Sent: Tuesday, September 28, 2021 11:17 AM
To: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>
Subject: [Non-DoD Source] Re: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs

Jessie:

With the submittal of the Corps of Engineers responses to public comments, County of Maui Planning Department comments, as received by the Hawaii CZM Program on September 27, 2021, and the responses to the Hawaii CZM Program questions received on September 20, 2021, there are NO other informational items needed to complete the CZMA federal consistency review. We are now evaluating the Corps' responses, in addition to the Corps' consistency determination, to formulate a decision on the consistency of the proposed action with the enforceable policies of the Hawaii CZM Program.

John Nakagawa
Hawaii Coastal Zone Management Program

From: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Sent: Monday, September 27, 2021 8:29 AM
To: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Erin Derrington <Erin.Derrington@co.maui.hi.us>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>; Jordan Hart <Jordan.Hart@co.maui.hi.us>
Subject: [EXTERNAL] RE: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs

Yes, this is. We got back comments from legal review of the final EA and had no issue with our responses provided on Friday.

From: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Sent: Monday, September 27, 2021 8:24 AM
To: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Erin Derrington <Erin.Derrington@co.maui.hi.us>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>; Jordan Hart <Jordan.Hart@co.maui.hi.us>
Subject: [Non-DoD Source] Re: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs

Jessie:

Received.

For clarification, is this the Corps of Engineers official response to the CZM Program request for responses to the County of Maui Planning Department comments that were referred to you via email on September 14, 2021?

John Nakagawa
Hawaii Coastal Zone Management Program

From: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Sent: Friday, September 24, 2021 4:37 PM
To: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Erin Derrington <Erin.Derrington@co.maui.hi.us>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>; Jordan Hart <Jordan.Hart@co.maui.hi.us>
Subject: [EXTERNAL] Re: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs

Aloha, John:

As follow-up to your email dated 9/14/21, the Corps has prepared responses to the sections you referenced int he County of Maui 9/13/21 letter. Attached you will find a matrix that includes responses to all public comments received to date, as well as the sections you specifically requested responses for in the COM Planning letter. This matrix will become part of the Final SEA and also identifies where the responses warranted revisions for the Final SEA. Where revisions could not be made to this document, and would be further developed into the design phase, is denoted in the matrix. We understand this may result in a conditional concurrence pending submittal of that information prior to final implementation/construction. It is currently in a draft final state, actively under legal and internal district quality control review. I do not foresee major changes from what is attached, but when that review is complete, I can send the final. I will try to call you Monday to discuss further.

Mahalo,
Jessie

From: Paahana, Jessie A CIV USARMY CEPOH (USA)
Sent: Monday, September 20, 2021 11:49 AM
To: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Erin Derrington <Erin.Derrington@co.maui.hi.us>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>
Subject: RE: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs

Aloha, John:

In response to your email below, the Corps is addressing the transmitted Hawaii CZM Program comments and attaching requested information. Hawaii CZM Program comments have been copied and pasted into the body of this email for ease of review:

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Please confirm receipt and direct any questions, comments or concerns to me directly via email or phone at 808-492-4193.

Mahalo,
Jessie

From: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Sent: Tuesday, September 14, 2021 2:00 PM
To: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Erin Derrington <Erin.Derrington@co.maui.hi.us>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>
Subject: [WARNING: MESSAGE ENCRYPTED][Non-DoD Source] CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs

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Please see the attached Office of Planning and Sustainable Development, Hawaii CZM Program, letter (September 14, 2021) requesting and taking the 15-day extension for the CZMA federal consistency review in accordance with 15 CFR § 930.41(b), thereby setting the end date for the CZM review as October 12, 2021.

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The Corps of Engineers responses to the comments and questions identified above as relevant to the CZMA federal consistency review should be directed to the Office of Planning and Sustainable Development, Hawaii CZM Program, and may be emailed to me at john.d.nakagawa@hawaii.gov.

Thank you.

John Nakagawa
Hawaii Coastal Zone Management Program

From: Nakagawa, John D
To: Paahana, Jessie A CIV USARMY CEPOH (USA)
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA); Herzog, Jeffrey A CIV USARMY CEPOH (USA); Hadley, Hannah F CIV USARMY CENWW (USA); Erin Derrington; Mendes, Debra L; Nihipali, Justine W; Barcina, Keelan MK
Subject: [Non-DoD Source] Re: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs
Date: Monday, September 20, 2021 4:03:08 PM

Jessie:

Confirming receipt.

Thank you.

John Nakagawa
Hawaii Coastal Zone Management Program

From: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Sent: Monday, September 20, 2021 11:49 AM
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Subject:	RE: CZMA Federal Consistency Review Comments and Questions - Iao Stream FCP Modifications and Repairs
Date:	Tuesday, September 14, 2021 6:35:54 PM

Aloha, John!

Mahalo for distilling the county Planning's comment down to what is necessary to respond to for the CZM review as well as providing formally the CZM Office comments. We will respond ASAP.

Mahalo,
Jessie

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Sent: Tuesday, September 14, 2021 2:00 PM
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Thank you.

John Nakagawa
Hawaii Coastal Zone Management Program

STATE OF HAWAII
OFFICE OF PLANNING
& SUSTAINABLE DEVELOPMENT

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

DAVID Y. IGE
GOVERNOR

MARY ALICE EVANS
DIRECTOR

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: https://planning.hawaii.gov/

Coastal Zone Management Program

Environmental Review Program

Land Use Commission

Land Use Division

Special Plans Branch

State Transit-Oriented Development

Statewide Geographic Information System

Statewide Sustainability Program

DTS202109131158NA

September 14, 2021

Ms. Jessie K. Paahana
U.S. Army Corps of Engineers, Honolulu District
Civil and Public Works Branch
Building 230
Fort Shafter, Hawaii 96858-5440
jessie.k.paahana@usace.army.mil

Dear Ms. Paahana:

Subject: Coastal Zone Management Act Federal Consistency Review for Iao Stream Flood Control Project Modifications and Scour Hole Repair, Wailuku, Maui

The Coastal Zone Management Act (CZMA) national consistency determination for the Iao Stream Flood Control Project modifications and scour hole repair is currently under review by the Hawaii Coastal Zone Management (CZM) Program. Due to the complexity of the review, we hereby request, and will be taking, the mandatory 15-day extension of time in accordance with 15 CFR § 930.41(b). The CZMA federal consistency review period began on July 28, 2021; therefore, the 15-day extended federal consistency review period will conclude on October 11, 2021.

Thank you for your cooperation on this CZMA federal consistency review. If you have any questions, please contact John Nakagawa with the CZM Program by email at john.d.nakagawa@hawaii.gov or phone at (808) 587-2878.

Sincerely,

Mary Alice Evans

Mary Alice Evans
Director

MICHAEL P. VICTORINO
Mayor

MICHELE CHOUTEAU MCLEAN, AICP
Director

JORDAN E. HART
Deputy Director

DEPARTMENT OF PLANNING
COUNTY OF MAUI
ONE MAIN PLAZA
2200 MAIN STREET, SUITE 315
WAILUKU, MAUI, HAWAII 96793

September 13, 2021

John Nakagawa
Hawaii Coastal Zone Management Program
Transmitted via email: john.d.nakagawa@hawaii.gov

U.S. Army Corps of Engineers, Honolulu District
Civil and Public Works Branch (CEPOH-PPC)
Attn: Jessie Paahana
Building 230
Fort Shafter, Hawaii 96858-5440
Transmitted via email:
CEPOH-Planning@usasce.army.mil
Jessie.K.Paahana@usace.army.mil

Dear Mr. Nakagawa and Ms. Paahana:

SUBJECT: COMMENTS ON FEDERAL CONSISTENCY AND DRAFT ENVIRONMENTAL ASSESSMENT FOR MODIFICATION TO THE IAO STREAM [SIC] FLOOD CONTR... (RFC 2021/0139 CZM... REVIEW...

Entire Letter can be found in Appendix A - Public Involvement

...eflect
... the transition between the
...channel upstream of the Market Street Bridge.

MAIN LINE (808) 270-7735 / FACSIMILE (808) 270-7634
CURRENT DIVISION (808) 270-8205 / LONG RANGE DIVISION (808) 270-7214 / ZONING DIVISION (808) 270-7253

From:	Nakagawa, John D
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Subject:	[Non-DoD Source] Re: CZM Federal Consistency Decision - Iao Stream FCP modifications and repairs, Wailuku, Maui
Date:	Thursday, September 30, 2021 12:36:53 PM

Jessie:

This confirms that the CZMA federal consistency notification period is closed effective September 30, 2021, with the U.S. Army Corps of Engineers acceptance of the conditions prescribed in the Hawaii CZM Program conditional concurrence dated September 28, 2021.

John Nakagawa
Hawaii Coastal Zone Management Program

From: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Sent: Thursday, September 30, 2021 12:18 PM
To: Nakagawa, John D <john.d.nakagawa@hawaii.gov>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Kucharski, Rhiannon L CIV USARMY CEPOH (USA) <Rhiannon.L.Kucharski@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Erin Derrington <Erin.Derrington@co.maui.hi.us>; Lum, Darryl C <darryl.lum@doh.hawaii.gov>; Downer, Alan S <alan.s.downer@hawaii.gov>; Neilson, Brian J <brian.j.neilson@hawaii.gov>; DLNR.CW.DLNRCWRM <dlnr.cwrm@hawaii.gov>; public.works@mauicounty.gov <public.works@mauicounty.gov>; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>
Subject: [EXTERNAL] RE: CZM Federal Consistency Decision - Iao Stream FCP modifications and repairs, Wailuku, Maui

Aloha, John:

In reference to the State CZM Office letter dated 28 Sep 21, USACE acknowledges the State's conditional concurrence and accepts the seven (7) conditions in your letter. USACE seeks confirmation from the State CZM Program that the federal consistency notification period is closed and USACE has satisfied its statutory requirements at 15 CFR 930 Part C, allowing USACE to move forward to the design phase of the subject federal agency action.

Mahalo,
Jessie

From: Nakagawa, John D <john.d.nakagawa@hawaii.gov>

Sent: Tuesday, September 28, 2021 3:32 PM
To: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Erin Derrington <Erin.Derrington@co.maui.hi.us>; Lum, Darryl C <darryl.lum@doh.hawaii.gov>; Downer, Alan S <alan.s.downer@hawaii.gov>; Neilson, Brian J <brian.j.neilson@hawaii.gov>; DLNR.CW.DLNRCWRM <dlnr.cwrm@hawaii.gov>; public.works@mauicounty.gov; Nihipali, Justine W <justine.w.nihipali@hawaii.gov>; Mendes, Debra L <debra.l.mendes@hawaii.gov>; Barcina, Keelan MK <keelan.mk.barcina@hawaii.gov>
Subject: [WARNING: MESSAGE ENCRYPTED][Non-DoD Source] CZM Federal Consistency Decision - Iao Stream FCP modifications and repairs, Wailuku, Maui

Please see the attached CZM Federal Consistency decision letter for the Iao Stream FCP modifications and repairs, Wailuku, Maui.

John Nakagawa
Hawaii Coastal Zone Management Program

Appendix E

Historic & Cultural Resources

- State Historic Preservation Division (SHPD) Concurrence Letter, September 29, 2021

- USACE Response to SHPD Request for Information, September 28, 2021

- SHPD Request for Additional Information, September 27, 2021

- USACE Request to Initiate Consultation Letters, August 26, 2021

    - SHPD (w/enclosures)
    - Ms. Janet Six, County Archaeologist (w/out enclosures)
    - Office of Hawaiian Affairs (w/out enclosures)
    - Aha Moku Council (w/out enclosures)
    - Central Maui Hawaiian Civic Club (w/out enclosures)
    - Hui O Na Wai Eha (w/out enclosures)

State Historic Preservation Division (SHPD) Concurrence Letter, September 29, 2021

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

September 29, 2021

IN REPLY REFER TO:
Project No.: 2021PR01056
Submission No.: 2021PR01056.002
Doc No.: 2109SH20
Archaeology

Chief Rhiannon L. Kucharski
Civil and Public Works Branch
U.S. Army Corps of Engineers, Honolulu District
Department of the Army
Fort Shafter, Hawaiʻi 96858-5440
Email Reply to: Jessie.k.Paahana@usace.army.mil

Electronic Transmittal Only, No Hard Copy to Follow

Dear Chief Kucharski:

SUBJECT: **National Historic Preservation Act (NHPA) Section 106 Review –**
Continued Consultation and Request for Concurrence with the Effect Determination
Iao Stream Flood Control Project Modifications, Wailuku River
Wailuku Ahupuaʻa, Pūʻali Komohana District, Island of Maui
TMK: (2) 3-4-030:888 and (2) 3-4-031:001

On August 27, 2021, the State Historic Preservation Division (SHPD) received a letter from the United States Army Corps of Engineers, Honolulu District (Corps) to initiate consultation for the Section 106 process and to request the State Historic Preservation Officer's (SHPO's) concurrence with the effect determination for the project to conduct Iao Stream Flood Control Modifications at the Wailuku River on the island of Maui. In a letter dated September 27, 2020, the SHPO did not concur due to the need for additional information. On September 29, 2020 the SHPD received the requested information.

According to the Corps first letter, the Corps over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP). The Iao Stream FCP was authorized for construction on August 13, 1968 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks. Several repair and rehabilitation projects have occurred since its original construction. The Iao Stream FCP was turned over to the County of Maui (County), the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperation Agreement. The Corps is currently assessing the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel and a nonstructural flood warning system. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The proposed project has been determined a federal undertaking as defined in 36 CFR 800.16(y). Therefore, the proposed project is subject to compliance with Section 106 of the NHPA.

The Corps has defined the undertaking as *Alternative 12* and states that Alternative 12 consists of three components termed by the Corps as *Alternative 2, Alternative 6,* and *Alternative 11*. The scope of the undertaking is described as follows:

Alternative 2 Removing the existing Revetment X left bank to allow the Wailuku River to meander and naturally slow velocities.

Revetment X is located on both banks of the stream between RS 55+50 to 48+50. In this area, the meandering natural channel was straightened and narrowed with boulder concrete lining of the banks, thereby constricting flow, increasing velocities and causing undermining of the lining on both the left and right banks. The existing channel bottom is a natural channel bottom, particularly susceptible to downcutting. A portion of Revetment X was damaged by a September 2016 event. USACE subsequently repaired the damaged sections under the Public Law 84-99 Rehabilitation and Inspection Program. The 2016 Repairs included repair and reinforcement of the right bank lining and toe and removal of immediate hazards along the left bank to address safety concerns. Alternative 2 will remove approximately 200 feet of the remaining portion of Revetment X along the left bank, widen the channel, allowing flows to dissipate across a wider area, and reduce velocity. No further stabilization or hardening of the left bank revetment is proposed. No maintenance is anticipated. No action is proposed along the right bank.

The Corps states that removing the left bank revetment could increase erosion on the unprotected left bank, rather than the hardened right bank, allowing the stream to flow onto an undeveloped designated floodplain during high water events. USACE anticipates Removal of Revetment X will provide the river with more flexibility to meander, as needed, to achieve dynamic equilibrium. Post-removal, the Corps will stabilize the exposed bank with vegetation and excess river rock, consistent with adjacent natural bank slopes upstream and downstream of Revetment X.

Alternative 6 Constructing an engineered, pre-formed scour hole to replace an existing scour hole in the channel.

The Corps described Alternative 6 stating, in this reach of the Iao Stream FCP, located downstream of Market Street Bridge and vertical drop structure, the transition from the upstream concrete channel bottom with cobble and boulders grouted in place, also known as boulder concrete lined invert, to the downstream unlined channel has eroded and is undermining the structural stability of the FCP. Under Alternative 6, the Corps would excavate the eroded channel invert and construct a “pre-formed scour hole” i.e., engineered stabilization of the scoured invert consisting of a boulder-concrete sloped toe with buried key and backfilled with natural material consistent with the existing channel bottom. This alternative will address existing erosion and prevent future, imminent erosion, thereby reducing downstream erosion and risk to community safety. Operation, Maintenance, Repair, Replacement and Rehabilitation requirements are anticipated to include sealing cracks in the concrete and removing vegetation, as needed.

The Corps asserts that details regarding construction means, methods and sequencing, best management practices and staging and access requirements is currently unavailable, pending authorization to fund this proposed action and proceed to the design phase, wherein construction detailing will become available. The Iao Stream FCP was constructed with maintenance accessways intended to facilitate maintenance repair to and within the channel. The Corps assumes use of existing maintenance accessways to complete the proposed action.

The conceptual design provided by the Corps on September 29, 2021 indicates excavation of the channel bed down 14’feet below grade wholly within the Iao Stream Flood Control Project channel lateral limits to stop existing erosion and prevent future erosion. The length of the structural footprint will be dependent upon the conditions at the time the design is being drafted and construction begins, noting that erosion is ongoing and continuous. The Corps estimates approximately 120-linear feet of stream bed will be impacted along the approximately 100-foot wide stream channel. The excavated area will be buried and restored to pre-construction condition. Because the excavation work will occur within an active, previously disturbed (both naturally and artificially) stream bed, the Corps does not anticipate any historic properties within the Alterative 6 footprint.

Alternative 11 A public flood warning system including installation of a stream gage, which essentially is a non-structural plan.

Installation of a stream gage affixed to an existing structure would improve community safety by increasing community and regional understanding of the potential for flooding as well as increased communication of imminent flood events. To establish a public warning system, the Corps would coordinate directly with the County of Maui Emergency Management Agency to establish a central base station or field station with necessary communications equipment (siren/beacon lights), and software at the County Emergency Management Offices. No new construction is proposed. When rainfall or rising water levels reach set thresholds, the automated station will notify emergency personnel. Sirens can be automatically or remotely activated. In addition to the audible sirens, most public warning systems also often include visual flashing beacon lights to warn the community of the immediate hazard.

The Corps notes that each of the three components are hydraulically independent and geographically discrete. In 2017 the Corps initiated the Section 106 process by letter dated December 5, 2016, seeking concurrence with an effect determination of *no adverse effects*. The Corps states no response was received from SHPD or consulting parties. The undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps has revised the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and Alternative 6, as depicted in Figures 4 and 5, of Enclosure 1 accompanying the Corps' letter. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. The Corps notes Alternative 11 is non-structural and does not have an APE. In an email dated September 29, 2021 the Corps confirmed that at this time there is no information regarding siting of the stream gauge, construction detail or other. It will likely be affixed to an existing structure, however, that level of detail at this stage of the planning is not available. If in the future we determine installation of the stream gauge (or any other component of the proposed action, for that matter) has the potential to cause effect to historic properties, the Corps will proceed with Section 106 consultation at that time (Jessie Paahana [Corps] to Stephanie Hacker [SHPD]).

The Corps has made a determination of *no historic properties affected*. **The SHPO concurs**.

Please submit all forthcoming information and correspondence related to the subject project to the SHPD HICRIS system under Project 2021PR01056 using the Project Supplement option.

The Corps is the office of record for this undertaking. Please maintain a copy of this letter with your environmental review record for this undertaking.

Please contact Stephanie Hacker, Historic Preservation Archaeologist IV, at Stephanie.Hacker@hawaii.gov or at (808) 692-8046 for matters regarding archaeological resources or this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

USACE Response to SHPD Request for Information, September 28, 2021

From:	Paahana, Jessie A CIV USARMY CEPOH (USA)
To:	Hacker, Stephanie
Cc:	Lebo, Susan A; Shun, Kanalei CIV USARMY CEPOD (USA); Herzog, Jeffrey A CIV USARMY CEPOH (USA); Mesko, Rachel C CIV USARMY CEMVP (USA); Kucharski, Rhiannon L CIV USARMY CEPOH (USA); McCallister, Andrew S; Kauhane, Iolani K
Subject:	RE: REQUEST for Clarification RE: Iao Stream Flood Control Project Modifications, Wailuku River
Date:	Tuesday, September 28, 2021 3:04:00 PM
Attachments:	image004.png
Importance:	High

Aloha Stephanie: Please see below for Alternative 11 description:

1.1.1 Alternative 11: Non-Structural Plan (Flood Warning System)

Warning of impending floods can save lives and prevent extensive property damage. Installation of a stream gage affixed to an existing structure would improve community safety by increasing community and regional understanding of the potential for flooding as well as increased communication of imminent flood events. A stream gage can provide valuable data to inform flood warning and evacuation plans, which contribute to improving life safety and community resilience for a relatively small cost.

Due to the flashy nature of the system, an automated warning system is recommended for Wailuku River. To establish a public warning system, USACE would coordinate directly with the County of Maui Emergency Management Agency to establish a central base station or field station with necessary communications equipment (siren / beacon lights), and software at the County Emergency Management Offices. No new construction is proposed. When rainfall or rising water levels reach set thresholds, the automated station will notify emergency personnel. Sirens can be automatically or remotely activated. In addition to the audible sirens, most public warning systems also often include visual flashing beacon lights to warn the community of the immediate hazard. OMRR&R requirements of the flood warning system would be annual inspections and testing.

The stream gage and flood warning system are expected to significantly reduce the potential for life loss by providing real-time data to improve warning times for evacuation. Another beneficial impact associated with implementation of the project is heightened awareness of the flood-related risks including both an increased understanding of the overall potential for flooding based on dissemination of project-related information as well as increased communication of imminent flood events via improvements real-time data gathering via the stream gage. This is expected to translate to increased levels of preparedness, thus improving community safety.

Per our earlier call, you should now have all info requested to complete your review. Please call or email if you have any questions.

Mahalo,
Jessie

From: Paahana, Jessie A CIV USARMY CEPOH (USA)
Sent: Tuesday, September 28, 2021 11:24 AM
To: Hacker, Stephanie <stephanie.hacker@hawaii.gov>
Cc: 'Lebo, Susan A' <susan.a.lebo@hawaii.gov>; Shun, Kanalei CIV USARMY CEPOD (USA) <Kanalei.Shun@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA)

<Jeffrey.A.Herzog@usace.army.mil>; Mesko, Rachel C CIV USARMY CEMVP (USA) <Rachel.C.Mesko@usace.army.mil>; Kucharski, Rhiannon L CIV USARMY CEPOH (USA) <Rhiannon.L.Kucharski@usace.army.mil>; McCallister, Andrew S <andrew.mccallister@hawaii.gov>; Kauhane, Iolani K <iolani.kauhane@hawaii.gov>
Subject: RE: REQUEST for Clarification RE: Iao Stream Flood Control Project Modifications, Wailuku River
Importance: High

Aloha Stephanie:

Please see below for interim responses to your request for additional information:

The Corps has made a determination of "no effect on historic properties." **The SHPO does not concur**. Additional information is needed. The SHPO requests the following:

The Corps letter mentions several Alternatives and states "Alternative 12", is the preferred alternative and is the Corps' currently proposed undertaking. The SHPD requests an explicit description of the location and scope of the proposed undertaking including the length, width, and depth of all ground disturbance. Please provide a map of the APE.

Alternative 2: Remove Revetment X

Revetment X is located on both banks of the stream between RS 55+50 to 48+50. In this area, the meandering natural channel was straightened and narrowed with boulder concrete lining of the banks, thereby constricting flow, increasing velocities and causing undermining of the lining on both the left and right banks. The existing channel bottom is a natural channel bottom, particularly susceptible to downcutting.

A portion of Revetment X was damaged by the September 2016 event. USACE subsequently repaired the damaged sections under the Public Law 84-99 Rehabilitation and Inspection Program. The 2016 Repairs included repair and reinforcement of the right bank lining and toe and removal of immediate hazards along the left bank to address safety concerns.

Alternative 2 would remove approximately 200 feet of the remaining portion of Revetment X along the left bank, widening the channel, allowing flows to dissipate across a wider area, and reducing velocity (Figure 2-2). No further stabilization or hardening of the left bank revetment is proposed. No maintenance is anticipated. No action is proposed along the right bank.

Figure 2-2. Revetment X, Photo taken from Right Bank, facing Left Bank and Upstream

With the removal of the revetment, USACE anticipates the Wailuku River would likely meander more in its attempt to lengthen the stream and achieve a shallower bed slope and possibly "bending" towards either the left or right bank. Removing the left bank revetment could increase erosion on the unprotected left bank, rather than the hardened right bank, allowing the stream to flow onto an undeveloped designated floodplain during high water events. USACE anticipates Removal of Revetment X will provide the river with more flexibility to meander, as needed, to achieve dynamic equilibrium. Post-removal, USACE will stabilize the exposed bank with vegetation and excess river rock, consistent with adjacent natural bank slopes upstream and downstream of Revetment X (Figure 2-3).

Figure 2-3. Photo taken upstream of Revetment X, facing Downstream

Note that the currently proposed action at the left bank of Revetment X (in addition to other previously proposed actions) was previously evaluated in the 2017 Final EA as a component of the recommended plan, “Alternative F”. Under Alternative 2, USACE carries forward the removal of the hardened portion of the left bank slope. Substantively, Alternative 2 is the same as was proposed under the 2017 Alternative F, for the removal of Revetment X, left bank, noting that the conceptual level of design currently proposed will be further fine-tuned in design phase to reflect current site conditions. Required interagency coordination and public involvement was completed under the 2017 final EA and USACE concluded a finding of no significant impact. USACE assessment of the anticipated environmental effects of Alternative 2 is predominately documented in the 2017 final EA with relevant updates to supplement past evaluation in Section 3 of this final SEA. The currently proposed action, herein described, is essentially identical to the description of the same proposed action in the 2017 final EA (Figure 2-4).

Figure 2-4. Alternative F (2017) Comparison to Alternative 2 (2021) Remove Revetment X Footprint

Note that the difference in footprint/APE comparison is relatively minor and will undergo further minor adjustment in the design phase when the Corps begins to draft the design to reflect on-site conditions. The APE was designated to encompass such minor variability expected from planning to design to construction phase. The potential impacts are considered up front in consultation so we know how to respond in the future during implementation.

Alternative 6: Install Pre-Formed Scour Hole

In this reach of the Iao Stream FCP, located downstream of Market Street Bridge and vertical drop structure, the transition from the upstream concrete channel bottom with cobble and boulders grouted in place as shown Figure 2-5, also known as boulder concrete lined invert, to the downstream unlined channel has eroded and is undermining the structural stability of the FCP (Figure 2-5). Under Alternative 6, USACE would excavate the eroded channel invert and construct a "pre-formed scour hole" i.e., engineered stabilization of the scoured invert consisting of a boulder-concrete sloped toe with buried key and backfilled with natural material consistent with the existing channel bottom (see concept drawing at Figure 2-6). This alternative would address existing erosion and prevent future, imminent erosion, thereby reducing downstream erosion and risk to community safety. OMRR&R requirements are anticipated to include sealing cracks in the concrete and removing vegetation, as needed.

Figure 2-5. Proposed Location of Pre-Formed Scour Hole

Details regarding construction means, methods and sequencing, best management practices and staging and access requirements is currently unavailable, pending authorization to fund this proposed action and proceed to the design phase, wherein construction detailing will become available. The Iao Stream FCP was constructed with maintenance accessways intended to facilitate maintenance repair to and within the channel. USACE assumes use of existing maintenance accessways to complete the proposed action.

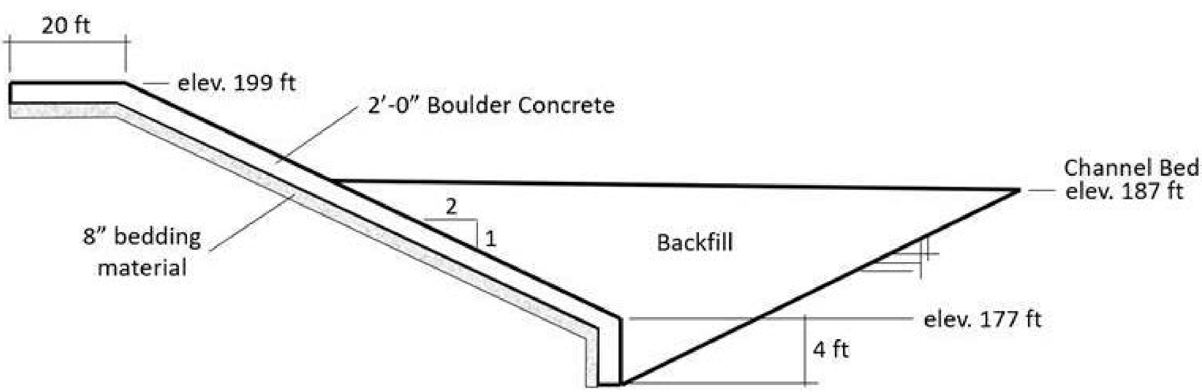

Figure 2-6. Cross-Section View of Proposed Pre-Formed Scour Hole Concept

The above conceptual design indicates excavation of the channel bed down 14'feet below grade wholly within the Iao Stream Flood Control Project channel lateral limits to stop existing erosion and prevent future erosion. The length of the structural footprint will be dependent upon the conditions at the time the design is being drafted and construction begins, noting that erosion is ongoing and continuous. The Corps estimates approximately 120-linear feet of stream bed will be impacted along the approximately 100-foot wide stream channel The excavated area will be buried and restored to pre-construction condition. Because the excavation work will occur within an active, previously disturbed (both naturally and artificially) stream bed, the Corps does not anticipate any historic properties within the Alterative 6 footprint/APE.

The Corps letter states it is concurrently consulting with consulting parties such as the County of Maui and Native Hawaiian Organizations, please provide copies or a summary of the Corps consultation efforts and any responses received. Any comments received should be taken into consideration prior to the Corps determining a finding of effect.

Please find attached copies of letters sent to NHOs (their enclosures were identical to SHPDs). Additionally the Corps transmitted via email to Ms. Six at the County and to Hui O Na Wai Eha. No response pursuant to Section 106 from any of the NHOs listed has been received by the Corps to date. Hui O Na Wai Eha did provide comment under NEPA in response to the draft Environmental Assessment. Their comments are also attached. The Corps considered their comments and incorporated into the final Environmental Assessment (in draft form pending 106 compliance), see attached comment summary table.

The Corps did not identify any historic properties in the APE, however correspondence related to the undertaking for which the Corps previously consulted (provided in the Corps Enclosure 2) suggests a possibility of encountering significant subsurface historic properties as well as human remains in the location of Alternative F. Please provide a description of the Corps efforts to identify historic properties as well as a copy of any survey reports used to support the Corps findings.

As documented in our draft Environmental Assessment, "…numerous archaeological investigations have been conducted in Iao Valley. Previous work includes archaeological assessments, archaeological surface survey, archaeological inventory survey, archaeological subsurface testing, and archaeological monitoring (USACE, 2017). A few of these projects were carried out within or near the current project area. The following list itemizes projects conducted in the immediate vicinity of the project area and the survey results. A detailed summary of each project and description of the survey results is provided in the 2017 Final EA.

- In 1998, Scientific Consulting Services, Inc. (SCS) conducted an Archaeological reconnaissance surveys with subsurface testing, for the Iao Stream FCP. The reconnaissance surveys revealed only one site, (State Inventory of Historic Places) SIHP No. 50-50-04-475 located in the vicinity, but outside of the current USACE are of potential effect (APE).
- An archaeological inventory survey (AIS) was carried out in 2004 by SCS for the proposed Imi Kala Street and Neki Place Extensions (USACE, 2017). The AIS revealed SIHP No. 50-50-04-1508, 50-50-04-5564, 50-50-04-5565 and 50-50-04-5566, all located in the vicinity, but outside of the current USACE APE. No other traditional archaeological sites or features were identified.
- An AIS was conducted by Pacific Consulting Services, Inc. in May 2014. The subsurface survey revealed no SIHP sites within the current USACE APE.
- An oral history survey was conducted in November of 2003 by Social Research Pacific, Inc., to obtain information regarding properties of cultural and historical significance and incorporated in a Cultural Impact Assessment (CIA) in accordance with National Park Service guidance (USACE, 2017). Based on the research and interviews incorporated into the CIA, there are no known traditional cultural properties within the current USACE APE, and traditional land uses of the project area have been discontinued.

…
Historic/Cultural Resources
A total of 31 properties and historic districts are listed on the National Register of Historic Places (NRHP) for Maui County. Of the 31 listed properties, two (Iao Theater and Waialae Bridge) are located outside of, but within 0.5 miles of the APE.
A total of 64 properties and historic districts are listed on the Hawaii Register of Historic Places for Maui County. Three (Iao Theater, Waialae Bridge and Naniloa Drive Overpass Bridge) of the 64 properties are located outside of, but within 0.5 miles of the APE. "
It is important to note that the only component of the previously proposed Alternative F (circa 2017) is the currently proposed Removal of Revetment X (i.e. Alternative 2). The footprint of Removal of Revetment X occurs wholly within the Iao Stream FCP channel. There are no designated historic properties within the APE for the proposed action. To reiterate the entirety of the proposed action i.e. Alternative 12, is comprised of 3 components: Alternative 2, Removal of Revetment X, existing structure within Iao Stream FCP, Alternative 6, Pre-Formed Scour Hole, rehabilitation of existing structure within Iao Stream FCP, and Alternative 11, public flood warning system, a non-structural alternative.

Please confirm your receipt of the requested additional information. We would still like to meet with you either via webinar or phone call to confirm we fully understand your request and adequately responded. We are under a very strict timeline wherein we must finalize our EA (including Section 106 compliance) by the end of this month or the project will be terminated and the County will not receive federal assistance for this effort. We appreciate your assistance thus far and recognize how aggressive this timeline is, but if there is anything we can do to close this out as quickly as possible so we may meet our suspense, we would be very grateful.

I can be reached at 808-492-4193.

Mahalo,
Jessie

From: Lebo, Susan A <susan.a.lebo@hawaii.gov>
Sent: Tuesday, September 28, 2021 7:36 AM
To: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>; Hacker, Stephanie <stephanie.hacker@hawaii.gov>; McCallister, Andrew S <andrew.mccallister@hawaii.gov>; Kauhane, Iolani K <iolani.kauhane@hawaii.gov>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Shun, Kanalei CIV USARMY CEPOD (USA) <Kanalei.Shun@usace.army.mil>
Subject: [Non-DoD Source] RE: REQUEST for Clarification RE: Iao Stream Flood Control Project Modifications, Wailuku River

Hello Stephanie,

Please let Jessie and I know your availability to discuss what additional information is needed.

Sincerely,

Susan

From: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>
Sent: Monday, September 27, 2021 10:19 PM
To: Lebo, Susan A <susan.a.lebo@hawaii.gov>; Hacker, Stephanie <stephanie.hacker@hawaii.gov>; McCallister, Andrew S <andrew.mccallister@hawaii.gov>; Kauhane, Iolani K <iolani.kauhane@hawaii.gov>
Cc: Shimabuku, Lorayne P CIV USARMY CEPOH (USA) <Lorayne.P.Shimabuku@usace.army.mil>; Hadley, Hannah F CIV USARMY CENWW (USA) <Hannah.F.Hadley@usace.army.mil>; Herzog, Jeffrey A CIV USARMY CEPOH (USA) <Jeffrey.A.Herzog@usace.army.mil>; Shun, Kanalei CIV USARMY CEPOD (USA) <Kanalei.Shun@usace.army.mil>
Subject: [EXTERNAL] REQUEST for Clarification RE: Iao Stream Flood Control Project Modifications, Wailuku River
Importance: High

Aloha, Susan:

Mahalo for the advanced e-transmittal. We understand SHPD requires additional information and without this information cannot concur with the Corps' No Effect determination. We would like to meet to ensure we fully understand what information is lacking so we can provide an adequate response. Are you or one of your staff available to meet tomorrow? Please let me know what time you are available and we will accommodate your schedule.

Mahalo,
Jessie

From: Lebo, Susan A <susan.a.lebo@hawaii.gov>
Sent: Monday, September 27, 2021 3:43 PM
To: Paahana, Jessie A CIV USARMY CEPOH (USA) <Jessie.K.Paahana@usace.army.mil>; Hacker, Stephanie <stephanie.hacker@hawaii.gov>; McCallister, Andrew S <andrew.mccallister@hawaii.gov>; Kauhane, Iolani K <iolani.kauhane@hawaii.gov>
Subject: [WARNING: MESSAGE ENCRYPTED][Non-DoD Source] Iao Stream Flood Control Project Modifications, Wailuku River

Hello,

Attached is a pdf copy of our division's review of the following:

National Historic Preservation Act (NHPA) Section 106 Review –
Initiation of Consultation and Request for Concurrence with the Effect Determination
Iao Stream Flood Control Project Modifications, Wailuku River

Wailuku Ahupuaʻa, Pūʻali Komohana District, Island of Maui
TMK: (2) 3-4-030:888 and (2) 3-4-031:001

Sincerely,

Susan

Susan A. Lebo, PhD
SHPD Archaeology Branch Chief
(808) 321-9000 cell

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Alan S. Downer, Ph.D.
Administrator
State Historic Preservation Division
Hawaii State Department of Land and Natural Resources
601 Kamokila Boulevard, Suite 555
Kapolei, HI 96707

Dear Dr. Downer:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui. The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). Several repair and rehabilitation projects have occurred since its original construction. The Iao Stream FCP was turned over to the County of Maui (County), the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperation Agreement.

The Corps is currently preparing an Environmental Assessment (EA) to supplement the 2017 EA[1] for previously proposed repairs, assessing the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel and a non-structural flood warning system. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The repairs consist of the following:

a) removal of the existing Revetment X left bank to allow the Wailuku River to meander and naturally slow velocities,

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c) a public flood warning system including installation of a stream gage, which essentially is a non-structural plan.

This project is a Federally funded action or “undertaking” and, as such, is subject to Federal laws and regulations, including the National Historic Preservation Act (NHPA) of 1966 (54 USC § 306108) and implementing regulations, 36 CFR Part 800. Section 106 of the NHPA mandates consultation with your office to ensure historic properties are protected during execution of the undertaking. The purpose of this letter is to initiate Section 106 consultation with your office for the undertaking as described below, and seek your concurrence on the Corps’ determination of effect.

The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative ‘F’ in 2017 (see Figure 2, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with your office and the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of ‘no adverse effect on historic property’ (Enclosure 2). To-date, neither your office nor any of the consulted NHOs have officially responded to the Corps’ letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a pre-formed scour hole (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system in coordination with the County, including installation of a stream or other climate gage in the vicinity of the Iao Stream FCP. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and is the Corps’ currently proposed undertaking. Note that each of these three components are hydraulically independent and geographically discrete.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps adjusted the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and Alternative 6, as depicted in Figures 4 and 5, Enclosure 1. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. Note, Alternative 11 is non-structural and does not have an APE.

Based on a review of past reports and surveys in and around the Iao Stream FCP, including an Archaeological Inventory Survey and Cultural Impact Assessment completed for the Corps' previously proposed undertaking, the APE for Alternatives 2 and 6 are absent of historic properties listed or eligible for listing on the National and State Registers of Historic Places and are absent of traditional cultural properties or cultural practices sites. Through past consultation with State Historic Preservation Office and State Historic Preservation Division, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps has determined that the undertaking involving removal of existing left bank Revetment X, construction of pre-formed scour hole, and installation of the non-structural stream gage, will have 'no effect on historic properties'. The Corps seeks your concurrence on this determination within 30 days of this finding pursuant to 36 CFR 800.4(d).

For your information, the Corps is concurrently consulting with County of Maui Archaeologist, Janet Six, as well as with the following NHOs on the currently proposed undertaking: The Central Maui Hawaiian Civic Club, Aha Moku O Maui, Hui O Na Wai Eha, and the Office of Hawaiian Affairs. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental EA for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

Primary contact for this undertaking as it relates to Section 106 consultation is Ms. Jessie Paahana, Environmental Coordinator of my branch, available at (808) 835-4042 and jessie.k.paahana@usace.army.mil.

Sincerely,

R. Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Janet Six
County of Maui Archaeologist
Kalana O Maui Building
200 S. High Street
Wailuku, HI 96793

Dear Ms. Six:

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For your information, the Corps is also concurrently consulting with the State Historic Preservation Division and the following NHOs on the currently proposed undertaking: the Office of Hawaii Affairs, the Central Maui Hawaiian Civic Club, Hui o Na Wai Eha and Aha Moku Advisory Committee-Moku o Piilani. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental EA for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

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R. Kucharski

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Chief, Civil and Public Works Branch

Enclosures

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Alan S. Downer, Ph.D.
Administrator
State Historic Preservation Division
Hawaii State Department of Land and Natural Resources
601 Kamokila Boulevard, Suite 555
Kapolei, HI 96707

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Aha Moku Advisory Committee-Moku o Piilani
Attention: Kyle Nakanaelua
2795 Kauhikoalani Place
Haikuhikoalani Pace
Haiku, HI 96708

Dear Mr. Nakanelua:

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

President
Central Maui Hawaiian Civic Club
P.O. Box 493
Wailuku, HI 96793

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The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative ‘F’ in 2017 (see Figure 2, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of ‘no adverse effect on historic property’ (Enclosure 2). To-date, none of the consulted NHOs have officially responded to the Corps’ letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a pre-formed scour hole (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system in coordination with the County, including installation of a stream or other climate gage in the vicinity of the Iao Stream FCP. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and the Corps’ currently proposed undertaking. Note each of these three components are hydraulically independent and geographically discrete.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps adjusted the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and 6, as depicted in Figures 4 and 5, Enclosure 1. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. Note, Alternative 11 is non-structural and does not have an APE.

Based on a review of past reports and surveys in and around the Iao Stream FCP, including an Archaeological Inventory Survey and Cultural Impact Assessment completed for the Corps’ previously proposed undertaking, the APE for Alternatives 2 and 6 are absent of historic properties listed or eligible for listing on the National and State Registers of Historic Places and is absent of traditional cultural properties or cultural practices sites. Through past consultation with the State Historic Preservation Office and State Historic Preservation Division, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties'.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps determined that the undertaking involving removal of existing left bank Revetment X and construction of pre-formed scour hole, will have 'no effect on historic properties'. The Corps seeks your concurrence on this determination within 30 days of this finding pursuant to 36 CFR 800.4(d).

For your information, the Corps is also concurrently consulting with the State Historic Preservation Division, the County of Maui Archaeologist and the following NHOs on the currently proposed undertaking: the Office of Hawaii Affairs, Hui o Na Wai Eha, and Aha Moku Advisory Committee-Moku o Piilani. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental EA for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

Primary contact for this undertaking as it relates to Section 106 consultation is Ms. Jessie Paahana, Environmental Coordinator of my branch, available at (808) 835-4042 and jessie.k.paahana@usace.army.mil.

Sincerely,

R.Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Sylvia Hussey, Ed.D.
Ka Pouhana/Chief Executive Officer
Office of Hawaiian Affairs
560 Nimitz Hwy #200
Honolulu, HI 96817

Dear Dr. Hussey:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui. The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). The Iao Stream FCP was turned over to the County of Maui, the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperating Agreement.

The Corps is currently preparing an Environmental Assessment (EA) to supplement the 2017 EA[1] for previously proposed repairs, assessing the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel and a non-structural flood warning system. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The repairs consist of the following:

a) removal of the existing Revetment X left bank to allow the Wailuku River to meander and naturally slow velocities,

b) construction of an engineered, pre-formed scour hole to replace an existing scour hole in the channel, and

c) a public flood warning system including installation of a stream gage, which essentially is a non-structural plan.

[1] Publicly available review documents such as the 2017 Environmental Assessment can be accessed online at: https://www.poh.usace.army.mil/Missions/Civil-Works/Civil-Works-Projects/Iao-Stream/.

This project is a Federally funded action or “undertaking” and, as such, is subject to Federal laws and regulations, including the National Historic Preservation Act (NHPA) of 1966 (54 USC § 306108) and implementing regulations, 36 CFR Part 800. Section 106 of the NHPA mandates consultation with your office to ensure historic properties are protected during execution of the undertaking. The purpose of this letter is to initiate Section 106 consultation with your office for the undertaking as described below, and seek your concurrence on the Corps’ determination of effect.

The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative ‘F’ in 2017(see Figure 2, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of ‘no adverse effect on historic property’ (Enclosure 2). To-date, none of the consulted NHOs have officially responded to the Corps’ letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a pre-formed scour hole (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system in coordination with the County, including installation of a stream or other climate gage in the vicinity of the Iao Stream FCP. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and the Corps’ currently proposed undertaking. Note each of these three components are hydraulically independent and geographically discrete.

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State Registers of Historic Places and is absent of traditional cultural properties or cultural practices sites. Through past consultation with State Historic Preservation Office and State Historic Preservation Division, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties'.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps determined that the undertaking involving removal of existing left bank Revetment X and construction of pre-formed scour hole, will have 'no effect on historic properties'. The Corps seeks your concurrence on this determination within 30 days of this finding pursuant to 36 CFR 800.4(d).

For your information, the Corps is also concurrently consulting with the State Historic Preservation Division, the County of Maui Archaeologist and the following NHOs on the currently proposed undertaking: The Central Maui Hawaiian Civic Club, Hui o Na Wai Eha and Aha Moku Advisory Committee-Moku o Piilani. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental Environmental Assessment for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

Primary contact for this undertaking as it relates to Section 106 consultation is Ms. Jessie Paahana, Environmental Coordinator of my branch, available at (808) 835-4042 and jessie.k.paahana@usace.army.mil.

Sincerely,

R. Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

Hui 0 Nā Wai ʻEhā

Ola i ka wai WWW.HUIONAWAIEHA.ORG

Hui o Nā Wai ʻEhā Board of Directors

Hōkūao Pellegrino (President)

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Maui Tomorrow (Collaborator)

Albert Perez (Executive Director)

Legal Counsel

Isaac Moriwake (Earthjustice)

Pamela W. Bunn (Dentons)

September 5, 2021

Re: Army Corps of Engineers ʻĪao Flood Control Project Modifications – Wailuku River

Aloha e Kākou,

On behalf of the Board of Hui o Nā Wai ʻEhā, including myself Hōkūao Pellegrino as Board President, we would like to extend our gratitude to you for allowing us to comment on the ʻĪao Flood Control Project Modifications – Wailuku River. As mentioned during your presentation in August, our organization takes all projects that involve our streams very seriously, especially if they are intended to alter, divert, modify stream flow or impact natural and cultural resources. Please accept our testimony based on the background information you provided. We would like to request the right to further expand and or even change our comments as more details are provided to us through the review and permitting process.

Although this project may be small in size compared to many other projects we review and provide comments on, we have experienced firsthand in recent years after the massive 2016 flood in Wailuku River, that even small projects can have serious consequences and impacts to our native and culture resources. In fact, a project literally feet away and just mauka from the proposed project on October 25, 2017, there was a major incident in which over fifteen massive 3 foot by 20 foot black corrugated pipe got washed down the river and ended up in the ocean and reef system, many of which could never be recovered. We were able to document the entire issue and to our disappointment, even with BMP's in place, it completely failed and caused irreparable damage to our ocean resources. The contractor, project team and company tasked with that project were from the mainland and knew very little to nothing about the characteristics and nature of our streams, especially around flash flooding events. Therefore, it is imperative that we request to be kept in the loop throughout the duration of the project, especially knowing that we are the eyes and ears on the ground with the Nā Wai ʻEhā and Wailuku community members. The Nā Wai ʻEhā and Wailuku community is very sensitive when it comes to seeing machines and other materials in our rivers and lot of times, they look to the Hui for answers and immediate responses to things that are out of the ordinary happening in our rivers and streams.

Hui o Nā Wai ʻEhā (501c3) · 213 West Waikō Road, Wailuku, Maui, Hawaii 96793
(808) 430-4534 · Huionawai4@gmail.com · www.huionawaieha.org ·

The Mission of Hui o Nā Wai ʻEhā is to advocate for the restoration and stewardship of mauka to makai streamflow in Waikapū, Wailuku, Waiehu, Waiheʻe Streams (Nā Wai ʻEhā), to protect cultural and natural resources pertaining to traditional and customary practices of Native Hawaiian kuleana kalo farmers and to engage the Maui community in water resource management education outreach programs.

Please see the numbered points below regarding concerns that we have.

1. Hui o Nā Wai ʻEhā opposes any work that is meant to cement, harden, cover over, channelize, and/or further modify the natural riverbed of Wailuku River. While we understand this won't be occurring on this particular project, we need to state that loud and clear because there have been numerous attempts by other governing agencies to further channelize the lower reaches of the Wailuku River. There are well-known and documented historical springs (Kawaiola) downstream from this proposed project that irrigate the pre-western wetlands/fishpond and loʻi kalo of Kaʻehu O Ka Moi, which are known as both naturally and culturally protected resources. Research has made it clear that former channelization work in the Wailuku River beginning in the 1960s has severely and negatively impacted the springs and other important water/cultural resources in the lower reaches of the Wailuku River. As more details come out for this project, we would like to take the opportunity to further review exact locations of the embankment stabilization work.

2. Hui o Nā Wai ʻEha requests that there be an archaeological monitor on-site due to the known pre-western and historic resources of Wailuku River in the location of the project. Following the massive 2016 flood in Wailuku, the proposed project area that is being discussed had numerous plantation era relics become exposed such as train tracks, train engine and car wheels and other things. The Wailuku Sugar Mill was located in the neighboring vicinity and the area close to the river was used as a dumping site. There may likely be other cultural layers beneath and/or adjacent to the proposed work area and therefore, we would request a monitoring plan in place as well as having an archaeologist on site to ensure that area is protected. The Pihanakalani and Hale Kiʻi Heiau are not that much farther downstream and it is important that all areas in and around the project area are protected, especially relating to Native Hawaiian cultural resources.

3. Hui o Nā Wai ʻEhā requests that the project contractors notify DLNR Aquatics Division about this project and to have an aquatic biologist conduct a native biota survey. This study is to better understand periods of native aquatic species spawning as well as upstream migration. A Project like this will likely require equipment in the stream as well of the possibility of making the stream turbid in the lower reaches when work commences. This most definitely has the potential to cause irreparable damage to native aquatic species habitat and survivability. Our organization has fought and advocated for over two decades to re-establish native aquatic habitats and since the Interim Instream Flow Standards were established in 2014 for Wailuku River, we have seen new and healthy native aquatic species recruitment occurring on a regular basis. If DAR is unable to

conduct this task, Hui asks that the County of Maui hire someone to conduct research on this.

4. Hui o Nā Wai ʻEhā opposes any request by the Army Corps of Engineers and Contractors to request CWRM to temporarily halt or alter Instream Flow Standards for any length of time that this project is being executed on. This is to ensure that mauka to makai flow is continual and natural flows undisturbed. This also includes any diversions of natural stream flows away from the project area. In, 2019, CWRM built a ʻOʻopu Ladder with the intent of protecting native species, however in the construction of this ladder, thousands of ʻoʻopu, ʻōpae and hīhīwai species were killed off because Wailuku Water Co. was allowed to "shut off" off the river via their diversion. Hui o Nā Wai ʻEhā condemned these acts of "playing god" by turning on and off rivers and would like to make this crystal clear that we do not support any and all attempts to reduce stream flow prior, during and/or following whatever work is conducted.

5. Hui o Nā Wai ʻEhā would like to see the BMP's for this project go above and beyond, especially knowing there may likely be heavy machinery, equipment and material in the riverbed. Paying close attention to daily whether guides. Knowing weather patterns as wells as the characteristics of the river will be super important not just for the safety of the crew but also the protection of our natural and cultural resources below the project area. (i.e. washing down of materials/equipment into the ocean and reef system).

6. Communication is key and the Hui requests that we be notified about the progression of the planning and entitlement process however, even more so, is when the project starts. We need to know details as to ensure when the community reaches out to us with concerns, we will be able to address their concerns. If and when plans for this project are approved, we request that we are notified on the exact scope of work, timeline, planed dates for work and communication plan.

Our streams and rivers deserve the utmost respect, protection and enforcement, a kuleana we don't take light. Mahalo nui for your time and ability to provide comments on this reject. Should you have any questions, please don't hesitate to reach out.

Me ka haʻahaʻa,

Hōkūao Pellegrino

Hōkūao Pellegrino
(President)

Hui o Nā Wai ʻEhā (501c3) · 213 West Waikō Road, Wailuku, Maui, Hawaii 96793
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Summary of Public Comments
Iao Stream Flood Control Project Modifications
Wailuku River, Wailuku, Maui, Hawai'i
Draft Supplemental EA Public Review Period: August 21, 2021 - September 13,

Name/Affiliation	Date/Source	Comment	USACE Response
Public Meeting Attendees: Erin Derrington – County of Maui Planning Department, Hokuao Pellegrino – Hui o Na Wai Eha, Skippy Hau – State Division of Aquatic Resources	8/26/21 Public Information Meeting via Oral Communication	In summary, commentors -requested clarification regarding the previously proposed Alternative F in comparison to the currently proposed Removal of Revetment X, a component of the former Alternative F, -opposed any alternative that hardens natural areas of Wailuku River, -recommended expanded stakeholder engagement to address concerns regarding native anadromous fish species such as life cycle information to inform construction windows, ensuring continuous flow to facilitate fish passage and accommodating cultural practices such as harvesting for consumption, -recommended further coordination with resource agencies and community members to develop BMPs that incorporate lessons learned such as requiring retrieval of construction materials washed downstream by storm events, -requested continued engagement with Hui O Na Wai Eha as a community organization that is often queried for up-to-date information to relay project information to the community,	-Clarification regarding rationale for down scoping the proposed action from the former Alternative F to the currently proposed preferred alternative that carried forward a single component of the former Alternative F and proposed one additional structural modification and non-structural component to comprise the proposed action was provided at the meeting. Additional clarification regarding the differences and similarities between the previous and current proposed action was also discussed at the meeting. Where appropriate within the final supplemental Environmental Assessment (EA), additional clarification, as noted above, was incorporated. -USACE acknowledged that new proposals for new hardening is not supported by the community at large. USACE reiterated that no new hardening is proposed under the preferred alternative, with the exception of Alternative 6 that expands the current fill footprint to bring the project up to current engineering and construction standards. -USACE took note of information shared by State Division of Aquatic Resources and Hui o Na Wai Eha regarding anadromous fish species and other aquatic biota. USACE will continue to engage local stakeholders and resource agencies for information regarding aquatic biota to develop and incorporate best management practices into the design phase. -USACE will continue to engage local stakeholders and resource agencies for information regarding construction best management practices to incorporate into the design phase. -USACE acknowledges this request, and will add Hui o Na Wai Eha to the project stakeholder list for engagement on this and future projects.

		-requested direct coordination with the County Emergency Management Department to identify existing public flood warning system to inform necessary improvements, and -requested sharing of hydrologic/hydraulic and sediment modelling data to inform community planning decisions.	-USACE Will coordinate further development of Alternative 11 with the County Emergency Management Department and community stakeholders to identify opportunities to improve and/or expand upon the existing public flood warning system. -USACE modelling efforts are partially complete and partially ongoing. USACE will continue to share the modelling results with the non-federal sponsor who may distribute the information and incorporate into future planning decisions.
John Duey Public Citizen Adjacent Landowner	9/1/21 Voicemail and Follow-Up Phone Call	Change name of project from "Iao Stream Flood Control Project" (FCP) to "Wailuku River FCP". Waterway name was formally restored in November 2015 to Wailuku River. Continued use by USACE of term Iao Stream FCP causes confusion and challenges ongoing efforts to get community and local government to use the restored name: Wailuku River.	Congress authorized federal funding to construct the flood control project with the name "Iao Stream Flood Control Project" [in 1968] prior to restoration of the waterway's legal name. While Honolulu District acknowledges the name change and deliberately refers to the project location as "Wailuku River" in all project documents, Congress has not formally received request to change the name of the federal project. The Honolulu District will look into Mr. Duey's request to correct the name of the Iao Stream Flood Control Project to the Wailuku River Flood Control Project. Any request to formally change the federal project name will be made independent of the proposed action.
		Opposes any new hardening	USACE described the components of the proposed action to Mr. Duey and highlighted that no new hardening was proposed. USACE explained that Removal of Revetment X proposes to remove hardening and restoral natural bank and Install Pre-Formed Scour Hole would construct engineered toe to address current and prevent further erosion of channel lining. Minimal expansion of fill footprint is necessary to reinforce existing channel lining and prevent imminent erosion consistent with current engineering standards. Public warning system is non-structural and proposes no new hardening. Mr. Duey responded positively to USACE description of the proposed action.
		Commentor requests notification of any future meetings concerning this project	USACE informed Mr. Duey that there are no more planned public meetings concerning the currently proposed action. However, as requested, the Honolulu District will add Mr. Duey to the project stakeholder list for future engagement.
County of Maui Planning	9/13/21 Letter transmitted via email	USACE should consider revising this Environment Assessment and Federal Consistency Determination request in order to: -clarify the current project scope and discussion of direct, indirect, and cumulative impacts including complementary project components or reasonably foreseeable future projects; - demonstrate alignment with existing plans and policies;	- The current environmental assessment is intended to supplement the analysis documented in the 2017 EA, document evaluation of the current project scope and has been updated with additional information regarding alternatives analysis, resource information, agency coordination, public engagement and relevant impact analyses in accordance with the September 14, 2020 NEPA rule. - This NEPA environmental assessment documents the federal action and compliance with federal laws and regulations. Additionally, the Corps completed the State of Hawaii Office of Planning CZM Federal Consistency

			Assessment Form to document the Corps' analysis of consistency with the State Coastal Zone Management Plan and concluding that the proposed modifications to the Iao Stream FCP are consistent with the enforceable State's policies and objectives.
		-improve impacts analysis with clear definitions of significance and commitments to mitigation measures; and	-The Corps has completed an evaluation of environmental effects that is commensurate to a rehabilitation project. The Corps' analysis is documented in its Environmental Assessment. The Corps conducted all required analyses and evaluations pursuant to all applicable federal laws including, but not limited to the Endangered Species Act, the Fish and Wildlife Coordination Act, the National Environmental Policy Act, the Coastal Zone Management Act and Clean Water Act. The individual and combined conclusion of all of those analyses is consistent with anticipated conclusions of a rehabilitation project of this scope and scale. Pursuant to each of these analyses, no extraordinary circumstances or potentially significant impacts were identified. The Corps will incorporate standard industry best management practices intended to avoid and/or minimize adverse impacts to natural and cultural resources, incorporating comments and recommendations received to date and which will be developed with greater detail in the design phase and prior to construction. The Corps' commitment to these best management measures will be incorporated into any contract as specifications.
		-expand public engagement and information sharing efforts.	-Based on the Corps' knowledge of the community, its stakeholders and general concern for activity in the Wailuku River watershed the Corps approach to public engagement expanded upon the Corps' NEPA implementation regulations in the following ways (as documented in Section 1.4 of the Environmental Assessment): 1) the Corps issued a public notice to notify the public and solicit comments on the Corps' intent to prepare an environmental assessment for the proposed action, and 2) hosted two public informational meetings during that review period, in addition, 3) the draft supplemental EA and Engineering Design Report Amendment was released for public review and comment and 4) the Corps hosted three public informational meetings during the draft EA review period. The Corps will continue to engage the local sponsor, the County of Maui, and other community stakeholders to promote information sharing through the design phase and into construction.
Hokuao Pellegrino, President Hui O Na Wai Eha (Hui) Native Hawaiian Organization	9/5/21 Letter Received 9/13/21 via email	Hui opposes any proposal to cement, harden, cover over, channelize and/or further modify the natural riverbed of Wailuku River. Hui acknowledges the proposed action does not propose new hardening but wants to make this concern a part of the public record.	As acknowledged by the Hui, no new hardening is proposed.

		Hui requests archaeological monitor on-site during construction due to known pre-western and historic resources in the location of the project. It is important to protect historic and cultural resources	USACE will continue to coordinate this project, in particular the construction specifications with the USACE archaeologist to determine whether an on-site archeological monitor is warranted based on the USACE evaluation of effects to historic properties including cultural resources pursuant to Section 106 of the National Historic Preservation Act. If warranted, such a requirement will be codified in the contract specifications. Contract specifications regarding inadvertent finds are standard conditions of any USACE construction contract.
		Hui requests USACE coordinate this project with the State of Hawaii Department of Land and Natural Resources Division of Aquatic Resources to identify any management measures, e.g., construction work windows, etc. to conserve and protect native aquatic biota and their habitat. In-water construction has the potential to adversely affect native biota, so care should be taken to insure the species' survival.	USACE will coordinate with the local sponsor, DLNR-DAR and any other subject matter expert with information necessary to assist the Corps in developing best management practices to avoid and minimize to the greatest extent practicable adverse effects to fish and wildlife resources, including native aquatic biota and their habitat. At a meeting on April 19, 2021, the U.S. Fish and Wildlife Service discussed the need to incorporate into the design passage for anadromous fish species known to occur in Wailuku River. At the August 27, 2021 public informational meeting concerning the draft supplemental environmental assessment review, "Skippy" Hau, DLNR-DAR attended and indicated availability to coordinate with USACE on native biota and habitat. USACE will continue to develop in greater detail best management practices to be incorporated into the proposed action that consider conservation of fish and wildlife resources in the design phase, prior to construction.
		Hui opposes any request by USACE to the Commission on Water Resources Management at the State to alter or otherwise reduce Instream Flow Standards for any period of time during this project to ensure continuous mauka to makai stream flow.	USACE does not propose or anticipate the need to propose temporarily halting or otherwise reducing instream flow standards. As construction details are further developed, USACE will ensure this concern is considered in the design phase.
		Hui wants to see USACE propose BMPs that go above and beyond to ensure protection of natural and cultural resources in and below the project area.	USACE will develop in greater detail the design plans and contract specifications, which include BMPs that avoid and/minimize natural and cultural resources to the greatest extent practicable and consistent with industry standard during the design phase, prior to construction. USACE will ensure contract specifications are developed to incorporate lessons learned from past malpractice involving in-water work and downstream impacts in Wailuku River.
		Hui requests to be apprised of the project timeline as the project progresses, and in particular of construction start. Hui is looked to by the community to inform the community of ongoing projects. Ensuring the Hui is informed will help to ensure the greater Wailuku community is informed.	USACE acknowledges this request, and the Honolulu District will add Hui o Na Wai Eha to the project stakeholder list for engagement on this and future projects.

SHPD Request for Additional Information, September 27, 2021

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

September 27, 2021

IN REPLY REFER TO:
Project No.: 2021PR01056
Submission No.: 2021PR01056.001
Doc No.: 2109SH19
Archaeology

Chief Rhiannon L. Kucharski
Civil and Public Works Branch
U.S. Army Corps of Engineers, Honolulu District
Department of the Army
Fort Shafter, Hawai'i 96858-5440
Email Reply to: Jessie.k.Paahana@usace.army.mil

Electronic Transmittal Only, No Hard Copy to Follow

Dear Chief Kucharski:

SUBJECT: **National Historic Preservation Act (NHPA) Section 106 Review –**
Initiation of Consultation and Request for Concurrence with the Effect Determination
Iao Stream Flood Control Project Modifications, Wailuku River
Wailuku Ahupua'a, Pū'ali Komohana District, Island of Maui
TMK: (2) 3-4-030:888 and (2) 3-4-031:001

The State Historic Preservation Division (SHPD) received a letter dated August 26, 2021 from the United States Army Corps of Engineers, Honolulu District (Corps) to initiate consultation for the Section 106 process and to request the State Historic Preservation Officer's (SHPO's) concurrence with the effect determination for the project to conduct Iao Stream Flood Control Modifications at the Wailuku River on the island of Maui. The SHPD received this submittal on August 27, 2021.

According to the subject letter, the Corps over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP). The Iao Stream FCP was authorized for construction on August 13, 1968 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks. Several repair and rehabilitation projects have occurred since its original construction. The Iao Stream FCP was turned over to the County of Maui (County), the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperation Agreement. The Corps is currently assessing the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel and a nonstructural flood warning system. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The proposed project has been determined a federal undertaking as defined in 36 CFR 800.16(y). Therefore, the proposed project is subject to compliance with Section 106 of the NHPA. The Corps states the repairs consist of the following:

- Removing the existing Revetment X left bank to allow the Wailuku River to meander and naturally slow velocities;
- Constructing an engineered, pre-formed scour hole to replace an existing scour hole in the channel; and
- A public flood warning system including installation of a stream gage, which essentially is a non-structural plan.

The Corps notes that collectively, these separate components pursued under a single contract are referred to as "Alternative 12", the preferred alternative and is the Corps' currently proposed undertaking; each of these three components are hydraulically independent and geographically discrete. In 2017 the Corps initiated the Section 106 process by letter dated December 5, 2016, seeking concurrence with an effect determination of *no adverse effect*. The Corps states no response was received from SHPD or consulting parties. The undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps has revised the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and Alternative 6, as depicted in Figures 4 and 5, of Enclosure 1 accompanying the Corps' letter. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. The Corps notes Alternative 11 is non-structural and does not have an APE.

The Corps has made a determination of "no effect on historic properties." **The SHPO does not concur**. Additional information is needed. The SHPO requests the following:

- The Corps letter mentions several Alternatives and states "Alternative 12", is the preferred alternative and is the Corps' currently proposed undertaking. The SHPD requests an explicit description of the location and scope of the proposed undertaking including the length, width, and depth of all ground disturbance. Please provide a map of the APE.
- The Corps letter states it is concurrently consulting with consulting parties such as the County of Maui and Native Hawaiian Organizations, please provide copies or a summary of the Corps consultation efforts and any responses received. Any comments received should be taken into consideration prior to the Corps determining a finding of effect.
- The Corps did not identify any historic properties in the APE, however correspondence related to the undertaking for which the Corps previously consulted (provided in the Corps Enclosure 2) suggests a possibility of encountering significant subsurface historic properties as well as human remains in the location of Alternative F. Please provide a description of the Corps efforts to identify historic properties as well as a copy of any survey reports used to support the Corps findings.

The SHPD looks forward to continuing the Section 106 process for the proposed project.

Please submit all forthcoming information and correspondence related to the subject project to the SHPD HICRIS Project No. 2021PR01056 using the Project Supplement option.

The Corps is the office of record for this undertaking. Please maintain a copy of this letter with your environmental review record for this undertaking.

Please contact Stephanie Hacker, Historic Preservation Archaeologist IV, at Stephanie.Hacker@hawaii.gov or at (808) 692-8046 for matters regarding archaeological resources or this letter.

Aloha,

Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

USACE Request to Initiate Consultation Letters, August 26, 2021

- o SHPD (w/enclosures)
- o Ms. Janet Six, County Archaeologist (w/out enclosures)
- o Office of Hawaiian Affairs (w/out enclosures)
- o Aha Moku Council (w/out enclosures)
- o Central Maui Hawaiian Civic Club (w/out enclosures)
- o Hui O Na Wai Eha (w/out enclosures)

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Alan S. Downer, Ph.D.
Administrator
State Historic Preservation Division
Hawaii State Department of Land and Natural Resources
601 Kamokila Boulevard, Suite 555
Kapolei, HI 96707

Dear Dr. Downer:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui. The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). Several repair and rehabilitation projects have occurred since its original construction. The Iao Stream FCP was turned over to the County of Maui (County), the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperation Agreement.

The Corps is currently preparing an Environmental Assessment (EA) to supplement the 2017 EA[1] for previously proposed repairs, assessing the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel and a non-structural flood warning system. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The repairs consist of the following:

a) removal of the existing Revetment X left bank to allow the Wailuku River to meander and naturally slow velocities,

b) construction of an engineered, pre-formed scour hole to replace an existing scour hole in the channel, and

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[1] Publicly available review documents such as the 2017 Environmental Assessment can be accessed online at: https://www.poh.usace.army.mil/Missions/Civil-Works/Civil-Works-Projects/Iao-Stream/.

c) a public flood warning system including installation of a stream gage, which essentially is a non-structural plan.

This project is a Federally funded action or "undertaking" and, as such, is subject to Federal laws and regulations, including the National Historic Preservation Act (NHPA) of 1966 (54 USC § 306108) and implementing regulations, 36 CFR Part 800. Section 106 of the NHPA mandates consultation with your office to ensure historic properties are protected during execution of the undertaking. The purpose of this letter is to initiate Section 106 consultation with your office for the undertaking as described below, and seek your concurrence on the Corps' determination of effect.

The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative 'F' in 2017 (see Figure 2, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with your office and the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of 'no adverse effect on historic property' (Enclosure 2). To-date, neither your office nor any of the consulted NHOs have officially responded to the Corps' letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a pre-formed scour hole (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system in coordination with the County, including installation of a stream or other climate gage in the vicinity of the Iao Stream FCP. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and is the Corps' currently proposed undertaking. Note that each of these three components are hydraulically independent and geographically discrete.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps adjusted the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and Alternative 6, as depicted in Figures 4 and 5, Enclosure 1. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. Note, Alternative 11 is non-structural and does not have an APE.

Based on a review of past reports and surveys in and around the Iao Stream FCP, including an Archaeological Inventory Survey and Cultural Impact Assessment completed for the Corps' previously proposed undertaking, the APE for Alternatives 2 and 6 are absent of historic properties listed or eligible for listing on the National and State Registers of Historic Places and are absent of traditional cultural properties or cultural practices sites. Through past consultation with State Historic Preservation Office and State Historic Preservation Division, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps has determined that the undertaking involving removal of existing left bank Revetment X, construction of pre-formed scour hole, and installation of the non-structural stream gage, will have 'no effect on historic properties'. The Corps seeks your concurrence on this determination within 30 days of this finding pursuant to 36 CFR 800.4(d).

For your information, the Corps is concurrently consulting with County of Maui Archaeologist, Janet Six, as well as with the following NHOs on the currently proposed undertaking: The Central Maui Hawaiian Civic Club, Aha Moku O Maui, Hui O Na Wai Eha, and the Office of Hawaiian Affairs. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental EA for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

Primary contact for this undertaking as it relates to Section 106 consultation is Ms. Jessie Paahana, Environmental Coordinator of my branch, available at (808) 835-4042 and jessie.k.paahana@usace.army.mil.

Sincerely,

R. Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

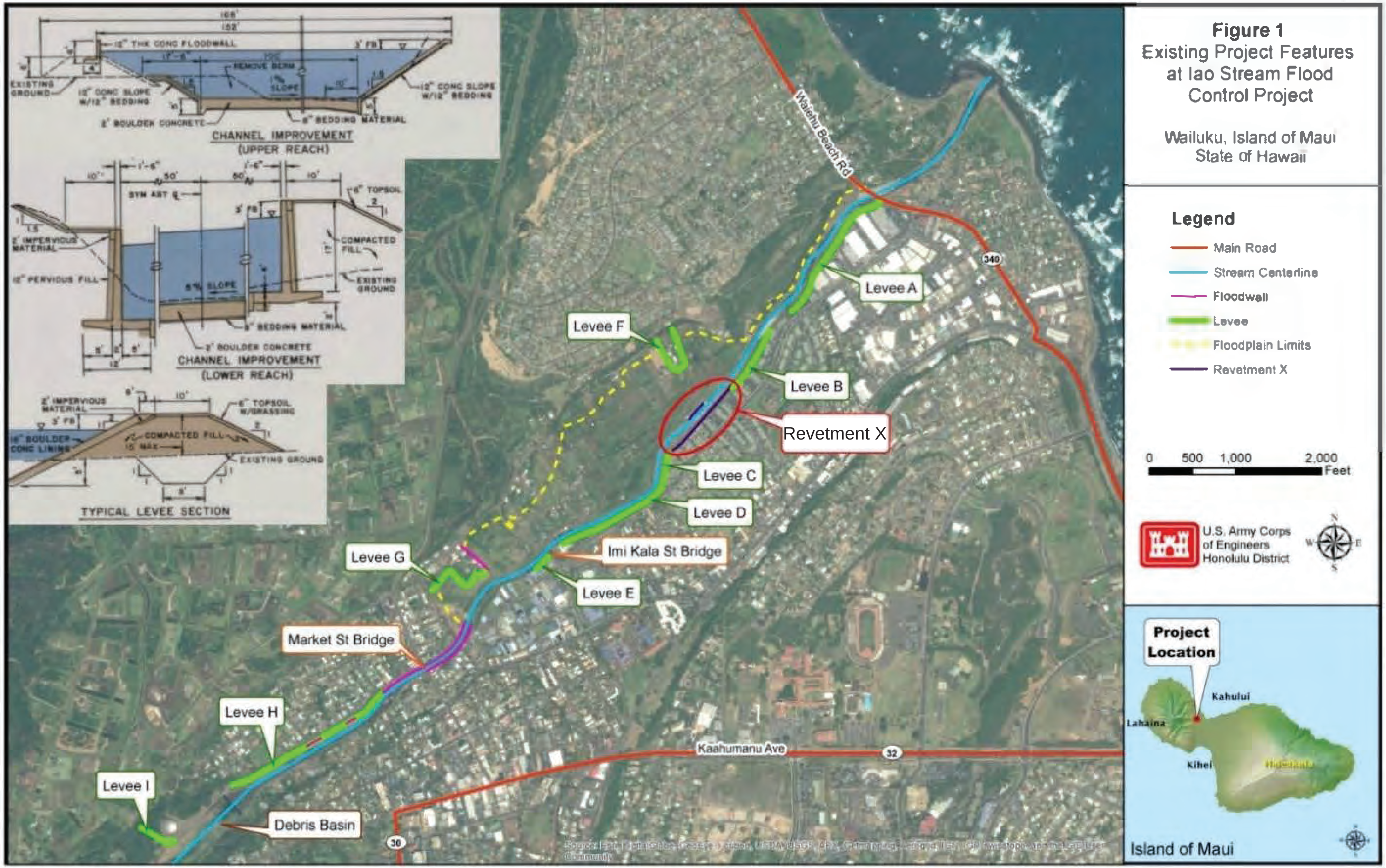


Figure 1
Existing Project Features at Iao Stream Flood Control Project
Wailuku, Island of Maui
State of Hawaii
Legend
Main Road
Stream Centerline
Floodwall
Levee
Floodplain Limits
Revetment X
0 500 1,000 2,000 Feet
U.S. Army Corps of Engineers Honolulu District
Project Location
Kahului
Lahaina
Kihei
Island of Maui
CHANNEL IMPROVEMENT (UPPER REACH)
CHANNEL IMPROVEMENT (LOWER REACH)
TYPICAL LEVEE SECTION
Levee A
Levee B
Levee C
Levee D
Levee E
Levee F
Levee G
Levee H
Levee I
Revetment X
Imi Kala St Bridge
Market St Bridge
Debris Basin
Waiehu Beach Rd
Kaahumanu Ave
340
32
30

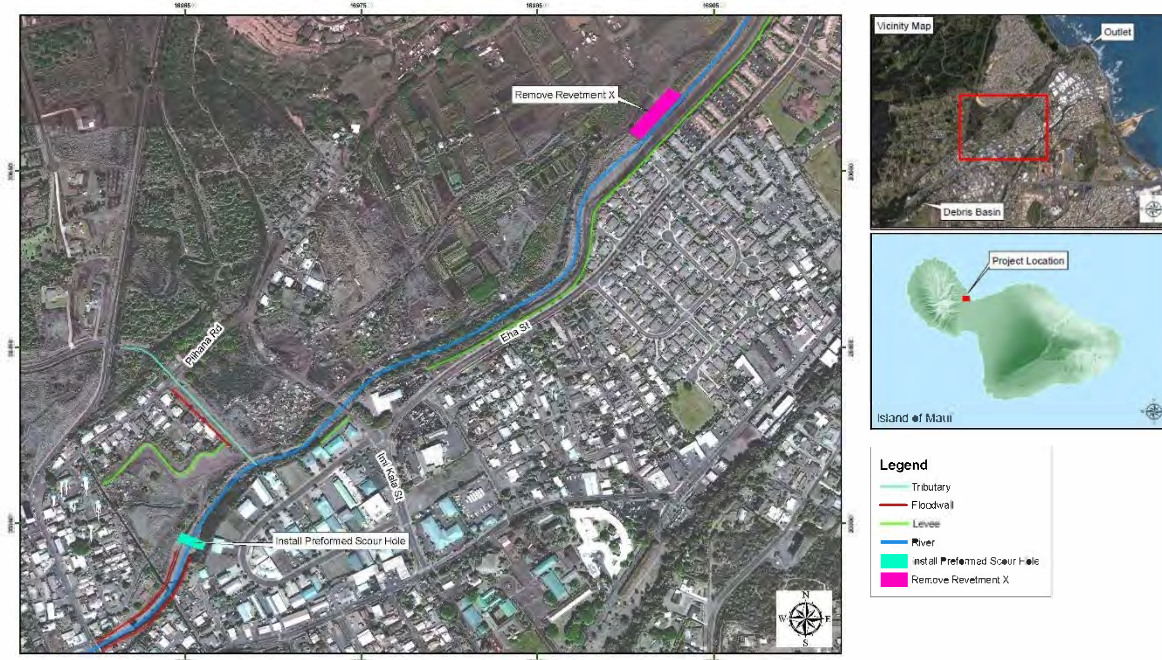
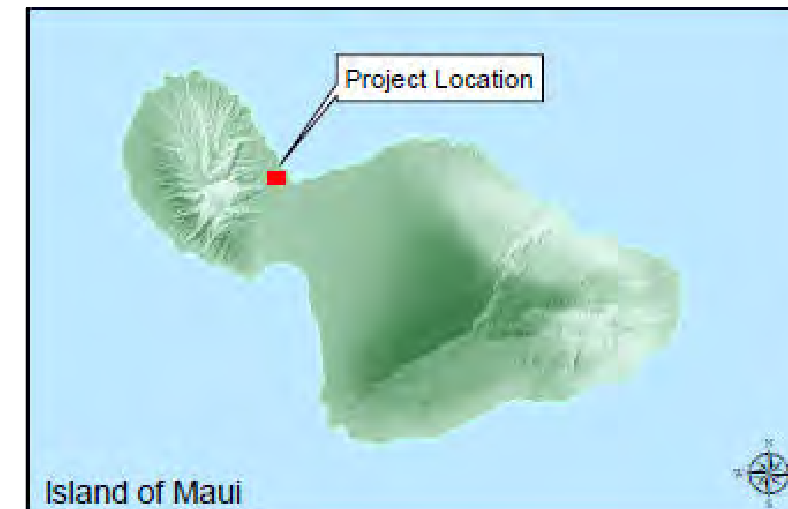


Figure 2:
Tentatively Selected Plan, General Site Plan
Iao Stream Flood Control Project
Wailuku, Island of Maui, Hawaii

U.S. Army Corps of Engineers
Honolulu District



Legend

- TMK 234030888
- Alt F Footprint '17
- Alt 2 Footprint '21

Note, the above polygons do not represent the APE

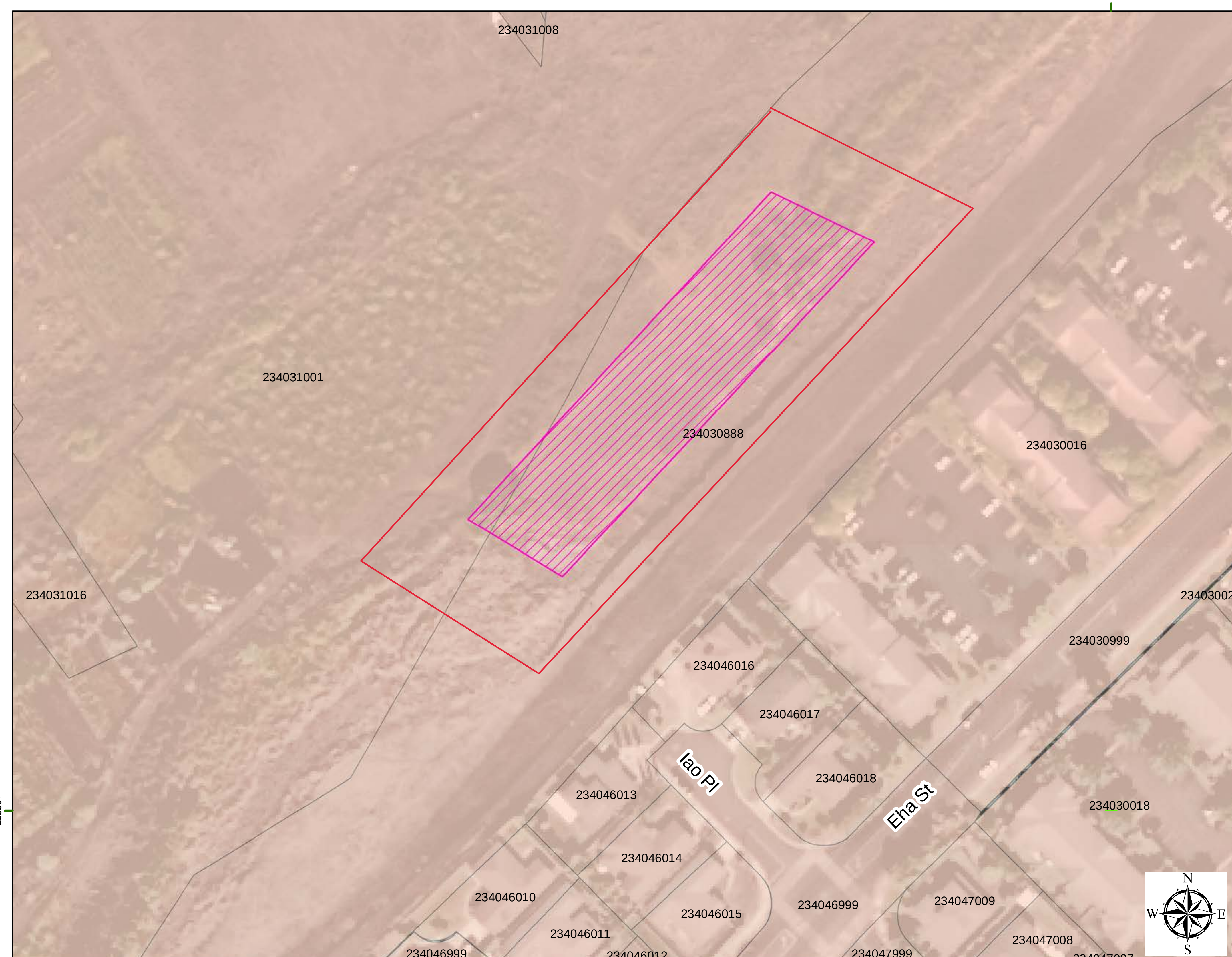
U.S. Army Corps of Engineers Honolulu District

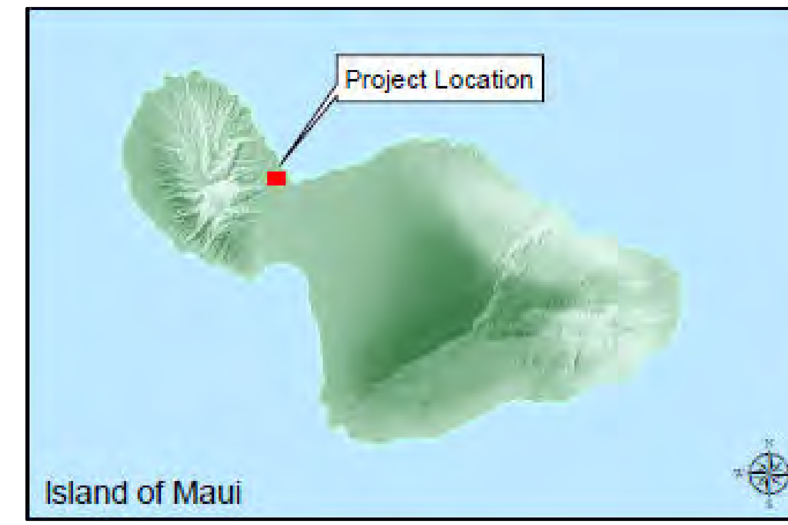
Figure 3: **Alternative 2 and Alternative F Iao Stream Flood Control Project Wailuku, Island of Maui, Hawaii**

0 150 300 Feet

0 50 100 Meters

Notes:
1. This map is for conceptual purposes only and all areas are approximate.
2. Coordinate System: Hawaii State Plane Zone 2, NAD 83 HARN, Feet
3. Imagery date: 2005, Source: DOQQ NRCS
4. Map produced by the Civil Works Technical Branch (CEPOH-EC-T) on July 8, 2021





Legend

- Alt 2 Footprint
- TMK Parcels
- APE Boundary

Alternative	TMK	Area (SF)
2	234031001	460

Note the area^ is an estimate of the construction footprint and not the APE

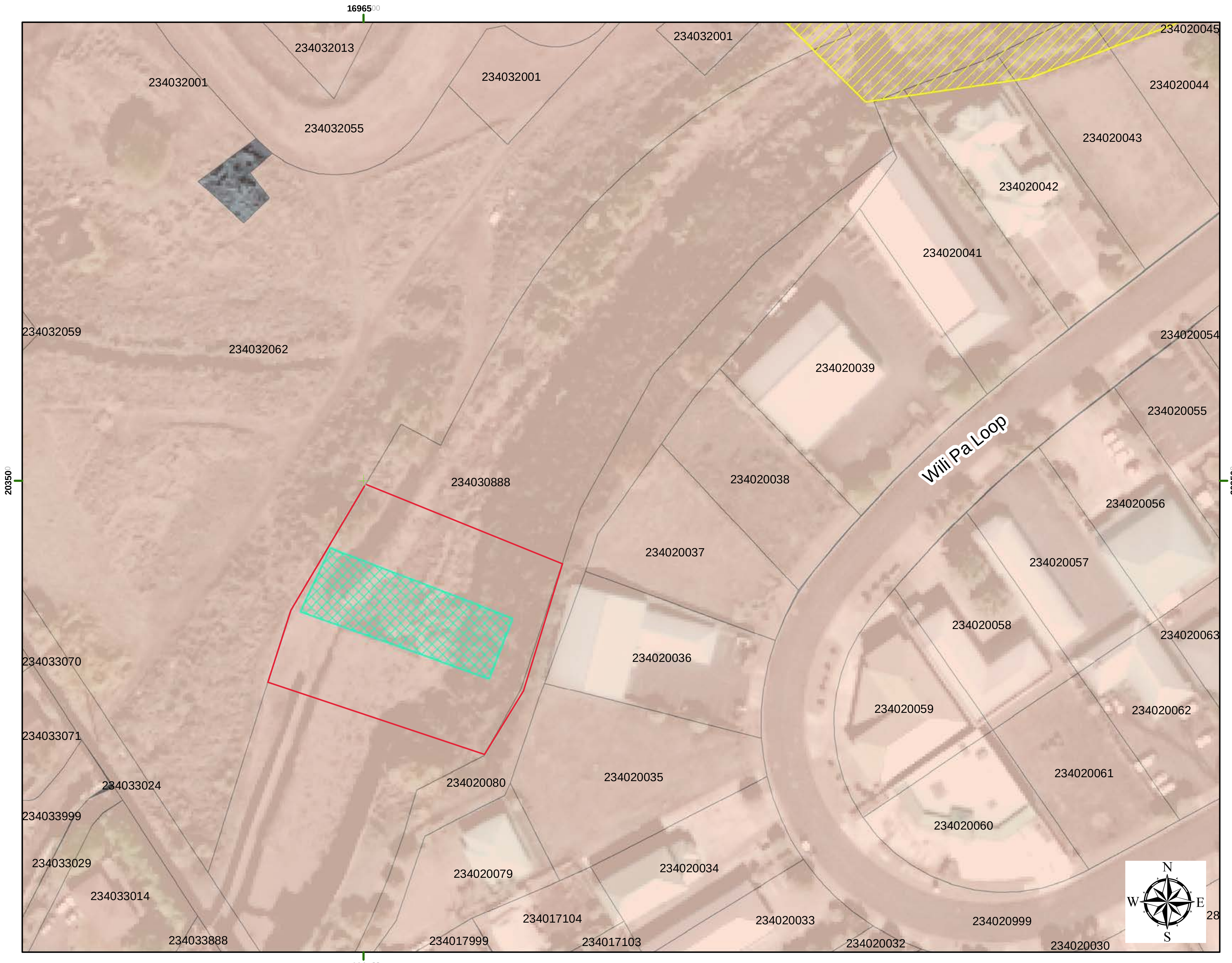
Figure 4:
Alternative 2 - Footprint and Parcel Map
Iao Stream Flood Control Project
Wailuku, Island of Maui, Hawaii

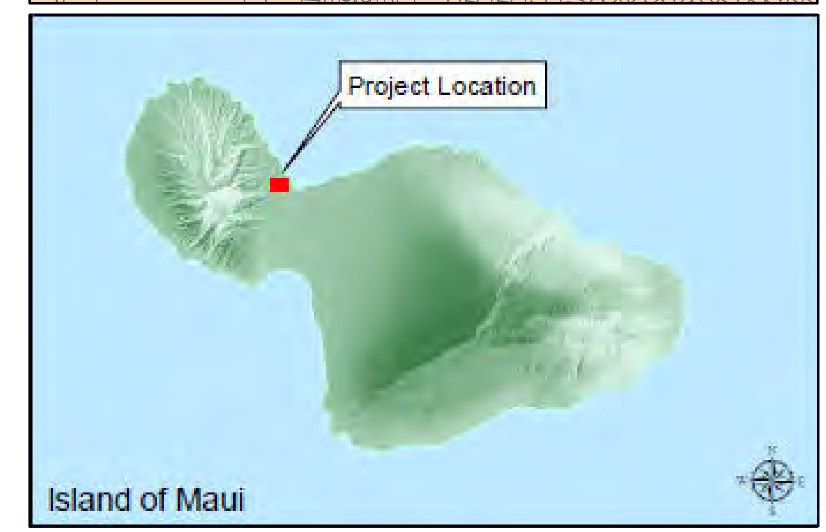
U.S. Army Corps of Engineers Honolulu District

0 100 200 Feet

0 25 50 Meters

Notes:
1. This map is for conceptual purposes only and all areas are approximate.
2. Coordinate System: Hawaii State Plane Zone 2, NAD 83 HARN, Feet
3. Imagery date: 2005, Source: DOQQ NRCS
4. Map produced by the Civil Works Technical Branch (CEPOH-EC-T) on February 1, 20





Legend

- Alt 6 Footprint
- Alt 9 Footprint
- TMK Parcels
- APE Boundary

Alternative	TMK	Area (SF)
6	234030888	8,075

Note the area^ is an estimate of the construction footprint and not the APE

U.S. Army Corps of Engineers Honolulu District

Iao Stream Flood Control Project

Figure 5: Alternative 6 - Footprint and Parcel Map Iao Stream Flood Control Project Wailuku, Island of Maui, Hawaii

0 100 200 Feet

0 25 50 Meters

Notes:
1. This map is for conceptual purposes only and all areas are approximate.
2. Coordinate System: Hawaii State Plane Zone 2, NAD 83 HARN, Feet
3. Imagery date: 2005, Source: DOQQ NRCS
4. Map produced by the Civil Works Technical Branch (CEPOH-EC-T) on February 1, 20

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

March 29, 1996

Planning and Operations Division

Don Hibbard, Ph.D.
Deputy State Historic Preservation Officer
State Historic Preservation Division
Department of Land and Natural Resources
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Dr. Hibbard:

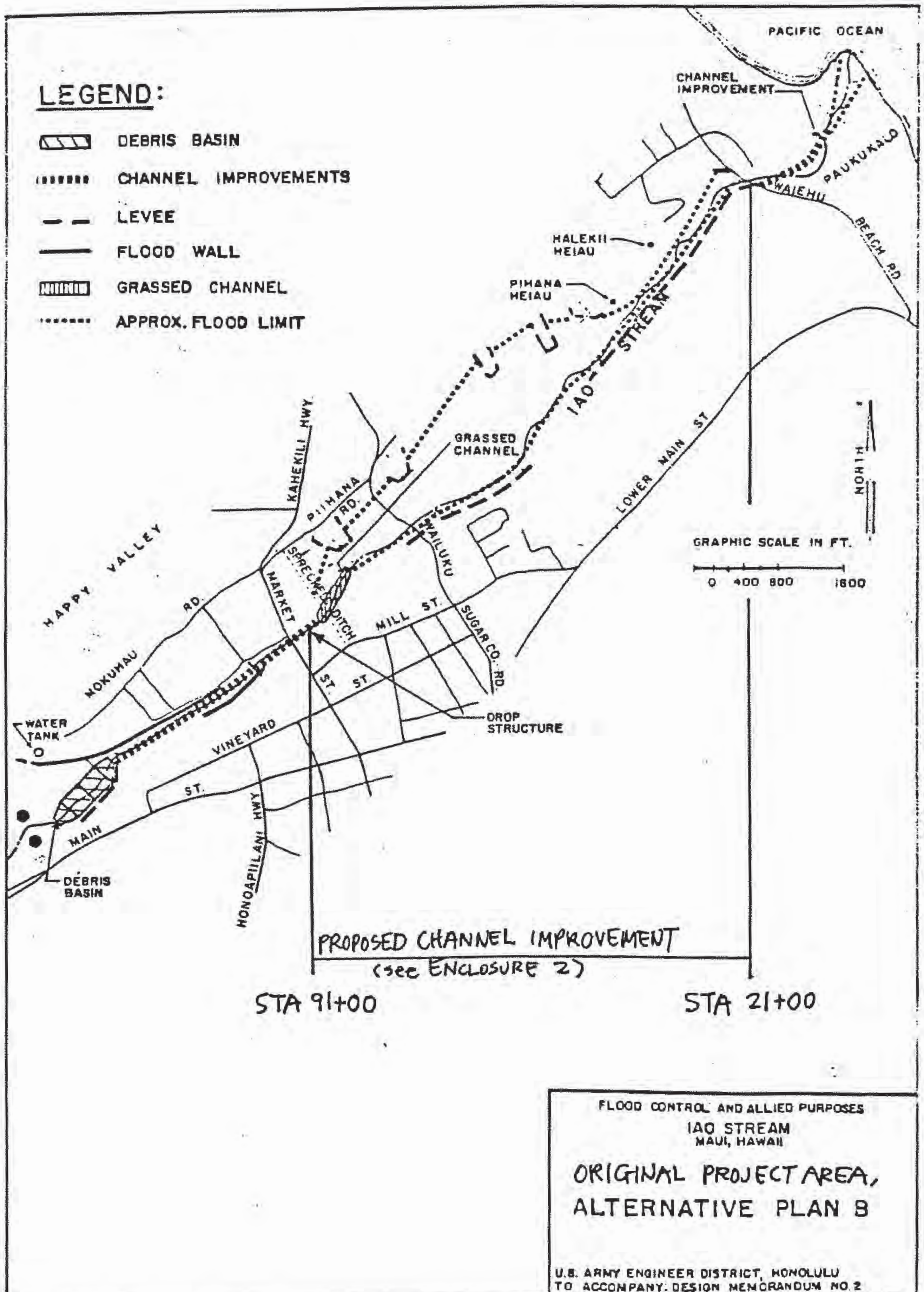
The U.S. Army Corps of Engineers, Honolulu Engineer District has assessed the potential effects of proposed modifications to the Iao Stream Flood Control Project area at Iao Stream, Wailuku, Maui Island (enclosures). The entire proposed undertaking consists of concrete drainage channel modifications confined to instream sections of the drainage way. Previous Section 106 consultation between the U.S. National Park Service and the President's Advisory Council on Historic Preservation in 1974 resulted in the Bishop Museum's identification of 2 historic properties in the uppermost portion of Iao Stream. This report is referenced in your library under Connolly, Robert, 1974, *Phase I Archaeological Survey of Iao Valley Flood Control Project Area, Maui*, Bishop Museum Manuscript Report 100374. This initial assessment did not identify any surface historic properties at the present project location and subsequent construction of the Iao Stream flood control improvements did not discover any unanticipated historic properties within the entire stream flow channel. Currently designated historic properties consisting of the Wailuku Historic District, Halekii and Pihana heiau, the Wallace System Complex, and the North Terrace System Complex are not located within the project area, nor will they be directly or indirectly impacted by any activities associated with construction of the proposed undertaking (enclosure). We request your comments and concurrence in determining that pursuant to 36 CFR Sections 800.4 and 800.5 of the regulations of the President's Advisory Council on Historic Preservation this proposed undertaking for flood control channel modifications at Iao Stream, Wailuku, Maui Island, will have No Effect on any identified or potential historic properties.

Thank you for your timely response in order that we may proceed to finalize the supplementary dEA and dFONSI and complete the Section 106 compliance process. If you have any further questions or comments, please contact Mr. Farley K. Watanabe, Staff Archaeologist at 438-7007 of my Planning & Operations Division.

Sincerely,

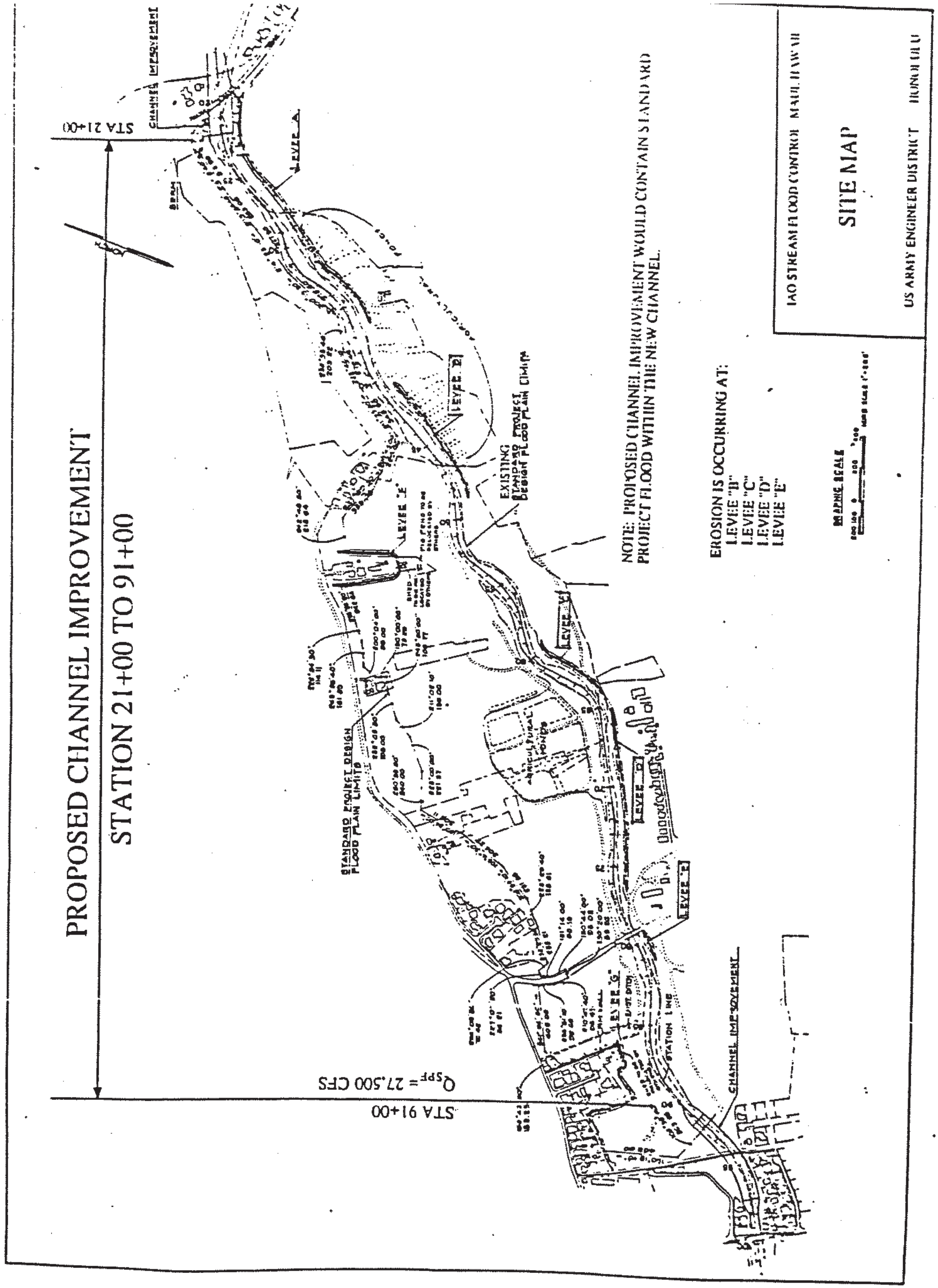
Ray H. Jyo, P.E.
Director of Engineering
and Technical Services

Enclosures

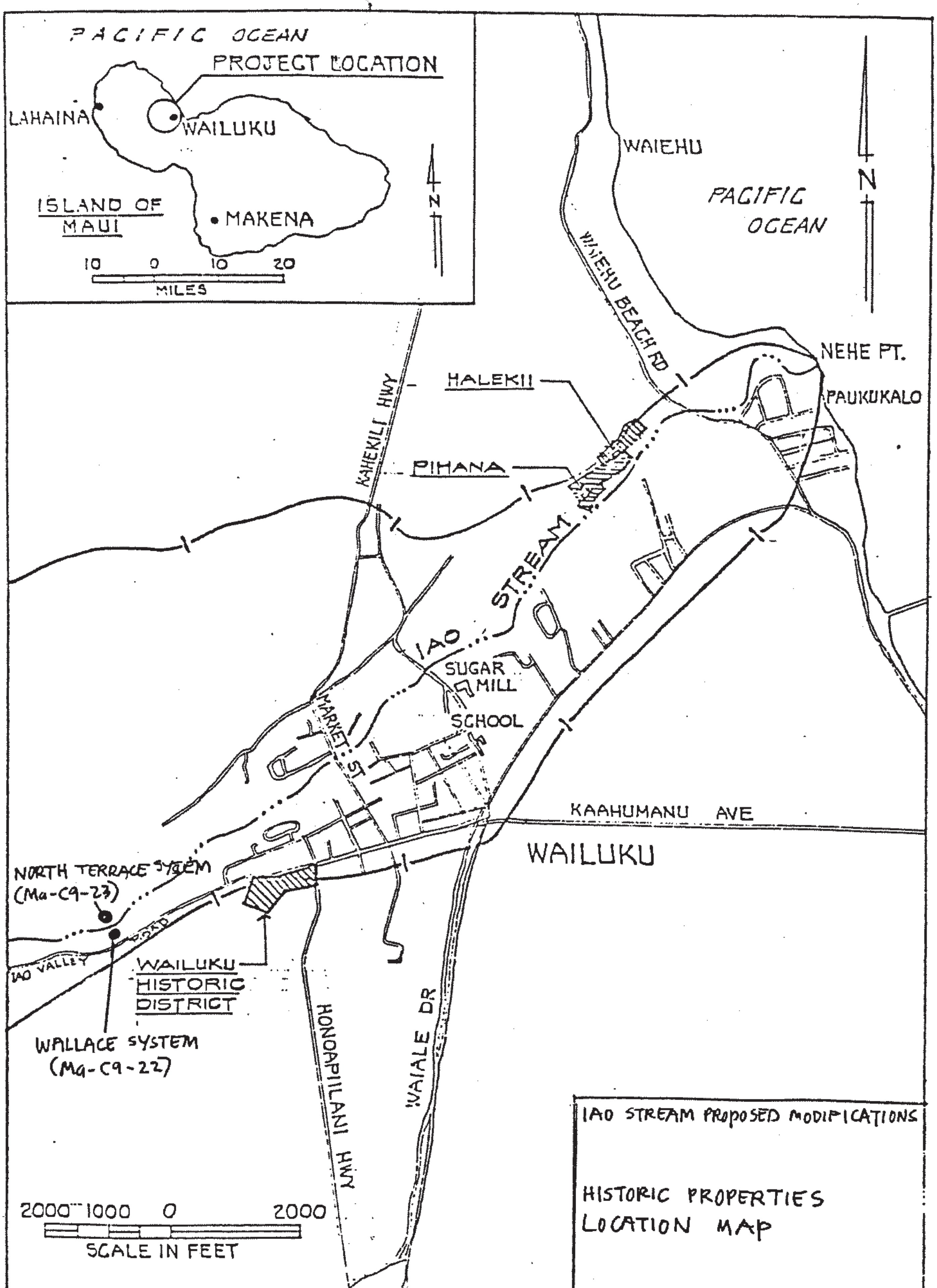


LEGEND:
DEBRIS BASIN
CHANNEL IMPROVEMENTS
LEVEE
FLOOD WALL
GRASSED CHANNEL
APPROX. FLOOD LIMIT
PACIFIC OCEAN
CHANNEL IMPROVEMENT
PAUKUKALO
WAIEHU
BEACH RD.
HALEKII HEIAU
PIHANA HEIAU
IAO STREAM
LOWER MAIN ST
NORTH
GRAPHIC SCALE IN FT.
0 400 800 1600
GRASSED CHANNEL
KAHEKILI HWY.
PIIHANA RD.
HAPPY VALLEY
RD.
SPRECKELS DITCH
MARKET
WAILUKU
MILL ST.
SUGAR CO. RD.
NOKUHAU
ST.
ST.
DROP STRUCTURE
WATER TANK
VINEYARD
ST.
MAIN
HONOAPIILANI HWY
DEBRIS BASIN
PROPOSED CHANNEL IMPROVEMENT
(see ENCLOSURE 2)
STA 91+00
STA 21+00
FLOOD CONTROL AND ALLIED PURPOSES
IAO STREAM
MAUI, HAWAII
ORIGINAL PROJECT AREA,
ALTERNATIVE PLAN B
U.S. ARMY ENGINEER DISTRICT, HONOLULU
TO ACCOMPANY: DESIGN MEMORANDUM NO. 2

Enclosure-1.


PROPOSED CHANNEL IMPROVEMENT
STATION 21+00 TO 91+00
STA 21+00
STA 91+00
Q_{SPF} = 27,500 CFS
CHANNEL IMPROVEMENT
BERM
LEVEE "A"
LEVEE "B"
LEVEE "C"
LEVEE "D"
LEVEE "E"
LEVEE "F"
LEVEE "G"
EXISTING STANDARD PROJECT DESIGN FLOOD PLAIN LIMITS
STANDARD PROJECT DESIGN FLOOD PLAIN LIMITS
AGRICULTURAL PONDS
STATION LINE
CHANNEL IMPROVEMENT
NOTE: PROPOSED CHANNEL IMPROVEMENT WOULD CONTAIN STANDARD PROJECT FLOOD WITHIN THE NEW CHANNEL.
EROSION IS OCCURRING AT:
LEVEE "B"
LEVEE "C"
LEVEE "D"
LEVEE "E"
GRAPHIC SCALE
IAO STREAM FLOOD CONTROL MAUI, HAWAII
SITE MAP
US ARMY ENGINEER DISTRICT HONOLULU

Enclosure 2


PACIFIC OCEAN
PROJECT LOCATION
LAHAINA
WAILUKU
ISLAND OF MAUI
MAKENA
N
10 0 10 20
MILES
WAIEHU
PACIFIC OCEAN
N
WAIEHU BEACH RD
NEHE PT.
PAUKUKALO
HALEKII
PIHANA
KAHEKILI HWY
IAO STREAM
SUGAR MILL
SCHOOL
MARKET ST
KAAHUMANU AVE
WAILUKU
NORTH TERRACE SYSTEM
(Ma-C9-23)
IAO VALLEY ROAD
WAILUKU HISTORIC DISTRICT
WALLACE SYSTEM
(Ma-C9-22)
HONOAPIILANI HWY
WAIALE DR
2000 1000 0 2000
SCALE IN FEET
IAO STREAM PROPOSED MODIFICATIONS
HISTORIC PROPERTIES LOCATION MAP

Enclosure 3.

PP-U

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

REF: HP-JEN

JUN 17 1996

Mr. Ray H. Jyo, Director of Engineering
Planning and Operations Division
Department of the Army
U.S. Army Engineer District, Honolulu
Ft. Shafter, Hawaii 96858-5440

LOG NO: 17189
DOC NO: 9606KD04

Dear Mr. Jyo:

SUBJECT: **National Historic Preservation Act, Section 106 Review of the Iao Stream Flood Control Project Modifications**
Wailuku, Wailuku District, Maui

The Corps of Engineers proposes to make improvements along sections of the existing Iao Stream channel, in an area between Market Street and Waiehu Beach Road in Wailuku. The improvements will be confined to the existing concrete channel area and are within the previously impacted zone of the Iao Flood Control Project.

As indicated in your letter, the proposed improvements will not occur within or near areas of known historic sites. We concur with your determination that the project will have "no effect" on historic sites.

Please contact Ms. Theresa K. Donham at 243-5169 if you have any questions.

Aloha,

Gilbert S. Coloma-Agaran
for MICHAEL D. WILSON,
State Historic Preservation Officer

KD:jen

	OFFICE	ACTION	INFO
2	Dir of Engrg	Tech Svcs	JN
1	Deputy		
	[illegible]		
	Const		
	Comty		
	Env		
3	Plng	L	19
	Svcs		
	Tech		

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

29 July, 2005

REPLY TO
ATTENTION OF

Environmental Technical Branch
Engineering and Construction Division

Mr. Clyde Namuo, Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namuo:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower (makai) segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figure 1). Five (5) alternatives are being considered as flood control measures and, for the most part, these measures are confined to the stream channel proper and certain areas of the northern banks of the stream in the upper (mauka) section of the project area. No modification is being envisioned along the banks of the stream in the lower portion (makai) of the project area, across from the area encompassing Halekii Heiau.

Typical cross-sections of the flood control measures are illustrated in Figures 2, 3, and 4. Alternative 1 will result in a trapezoidal concrete-lined channel. Alternative 2 will consist of a rectangular concrete-lined channel plus approximately 50-feet wide modification on the left (north) bank floodplain. Alternative 3 will have the channel concrete lined with boulder inverts and modifications to the left bank flood plain, again about 50 feet wide. Alternative 4 will consist of levee construction with toe repairs. The fifth alternative would leave the channel in its natural state with the removal of all existing flood control features.

Archaeologist from my Environmental Technical Branch visited the project area with the State Historic Preservation Office Maui Island staff archaeologist, Dr. Melissa Kirkendall. During the site visit, it was determined that potential significant subsurface cultural resources may be present in the floodplain banks along the upper sections of the project area. Proposed modification of the floodplain banks in these upper areas may potentially impact these buried significant cultural resources. It was determined that a program of archaeological monitoring during construction should ensure that these resources will not be adversely impacted by the flood control construction activities.

A cultural impact study (CIS) was also undertaken for this project. The CIS included personal interviews of a number of native Hawaiian cultural experts knowledgeable in the folklore of the project area and its surroundings. The study identified no areas of traditional importance within the project area; however, this conclusion is still in draft format and a copy of this report will be submitted to your office for review and comments. A copy of the final report will then be furnished to your office.

Based on the above information, POH has made the determination that the proposed Iao Stream Flood Control Project will have "no adverse effect on historic properties", provided a program of archaeological monitoring accompanies construction activities at the upper portion of the project area. Furthermore, an archaeological monitoring plan will need to be compiled for review and acceptance by your office prior to the start of any construction activities. Furthermore, the archaeological monitoring will be undertaken by a reputable archaeological firm with prolonged experience in Hawaiian archaeology. In compliance with the National Historic Preservation Act of 1966, pursuant to implementing regulations 36 CFR Part 800 (NHPA), your concurrence to this determination is being requested. POH is also requesting concurrence from the Hawaii State Historic Preservation Officer and the Central Maui Hawaiian Civic Club, in accordance with the NHPA.

Should you require any additional information, please contact Kanalei Shun at 438-7000.

Sincerely,

James L. Bersson
Chief, Engineering and
Construction Division

Enclosures (4)

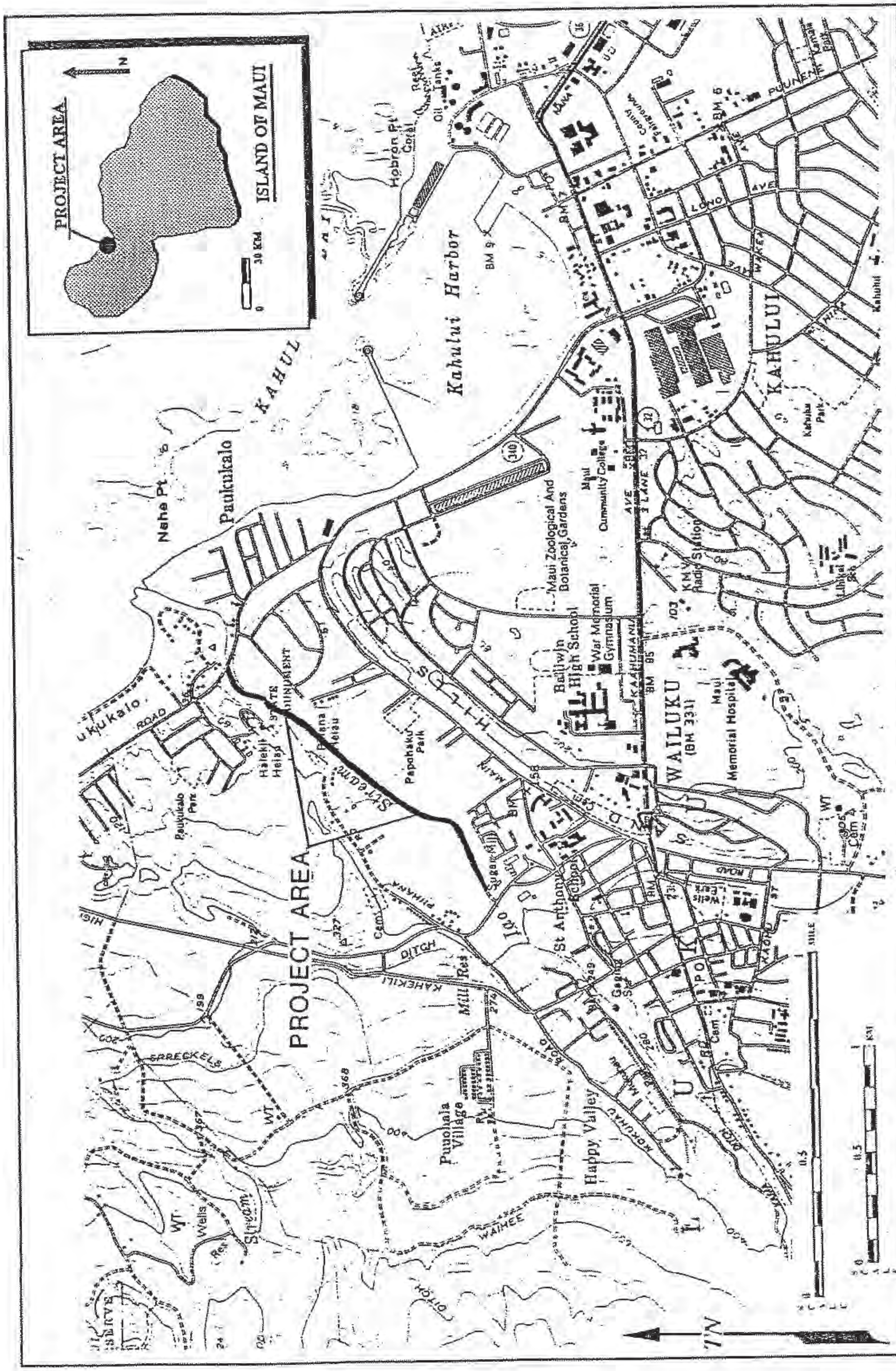


Figure 1: USGS Wailuku Quadrangle Showing Project Area.

FIG. 2

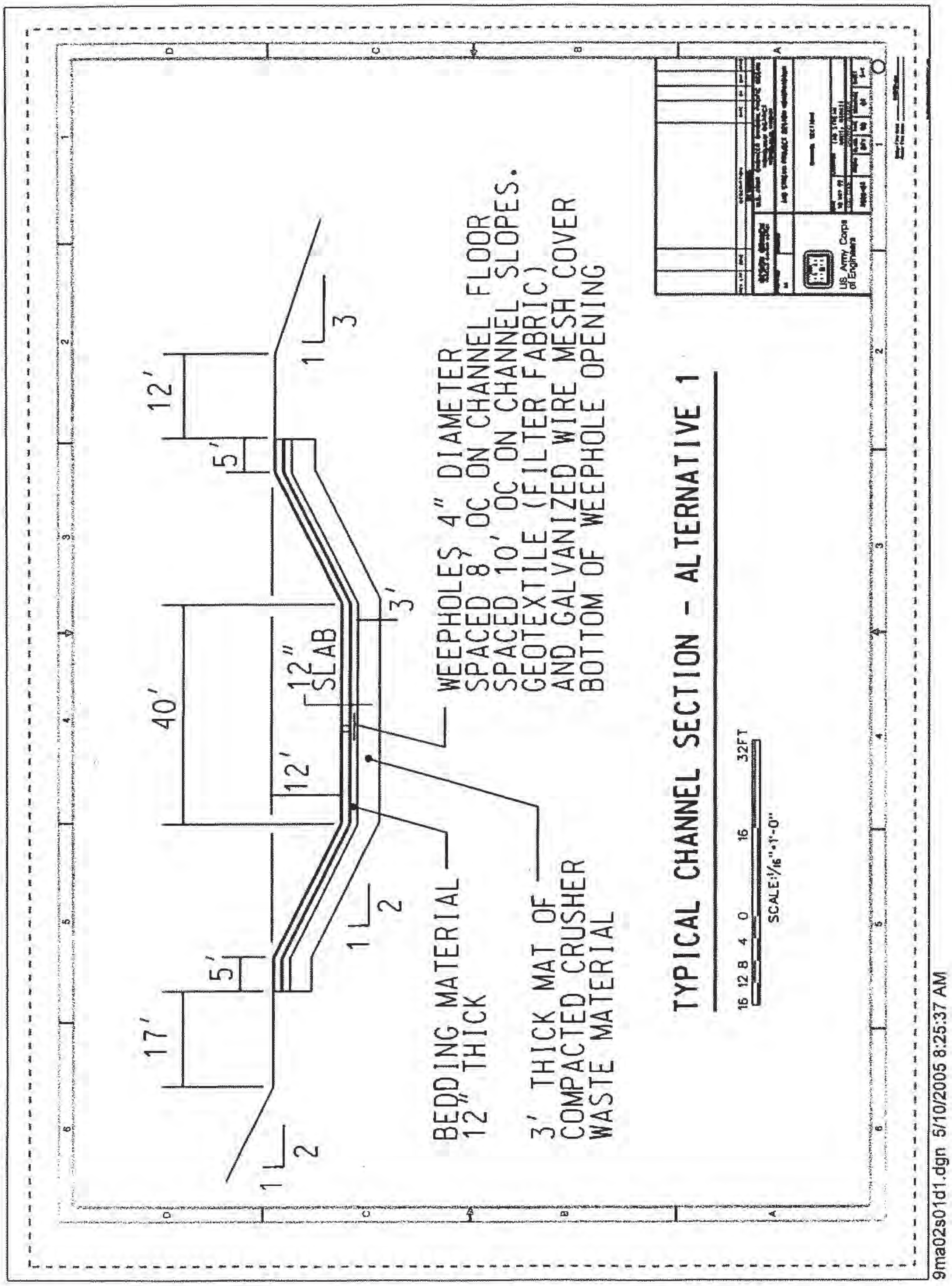

TYPICAL CHANNEL SECTION - ALTERNATIVE 1
17'
5'
40'
12'
12" SLAB
3'
5'
12'
1
2
1
2
1
2
1
3
BEDDING MATERIAL 12" THICK
3' THICK MAT OF COMPACTED CRUSHER WASTE MATERIAL
WEEPHOLES 4" DIAMETER SPACED 8' OC ON CHANNEL FLOOR SPACED 10' OC ON CHANNEL SLOPES.
GEOTEXTILE (FILTER FABRIC) AND GALVANIZED WIRE MESH COVER BOTTOM OF WEEPHOLE OPENING
16 12 8 4 0 16 32FT
SCALE:1/16"=1'-0"
US Army Corps of Engineers
9ma02s01d1.dgn 5/10/2005 8:25:37 AM

FIG. 3

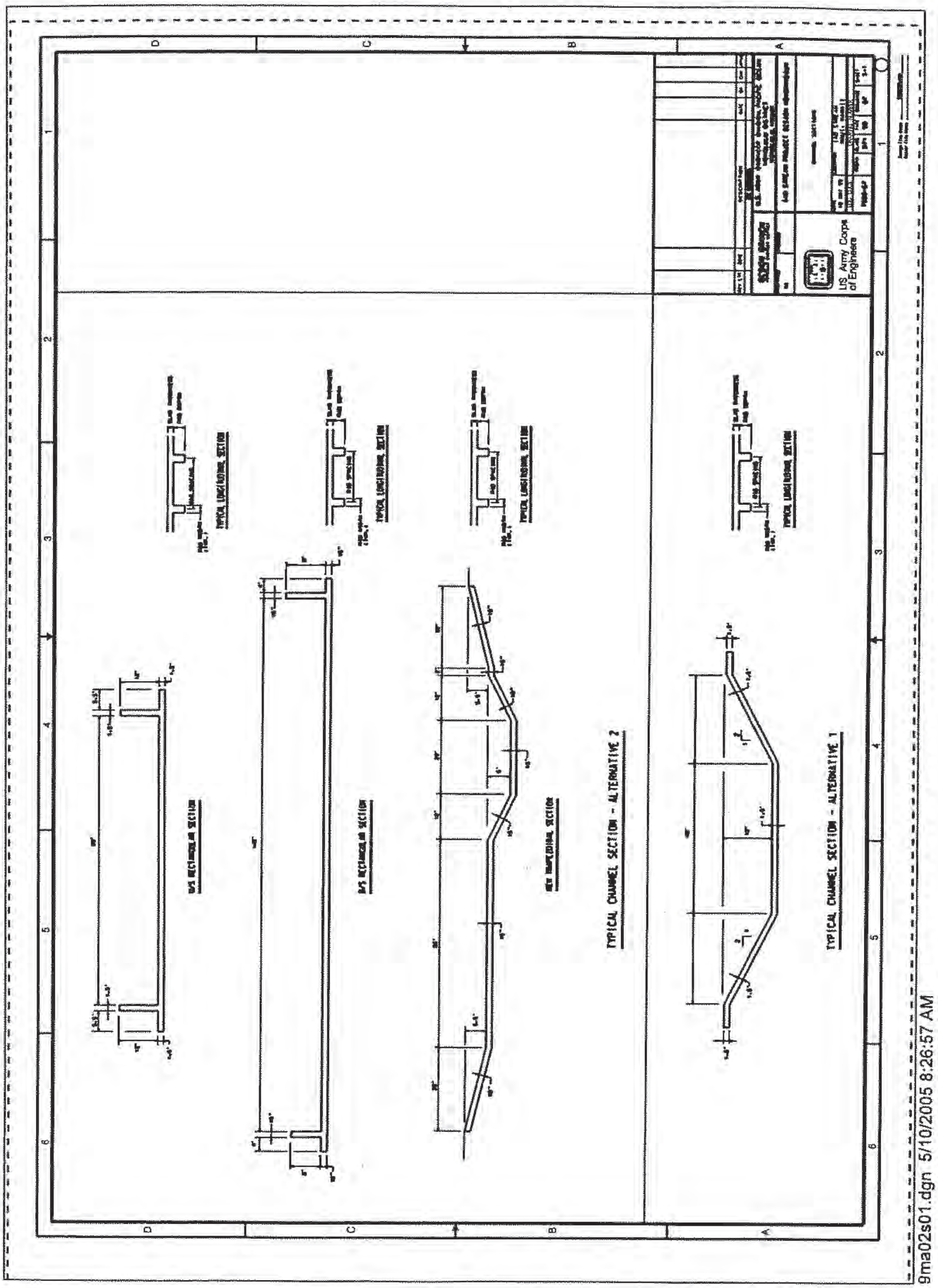
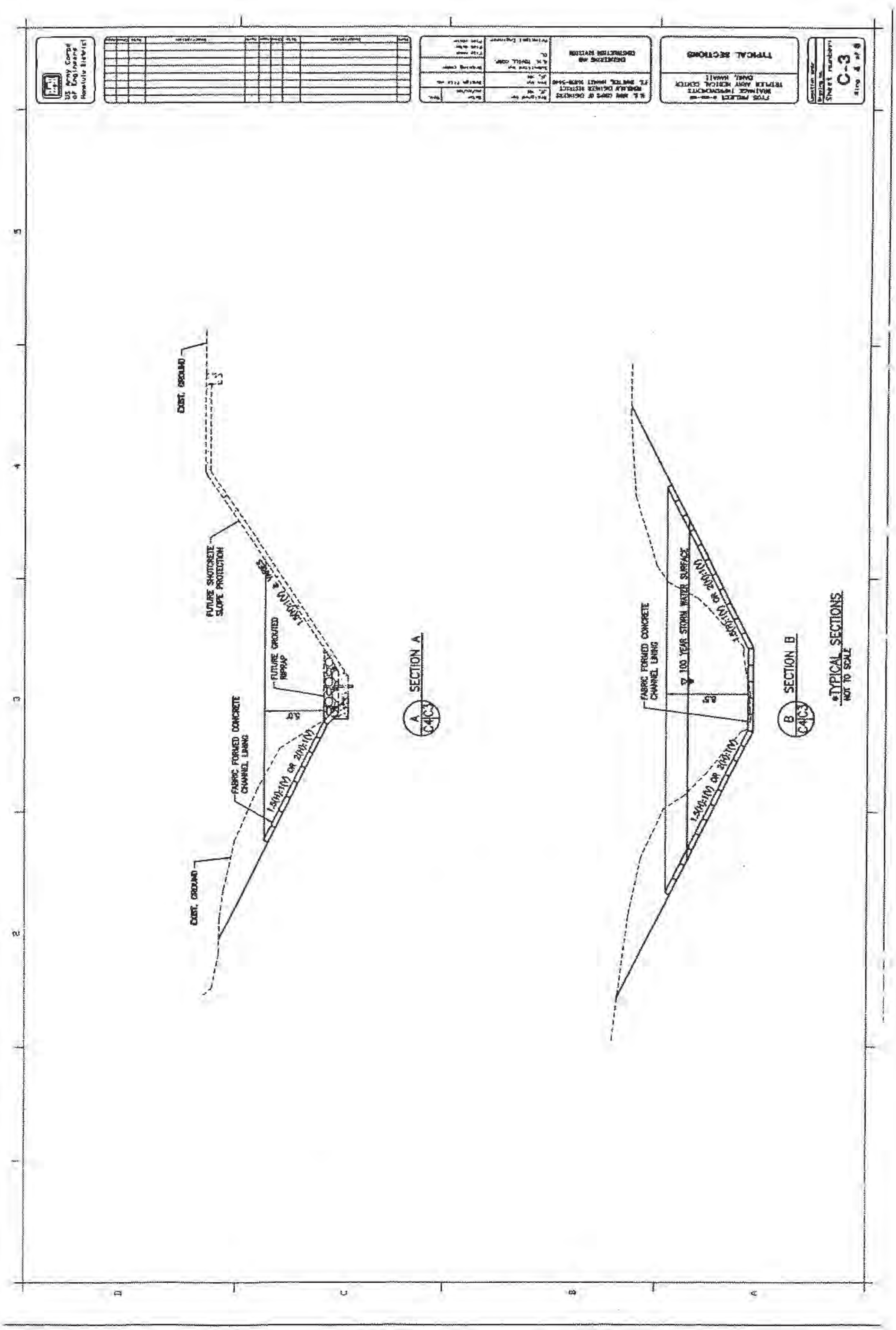

TYPICAL CHANNEL SECTION - ALTERNATIVE 2
TYPICAL CHANNEL SECTION - ALTERNATIVE 1
US Army Corps of Engineers
9ma02s01.dgn 5/10/2005 8:26:57 AM

FIG. 4


EXIST. GROUND
FUTURE SHOTCRETE SLOPE PROTECTION
FUTURE GROUTED RIPRAP
FABRIC FORMED CONCRETE CHANNEL LINING
SECTION A
100 YEAR STORM WATER SURFACE
SECTION B
TYPICAL SECTIONS
NOT TO SCALE
US Army Corps of Engineers Honolulu District
TYPICAL SECTIONS
C-3

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

September 10, 2007

REPLY TO

Engineering and Construction Division

Mr. Clyde W. Namu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd, Suite 500
Honolulu, Hawaii 96813

Dear Mr. Namu'o:

The U.S. Army Engineer District, Honolulu (POH) is proposing to undertake a flood control project on the lower segments of Iao Stream (multiple TMK) in Wailuku, Maui Island (Figures 1, 2a, 2b, and 2c). The project area begins on the makai (east) end of Waiehu Beach Road The project was designed for Standard Project Flood (SPF) protection with a peak design discharge of 27,500 cubic feet/second (cfs) downstream at Station 22+00 and 26,000 cfs upstream at Station 92+02 (Figures 3-6). Five (5) alternatives are being considered for the flood control measures, and Alternative III has been proposed as the most viable based on engineering and cost benefits. A summary of the work under Alternative III is attached herein as Enclosure 1. Work proposed under Alternative III is an undertaking requiring consultation in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. The purpose of this letter is to initiate the Section 106 consultation process.

The area of potential effect (APE) of most of the work proposed under Alternative III is confined to the already highly disturbed stream channel. This work, listed under items 3-5, 7, and 9 in Enclosure 1, consists of modification to the existing channel. Such work should not affect any significant cultural resources as none is anticipated to be present within the stream channel itself.

The remaining work, listed under items 1, 2, 6, and 8, will entail new construction and/or construction excavations. A diversion levee in the form of a trapezoidal-shaped structure, 500 feet long, 65 feet wide, and 9 feet high, and a new ground water recharge basin are being proposed for construction at the upper end of the project area (see Figures 7a and 7b). Stream re-alignment and widening, anticipated to be no more than 30 feet wide, is being proposed between Stations 76+00 and 85+30 where the left (north) bank of the stream (see Figure 6) will be widen to reduce water surface profile to accommodate the County's proposed Imi Kala Bridge expansion construction. The areas of potential effect for this work is within the Iao Stream flood plain, and in the immediate vicinity of the channel. Based on previous archaeological investigations and historical accounts, prehistoric remains, except for *auwai* to feed taro loi, would not be anticipated to be present this type of terrain. Visual inspection of the stream channel's north embankment in the Imi Kala bridge location found no evidence to indicate potential presence of an *auwai* system. Thus, a determination can be made that this new construction work will not affect potentially surface or subsurface historic sites. However, to ensure that such will remain the case, POH is recommending that a professional archaeological monitor be present during construction excavation activities associated with any work in this area. Lastly, the raising of the right bank levee in the area between stations 45+37 to 48+85 and 25+62 to 26+46 are add-ons to existing levee and should not impact any cultural resources.

Thus, POH has made the determination that the proposed modification actions to the floodplain banks and immediate adjacent areas of the existing Iao Stream channel will have no affect to historic sites. To ensure no adverse impact will result to potentially significant subsurface cultural resources from construction activities to the north embankment in the Imi Kala bridge area, a program of archaeological monitoring during construction is being proposed. An archaeological monitoring plan will be compiled for review and acceptance by your office prior to the start of any construction; the archaeological monitoring will be undertaken by a reputable archaeological firm with prolonged experience in Hawaiian archaeology. The proposed archaeological monitoring program should ensure that the Alternative III will result in a "no effect to historic properties" determination. In compliance with the National Historic Preservation Act of 1966, pursuant to implementing regulations 36 CFR Part 800 (NHPA), your concurrence to this determination is being requested. POH is also requesting concurrence from the Hawaii State Historic Preservation Office, the Maui County Cultural Resources Commission, and the Central Maui Hawaiian Civic Club, in accordance with the NHPA.

We are also forwarding a copy of this letter to Mr. Stanley Solamilo, Maui County Cultural Resources Commission Minute, Maui County Planning Department, 250 S. High Street, Wailuku, Hawaii 96793. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Todd C. Barnes, P.E.
Chief, Engineering and
Construction Division

Enclosures

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

October 5, 2007

REPLY TO
ATTENTION OF:

Engineering and Construction Division

Ms. Laura H. Thielen
Interim Chairman and State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Ms. Thielen:

Enclosed for your review and comment is a copy of the Cultural Impact Assessment (CIA) report that was compiled as part of the U.S. Army Engineer District, Honolulu (POH) Iao Stream Flood Control Project. The study was conducted by our Small Business contractor, Social Research Pacific, Inc., for the Environmental Assessment (EA) being prepared by POH for the project in compliance with the National Environmental Policy Act (NEPA). The CIA study was performed in accordance with Chapter 343 of the Hawaii Revised Statute and with the "Guidelines for Assessing Cultural Impacts" adopted in 1977 by the Environmental Council of the State of Hawaii.

In our 5 September 2007 letter to your office, POH initiated consultation for the project with your office in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, pursuant to implementing regulations 36 CFR Part 800. We await your response to our letter.

A copy of this report is also being forwarded to the Office of Hawaiian Affairs, the Maui County Cultural Resources Commission, the Central Maui Hawaiian Civic Club, and the President of the Association of Hawaiian Civic Clubs for review and comment. If you require any additional information, please contact Mr. Kanalei Shun at 438-7000.

Sincerely,

Curtis I. Yokoyama, S.E., P.E.
Chief, Engineering and
Construction Division

Enclosure

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

HRD07/3219B

October 30, 2007

Curtis Yokoyama. Chief
Department of the Army
U.S. Army Engineer District
Fort Shafter, Hawai'i 96858-5440

RE: Cultural Impact Assesment for 'Iao Stream Flood Control Project, Maui, Hawai'i.

Dear Mr. Yokoyama,

The Office of Hawaiian Affairs (OHA) is in receipt of your request for written comments regarding the Cultural Impact Statement (CIS) for the 'Iao Stream flood control project on Maui. We have the following comments:

OHA requests that the TMK number for this project be given so that we can determine whether this project will impact any of our ceded lands.

This CIS was sent to us separate from the environmental assessment (EA) for which it is to be incorporated into. OHA recognizes that this was done in order to begin the consultation process; however, it is not particularly useful to do so. It is difficult to review a CIS out of context form its associated project. Further, OHA understands that the EA for this CIS will be released soon and we will review it at that time. That being said, OHA wishes to make clear that we are always pleased to see an applicant working on a CIS and as such are happy to assist with its preparation. However, the review of the CIS as a stand-alone document is not the intent of the environmental review process and, as said, a bit difficult.

OHA also notes that the invitation to comment mentions that a Section 106 consultation was initiated by the U.S. Army Engineer District on September 5, 2007. However, our agency has no record of receiving this document and as such, does not recognize the initiation of the 106 process as of now.

In terms of the CIS, OHA appreciates that a number of sources were consulted in preparation of this document including archival searches, field studies, oral histories from kūpuna in the area, public scoping meetings and surveys. However, there are numerous lo'i, heiau, and other culturally significant sites in the area as well as constitutionally protected Native Hawaiian rights being practiced in the area. As such, OHA both compliments the research done for the CIS, while reserving the right to further comment for the EA.

Thank you for the opportunity to comment. If you have any further questions or concerns please contact Grant Arnold at (808) 594-0239 or granta@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

C: Thelma Shimaoka, Community Resource Coordinator
Office of Hawaiian Affairs, Maui Office
140 Ho'ohana St., Ste. 206
Kahului, Hawai'i 96732

From: Shun, Kanalei POH
To: Morgan.E.Davis@hawaii.gov; Jenny Pickett ARCHAEOLOGY
Cc: Shimabuku, Lorayne P POH; Miya Akiba; Dennis Gosser
Subject: Alt. F Iao Stream Flood Control Project - EOF report for AIS (UNCLASSIFIED)
Attachments: image001.png
image002.png
image003.png
image004.png
Final EOF Report 13June2014.pdf

Classification: UNCLASSIFIED
Caveats: NONE

Aloha Morgan and Jenny:

Attached, for you information, is the end-of-field report for an AIS, performed by the archaeological firm, Pacific Consulting Services, Inc. (PCSI). AIS was done for Alternative F of the Iao Stream Flood Control Project. WE did a site visit of the project area with Hinano early this year. Tell Hinano sour sup tree went, not sure where and how.

Anyway, no subsurface cultural deposits were identified in any of PCSI excavated trenches (10 in all). Based on PCSI's background research, we did not think there would be any remnants of loi terraces in that area as it was too susceptible to big time flooding. Currently, I am leaning toward a no effect to historic properties determination, unless we come across some other evidence showing otherwise. I would recommend to ensure no impact to significant cultural resources, a program of archaeological monitoring during construction.

If either of you think of other avenues we should pursue for evidence of other subsistence or land use pattern, let me know.

I will wait for the final report to make the final determination of effect.

Thank you and take care.

Kanalei

Classification: UNCLASSIFIED
Caveats: NONE

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

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Lui K. Hokoana
Pelekikena
Central Maui Hawaiian Civic Club
P.O. Box 1493
Wailuku, Hawaii 96793

Dear Mr. Hokoana:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

Alternative F consists of features that would reconnect the main channel with the existing floodplain on the left bank to reduce damaging flows along the main channel and right bank levees. The reconnection would be accomplished by lowering the left bank approximately five to nine feet for an approximate length of 417 feet along the left bank and grading the overflow area to disperse flow into the floodplain. Revegetation (in the form of grass) would be provided throughout the approximately 116,060-square-foot overflow channel to prevent soil erosion during diversion of stream waters. The stream would be constricted by a concrete diversion wall that would force flood flows to leave the main channel and enter the existing designated floodplain area on the left bank. Flood flows entering the floodplain at the overflow channel would spread out and follow the natural topographic gradient until re-entering the main channel downstream at the outflow section. This alternative replicates to the extent practical, the natural hydrological pattern of an alluvial floodplain that existed within the area prior to modern development.

The Iao Stream Flood Control Project has been ongoing for more than 10 years. The Corps has conducted Section 106 consultation with your office for various alternatives, including the earliest letter we have on file, dated October 4, 2007, when roman numerals were used for each of the alternatives. Alternative F is a more recent development in 2013, and discussion on its impact on significant cultural and archaeological resources has been ongoing.

The surface of the Alternative F project area consists of an active alluvial flat that has been subjected to many recent flooding episodes in the recent past that, in all likelihood, wiped out any and all past (historic and prehistoric) significant human surface material remains. An Archaeological Inventory Survey (AIS), however, was deemed best and necessary to identify potentially significant subsurface archaeological remnants that may still be present. Pacific Consultant Services, Inc., a cultural resource consulting firm based on the island of Oahu, Hawaii, was subsequently contracted by the Corps to conduct an AIS study and investigation to determine presence of any archaeological remnants within the Alternative F project area. The Final AIS in Support of the Modification to the Iao Stream Flood Control Project, Alternative F, Wailuku Ahupuaa, Wailuku District, Maui Island, Hawaii, TMK: [2] 3-4-032:001 [por.] documenting the results of the study is enclosed for your information and review.

The AIS includes archival and background research, subsurface excavations trenching methods and strategies, data results and analysis, and conclusion. The investigation identified no significant cultural deposits. However, based on the likelihood of the presence of certain types of potentially significant cultural remains such as human burial remains, and *ahu* or stone markers, the AIS recommends archaeological monitoring during project construction to ensure there are no adverse effect on any significant cultural remnants.

The Corps fully intends to follow the recommendation of the AIS during the construction phase of Alternative F. An Archaeological Monitoring Program (AMP) will be in place during construction activities associated with Alternative F, and it will be followed and adhered to. The program will ensure that a qualified archaeologist is present to monitor all construction activities, particularly those involving all new ground-breaking excavations by ground moving heavy machineries. The monitoring activities will be conducted in consultation with your office, including the review of an archaeological monitoring plan, significance assessment of any potentially significant cultural deposits (including human burial remains) located during the monitoring, and subsequent data recovery actions and plans.

With the AMP in place, the Corps makes the determination that construction of Alternative F will have a no adverse effect on historic properties. In compliance with Section 106 of the NHPA, the Corps seeks your review and comments. The Corps is also consulting with, and seeking comments from the State Historic Preservation Office, and other Native Hawaiian Organizations such as Office of Hawaiian Affairs, Hui

Malama I Na Kupuna O Hawaii Nei, and Maui/Lanai Islands Burial Councils.

For questions, please contact Mr. Kanalei Shun, Senior Archaeologist in my Environmental Programs Branch, at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

for Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

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

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Alan S. Downer, Ph.D.
Administrator
State Historic Preservation Office
Department of Land and Natural Resources
State of Hawaii
601 Kamokila Boulevard, Suite 555
Kapolei, Hawaii 96707

Dear Dr. Downer:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

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The Iao Stream Flood Control Project has been ongoing for more than 10 years. The Corps has conducted Section 106 consultation with your office for various alternatives, including the earliest letter we have on file, dated October 4, 2007, when roman numerals were used for each of the alternatives. Alternative F is a more recent development from 2013, and discussion on its impact on significant cultural and archaeological resources has been ongoing since then, beginning with a 2013 field and on-site visit and discussion with all three members of your Maui Office staff at the time, Mr. Morgan Davies, Ms. Jenny Pickett, and Mr. Hinano Rodrigues.

The surface of the Alternative F project area consists of an active alluvial flat that has been subjected to many recent flooding episodes that, in all likelihood, wiped out any and all past (historic and prehistoric) significant human surface material remains. However, during the 2013 site visit with your staff members, an Archaeological Inventory Survey (AIS) was deemed best and necessary to identify potentially significant subsurface archaeological remnants that may still be present. Pacific Consultant Services, Inc., a cultural resource consulting firm based on the island of Oahu, Hawaii, was subsequently contracted by the Corps to conduct the AIS study and investigation. The Final AIS in Support of the Modification to the Iao Stream Flood Control Project, Alternative F, Wailuku Ahupuaa, Wailuku District, island of Maui, Hawaii, TMK: [2] 3-4-032:001 [por.] documenting the results of the study is enclosed for your information and review.

The AIS includes archival and background research, subsurface excavations trenching methods and strategies, data results and analysis, and conclusion. The investigation identified no significant cultural deposits. However, based on the likelihood of the presence of certain types of potentially significant cultural remains such as human burial remains, and *ahu* or stone markers, the AIS recommends archaeological monitoring during project construction to ensure no adverse effect on any significant cultural remnants.

The Corps fully intends to follow the recommendation of the AIS and will put in place an Archaeological Monitoring Program (AMP) to be followed and adhered to during the construction phase of Alternative F. The program will ensure that a qualified archaeologist is present to monitor all construction activities, particularly those involving all new ground-breaking excavations by ground moving heavy machineries. The monitoring activities will be conducted in consultation with your office, including the review of the archaeological monitoring plan, significance assessment of any potentially significant cultural deposits (including human burial remains) identified during construction monitoring, and subsequent data recovery actions and plans.

With the AMP in place, the Corps makes the determination that construction of Alternative F will have a no adverse effect on historic properties. In compliance with Section 106 of the NHPA, the Corps seeks your concurrence with this determination.

The Corps is also seeking review and comments on its determination from the Office of Hawaiian Affairs, and other Native Hawaiian Organizations such as the Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and Maui/Lanai Islands Burial Councils.

Two additional copies of this letter and the AIS are provided to you for circulation and review for your History and Culture Branch and the Maui & Lanai Burial Council. They have participated in previous consultations for this project, and we would like to continue to receive their feedback as well.

For questions, please contact Mr. Kanalei Shun, Senior Archaeologist in my Environmental Programs Branch, at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

Jon K. Yoshimura

for Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

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

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Edward Halealoha Ayau, Esq.
Poo
Hui Malama I Na Kupuna O Hawaii Nei
P.O. Box 365
Hoolehua, Hawaii 96729

Dear Mr. Ayau:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

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The Iao Stream Flood Control Project has been ongoing for more than 10 years. The Corps has conducted Section 106 consultation with your office for various alternatives, including the earliest letter we have on file, dated October 4, 2007, when roman numerals were used for each of the alternatives. Alternative F is a more recent development in 2013, and discussion on its impact on significant cultural and archaeological resources has been ongoing.

The surface of the Alternative F project area consists of an active alluvial flat that has been subjected to many recent flooding episodes in the recent past that, in all likelihood, wiped out any and all past (historic and prehistoric) significant human surface material remains. An Archaeological Inventory Survey (AIS), however, was deemed best and necessary to identify potentially significant subsurface archaeological remnants that may still be present. Pacific Consultant Services, Inc., a cultural resource consulting firm based on the island of Oahu, Hawaii, was subsequently contracted by the Corps to conduct an AIS study and investigation to determine presence of any archaeological remnants within the Alternative F project area. The Final AIS in Support of the Modification to the Iao Stream Flood Control Project, Alternative F, Wailuku Ahupuaa, Wailuku District, Maui Island, Hawaii, TMK: [2] 3-4-032:001 [por.] documenting the results of the study is enclosed for your information and review.

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The Corps fully intends to follow the recommendation of the AIS during the construction phase of Alternative F. An Archaeological Monitoring Program (AMP) will be in place during construction activities associated with Alternative F, and it will be followed and adhered to. The program will ensure that a qualified archaeologist is present to monitor all construction activities, particularly those involving all new ground-breaking excavations by ground moving heavy machineries. The monitoring activities will be conducted in consultation with your Hui, including the review of an archaeological monitoring plan, significance assessment of any potentially significant cultural deposits (including human burial remains) located during the monitoring, and subsequent data recovery actions and plans.

With the AMP in place, the Corps makes the determination that construction of Alternative F will have a no adverse effect on historic properties. In compliance with Section 106 of the NHPA, the Corps seeks your review and comments. The Corps is also consulting with and seeking comments from the State Historic Preservation Office, and other Native Hawaiian Organizations such as Office of Hawaiian Affairs, Central

Maui Hawaiian Civic Club, and Maui/Lanai Islands Burial Councils.

For questions, please contact Mr. Kanalei Shun, Senior Archaeologist in my Environmental Programs Branch, at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

Fr Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

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

DEC 0 5 2016

Environmental Programs Branch
Programs and Project Management Division

Mr. Kamanaopono M. Crabbe, Ph.D.
Ka Pouhana
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

Dear Dr. Crabbe:

The Honolulu District, U.S. Army Corps of Engineers (Corps) is initiating official coordination and consultation with your office in compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and implementing regulations 36 U.S. Code of Federal Regulation Part 800, with respect to Alternative F as being proposed under the Environmental Assessment (EA) prepared for its Iao Stream Flood Control Project in Wailuku, Maui Island, Hawaii (Multiple Tax Map Keys (TMKs)). The EA evaluates six alternatives, including the No Action and an Alternative F, and concludes the latter as the preferred alternative.

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The Iao Stream Flood Control Project has been ongoing for more than 10 years. The Corps has conducted Section 106 consultation with your office for various alternatives, including the earliest letter we have on file, dated October 4, 2007, when roman numerals were used for each of the alternatives. Alternative F is a more recent development in 2013, and discussion on its impact on significant cultural and archaeological resources has been ongoing.

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The AIS includes archival and background research, subsurface excavations trenching methods and strategies, data results and analysis, and conclusion. The investigation identified no significant cultural deposits. However, based on the likelihood of the presence of certain types of potentially significant cultural remains such as human burial remains, and *ahu* or stone markers, the AIS recommends archaeological monitoring during project construction to ensure there are no adverse effect on any significant cultural remnants.

The Corps fully intends to follow the recommendation of the AIS during the construction phase of Alternative F. An Archaeological Monitoring Program (AMP) will be in place during construction activities associated with Alternative F, and it will be followed and adhered to. The program will ensure that a qualified archaeologist is present to monitor all construction activities, particularly those involving all new ground-breaking excavations by ground moving heavy machineries. The monitoring activities will be conducted in consultation with your office, including the review of an archaeological monitoring plan, significance assessment of any potentially significant cultural deposits (including human burial remains) located during the monitoring, and subsequent data recovery actions and plans.

With the AMP in place, the Corps makes the determination that construction of Alternative F will have a no adverse effect on historic properties. In compliance with Section 106 of the NHPA, the Corps seeks your review and comments. The Corps is also consulting with, and seeking comments from the State Historic Preservation Office, and other Native Hawaiian Organizations such as the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and Maui/Lanai Islands Burial Councils.

For questions, please contact Mr. Kanalei Shun, Senior Archaeologist in my Environmental Programs Branch, at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

Jon K. Yoshimura

For Stephen N. Cayetano, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Janet Six
County of Maui Archaeologist
Kalana O Maui Building
200 S. High Street
Wailuku, HI 96793

Dear Ms. Six:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui. The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). The Iao Stream FCP was turned over to the County of Maui, the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperation Agreement.

The Corps is currently preparing an Environmental Assessment (EA) to supplement the 2017 EA[1] for previously proposed repairs, assessing the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel and a non-structural flood warning system. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The repairs consist of the following:

a) removal of the existing Revetment X left bank to allow the Wailuku River to meander and naturally slow velocities,

b) construction of an engineered, pre-formed scour hole to replace an existing scour hole in the channel, and

[1] Publicly available review documents such as the 2017 Environmental Assessment can be accessed online at: https://www.poh.usace.army.mil/Missions/Civil-Works/Civil-Works-Projects/Iao-Stream/.

c) a public flood warning system including installation of a stream gage, which essentially is a non-structural plan.

This project is a Federally funded action or “undertaking” and, as such, is subject to Federal laws and regulations, including the National Historic Preservation Act (NHPA) of 1966 (54 USC § 306108) and implementing regulations, 36 CFR Part 800. Section 106 of the NHPA mandates consultation with your office to ensure historic properties are protected during execution of the undertaking. The purpose of this letter is to initiate Section 106 consultation with your office for the undertaking as described below, and seek your concurrence on the Corps’ determination of effect.

The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative ‘F’ in 2017(see Figure 2, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of ‘no adverse effect on historic property” (Enclosure 2). To-date, none of the consulted NHOs have officially responded to the Corps’ letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a pre-formed scour hole (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system in coordination with the County, including installation of a stream or other climate gage in the vicinity of the Iao Stream FCP. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and the Corps’ currently proposed undertaking. Note that each of these three components are hydraulically independent and geographically discrete.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps has adjusted the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and Alternative 6, as depicted in Figures 4 and 5, Enclosure 1. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. Note, Alternative 11 is non-structural and does not have an APE.

Based on a review of past reports and surveys in and around the Iao Stream FCP, including an Archaeological Inventory Survey and Cultural Impact Assessment completed for the Corps' previously proposed undertaking, the APE for Alternatives 2 and 6 are absent of historic properties listed or eligible for listing on the National and State Registers of Historic Places and is absent of traditional cultural properties or cultural practices sites. Through past consultation with State Historic Preservation Office and State Historic Preservation Division, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps determined that the undertaking involving removal of existing left bank Revetment X and construction of pre-formed scour hole, will have 'no effect on historic properties. The Corps seeks your concurrence on this determination within 30 days of this finding pursuant to 36 CFR 800.4(d).

For your information, the Corps is also concurrently consulting with the State Historic Preservation Division and the following NHOs on the currently proposed undertaking: the Office of Hawaii Affairs, the Central Maui Hawaiian Civic Club, Hui o Na Wai Eha and Aha Moku Advisory Committee-Moku o Piilani. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental EA for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

Primary contact for this undertaking as it relates to Section 106 consultation is Ms. Jessie Paahana, Environmental Coordinator of my branch, available at (808) 835-4042 and jessie.k.paahana@usace.army.mil.

Sincerely,

R.Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Sylvia Hussey, Ed.D.
Ka Pouhana/Chief Executive Officer
Office of Hawaiian Affairs
560 Nimitz Hwy #200
Honolulu, HI 96817

Dear Dr. Hussey:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui. The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). The Iao Stream FCP was turned over to the County of Maui, the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperating Agreement.

The Corps is currently preparing an Environmental Assessment (EA) to supplement the 2017 EA[1] for previously proposed repairs, assessing the significance of the potential environmental impacts of its proposed action involving discrete repairs at two locations wholly occurring within the lateral limits of the Iao Stream FCP channel and a non-structural flood warning system. The proposed action is designed to improve public safety and reduce future maintenance requirements for the County of Maui. The repairs consist of the following:

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This project is a Federally funded action or "undertaking" and, as such, is subject to Federal laws and regulations, including the National Historic Preservation Act (NHPA) of 1966 (54 USC § 306108) and implementing regulations, 36 CFR Part 800. Section 106 of the NHPA mandates consultation with your office to ensure historic properties are protected during execution of the undertaking. The purpose of this letter is to initiate Section 106 consultation with your office for the undertaking as described below, and seek your concurrence on the Corps' determination of effect.

The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative 'F' in 2017(see Figure 2, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of 'no adverse effect on historic property' (Enclosure 2). To-date, none of the consulted NHOs have officially responded to the Corps' letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a pre-formed scour hole (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system in coordination with the County, including installation of a stream or other climate gage in the vicinity of the Iao Stream FCP. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and the Corps' currently proposed undertaking. Note each of these three components are hydraulically independent and geographically discrete.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps adjusted the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and 6, as depicted in Figures 4 and 5, Enclosure 1. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. Note, Alternative 11 is non-structural and does not have an APE.

Based on a review of past reports and surveys in and around the Iao Stream FCP, including an Archaeological Inventory Survey and Cultural Impact Assessment completed for the Corps' previously proposed undertaking, the APE for Alternatives 2 and 6 are absent of historic properties listed or eligible for listing on the National and

State Registers of Historic Places and is absent of traditional cultural properties or cultural practices sites. Through past consultation with State Historic Preservation Office and State Historic Preservation Division, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties'.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps determined that the undertaking involving removal of existing left bank Revetment X and construction of pre-formed scour hole, will have 'no effect on historic properties'. The Corps seeks your concurrence on this determination within 30 days of this finding pursuant to 36 CFR 800.4(d).

For your information, the Corps is also concurrently consulting with the State Historic Preservation Division, the County of Maui Archaeologist and the following NHOs on the currently proposed undertaking: The Central Maui Hawaiian Civic Club, Hui o Na Wai Eha and Aha Moku Advisory Committee-Moku o Piilani. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental Environmental Assessment for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

Primary contact for this undertaking as it relates to Section 106 consultation is Ms. Jessie Paahana, Environmental Coordinator of my branch, available at (808) 835-4042 and jessie.k.paahana@usace.army.mil.

Sincerely,

R. Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Aha Moku Advisory Committee-Moku o Piilani
Attention: Kyle Nakanaelua
2795 Kauhikoalani Place
Haikuhikoalani Pace
Haiku, HI 96708

Dear Mr. Nakanelua:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has been investigating solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui. The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). The Iao Stream FCP was turned over to the County of Maui, the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperation Agreement.

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Sincerely,

R. Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

President
Central Maui Hawaiian Civic Club
P.O. Box 493
Wailuku, HI 96793

Dear Sir or Ma'am:

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Sincerely,

R. Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

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

August 26, 2021

Civil and Public Works Branch
Programs and Project Management Division

Alan S. Downer, Ph.D.
Administrator
State Historic Preservation Division
Hawaii State Department of Land and Natural Resources
601 Kamokila Boulevard, Suite 555
Kapolei, HI 96707

Dear Dr. Downer:

The U.S. Army Corps of Engineers, Honolulu District (Corps), over the past years, has investigated solutions to address existing design deficiency of the Iao Stream Flood Control Project (FCP), Wailuku River, Wailuku, Island of Maui. The Iao Stream FCP was authorized for construction on August 13, 1968, under Section 203 of the Flood Control Act of 1968, Public Law (PL) 90-483 and construction of the project was completed by the Corps in 1981. The project consisted of a debris basin, located 2.5 miles upstream from the mouth of the stream, a 3,500 feet long lined channel downstream from the basin, and levees along the left and right banks (Figure 1, Enclosure 1). Several repair and rehabilitation projects have occurred since its original construction. The Iao Stream FCP was turned over to the County of Maui (County), the non-Federal sponsor, to operate and maintain in accordance with the Local Cooperation Agreement.

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The current Revetment X (or Alternative 2) footprint is substantively consistent with the footprint proposed under Alternative ‘F’ in 2017 (see Figure 2, Enclosure 1). The Corps initiated Section 106 consultation for the 2017 undertaking with your office and the following Native Hawaiian Organizations (NHOs), the Central Maui Hawaiian Civic Club, Hui Malama I Na Kupuna O Hawaii Nei, and the Office of Hawaiian Affairs by letter dated December 5, 2016, seeking concurrence to its determination of ‘no adverse effect on historic property’ (Enclosure 2). To-date, neither your office nor any of the consulted NHOs have officially responded to the Corps’ letter; however, implementation of the undertaking proposed in 2017 was not carried through to construction. The only component of that undertaking that the Corps continues to pursue under the current undertaking is the removal of Revetment X, left bank only, to restore natural meandering to the stream at this location. Additionally, the Corps proposes construction of a pre-formed scour hole (or Alternative 6) to rehabilitate the channel invert at its transition from a lined channel to an unlined channel upstream of the Imi Kala Street Bridge (Figure 3, Enclosure 1) and development of a public flood warning system in coordination with the County, including installation of a stream or other climate gage in the vicinity of the Iao Stream FCP. Collectively, these separate components pursued under a single contract are referred to as Alternative 12, the preferred alternative and is the Corps’ currently proposed undertaking. Note that each of these three components are hydraulically independent and geographically discrete.

The Area of Potential Effects (APE) for the 2017 undertaking consisted of the entire stream channel below Imi Kala Bridge and the flood plains west, or left, of the stream banks. The Corps adjusted the APE for the currently proposed undertaking to two separate polygons that bound the areas wherein the Corps anticipates potential for direct and indirect effects to historic properties at Alternative 2 and Alternative 6, as depicted in Figures 4 and 5, Enclosure 1. The undertaking will occur wholly within the lateral limits of the Iao Stream FCP and the Corps anticipates the construction contractor will use existing maintenance accessways and easements for staging, stockpiling and access. Note, Alternative 11 is non-structural and does not have an APE.

Based on a review of past reports and surveys in and around the Iao Stream FCP, including an Archaeological Inventory Survey and Cultural Impact Assessment completed for the Corps' previously proposed undertaking, the APE for Alternatives 2 and 6 are absent of historic properties listed or eligible for listing on the National and State Registers of Historic Places and are absent of traditional cultural properties or cultural practices sites. Through past consultation with State Historic Preservation Office and State Historic Preservation Division, the Corps understands that due to the Wailuku River's natural tendency to flooding, the Iao Stream FCP channel is very unlikely to contain significant cultural remnants. Hence, any construction activities contained entirely within the stream banks would have 'no effect on historic properties.

In conclusion, due to the absence of historic and cultural resources within the APE for the current undertaking occurring wholly within the lateral limits of the Iao Stream FCP channel, and where presence of significant cultural resources is considered very unlikely, the Corps has determined that the undertaking involving removal of existing left bank Revetment X, construction of pre-formed scour hole, and installation of the non-structural stream gage, will have 'no effect on historic properties'. The Corps seeks your concurrence on this determination within 30 days of this finding pursuant to 36 CFR 800.4(d).

For your information, the Corps is concurrently consulting with County of Maui Archaeologist, Janet Six, as well as with the following NHOs on the currently proposed undertaking: The Central Maui Hawaiian Civic Club, Aha Moku O Maui, Hui O Na Wai Eha, and the Office of Hawaiian Affairs. Note that Hui Malama I Na Kupuna O Hawaii Nei, to our knowledge, has disbanded and we will not be consulting with the former NHO at this time. Additionally, the Corps released the draft Supplemental EA for public comment, in accordance with the National Environmental Policy Act and the Corps' implementing regulations at 33 CFR 230. The public comment period will close on September 13, 2021.

Primary contact for this undertaking as it relates to Section 106 consultation is Ms. Jessie Paahana, Environmental Coordinator of my branch, available at (808) 835-4042 and jessie.k.paahana@usace.army.mil.

Sincerely,

R.Kucharski

Rhiannon L. Kucharski
Chief, Civil and Public Works Branch

Enclosures

Iao Stream Flood Control Project
Wailuku, Maui, Hawaii

Engineering Documentation Report Amendment

Appendix G: Letter of Support from Non-Federal Sponsor

September 2021

US Army Corps of Engineers
Honolulu District

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MICHAEL P. VICTORINO
Mayor

SANDY K. BAZ
Managing Director

OFFICE OF THE MAYOR
COUNTY OF MAUI
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September 28, 2021

LTC Eric S. Marshall, PE, PMP
District Engineer
U.S. Army Engineer District
Honolulu District
Building 230
Fort Shafter, Hawaii 96858

LTC Eric S. Marshall:

SUBJECT: IAO STREAM FLOOD CONTROL PROJECT

The County of Maui ("County") has partnered with the U.S. Army Corps of Engineers Honolulu District ("Corps") to address an identified design deficiency and develop the recommended plan in the EDR Amendment Report for the Iao Stream Flood Control Project ("FCP"), Maui, Hawaii. The County concurs with the recommended plan that includes removal of Revetment X, installation of a pre-formed scour hole, and implementation of a flood warning system.

Staff from both Maui County Departments of Planning and Public Works will coordinate directly with the Corps to ensure consistency with local plans and policies integral to the development of this project's design. We appreciate the due diligence being applied to maximize project features that support the reduced risks to the community as well as reducing the operations and maintenance burden the County has been forced to endure as a result of the identified design deficiency.

It is our understanding that the County will be responsible for the acquisition of property necessary to implement the project, in compliance with federal and local laws. Use of the property would include but not be limited to the following: temporary and permanent easements, rights of way for construction, rights of entry, and staging areas. It is also our understanding that depending on the final cost share allocation, costs associated with real estate acquisition, including nominal administration fees can be credited back to the Sponsor, namely the County of Maui, during construction. The exact amounts will be determined during design in a final real estate plan and notice to acquire.

Finally, we understand that the County will continue to be responsible for operations and maintenance of the project into perpetuity and such obligations will be outlined in the partnership agreement executed in the next phase. We understand that this letter of support in no way obligates the Corps or the County to financial or legal commitments.

For further information please contact Rowena M. Dagdag-Andaya, Director of the Department of Public Works for the County of Maui at (808) 270-7845.

Sincerely,

Michael P Victorino

MICHAEL P. VICTORINO
Mayor, County of Maui

cc: Rhiannon Kucharski, U.S. Army Corp of Engineers
Michele McLean, Department of Planning
Rowena M. Dagdag-Andaya, Department of Public Works