

Streamflow availability during low-flow conditions, Southeast Kauaʻi

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Goals

1. Quantify surface-water availability for selected stream locations

- Natural (unregulated) flow
- Express as flows below the median flow (Q_{50} flow)

2. Quantify the magnitude of GW/SW interaction at selected stream reaches

- Conduct seepage runs to determine streamflow gains and losses
- Determine whether streams support mauka to makai flow

Instream flow standard (IFS)

Off-stream uses

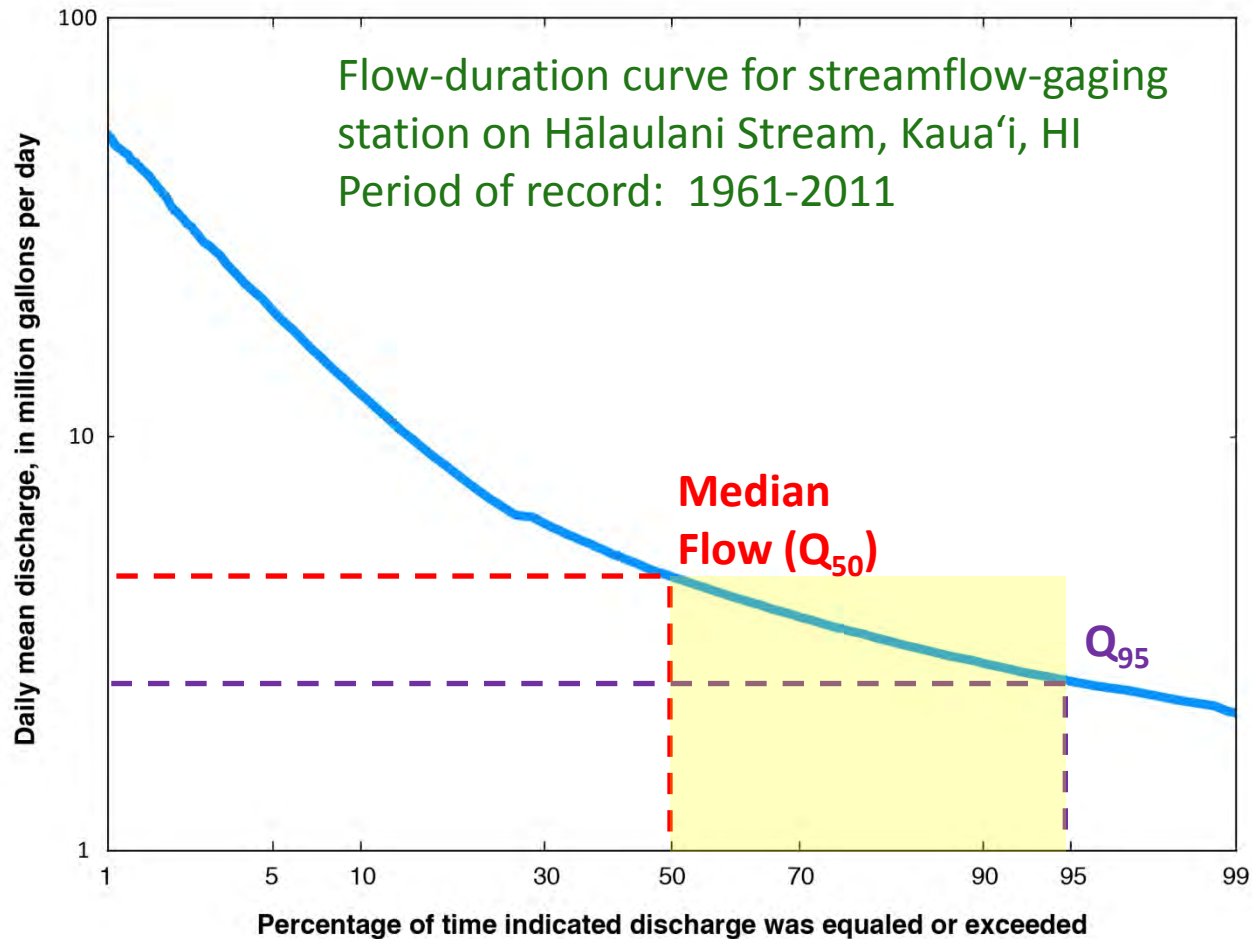
- Domestic water supply
- Agricultural use
- Municipal use

Instream uses

- Traditional Hawaiian practices
- Conveyance of water supplies
- Fish and wildlife habitat
- Ecosystem maintenance
- Recreation
- Aesthetics
- Water quality

Surface-water availability

Water availability is oftentimes characterized with duration discharges



Measurement sites used in low-flow studies

CONTINUOUS RECORD

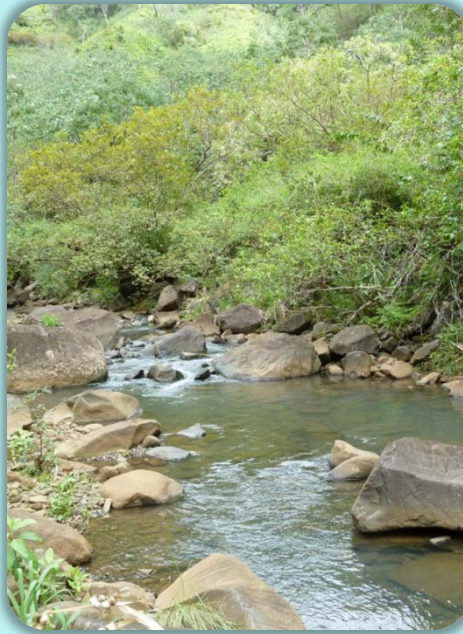
Provides continuous record of discharge at a particular location



NF Wailua River, Kaua'i

PARTIAL RECORD

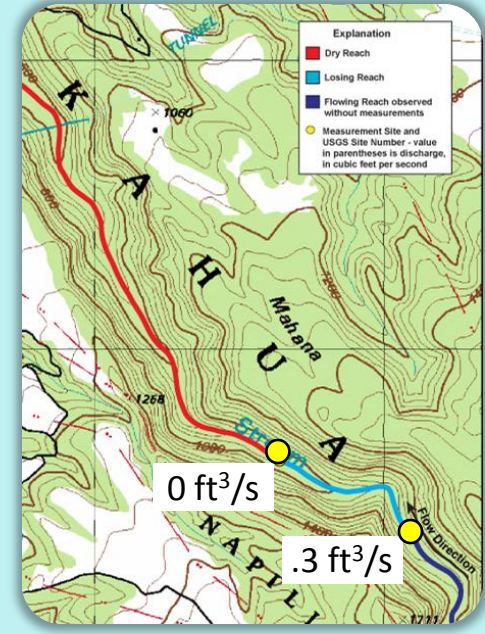
Discharge measurements made repeatedly at a particular location during low-flow periods



Anahola Stream, Kaua'i

SEEPAGE RUN

Nearly concurrent discharge measurements made at several locations along a stream



Honokahua Stream, Maui

Study objectives

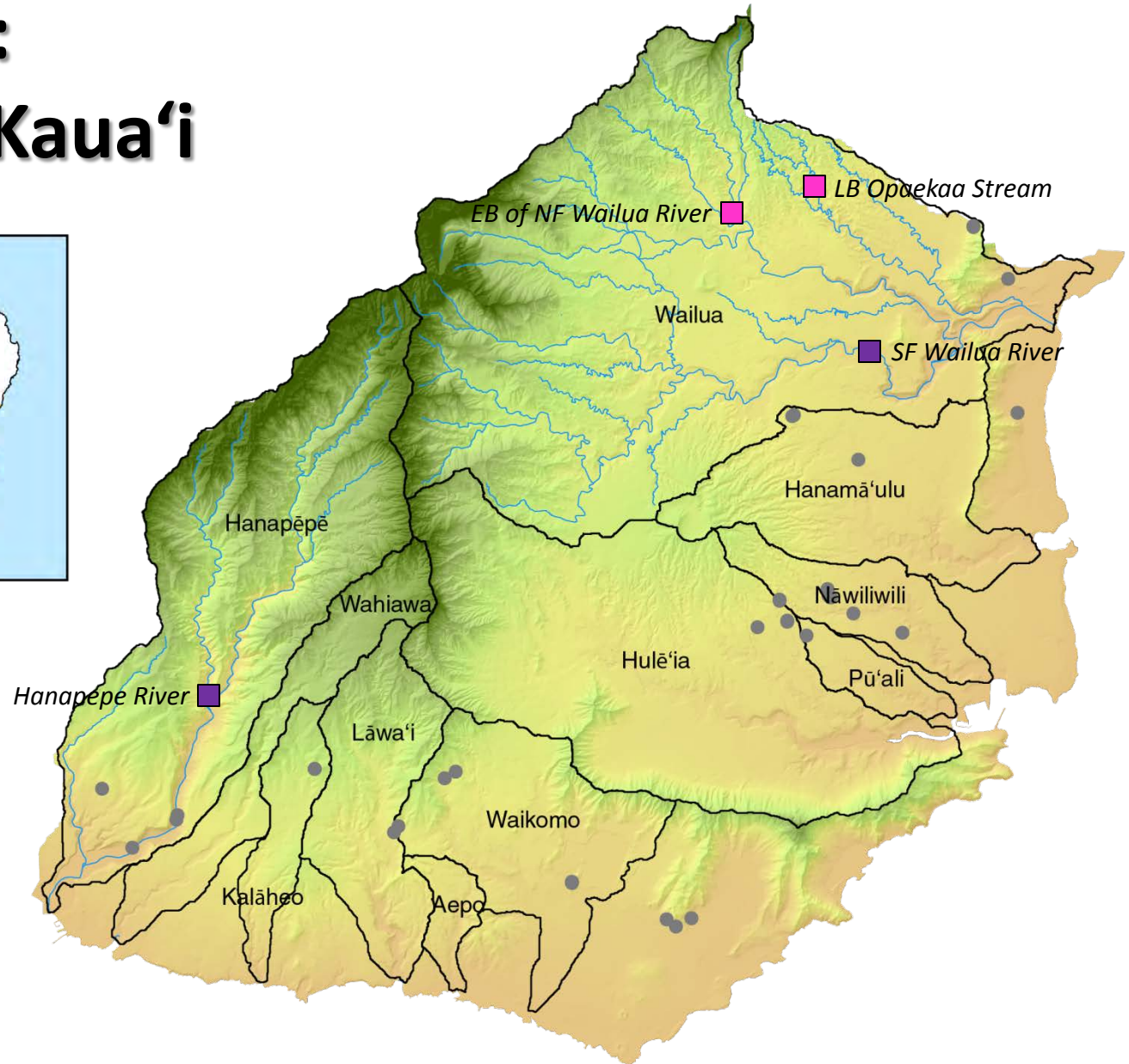
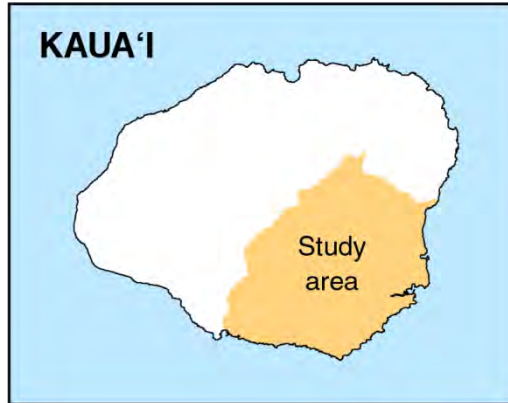
Quantify streamflow characteristics above existing diversions

Quantify streamflow gains and losses along the main stream channel



Hanapēpē River, Kauaʻi

Study area: Southeast Kaua'i



● Municipal wells

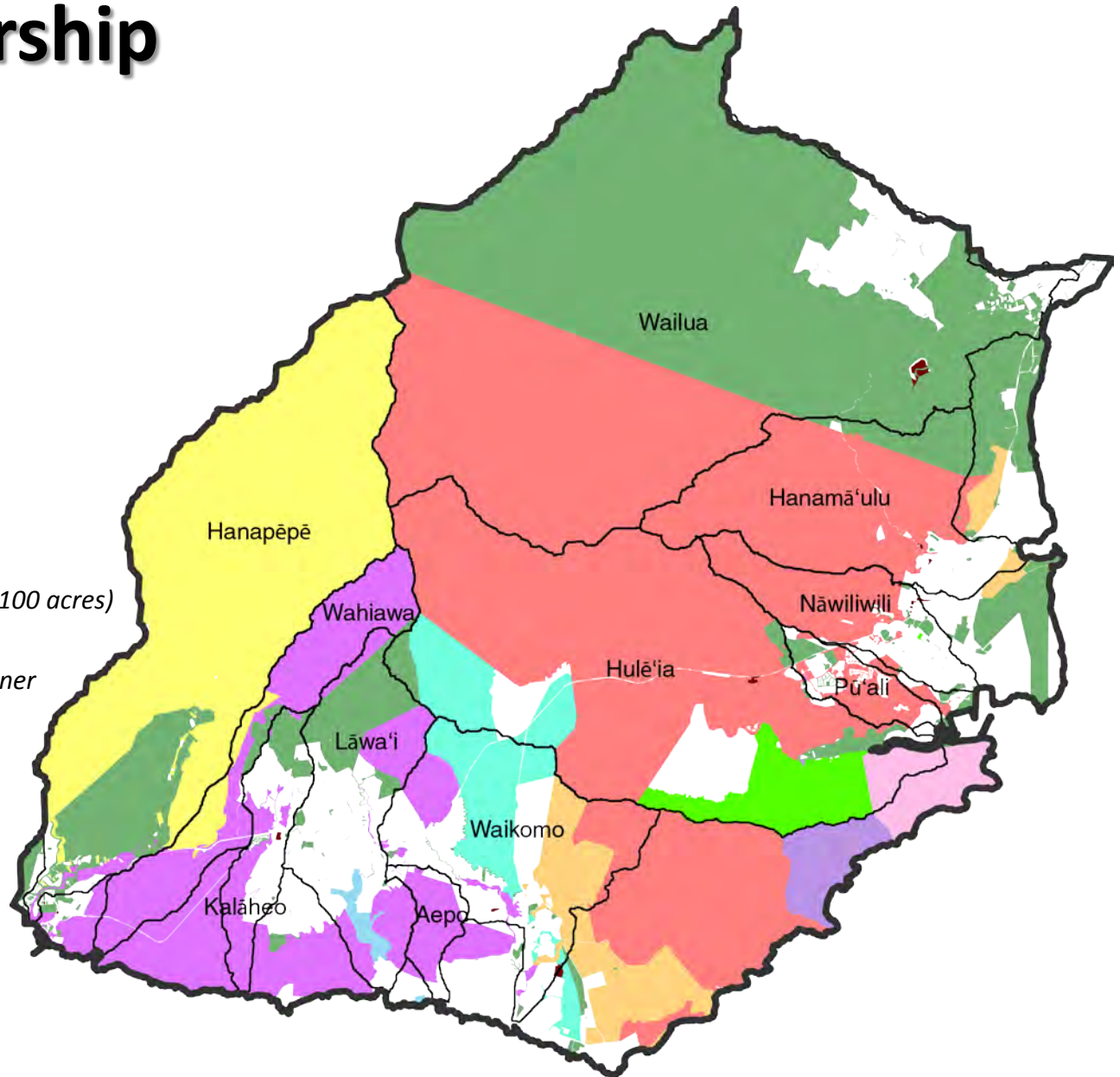
USGS streamflow-gaging station
currently in operation

■ Natural flow

■ Regulated flow

Land ownership

- Government
 - Grove Farm
 - Robinson Family
 - Alexander & Baldwin
 - E.A. Knudsen Trust
 - Visionary LLC
 - W.H. Rice
 - D.R. Campion
 - Share No.1
 - Nat'l Trop. Bot. Garden
 - Small private landowners (< 100 acres)
- White areas indicate landowner information unavailable



Study approach: Objective 1

Step 1: Collect data

Establish low-flow partial-record stations and measure discharge during independent low-flow periods



Step 2: Select index station

Identify the continuous-record station with discharge that best correlates with concurrent discharge at each low-flow partial-record station



Step 3: Compute low-flow characteristics

Estimate duration discharges at low-flow partial-record stations using streamflow data from index station

Collect Data

Establish low-flow partial-record sites

Measurement sites are mainly upstream from diversions

Measure flow during low-flow periods

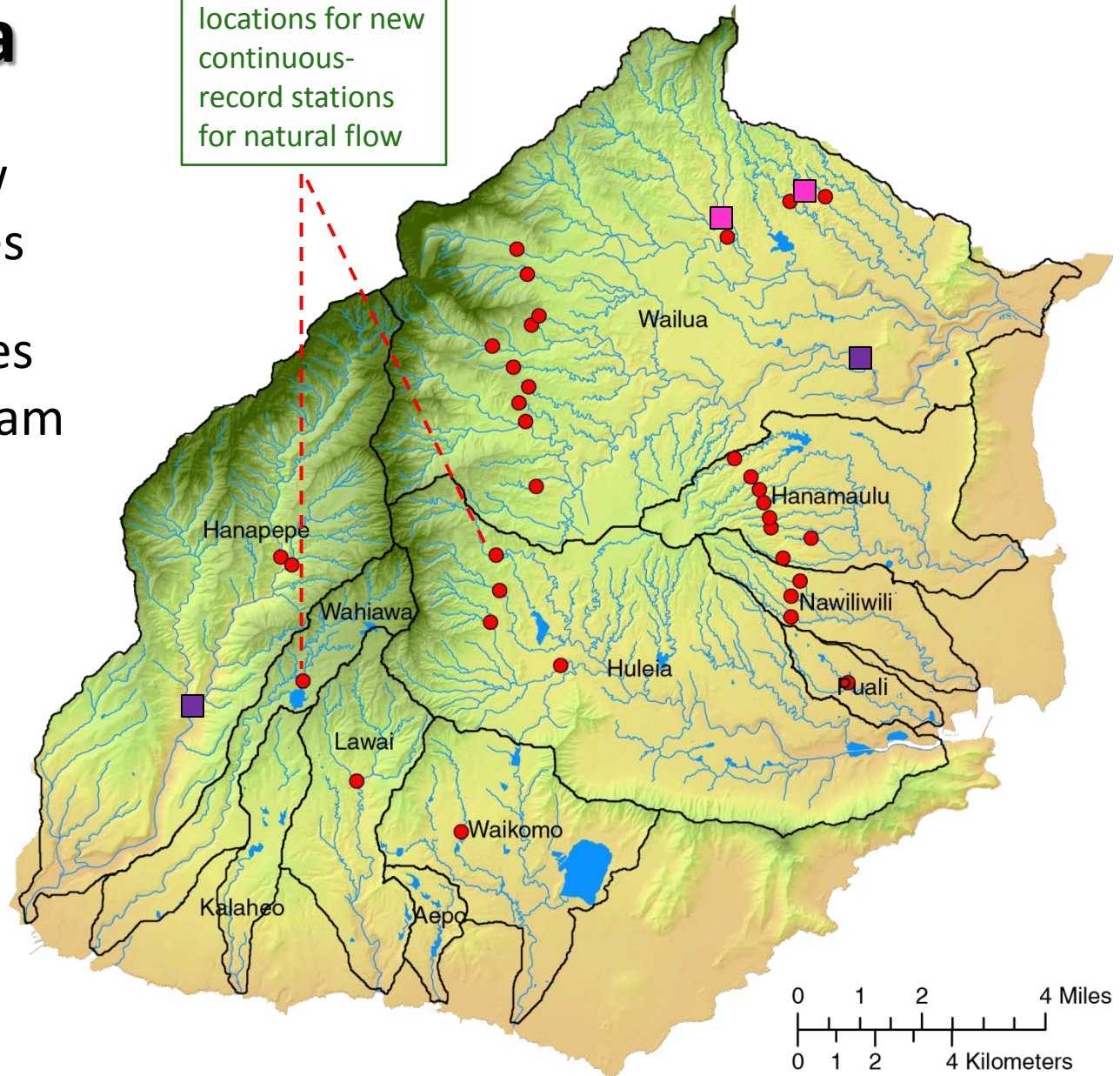
Potential locations for new continuous-record stations for natural flow

● Potential partial-record sites

USGS streamflow-gaging station currently in operation

■ Natural flow

■ Regulated flow



Study approach: Objective 2

- Reconnaissance survey to select measurement sites based on:
 - Tributary inflows
 - Diversions
- Determine gains and losses along measured reaches of the streams



Timeline and funding summary

| | 2015 | | | 2016 | | | | 2017 | | | | 2018 | | | 2019 | | |
|------------|------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | Jun | Jul - Sep | Oct - Dec | Jan - Mar | Apr - Jun | Jul - Sep | Oct - Dec | Jan - Mar | Apr - Jun | Jul - Sep | Oct - Dec | Jan - Mar | Apr - Jun | Jul - Sep | Oct - Dec | Jan - Mar | Apr - Jun |
| Research | ■ | ■ | | | | | | | | | | | | | | | |
| Field work | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| Analyses | | | | | | | | | | | ■ | ■ | ■ | | | | |
| Report | | | | | | | | | | | | | | ■ | ■ | ■ | ■ |

Approximate cost of study: \$707,000

USGS cost share \$212,100 (30%)

Other partners share \$494,900 (70%)

- CWRM share \$390,000
- Kauai share \$100,000?

Deliverables



Prepared in cooperation with the State of Hawai'i Department of Hawaiian Home Lands

Availability and Distribution of Low Flow in Anahola Stream, Kaua'i, Hawai'i



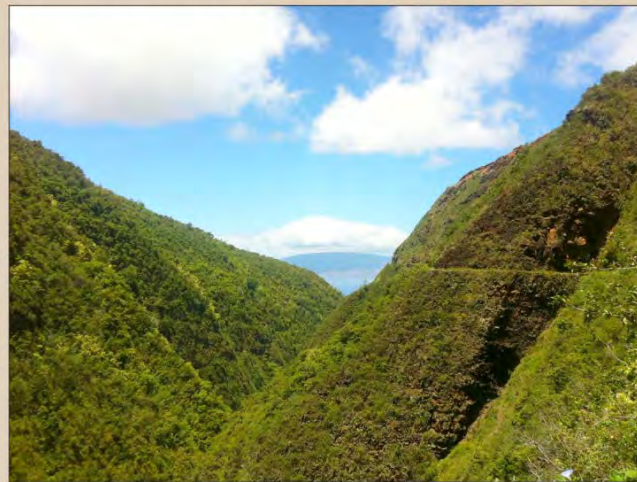
Scientific Investigations Report 2012-5264

U.S. Department of the Interior
U.S. Geological Survey



Prepared in cooperation with the State of Hawai'i Commission on Water Resource Management

Low-Flow Characteristics of Streams in the Lahaina District, West Maui, Hawai'i



Scientific Investigations Report 2014-5087

U.S. Department of the Interior
U.S. Geological Survey

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DATA CENTER

Current conditions data

- ◆ Streamflow
- ◆ Groundwater
- ◆ Water quality
- ◆ Rainfall
- ◆ Lake/Reservoir

Historical data

- ◆ Streamflow
- ◆ Groundwater
- ◆ Water quality
- ◆ Rainfall
- ◆ Annual data reports
- ◆ Duration hydrographs
- ◆ Instantaneous Data Archive (IDA)
- ◆ Hawaii Water-Use Data

USGS WaterWatch

- ◆ Current streamflow
- ◆ Floods | Droughts
- ◆ Water quality

Groundwater Networks

- ◆ Water level
- ◆ Climate response

Geospatial Information

- ◆ National Geospatial Program
- ◆ EarthExplorer
- ◆ The National Map
- ◆ National Hydrography Dataset
- ◆ Watershed Boundary Dataset

ABOUT THE PACIFIC ISLANDS WSC

Water Resources of the Pacific Islands

Aloha! Welcome to the USGS Web page for the water resources of Hawaii and the Pacific area. This is your direct link to water-resource information and products for the State of Hawaii, the U.S. Territories of Guam and American Samoa, the U.S. Commonwealth of the Northern Mariana Islands, the Republic of Palau, the Republic of the Marshall Islands, and the Federated States of Micronesia.

Current Streamflow Conditions in Hawaii

Monday, April 27, 2015 15:00ET



| Explanation - Percentile classes | | | | | | | |
|----------------------------------|-------------------|--------------|--------|--------------|-------------------|------|------------|
| ● | ● | ● | ● | ● | ● | ● | ○ |
| Low | <10 | 10-24 | 25-75 | 76-90 | >90 | High | Not ranked |
| | Much below normal | Below normal | Normal | Above normal | Much above normal | | |



Quick Links to Current Conditions Data:

- [Streamflow](#)
- [Groundwater](#)
- [Water Quality](#)
- [Rainfall](#)
- [All](#)

Quick Links to Tools:

- [NWISMapper](#)--map-based search tool
- [USGS WaterNow](#)--on-demand current conditions sent to mobile phone or email
- [USGS WaterAlert](#)--receive alert when user-defined threshold is exceeded

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[Scientific Investigations Report 2015-5010](#) **NEW**
 Spatially Distributed Groundwater Recharge for 2010 Land Cover Estimated Using a Water-Budget Model for the Island of O'ahu, Hawai'i.

[Scientific Investigations Report 2014-5158](#)
 Baseline Water-Quality Sampling to Infer Nutrient and Contaminant Sources at Kaloko-Honokōhau National Historical Park, Island of Hawai'i, 2009.

[Scientific Investigations Report 2014-5168](#)
 Spatially Distributed Groundwater Recharge Estimated Using a Water-Budget Model for the Island of Maui, Hawai'i, 1978-2007.

[Open-File Report 2014-1173](#)
 Water-Chemistry Data Collected in and near Kaloko-Honokōhau National Historical Park, Hawai'i, 2012-2014.

[Scientific Investigations Report 2014-5087](#)
 Low-Flow Characteristics of Streams in the Lahaina District, West Maui, Hawai'i.

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USGS Groundwater Resources Program

- [Hawaii Volcanic-Rock Aquifer Study](#)

Threatened and Endangered Gages

- [State of Hawaii](#) | [Territory of Guam](#)

Active Data-Collection Sites in Hawaii and Guam

- [State of Hawaii](#) | [Territory of Guam](#)

Hawaii StreamStats

- [Hawaii StreamStats: A Web Application for Defining Drainage-Basin Characteristics and Estimating Peak-Streamflow Statistics](#)

Recent Hydrologic Conditions

- [State of Hawaii](#) | [Iao and Waihee Aquifers, Maui](#)

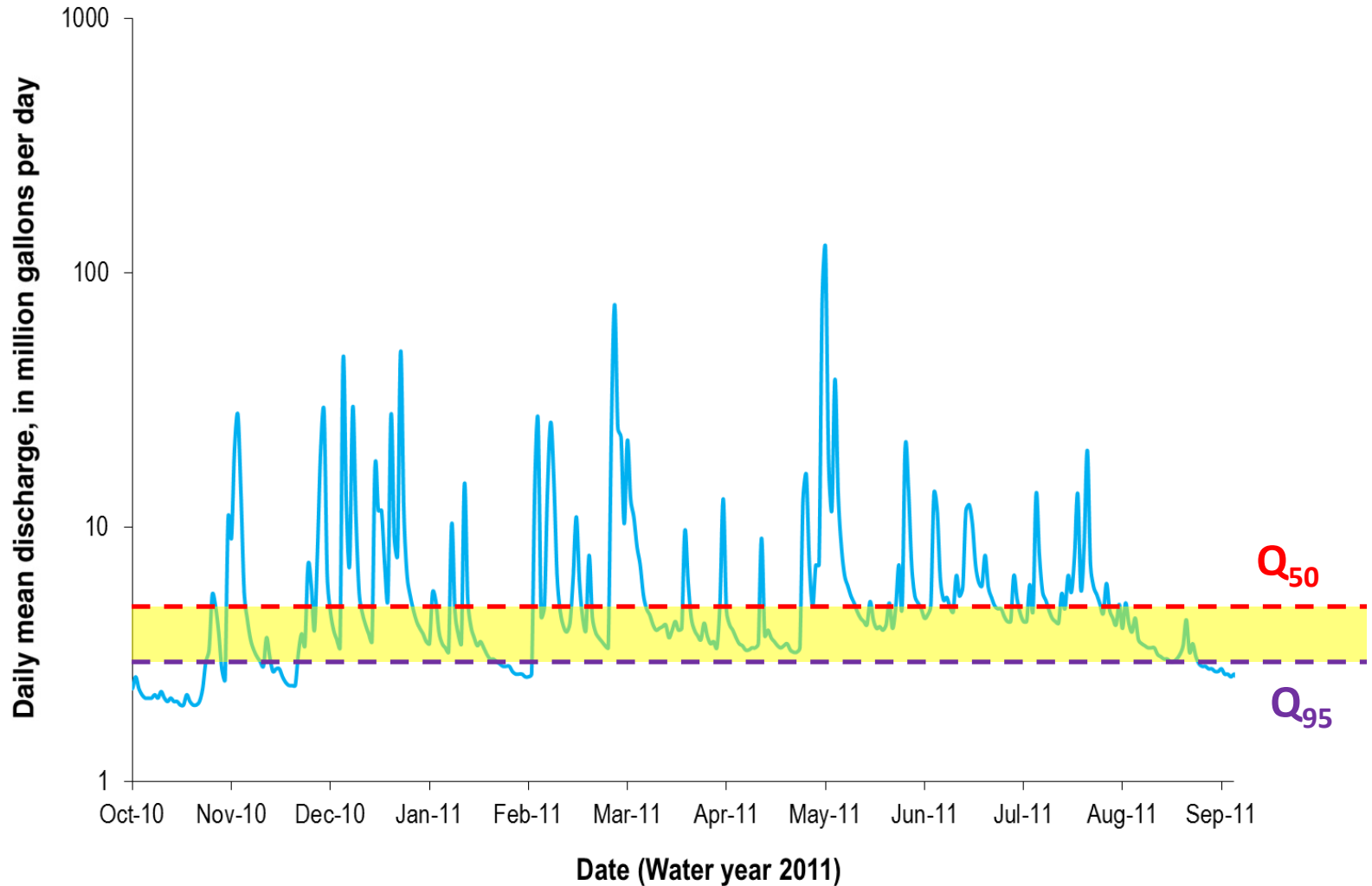
Seismic Groundwater-Level Measurements



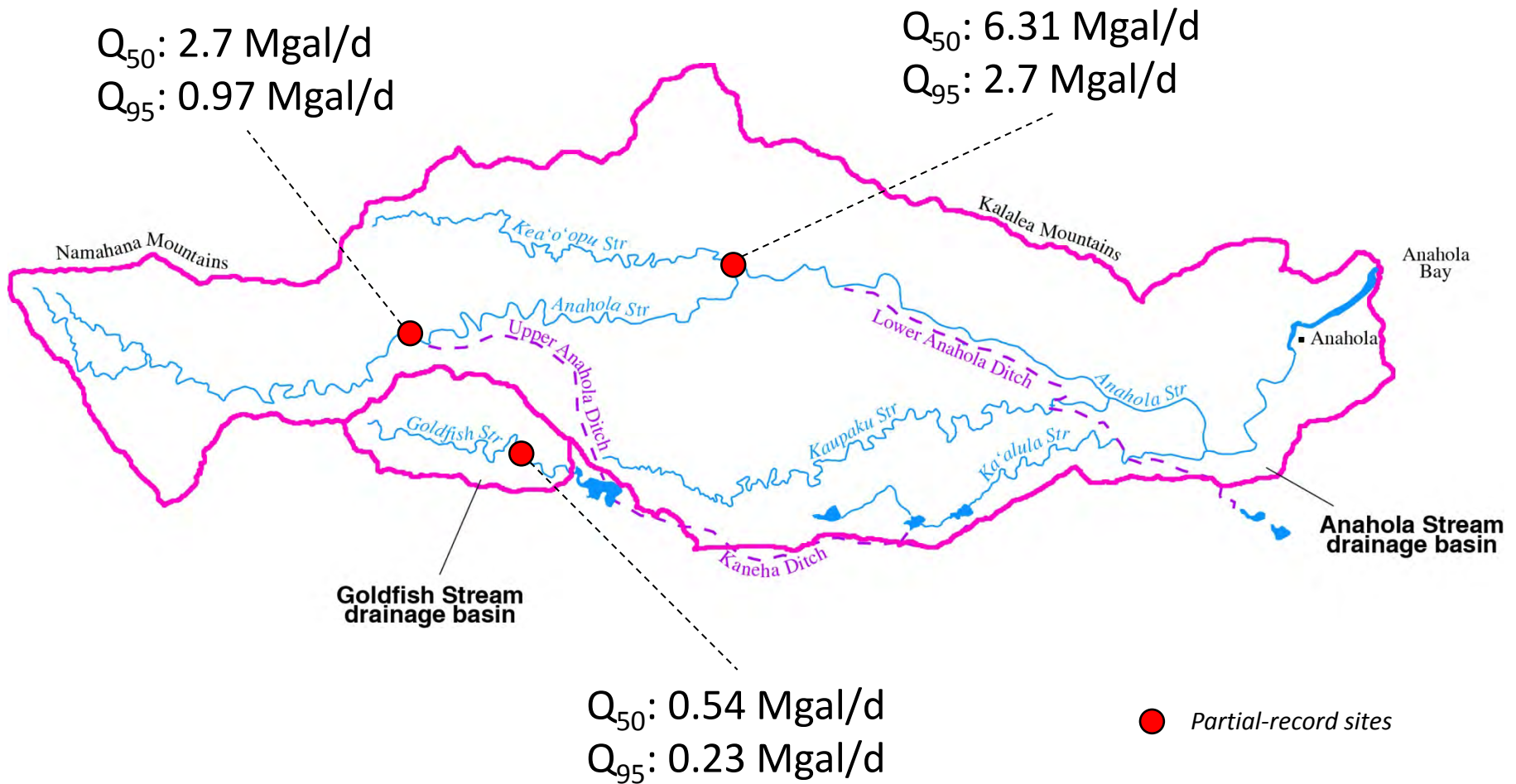
Questions
ccheng@usgs.gov

Low-flow statistics

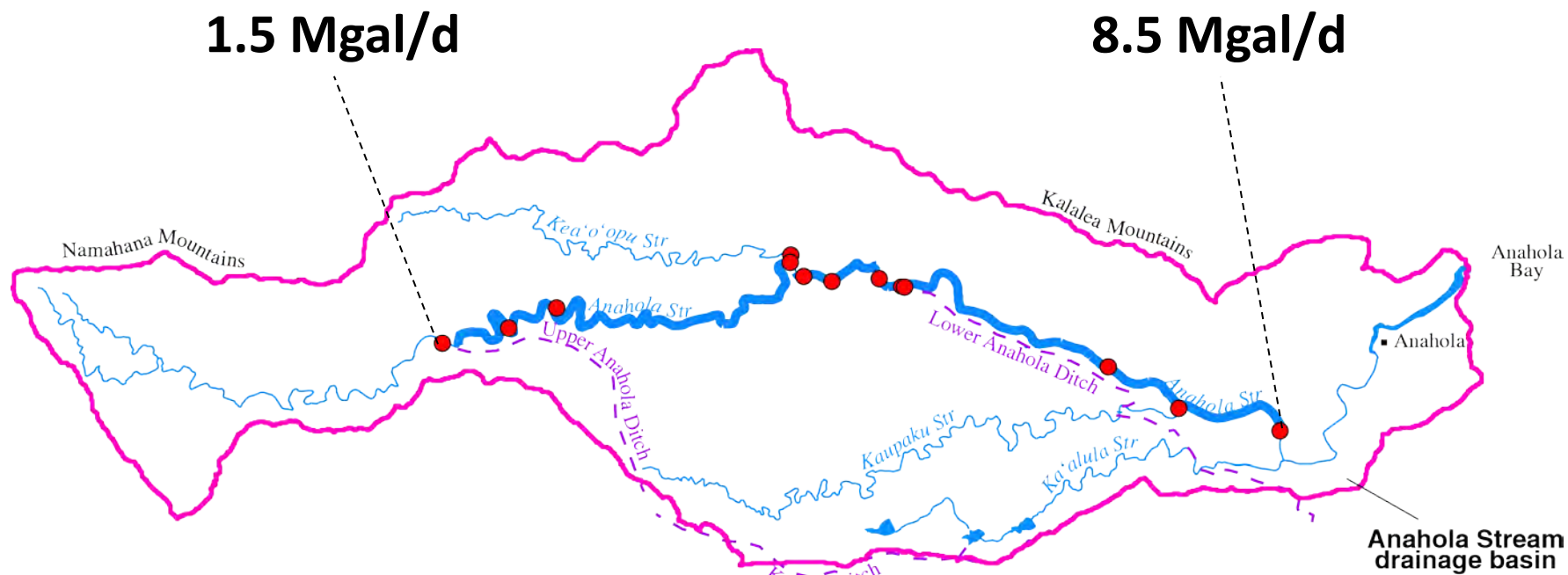
Hydrograph of stream-gaging station on Hālaulani Stream, Kauaʻi, HI



Flow statistics, Anahola Study

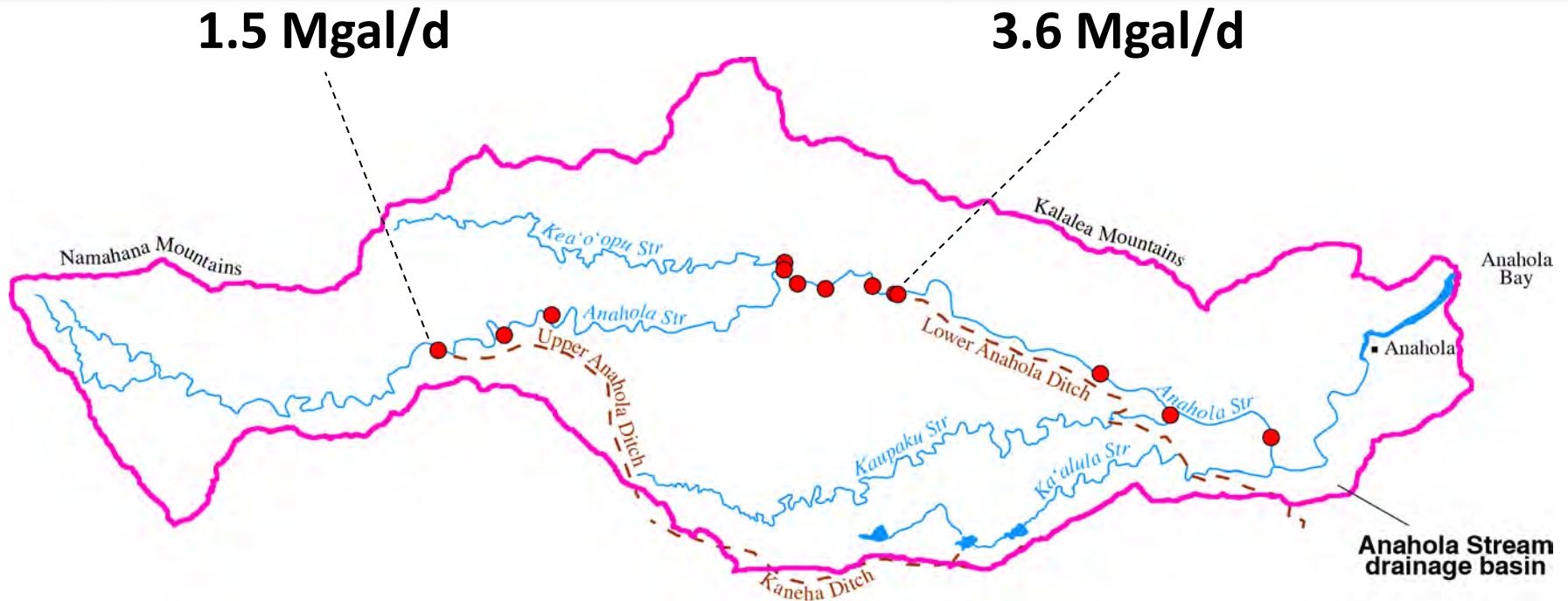


Seepage analysis, Anahola Stream



Wet season total seepage gain of about 7 Mgal/d

Flow reduction by diversion



The amount of flow left near the lower intake is about 2.1 Mgal/d (3.6 - 1.5 Mgal/d).