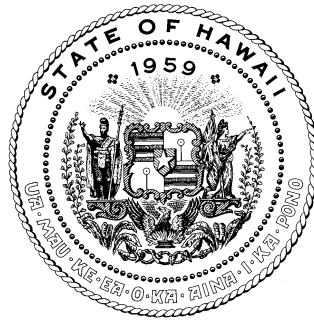


Report to the Thirtieth Legislature  
2020 Regular Session

**THE HAWAII DAM AND RESERVOIR SAFETY PROGRAM  
STATE FISCAL YEAR 2019**



Prepared by the  
Department of Land and Natural Resources  
State of Hawaii

In response to  
Section 179D-29, Hawaii Revised Statutes

November 2019

## **THE HAWAII DAM AND RESERVOIR SAFETY PROGRAM STATE FISCAL YEAR 2019**

This report is prepared pursuant to Hawaii Revised Statutes (HRS) Section 179D-29 and covers the period from July 1, 2018 through June 30, 2019.

### **INTRODUCTION**

The Department of Land and Natural Resources' (Department) Engineering Division administers the Hawaii Dam and Reservoir Safety Act of 2007 (Act), codified as HRS Chapter 179D (Dam and Reservoir Safety Program). This Act, in conjunction with Hawaii Administrative Rules (HAR) Chapter 13-190.1, "Dams and Reservoirs", governs the design, construction, operation, maintenance, enlargement, alteration, repair, and removal of dams, reservoirs, and their appurtenant works in the State of Hawaii, to protect the health, safety, and welfare of the citizens of the State by reducing the risk of failure of the dams or reservoirs. Pursuant to HRS Section 179D-29, the Department shall submit an annual report to the governor and the legislature by January 5 of each year concerning the activities of the department relating to this chapter for the preceding fiscal year. The report shall include but not be limited to information on the following:

- (1) Approvals of plans and specifications for the construction of dams and reservoirs and for alterations, modifications, repairs, removal, and enlargements of any dams and reservoirs;
- (2) A listing of dam and reservoir safety inspections made;
- (3) Use of appropriated funds;
- (4) Rules adopted or amended;
- (5) Enforcement orders and proceedings;
- (6) Dam and reservoir failures and department evaluations of the reasons for the failure, if known; and
- (7) Any other available data regarding the effectiveness of the State's dam and reservoir safety program.

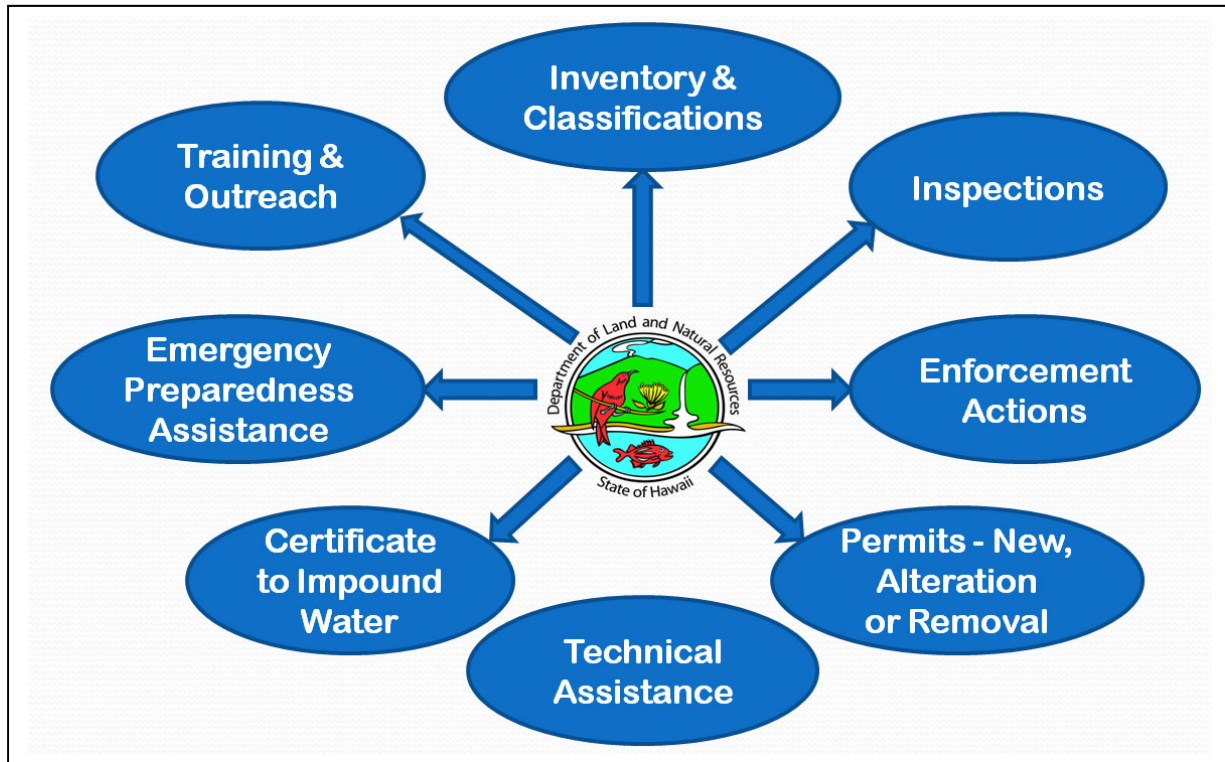
### **BACKGROUND**

Historically, dams and reservoirs in Hawaii were predominately developed by the agriculture industry in the early 1900s. Today, dams and reservoirs continue to be used by the agriculture industry, in addition to providing storage for drinking water, flood control, hydro-electric, recreation and other purposes.

Only dams that meet a certain jurisdictional size criteria (height and volume) are regulated by the Department. Regulated dams are identified as having artificial barriers which are 25-feet or more in height or have an impounding capacity of 50-acre-feet (~17 million gallons) or more. Dams less than 6-feet in height, regardless of storage capacity, or that have a storage capacity less than 15-acre-feet (5 million gallons) regardless of height, do not fall under State of Hawaii jurisdiction, unless otherwise specified by the Dam and Reservoir Safety Program.

## THE HAWAII DAM AND RESERVOIR SAFETY PROGRAM

The Dam and Reservoir Safety Program is comprised of several core functions:



**Regulated Dam Inventory and Dam Classifications:** The Department maintains a database of regulated structures, including classifications of each in regard to size, hazard potential and overall condition. The Department verified and updated their inventory of regulated dams in 2006. Hazard potential classifications were updated and assigned by the department as a product of their statewide dam break modeling analysis conducted between 2007 and 2011. Subsequent updates to the hazard classifications have been made for newly added facilities or those with new data affecting this classification. The overall condition assessment classification is a relatively new field which the Dam and Reservoir Safety Program is working to consistently apply across the state based on the condition assessments conducted on all regulated dams. All regulated dams were assessed and assigned an overall condition assessment classification during phase I inspections conducted statewide in 2007-2009. These condition assessment classifications are being updated based on ongoing inspection findings.

**Dam Safety Inspections:** The Department staff routinely inspects regulated structures statewide and retains consultants as necessary, to confirm or provide additional assessments. The Department presently targets inspecting dams on a two-year frequency, although due to staff vacancies in 2016 & 2018 has had to stretch the duration out a little longer. The Department processed several contracts with consultants to provide Phase I Inspections at various dams throughout the State in Fiscal Year (FY) 2018 & 2019. The Department plans to retain additional consultants in FY 2020 or until most of the regulated high hazard dams have an updated Phase I Inspection report, (dependent on available funding).

In FY 2019, the Department contracted Potential Failure Mode Analysis for four (4) dams on the island of Kauai. The potential failure mode analysis process is an effective way to review, evaluate and rate the probability of various failure mechanisms on a dam in relation to the dam's current operations and provides a uniform way to rank this dam in relation to others in the inventory. These types of analysis allow a more real-world view of the deficiencies and failure possibilities at each facility and highlights the highest risk dangers for the owners and regulators to focus on. Once an owner or agency is able to complete these types of analysis for their portfolio of dams, they can objectively prioritize them by risk and urgency for remedial actions. The Department intends to continue these Potential Failure Mode Analysis in FY 2020 and include several dam owners into the process for their input and train them on the process.

The Department also conducts construction or other informal inspections that are in addition to these visual dam safety inspections. Listings of the dams inspected this past fiscal year are attached at the end of this report.

**Enforcement Actions:** The Hawaii Dam and Reservoir Safety Act of 2007 authorized the Department to take enforcement action for both emergencies and any other violations of the Act. The Department has established administrative enforcement action procedures that are initiated by various actions such as the following:

- Failure to timely address unsafe or emergency conditions
- Conducting construction work on a dam without a permit
- Non-compliance with dam safety permit general terms and special conditions
- Failure to furnish requested information or submit required documents or reports
- Failure to submit a required emergency action plan (EAP) or EAP update
- Failure to pay the annual dam owner fee
- Failure to complete corrective actions as ordered by the Board or its agent

Enforcement actions pursued by the Department in Fiscal Year 2019 is described in Section D of this report.

**Dam Safety Construction Permits:** A permit from the Board of Land and Natural Resources (Board) is required for all dam construction, alteration, enlargement, modifications or removal work. Dams are uniquely engineered structures that require knowledge and experience in dam safety, particularly how to safely handle water flows in and out of the structure through appurtenant features, as well as mitigating the hazards of water passing through the dam embankment itself (seepage). Dams sustain high hydrostatic water loads, which can result in failure of the embankment if they are not properly designed. Dam safety permits allow the Department to review and check proposed improvements for concurrence with current dam safety practices and guidelines. Work that is not considered routine maintenance requires prior approval from the Board. Detailed procedures and requirements for this permitting process are provided in HAR Chapter 190.1. The Department also has developed additional guidance documents for dam owners and designers as well as a standard set of general permit requirements.

**Certificate of Approval to Impound:** The Certificate of Approval to Impound (CAI) water requirement was included in the Hawaii Dam and Reservoir Safety Act of 2007. Issuance of this certificate will be dependent on dam and reservoir owners ensuring their structures are remedied of critical deficiencies and meet minimum operational criteria.

The Department has developed guidelines and procedures for this certificate in coordination with dam owners on the implementation of this new requirement. The Department sent out notices to complete and submit CAI applications, to all owners of regulated dams and reservoirs in the state in Fiscal Year 2014. The Department received CAI applications for most of the regulated structures and is in the process of reviewing these submissions.

Understanding that many of these dams are over 80 years old, and almost all were constructed before the development of any modern dam safety standards, the Department is working with owners to establish a reasonable improvement schedule for these facilities to meet current regulations. In the interim period, the department is working with owners to mitigate these deficiencies through operational restrictions or other types of mitigative actions.

**Emergency Preparedness:** HRS Chapter 179D requires that all dam owners of High and Significant Hazard Potential dams complete and submit an Emergency Action Plan (EAP) to the Department. The Department developed guidelines and an EAP template for dam owners to utilize in formulating and executing a plan of action should a possible threat or deficiency occur on their dam facilities. The Department provides training and technical assistance to dam owners and emergency management officials to assist them in the completion and execution of the EAPs. Additionally, the Department is identified as a technical advisor during dam safety emergencies where an EAP is activated.

At present, the Department has an EAP for every regulated dam in the state. Recently the Department released a new online EAP tool, which simplifies the creation and routine updates of the EAP process. The tool allows the department to easily update the statewide template quickly and users can process revisions to EAPs almost instantly. Owners have responded with positive feedback regarding this new tool. As of 2019, 93 dams have EAPs processed by this tool which is more than doubled from the previous year. The goal is to have all owners migrate over to the new online tool and update their EAPs annually.

**Training and Outreach:** The Department provides technical assistance to the dam owners, operators and consultants, as well as to the broader community of hazard mitigation partners and agencies. The Department works closely with the Association of State Dam Safety Officials, (ASDSO) to collaborate on public outreach and national awareness of the importance of dam and reservoir safety programs. Past Dam Safety training events in the last 10 years include:

- 2006 Dam Safety Evaluation of Dams Seminars – Statewide
- 2008 Dam Safety Failure Mechanisms and Inspections - Statewide
- 2012 Dam Safety Operation and Maintenance Training – Statewide
- 2014 Dam Safety Inspections – Statewide

- 2015 Dam Safety Emergency Actions Workshops – Statewide
- 2017 Dam Evaluation and Rehabilitation Workshops – Statewide
- 2017 Dam Safety Rehabilitation Technical Seminar – Oahu
- 2019 Dam Safety Emergency Intervention Workshops – Kauai, Maui, & Oahu

In FY 2019 the Department, at the request of the Honolulu Board of Water Supply (BWS), participated in two (2) neighborhood board meeting question and answer outreach sessions in response to the mitigative actions taken at the Nuuanu No. 1 Reservoir. Following the hurricane events of Flossie and Lane, the BWS, took proactive steps to lower the water level in the Nuuanu No. 1 Reservoir utilizing a variety of siphons, pumps and fire trucks. Although the water level had not reach alarm or spillway levels, the potential amount of rainfall prompted the BWS to initiate these more aggressive means to safeguard the community.

Unfortunately, there was much confusion as most residents did not realize there are multiple reservoirs in the Nuuanu Area. This situation was compounded as some media outlets showed photos of the Nuuanu No. 4 Reservoir, which is significantly larger than Nuuanu No. 1. The BWS embarked on an extensive outreach effort to the downstream neighborhood and requested the Departments presence at the local neighborhood board meetings.

To aid in communicating the risks of dam in the community, the Department coordinated with the Counties to provide their current Dam Evacuation Maps on the Department’s dam safety inventory website for the public to download. ([dams.hawaii.gov](http://dams.hawaii.gov)). Residents are also able to quickly identify if their parcels are in a dam evacuation area by entering their address into the Department’s Flood Hazard Assessment Tool ([HawaiiNFIP.org](http://HawaiiNFIP.org)) and click on the detailed flood report.

**FUNDING**

The Dam and Reservoir Safety Program is funded under the Department’s LNR 810 Program, Prevention of Natural Disasters, and receives operational funding from two state special funds and one federal grant from the Unites States Department of Homeland Security, Federal Emergency Management Agency (FEMA). The following is a breakdown of available funds to the Department for its dam safety activities in FY 2019:

Dam Safety Program Budget

State of Hawaii – Special Land and Development Fund (operating)	\$ 445,000
State of Hawaii – Dam and Reservoir Safety Special Fund (DRSSF)	\$ 1,300,000
Revenues (Annual Fees, Permit Fees, Enforcements)	\$ 584,286
<u>FEMA – National Dam Safety Program Grant (Federal FY 2019)</u>	<u>\$ 52,709.00</u>
Total	\$ 2,381,995
<u>Emergency Contingency Reserve</u>	<u>\$ &lt;700,000&gt;</u>
Total Available Funding	\$ 1,681,995

FY 2019 expenditures from the various funding sources were made as follows:

	Operating Special Fund	Dam and Reservoir Safety Special Fund	Federal Funds	Total
Personnel Services	\$ 409,000	\$ 0	\$ 0	\$ 409,000
Consultant Services*	\$ 0	\$ 462,415	\$ 12,712	\$ 475,127
Inspections Costs (including travel)	\$ 0	\$ 15,458	\$ 0	\$ 15,458
Training Expense (including travel)	\$ 0	\$ 6,881	\$ 14,090	\$ 20,971
Other Expenses (Supplies, Operating & Equipment)	\$ 6,100	\$ 33,703	\$ 25,906	\$ 65,709
B&F Management Fee	\$ 11,400	\$ 44,865	\$ 0	\$ 56,265
	\$ 426,500	\$ 563,322	\$ 52,709	\$ 1,042,530

\* Does not included \$ 850,000 of funds for consultant contracts which will be executed in FY20.

Operating funding for the State LNR 810 Program supports multiple sub-programs which include the State oversight of the National Flood Insurance Program, the State General Flood Control Plan and the Dam and Reservoir Safety Program. Some assumptions were taken to separate costs between these programs for this report. The Dam and Reservoir Safety Special Fund was intended to maintain a funding source for ongoing operations as well as a dam safety emergency reserve. HAR Chapter 190.1 enables the Department to collect Dam Safety Annual Fees from regulated dam owners. The collection of these fees has enabled the Department to meet the targeted \$ 700,000 minimum emergency reserve.

In FY 19, the Department completed the Probable Failure Mode Analysis on several dams to aid the Department better managing the risks of the current regulated dam portfolio. The Department initiated Phase I investigations on the island of Maui and contracted for Phase I inspections on Oahu. The Department completed several major outreach campaigns including neighborhood meetings, making dam evacuation maps available online and providing dam owners with training on how to perform response actions during emergency situations. Several ongoing projects included maintenance and enhancements to the Dam Inventory Management System and remote water level gages installation and software application to monitor these gages were continued.

#### **DAM SAFETY ACTIVITIES:**

- A. Approvals of plans and specifications for the construction of dam and reservoirs and for alterations, modifications, repairs, removals, and enlargements of any dams and reservoirs;

During FY 2019, no dam safety alteration permit applications were received.

The following is a listing of active permits in FY 2019 and their status:

Permit No.	State ID	Dam Name	Description of Improvements	Status / Comments
19	MA-0141	Kehalani Retention Basin	New Construction	Under Construction Permit revisions pending
20	KA-0098	Alexander Dam	Spillway Repairs/Veg	Constructed, pending approved close-out documents
39	KA-0113	Omao Reservoir	Dam removal	Permit Approved, Pending Construction
44	KA-0013	Upper Kapahi Reservoir	Dam Safety Improvements	Constructed, pending approved close-out documents
53	HA-0042	Waimea 60 MG Reservoir (Puukapu)	Dam improvement - lining, outlet slip-line, upstream control, subdrain	In construction; On hold pending design revision
54	HA-0131	Paauilo Reservoir	Dam improvement - upstream control, vegetation	In construction; On hold pending design revision
55	HA-0123	Puu Pulehu Reservoir	Dam improvement - buttress w/ subdrain, rehab DS slope, spillway imp	Permit Application under Review. Owner redesigning
59	HA-0040	Waikaloa Reservoir No. 1	Major repair.	In construction; On hold pending design revision
61	OA-0149	Maunaolu Reservoir	Drainage improvements	Constructed, pending approved close-out documents
66	OA-0001	Nuuanu No. 4 Reservoir	Repair and improvement	In Construction
71	KA-0061	Lower Kapahi Reservoir	Removal	Permit Application under Review
72	OA-0020	Opaeula Reservoir 15	Removal	Completed
73	KA-0064	Field 2 Kealia Reservoir	Removal	Approved, Pending Construction
74	KA-0065	Upper Anahola Reservoir	Reduction	Permit Application under Review
75	KA-0066	Lower Anahola Reservoir	Removal	Approved, Pending Construction
76	KA-0067	Field 1 Kealia Reservoir	Reduction	Permit Application under Review
77	MA-0140	Ukumehame Reservoirs	Removal	Approved; Pending Design Scope Revision
78	KA-0004	Kitano Reservoir	Removal	In Construction
80	KA-0105	Elima Reservoir	Outlet Work Repair	In Construction
81	KA-0024	Kalihiwai Reservoir	Spillway & Emb. Rehab.	Owner Revising Plan



Two permits were closed in FY 2019:

Permit No.	State ID	Dam Name	Description of Improvements	Status / Comments
79	OA-0018	Opaucala Reservoir 1	Outlet Work Repair	Closed-out permit
72	OA-0020	Opaucala Reservoir 15	Removal	Closed-out permit Removed from Inv.

B. Listing of dam and reservoir safety inspections;

In FY 2019, Dam and Reservoir Safety Program staff conducted 36 visual dam safety inspections on regulated dams. In addition to these inspections, the department also conducted 6 informal dam safety inspection visits (including remote gage siting visits and storm related inspections) and conducted one inspection to monitor construction activity. The inspection numbers for this fiscal year are very low and steps are being implemented to bring the program inspection number back on track to at least inspecting every dam on a two-year cycle. The Department has continued contracting with consultants to update the Phase I inspections on selected dams statewide. A listing of the visual dam safety inspections is provided below:

State ID	Dam Name	Inspection Type	Date of Inspection
MA-0046	Waikamoi Dam No. 2	Phase 1 Inspection	29-Apr-19
MA-0047	Piiholo 50 MG	Phase 1 Inspection	30-Apr-19
MA-0048	Olinda	Phase 1 Inspection	30-Apr-19
MA-0058	Honokowai	Phase 1 Inspection	1-May-19
MA-0059	Reservoir 140	Phase 1 Inspection	1-May-19
MA-0068	Reservoir 14	Phase 1 Inspection	2-May-19
MA-0069	Reservoir 15	Phase 1 Inspection	2-May-19
MA-0084	Reservoir 74	Phase 1 Inspection	2-May-19
MA-0133	Puu Koa Reservoir	Phase 1 Inspection	30-Apr-19
MA-0138	Kahakapao	Phase 1 Inspection	29-Apr-19
MA-0144	Mahinahina	Phase 1 Inspection	1-May-19
MA-0152	Waikamoi Reservoirs	Phase 1 Inspection	29-Apr-19
MO-0041	Kualapuu	Phase 1 Inspection	3-May-19
MA-0054	Horner	Phase 1 Inspection	18-Dec-18
MA-0057	Kahoma	Phase 1 Inspection	21-Dec-18
MA-0073	Reservoir 24	Phase 1 Inspection	20-Dec-18
MA-0083	Reservoir 73	Phase 1 Inspection	19-Dec-18
MA-0091	Peahi	Phase 1 Inspection	20-Dec-18
MA-0093	Kaupakalua	Phase 1 Inspection	20-Dec-18
MA-0095	Haiku	Phase 1 Inspection	19-Dec-18
MA-0096	Pauwela	Phase 1 Inspection	19-Dec-18

State ID	Dam Name	Inspection Type	Date of Inspection
MA-0126	Kahana	Phase 1 Inspection	18-Dec-18
MA-0151	Wailuku Water 10	Phase 1 Inspection	21-Dec-18
KA-0011	Aii	Visual Dam Safety	14-Nov-18
KA-0014	Okinawa	Visual Dam Safety	14-Nov-18
KA-0016	Mimino Reservoir	Visual Dam Safety	3-Dec-18
KA-0030	Kaloko	Visual Dam Safety	12-Dec-18
KA-0060	Wailua	Visual Dam Safety	28-Nov-18
KA-0061	Lower Kapahi	Visual Dam Safety	28-Nov-18
KA-0099	Waita	Visual Dam Safety	7-Nov-18
KA-0100	Kapa	Visual Dam Safety	10-Jul-18
KA-0109	Ipuolono	Visual Dam Safety	10-Jul-18
KA-0118	Manuhonuhonu	Visual Dam Safety	28-Nov-18
KA-0120	Papuaa	Visual Dam Safety	7-Nov-18
KA-0121	Halenanahu	Visual Dam Safety	7-Nov-18
KA-0155	Pond No. 1 at Kauai Ranch	Visual Dam Safety	3-Dec-18

Other Inspections Conducted Statewide:

State ID	Dam Name	Inspection Type	Date of Inspection
KA-0004	Kitano	Construction	14-May-19
KA-0015	Kaneha	Informal	3-Dec-18
MA-0073	Reservoir 24	Informal	5-Dec-18
MA-0093	Kaupakalua	Informal	5-Dec-18
MA-0151	Wailuku Water 10	Informal	16-Jul-18
OA-0001	Nuuanu No 4	Informal - gage	10-Jun-19
OA-0124	Kaneohe	Informal - gage	5-Jun-19

C. Rules adopted or amended;

No Dam Safety rules were adopted or amended in FY 2019.

D. Enforcement orders and proceedings;

The Department issued penalty fines via enforcement action for delinquent submissions to the dam owner of the following dams in FY 2019:

HA-0042	Waimea 60 MG Reservoir (Delinquent Permit Action)	\$2000.00
KA-0024	Kalihiwai Reservoirs (Delinquent Annual Fee)	\$ 519.75

The Department issued 25 notice of dam safety deficiencies in FY 2019 requiring the owners to restrict the level of the water in the dam/reservoir. A listing of these dams are as follows:

<b>State ID</b>	<b>Dam Name</b>	<b>Deficiencies</b>	<b>DLNR Restriction</b>
MA-0073	MAUI RESERVOIR 24	Reservoir Overtops from Design Rainstorm event	Keep and maintain empty under normal conditions, alert / coordinate downstream population notification with Maui EMA.
MA-0093	KAUPAKALUA RESERVOIR	Reservoir Overtops from Design Rainstorm event and seepage at toe	Keep and maintain empty under normal conditions, alert / coordinate downstream population notification with Maui EMA.
MA-0096	PAUWELA RESERVOIR	Reservoir Overtops from Design Rainstorm event	Drain and maintain water at outlet works elevation, alert / coordinate downstream population notification with Maui EMA.
MA-0095	HAIKU RESERVOIR	Reservoir Overtops from Design Rainstorm event and has piping along outlet	Drain and maintain empty, alert Maui EMA of potential hazard
MA-0094	KAPALAALAEA RESERVOIR	Reservoir Overtops from Design Rainstorm event and has piping along outlet	Maintain Empty
MA-0084	MAUI RESERVOIR 74	Reservoir Overtops from Design Rainstorm event	Maintain Empty
MA-0083	MAUI RESERVOIR 73	Repairs needed, requires H&H and stability study	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0091	PEAHI RESERVOIR	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0069	MAUI RESERVOIR 15	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0088	MAUI RESERVOIR 84	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0092	PAPAAEA RESERVOIR	Repairs needed, requires H&H, topo & stability study	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0070	MAUI RESERVOIR 20	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0068	MAUI RESERVOIR 14	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0090	MAUI RESERVOIR 92	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0079	MAUI RESERVOIR 52	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0080	MAUI RESERVOIR 60	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0074	MAUI RESERVOIR 25	Reservoir Overtops from Design Rainstorm event	Maintain Empty, unless water required, coordinate safe level with DLNR
MA-0081	MAUI RESERVOIR 61	Reservoir does not have required safety freeboard	Maintain water level at least 5' below spillway elevation

<b>State ID</b>	<b>Dam Name</b>	<b>Deficiencies</b>	<b>DLNR Restriction</b>
MA-0086	MAUI RESERVOIR 81	Requires H&H and stability study	Maintain water level at least 5' below spillway elevation
MA-0078	MAUI RESERVOIR 42	Poor condition, requires H&H and stability study	Maintain water level at least 5' below spillway elevation
MA-0082	MAUI RESERVOIR 70	Repairs needed, requires H&H, topo & stability study	Maintain water level at least 5' below spillway elevation
MA-0087	MAUI RESERVOIR 82	Poor Condition, require Freeboard Buffer	Maintain water level at least 5' below spillway elevation
MA-0085	MAUI RESERVOIR 80	Requires H&H and stability study	Maintain water level at least 5' below spillway elevation
MA-0076	MAUI RESERVOIR 33	Requires H&H and stability study	Maintain water level at least 5' below spillway elevation
MA-0089	MAUI RESERVOIR 90	Requires H&H and stability study	Maintain water level at least 5' below spillway elevation

The Department also maintained the following dam safety restrictions issued in previous years.

<b>State ID</b>	<b>Dam Name</b>	<b>Deficiency</b>	<b>DLNR Restriction</b>
KA-0002	PUU LUA RESERVOIR	No Spillway	Keep Below 59 ft. (Top of Dam = 111 ft.)
KA-0003	PUU OPAE RESERVOIR	Abandoned Condition	Keep Empty
KA-0005	MANA RESERVOIR	No Spillway	Keep Empty
KA-0010	WAIKALUA RESERVOIR	Requires Hydraulic and Stability Studies	Keep below 9 ft (Top = 19 ft)
KA-0014	OKINAWA RESERVOIR	Requires Hydraulic and Stability Studies	Keep 10-ft Below Top of Dam
KA-0015	KANEHA RESERVOIR	Spillway Undersized	Keep Below 22' (Spillway = 42')
KA-0016	MIMINO RESERVOIR	Spillway Undersized	Keep Below 26' (Spillway = 36')
OA-0017	WAHIAWA DAM	Spillway Undersized	Keep Below 65' (Spillway = 80')

<b>State ID</b>	<b>Dam Name</b>	<b>Deficiencies</b>	<b>DLNR Restriction</b>
OA-0023	HELEMANO 6 RESERVOIR	Spillway Erosion	Keep 15' Below Top of Dam
KA-0024	KALIHIWAI RESERVOIR	Requires Hydraulic and Stability Studies	Keep Below 10.2' (Top = 18.6')
OA-0025	KU TREE RESERVOIR	Abandoned Condition	Keep Empty
KA-0030	KALOKO RESERVOIR	Partially Breached - No Permanent Repair	Keep Below 21.0' (Spillway = 22.7') (Top >40')
HA-0049	KEAIWA RESERVOIR	Earthquake Damage	Keep Empty
HA-0051	HAWI NO. 5 RESERVOIR	Outlet Not Functioning Properly	Keep Empty
MA-0054	HORNER RESERVOIR	Requires Hydraulic and Stability Studies	Keep Below 300" Gage (Spillway = 360" Gage)
KA-0061	LOWER KAPAHI RESERVOIR	No Spillway	Keep Empty
KA-0062	TWIN RESERVOIRS	Spillway Undersized / Abandoned Condition	Keep Empty
KA-0063	AAHOAKA RESERVOIR	No Functioning Outlet / Spillway Undersized	Keep at Outlet Elevation (426.8)
KA-0064	FIELD 2 KEALIA RESERVOIR	Abandoned Condition	Keep Empty
KA-0065	UPPER ANAHOLA RESERVOIR	Abandoned Condition	Keep Empty
KA-0066	LOWER ANAHOLA RESERVOIR	Abandoned Condition	Keep Empty
KA-0067	FIELD 1 KEALIA RESERVOIR	Abandoned Condition	Keep Empty
KA-0100	KAPA RESERVOIR	Requires Hydraulic and Stability Studies	Keep Below 6' (Spillway = 11')
KA-0101	HUKIWAI RESERVOIR	No Spillway	Keep Below 12' (Top =17')
KA-0102	IOLEAU RESERVOIR	Spillway Undersized	Keep Below 25'

<b>State ID</b>	<b>Dam Name</b>	<b>Deficiencies</b>	<b>DLNR Restriction</b>
KA-0107	PUU O HEWA RESERVOIR	Requires Hydraulic and Stability Studies	Keep Below Lower Spillway Elevation
KA-0105	ELIMA RESERVOIR	Spillway Undersized	Keep Below 7' (Spillway = 22')
KA-0106	KUMANO RESERVOIR	No Spillway	Keep Empty
KA-0108	KAUPALE RESERVOIR	Spillway Undersized	Keep Empty
KA-0109	IPUOLONO RESERVOIR	Spillway Undersized	Keep Below 25' (Spillway = 45')
KA-0111	AEPOEKOLU RESERVOIR	Spillway Undersized	Keep Empty
KA-0112	AEPOEHA RESERVOIR	Spillway Undersized	Keep Below 27' (Spillway = 37')
KA-0113	OMAO RESERVOIR	Spillway Undersized	Keep Empty
KA-0114	PIWAI RESERVOIR	Spillway Undersized	Keep Empty
KA-0115	PIA MILL RESERVOIR	Requires Hydraulic and Stability Studies	Keep 5ft. Below Spillway
KA-0116	MAU RESERVOIR	Spillway Undersized	Keep Empty
KA-0117	ELUA RESERVOIR	Spillway Undersized	Keep Below 16' (Spillway = 26.6')
KA-0118	MANUHONUHONU RESERVOIR	No Spillway	Keep Empty
KA-0119	MAUKA RESERVOIR	Requires Hydraulic and Stability Studies	Keep 5 ft. Below Spillway
KA-0121	HALENANAHU RESERVOIR	Requires Hydraulic and Stability Studies	Keep 20 ft. Below Spillway
MA-0140	UKUMEHAME RESERVOIRS	Spillway Undersized	Res 2: Keep Below 2' Res 3: Keep Below 10'
KA-0146	HALAULA RESERVOIR	Requires Hydraulic and Stability Studies	Keep Below Spillway

State ID	Dam Name	Deficiencies	DLNR Restriction
MA-0151	WAILUKU WATER RESERVOIR 10	Requires Hydraulic and Stability Studies	Keep Below 9' (Spillway = 11.6')
OA-0154	NUUANU RESERVOIR NO. 1	No Functioning Outlet / Spillway Undersized	Keep Below 381.5

E. Dam and reservoir failures and department evaluations of the reasons for the failure, if known;

There were no known dam failures or incidents in FY 2019.

Although there were no official dam incidents in FY 2019, the Nuuanu No. 1 Reservoir Public Notice issued by the Honolulu BWS did prompt much attention and concern for the Downtown Honolulu area. This was not classified as an incident as there was no damage to the facility and no alert levels were triggered. However due to the severity of the potential storm event this event was treated as if it were an incident. The dam owner, the BWS, took full responsibility for their proactive approach and conducted extensive public outreach to the downstream and neighboring community. The BWS has also contracted with a dam safety consultant to evaluate and design remediation plans for this facility. The Department does have a real-time water level monitoring gage on the facility and has restricted the water level allowed to be stored in the reservoir until such repairs are completed.

F. Other available data regarding the effectiveness of the State’s Dam and Reservoir Safety Program.

The Dam and Reservoir Safety Program has been working with dam owners in the preparation of their Emergency Action Plans (EAP) for their facilities. EAPs are required by Statute for all high and significant hazard potential classifications of dams. Out of the 131 regulated dams in FY 2019, 126 are classified as high or significant hazard potential structures. All regulated dams have EAPs on file with the Department, and 93 of them have been prepared using the Department’s new online “Easy EAP” Tool. The following is a summary of EAPs on file with the Department for all classifications.

FY 2004	FY 2007	FY 2010	FY 2012	FY 2015	FY 2018	FY 2019
12	55	121	125	130	132 of 132	131 of 131