Hawaii Department of Transportation, Highways Division NPDES MS4 Permit
Post-Construction Storm Water Management in the
New Development and Significant Redevelopment Program

Retrofit Feasibility Study
Scope

Background

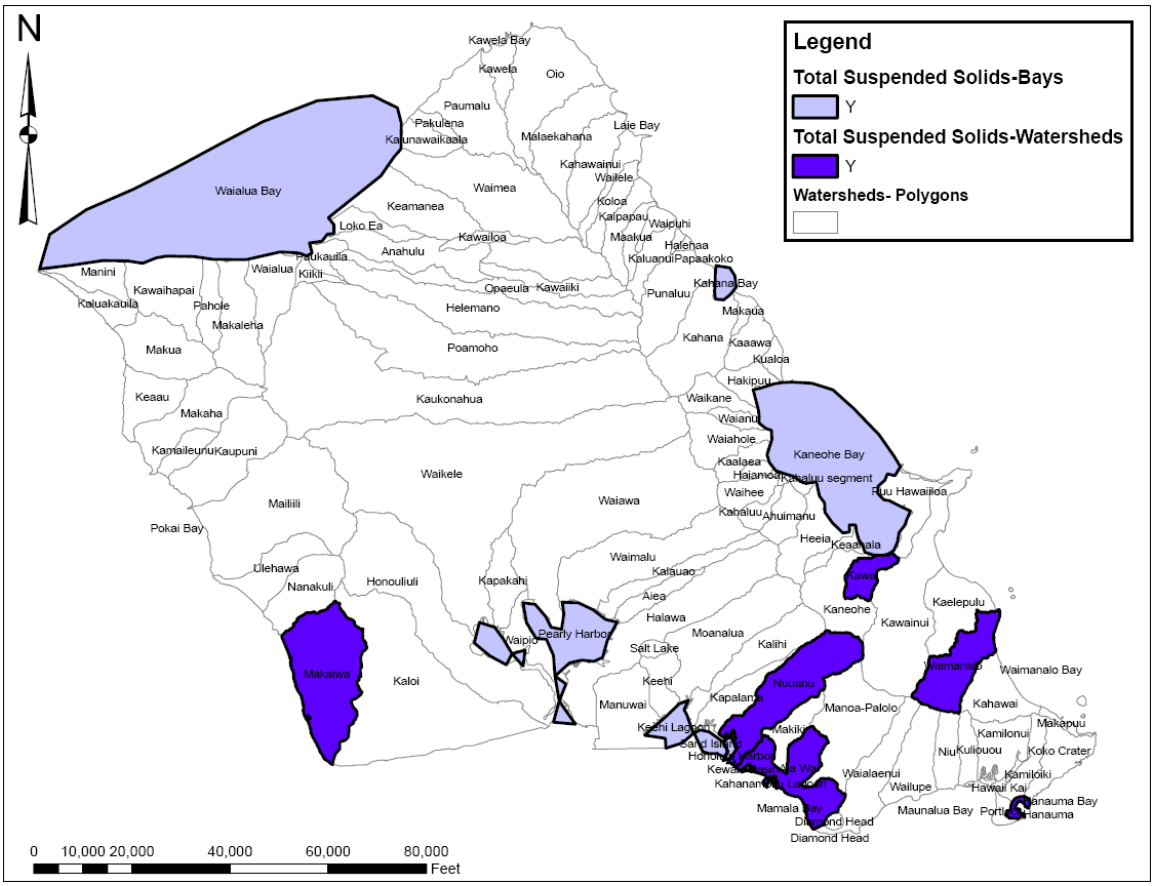
As part of the its NPDES MS4 Permit requirements, HDOT Highways Division will complete a feasibility study for retrofitting the existing MS4 discharges to receiving waters listed pursuant to Section 303(d) of the Clean Water Act for either sediment, siltation, turbidity, and/or trash. The retrofits may include water quality Best Management Practices (BMPs) to meet State Water Quality Standards.

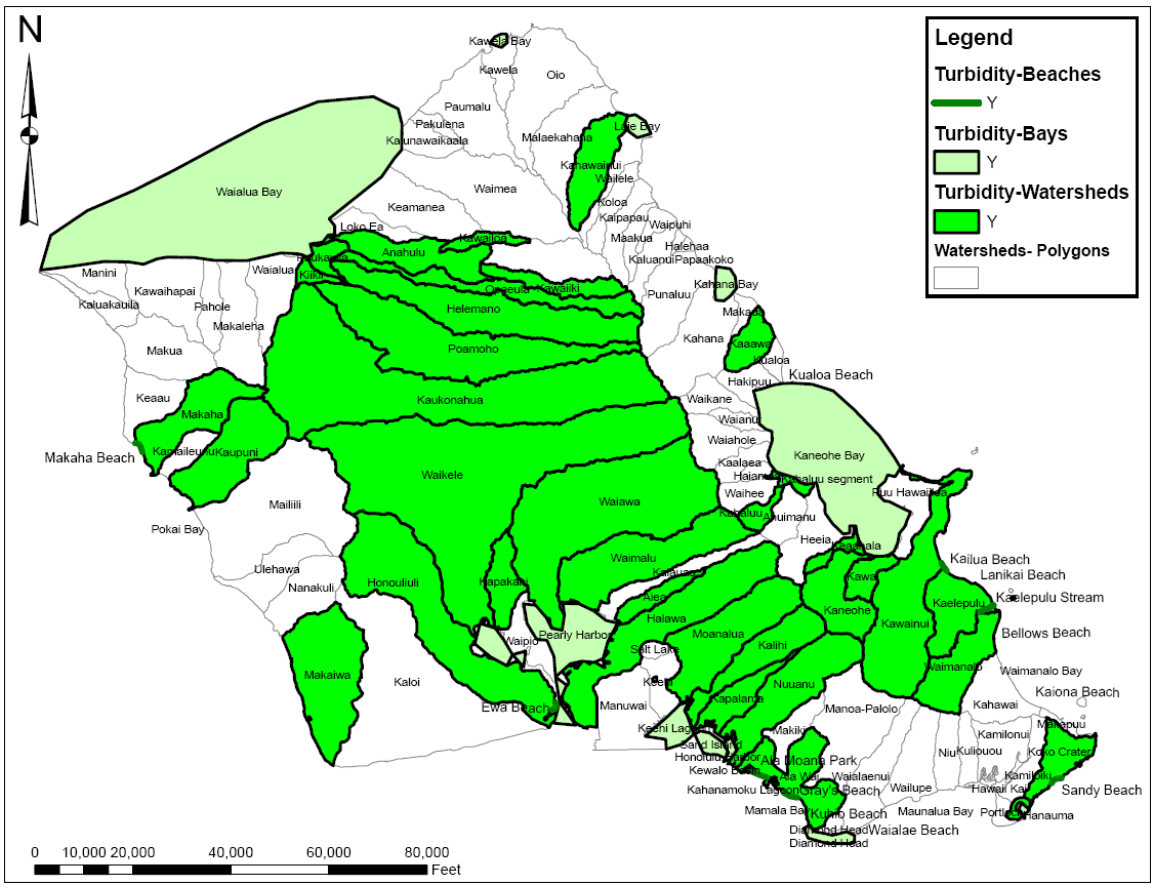
List of Impaired Waters in Oahu

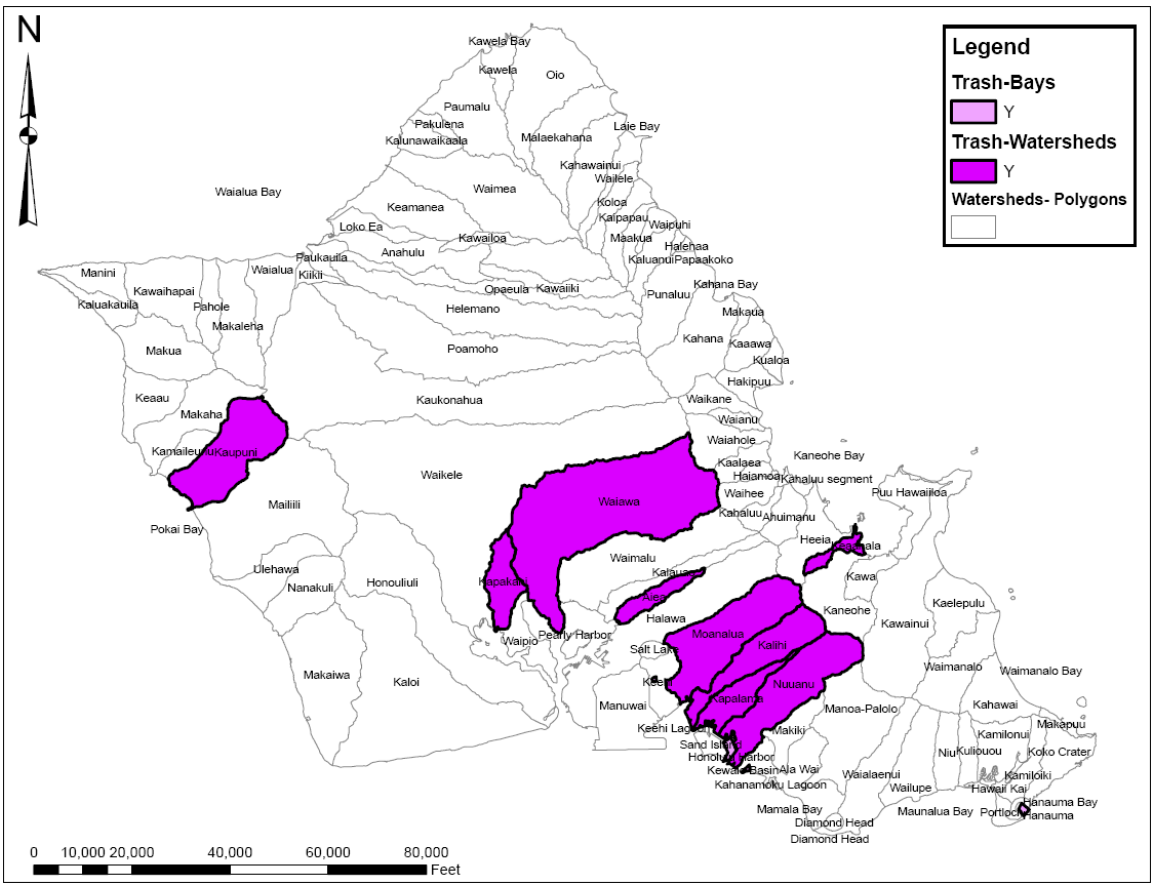
Listed Waterbody	Geographic Scope of Listing	Pollutants
Aiea Stream		turbidity, trash
Anahulu Stream		turbidity
Halawa Stream		turbidity
Kaaawa Stream		turbidity
Kaelepulu Stream		turbidity
Kahaluu Stream		turbidity
Kahawainui Stream		turbidity
Kalihi Stream		Turbidity, trash
Kamooalii Stream		turbidity
Kaneohe Stream		turbidity
Kapaa Stream		Turbidity, suspd.solids
Kapakahi Stream		Turbidity, trash
Kapalama Stream		Turbidity, trash
Kaupuni Stream		Turbidity, trash
Kawa Stream		Turbidity, suspd.solids
Keaahala Stream		Turbidity, trash
Kiikii Stream		turbidity
Manoa Stream		turbidity
Maunawili Stream		Turbidity, trash
Moanalua Stream		Turbidity, trash

Listed Waterbody	Geographic Scope of Listing	Pollutants
Nuuanu Stream		turbidity
Palolo Stream		trash
Paukauila Stream		turbidity
Waiawa Stream		Turbidity, trash
Waikele Stream		turbidity
Waimalu Stream		turbidity
Waimanalo Stream		Turbidity, suspd.solids
Waimano Stream (Tributary to Waiawa)		turbidity
Ala Wai Canal and Harbor	Ala Wai Canal and Boat Harbor	Turbidity, suspd.solids
Ala Wai Canal and Harbor	Ala Wai Canal (Diamond Head end) Station	turbidity
Ala Wai Canal and Harbor	Ala Moana Bridge station	turbidity
Manoa Stream		turbidity
Ala Wai Canal and Harbor	Manoa-Palolo Stream mouth station	turbidity
Ala Wai Canal and Harbor	Manoa-Palolo Stream (KHS) station	turbidity
Ala Wai Canal and Harbor	Palolo Stream Fork station	turbidity
Ewa Beach Park		turbidity
Gray's Beach		turbidity
Hanauma Bay	Hanauma Bay (oceanic) station	trash
Hanauma Bay	Hanauma Bay station	turbidity
Honolulu Harbor and Shore Areas	Nearshore waters to 30'	suspd.solids
Honolulu Harbor and Shore Areas	Ala Moana Park Center station	turbidity
Honolulu Harbor and Shore Areas	Kewalo Basin	Turbidity, suspd.solids, trash
Honolulu Harbor and Shore Areas	Kewalo Basin station	turbidity
Honolulu Harbor and Shore Areas	Honolulu Waterfront-Aloha Tower	Turbidity, trash
Honolulu Harbor and Shore Areas	Sand Island Point #2	turbidity
Honolulu Harbor and Shore Areas	Sand Island Point #3	turbidity
Kaelepulu Stream		turbidity
Kahana Bay	Nearshore waters to 30'	Turbidity, suspd.solids
Kahana Bay	Kahana Park (1) station	turbidity
Kailua Beach	Kailua Beach Park station	turbidity
Kailua Beach	Oneawa Beach station	turbidity
Kaneohe Bay	Nearshore waters at mouths of Kaneohe and Kawa Streams	turbidity
Kaneohe Bay	Kaneohe Bay (Central Region) station	turbidity
Kaneohe Bay	Kaneohe Bay (Northern Region) station	turbidity
Kaneohe Bay	Kaneohe Bay (Southern Region) station	turbidity
Kaneohe Bay	Kokokahi Pier	turbidity
Kaneohe Bay	Kaneohe Beach Park station	turbidity
Kawela Bay		turbidity
Keehi Lagoon		turbidity suspd.

Listed Waterbody	Geographic Scope of Listing	Pollutants
Laie Bay		turbidity
Makaha Beach		turbidity
Pearl Harbor	Harbor waters and nearshore waters to 30' from Keehi Lagoon to Oneula Beach	Turbidity, suspd.solids
Pearl Harbor	Blaisdell Park	turbidity
Public Bath Beach		turbidity
Salt Lake		turbidity
		trash
Sandy Beach Point		turbidity
Waialua/Kaiaka Bays	Nearshore waters to 60'	turbidity
Waialua/Kaiaka Bays	Kaiaka Bay	turbidity




N
Legend
Turbidity-Beaches
Y
Turbidity-Bays
Y
Turbidity-Watersheds
Y
Watersheds- Polygons
Waialua Bay
Kawela Bay
Kawela
Oio
Paumalu
Pakulena
Kaunawaikaala
Malaekahana
Laie Bay
Kahawainui
Waiiele
Waimea
Koloa
Keamanea
Kaipapau
Waipuhi
Loko Ea
Maakua
Halehaa
Kaluanui
Papaakoko
Anahulu
Kawailoa
Manini
Waialua
Kaiaka
Kahana Bay
Punaluu
Kawaihapai
Kaluakauila
Pahole
Makaleha
Helemano
Poamoho
Makua
Kahana
Kaaawa
Kualoa
Kualoa Beach
Hakipuu
Keaau
Makaha
Kaukonahua
Waikane
Waiahole
Makaha Beach
Kaiailelua
Kaupuni
Waikele
Kaneohe Bay
Kaalaea
Waihee
Waiawa
Mailiili
Pokai Bay
Heeia
Kaalaea
Kailua Beach
Lanikai Beach
Kaelepulu Stream
Kaelepulu
Kaneohe
Kawainui
Bellows Beach
Ulehawa
Nanakuli
Honouliuli
Waimalu
Kapakahi
Aiea
Halawa
Pearl Harbor
Waipio
Moanalua
Kalihi
Salt Lake
Waimanalo
Waimanalo Bay
Kaiona Beach
Makaiwa
Kaloi
Kea
Nuuanu
Kapalama
Manuwai
Ewa Beach
Manoa-Palolo
Kahawai
Makiki
Kamilonui
Niu
Kulipuou
Kaiwi Crater
Honolulu Harbor
Ala Moana Park
Kewalo Basin
Waialaenui
Kahanamoku Lagoon
Brady's Beach
Wailupe
Hawaii Kai
Kamiloiki
Sandy Beach
Mamala Bay
Kuhio Beach
Maunalua Bay
Portlock
Hanauma
Diamond Head
Waialae Beach
Diamond Head
0
10,000 20,000
40,000
60,000
80,000
Feet



Study Objectives

The following are the major objectives of the retrofit study:

1. Identify and evaluate potential pollutant sources (sediment, siltation, turbidity, and/or trash) from HDOT MS4 that may cause storm water pollution and stream degradation;
2. Identify management measures related to HDOT Highways activities for the reduction of pollution and reestablishment of stream stability;
3. Identify potential opportunities for installing permanent BMPs controls within HDOT rights-of way for the reduction of pollution and reestablishment of stream stability;
4. Rank and prioritize all management and control BMPs identified in the study; and
5. Prepare a comprehensive feasibility study report to be used as a HDOT's framework for storm water retrofit and stream restoration.

Technical Approach

The following step-by-step technical approach will be followed for conducting the retrofit study for each of the listed 303(d) waterbodies:

- Watershed Approach – Focus on the listed waterbodies (streams or coastal bays), as well as its contributing watershed
- Source-based Control BMPs – Evaluate the retrofit potential at the source of storm water runoff
- Stream-based Control BMPs – Evalaute the retrofit potential at the receiving waterways and channels
- Water Quality Focused Prioritization Matrix – Develop a set of prioritization matrix with primary focus on water quality impacts, effectiveness of retrofits, implementation methods, and cost benefit ratios

Detailed Scope

1. Watershed Characterization

For each of the impaired waterbodys listed in the 303(d) list, a broad characterization of its watershed basin and stream network will be performed. Collected watershed data will be categorized and stored in the GIS database of the Asset Management System (AMS).

1.1 Utilization of HDOT's GIS-based Asset Management System

As HDOT develops its comprehensive GIS AMS, many GIS thematic layers and data relevant to storm water will become available for conducting this retrofit study. Geo-referenced data in the AMS will be used in the watershed analysis. The AMS will be also be used to store, analyze, and display storm drains, streams, and water quality data.

1.2 Field Review

A field review for each of the watersheds will be performed to verify GIS data and to broadly characterize land uses, storm drain system, and stream morphology. In the field review, a thorough understanding of the topography, geologic features, and storm drain and stream networks will be obtained. This information will help in formulating the watershed evaluation process and approaches for conducting the retrofit study.

1.3 Develop Hydrologic and Hydraulic Analysis Plan

Watershed-wide hydrologic and hydraulic analyses will be conducted. These may include precipitation data, water quality data, gauging data, regression analysis, and/or modeling.

2. Source-Based Control BMPs Evaluation – Storm Water Management Assessment

2.1 Identification and evaluation of existing storm water BMPs

The information on HDOT's existing storm water BMP facilities will be inventoried and categorized in the AMS. Field surveys will be conducted to

assess and photo-document the type and condition of facilities, erosion problems 300 feet below the outfall, and opportunities for BMP improvements. These assessments will also verify whether adequate land exists for BMP improvement. Data from the field survey forms will be entered into AMS.

2.2 Identification of Permanent BMP Potential at Storm Drain Inlets and Outfalls

As part of the AMS development, all inlets, pipe network and major outfalls of HDOT's MS4 will be inventoried and geo-referenced. As a separate task, the condition of all major storm drain outfalls will also be assessed and documented in the AMS. In this islandwide retrofit study, a detailed assessment for up to 90 selected inlets and major outfalls (36 inches or greater in diameter; have a distance of 50 feet or more to the stream channel; and have contributing impervious drainage area of one acre or larger) will be conducted for the retrofit feasibility study. This assessment will further verify the size and type of inlets and outfalls and the condition of the channels downstream of the outfalls. During the assessment, the potential for installing BMPs at either the inlets or the outfalls will be examined based on the various relevant factors (e.g., available rights-of-way, channel slope, contributing impervious area, vegetative condition, etc.). The assessment retrofit data will be entered into AMS for each impaired waterbody, including conditions and type of retrofit potential.

2.3 Identification of Permanent BMP Potential within Highway Right-of-Ways

Beside inlets, pipe network and major outfalls of HDOT's MS4, potential for installing permanent BMPs will be evaluated for all suitable areas within HDOT Highways rights-of-way. Types of potential permanent BMPs may include grassed swales, infiltration trenches/basins, bioretention pondss, detention basins, storm water wetlands, and other hydrodynamic devices. Consideration will be given to land availability, topography, soil condition, and traffic concerns in the process of the feasibility evaluation. The assessment data will be entered into AMS for each impaired waterbody, including conditions and type of retrofit potential.

2.4 Identification of Management BMPs Related to HDOT activities

Through the field review process and with the MS4 data and information provided by the AMS, suitable management BMPs will be identified for selected HDOT highway segments located within certain impaired waterbodies/watersheds. These management BMPs may include increased frequency of street sweeping, cleaning of inlets, pipes, and outfalls. These potential management BMPs and/or "change of behavior" management measures will be documented and coordinated with appropriate HDOT highway maintenance units. Tracking of these activities may be done in the AMS.

2.5 Identification of Retrofit Opportunities within HDOT Maintenance Baseyards

HDOT Highway operates eight maintenance baseyards. Each of the baseyards follows a Storm Water Pollution Control Plan (SWPCP) in implementation of general site best management practices. Maintenance baseyards, however, have the potential to generate storm water pollution due to the nature of their operation.

Therefore, these baseyards are considered potential "hot spots" in storm water pollution. Through the field review process and with the MS4 data and information provided by the AMS, site specific BMPs will be identified for each of the baseyards. Possible BMPs may include oil/grit separators, CDS or similar devices for trash removal, and other "hydrodynamic" devices to remove sediment. Tracking the implementation of these BMPs may be done via the AMS

3. Stream-Based Control BMPs Evaluation - Stability Assessment

3.1 Stability and Geomorphic Assessment of Outfall Channels and Receiving Streams

Eroded drainage channels and receiving natural streams are major source of sediment pollutants. Stabilization of these channels presents a great opportunity for HDOT to reduce sediment loadings from its MS4. For each of the303(d) listed impaired waterbodies, the outfall channel within the HDOT Highways rights-of-way will be assessed for stability concerns. The geomorphic condition of the natural streams within the right-of-way will be evaluated as well. If the stability of the stream channel requires a system-wide stream corridor restoration beyond the HDOT Highways right-of-way, HDOT may elect to extend the limits of the feasibility study outside the area, provided that HDOT can receive permission from adjacent land owners. HDOT will review available topography, geology, soils, and aerial photographs. For natural stream channels, ranges of hydraulic geometry relationships based on the discharge will be assessed. The assessment method will consist of a team of two engineers walking the entire length of each channel/stream and performing rapid field assessments of individual reaches. Measurements using a stretched tape and surveying rod will be performed to estimate the channel geometry.

Natural channel morphology features will be estimated by observation and map interpretation and will include:

- Entrenchment ratio range
- Sinuosity range
- Depositional features
- Channel substrate
- Stream Classification Type (Rosgen), if applicable
- Bank Failure Assessment
- Channel slope range
- Width/depth ratio range
- Meander pattern
- Channel stability: aggrading, degrading, lateral stability
- Geologic controls

Observations will be made of:

- Channel Disturbances

Bank instabilities	Debris blockages
Altered channels	Utilities: exposed/leaking sewer lines, manholes, etc.
Culvert (type, shape, estimated span, EOP pool)	

- Channel Habitat

Fish blockages	Riparian cover/composition/density
Riparian width for each side of the channel	Canopy cover (percent over channel)

A field data form will be developed and completed for each reach. Photographs shall be taken at each cruised reach and coded for future reference.

3.2 Identification of Restoration Opportunities

In addition, the field team will identify channel stabilization or stream rehabilitation projects. Project descriptions will include location, purpose of improvements, linear extent, types of improvements, potential for success, and potential benefits. Sufficient information shall be collected so "revisits" during plan preparation tasks may be limited. A standard field data form will be used to record potential projects.

3.3 Database Development via AMS

A database will be developed in the GIS based AMS. The field information obtained in tasks 3.2 and 3.4 will be recorded in the database, geo-coded, and categorized for each of the listed waterbodies.

4. Ranking and Prioritization of Water Quality Problems and Retrofit Opportunities

4.1 Identification and Ranking of Water Quality Problems

HDOT will integrate watershed characteristics, field assessment results and the channel/stream stability analysis into a comprehensive evaluation of the existing and potential water quality problems for each watershed. Ranking criteria for water quality problems will be developed based on specific pollutant reduction goals. The water quality problems will be ranked on a comparative basis as to their impacts and relative magnitude of contribution to the overall water quality deterioration in the entire Island of Oahu.

4.2 Inventory of Potential Retrofit Opportunities

All potential retrofit and BMPs sites developed under the above sections will be inventoried in the AMS. Retrofit opportunities may include, but not be limited to, riparian plantings, new storm water permanent BMPs, storm drain retrofit, increased street sweeping frequencies, community education, floodplain/wetland establishment, converting impervious areas into pervious landscapes, channel stabilization, and stream restoration. The locations of these projects shall be provided on a map. Each recommended project shall include a preliminary cost

estimate. Costs will not include land acquisition. Location of all retrofit BMPs will be mapped in the GIS-based AMS.

4.3 Retrofit Prioritization

A ranking methodology, which will include water quality improvement benefits and construction costs, will be prepared for this feasibility study. All retrofit opportunities identified in the study will be ranked according to this methodology.

5. Preparation of Feasibility Study Report

A comprehensive, integrated study report will be prepared for the island of Oahu and will incorporate the results of the tasks described in the previous sections. Appendices will be included that contain technical and data support documentation.

6. Schedule

The feasibility study will take three years to completed and the final report will be submitted to DOH by March 30, 2009