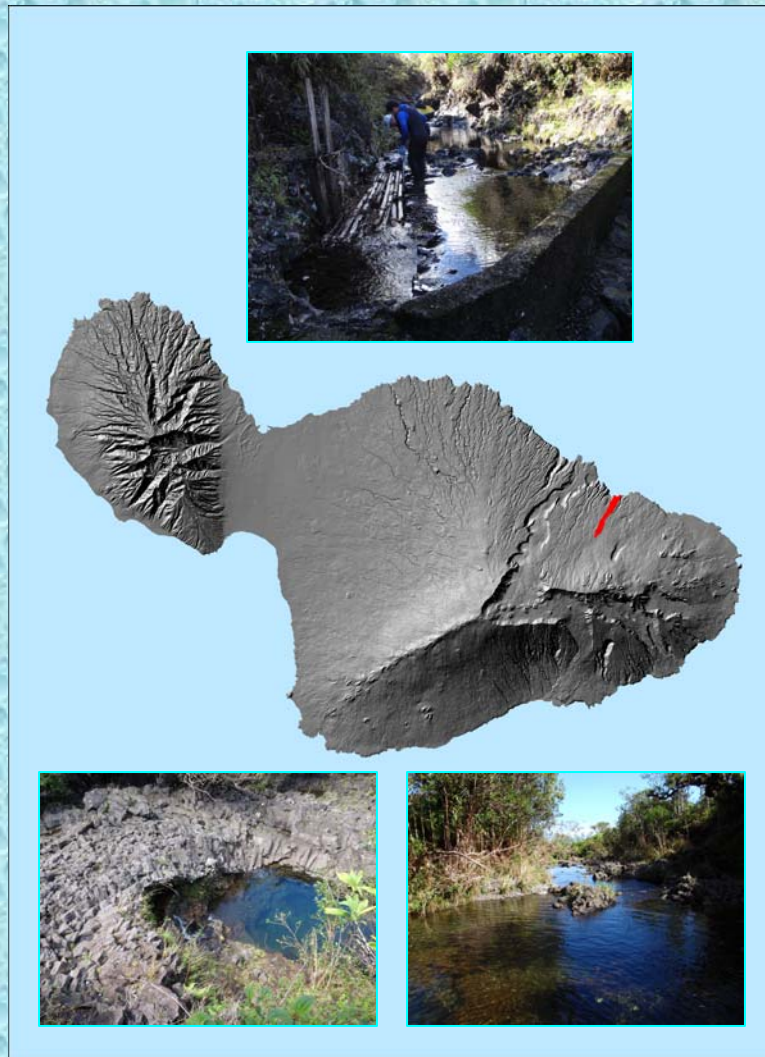


Report on Kapā'ula Gulch Maui, Hawaii



August 2009

State of Hawai'i
Department of Land and Natural Resources
Division of Aquatic Resources

and

Bishop Museum





Funded in part by the Commission on
Water Resource Management, DLNR
and



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Report on Kapā‘ula Gulch Maui, Hawai‘i

August 2009

Prepared for
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawai‘i

Prepared by
Division of Aquatic Resources¹
Department of Land and Natural Resources
State of Hawai‘i
and
Bishop Museum²

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Section 1: Introduction

Overview

On May 24, 2001, the Native Hawaiian Legal Corporation (NHLC) filed a Petition to Amend the Interim Instream Flow Standard (IIFS) for 27 streams in east Maui on behalf of resident taro farmers. Since the acceptance of the petitions in July 2001, the Commission on Water Resource Management (CWRM) has been focused on gathering information for the 27 petitioned streams. Shortly thereafter, NHLC and CWRM staff reached an agreement that efforts would focus on 8 of the 27 petitioned streams: Honopou, Hanehoi, Huelo, Waiokamilo, Kualani, Pi'ina'au, Palauhulu, and Wailua Nui Streams. Currently, the CWRM is collaborating with the State's Division of Aquatic Resources and the U.S. Geological Survey (USGS) for assistance in collecting biological and hydrologic data to determine measurable interim IFS. CWRM has also requested biological data on the remaining 19 petitioned streams which is the main purpose of this report.

This report is an accounting of the aquatic resources that have been observed in Kapā'ula Gulch, Maui from year 2000 to present. The focus of this report is on the animals and insects that live in the stream and the data collected during surveys. The report covers four main sections, including:

- Introduction
- Watershed Atlas Report
- DAR Point Quadrat Survey Report
- Photographs of stream taken during stream surveys

The introduction provides the overview for the purpose of this report, a summary of the findings on the stream and its animals, and a discussion of the importance of the findings and how stream conditions influence native species populations. The Watershed Atlas Report provides a description of the watershed and its aquatic resources from Division of Aquatic Resources (DAR) and other published/unpublished surveys, including a rating of the condition of the stream compared to other streams on Maui as well as statewide. The DAR Point Quadrat Survey Report describes the distribution, habitats, and species observed during the standardized DAR stream surveys. Finally, the photographs provide context to the conditions that the stream surveyors encountered in the stream.

This overview reports on the highlights of these findings and provides a discussion of the importance of the information presented. We hope that this format provides the reader with a simplified, general discussion and understanding of the conditions of Kapā'ula Gulch while also providing substantial evidence to support the conclusions presented.

Findings for Kapā'ula Gulch, Maui

Kapā'ula is very small (0.8 sq mile), steep (in the upper watershed), and has a little embayment. It is mostly zoned for conservation (72%) and agriculture (28%). The land cover is mostly evergreen forest (81%), scrub (9%), grassland (7%) and bare land (2%). Several stream surveys of different types have been completed in Kapā'ula Gulch beginning in 1962 to the present. This

watershed rates minimal, based on the data contained in the DAR aquatic surveys database, in comparison to other watersheds in Maui and statewide. It has a total watershed rating of 6 out of 10, a total biological rating of 4 out of 10, and a combined overall rating of 3 out of 10.

Native species observed in the stream include the following categories and species:

Crustaceans - *Atyoida bisulcata*

Insect – *Anax junius*, *Anax* sp. and *Megalagrion* sp.

The native animals were observed using sites with deeper water. Suitable depths for all native species were approximately 20 inches or deeper. This is consistent with findings statewide. The diversions resulted in an increase frequency of dry sites as compared to streams statewide. The distribution of depths in comparison to elevation showed that the stream was shallower downstream of the diversions than would be expected in a normal stream. The lack of suitable depths likely restricts native adult animal habitat in some stream sections.

Discussion

Kapā'ula Gulch is narrow, small and steep in the upper reaches with little to no embayment at the stream mouth. The stream was characterized by a series of plunge pools and cascading waterfalls straight to the ocean.

Kapā'ula Gulch was accessed through East Maui Irrigation (EMI) ditch roads via Hāna Highway during surveys conducted above the highway. Aerial reconnaissance by helicopter showed that there was no access to the mouth of the stream by helicopter or truck. A terminal waterfall to the ocean with no estuary present provided no landing zone, preventing surveys to be conducted at the mouth and lower reach below the highway.

Point quadrat surveys were conducted in the upper reach of Kapā'ula Gulch upstream from Hāna Highway. DAR surveyors accessed the stream by following a polyvinyl chloride (PVC) pipe up a dry wash and found an old tunnel that led to the stream, which could have been an older diversion that no longer collects water but was not dismantled. The streambed consisted mainly of cobble, bedrock and boulders and standing water with no flow. A second diversion was found upstream, which was taking 100% of stream flow, sending water into the ditch through metal grating (Figure 4-3). The stream had moderate flow above the second diversion where flow was measured.

Kapā'ula Gulch above the second diversion had ideal conditions for stream animal habitat. Water temperature averaged 18.5° C with substantial flow and good water depth. A total of 29 native shrimp, **‘ōpae kala’ole** (*Atyoida bisulcata*), in 8 samples and one *Megalagrion* species was observed in the upper reaches above the second diversion. No native goby or other native species were observed above the second diversion, which is likely the result of the second diversion prohibiting access by those species.

Overall, Kapā'ula Gulch has poor instream habitat for **‘o‘opu nōpili** (*Sicyopterus stimpsoni*), **‘o‘opu naniha** (*Stenogobius hawaiiensis*), **‘o‘opu ‘akupa** (*Eleotris sandwicensis*), and **‘ōpae ‘oeha‘a** (*Macrobrachium grandimanus*), due to the overall substrate at the lower reaches. Restoration of a small amount of flow downstream would provide habitat for *A. bisulcata* and **‘o‘opu ‘alamo‘o** (*Lentipes concolor*) juvenile recruit downstream of the diversion.

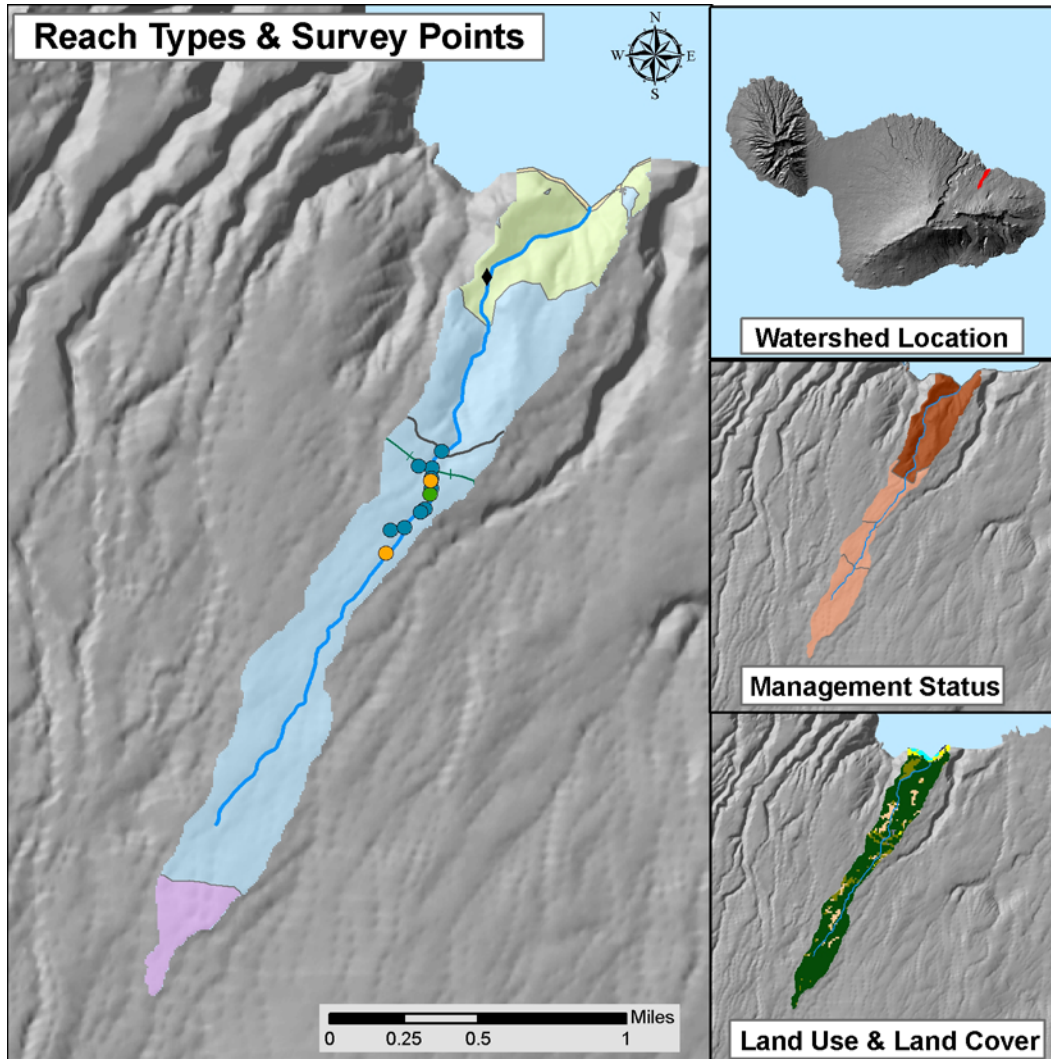
Improvement for fish passage for both up and down stream migration would substantially increase habitat for *L. concolor* and *A. bisulcata* but will not enhance the overall productivity of Kapā'ula significantly.

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Section 2: Watershed Atlas

DAR Watershed Code: 64021

Kapā‘ula Gulch, Maui



Watershed Features

Kapā‘ula Gulch watershed occurs on the island of Maui. The Hawaiian meaning of the name is the red enclosure. The area of the watershed is 0.8 square mi (2.1 square km), with maximum elevation of 2661 ft (811 m). The watershed's DAR cluster code is 2, meaning that the watershed is small, steep in the upper watershed, and with little embayment. The percent of the watershed in the different land use districts is as follows: 27.9% agricultural, 72.1% conservation, 0% rural, and 0% urban.

Land Stewardship: Percentage of the land in the watershed managed or controlled by the corresponding agency or entity. Note that this is not necessarily ownership.

<u>Military</u>	<u>Federal</u>	<u>State</u>	<u>OHA</u>	<u>County</u>	<u>Nature Conservancy</u>	<u>Other Private</u>
0.0	0.0	54.1	0.0	0.0	0.0	45.9

Land Management Status: Percentage of the watershed in the categories of biodiversity protection and management created by the Hawaii GAP program.

Permanent Biodiversity <u>Protection</u>	Managed for Multiple <u>Uses</u>	Protected but <u>Unmanaged</u>	<u>Unprotected</u>
0.0	54.1	0.0	45.9

Land Use: Areas of the various categories of land use. These data are based on NOAA C-CAP remote sensing project.

	<u>Percent</u>	<u>Square mi</u>	<u>Square km</u>
High Intensity Developed	0.0	0.00	0.00
Low Intensity Developed	0.5	0.00	0.01
Cultivated	0.0	0.00	0.00
Grassland	7.3	0.06	0.15
Scrub/Shrub	8.8	0.07	0.18
Evergreen Forest	80.5	0.65	1.69
Palustrine Forested	0.0	0.00	0.00
Palustrine Scrub/Shrub	0.0	0.00	0.00
Palustrine Emergent	0.0	0.00	0.00
Estuarine Forested	0.0	0.00	0.00
Bare Land	1.7	0.01	0.04
Unconsolidated Shoreline	1.2	0.01	0.02
Water	0.1	0.00	0.00
Unclassified	0.0	0.00	0.00

Stream Features

Kapā'ula Gulch is a perennial stream. Total stream length is 2.7 mi (4.3 km). The terminal stream order is 1.

Reach Type Percentages: The percentage of the stream's channel length in each of the reach type categories.

<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
0.0	0.6	22.9	76.6	0.0

The following stream(s) occur in the watershed:

Kapā'ula

Biotic Sampling Effort

Biotic samples were gathered in the following year(s):

1962 2003 2009

Distribution of Biotic Sampling: The number of survey locations that were sampled in the various reach types.

<u>Survey type</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
DAR Point Quadrat	0	0	0	8	0
DAR Rapid BioAssessment	0	0	0	1	0
HDFG	0	0	0	2	0
Published Report	0	0	0	1	0

Biota Information

Species List

Native Species

Crustaceans *Atyoida bisulcata*

Native Species

Insects *Anax junius*
Anax sp.
Megalagrion sp.

Species Size Data: Species size (inches) observed in DAR Point Quadrat Surveys.

<u>Scientific Name</u>	<u>Status</u>	<u>Minimum Size</u>	<u>Maximum Size</u>	<u>Average Size</u>
<i>Atyoida bisulcata</i>	Endemic	1	1.5	1.4
<i>Megalagrion</i> sp.	Endemic	1.25	1.25	1.3

Average Density: The densities (#/square yard) for species observed in DAR Point Quadrat Surveys averaged over all sample dates in each reach type.

<u>Scientific Name</u>	<u>Status</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
<i>Atyoida bisulcata</i>	Endemic				10.0	

Species Distributions: Presence (P) of species in different stream reaches.

<u>Scientific Name</u>	<u>Status</u>	<u>Estuary</u>	<u>Lower</u>	<u>Middle</u>	<u>Upper</u>	<u>Headwaters</u>
<i>Atyoida bisulcata</i>	Endemic				P	
<i>Megalagrion</i> sp.	Endemic				P	
<i>Anax junius</i>	Indigenous				P	
<i>Anax</i> sp.	Indigenous				P	

Historic Rankings

Historic Rankings: These are rankings of streams from historical studies. "Yes" means the stream was considered worthy of protection by that method. Some methods include non-biotic data in their determination. See Atlas Key for details.

Multi-Attribute Prioritization of Streams - Potential Heritage Streams (1998): No

Hawaii Stream Assessment Rank (1990): Limited

U.S. Fish and Wildlife Service High Quality Stream (1988): No

The Nature Conservancy- Priority Aquatic Sites (1985): No

National Park Service - Nationwide Rivers Inventory (1982): No

Current DAR Decision Rule Status: The following criteria are used by DAR to consider the biotic importance of streams. "Yes" means that watershed has that quality.

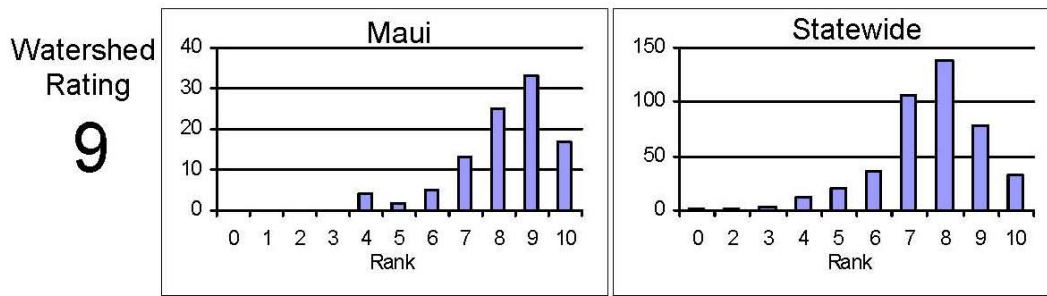
Native Insect Diversity <u>> 19 spp.</u>	Native Macrofauna <u>Diversity > 5 spp.</u>	Absence of Priority 1 <u>Introduced</u>
No	No	Yes
Abundance of Any <u>Native Species</u>	Presence of Candidate <u>Endangered Species</u>	Endangered Newcomb's <u>Snail Habitat</u>
No	No	No

CURRENT WATERSHED AND STREAM RATINGS

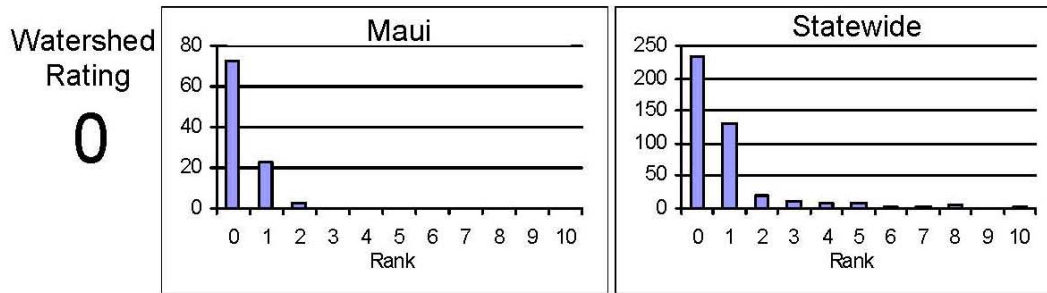
The current watershed and stream ratings are based on the data contained in the DAR Aquatic Surveys Database. The ratings provide the score for the individual watershed or stream, the distribution of ratings for that island, and the distribution of ratings statewide. This allows a better understanding of the meaning of a particular ranking and how it compares to other streams. The ratings are standardized to range from 0 to 10 (0 is lowest and 10 is highest rating) for each variable and the totals are also standardized so that the rating is not the average of each component rating. These ratings are subject to change as more data are entered into the DAR Aquatic Surveys Database and can be automatically recalculated as the data improve. In addition to the ratings, we have also provided an estimate of the confidence level of the ratings. This is called rating strength. The higher the rating strength the more likely the data and rankings represent the actual condition of the watershed, stream, and aquatic biota.

WATERSHED RATING: Kapā'ula Gulch, Maui

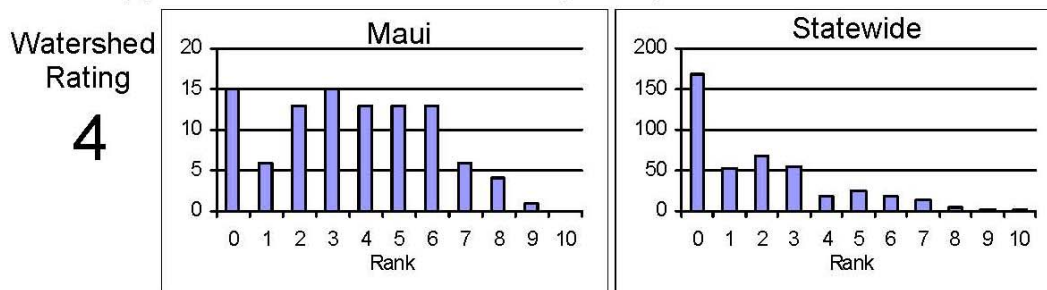
Land Cover Rating: Rating is based on a scoring system where in general forested lands score positively and developed lands score negatively.



Shallow Waters Rating: Rating is based on a combination of the extent of estuarine and shallow marine areas associated with the watershed and stream.

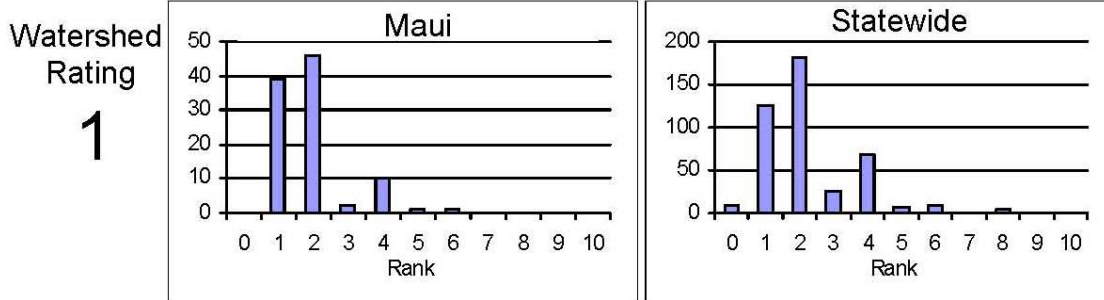


Stewardship Rating: Rating is based on a scoring system where higher levels of land and biodiversity protection within the watershed score positively.

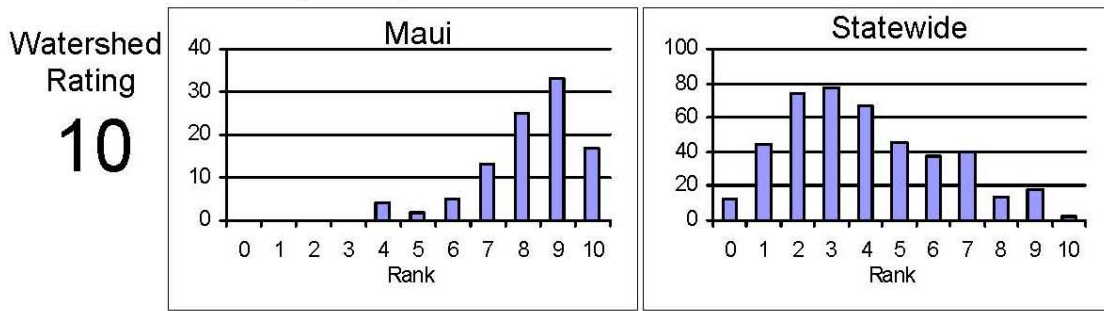


WATERSHED RATING (Cont): Kapā'ula Gulch, Maui

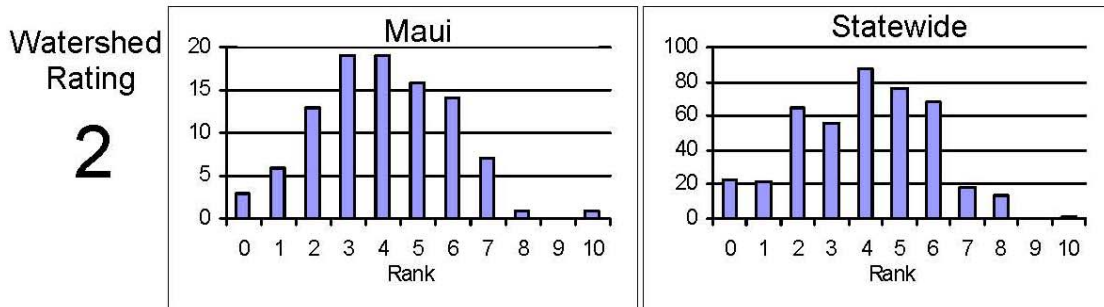
Size Rating: Rating is based on the watershed area and total stream length. Larger watersheds and streams score more positively.



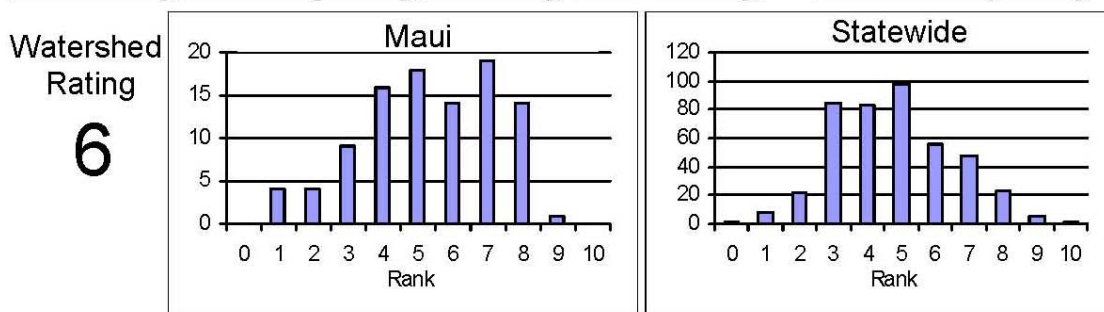
Wetness Rating: Rating is based on the average annual rainfall within the watershed. Higher rainfall totals score more positively.



Reach Diversity Rating: Rating is based on the types and amounts of different stream reaches available in the watershed. More area in different reach types score more positively.



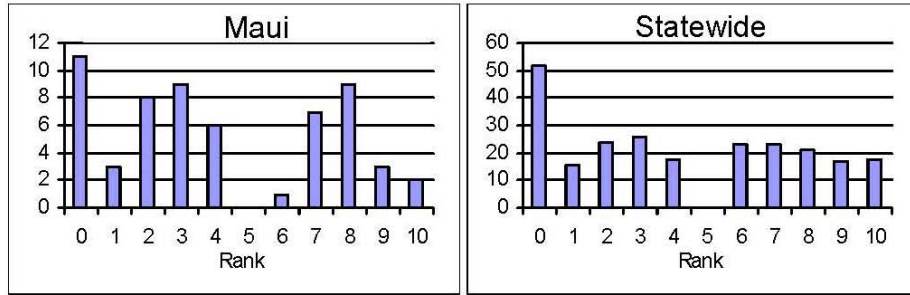
Total Watershed Rating: Rating is based on combination of Land Cover Rating, Shallow Waters Rating, Stewardship Rating, Size Rating, Wetness Rating, and Reach Diversity Rating.



BIOLOGICAL RATING: Kapā'ula Gulch, Maui

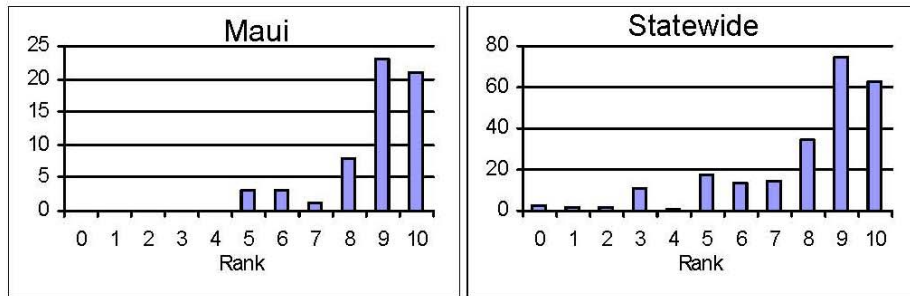
Native Species Rating: Rating is based on the number of native species observed in the watershed.

Stream Rating
NR



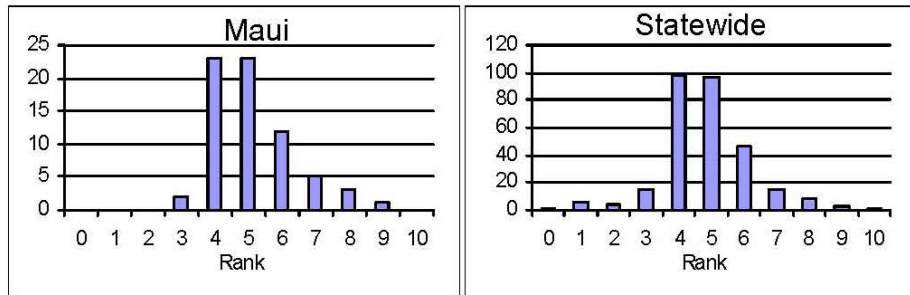
Introduced Genera Rating: Rating is based on the number of introduced genera observed in the watershed.

Stream Rating
NR



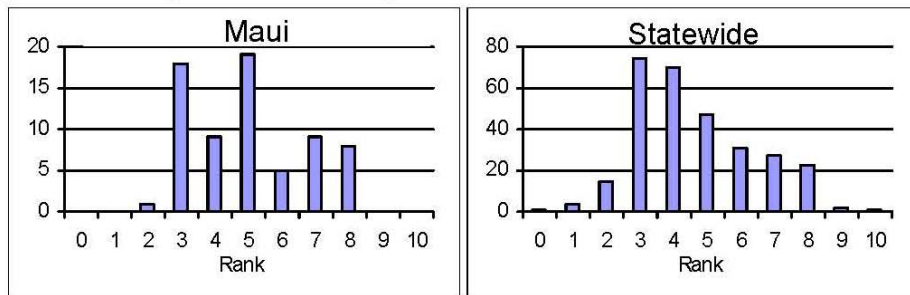
All Species' Score Rating: Rating is based on the Hawaii Stream Assessment scoring system where native species score positively and introduced species score negatively.

Stream Rating
5



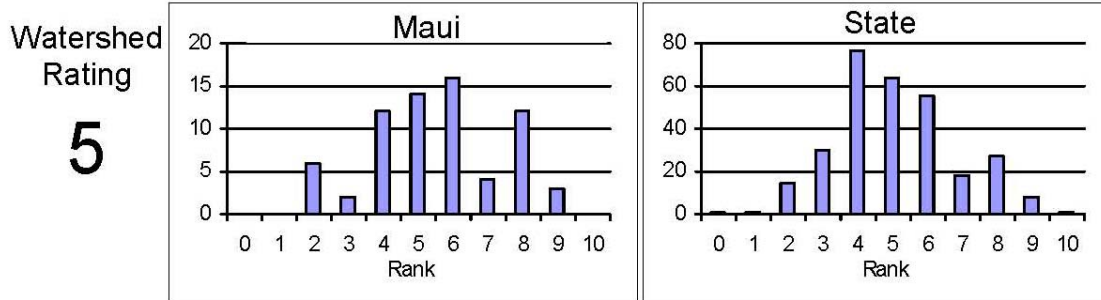
Total Biological Rating: Rating is the combination of the Native Species Rating, Introduced Genera Rating, and the All Species' Score Rating.

Stream Rating
4



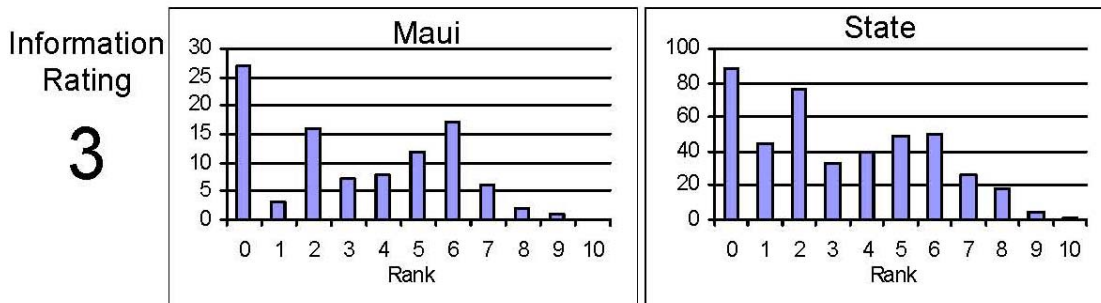
OVERALL RATING: Kapā'ula Gulch, Maui

Overall Rating: Rating is a combination of the Total Watershed Rating and the Total Biological Rating.



RATING STRENGTH: Kapā'ula Gulch, Maui

Rating Strength: Represents an estimate of the overall study effort in the stream and is a combination of the number of studies, number of different reaches surveyed, and the number of different survey types.



REFERENCES

- 1961. Shima, S.I. Limnological Survey for Introduction of Exotic Species of Fish.
- 2005. Gingerich, S.B. and R.H. Wolff. Effects of Surface-Water Diversions on Habitat Availability for Native Macrofauna, Northeast Maui, Hawai'i.
- 2008. Hawai'i Division of Aquatic Resources. DAR Point Quadrat Survey Data from the DAR Aquatic Surveys Database.
- 2008. Hawai'i Division of Aquatic Resources. Rapid Assessment Surveys in DAR Aquatic Surveys Database.

Section 3: DAR Point Quadrat Report for Kapā'ula Gulch, Maui

For Surveys from 2/10/2009 to 2/11/2009

Introduction

This is a report of the Hawai'i Division of Aquatic Resources stream surveys using the Point Quadrat Methodology. Trained biologists and technicians survey a series of randomly located points in a stream to generate an assessment of the species and habitat in the stream. The Point Quadrat Methodology is one of several techniques that could be chosen for the surveys and is used to develop a statistically comparable stream survey. This methodology is a standardized visual survey technique involving snorkeling, and it is well suited for the physical and ecological characteristics of Hawai'i streams. The small, steep, dynamic nature of Hawaiian streams with their unique aquatic species is easily observed with this methodology. The in-stream distribution by elevation, behavior, and amphidromous life cycles are easily observed using this technique.

Methods

The point quadrat methodology requires underwater observation. Sampling was conducted using a dive mask, snorkel and two-piece wet suit with hood and glove. Spiked felt-soled wading boots or Japanese spiked **tabis** are also necessary for easy climbing on the wet, algae-covered rocks. After the initial survey site is chosen all the survey sites upstream are selected randomly to prevent any bias in habitat type selection (e.g., pools and runs) and to obtain a representative sample of all habitat types in the stream. At each site, fish and invertebrate observations are recorded and data is collected on the species present, number, size, and sex. Habitat and substrate type, depth and site dimension data are also collected. Other site observations recorded at each station include GPS coordinates and the following water quality parameters using a Hydrolab Quanta: temperature (° C), salinity (PSS), dissolved oxygen (mg/L), pH, conductivity (mS/cm) and turbidity (NTU). Stream flow measurements are collected using a Marsh McBirney Flo-Mate 2000 at the beginning and ending of each survey as well as at tributaries and diversions.

The watersheds (and watershed ID), region, and island surveyed in this report are:

Kapā'ula Gulch (ID: 64021), Ke'anae, Maui

Surveys were conducted by these personnel:

Hau, Skippy
Kuamo'o, Darrell
Shimoda, Troy

Results

Table 3-1. The distribution of sites by reach during this survey effort.

Reach	Total number of surveys
Estuary	0
Lower	0
Middle	0
Upper	8
Headwaters	0
Unknown	0

Upper Reach

Table 3-2. Number of Habitat Types surveyed in the upper stream reach.

Reach	Total Habitats Surveyed	Plunge Pool	Cascade	Riffle	Run	Pool	Side Pool	No Water	Dirty Water	Unknown
Upper	7	1	0	2	2	1	0	1	0	0

Table 3-3. Observed Substrates (%) in point quadrat samples in the upper stream reach.

Reach	Detritus	Sediment	Sand	Gravel	Cobble	Boulder	Bedrock
Upper	0	0	0	4	13	5	78

Table 3-4. Observed Water Quality in point quadrat samples in the upper stream reach.

Reach	Temp (° C)	sCond (mS/cm)	DO (mg/L)	pH
Upper	18.525	0.046	1347.	7.083

Table 3-5. Summary of species observed in the upper reach of the watershed.

<u>Category</u>	<u>Status</u>	<u>Scientific Name</u>
Crustacean	Endemic	<i>Atyoida bisulcata</i>
Insect	Endemic	<i>Megalagrion sp.</i>

Table 3-6. Average Density and Total number of animals observed in the upper stream reach. Density values are calculated only for random sites, not non-random or outside sites, greater than 6 by 6 inches. Density values are in number of animals per square yard.

<u>Category</u>	<u>Status</u>	<u>Scientific Name</u>	<u>Reach</u>	<u>Avg. Density</u>	<u>Total # observed</u>
Crustaceans	Endemic	<i>Atyoida bisulcata</i>	Upper	10.37	29
Insects	Endemic	<i>Megalagrion sp.</i>	Upper	0.36	1

Table 3-7. Flow data taken during point quadrat surveys in the upper reach.

Latitude	Longitude	Total CFS	MGD
20.80955	-156.11530	1.32	0.85
20.80752	-156.11748	0.63	0.41

Table 3-8. Locations of the diversions found within the upper reach and their corresponding tributary.

Latitude	Longitude	Tributary
20.81005	-156.11531	64021001
20.80955	-156.11530	64021001

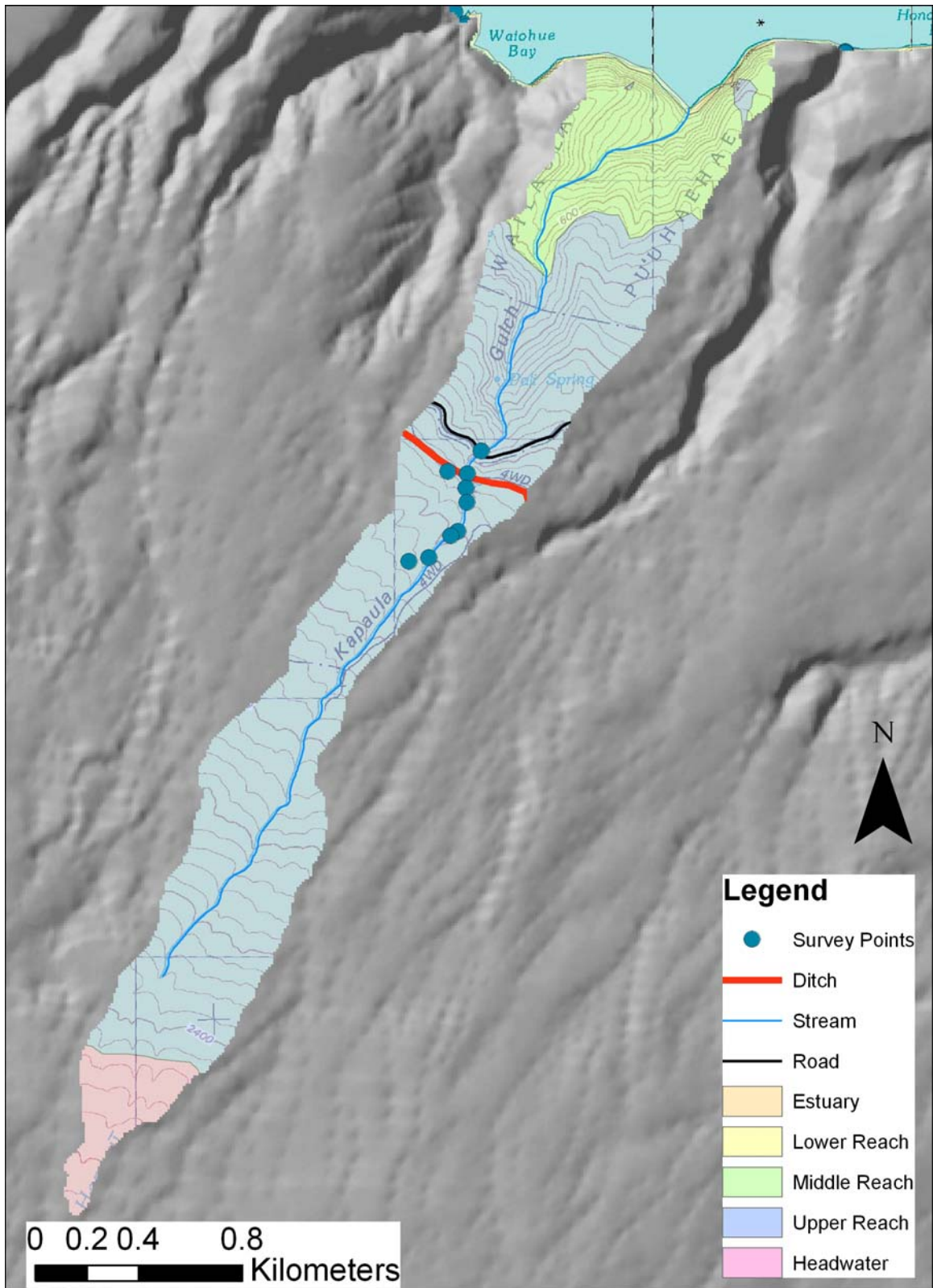


Figure 3-1. Locations of point quadrat surveys conducted in Kapā'ula Gulch.

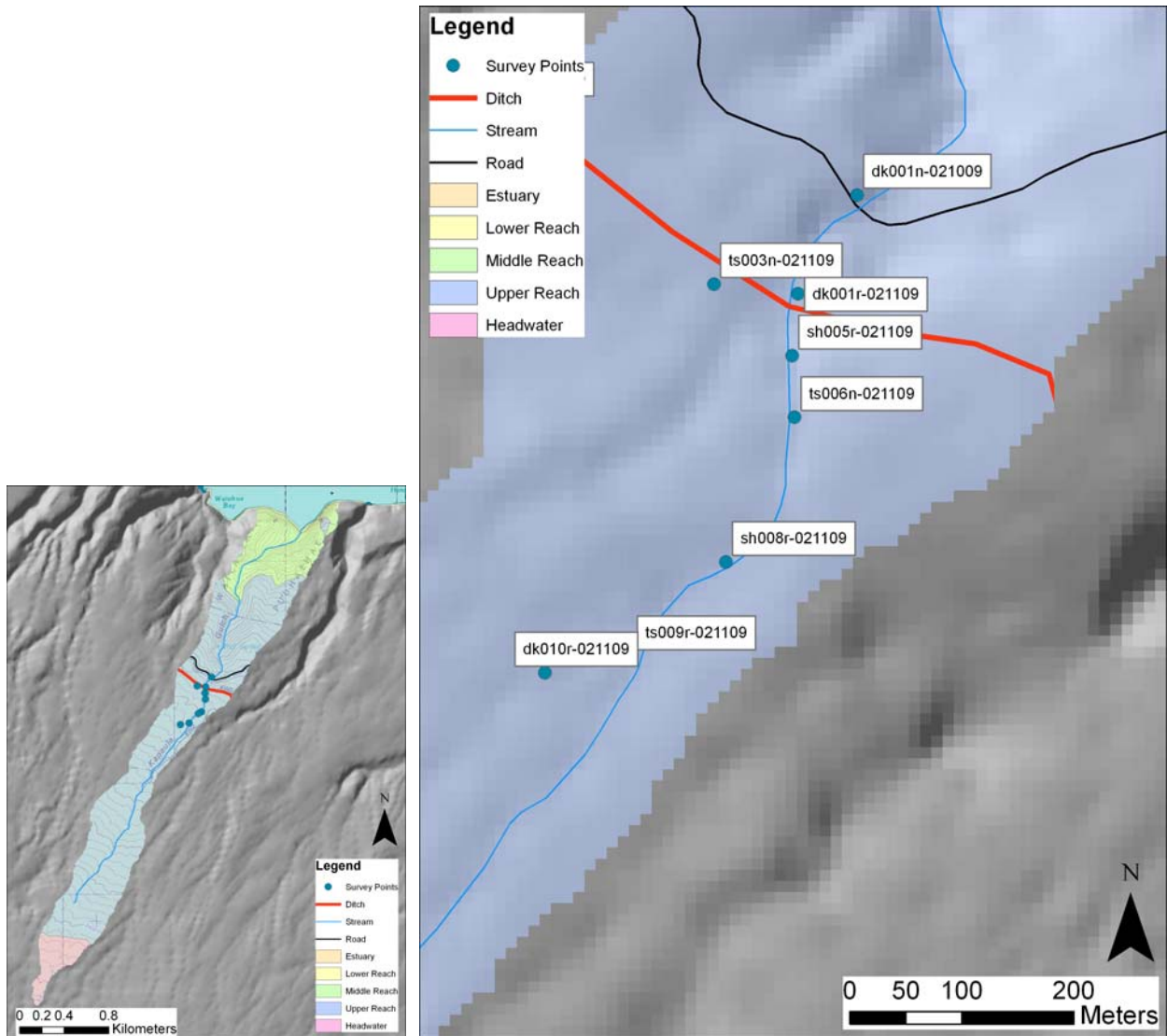


Figure 3-2. Locations of surveys conducted in the upper reach of Kapā'ula Gulch.

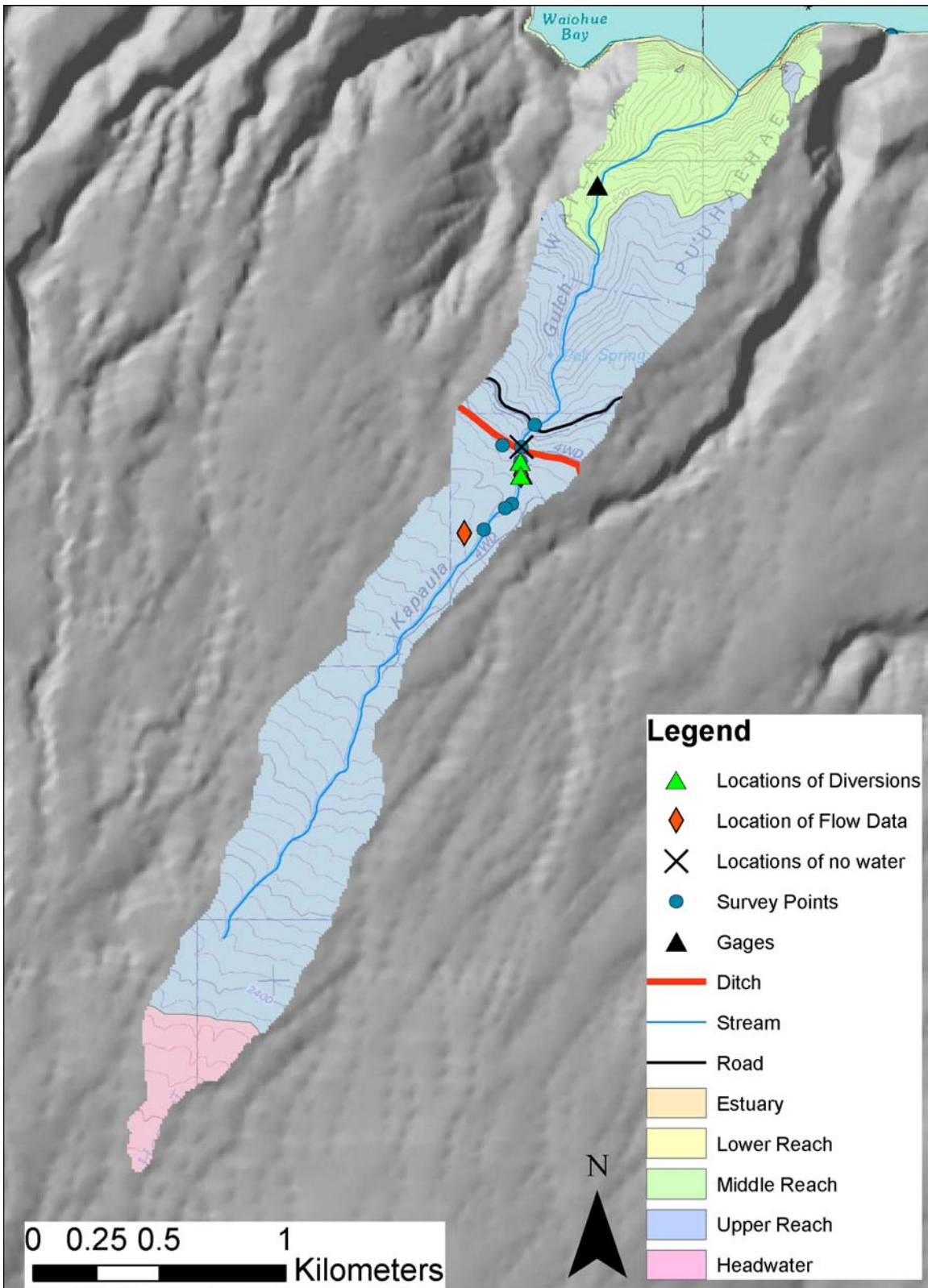


Figure 3-3. Location of flow measurements, diversions, and no water conditions observed in Kapā'ula Gulch.

Section 4: Photographs taken during stream surveys

Upper Reach

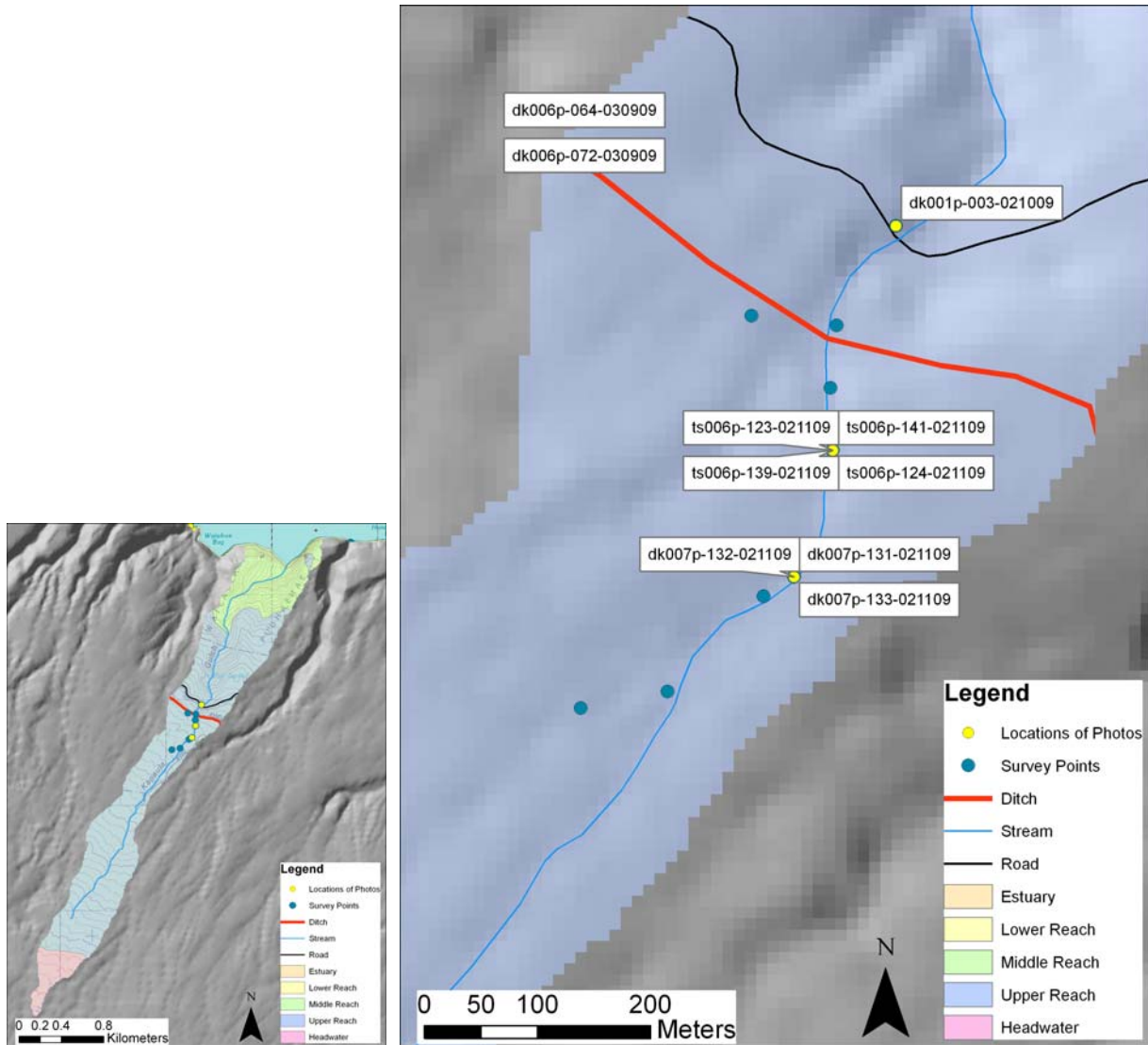


Figure 4-1. Photo locations in the upper reach of Kapā'ula Gulch.

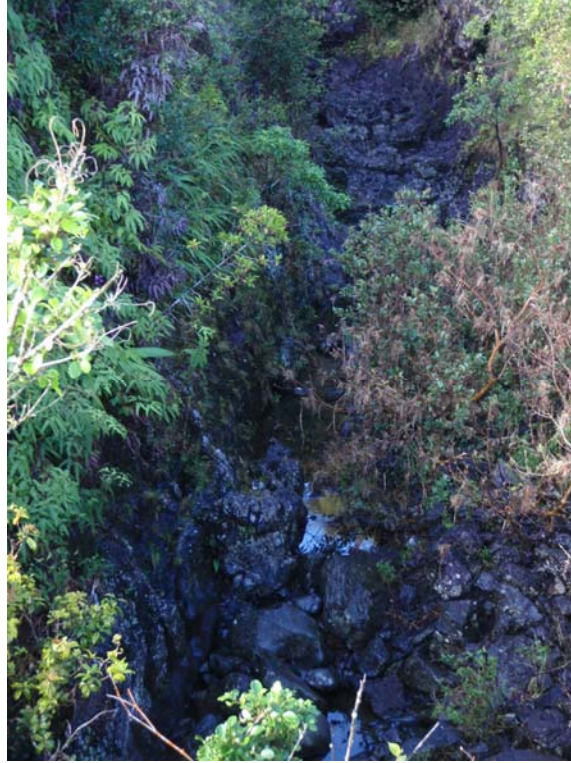


Figure 4-2. Dry stream bed with rain-fed pools in Kapā'ula Gulch just below site 1. (2/10/2009; Tributary name: Kapā'ula(64021001); PBN: dk001p-003-021009; Surveyor: Kuamo'o, D.; SBN: dk001n-021009; Lat.(DD): 20.81134, Long.(DD): -156.11473).



Figure 4-3. Concrete weir next to survey site 6. Photo is taken in the upstream direction. (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: ts006p-123-021109; Surveyor: Shimoda, T.; Habitat type: Riffle; SBN: ts006n-021109; Lat. (DD): 20.80955, Long. (DD): -156.11530).



Figure 4-4. Photo is looking upstream towards the survey site 6 and the diversion. (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: ts006p-124-021109; Surveyor: Shimoda, T.; Habitat type: Riffle; SBN: ts006n-021109; Lat. (DD): 20.80955, Long. (DD): -156.11530).



Figure 4-5. Photo is taken looking upstream towards the diversion and survey site 6. (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: ts006p-141-021109; Surveyor: Shimoda, T.; Habitat type: Riffle; SBN: ts006n-021109; Lat. (DD): 20.80955, Long. (DD): -156.11530).



Figure 4-6. A pool in a dry stream bed downstream of concrete weir and westward of site 6 in Kapā'ula Gulchi. (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: ts006p-139-021109; Surveyor: Shimoda, T.; Habitat type: Riffle; SBN: ts006n-021109; Lat. (DD): 20.80955, Long. (DD): -156.11530).



Figure 4-7. Photo is taken upstream from survey site 6 and the diversion. (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: ts006p-128-021109; Surveyor: Shimoda, T.; Habitat type: Riffle; SBN: ts006n-021109; Lat. (DD): 20.80955, Long. (DD): -156.11530).



Figure 4-8. DAR staff conducting survey at site 7 (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: dk007p-132-021109; Surveyor: Kuamo'o, D.; Habitat type: Run; SBN: dk007r-021109; Lat. (DD): 20.80854, Long. (DD): -156.11565).



Figure 4-9. Photo taken above survey site 7 in an upstream direction. (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: dk007p-131-021109; Surveyor: Kuamo'o, D.; Habitat type: Run; SBN: dk007r-021109; Lat. (DD): 20.80854, Long. (DD): -156.11565).



Figure 4-10. Photo of a pool taken downstream at site 7 in upper reach above the diversion. (2/11/2009; Tributary name: Kapā'ula (64021001); PBN: dk007p-133-021109; Surveyor: Kuamo'o, D.; Habitat type: Run; SBN: dk007r-021109; Lat. (DD): 20.80854, Long. (DD): -156.11565).

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Appendix: Survey Sites Latitude and Longitude

Tributary	Stream	Survey Book #	Site	Surveyor	Date	Latitude	Longitude
64021001	Kapā'ula	dk001n-021009	1	Kuamo'o, Darrell	2/10/2009	20.81134	-156.11473
64021001	Kapā'ula	dk001r-021109	1	Kuamo'o, Darrell	2/11/2009	20.81055	-156.11525
64021001	Kapā'ula	sh005r-021109	5	Hau, Skippy	2/11/2009	20.81005	-156.11531
64021001	Kapā'ula	ts006n-021109	6	Shimoda, Troy	2/11/2009	20.80955	-156.11530
64021001	Kapā'ula	dk007r-021109	7	Kuamo'o, Darrell	2/11/2009	20.80854	-156.11565
64021001	Kapā'ula	sh008r-021109	8	Hau, Skippy	2/11/2009	20.80839	-156.11591
64021001	Kapā'ula	ts009r-021109	9	Shimoda, Troy	2/11/2009	20.80764	-156.11674
64021001	Kapā'ula	dk010r-021109	10	Kuamo'o, Darrell	2/11/2009	20.80752	-156.11748

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