Storm Water Management Program
Annual Monitoring Plan 2021 – 2022

State of Hawaii, Department of Transportation
Highways Division, Oahu District
MS4 NPDES Permit No. HI S000001

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STATE OF HAWAII DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION, OAHU DISTRICT

STORM WATER MANAGEMENT PROGRAM

ANNUAL MONITORING PLAN 2021 – 2022

MS4 NPDES Permit No. HI S000001

State of Hawaii Department of Transportation
Highways Division, Oahu District
727 Kakoi Street, Honolulu, Hawaii 96819

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Acronyms and Abbreviations

AMS	Asset Management System
BMP	Best Management Practice
CCH	City and County of Honolulu
City SWQ	City and County of Honolulu Department of Facility Maintenance, Storm Water Quality Division
COC	Chain of Custody
CWB	State of Hawaii Department of Health, Clean Water Branch
DOH	State of Hawaii Department of Health
DOT-HWYS	State of Hawaii Department of Transportation, Highways Division, Oahu District
EPA	U.S. Environmental Protection Agency
HAR	Hawaii Administrative Rules
IDDE	Illicit Discharge Detection and Elimination
I&M	Implementation and Monitoring
LCS	Laboratory Control Samples
MEP	Maximum Extent Practicable
MS	Matrix Spikes
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
PBMP	Post-construction BMP
PID	Point Identification Number
QA/QC	Quality Assurance/Quality Control
ROW	Right-of-Way
RPD	Relative percent difference
SOC	Schedules of Compliance
SWMPP	Storm Water Management Program Plan
SWPCP	Storm Water Pollution Control Plans
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TRP	Trash Reduction Plan
TSS	Total Suspended Solids
VTA	Visual Trash Rapid Assessment
WLA	Waste Load Allocation

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1.0 MS4 NPDES Permit Requirements for DOT-HWYS SWMP

The State of Hawaii Department of Transportation, Highways Division, Oahu District (DOT-HWYS) owns and operates a municipal separate storm sewer system (MS4) and has developed and implemented a Storm Water Management Program (SWMP) in order to comply with National Pollutant Discharge Elimination System (NPDES) Permit No. HI S000001 (hereinafter MS4 NPDES Permit), effective September 1, 2020.

The MS4 NPDES Permit requires that DOT-HWYS SWMP effectively prohibit non-storm water discharges through its MS4 into state waters, and from its baseyards. The intention of the MS4 NPDES Permit is to ensure that DOT-HWYS will "develop, achieve, and implement a timely, comprehensive, [and] cost-effective" SWMP that reduces the discharge of pollutants to the maximum extent practicable (MEP) from its MS4 to state waters.

This *Annual Monitoring Plan 2021–2022* (hereinafter *Monitoring Plan*) is submitted to satisfy MS4 NPDES Permit Part F.1, which requires DOT-HWYS to submit an Annual Monitoring Plan to DOH for review and acceptance by June 1st of each year. The activities described in the Annual Monitoring Plan will be implemented over the fiscal year from July 1 through June 30, which hereinafter is referred to as the "Monitoring Year".

1.1 Revised Storm Water Management Program Plan

The MS4 NPDES Permit Parts A.1 and D.1 require DOT-HWYS to maintain a *Storm Water Management Program Plan (SWMPP)*, and clarifies that DOT-HWYS must comply with the *2015 SWMPP* until the revised SWMPP (hereinafter *2022 SWMPP*) is submitted to the State of Hawaii Department of Health (DOH) by February 28, 2022. This Monitoring Plan is due to be submitted to DOH by June 1, 2021, therefore, this *Monitoring Plan* was created under guidance of the *2015 SWMPP*, and developed concurrently with consideration to modifications that will be anticipated in the *2022 SWMPP*.

1.2 MS4 Program Compliance Audit Report in August 2020

From June 4 to July 17, 2020, the U.S. Environmental Protection Agency (EPA) and the DOH (collectively hereinafter Audit Team) conducted an audit of DOT-HWYS SWMP. On August 26, 2020, DOH published the final MS4 Program Compliance Audit Report (hereinafter Audit Report).

The Audit Report highlighted exceptional aspects of the program, as well as several deficiencies and one potential violation. In response, DOT-HWYS has prioritized these

areas of the SWMP for improvement, one of which includes the Monitoring Program. Details regarding actions taken to address audit findings are discussed in Section 2.0.

1.3 Modifications to the Annual Monitoring Plan 2021-2022

The contents and format of this *Monitoring Plan* are modified to address changes to the 2020 MS4 NPDES Permit Part F.1, and based on the feedback provided in the Audit Report. The previous annual monitoring plan format was structured to address the applicable sections of the MS4 NPDES Permit in consecutive order. Since many of the MS4 NPDES Permit Part F.1 sections are applicable to multiple elements of the SWMP, the previous format resulted in unnecessary redundancies.

The three major goals of the modifications are as follows.

1. Clarify the short- and long-term objectives set forth by the DOT-HWYS Monitoring Program.
2. Provide a clearer path to demonstrate MS4 NPDES Permit compliance.
3. Improve the readability and flow of the document.

1.4 Annual Storm Water Monitoring Plan Overview

The Annual Monitoring Plan per MS4 NPDES Permit Part F.1.b shall, at a minimum, include the following.

- A narrative of the proposed objectives and activities, including, but not limited to the objectives identified in MS4 NPDES Permit Part F.1.a.
- A description of how the results of these activities will be used to determine compliance with the MS4 NPDES Permit.
- Identification of how management measures will be proven to be effective and/or ineffective at reducing pollutants and flow.

These three permit requirements are addressed throughout the *Monitoring Plan*, with a focus on permit compliance in Section 2.0 Monitoring Program Activities, and an emphasis on overall program effectiveness in Section 6.0 Program Effectiveness Monitoring. Each *Monitoring Plan* section includes a narrative of the proposed objectives and activities. A proposed "effectiveness assessment" of these objectives and activities is provided in detail in the relevant subsections, and/or is provided in Section 6.0 Program Effectiveness Monitoring.

1.4.1 MS4 NPDES Permit Requirements for DOT-HWYS Monitoring Program

Table 1 provides the requirements for DOT-HWYS Monitoring Program per MS4 NPDES Permit Part F Monitoring Requirements, and lists the corresponding section of the *Monitoring Plan* that addresses each permit requirement. Note that MS4 NPDES Permit Part G.2 Annual Monitoring Report will be addressed in the Annual Monitoring Report.

Table 1. MS4 NPDES Permit Requirements for the Monitoring Program.

MS4 NPDES Permit Requirements	Plan Section
Part F.1.a Annual Monitoring Plan – The Permittee shall submit the Annual Monitoring Plan to the Director by June 1st of each year for review and acceptance. The Annual Monitoring Plan shall be implemented over the coming fiscal year. The monitoring program must be designed and implemented to meet the following objectives:	1.0 to 6.0
Part F.1.a.(1) – Assess compliance with this permit (including TMDL I&M Plans and demonstrating consistency with WLAs);	2.1
Part F.1.a.(2) – Measure the effectiveness of the Permittee's storm water management program;	6.0 to 6.5
Part F.1.a.(3) – Assess the overall health based on the chemical, physical, and biological impacts to receiving waters resulting from storm water discharges and an evaluation of the long-term trends;	2.1 and 2.3
Part F.1.a.(4) – Characterize storm water discharges;	2.1 to 2.3
Part F.1.a.(5) – Identify sources of specific pollutants;	2.1 to 2.3
Part F.1.a.(6) – Detect and eliminate illicit discharges and illegal connections to the MS4; and	2.2
Part F.1.a.(7) – Assess the water quality issues in watershed resulting from storm water discharges to receiving waters.	2.1 and 2.3
Part F.1.b.(1) – Written narrative of the proposed monitoring plan's objectives, including but not limited to the objectives identified in Part F.1.a., and description of activities;	2.0 to 6.0
Part F.1.b.(2) – For each activity, a description of how the results will be used to determine compliance with this permit.	2.0 to 6.0

MS4 NPDES Permit Requirements	Plan Section
Part F.1.b.(3) – Identification of management measures proven to be effective and/or ineffective at reducing pollutants and flow.	2.0 to 6.0
Part F.1.b.(4) – Written documentation of the following: (i) Characteristics (timing, duration, intensity, total rainfall) of the storm event(s); (ii) Parameters for measured pollutant loads; and (iii) Range of discharge volumes to be monitored, as well as the timing, frequency, and duration at which they are identified;	3.0 and 4.0
Part F.1.b.(5) – Written documentation of the analytical methods to be used;	3.0
Part F.1.b.(6) – Written documentation of the Quality Assurance/Quality Control procedures to be used; and	4.0
Part F.1.b.(7) – Estimated budget to be implemented over the coming fiscal year.	5.0
Part F.2 Storm Water Associated with Baseyard Activities – The Permittee shall continue to implement its latest SWPCP for each DOT-HWYS baseyards.	2.0
Part F.3 – TMDL Implementation and Monitoring for Ala Wai Canal, Kawa Stream, Waimanalo Stream, Kapaa Stream, Kaneohe Stream, and Waikele Stream watersheds.	2.0
Part F.4 Other TMDLs – As additional TMDLs are adopted by DOH and approved by the EPA that identify the Permittee as a source, the Permittee shall develop I&M Plans for a minimum of one (1) additional TMDL per year within one (1) year of the approval date.	2.0
Part F.5 Re-opener – In accordance with 40 CFR Parts 122 and 124, this permit may be modified (i.e., to include compliance schedules, permit conditions, etc.) to address additional or revised TMDLs as adopted by DOH and approved by the EPA.	2.0

1.4.2 Purpose

The Monitoring Program assesses the effectiveness of the SWMP in meeting MS4 NPDES Permit requirements. Monitoring activities conducted under the Monitoring Program are designed to characterize storm water discharges from the MS4, identify sources of pollutants, detect and eliminate illicit discharges and illegal connections and to assess impacts to receiving waters and watersheds.

The purpose of this *Monitoring Plan* is to outline the Monitoring Program activities for the Monitoring Year 2021-2022. The Monitoring Program activities provide DOT-HWYS with the data necessary to meet the objectives of MS4 NPDES Permit Parts F.1.a.(1) through F.1.a.(7), as follows.

1. Assess compliance with the MS4 NPDES Permit, including Total Maximum Daily Load (TMDL) Implementation and Monitoring (I&M) Plans and demonstrating consistency with Waste Load Allocations (WLAs).
2. Measure the effectiveness of DOT-HWYS Storm Water Management Program.
3. Assess the overall health based on the chemical, physical, and biological impacts to receiving waters resulting from storm water discharges and an evaluation of the long-term trends.
4. Characterize storm water discharges.
5. Identify sources of specific pollutants.
6. Detect and eliminate illicit discharges and illegal connections to the MS4.
7. Assess water quality issues in watersheds resulting from storm water discharges to receiving waters.

1.4.3 Monitoring Program Framework Documents

The MS4 NPDES Permit requires five types of plans and reports to address and report on SWMP monitoring activities. The plans and reports, along with the MS4 NPDES Permit submittal date requirements for each, are as follows.

- *SWMPP* – Submitted April 27, 2015, and to be revised by March 1, 2022.
- *Annual Report* – To be submitted each year by October 31st reporting on the previous fiscal year.
- *TMDL I&M Plans* – Five plans submitted October 28, 2014, and one plan submitted May 8, 2020.

- *Annual Monitoring Plan* – To be submitted each year by June 1st, describing planned monitoring activities for the upcoming fiscal year.
- *Annual Monitoring Report* – To be submitted each year by October 31st, reporting on monitoring activities during the previous fiscal year.

These documents comprise the framework by which DOT-HWYS monitors and evaluates the compliance status, and effectiveness of the SWMP. Collectively, they detail program activities, standards and milestones, assessment methods, and results of SWMP implementation.

The *2015 SWMPP*, appendices, and related plans are provided at the website https://www.stormwaterhawaii.com/.

2.0 Monitoring Program Activities

This section describes DOT-HWYS proposed monitoring activities for Monitoring Year 2021-2022, and long-term objectives of the Monitoring Program. DOT-HWYS monitoring activities are categorized into three subprograms:

1. Watershed Water Quality Monitoring Program
    i. Existing TMDL Watersheds Monitoring
    ii. Future TMDL Watersheds Monitoring
2. Illicit Discharge Detection and Elimination Monitoring Program
3. Receiving Water Quality & Bioassessment Monitoring Program

2.1 Watershed Water Quality Monitoring Program

DOT-HWYS conducts water quality monitoring as a part of the SWMP to assess pollutant load contributions from DOT-HWYS right-of-way (ROW) to state waters. The primary purpose of this monitoring is to assess the characteristics of storm water (quality and quantity), and evaluate potential impacts to the watershed and receiving waterbodies so that effective control mechanisms can be developed and implemented.

Historic, ongoing, and future efforts of the Watershed Water Quality Monitoring Program focus on watersheds with impaired waterbodies per Clean Water Act (CWA) Section 303(d), and in watersheds where TMDLs that have been approved that identify DOT-HWYS as a pollutant source through the assignment of a WLA.

DOT-HWYS is also proactively implementing monitoring in anticipation of future TMDLs that may be approved during the current permit term. Water quality monitoring activities are conducted in watersheds that are listed as High Priority for a TMDL in the *State of Hawaii Water Quality Monitoring and Assessment Report* (Clean Water Branch 2018) Appendix C, and in watersheds identified by DOH through informal communications.

This section of the *Monitoring Plan* describes the monitoring activities planned on a watershed basis to assess water quality issues resulting from storm water discharges to receiving waters.

2.1.1 Existing TMDL Monitoring

This section describes DOT-HWYS compliance with the MS4 NPDES Permit TMDL I&M Plans, which is accomplished through the ongoing implementation and evaluation of

applicable SWMP programs, and achievement of milestones and deliverables required by the MS4 NPDES Permit Part F.3.c TMDL Schedules of Compliance (SOCs).

The EPA has approved TMDLs for the Ala Wai Canal, Kawa Stream, Waimanalo Stream, Kapaa Stream, Kaneohe Stream and Waikele Stream Watersheds. To demonstrate compliance with the MS4 NPDES Permit, DOT-HWYS must meet the milestones included in the SOC tables provided in MS4 NPDES Permit Part F.3. DOT-HWYS shall comply with the waste load reductions consistent with the assumptions of the applicable TMDL document by the Final Compliance Date.

The I&M Plans describe DOT-HWYS approach to meet the SOCs, and to attain pollutant load reductions, in order to comply with the WLAs assigned to DOT-HWYS in each of the TMDL documents. On October 27, 2014, DOT-HWYS submitted I&M Plans for the Ala Wai Canal, Kawa Stream, Waimanalo Stream, Kapaa Stream, and Kaneohe Stream. On May 8, 2020, DOT-HWYS submitted the I&M Plan for the Waikele Watershed.

In October 2020, DOT-HWYS submitted *TMDL Schedule of Compliance Status Report – Year 7* to DOH. This report documented the submission of the Completion Report for Kawa Stream, as well as requirements related to post-construction Best Management Practices (BMPs) for Kapaa Stream and Kaneohe Stream.

In October 2021, DOT-HWYS is scheduled to submit a *TMDL Schedule of Compliance Status Report – Year 8* to DOH to document the implementation of activities required to demonstrate progress towards compliance with the TMDL I&M Plans and compliance with WLAs.

Table 2 shows the specific milestones and deliverables anticipated for the Year 8 Report.

Table 2. TMDL Schedules of Compliance - Milestones and Deliverables for Monitoring Year 2021 – 2022.

TMDL Document	Milestone/Deliverable
Ala Wai Canal	None (WLA Completion Report submitted in 2018)
Kawa Stream	None (WLA Completion Report submitted in 2020)
Waimanalo Stream	None (WLA Completion Report submitted in 2018)
Kapaa Stream	Post-construction BMPs: Commence construction
Kaneohe Stream	Post-construction BMPs: Commence construction
Waikele Stream	Erosion Control: PID 21 - Complete 100% PS&E

Monitoring Activities

During Monitoring Year 2021-2022, DOT-HWYS Monitoring Program will continue monitoring activities in DOT-HWYS ROW located in the six TMDL areas as described in the applicable I&M Plans. These monitoring methods include tracking and analysis of BMPs such as street sweeping and other debris control operations and maintenance activities. A complete description of the BMPs, monitoring activities, and assessment methods for each TMDL watershed are provided in their corresponding I&M Plan.

The six I&M Plans are provided at https://www.stormwaterhawaii.com/resources/plans/.

2.1.2 Future TMDL Monitoring

In addition to conducting monitoring activities in approved TMDL areas, DOT-HWYS also proactively plans and implements monitoring activities in anticipation of future TMDLs. Monitoring is conducted in watersheds that are listed as High Priority for a TMDL in Appendices B and C of the *State of Hawaii Water Quality Monitoring and Assessment Report* (Clean Water Branch 2018), and in watersheds identified by DOH through informal communications.

Kaelepulu Stream Watershed and Moanalua Stream Watershed are currently prioritized by DOH for the development of future TMDLs. During Monitoring Year 2021-2022 DOT-HWYS will initiate monitoring activities in these two watersheds. Collection of samples that characterizes storm water runoff from DOT-HWYS ROW in these specific watersheds will

provide data for potential WLAs that may be assigned to DOT-HWYS, as well as provide data to identify effective operational and structural BMPs.

Monitoring Activities

During Monitoring Year 2021-2022, DOT-HWYS will begin conducting water quality monitoring activities in the Kaelepulu Stream Watershed and Moanalua Stream Watershed as described below.

Kaelepulu Stream Watershed

- Site #1: Water quality monitoring of MS4 network along Kalanianaole Highway which connects to the City and County of Honolulu's (CCH) MS4 and then discharges to Kaelepulu Stream approximately 0.5-mile upstream of Kaelepulu Pond.
- Site #2: Water quality monitoring of MS4 network along Kalanianaole Highway which discharges to an intermittent portion of Kaelepulu Stream.

Moanalua Stream Watershed

- Site #1: Water quality monitoring of MS4 network along H-1 Freeway and Ala Napunani Street interchange which discharges to an intermittent portion of Moanalua Stream.
- Site #2: Water quality monitoring of MS4 network along Puuloa Road, North King Street, and H-1 Freeway interchange which discharges to Moanalua Stream, approximately one mile upstream from Keehi Lagoon.
- Site #3: Water quality monitoring of MS4 network along H-1 Freeway near the Funston Road interchange which discharges to an intermittent portion of Moanalua Stream (Kahauiki Tributary).

Figures that identify the proposed locations of storm water quality sampling sites for Monitoring Year 2021-2022 are provided in Appendices A.1 and B.1. Details about planned monitoring activities at each location are provided in the following sections.

2.1.2.1 Kaelepulu Stream Watershed Monitoring

The Kaelepulu Watershed is located on the windward slopes of the Koolau Mountain range. It is bordered on the west by Kawainui Stream Watershed, and Waimanalo Stream Watershed to the east. The development in the watershed is mostly residential, with some small businesses and agricultural parcels. There are two state roads in the watershed, Kailua Road (Route 61) and Kalanianaole Highway (Route 73). Kalanianaole Highway is located in the watershed approximately one mile southeast from its junction with the

Kailua Road, and extends to the southeast, past Keolu Drive. The east border of Kaelepulu Watershed intersects Kalanianaole Highway approximately 850 feet from the southern outlet for Old Kalanianaole Road.

Several curb and median storm drainage networks along the Kalanianaole Highway direct runoff from the highway lanes downslope to the base of the highway fill slope. These flows combine with sheet flows from upslope private and state lands, and drain into storm drain pipes beneath the highway. These pipes connect to the CCH MS4, which eventually drains into intermittent and perennial branches of Kaelepulu Stream, then to Kaelepulu Pond, an estuary at the center of the Enchanted Lake Community. Kaelepulu Pond was a freshwater fishpond and marsh before development of the Enchanted Lake subdivision in the 1960s (ELRA 2021). It is currently privately-owned by the Enchanted Lake Resident Association. Development of the surrounding areas and non-point source pollution from the urban neighborhoods has contributed to significant sediment and other pollutant discharges to the pond resulting in decreased biological diversity, increased turbidity of the water, and threatening of endangered waterbirds.

This basin eventually discharges into Kailua Bay at Kailua Beach. Kailua Bay is categorized as a Class A receiving water by Hawaii Administrative Rules Chapter 11, Section 54-3 (DOH 2014). Over the years, the mouth of Kaelepulu Stream has been monitored as part of both CCH's (City DES 2007) and DOH's coastal beach water quality monitoring programs (DOH 2021). DOT-HWYS previously conducted water quality monitoring within Kaelepulu Watershed in Monitoring Years 2007-2008 and 2009-2010.

Kaelepulu Stream to Kailua Beach are listed as impaired for Enterococci, Total Nitrogen (TN), Nitrate-Nitrite, Total Phosphorus (TP), Turbidity and Chlorophyll A on the 2018 CWA Section 303(d) List of Impaired Waters on Oahu. In 2019, DOH's Clean Water Branch (CWB) announced a water quality assessment project in the Kaelepulu Watershed which was initiated to determine the current status of the water quality in the region. DOH collected water samples from the shoreline of the stream and lake for fecal indicator bacteria (Enterococci, Clostridium Perfringens), TN, TP, Nitrate-Nitrite, Chlorophyll A, Silicates, Turbidity, and Total Suspended Solids (TSS).

In 2020, DOT-HWYS initiated a dialogue with CWB regarding the Kaelepulu Watershed water quality assessment project, and subsequently shared storm water quality and rainfall data that was collected by DOT-HWYS in the watershed. DOT-HWYS will continue to communicate and share data from the Kaelepulu Watershed with DOH to assist with the water quality assessment of this watershed.

During Monitoring Year 2021-2022, DOT-HWYS will resume water quality sampling in the watershed to help characterize storm water runoff from DOT-HWYS, and assess the

potential for implementing enhanced operational or structural BMPs along Kalanianaole Highway. DOT-HWYS will collect storm water quality samples from two new monitoring sites in the Kaelepulu Stream Watershed.

See Appendix A.1 for the location figure of the Kaelepulu Stream Watershed Monitoring Sites.

Kaelepulu Stream Watershed Monitoring Site #1

During Monitoring Year 2021-2022, DOT-HWYS will conduct storm water monitoring on a portion of Kalanianaole Highway which lies immediately west of the intersection with Keolu Drive. The drainage alignment is approximately 250 yards long and has an area just under two acres. Storm water runoff in the area flows off the highway and is collected by a network of grated drain inlets in a concrete median and the makai shoulder of the northbound road. This drainage area discharges to a 30-inch pipe which connects to the CCH MS4 at manhole Point Identification Number (PID) 201749. Discharge from the DOT-HWYS ROW is then mixed with runoff from the residential neighborhood along Keolu Drive, which flows into a perennial portion of Kaelepulu Stream, approximately 0.5 miles upstream of Kaelepulu Pond.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix A.2 for the location figure of the Kaelepulu Stream Watershed Monitoring Site #1.

Kaelepulu Stream Watershed Monitoring Site #2

During Monitoring Year 2021-2022, DOT-HWYS will conduct storm water monitoring on a portion of Kalanianaole Highway which lies south of Keolu Drive. The drainage area is approximately 500 yards long and has an area of approximately one-and-a-half acres. Storm water runoff in the drainage area sheet flows off the highway and is collected by a series of grated drain inlets on the shoulder. This drainage area discharges to a channelized culvert via an open channel at outfall PID 304739. The channelized culvert drains to a grassed area that connects to an intermittent portion of Kaelepulu Stream.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix A.3 for the location map of the Kaelepulu Stream Watershed Monitoring Site #2.

2.1.2.2 Moanalua Stream Watershed Monitoring

Moanalua Stream Watershed is located near a densely populated portion of the City of Honolulu near Daniel Inouye International Airport and the neighborhoods of Salt Lake and Kalihi. Moanalua Stream Watershed was selected for monitoring since it contains the largest amount of DOT-HWYS ROW which drains to Keehi Lagoon, a Class A receiving waterbody determined to be a high priority for TMDL development by DOH. Keehi Lagoon also receives runoff from Keehi Lagoon Watershed, Manuwai Stream Watershed, and Kalihi Stream Watershed. The higher regions of Moanalua Stream Watershed contain mixed residential and business developments, while the lower portion of the watershed contain commercial and industrial facilities. State routes in the watershed include H-1 Freeway, H-201 Freeway and Nimitz Highway (Route 92). Keehi Baseyard and Kakoi Baseyard are located in Moanalua Stream Watershed.

DOH has been conducting monitoring at Keehi Lagoon since 1973 for a variety of parameters including, but not limited to bacteria, nutrients and general physical chemistry (National Water Quality Monitoring Council 2021). In 2018, Keehi Lagoon was listed as an impaired waterbody for Enterococci, TN, TP, Nitrate-Nitrite, Chlorophyll A, Turbidity and TSS. Moanalua Stream is listed as impaired for Turbidity, TN, and Trash.

During Monitoring Year 2021-2022, DOT-HWYS will commence water quality sampling of discharges from DOT-HWYS ROW into Moanalua Stream to help characterize storm water runoff and assess the potential of implementing enhanced operational or structural BMPs in the watersheds (or other watersheds which drain to the impaired waters of Keehi Lagoon).

See Appendix B.1 for the location figure of the Moanalua Stream Watershed Monitoring Sites.

Moanalua Stream Watershed Monitoring Site #1

During Monitoring Year 2021-2022, DOT-HWYS will conduct storm water monitoring on a portion of the H-1 Freeway and adjacent roads near the Ala Napunani Street interchange. The drainage area is approximately five acres. Storm water runoff in the area is collected by a network of grated drain inlets in the concrete medians along the freeway, adjacent roads and ramps. This drainage area discharges to a 60-inch pipe which outfalls at PID 300311 directly into an intermittent portion of Moanalua Stream.

Storm water quality samples will be collected at grated drain inlet PID 110647, which is approximately 325 yards upstream of the outfall to Moanalua Stream. This point of the MS4 network was selected since it does not contain contributions from the non-DOT-HWYS property along Ala Napunani Street.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix B.2 for the location map of Moanalua Stream Watershed Monitoring Site #1.

Moanalua Stream Watershed Monitoring Site #2

During Monitoring Year 2021-2022, DOT-HWYS will conduct storm water monitoring on a portion of Puuloa Road, H-1 Freeway, and North King Street near the Puuloa Road interchange. The drainage area is approximately 12 acres. Storm water runoff from the north end of Puuloa Road, the on-ramp to North King, a 0.25-mile length of H-1 Freeway, and the Kaua Street on-ramp, drains into a 54-inch pipe that runs along North King Street. This pipe splits at inlet PID 115335 and discharges directly into Moanalua Stream via two 42-inch outfalls (PID 304426 and PID 303121), approximately one mile upstream of Keehi Lagoon.

Storm water quality samples will be collected at inlet PID 103372 since the outfalls to the stream are partially buried in the stream bank and will likely be submerged under stream water during large storm events and/or high tide. The inlet closer to the stream, PID 115335, is also inaccessible for sampling.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix B.3 for the location figure of Moanalua Stream Watershed Monitoring Site #2.

Moanalua Stream Watershed Monitoring Site #3

During Monitoring Year 2021-2022, DOT-HWYS will conduct storm water monitoring on a portion of the H-1 Freeway near the Funston Road interchange. The drainage area is approximately three acres. Storm water runoff in the area flows off the highway and is collected by a network of grated drain inlets in the concrete medians and shoulders of the road. This drainage area discharges to a 24-inch pipe which outfalls at PID 304595 to a grassed area, and eventually into an intermittent portion of Moanalua Stream (Kahauiki Tributary).

Storm water quality samples will be collected from inlet PID 103381 if outfall PID 304595 is not accessible.

Storm water quality samples will be collected from this site using automated samplers, grab samples, or a combination of both.

See Appendix B.4 for the location figure of Moanalua Stream Watershed Monitoring Site #3.

2.1.3 Other High-Priority Waterbodies and Watersheds

Per MS4 NPDES Permit Part F.4, as additional TMDLs are adopted by DOH, which are approved by the EPA and that identify DOT-HWYS as a source, DOT-HWYS shall develop I&M Plans for a minimum of one additional TMDL waterbody or watershed per year within one year of the approval date.

As part of a proactive watershed-based approach to monitoring, DOT-HWYS will continue to periodically review the most recent release of the *State of Hawaii Water Quality Monitoring and Assessment Reports*, in particular Appendix C, which contains the CWA Section 303(d) List of Impaired Waters on Oahu.

DOT-HWYS will also continue to proactively collaborate and share data with DOH and EPA in order to assist the agencies in the long-term planning efforts towards assessing impaired waterbodies, and identifying and developing TMDLs for watersheds. The Pearl Harbor sub-watersheds remain a High Priority on the CWA Section 303(d) List of Impaired Waters, with Waikele Watershed approved as the first TMDL in Pearl Harbor basin in 2019. DOT-HWYS has previously conducted water quality monitoring in other sub-watersheds of Pearl Harbor, including Kapakahi, Waiawa, Waimalu, Aiea, and Halawa.

Poamoho Watershed was recently added as Medium Priority for TMDL development in the 2018 release of the *State of Hawaii Water Quality Monitoring and Assessment Reports*. DOT-HWYS will continue to coordinate with DOH and other regulating agencies regarding high priority waterbodies in order to facilitate and prepare for the development of new TMDLs.

2.2 Illicit Discharge Detection and Elimination Monitoring Program

MS4 NPDES Permit Parts F.1.a.(5) and (6) require that objectives of the DOT-HWYS Monitoring Program include measures for identifying sources of specific pollutants, and detecting and eliminating illicit discharges and illegal connections to the MS4. The MS4 NPDES Permit Parts F.1.a.(5) and (6) are addressed together in Section 2.2, as both requirements are interrelated and will involve a similar analysis. This section discusses DOT-HWYS processes for identifying sources of specific pollutants, and detecting and eliminating illicit discharges and illegal connections to the MS4, through implementation of the Industrial Commercial Activities Discharge Management Program (hereinafter Industrial and Commercial Program), Illicit Discharge Detection and Elimination Program (IDDE) Program, Baseyard Inspections, and the *Trash Reduction Plan*.

The Industrial and Commercial Program and IDDE Program work closely together to reduce, to the MEP, the discharge of pollutants from all industrial and commercial facilities and activities which initially discharge into the DOT-HWYS MS4. The Industrial and Commercial Program administers permits for private drain connections to the MS4, and the IDDE Program conducts investigations of parcels suspected of illicit discharges or illegal connections. Suspected illicit discharges or illegal connections are investigated by tracing the source of the discharge or connection.

Investigations are initiated by the following:

- Scheduled inspections of industrial and commercial facilities and activities
- Water quality monitoring
- Storm drain inspections and cleaning
- Outfall field screening
- Public reporting or complaints
- Cases forwarded from CCH or other MS4 permittees

The MS4 NPDES Permit requires DOT-HWYS to implement BMPs through the Industrial and Commercial Program and IDDE Programs in order to monitor for illicit discharges and illegal connections. A detailed list of these mechanisms is presented in the *2015 SWMPP* Table 3-4. The primary tools for identifying illegal connections and illicit discharges include inspections of industrial and commercial facilities, and outfall and structure inspections.

DOT-HWYS determines compliance with the IDDE Program requirements by identifying sources of potential pollutants and detecting, investigating, and closing out IDDE investigations. DOT-HWYS continues to implement the IDDE Program to detect and eliminate illicit discharges and illegal connections to the MS4. The Industrial and Commercial Program and IDDE Program submit a summary of these activities in the Annual Report, including the Illicit Discharge Detection and Elimination Investigation Log, which documents the IDDE investigation for that reporting period, and includes details regarding the source of the flow and whether or not it was identified and/or stopped. See *2015 SWMPP* Chapter 3 for more information about the IDDE Program objectives and protocols.

The following sections provide further details regarding IDDE monitoring activities related to the Industrial and Commercial Program, Outfall Field Screening Program, Baseyard Facilities Inspections, and the *Trash Reduction Plan.* Combined, these programs provide

DOT-HWYS with an extensive toolset to detect, identify, and eliminate illicit discharges into the DOT-HWYS MS4 and receiving waters.

2.2.1 Industrial and Commercial Activities Discharge Management Program

DOT-HWYS implements its Industrial and Commercial Program per MS4 NPDES Permit Part D.1.g. The Industrial and Commercial Program conducts inspections of industrial and commercial facilities and activities that initially discharge into the MS4, tracks information about these facilities and activities, and implements enforcement policies in order to reduce the discharge of pollutants associated with industrial and commercial facilities and activities to the MEP. DOT-HWYS maintains a *Prioritized Area Plan* which designates priority areas for industrial and commercial facility inspections according to the relative risk that any discharge might be contaminated with pollutants. The prioritization of areas is based on factors including previous deficiencies and/or violations, industrial and commercial inventories, facility densities in priority areas, and water quality impairments (i.e., TMDLs, WLAs, and CWA Section 303(d) listed impaired water bodies).

IDDE investigations can be initiated by Inspectors during routine site visits conducted by the Industrial and Commercial Program. If a suspected illicit discharge is observed during these inspections, the Industrial and Commercial Team will follow the protocols described in Section 2.2.5. The Inspectors may choose to conduct water quality analysis if source tracing and other methods are not successful at detecting and eliminating the illicit discharge.

During Monitoring Year 2021-2022, DOT-HWYS will continue to implement the Industrial and Commercial Program and will consider suspected IDDE cases for water quality sampling. The Illicit Discharge Detection and Elimination Investigation Log will be provided in the *Annual Report 2021- 2022.*

Refer to Section 3.2 Illicit Discharge Detection and Elimination Monitoring for more information regarding the analytical methods that will be utilized if water quality analysis is conducted at an industrial and commercial facility by DOT-HWYS.

Refer to the *2015 SWMPP* Chapter 10 for more information regarding the Industrial and Commercial Program.

2.2.2 Dry Weather Outfall Field Screening Plan

DOT-HWYS implements the *Outfall Field Screening Plan* to identify sources of pollutants and detect and eliminate illicit discharges and illegal connections to the MS4. The *2015*

SWMPP Appendix C.3 *Outfall Field Screening Plan* provides guidance for the IDDE Program. Per MS4 NPDES Permit Part D.1.c.(2), DOT-HWYS uses the *Outfall Field Screening Plan* to prioritize areas for screening, frequency of screening, and the procedures to be followed if a discharge is observed. If an illegal connection and/or the source of the discharge is identified, Inspectors initiate DOT-HWYS escalating enforcement actions that are administered by the Industrial and Commercial Program. The Enforcement Policy is described in the *2015 SWMPP* Chapter 10.8.

In Monitoring Year 2020-2021, DOT-HWYS inventoried outfalls in the Asset Management System (AMS) and reprioritized the inspection frequencies in order to identify hotspots for illicit discharges and illegal connections to the MS4. During Monitoring Year 2021-2022, DOT-HWYS will continue to conduct outfall inspections per the *Outfall Screening Plan*, and will monitor and track the identification of any illicit discharges and illegal connections. A summary of the number of outfall inspections conducted, and any illegal connections or dry weather flows discovered during these outfall inspections will be provided in the *Annual Report 2021-2022*.

Refer to the *2015 SWMPP* Section 3.3 for more information regarding the Outfall Field Screening Plan.

2.2.3 Baseyard Facilities Inspections

Per MS4 NPDES Permit Part E DOT-HWYS Baseyard Facilities (previously Municipal Industrial Program in the 2016 MS4 NPDES Permit), DOT-HWYS shall continue to implement its latest Storm Water Pollution Control Plan (SWPCP) at each of the five baseyards. A designated individual at each facility is trained and responsible for ensuring implementation of the SWPCP, including but not limited to, conducting inspections, identifying deficiencies, and performing corrective actions. DOT-HWYS must also identify an individual (also trained in the above, but independent of any specific baseyard) to conduct semiannual inspections of all five baseyards.

DOT-HWYS Baseyard Facilities semiannual inspections are conducted by the Baseyard Facility Inspection Team. If a suspected illicit discharge is observed during these inspections, the Baseyard Facility Inspection Team will follow the protocols described in Section 2.2.1 and Section 2.2.5. The inspectors may choose to conduct water quality analysis if source tracing and other methods are not successful at detecting and eliminating the illicit discharge.

Refer to Section 3.2 Illicit Discharge Detection and Elimination Monitoring for more information regarding the analytical methods that will be utilized if water quality analysis is conducted at a DOT-HWYS baseyard.

Refer to the *2015 SWMPP* Section 11.1.1 for more information regarding DOT-HWYS baseyard facilities inspections.

2.2.4 Trash Reduction Program

The MS4 NPDES Permit Part D.1.f.(1)(v) requires DOT-HWYS to continue implementation of the *Trash Reduction Plan,* which was submitted to DOH in October 2016, as required by the MS4 NPDES Permit. The *Trash Reduction Plan* provides a quantitative estimate of the debris currently being discharged from the MS4 (baseline load); a short-term plan and proposed compliance deadline for reducing the discharge of trash from the MS4 by 50% from the baseline load; and a long-term plan and proposed compliance deadline for reducing trash discharges from the MS4 by 100% from the baseline load.

SWMP programs that physically intercept trash before it is discharged from the MS4, including street sweeping, MS4 cleaning, post-construction BMP maintenance, roadside litter pick-up programs, and DOT-HWYS operation and maintenance activities, are tracked in the Trash Reduction Program. In 2017, DOT-HWYS conducted a baseline Visual Trash Rapid Assessment (VTA) of 508 DOT-HWYS ROW segments on Oahu. The VTA protocol provides qualitative and quantitative measurements of trash on DOT-HWYS roadways and adjacent ROW. DOT-HWYS conducted a follow-up VTA in Monitoring Year 2018-2019 to verify the validity of the protocol and estimate progress made through implementation of the Trash Reduction Plan. Select programs were also identified for enhanced trash reduction activities, including increases in roadside litter pick-up and street sweeping.

During Monitoring Year 2021-2022, DOT-HWYS will continue to assess progress made toward trash reduction goals as defined in the Trash Reduction Plan. Monitoring activities will include completing a third VTA and continued monitoring and tracking of trash control activities. Trash volumes removed by the Trash Reduction Program will be provided in the *Annual Report 2021-2022*.

Refer to the *2015 SWMPP* Section 6.6 for more information regarding the Trash Reduction Program.

2.2.5 Storm Water Quality Monitoring for the IDDE Program

In the Monitoring Year 2021-2022, DOT-HWYS will continue to utilize water quality sampling when source tracing and other methods are not successful. Water quality sampling may help to characterize the composition of illicit discharges, identify specific pollutants of concern, and determine the source of pollutants. The necessity for sampling will be decided after the investigation of a potential illicit discharge or illegal connection, per the IDDE Program protocols detailed in the *2015 SWMPP* Chapter 3. Desktop research

about the parcel will provide background information on the property's activities. Site reconnaissance will further aid the inspectors in determining the type of pollutant potentially present in the discharge, and the feasibility of sampling.

The location and frequency of sampling will be determined on an as-needed basis after recommendation from the IDDE Team. Samples will be collected by the IDDE Program Inspectors or a designated individual from the Monitoring Program Team. Investigations for non-storm water discharges are normally conducted during dry weather, however IDDE sampling may be conducted in wet weather. The IDDE Team will determine the specific parameters for laboratory analysis on a case-by-case basis. The IDDE Team may use a field kit or submit samples to a certified laboratory for analysis.

In 2020, the IDDE Program developed an Inspector Field Sampling Kit to be used for 100% of suspected illicit discharges when source tracing and other methods are not successful at identifying the discharge. The IDDE Program selected a variety of parameters which would serve as indicators and assist in the detection of pollutants most commonly/historically found in illicit discharges to the DOT-HWYS (e.g., wash water, human wastewater, and industrial discharge).

See Section 3.2 Illicit Discharge Detection and Elimination Monitoring for more details regarding the analytical methods proposed for water quality monitoring conducted under the IDDE Program.

2.3 Receiving Water Quality and Bioassessment Monitoring Program

MS4 NPDES Permit Part F.1.a.(3) and Part F.1.a.(7) are addressed together in Section 2.3, as both requirements are interrelated and will involve a similar analysis. The objective of this section of the *Monitoring Plan* is to assess the overall health of watersheds and water quality issues based on the chemical, physical, and biological impacts to receiving waters as a result of DOT-HWYS storm water discharges; and to provide an evaluation of long-term trends.

DOT-HWYS will continue to assess the overall health of watersheds by analyzing historical storm and stream water quality data, in addition to data collected through direct sampling efforts. DOT-HWYS retains an inventory of water quality sampling data that will be used, together with water quality data from other sources on the Island of Oahu, to evaluate trends in overall water quality and impacts to receiving waters due to discharges from DOT-HWYS MS4. DOT-HWYS will also obtain water quality sampling results from other sources (e.g., CCH, DOH, EPA, and United States Geological Survey, and other educational and research institutions), to develop an overall assessment of watershed health, and the contributions attributed to discharges from the DOT-HWYS MS4 to

receiving waters. As discussed in Section 2.1, DOT-HWYS has historically focused the Monitoring Program in TMDL watersheds, and has focused monitoring efforts in watersheds determined to be high priority by DOH.

During Monitoring Year 2021-2022, DOT-HWYS plans to review existing water quality data from Oahu's receiving waters (i.e., surface water such as streams, estuaries, or marine shorelines) for select TMDL or high-priority watersheds. Data collected will be used in conjugation with relevant water quality data collected during storm water discharges. DOT-HWYS will use the combination of data to assess impacts to receiving waters and specific water quality issues resulting from storm water discharges from the DOT-HWYS MS4, as well as to evaluate the long-term trends. DOT-HWYS proposes to assess the overall health of receiving waters and watersheds by using the results of laboratory analyses from water quality samples collected from the MS4 to characterize the impact of DOT-HWYS discharges from the MS4 to receiving waters.

DOT-HWYS will continue to collaborate and communicate with regulatory agencies such as DOH and EPA, and will consider the locations of other agencies' stream monitoring sites while planning and reporting on DOT-HWYS storm water monitoring activities. The results of the assessment of DOT-HWYS impact to the overall health of the receiving waters, based on the chemical, physical, and biological impacts resulting from storm water discharges, will assist DOT-HWYS to identify management measures proven to be effective or ineffective at reducing pollutants and flow, and provide guidance for future planning and design of institutional and post-construction BMPs.

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3.0 Analytical Methods

This section satisfies MS4 NPDES Permit Part F.1.b.(5) and describes the analytical methods that DOT-HWYS Monitoring Program will use during Monitoring Year 2021-2022. DOT-HWYS monitoring activities for Monitoring Year 2021-2022 are categorized into three subprograms:

1. Watershed Water Quality Monitoring
    i. Existing TMDL Watersheds Monitoring Program
    ii. Future TMDL Watersheds Monitoring Program
2. Illicit Discharge Detection and Elimination Monitoring Program
3. Receiving Water Quality & Bioassessment Monitoring Program

Specific water quality parameters will be monitored based on the purpose of each program and/or site-specific conditions. The Receiving Water Quality & Bioassessment Monitoring Program is primarily comprised of data collection efforts, therefore specific parameters will be determined by existing data and will be compared to data collected in the programs outlined in Sections 3.1 to 3.2.

3.1 Watershed Water Quality Monitoring

Storm water samples collected under the Watershed Water Quality Monitoring Program, as described in Section 2.1, will be collected and analyzed for Total Nitrogen (TN), which is a calculation of Nitrate plus Nitrite, and Total Kjeldahl Nitrogen (TKN), Total Phosphorus, and Total Suspended Solids (TSS) by a State-approved laboratory. These parameters were selected since they are the most representative of the of the pollutants of concern for the watersheds of interest in the approved TDMLs and the 303(d) List of Impaired Waters.

Table 3 lists the preferred analytical methods and their associated holding times and preservation methods. If the analytical methods in Table 3 are not available, alternative methods may be approved under the guidelines of *Code of Federal Regulations, Title 40, Subchapter D, Part 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants*.

Table 3. Storm Water Monitoring Parameters.

Parameter (mg/L)	Analytical Method	Holding Time (Days)	Preservation Method
Total Kjeldahl Nitrogen (TKN)	EPA 351.2	28	Cool to ≤6°C pH<2 using sulfuric acid
Nitrate + Nitrite	EPA 353.2	28	Cool to ≤6°C pH<2 using sulfuric acid
Total Nitrogen (TN)	Calculated by TKN plus Nitrate + Nitrite		
Total Phosphorus (TP)	EPA 365.3	28	Cool to ≤6°C, pH<2 using sulfuric acid
Total Suspended Solids (TSS)	SM 2540D	7	Cool to ≤6°C

Holding time is the maximum suggested period between sample collection and laboratory analysis. The laboratory will notify the Project Manager and note in the Analytical Report if samples are received outside of the holding time. Holding times assume proper preservation methods have been followed.

Per DOH's Data Acceptance Criteria memo, DOT-HWYS will collect a minimum of 30 samples per parameter at each monitoring site, over a minimum of two consecutive monitoring years. For more information regarding the Data Acceptance Criteria, see Section 6.4.3.

Water quality testing parameters under other SWMP programs may differ from those listed in Table 3. The Monitoring and/or IDDE Team will determine the specific parameters for field or laboratory analysis on a case-by-case basis. More details regarding analytical methods for monitoring conducted under other SWMP programs are included in the following sections.

3.2 Illicit Discharge Detection and Elimination Monitoring

During Monitoring Year 2021-2022, DOT-HWYS will utilize water quality sampling to identify pollutants of concern, and determine the source of pollutants when source tracing and other methods are not successful. The necessity for sampling will be determined after the investigation of a potential illicit discharge or illegal connection, per the IDDE Program protocols detailed in the *2015 SWMPP* Chapter 3.

Desktop research about the parcel will provide background information on the property's activities. Site reconnaissance will further aid the Inspectors in determining the type of pollutant potentially present in the discharge, and the feasibility of sampling. Should it be determined that a water quality sample is required to identify the specific pollutant(s) emanating from an illicit connection or non-point source discharge, the IDDE Team will collect grab samples.

The location and frequency of sampling will be determined on an as-needed basis after recommendation from the IDDE Team. Samples will be collected by the IDDE Program Inspectors or a designated individual from the Monitoring Program Team. Investigations for non-storm water discharges are normally conducted during dry weather, however IDDE sampling may be conducted in wet weather. The IDDE Team will determine the specific parameters for laboratory analysis on a case-by-case basis. The IDDE Team may use a field kit or submit samples to a certified laboratory for analysis.

Personnel will follow the standard sampling methodologies and Quality Assurance/ Quality Control (QA/QC) protocols provided in Section 4.0, in addition to the existing IDDE Program protocols. Due to the sporadic nature of illicit discharges, and the potentially short window of time that these discharges may last, IDDE sampling will also utilize the Field Sampling Kit for ammonia, pH, temperature, turbidity, conductivity, and flow rate over time. Measurements may be obtained *in situ* (using a sampling kit or sensor probe), and/or collected and analyzed by a laboratory.

Table 4 lists the requirements for storm water monitoring associated with the IDDE Program. However, the specific parameters to be tested may differ from those listed in Table 4, depending on specific site conditions.

Table 4. Monitoring Parameters for the Illicit Discharge Detection and Elimination Program.

Parameter	Sample Type
Flow (gallons)	Calculated or Estimated
pH Range (Standard Units)	In situ or Grab
Ammonia Nitrogen (mg/l)	In situ or Grab
Turbidity (0.1 NTU)	In situ or Grab
Temperature (0.1°C)	In situ or Grab
Conductivity (0.1 ohm)	In situ or Grab

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4.0 Quality Assurance/Quality Control Procedures

Quality Assurance/Quality Control (QA/QC) is an important element of an effective sampling program. As required by MS4 NPDES Permit Parts F.1.b.(4) through F.1.b.(6), this section provides details of storm event characterization, laboratory analytical methods, QA/QC procedures to be used in TMDL watershed monitoring, illicit discharge sampling, post-construction BMP effectiveness studies, and other storm water discharge characterization conducted as part of DOT-HWYS SWMP.

4.1 Field Sampling Methods

This section provides information regarding the specific field methods that will be used to accomplish the water quality monitoring activities.

4.1.1 Precipitation Monitoring

Precipitation will be monitored using a combination of on-site or web-based rain gauges, and the Molokai radar managed by the National Oceanic and Atmospheric Administration's National Weather Service. This data will be used to delineate storm characteristics (timing, duration, intensity, and relative total rainfall), and the range of discharge volumes that occur during sampling events.

4.1.2 Automated Sample Collection

Automatic samplers may be used to collect samples and provide data control and logging for sensors. Each automatic sampler will be programmed to obtain a timed series of samples throughout a rainfall event. Once the water flow in the drainage structure reaches a predetermined depth, samplers will collect runoff at a prescribed time frequency. The samples are automatically collected by a pumping mechanism that draws water from the main channel of flow through a laboratory-grade vinyl tube and into a clean plastic bottle.

Automatic samplers will normally be programmed to collect samples every 2-15 minutes to increase the chances of capturing a runoff event. In the occurrence of larger storms, samples may be collected at less frequent intervals to provide a more accurate representation of runoff from the entire storm. Samples will be collected until runoff slows to a point where there is insufficient water at the intake, there is no flow, and/or the supply of bottles is exhausted. The bottles can be submitted to the laboratory as discrete samples, or as composite sample(s), which can be obtained from combining multiple containers from different periods of the storm event. Automatic samplers will be serviced immediately following a storm event.

All samples will be delivered to the laboratory for analysis within 12 hours of collection of the first sample, or they will be placed on ice and maintained at a temperature equal to or less than 6 degrees Celsius (°C) until they are delivered to the laboratory. Sample containers will be packaged and handled to protect the integrity of the water samples.

4.1.3 Manual Sample Collection

Manual samples may be collected by field personnel during a storm event. Storm events will be monitored by radar so that field personnel can be present in the watershed during active storms to obtain manual samples. Samples will be manually collected at 1-minute to 60-minute intervals depending on the anticipated storm duration and intensity. Samples will be deposited into clean, labeled plastic bottles. If necessary, an extension pole, rope or other apparatus can be used to aid in sample collection, especially during high flow conditions. Samples collected by this method will be considered a grab sample.

Manual samples will be delivered to the laboratory for analysis within 12 hours of collection of the first sample, or they will be placed on ice and maintained at a temperature equal to or less than 6°C until they are delivered to the laboratory. Sample containers will be packaged and handled to protect the integrity of the water samples.

4.1.4 Sampling Equipment Decontamination

Samples collected using non-disposable or non-dedicated equipment will require decontamination between samples to prevent cross-contamination. Prior to the start of sampling, surfaces of the sampling equipment that come into direct contact with sample water will be decontaminated. After each use, sample collection containers and lids will be decontaminated by a certified laboratory according to standard sampling protocols. In the event that this is not possible, containers will be washed using a non-phosphate detergent solution and brushed to remove sediment. Each bottle will then be triple rinsed and air-dried.

4.2 Data Management

Precautions will be taken in the storage and analysis of data to prevent errors, loss or misinterpretation of data. Before data is modified or analyzed, a copy of the original data will be archived.

4.2.1 Documentation

Information will be hand recorded on standardized Field Logs and Chain of Custody (COC) forms, which are scanned and electronically filed in a dedicated project folder on a secure server. The COC forms will accompany all samples. A Field Log will be kept for each sampling site with the details of the date, time, personnel, purpose of visit, weather,

conditions observed, samples collected, and actions performed. Photographs may be used to document field conditions and samples.

Hard copies of COC forms and Field Logs will be stored for at least 30 days after the *Annual Monitoring Report 2021-2022* is submitted to DOH.

4.2.1.1 Sample Labeling

All sample bottles are given simple consecutive labels specific to each sample location. Information such as sample date, time, analysis method, preservation method (if any), conditions, and personnel present are recorded in the Field Logs and COC forms, and linked to specific sample bottle numbers when appropriate.

4.2.1.2 Chain of Custody

The COC forms will be used to trace the possession of each sample from the time it is collected until completion of analyses. All samples submitted to the laboratory will be accompanied with a COC form. The COC form details the following information, at minimum, as follows:

- Name and contact information of sampling personnel
- Name and contact information for laboratory
- Sampling contract name
- Sample ID number
- Date and time of sample collection
- Sample matrix
- Sample location
- Number of containers
- Preservation method, if any
- Analytical test parameters
- Analytical method
- Sample temperature
- Name and signature(s) of persons involved in the Chain of Custody
- Date and method of delivery

DOT-HWYS and the laboratory will maintain electronic copies of each COC form. Electronic copies of the completed COC forms will be submitted to DOH as an appendix of the *Annual Monitoring Report 2021-2022*.

Custody seals will be affixed to sample coolers to ensure that the sample chain of custody has not been compromised during transit to the laboratory.

4.2.1.3 Field Logs

Fields Logs are completed during every sampling event to document the details of site visits such as location, date, time, personnel, purpose of visit, weather, conditions observed, samples collected, and actions performed.

4.2.1.4 Photographs

Photographs may be taken of each sample, by DOT-HWYS or the laboratory, to document visual characteristics of the sample contents. Photographs will be stored electronically in a dedicated project folder on a secure server.

4.3 Analytical Results

Each set of sample results will be provided in the analytical laboratory's analysis results report. This report will contain relevant information about the sample receipt and analysis procedures, including descriptions of problems with the analyses, corrective actions if applicable, deviations from analytical methods, QC results, and a definition list for each qualifier used. The laboratory analysis results reports will be maintained in a dedicated project folder on a secure server.

4.4 Data Quality Assessment

All generated data will undergo data verification and validation. The items listed below will be evaluated, as applicable to the analytical method. Qualifiers will be applied, as necessary.

- Deliverables
- Chain of Custody/Condition of samples at laboratory receipt
- Holding times
- Calibration (initial and continuing)
- Blanks (method and calibration)
- Laboratory replicates
- Laboratory Control Samples/Laboratory Control Sample Duplicates

- Matrix Spikes/Matrix Spikes Duplicates
- Field QC samples
- Compound quantification and reported detection limits
- Overall assessment of data

The data will be reviewed in accordance with appropriate EPA method-specific, and/or laboratory-specific QC guidance documents.

4.5 Data Analysis Procedure

If the QA/QC criteria are met, then the data will be used to confirm the literature post-construction BMP removal efficiency for each analyte. This efficiency will be assessed in relation to the rainfall data to allow for evaluation of removal efficiency in comparison to flow.

A performance efficiency per storm event will also be calculated using the average inlet and outlet concentrations. This will also be compared to rainfall intensity and therefore flow, in order to determine a range of flows and pollutant concentrations which can be sufficiently treated by the PBMP.

4.6 Field QA/QC

The field and laboratory QA/QC procedures ensure the reliability and validity of field data gathered as part of the overall program.

4.6.1 Equipment Rinsate Blanks

Equipment rinsate blanks verify the adequacy of the decontamination process and whether the equipment is a source of sample contamination. To confirm that non-dedicated, non-disposable sampling devices have been effectively decontaminated, rinsate samples will be collected and submitted to the laboratory for analysis. These samples will be submitted for analysis as normal samples.

The equipment rinsate blank will be collected from the decontaminated equipment prior to or after the completion of sampling. These samples will be obtained by pouring distilled or deionized water through or over sampling equipment. The water will be collected in a clean sample container and will be transported to the laboratory for analysis. Equipment rinsate blanks will be collected and analyzed for the same parameters listed in Table 3 and/or Table 4, as applicable.

Should the rinsate blank contain levels of contaminants within an order of magnitude above the analysis detection limits or within an order of magnitude of associated samples, potential contamination will be documented. No field rinsate blank is required for dedicated equipment (not reused to obtain other samples). Equipment rinsate blanks will be collected at a frequency of one per twenty normal samples per matrix, or one per sampling event, whichever is more frequent.

4.6.2 Field Duplicates

A field duplicate will be collected at the same location immediately following the parent sample and will be composited with the parent sample. Duplicate samples will be assigned a different sample ID but is labeled in a manner such that it is not apparent to the laboratory. Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. The field duplicates will be sent blind to the laboratory. A minimum of 10% of normal samples will have a corresponding field duplicate sample.

Field duplicates will be collected and analyzed for the same parameters listed in Table 3 and/or Table 4, as applicable. Results for field duplicates will be used to verify the precision of the laboratory and/or sampling method and serve as an indicator of potential cross-contamination.

4.6.3 Equipment Calibration

Field equipment will be calibrated according to manufacturer's instructions.

4.7 Laboratory Quality Assurance/Quality Control

The laboratory QA/QC procedures ensure the reliability and validity of field and analytical laboratory data gathered as part of the overall program.

4.7.1 Container Certificate of Analysis

Bottles used for preservation and shipping are provided by the laboratory and are certified according to the container manufacturer's Certificate of Analysis.

4.7.2 Laboratory Quality Control Samples

Laboratory QC samples are analyzed as part of standard laboratory practice. The laboratory monitors the precision and accuracy of the results of analytical procedures through the analysis of QC samples, including Laboratory Control Samples (LCS)/LCS Duplicate (LCSD) samples, method blanks, laboratory replicates, and Matrix Spikes (MS)/MS Duplicates (MSD) samples, one per batch per analysis.

A routinely collected water sample contains sufficient mass for both routine sample analysis and additional laboratory QC analyses, with the exception of MS/MSD samples. These will be analyzed at a frequency of one per sampling event. Precision, accuracy/bias, representativeness, completeness, and comparability are the data quality indicators used to assess the sampling results for usability. Each data quality indicator is described as follows, including a definition of the terminology and the process for calculating the indicator.

4.7.2.1 Precision

Precision criteria monitor analytical reproducibility, and is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. The QC measures for precision include field duplicates, laboratory duplicates, LCS and LCSD samples, and MS and MSD samples. Precision is expressed as relative percent difference (RPD), which is calculated by dividing the absolute difference of two samples by their mean, as shown in the equation below.

The method performance criteria for precision is RPD ≤ 30%.

$$\textit{Relative Percent Difference} = \frac{(Result_{\textit{Parent Sample}} - Result_{\textit{Duplicate Sample}})}{\frac{(Result_{\textit{Parent Sample}} + Result_{\textit{Duplicate Sample}})}{2}}$$

Precision variability may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, or spatial variation (heterogeneous sample matrices). To identify the cause of imprecision, the field sampling design rationale and sampling techniques will be evaluated, and both field and analytical duplicate sample results will be reviewed. If poor precision is indicated in both the field and analytical duplicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error.

4.7.2.2 Accuracy/Bias

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) that are due to sampling and analytical operations. Examples of QC measures for accuracy include MS, LCS, and equipment rinsates (if non-dedicated sampling equipment is used). Accuracy is measured by the percent recovery for spiked samples (LCS/LSCD, and MS/MSD). The method performance criteria for accuracy/bias will

be established based upon the specific laboratory's statistically determined internal performance QC limits.

4.7.2.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct, normal circumstances. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. The method performance criteria for completeness is 90%. Completeness measures the effectiveness in sample collection, analysis, and result reporting of the entire Monitoring Program, and is calculated on a per-analyte basis by the percentage of usable data (usable data divided by the total possible data), as follows.

$$\% \text{ Completeness} = \frac{\text{Number of Valid Results}}{\text{Number of Possible Results}} \times 100$$

'Number of Valid Results' is the number of possible results minus the number of possible results not reported. Results may not be reported in instances which the of sample(s) are not analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.).

4.7.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. In order to meet the needs of the data users, the samples will be collected using the Monitoring Plan guidelines, applicable field sampling techniques, and specific analytical methodology. If field QC issues affecting comparability are identified, data will be qualified as estimated.

5.0 Estimated Budget for Monitoring Program

This section addresses MS4 NPDES Permit Part F.1.b.(7), which requires an estimated budget for Monitoring Year 2021-2022.

Elements that will require funding include the following:

- Sampling site setup and maintenance
- Storm water sampling and analysis
- Data analysis and reporting
- Administration and recordkeeping

Table 5 shows the estimated costs associated with water quality monitoring for Monitoring Year 2021-2022, as detailed in Section 2.0.

Table 5. Estimated Costs Associated with the 2021-2022 Monitoring Program.

Program Element	Estimated Annual Cost
Labor	$80,000
Materials	$15,000
Lab Analyses	$75,000
Modem Accounts	$900
ESTIMATED TOTAL	$179,900

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6.0 Program Effectiveness Monitoring

The MS4 NPDES Permit Part F.1.a.(2), requires that the Monitoring Program assess the effectiveness of the SWMP implementation.

6.1 SWMP Program Effectiveness Strategy

In accordance with MS4 NPDES Permit Part G.1.d, DOT-HWYS submitted a *Program Effectiveness Strategy* in October 2014. The strategy includes water quality monitoring efforts as well as program implementation information and other indicators. The approach incorporates elements from the California Stormwater Quality Association's model, which is based on the Outcome Levels framework, assessment parameters, analytical methods, and targeted outcomes.

In September 2019, DOT-HWYS revised the *Program Effectiveness Strategy* to reflect the evolution of the *2015 SWMPP* from a compliance-based approach to one where systematic program enhancements are made with the determination of measurable goals for BMP effectiveness. The *Program Effectiveness Strategy* was further updated in December 2020.

The *Program Effectiveness Strategy* is a guidance document for future planning, assessment, and improvement to the SWMP, which defines a framework of Outcome Levels that establish measurability when assigned to current BMPs. The *Program Effectiveness Strategy* provides a worksheet for Program Leads to develop an assessment strategy for enhancement of selected BMPs. Implementation of the Enhanced BMPs are documented in the Annual Report Section 2 Program BMPs Assessment, and Future Enhanced BMPs are documented in Section 3 Future Activities.

In Monitoring Year 2021-2022, the Monitoring Program will coordinate with the *Program Effectiveness Strategy* and *Annual Report 2021-2022* to satisfy the MS4 NPDES Permit Part F.1.a.(2). DOT-HWYS will assess BMP effectiveness for Monitoring Program activities, per the Outcomes Levels 1 to 6 assigned by the *Program Effectiveness Strategy* Chapter 3 Methodology and Approach.

6.2 Revised 2022 SWMPP

In accordance with MS4 NPDES Permit Part D.1, DOT-HWYS must revise the SWMPP within 18 months after the effective date of permit issuance. One required component of the revised SWMPP is to include "monitoring to determine effectiveness of the controls and of the overall storm water program". DOT-HWYS is scheduled to submit the revised SWMPP in March 2022. The most updated *Program Effectiveness Strategy* will be included in the *2022 SWMPP*.

6.3 MS4 Program Compliance Audit Report

From June 4 to July 17, 2020, the EPA and DOH (collectively hereinafter Audit Team) conducted an audit of DOT-HWYS SWMP. On August 26, 2020, DOH published the final *MS4 Program Compliance Audit Report* (hereinafter *Audit Report*).

DOH's *Audit Report* highlighted exceptional aspects of the program, including the high degree of competence by managers, staff, and consultants assigned to implement DOT-HWYS SWMP, the commitment towards water pollution prevention, and the strong culture of cooperation. The Audit Team also identified several deficiencies and one potential violation. Two of the items are specifically related to the DOT-HWYS Monitoring Program, and are noted below.

Monitoring activities which offer the opportunity for improvement include:

- *Deficiency:* DOT-HWYS annual monitoring program does not assess the water quality impact of storm water discharges on a watershed scale.
- *Potential Violation:* Exceedances of storm water effluent limitations at the Pearl City Baseyard.

DOT-HWYS has taken the reissuance of the MS4 NPDES Permit in September 2020 as an opportunity to re-envision the entire SWMP, focus on the recommendations identified in the *Audit Report*, and evaluate if there are specific program changes required in its forthcoming SWMPP.

As described in Section 1.1, the Monitoring Program is constantly evolving and will also implement several improvements in 2021 in accordance with the 2020 MS4 NPDES Permit and upcoming revisions to the SWMPP. These changes include:

1) Restructuring the Annual Monitoring Plan.
2) Renewed focus on TMDL watershed-based monitoring.
3) Proactive collaboration with DOH and other stakeholders in high-priority, impaired watersheds.

The intention of these three efforts is to demonstrate compliance with the MS4 NPDES Permit more clearly, to actualize long-term improvements in the water quality of storm water discharging from DOT-HWYS ROW, and ultimately, to reduce the impact of these storm water discharges to receiving waterbodies.

6.4 Effectiveness of the Monitoring Program

DOT-HWYS recognizes that in order to implement certain Enhanced BMPs and achieve large-scale improvements, it is necessary to develop short- and long-term goals, and use a dynamic planning approach.

6.4.1 Long-Term Planning

DOT-HWYS Monitoring Program will continue to participate in the *Program Effectiveness Strategy* as described in Section 6.1, and will utilize Assessment Strategy Worksheets for short- and long-term milestones, which propose timelines for implementation and execution of each Enhanced BMP.

6.4.2 TMDL Watershed Approach and Impacts to Receiving Waters

As discussed in Section 6.3, one of the deficiencies stated by the *Audit Report* is that the annual monitoring program "does not assess the water quality impact of storm water discharges on a watershed scale". DOT-HWYS recognizes this opportunity for improvement in the Monitoring Program and believes that conducting this assessment will require coordination with other DOT-HWYS SMWP elements as well as a variety of stakeholders in the watersheds.

During the Monitoring Year 2021-2022, DOT-HWYS will explore additional efforts to properly assess the water quality impact of storm water discharges on a watershed scale, whether it be through means such as research and data collection, or increased collaboration with other internal and external SWMP programs, regulating agencies, and stakeholders in the watersheds of concern. DOH also encourages stakeholders to attend the local community meetings and to participate in events dedicated to improving water quality, such as the removal of invasive species, the cultivation of rain gardens, or installation of rain barrels.

DOT-HWYS will continue proactive collaboration with DOH, EPA, and other stakeholders in high-priority, impaired watersheds, and will look for additional opportunities to form long-term partnerships with research institutions and nonprofits who are involved in watershed restoration, and educational community-based programs. DOT-HWYS Monitoring Program will also continue to coordinate long-term objectives and activities with other DOT-HWYS SWMP elements, such as the Debris Control Program, Illicit Discharge Detection and Elimination Monitoring Program, and Public Education Program.

6.4.3 DOH Data Acceptance Criteria

In September 2020, DOH published the memo *Data Acceptance Criteria*. Data is routinely submitted to CWB for the purpose of assessing state water quality and developing TMDLs,

and this data may be used to fulfill various federal CWA requirements. Decisions and conclusions resulting from the data submitted to CWB can have broad and long-standing implications to the state water quality program, as well as for watershed stakeholders such as DOT-HWYS. It is therefore imperative that only data of known and acceptable quality is used to assess waters for conformance with state water quality standards. Data that is credible, scientifically valid, and defensible, is collectively referred to as "valid data".

Although DOT-HWYS has previously established QA/QC procedures for their Monitoring Program, DOT-HWYS will also refer to CWB's *Data Acceptance Criteria* memo as feasible, and will consult with EPA's Quality Assurance Project Plan for further guidance. Applying these guidelines in the planning and data generating process will help both DOT-HWYS and regulating agencies during efforts to collect and share valid data for use in the development of TMDLs.

6.5 Proposed Revisions to Hawaii Administrative Rules Chapter 11

The DOH is in the process of making revisions to Hawaii Administrative Rules (HAR) Chapters 11-53 to 11-56. Many of these chapters effect DOT-HWYS SWMP, therefore changes to the rules may require that DOT-HWYS adapt program elements, or at least take consideration of how these rule revisions may affect other watershed stakeholders. DOT-HWYS will continue to monitor and review proposed changes to HAR Chapters 11-53 to 11-56, and provide comments to DOH as necessary.

7.0 References

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APPENDIX A.1

Location Figure for Kaelepulu Stream Watershed Monitoring Sites

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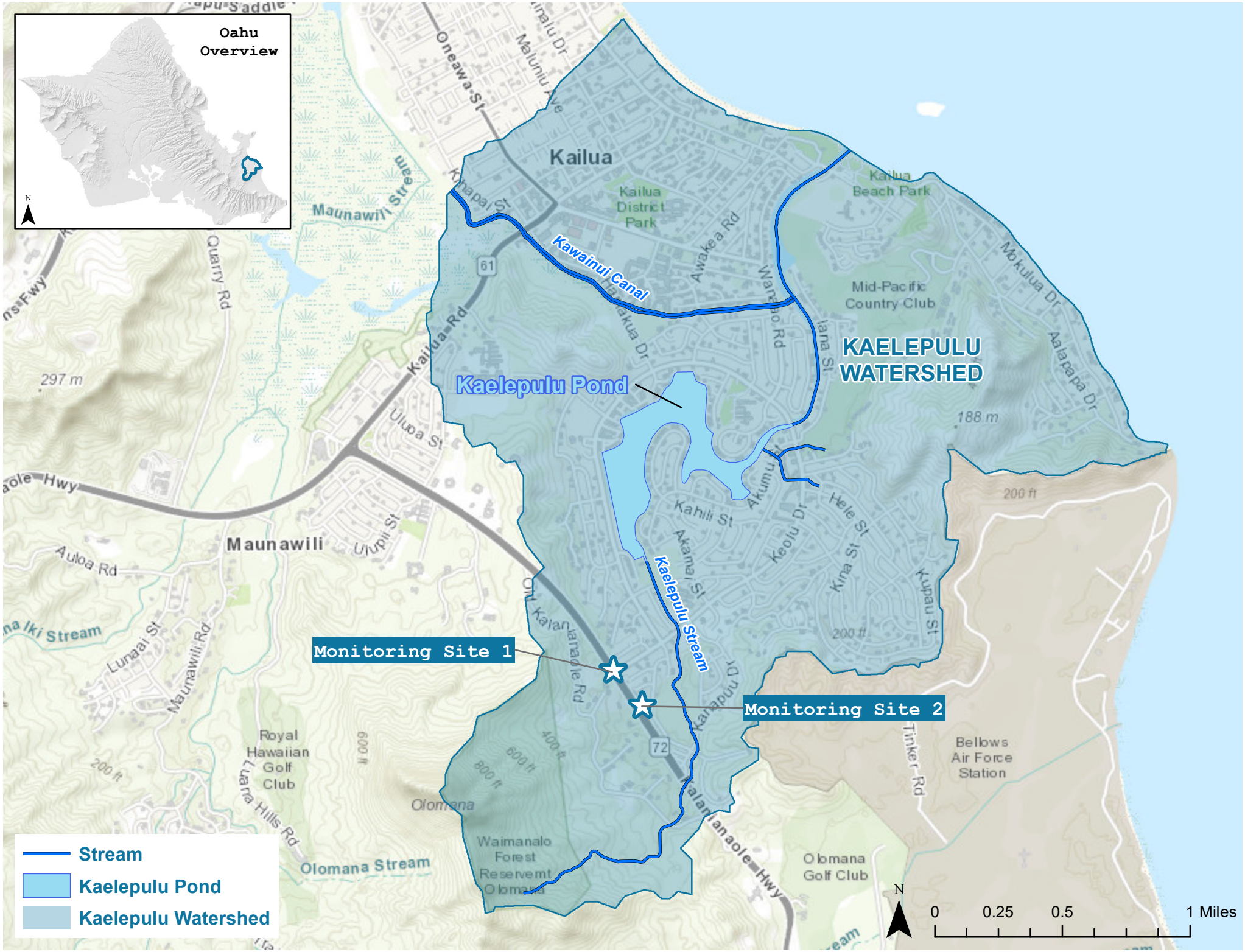
Oahu
Overview
N
Kailua
Kailua
Beach Park
Kailua
District
Park
Kawainui Canal
Mid-Pacific
Country Club
KAELEPULU
WATERSHED
Kaelepulu Pond
188 m
297 m
200 ft
Maunawili
Kaelepulu Stream
Monitoring Site 1
Monitoring Site 2
Royal
Hawaiian
Golf
Club
Olomana
Waimanalo
Forest
Reservemt
Olomana
Olomana
Golf Club
Bellows
Air Force
Station
Olomana Stream
Stream
Kaelepulu Pond
Kaelepulu Watershed
N
0
0.25
0.5
1 Miles

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APPENDIX A.2

Location Figure for Kaelepulu Stream Watershed Monitoring Site #1

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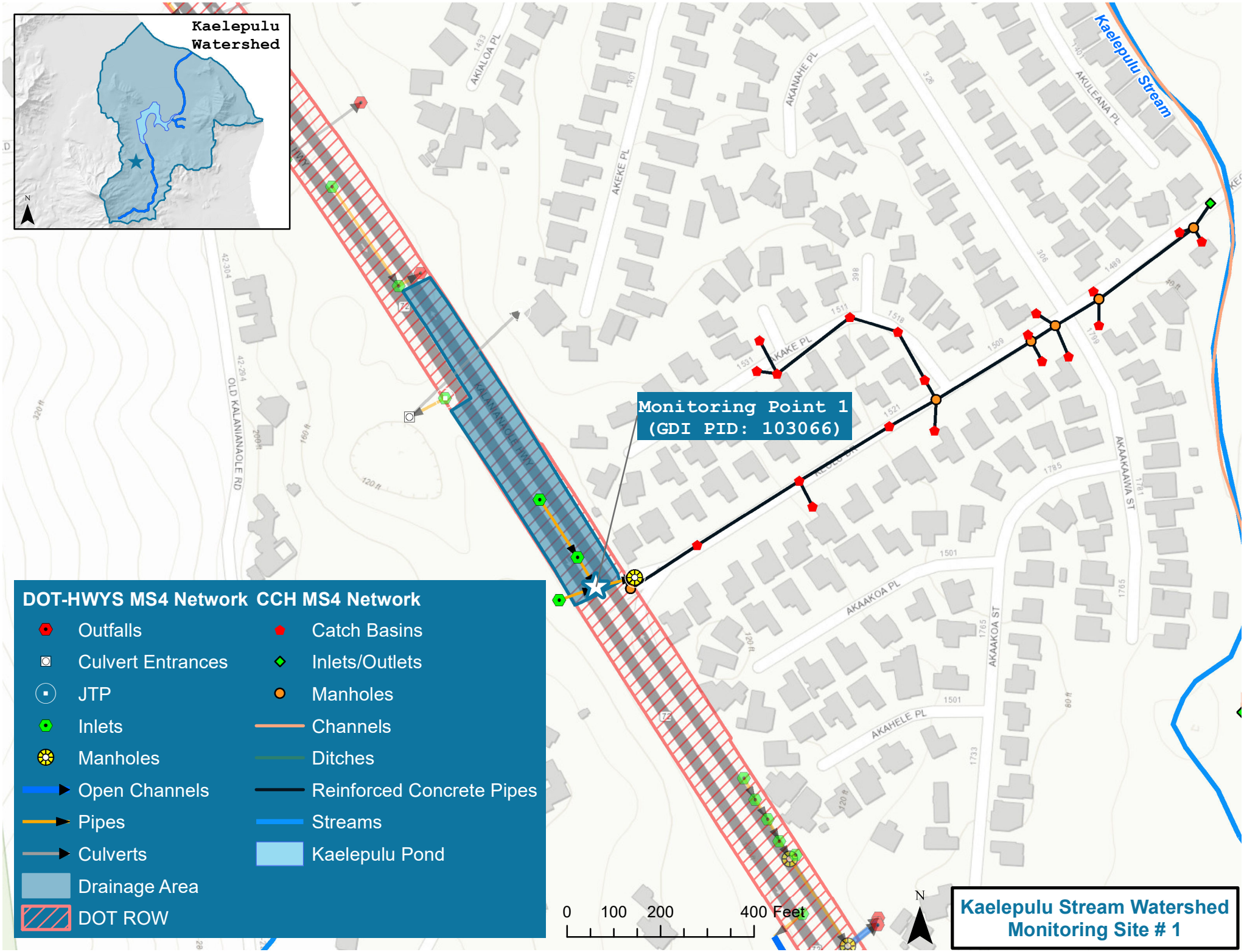
Kaelepulu Watershed
Monitoring Point 1
(GDI PID: 103066)
Kaelepulu Stream
KUALANIANAOLE HWY
OLD KALANIANAOLE RD
AKAAKOA PL
AKAAKOA ST
AKAAKAAWA ST
AKAHELE PL
AKEKE PL
AKANAHE PL
AKULEANA PL
AKALOA PL
DOT-HWYS MS4 Network
Outfalls
Culvert Entrances
JTP
Inlets
Manholes
Open Channels
Pipes
Culverts
Drainage Area
DOT ROW
CCH MS4 Network
Catch Basins
Inlets/Outlets
Manholes
Channels
Ditches
Reinforced Concrete Pipes
Streams
Kaelepulu Pond
0 100 200 400 Feet
N
Kaelepulu Stream Watershed
Monitoring Site # 1

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APPENDIX A.3

Location Figure for Kaelepulu Stream Watershed Monitoring Site #2

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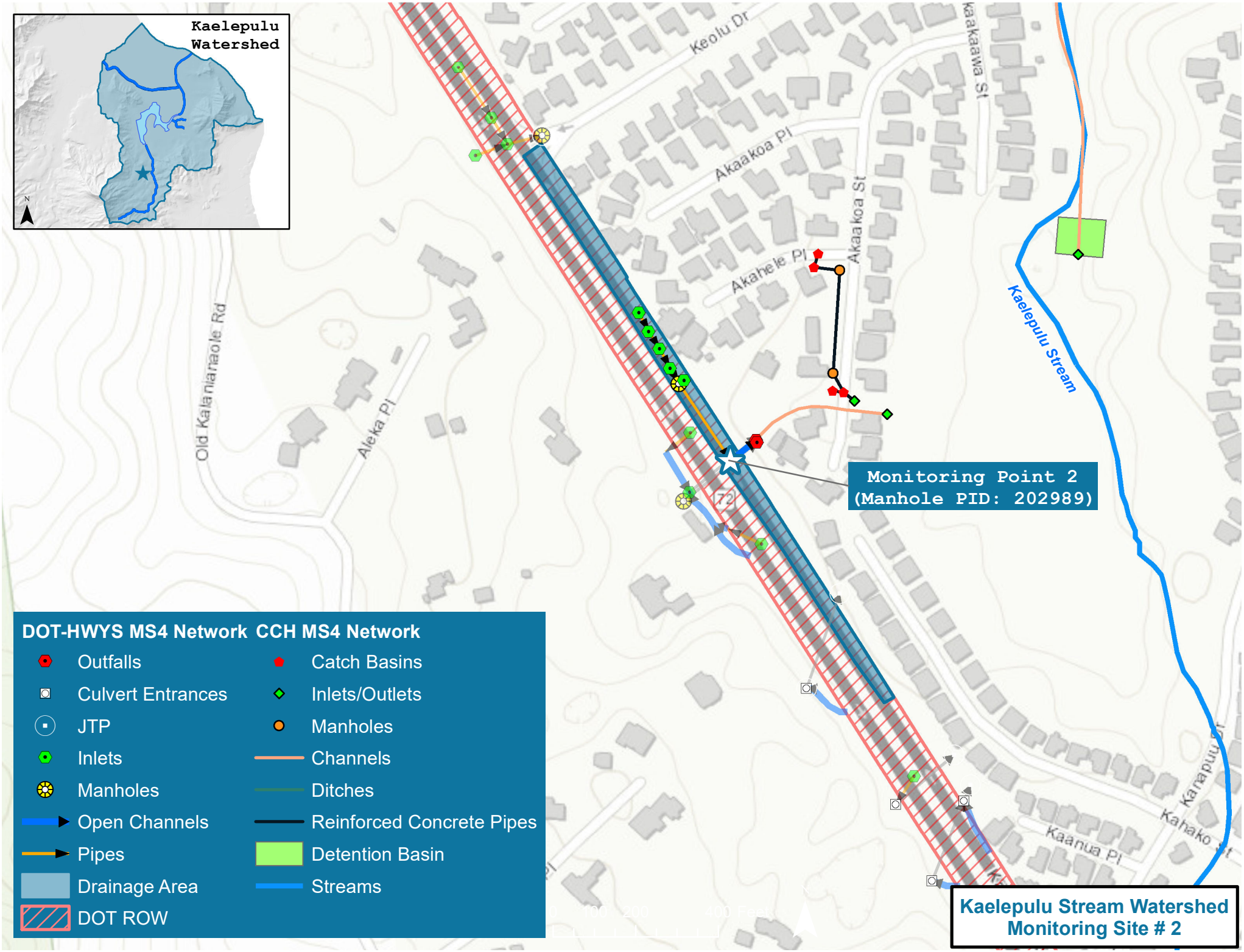
Kaelepulu Watershed
Keolu Dr
Akaakoa Pl
Akaakoa St
Akahele Pl
Kaakaawa St
Kaelepulu Stream
Old Kalanianaole Rd
Aleka Pl
Monitoring Point 2
(Manhole PID: 202989)
Kaanua Pl
Kahako St
Kaelepulu Stream Watershed
Monitoring Site # 2
DOT-HWYS MS4 Network
Outfalls
Culvert Entrances
JTP
Inlets
Manholes
Open Channels
Pipes
Drainage Area
DOT ROW
CCH MS4 Network
Catch Basins
Inlets/Outlets
Manholes
Channels
Ditches
Reinforced Concrete Pipes
Detention Basin
Streams

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APPENDIX B.1

Location Figure for Moanalua Stream Watershed Monitoring Sites

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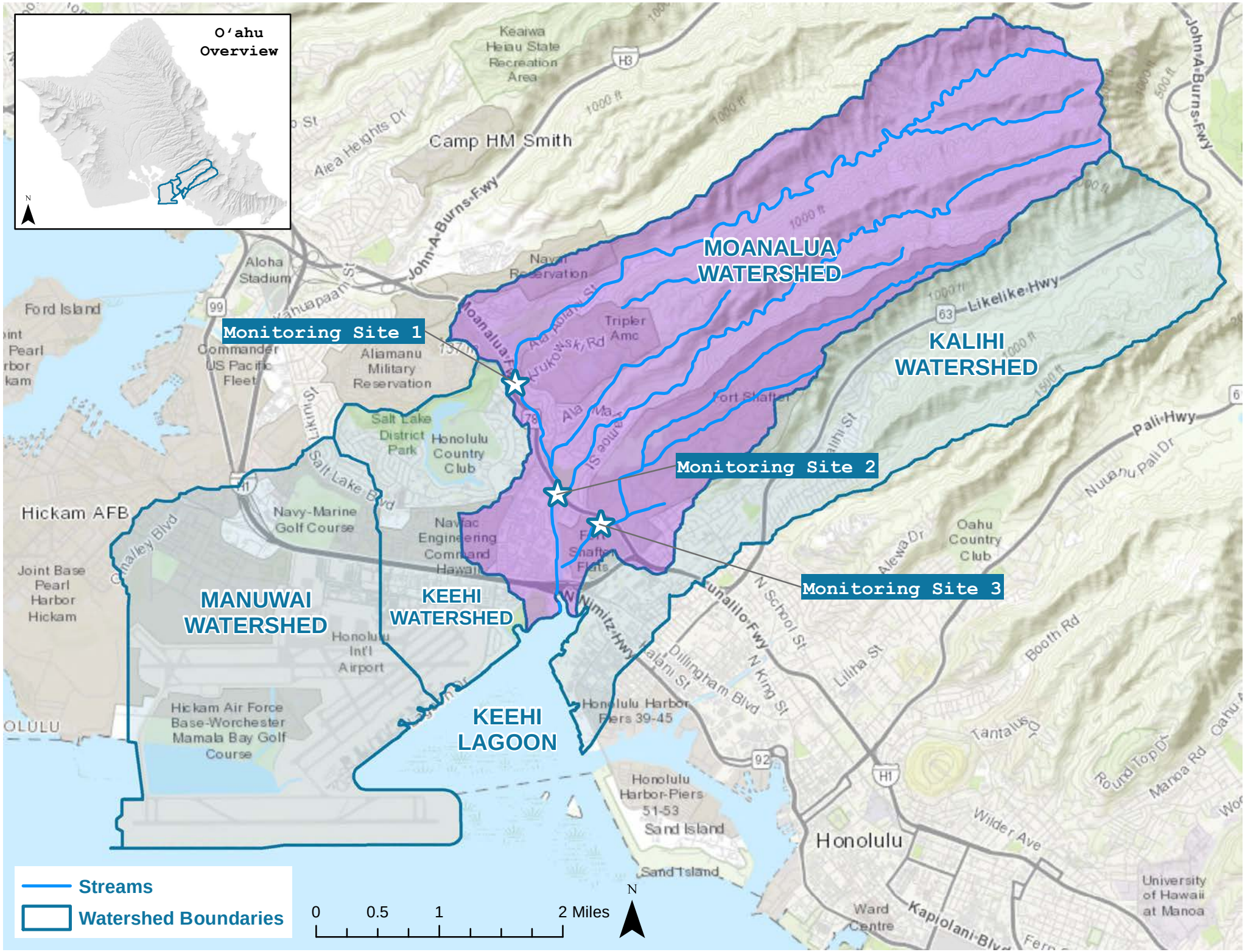
O'ahu Overview
MOANALUA WATERSHED
KALIHI WATERSHED
MANUWAI WATERSHED
KEEHI WATERSHED
KEEHI LAGOON
Monitoring Site 1
Monitoring Site 2
Monitoring Site 3
Camp HM Smith
Hickam AFB
Honolulu
Streams
Watershed Boundaries
0 0.5 1 2 Miles
N

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APPENDIX B.2

Location Figure for Moanalua Stream Watershed Monitoring Site #1

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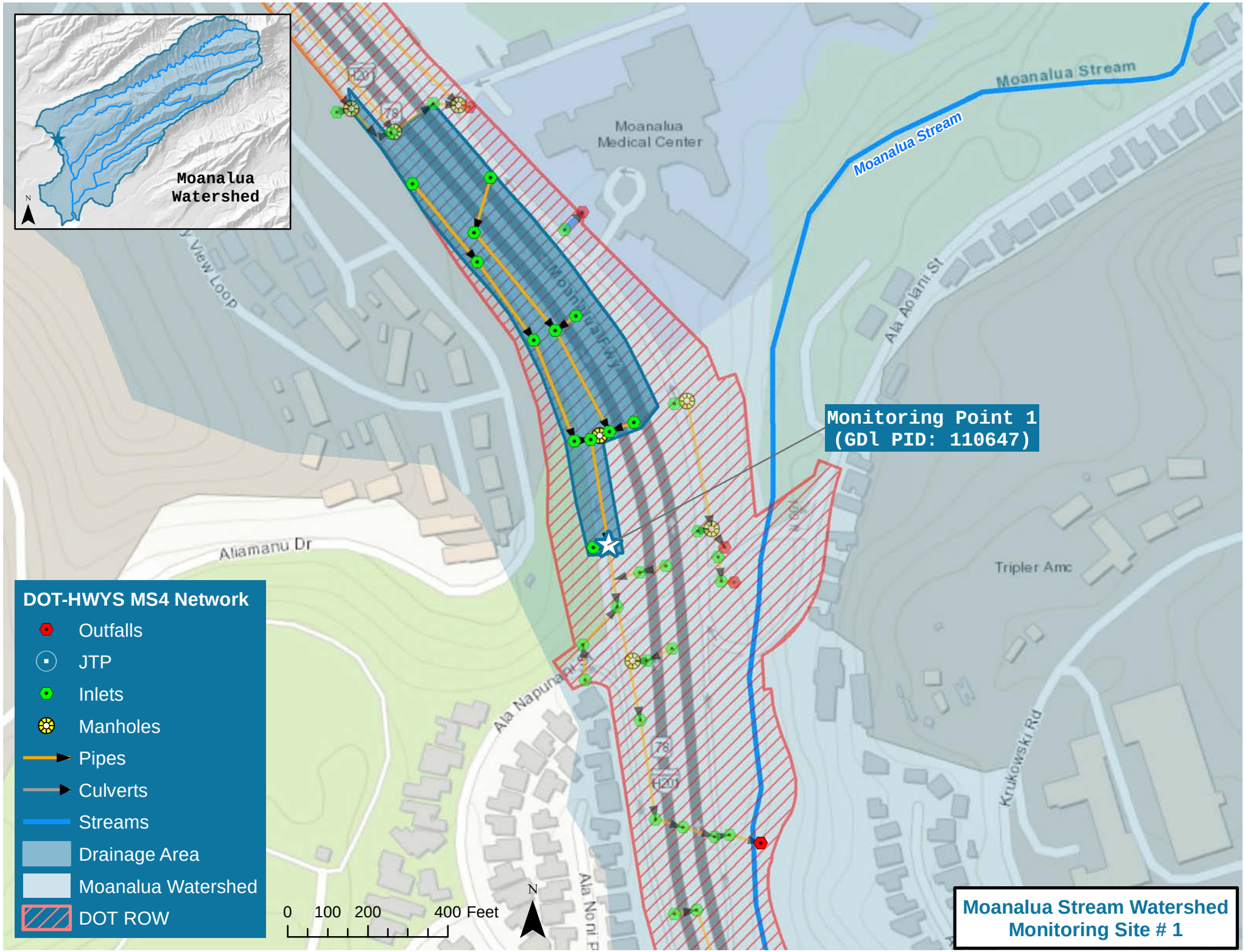
Moanalua Watershed
Moanalua Medical Center
Moanalua Stream
Moanalua Stream
Ala Aolani St
Monitoring Point 1
(GDl PID: 110647)
Aliamanu Dr
Tripler Amc
Ala Napunahi St
Krukowski Rd
Ala Noni P
DOT-HWYS MS4 Network
Outfalls
JTP
Inlets
Manholes
Pipes
Culverts
Streams
Drainage Area
Moanalua Watershed
DOT ROW
0 100 200 400 Feet
N
Moanalua Stream Watershed
Monitoring Site # 1

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APPENDIX B.3

Location Figure for Moanalua Stream Watershed Monitoring Site #2

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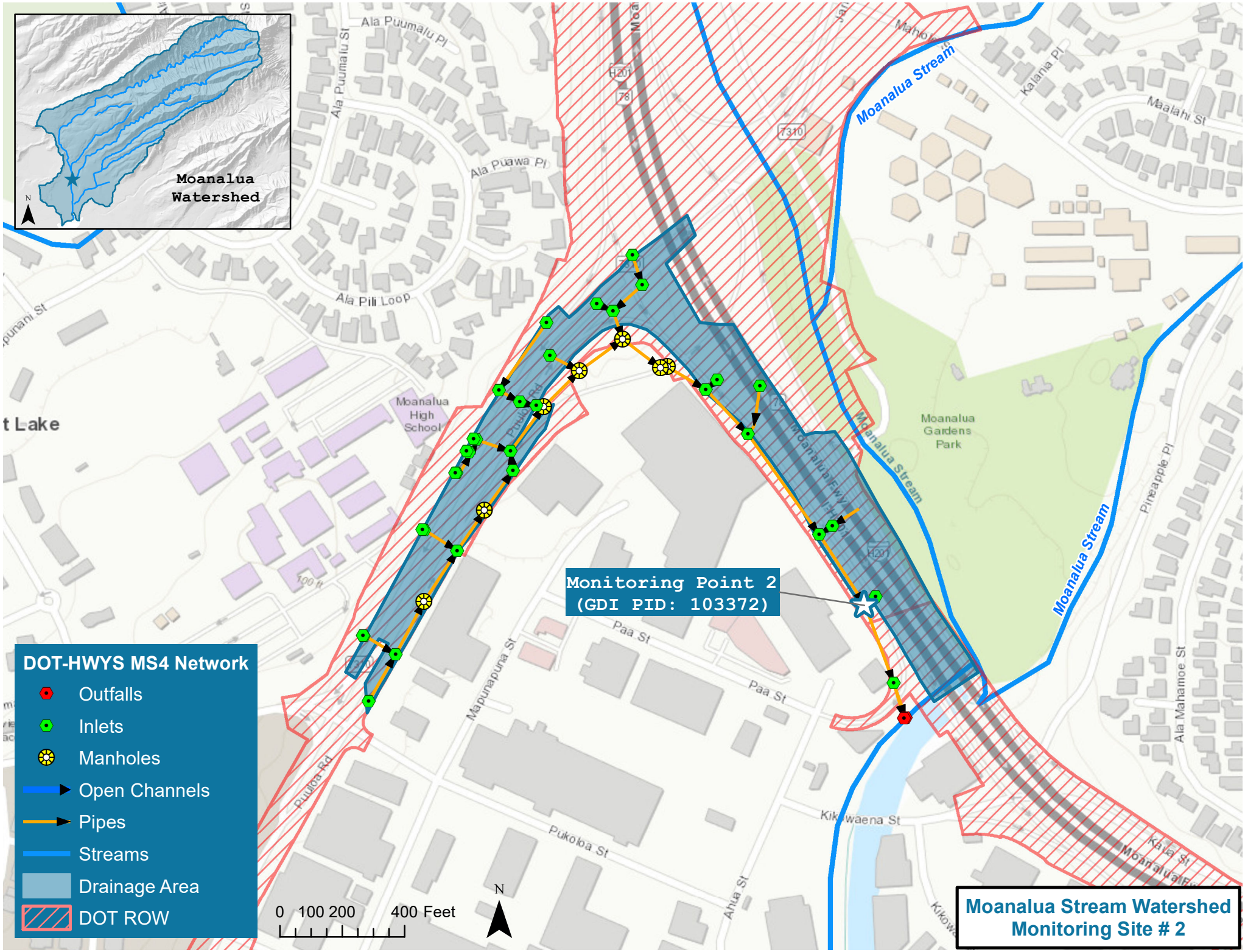
Moanalua Watershed
N
Monitoring Point 2
(GDI PID: 103372)
DOT-HWYS MS4 Network
Outfalls
Inlets
Manholes
Open Channels
Pipes
Streams
Drainage Area
DOT ROW
0 100 200 400 Feet
N
Moanalua Stream Watershed
Monitoring Site # 2
Moanalua Stream
Ala Puumalu Pl
Ala Puawa Pl
Ala Pili Loop
Moanalua High School
Moanalua Gardens Park
Mapunapuna St
Paa St
Pukoloa St
Kikowaena St
Puuloa Rd
Ahua St
Ala Mahamoe St
Pineapple Pl
Kalania Pl
Maalahi St
Kaiai St
Moanalua Fwy
H201
78
7310

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APPENDIX B.4

Location Figure for Moanalua Stream Watershed Monitoring Site #3

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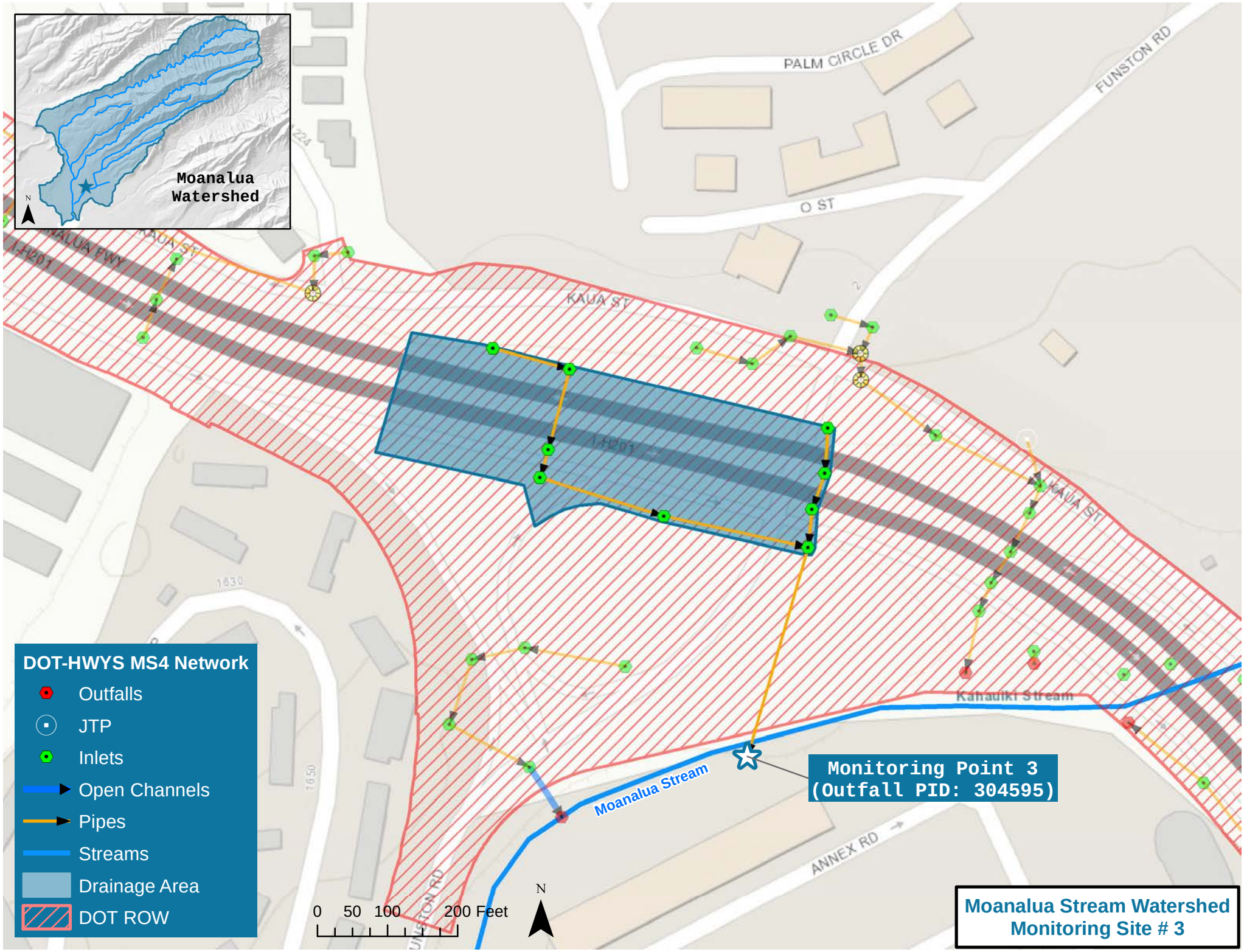
Moanalua Watershed
N
PALM CIRCLE DR
FUNSTON RD
O ST
KAUA ST
H-1 FWY
I-H201
1630
1650
Kahauiki Stream
Moanalua Stream
ANNEX RD
Monitoring Point 3
(Outfall PID: 304595)
DOT-HWYS MS4 Network
Outfalls
JTP
Inlets
Open Channels
Pipes
Streams
Drainage Area
DOT ROW
0 50 100 200 Feet
N
Moanalua Stream Watershed
Monitoring Site # 3

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