



Townscape Inc.

Ala Wai Watershed Restoration



*ALA WAI WATERSHED RESTORATION
OCEANIT
Dayananda Vithanage P.E. PhD*

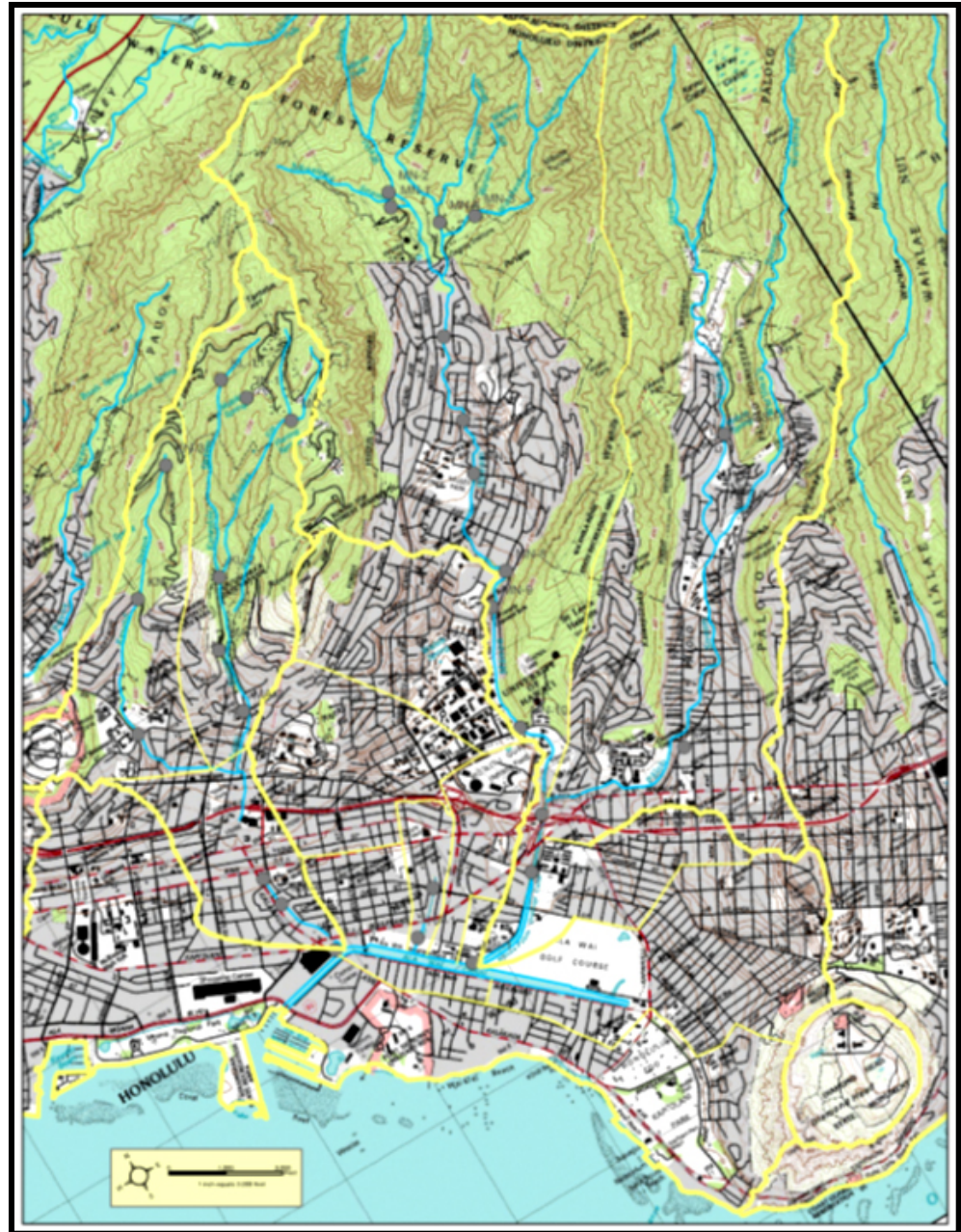
PROJECT AREA

Ala Wai Watershed

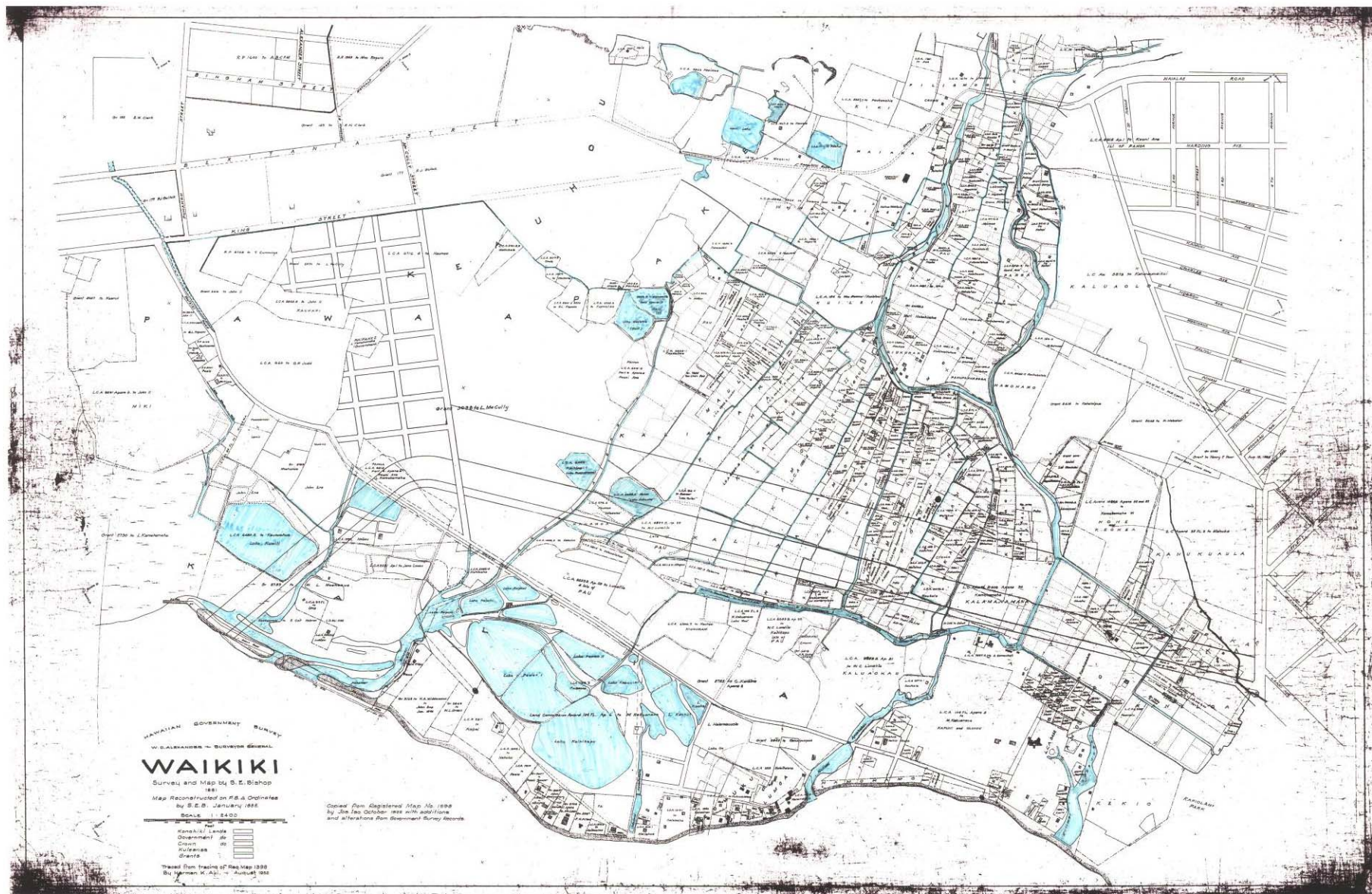
- Makiki
- Mānoa
- Pālolo
- Houston Ditch
- Waikīkī
- Kapahulu
- McCully
- Mo'ili'ili



Ala Wai Watershed Today







ALA WAI WATERSHED 1881

Bishop 1881 Map at Half Size

1 inch equals 400 feet

0 400 800 1,200 1,600 Feet



DEVELOPMENT PRESSURE ON STREAM AND FLOOD PLAIN

- **ALTER PATH OF THE NATURAL STREAMS**
- **STREAM OWNERSHIP: MAINTENANCE PROBLEMS**
- **BRIDGES AND OTHER FLOW RESTRICTIONS**
- **INCREASING RUNOFF (ROADS, PAVING, ROOFS)**
- **DRAINAGE SYSTEMS, LINED CHANNELS**
- **DISRUPT NATURAL STREAM AND GROUND WATER EXCHANGE**
- **LARGE VARIATIONS IN STREAM FLOW**
- **ECOLOGICAL IMPACTS**

DEVELOPMENT PRESSURES CONTINUED

- **REMOVAL OF SHADE**
- **HEATING DURING LOW FLOW CONDITIONS**
- **ALIEN SPECIES INTRODUCTION**
- **POLLUTION AND WATER QUALITY**
- **FLORA AND FAUNA CHANGES**
- **DISRUPTING NATURAL LIFE CYCLES**

An aerial photograph of a city, likely Honolulu, Hawaii, showing a river (the Kalihi River) flowing through the urban landscape. The river is surrounded by green spaces, parks, and residential areas. In the background, the city extends to the coast, with the Pacific Ocean and a prominent mountain (Diamond Head) visible under a clear sky. The text 'PROJECT OBJECTIVES' is overlaid on the upper part of the image.

PROJECT OBJECTIVES

- Stream and Riparian Area Ecological Restoration
- Restore Habitat for Native Aquatic Species
- Remove Barriers to Migration and Spawning
- Stabilize Streams to Improve Habitats

An aerial photograph of a city, likely Honolulu, Hawaii, showing a river (Kalia Stream) flowing through the urban landscape. The city is densely packed with high-rise buildings, and a large mountain (Diamond Head) is visible in the background under a clear blue sky. The text of the presentation is overlaid on this image.

PROJECT APPROACH

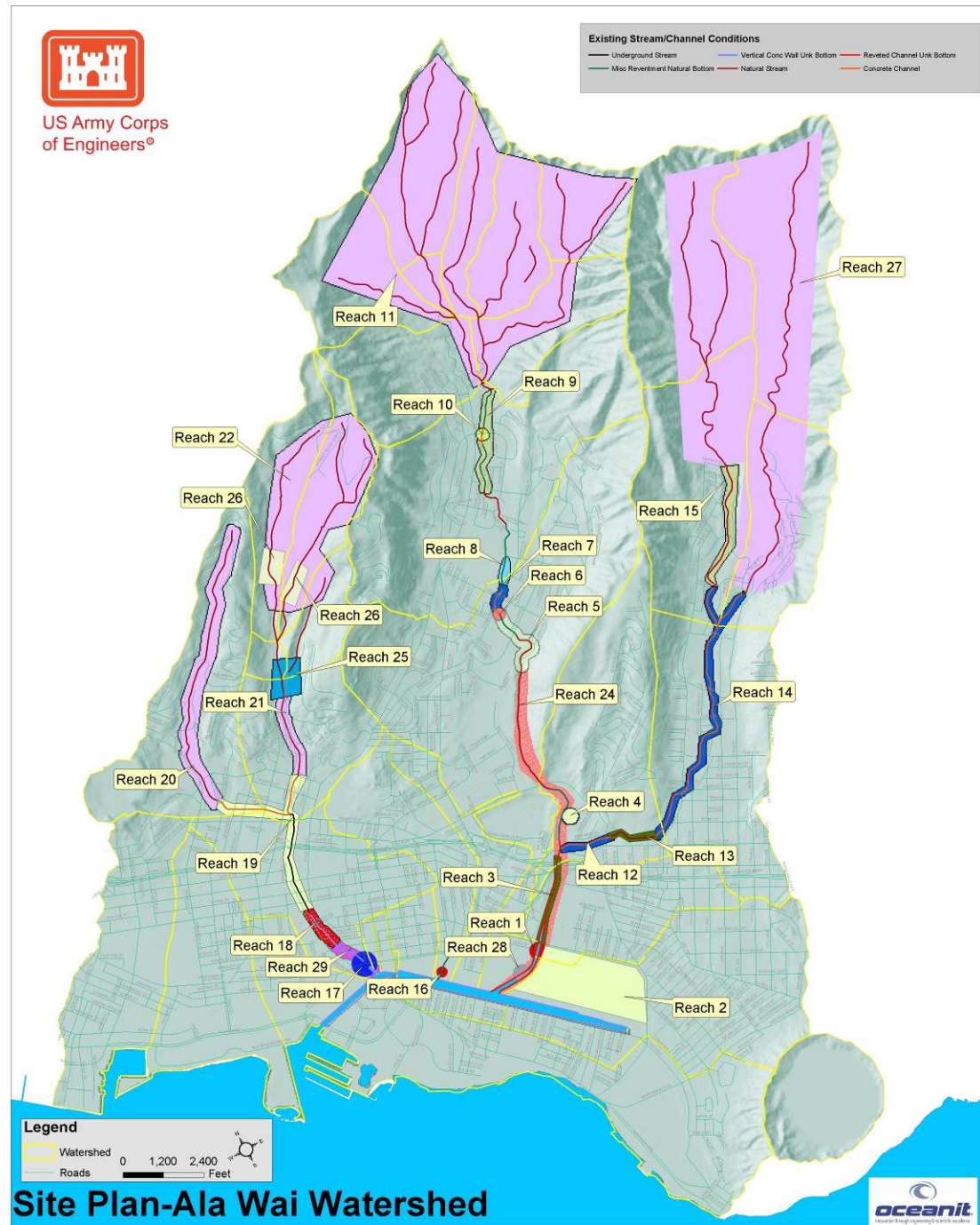
- Conduct Historical Research
- Define the Status of the Existing Environment
 - Botanical Survey
 - Stream Fauna Survey
 - Physical Stream Attributes
- Prioritize List of Problems
- Develop List of Potential Solutions for

ECOLOGICAL RESTORATION

*Ala Wai
Watershed
Survey Site
Locations*



Ala Wai Watershed Restoration Project Site Locations



PROBLEMS OBSERVED STREAM GEOMETRY

- Insufficient Sinuosity
- Eroded Stream Banks
- Eroded Stream Bed
- Concrete Lined Channels
- Heavily Silted Stream Bed

FAUNAL PROBLEMS

- Insufficient Resting and Hiding Places
- Insufficient Shade
- Trash in Stream bed
- Invasive Species (Tilapia, Armored Cat Fish, Mosquito Fish, etc.)
- Lack of Habitat (Riffle and Pool)
- High water Temperature

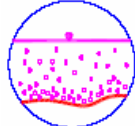
Other Issues

- Sediment Generation (Pig Wallows etc.)
- Invasive Vegetation
- Too Dense Tree Cover
- Stream Diversions, Pipe Crossings, Walls
- Heavy Bank Vegetation
- Mangrove Overgrowth
- Algae in Stream Bed

STREAM ECOSYSTEM RESTORATION METHODS



Trash Collectors



Sediment Interceptor



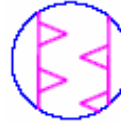
Constructed Wetland



Low-flow channel



Stabilize Stream Bank



Energy Dissipator



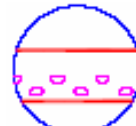
Boulder Check Dam



Added Instream Habitat



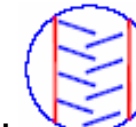
Trail Cleanup



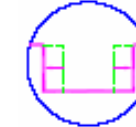
Concrete Habitat Structure



Daylight Stream Section



Fish Ladder



Widen Channel



Bike / Maint. Pathway



Plant Shade Trees



Detention basin



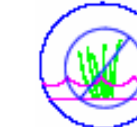
Reduce Pig Population



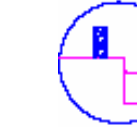
Remove Mangroves



Reduce Tree cover



Clear Vegetation

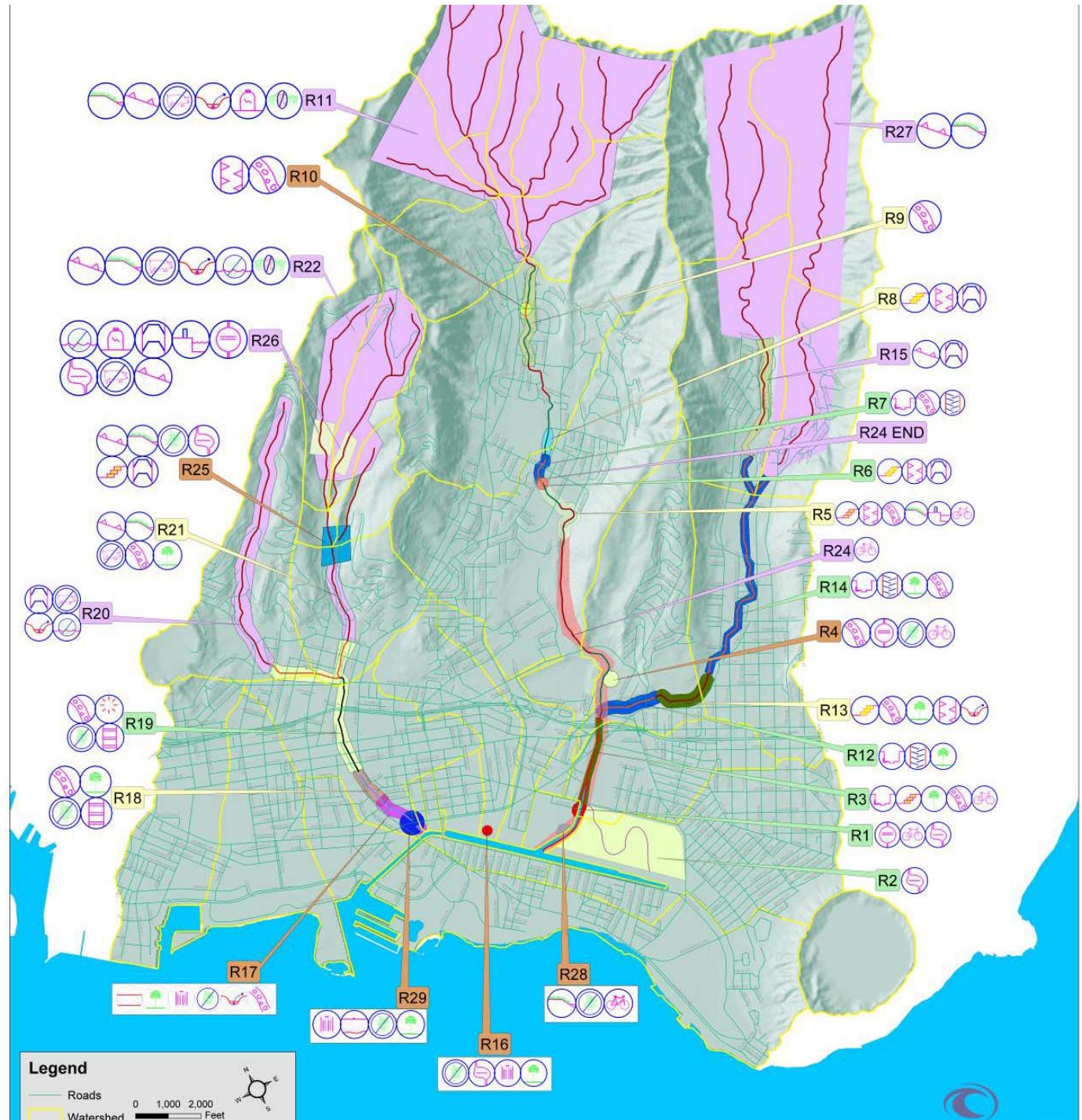


Add floodwalls

Matrix of Potential Solutions

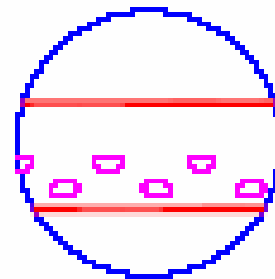
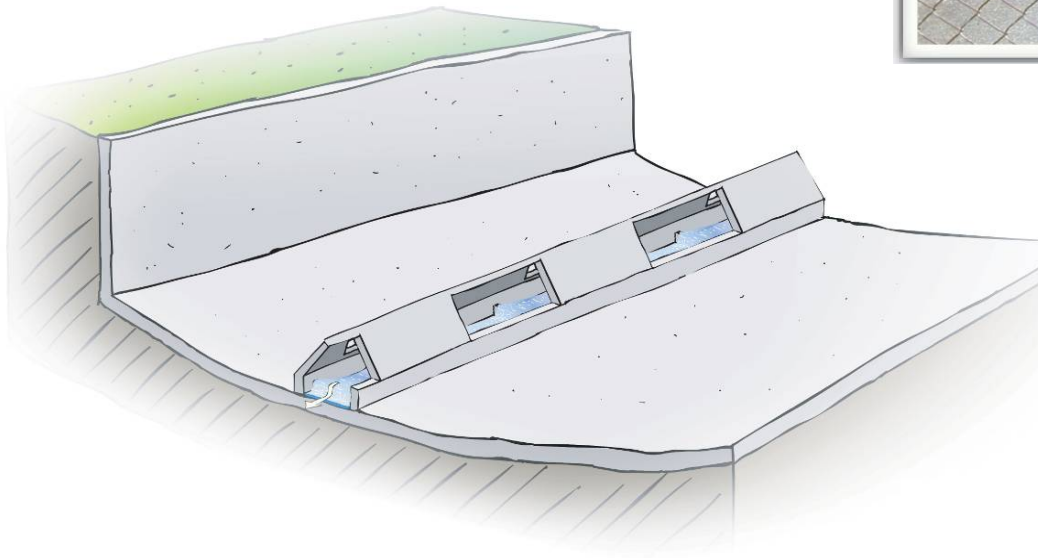
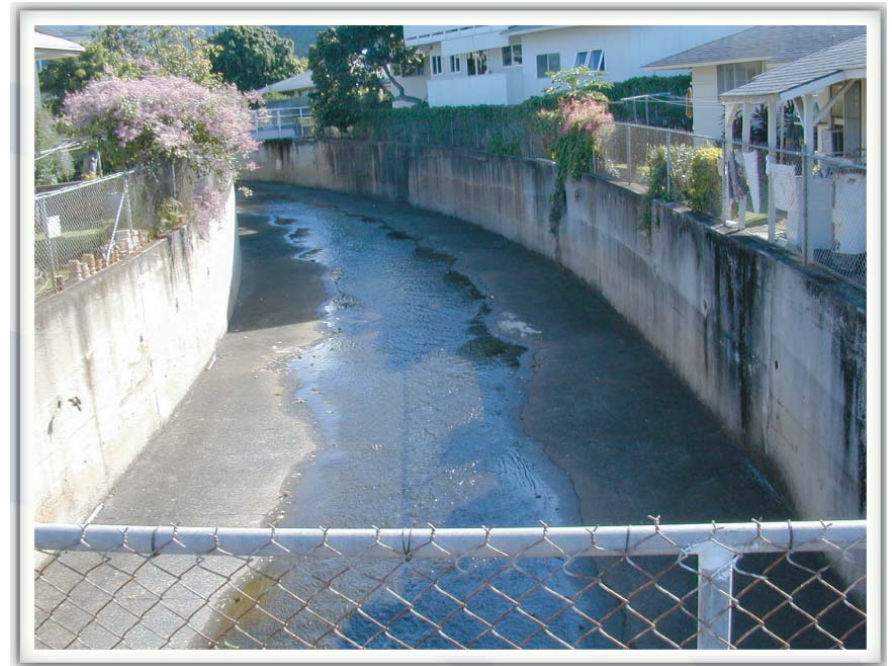
by

Stream Reach

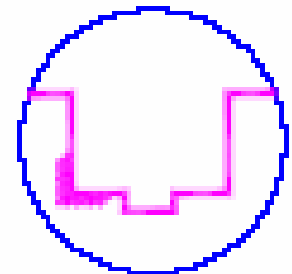


Upper Palolo Channel

Reach 14



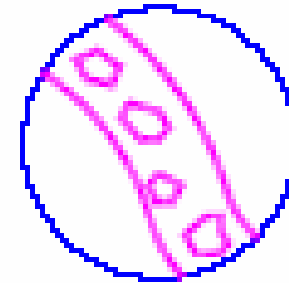
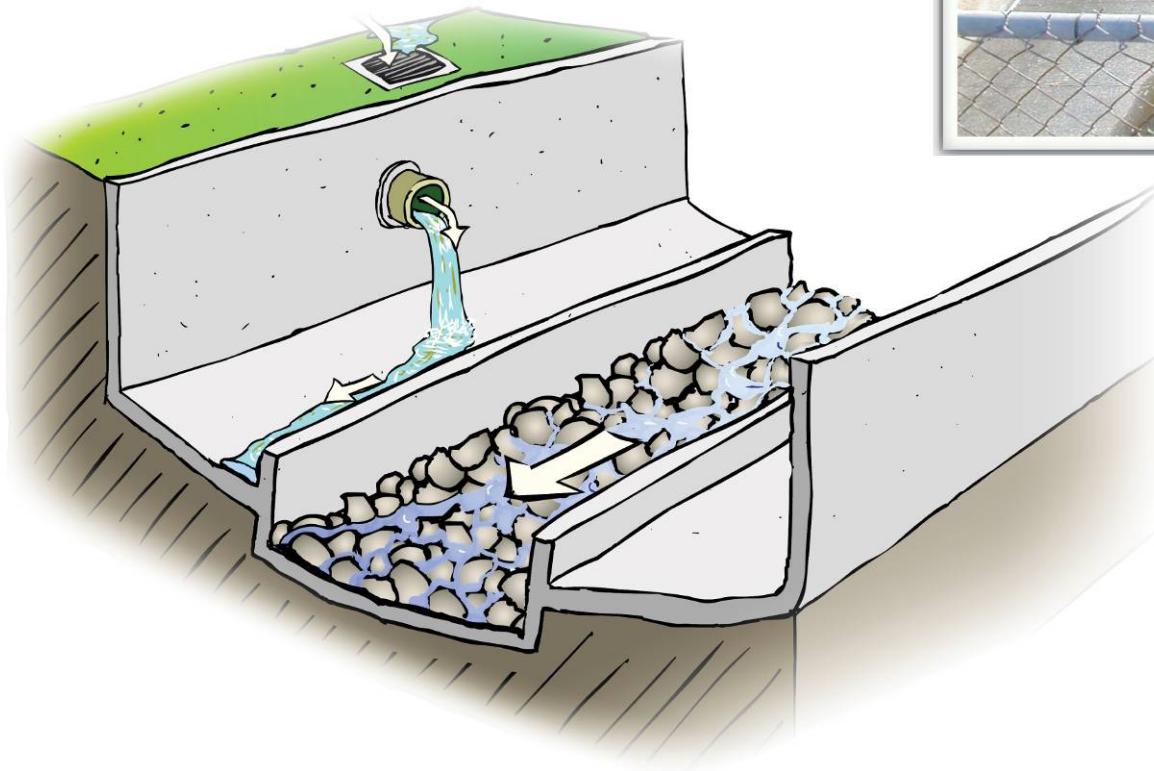
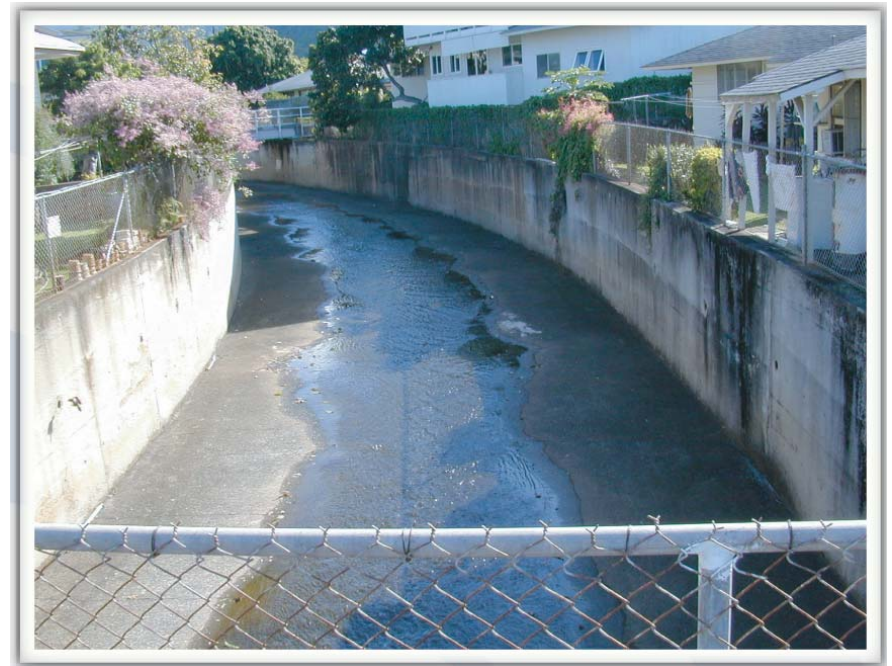
VERTICAL CONCRETE PANELS
FOR HABITAT



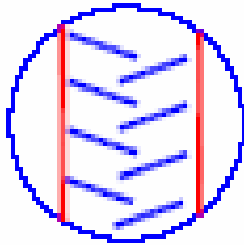
LOW FLOW CHANNEL

Upper Palolo Channel

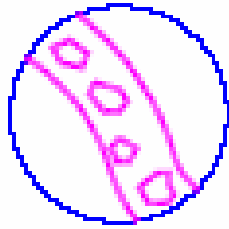
Reach 14



ALUMINUM IN-STREAM
WATERWAY



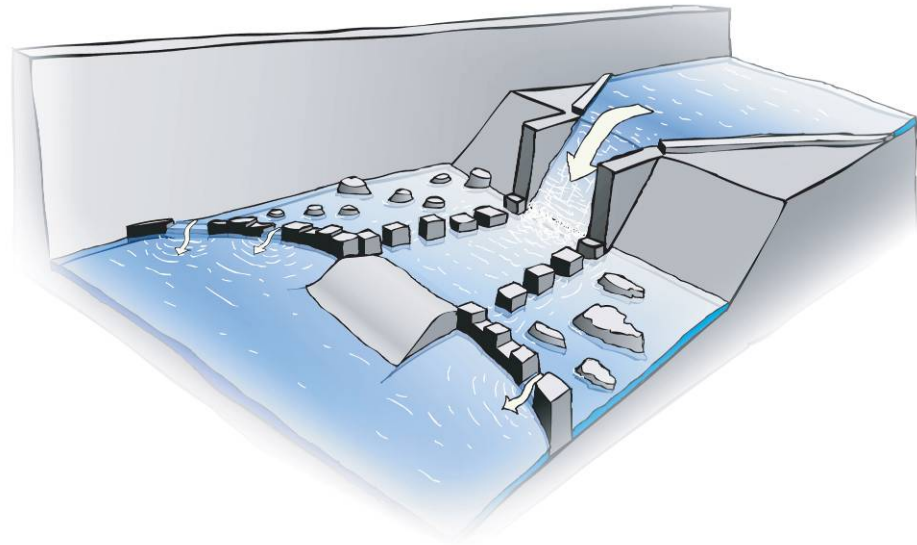
FISH LADDER



ARTIFICIAL IN-STREAM
HABITAT

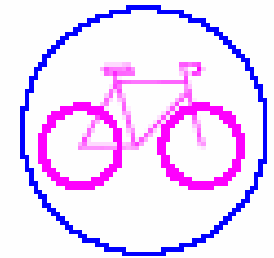
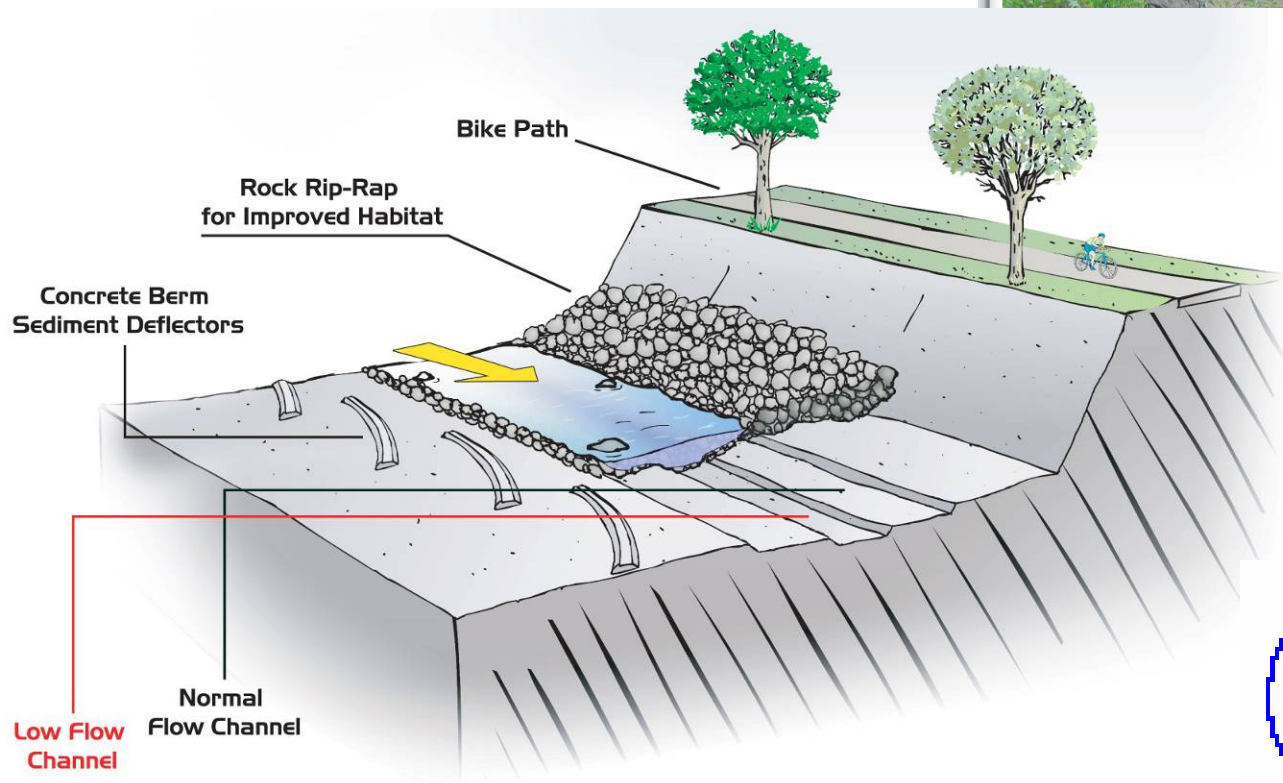
Concrete Channel

Fish Ladder

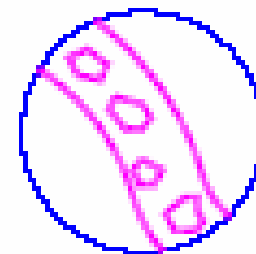


Manoa Palolo Channel

Reach 3

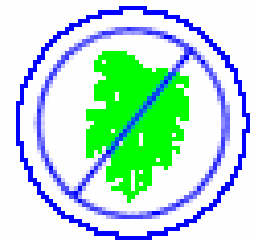
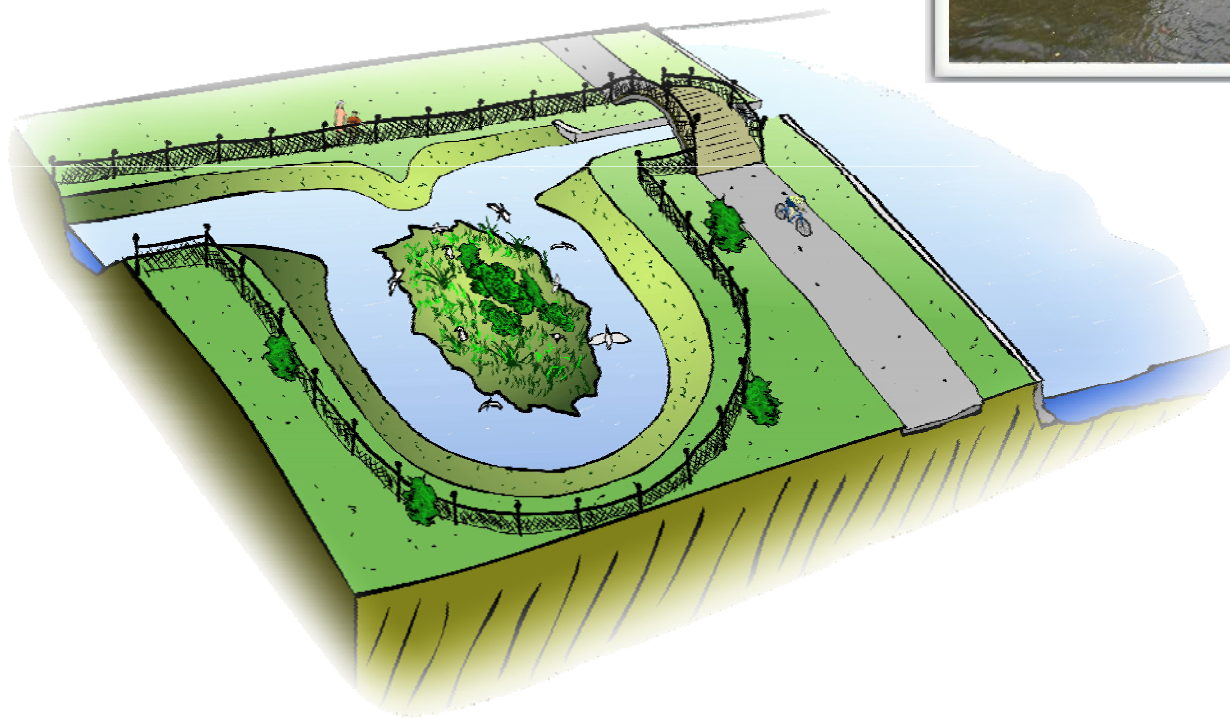
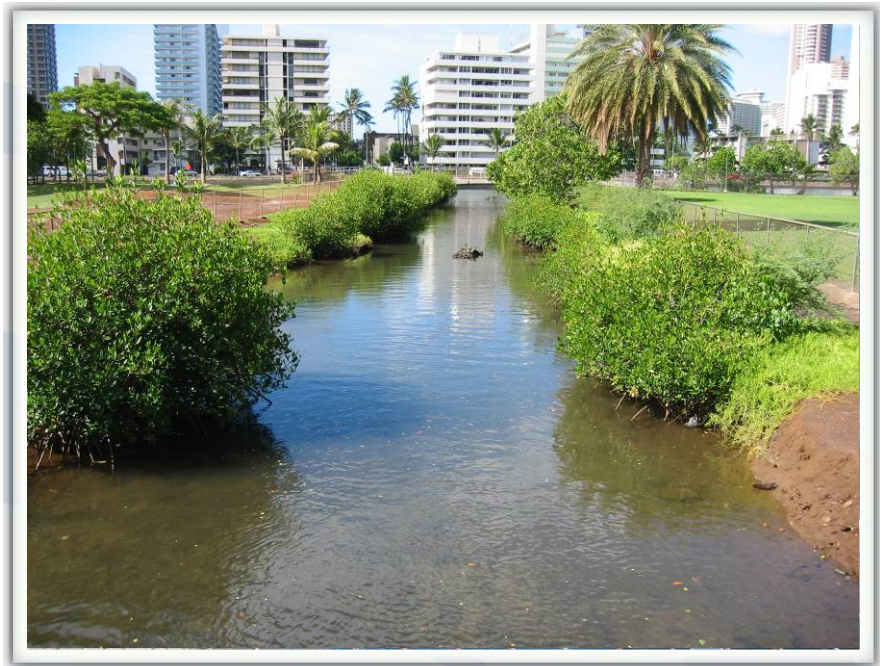


BIKE/ALUMINUM PATH

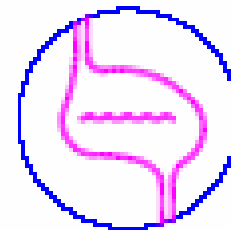


ALUMINUM IN-STREAM
HABITAT

Hausten Ditch

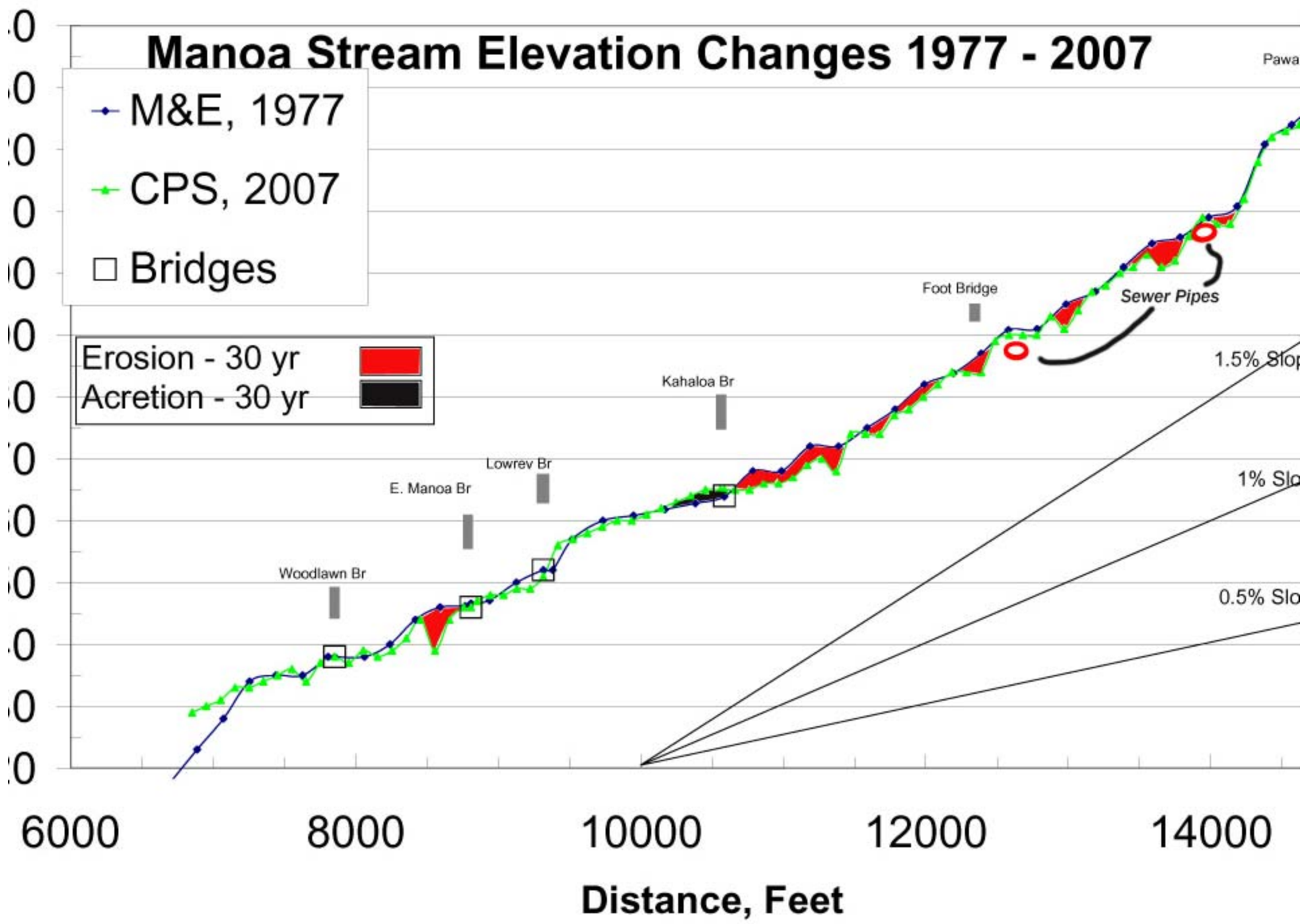


RESTRICTED MANICURING/
HIGH-MAINTENANCE



WETLAND









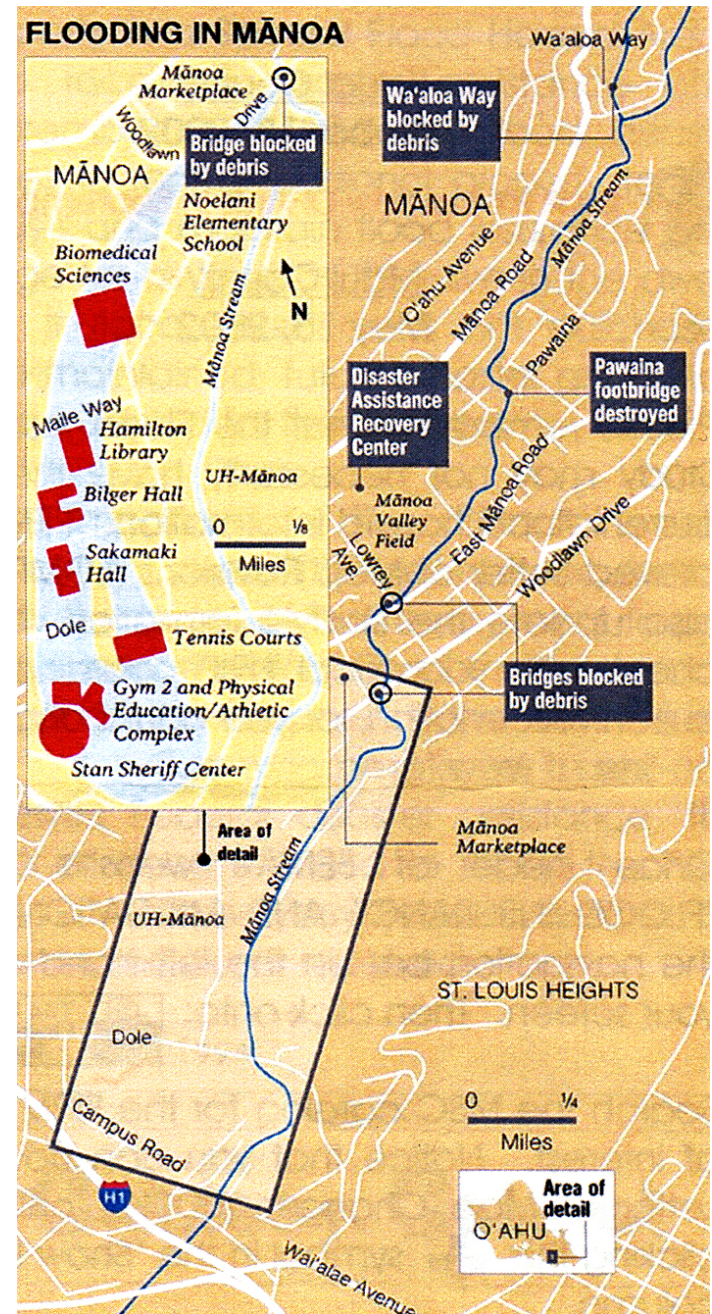








Ala Wai Stream Flooding on October 30, 2004



Cars Moved by Flood Waters





Tree Brought Down by Scour



Tree Brought with Stream Flow



Foot Bridge Destroyed by Flood



Erosion of Back of Wall by Overtopping Water



Trash Collected in Ala Wai Boat Harbor





All Pau...