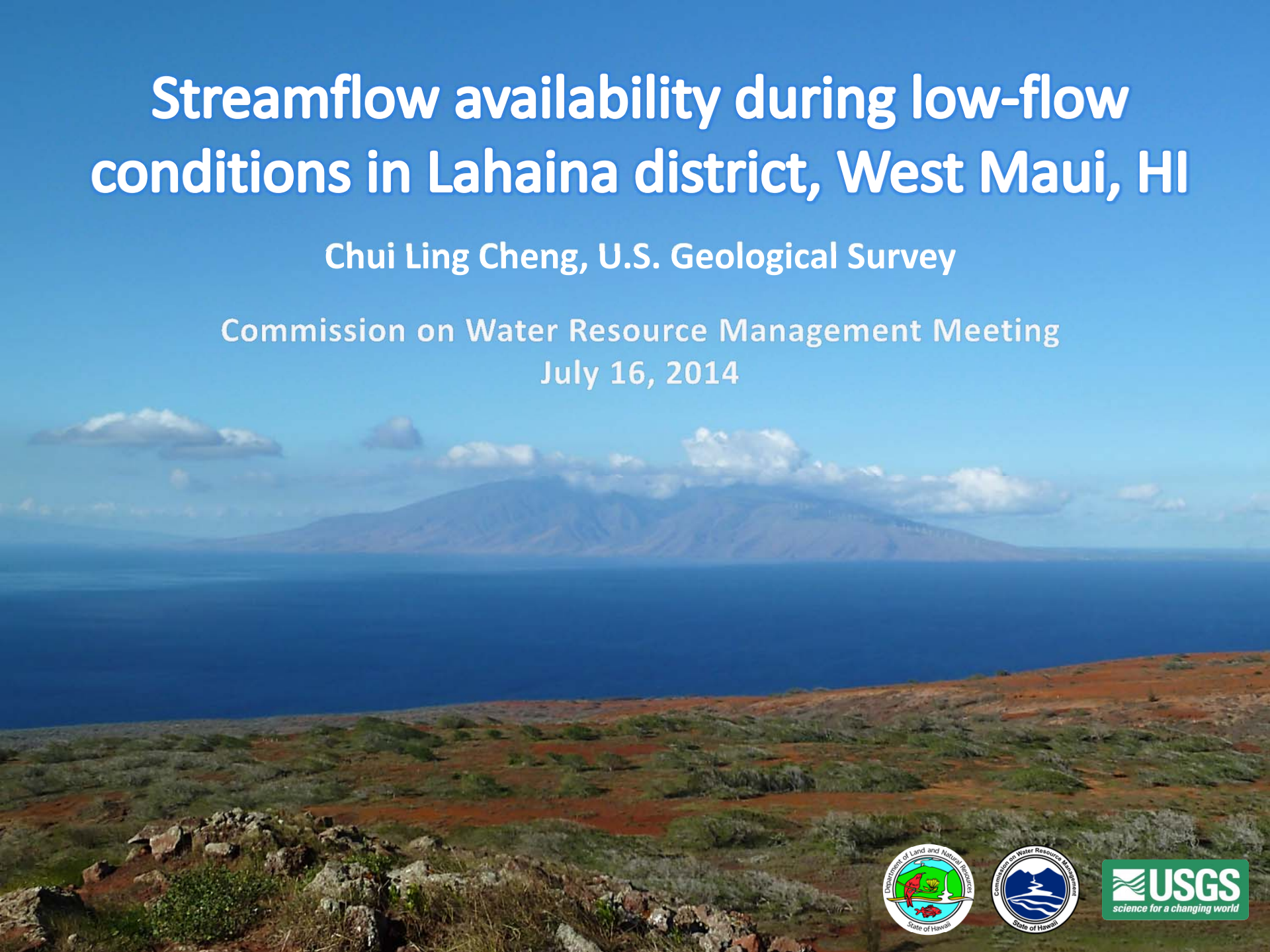
Streamflow availability during low-flow conditions in Lahaina district, West Maui, HI

Chui Ling Cheng, U.S. Geological Survey

Commission on Water Resource Management Meeting
July 16, 2014



Publication (June 30, 2014)

Report is available at http://hi.water.usgs.gov/

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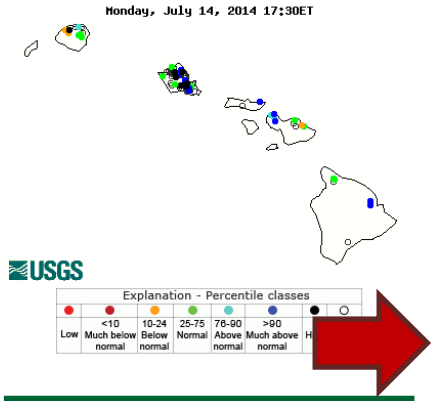
Water Resources of the Pacific Islands

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



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Hydrogeology Journal, 2013 (accessed Jan. 15, 2013)
Estimating Hydraulic Properties from Tidal Attenuation in the Northern Guam Lens Aquifer, Territory of Guam, USA.

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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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Highlights

- North of Lahaina, mainly ephemeral streams
- South of Lahaina, streams generally flow perennially in the upper reaches and lose flow in the lower reaches
  - Streams flow mauka to makai 95% of the time under natural-flow conditions

Kahoma Valley, Maui

Kapāloa Stream, Maui

What do we know?

Ukumehame Gulch, Maui

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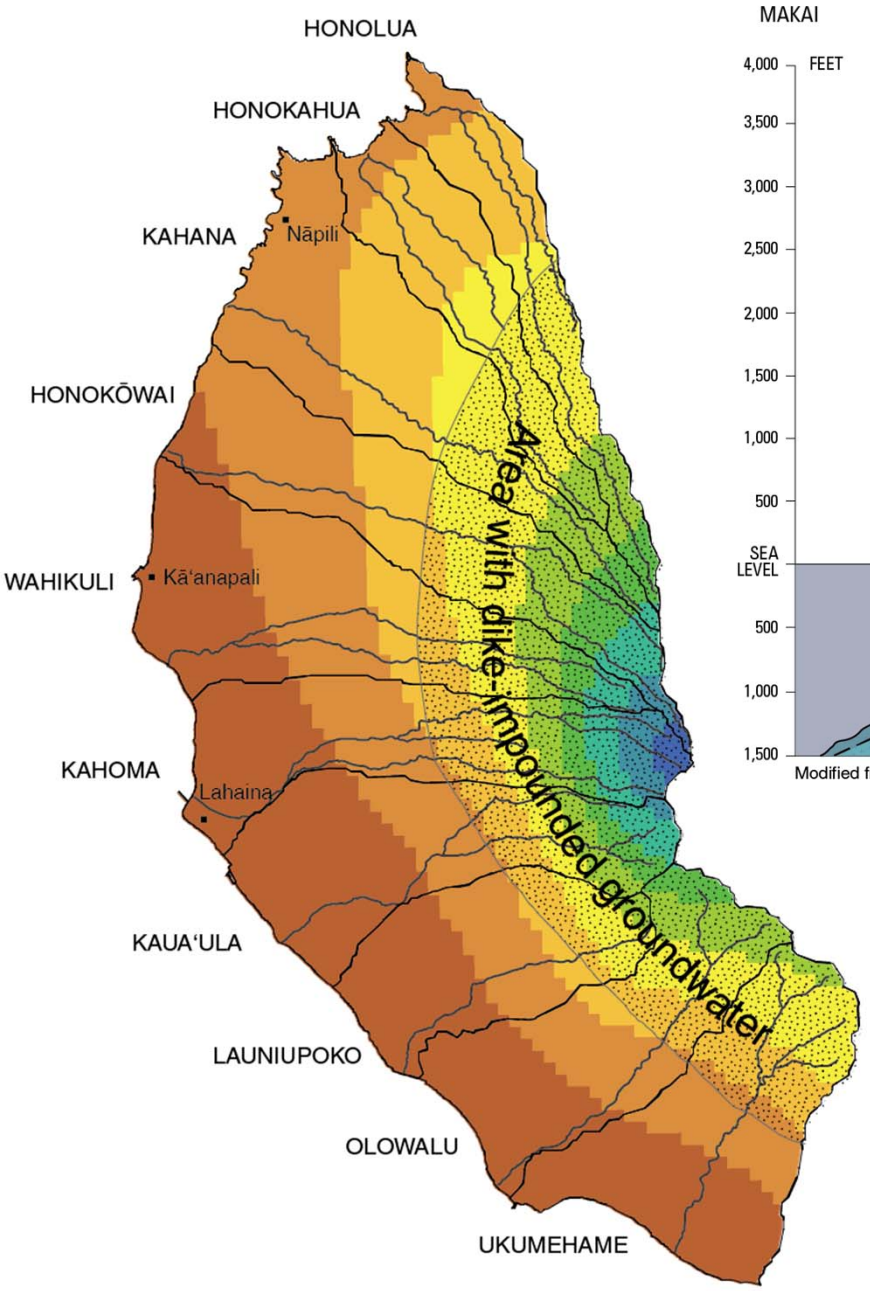
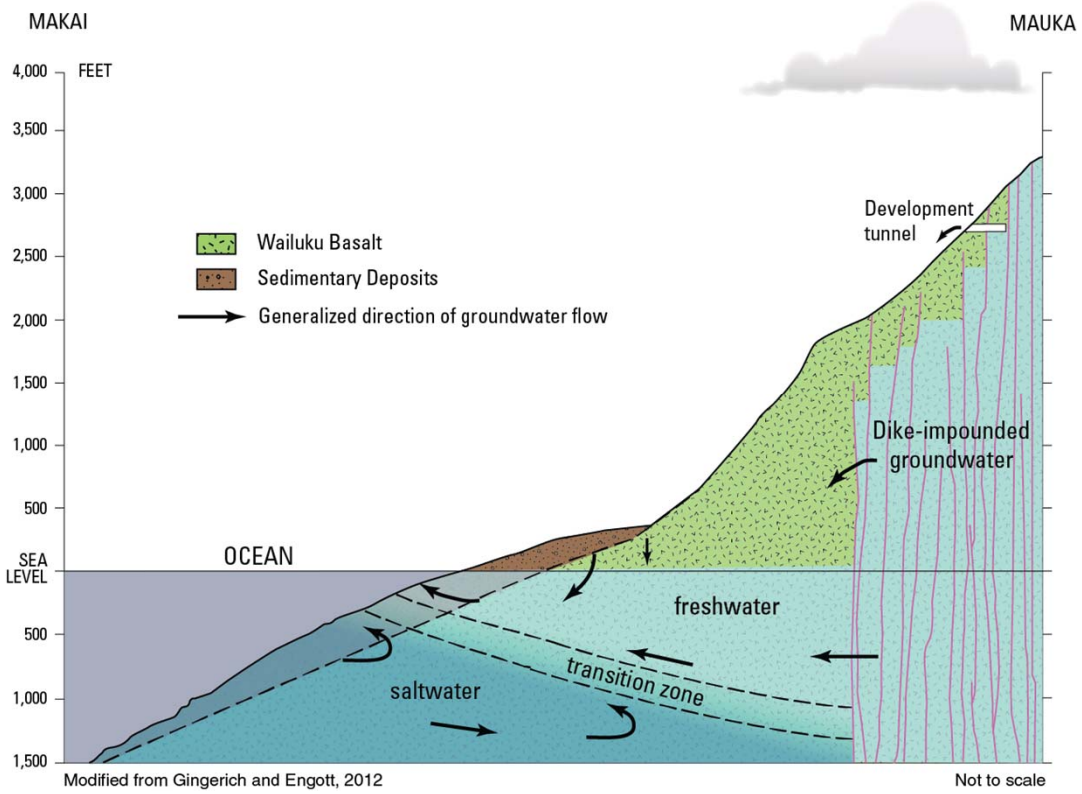
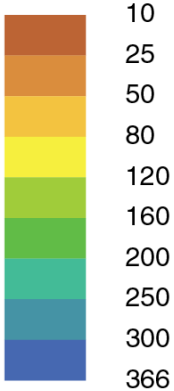




Mean annual rainfall, in inches
(modified from Giambelluca and others, 2013)



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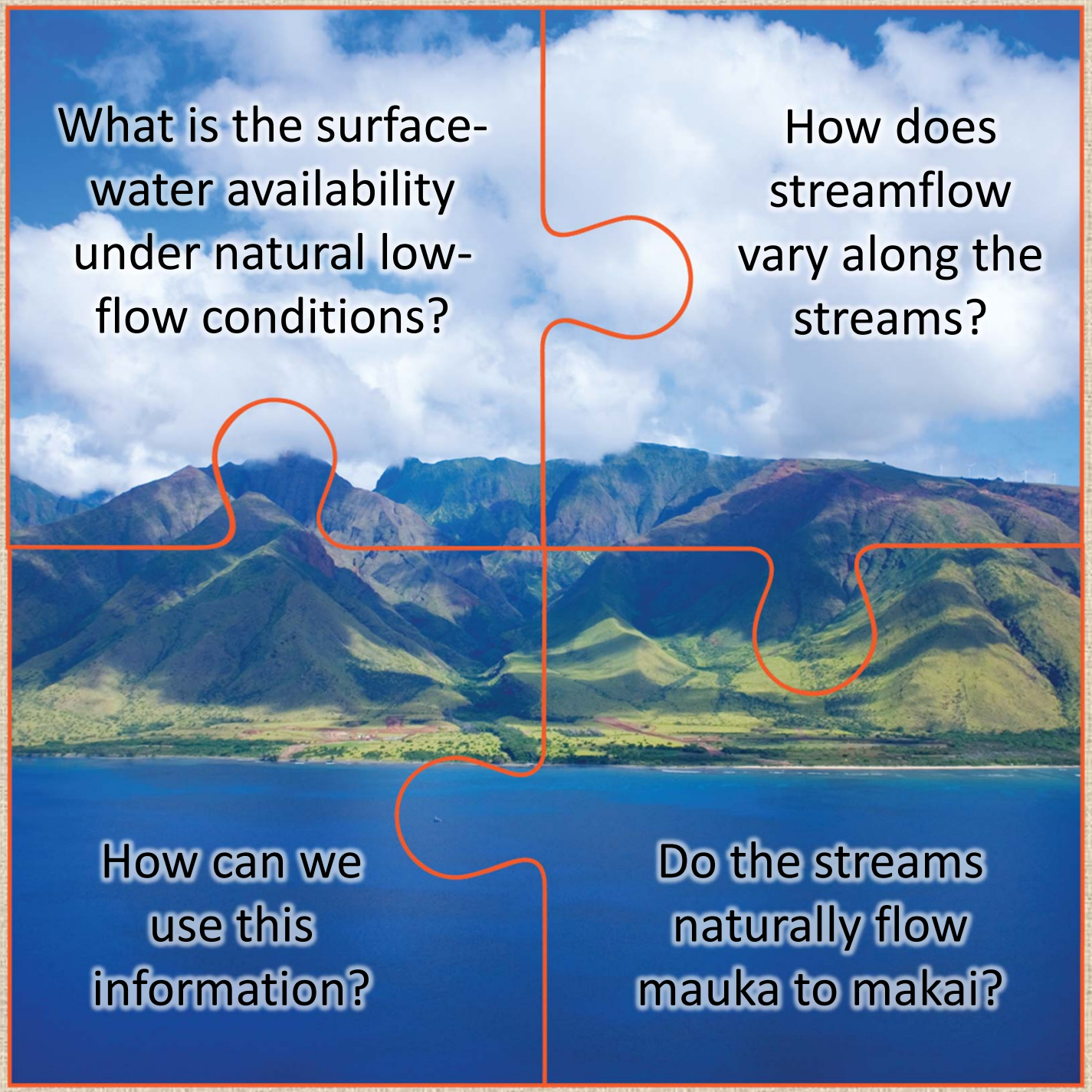

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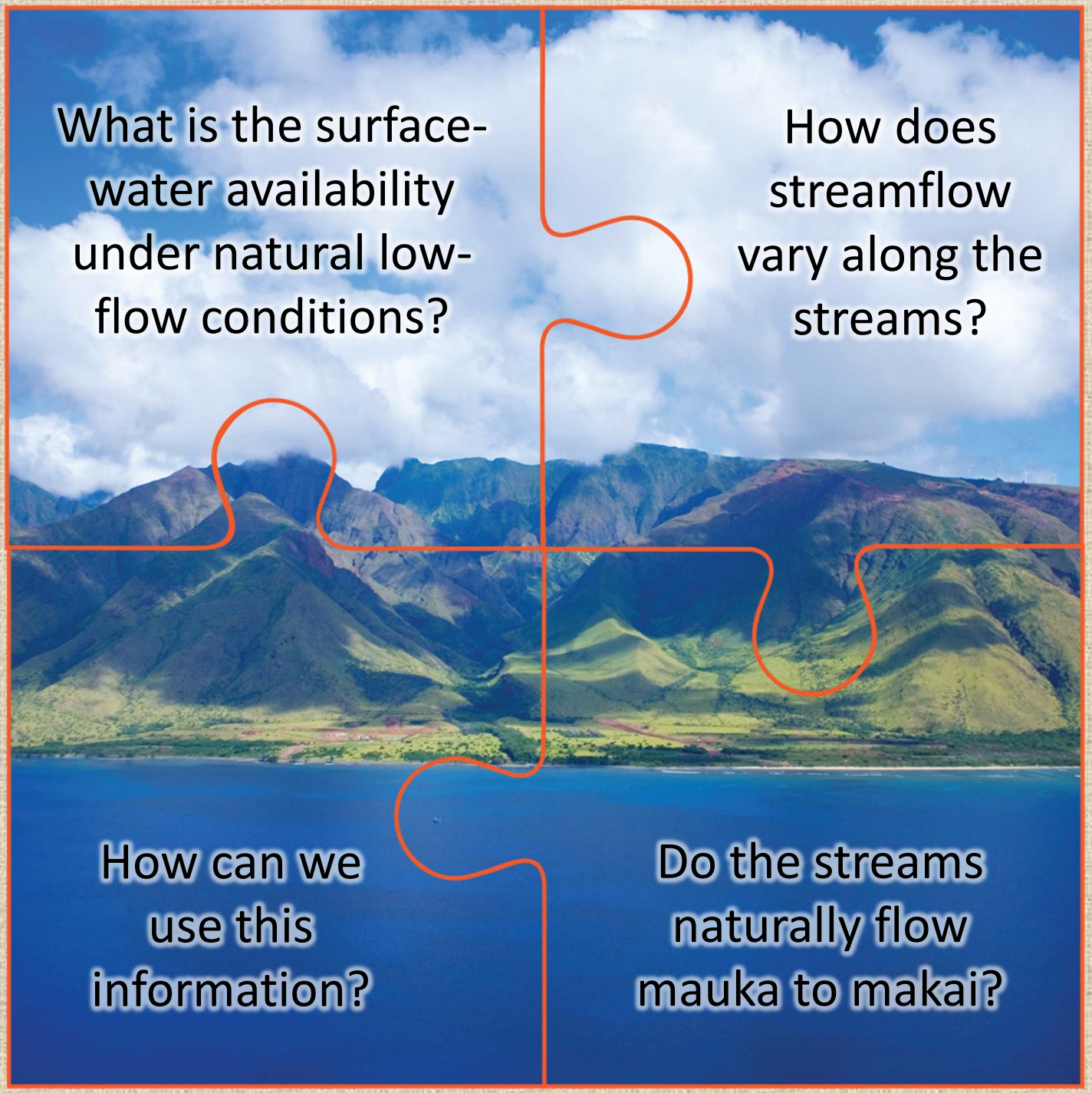

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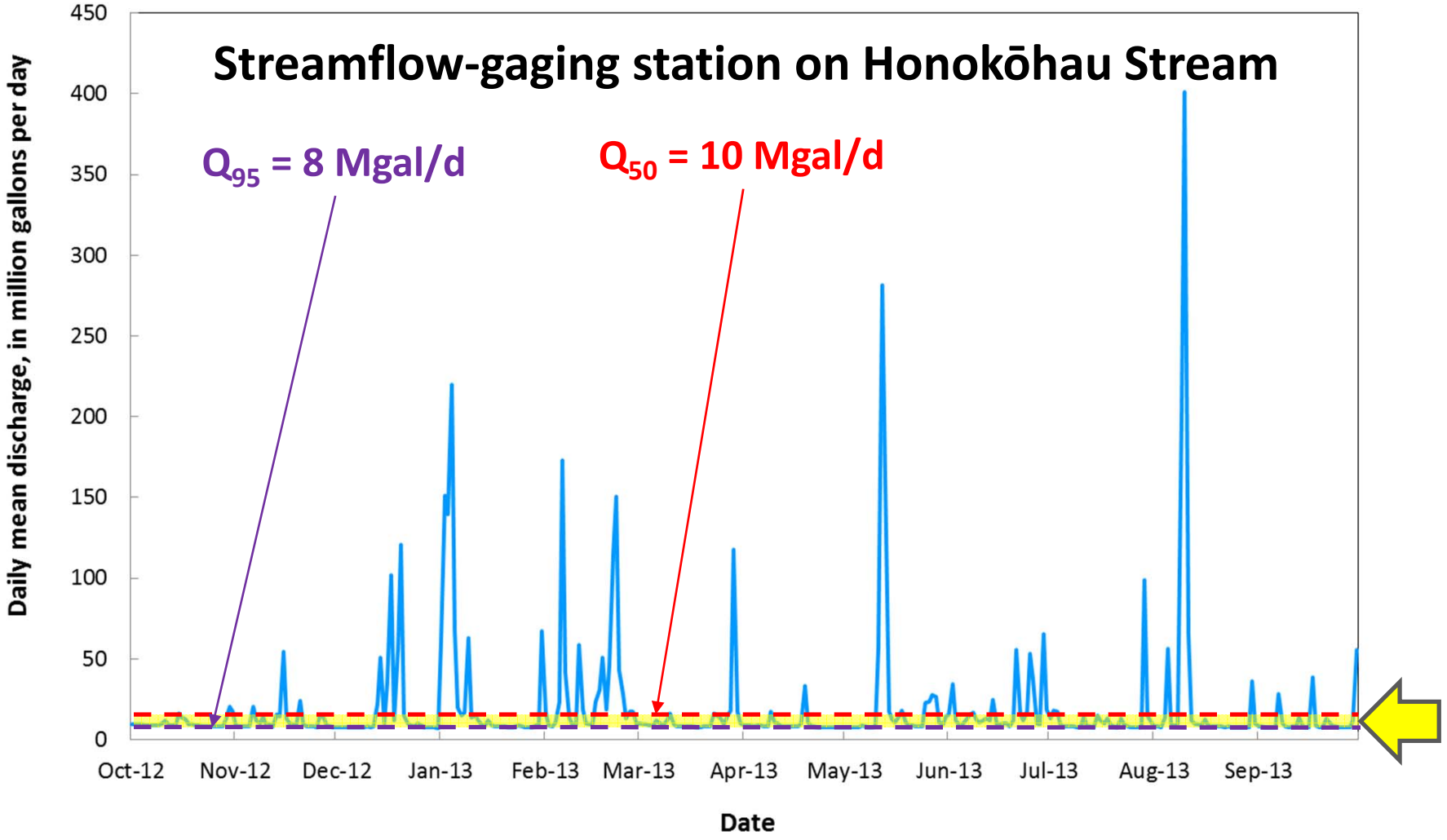
Surface-water availability



Study approach

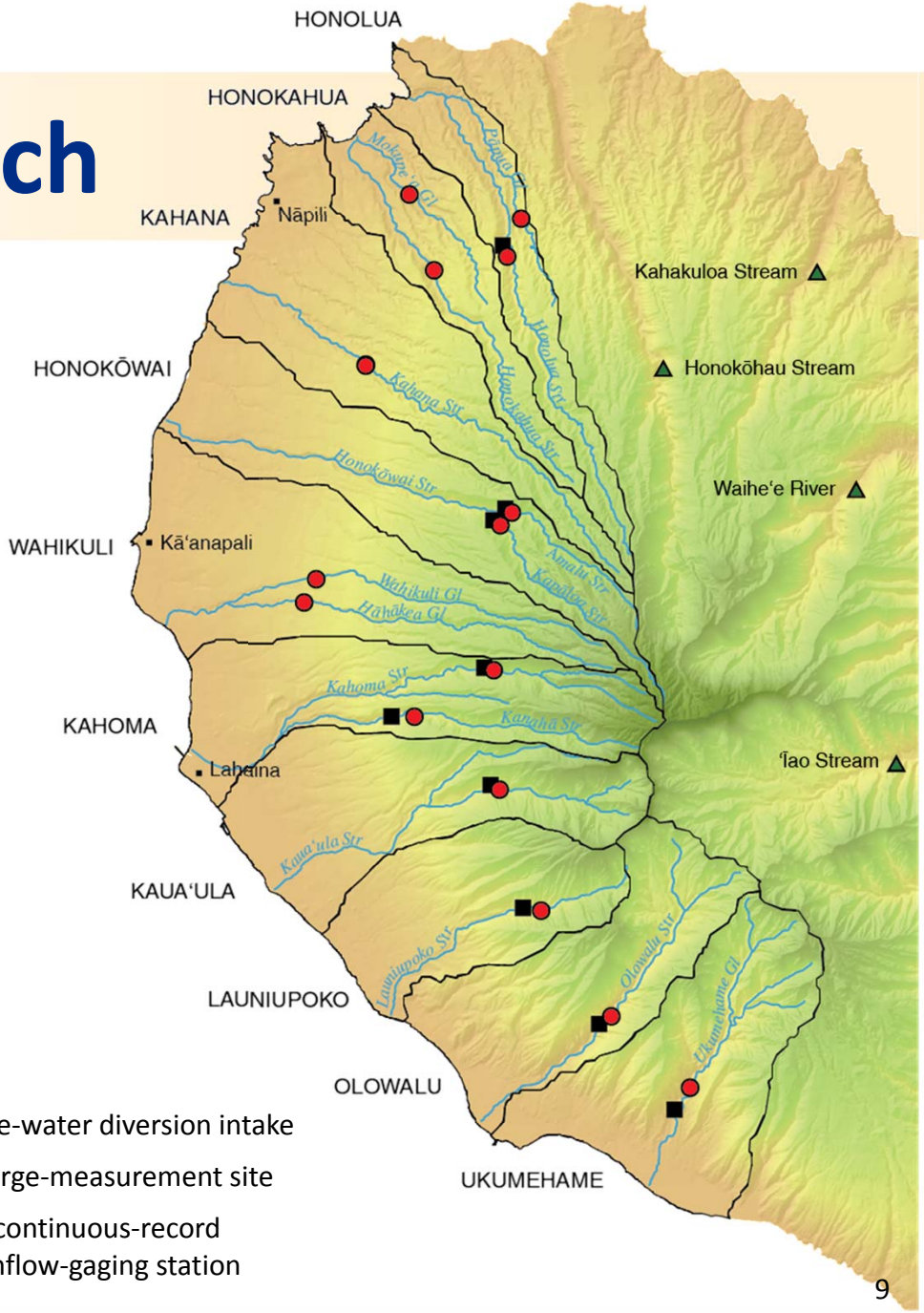
Measure flow (2012-2013)

↓

Select continuous-record stations

↓

Derive low-flow characteristics



Compute low-flow characteristics

Base period: 1984-2013

Discharges at continuous station

Statistical relation

$$Y_i = m_y + \frac{s_y}{s_x}(x_i - m_x)$$

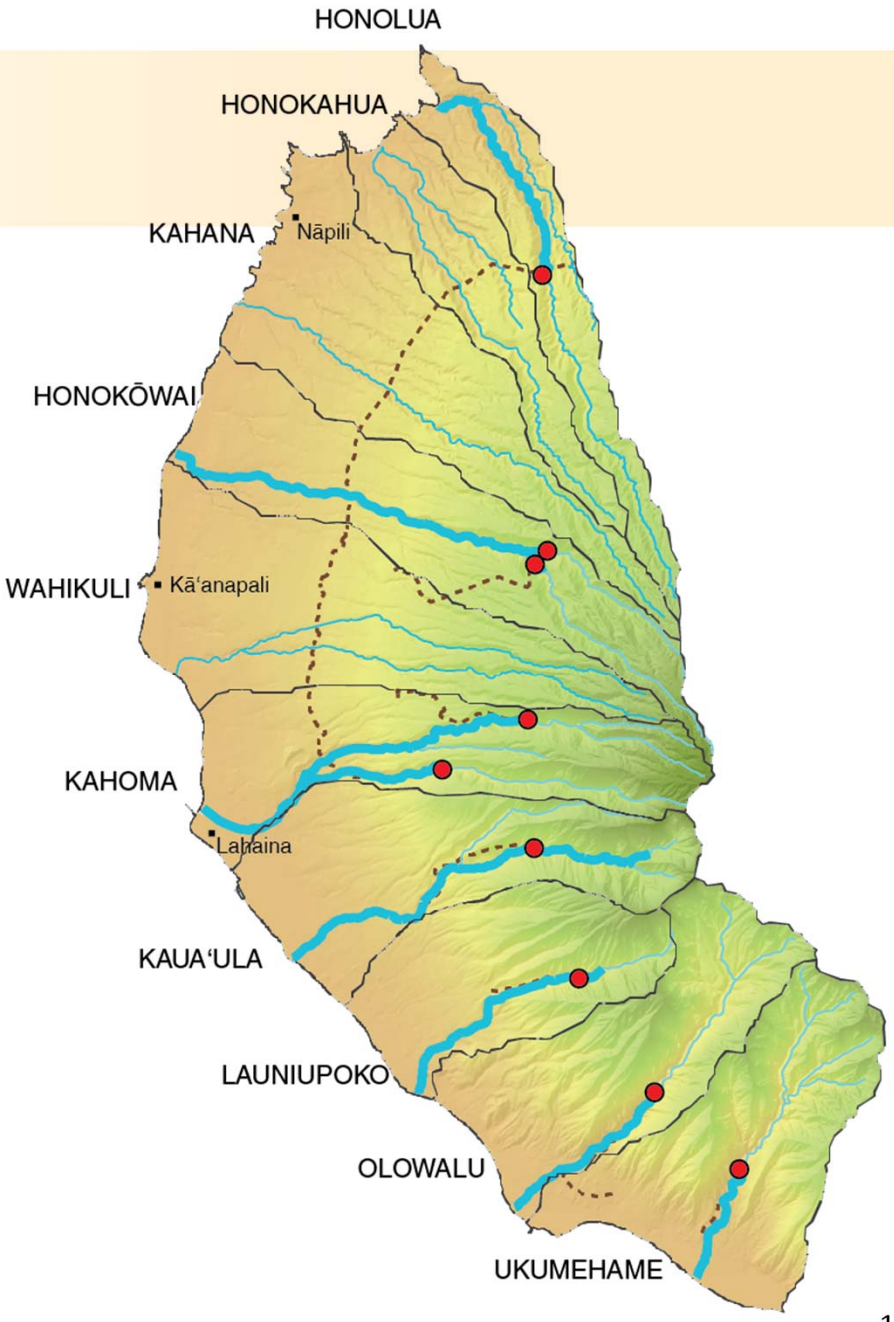
Discharges at measurement site

Equation from: Hirsch, R.M., 1982, A comparison of four streamflow record extension techniques: Water Resources Research, v. 18, no. 4, p. 1081–1088.

Results

Duration discharges, in million gallons per day, under natural-flow conditions

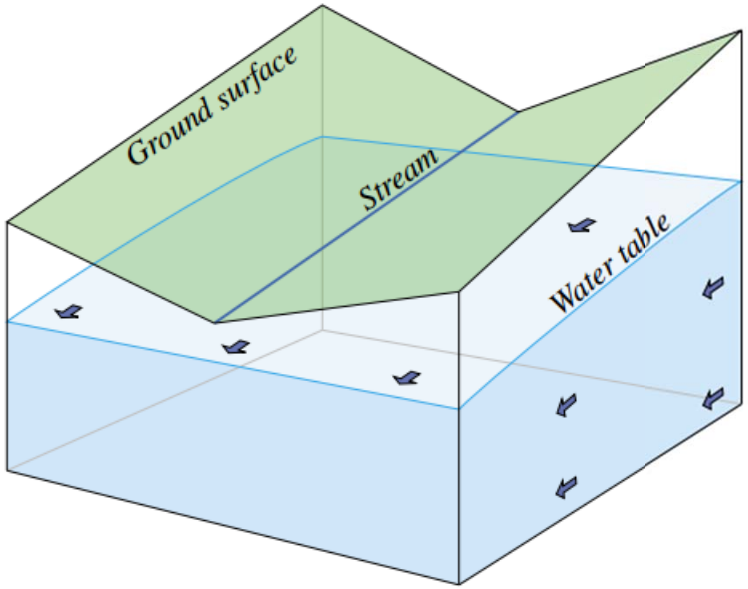
Stream	Q_{50}	Q_{95}
Honolua	2.4	0
Honokōwai	3.5	2.2
Kahoma	3.7	1.3
Kanahā	3.2	2.6
Kaua‘ula	6.1	3.1
Launiupoko	0.30	0.22
Olowalu	3.9	2.0
Ukumehame	3.2	1.9

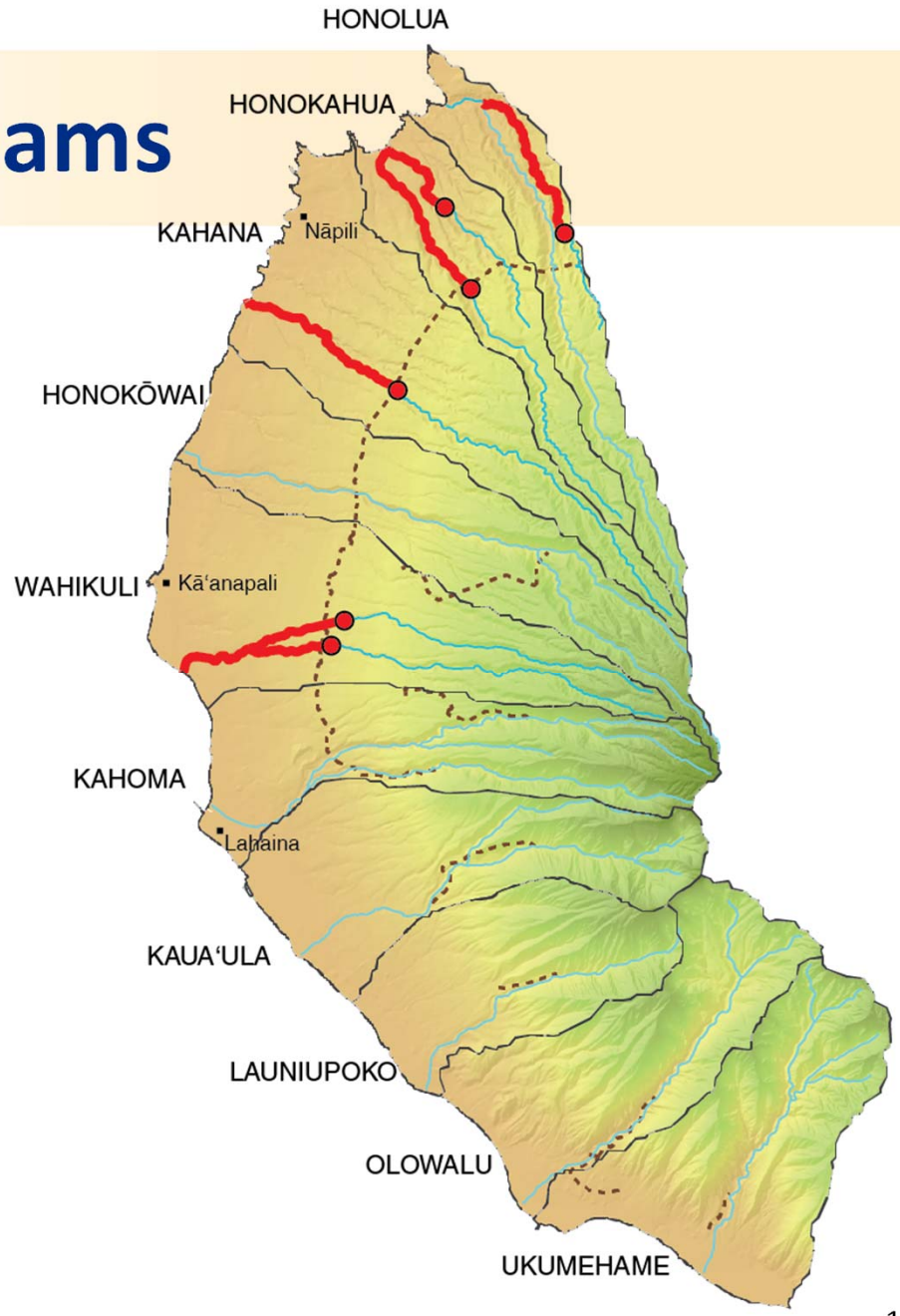


Ephemeral streams

Streams that flow only in response to rainfall
(downstream from measurement sites)

They are dry at least 50% of the time ($Q_{50} = 0$).





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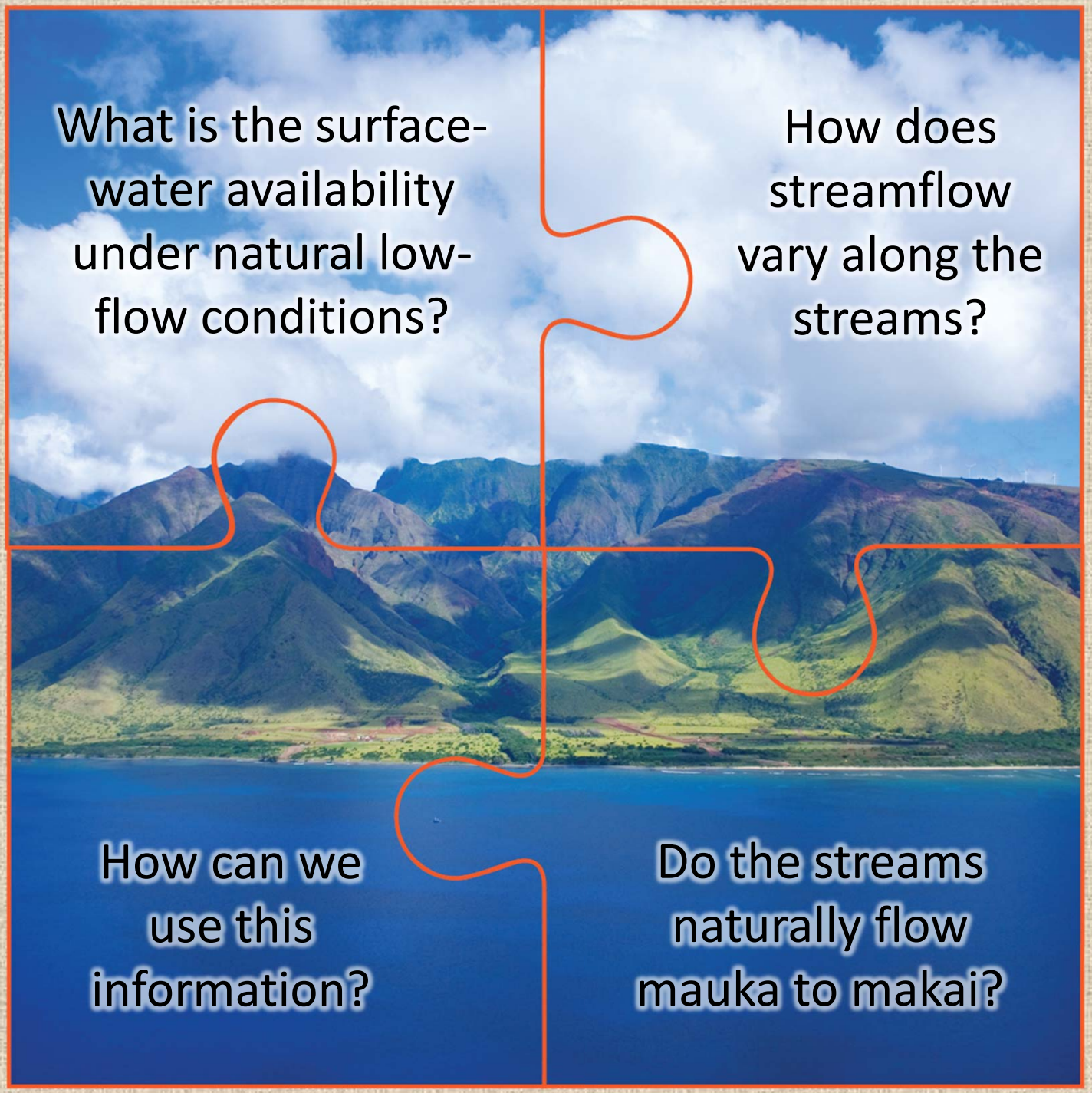

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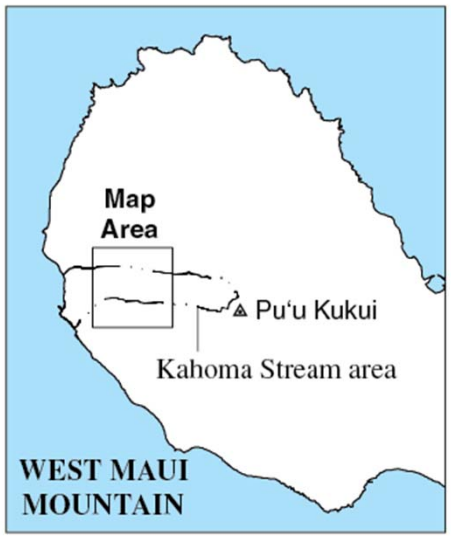
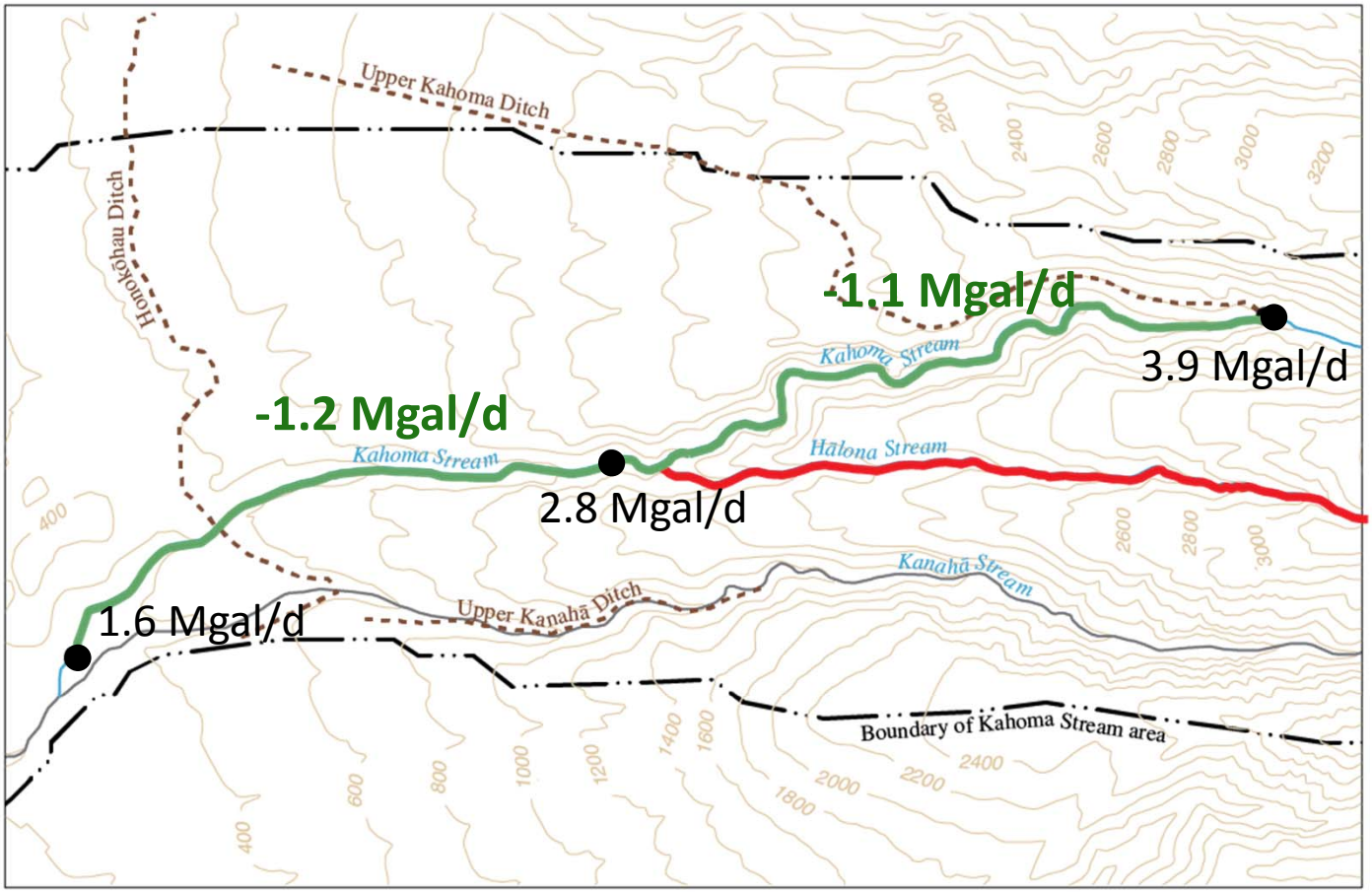
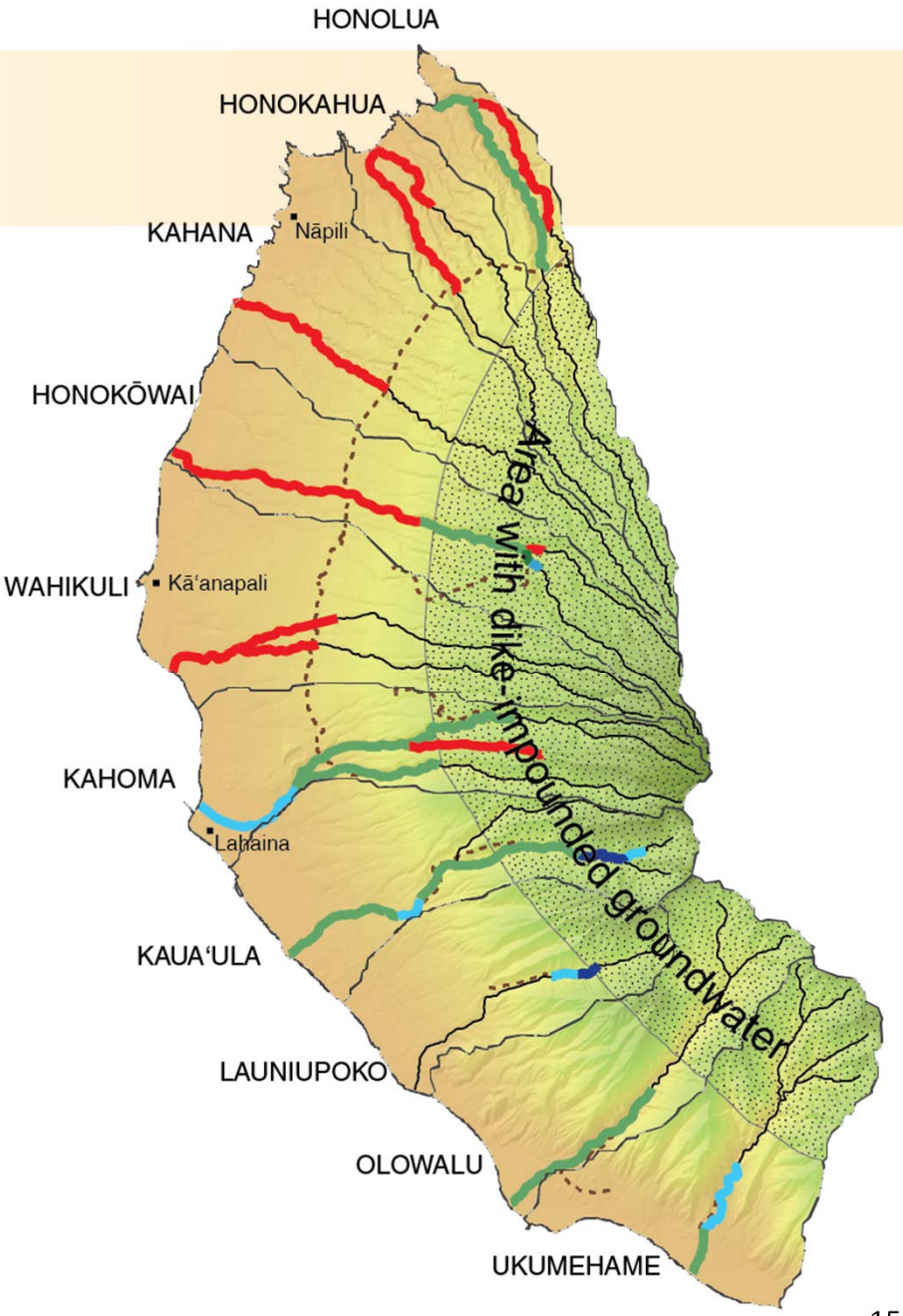
Streamflow gains and losses

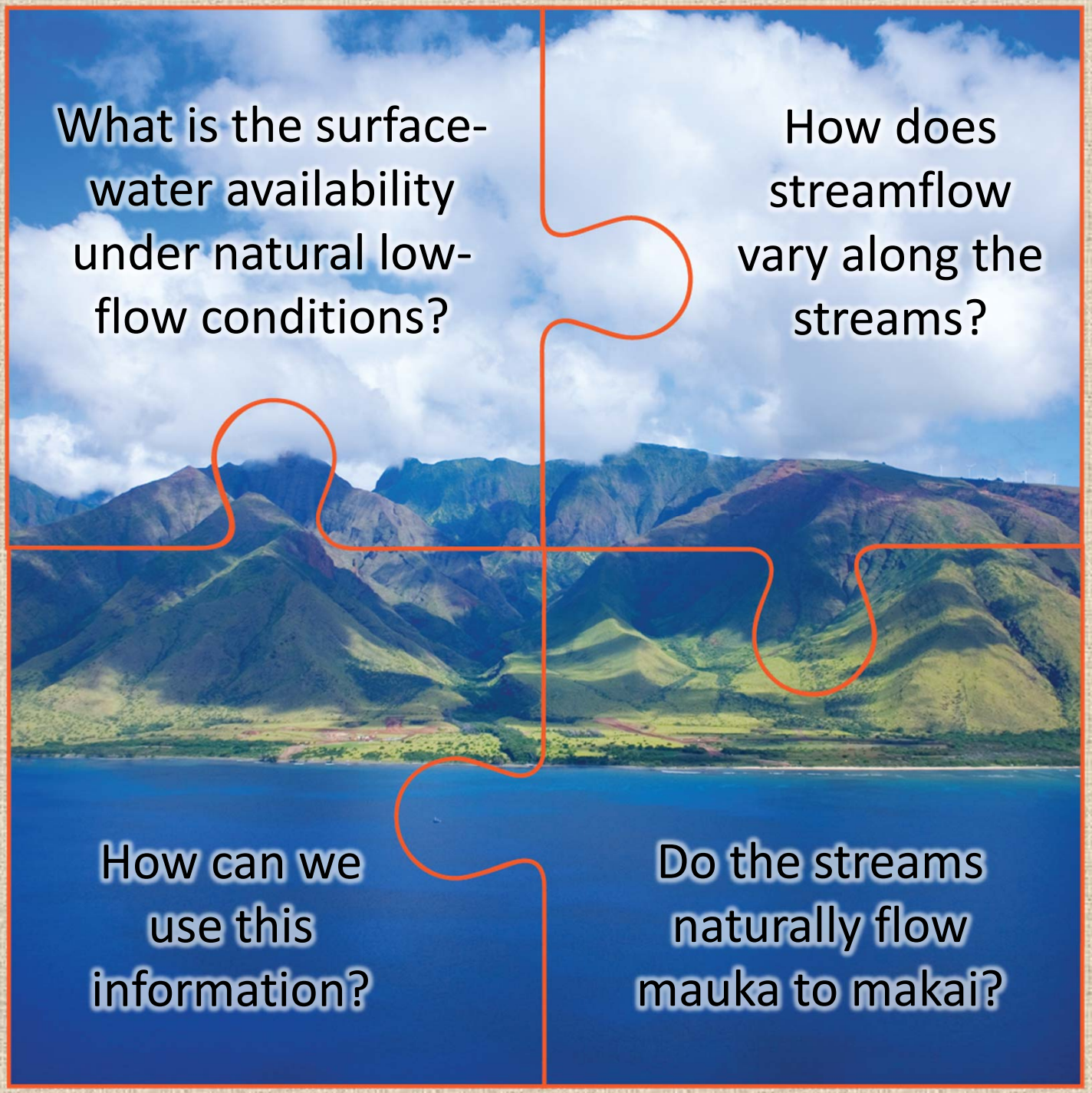




Results

- Losses measured in lower reaches (ranged from 0.029 to 1 Mgal/d per mile of stream reach)
- Gains measured in upper reaches (ranged from 0.48 to 3.3 Mgal/d per mile of stream reach)
- Dry reaches mainly in lower reaches north of Kahoma Stream
- Flowing reaches observed without measurements





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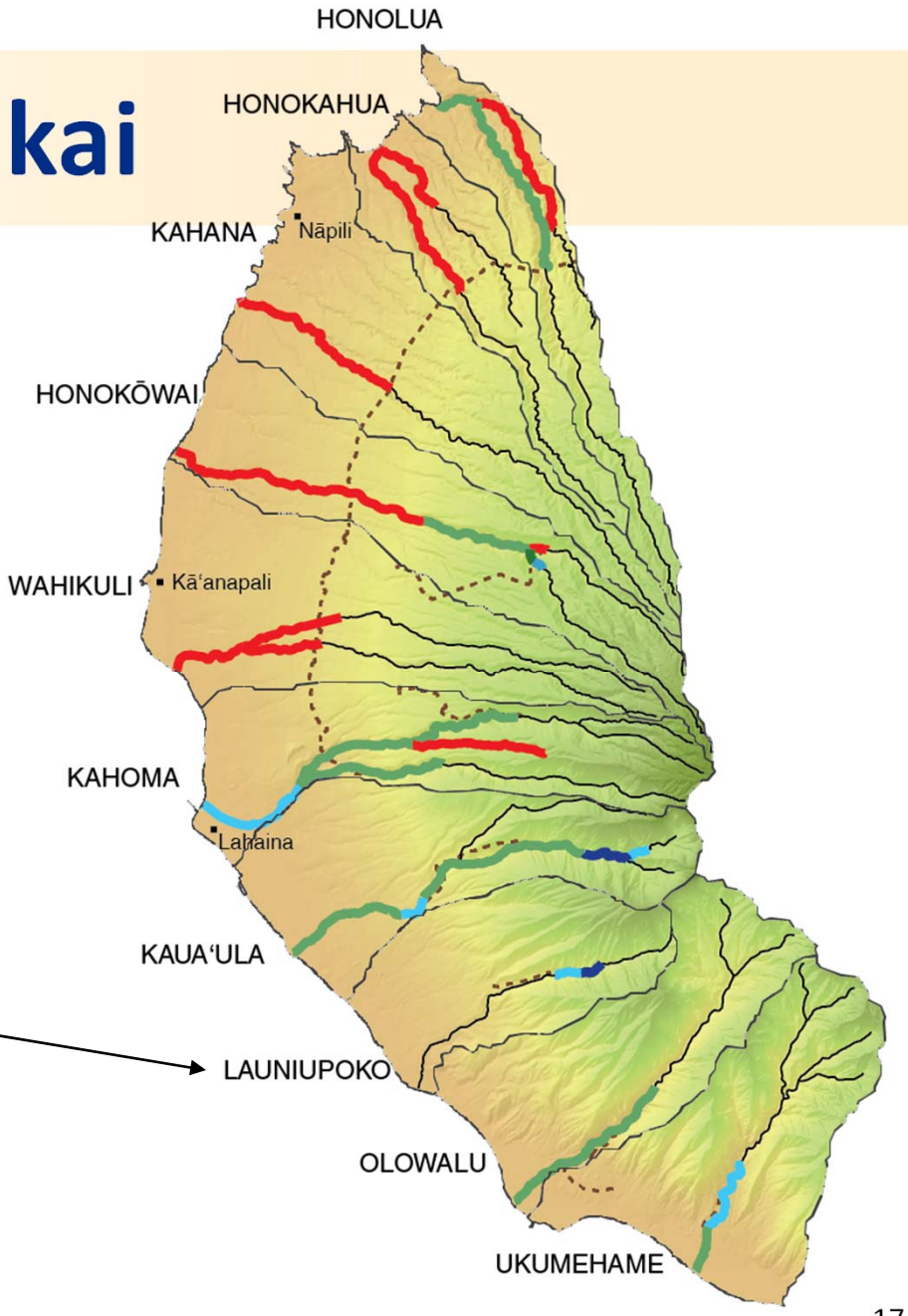
Mauka to makai

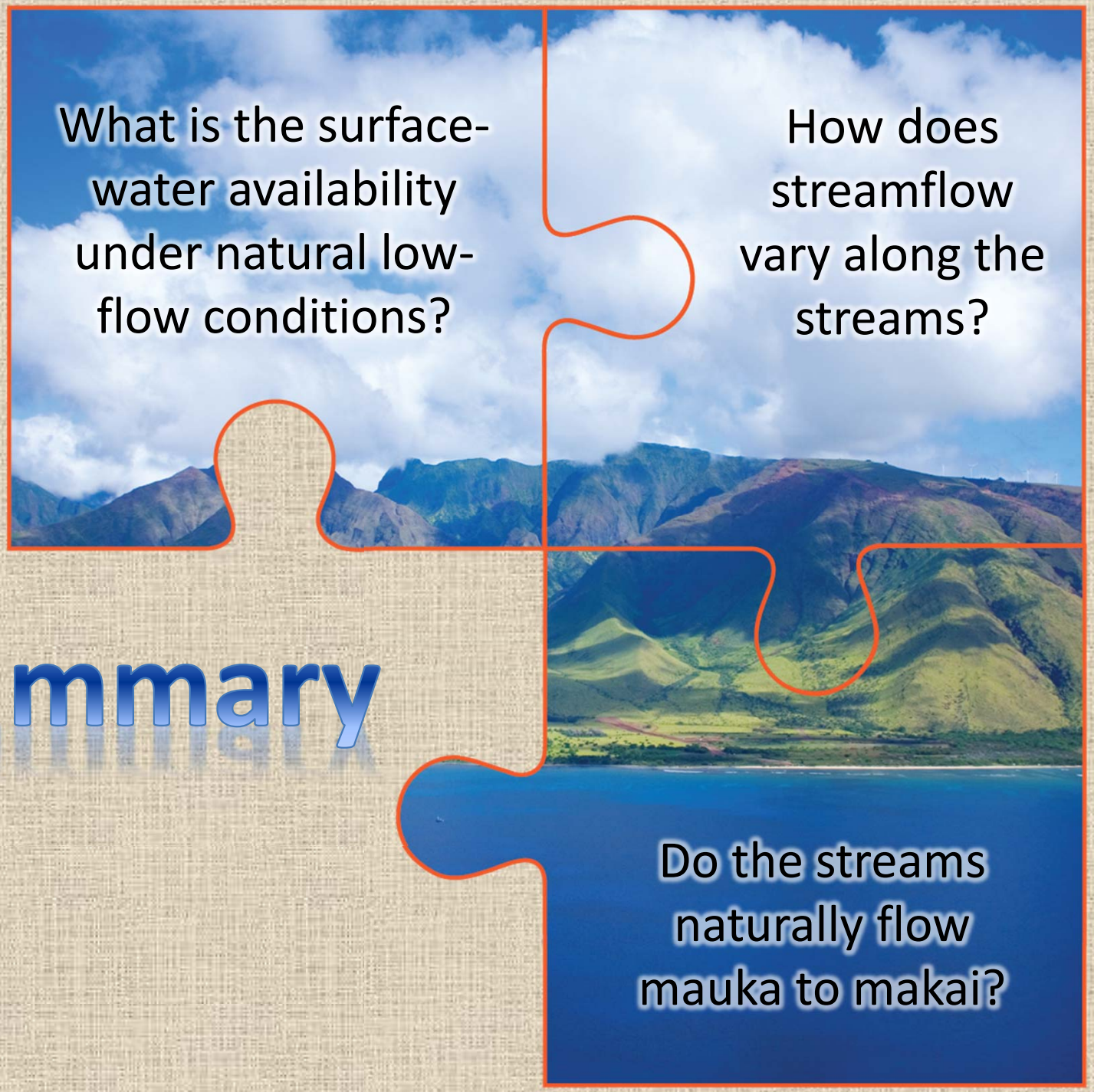
Median natural-flow conditions:
(Results shown on the right)
Honokahua Stream to Wahikuli Gulch do not flow to the ocean

Q_{95} natural-flow conditions:
In addition to the above streams, Honolua Stream does not flow to the ocean

Data insufficient for Launiupoko Stream to determine streamflow gains and losses



Summary


What is the surface-water availability under natural low-flow conditions?
How does streamflow vary along the streams?
Do the streams naturally flow mauka to makai?

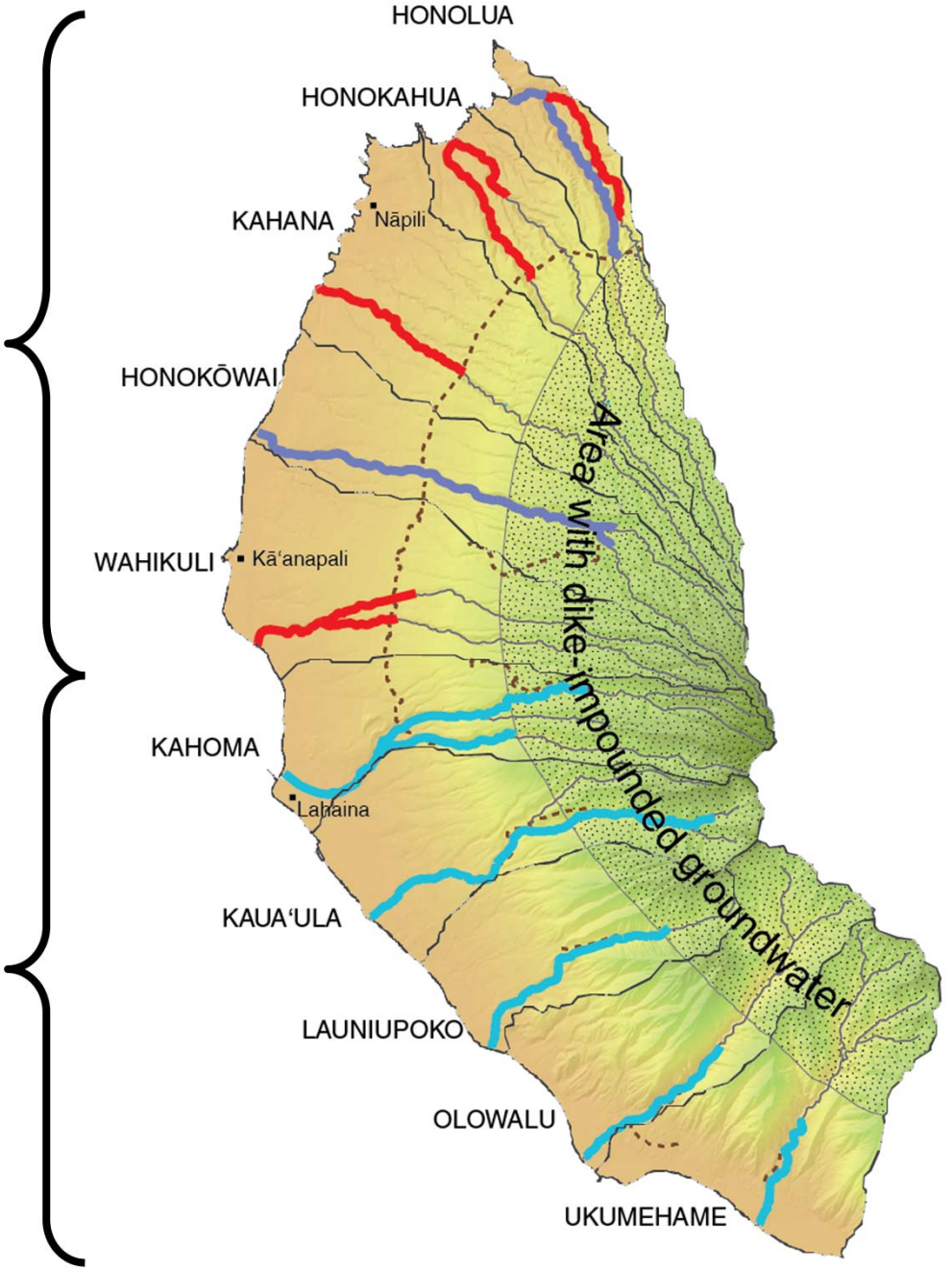
Under natural-flow conditions:

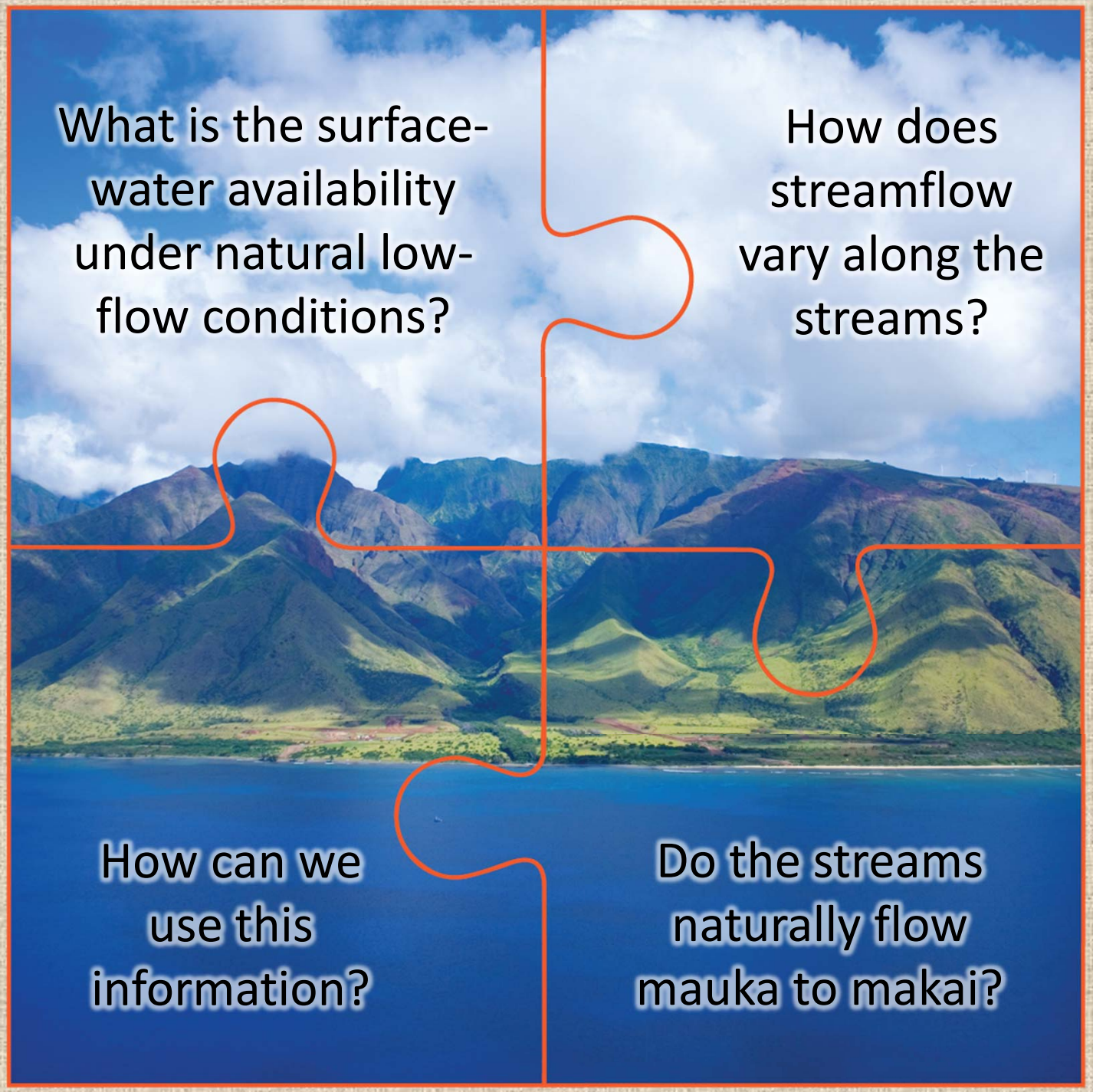
- Many are ephemeral streams
- Honolua Stream does not flow to the ocean 20% of the time
- Honokōwai Stream runs dry before reaching the ocean at least 50% of the time

- Supports mauka-to-makai flow at least 95% of the time

Generally,

- gains flow in upper reaches
- loses flow in lower reaches





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Information use

- Establish instream-flow standards
- Quantify surface-water availability for downstream use
- Determine habitat availability for stream fauna
- Estimate groundwater recharge from streams
- Prioritize areas for further study


Kaua‘ula Valley, Maui

Thank you!

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Photo by Sarah Rosa

Questions?