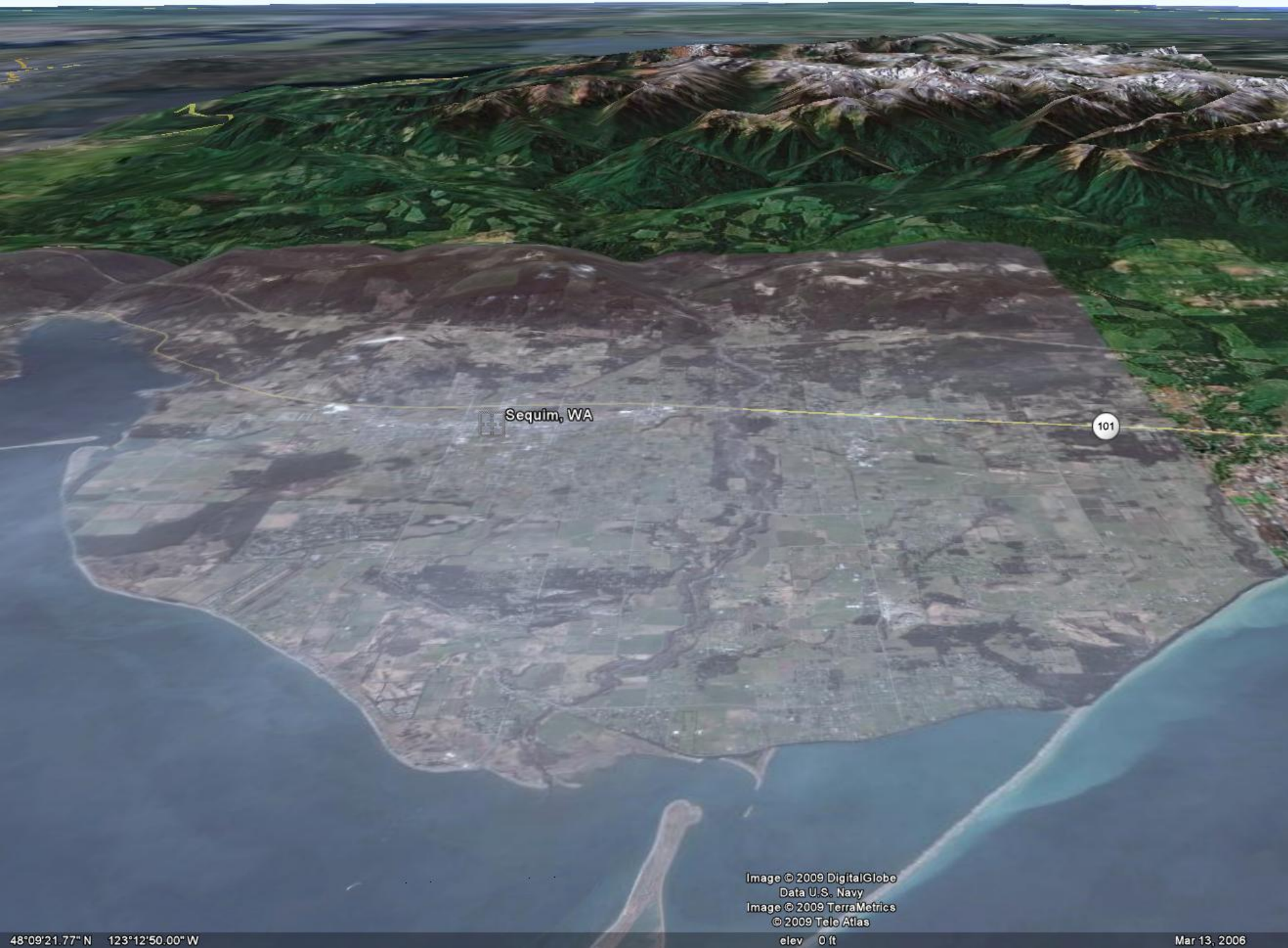
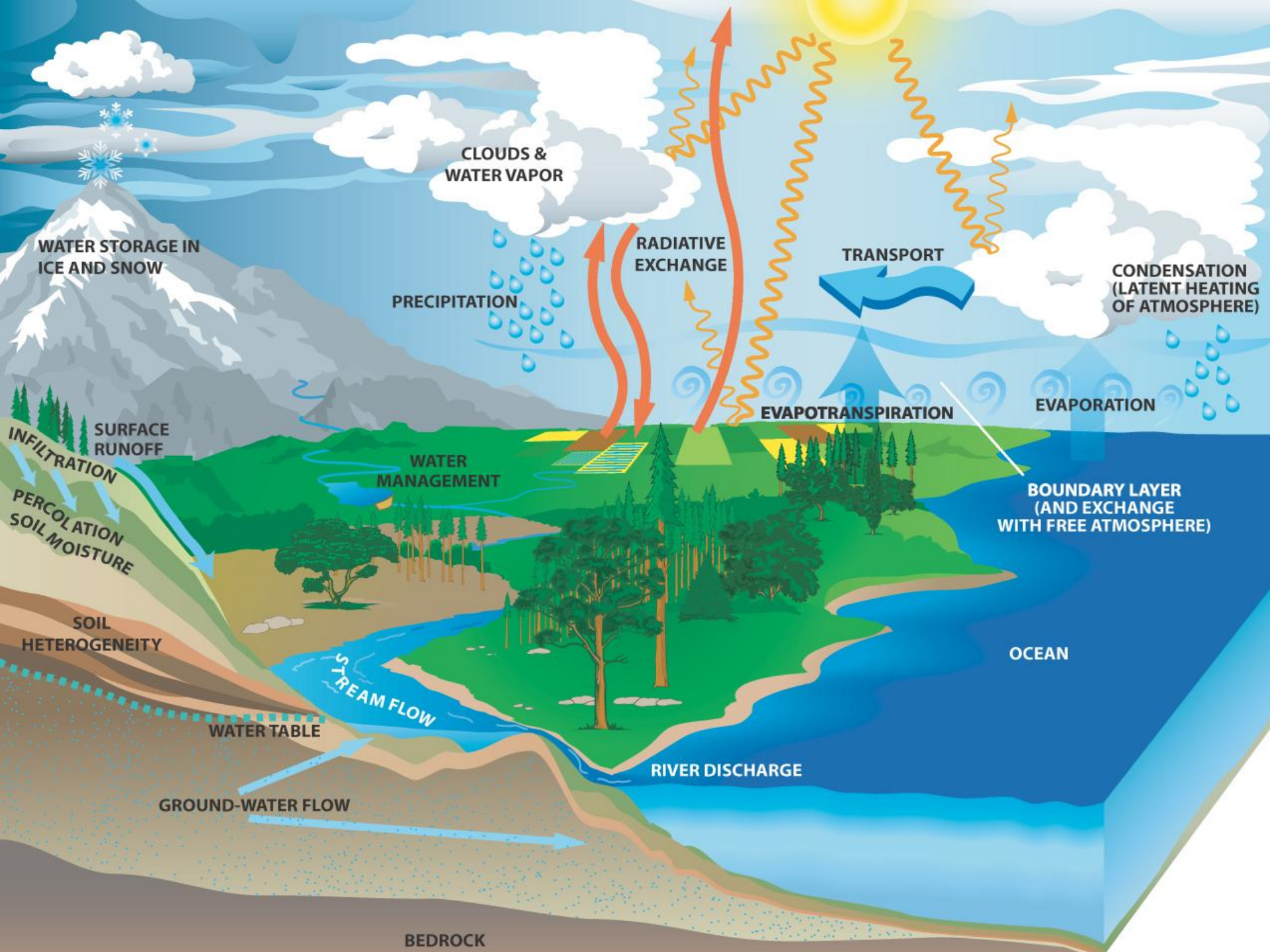
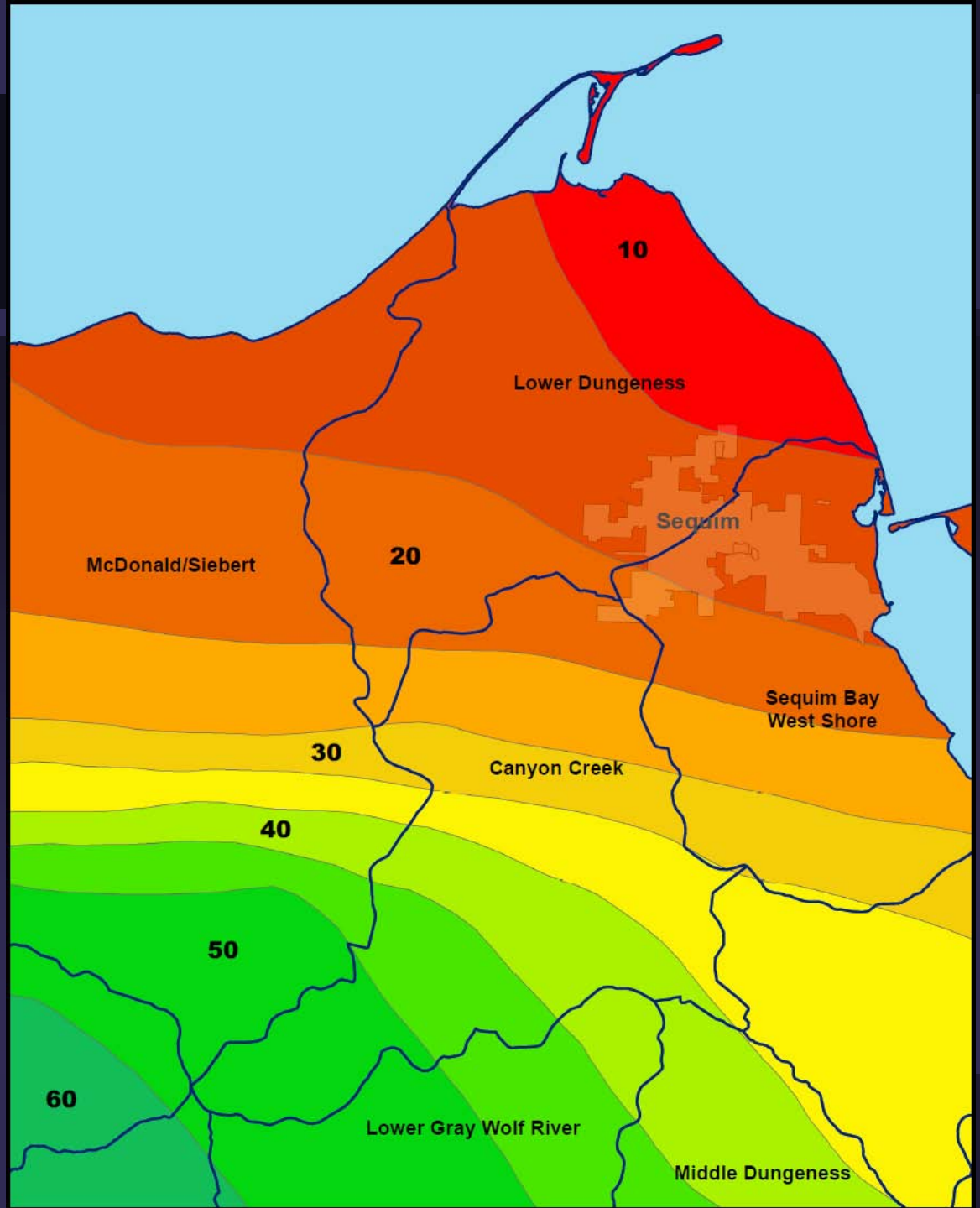

Sequim, WA
101
Image © 2009 DigitalGlobe
Data U.S. Navy
Image © 2009 TerraMetrics
© 2009 Tele Atlas
48°09'21.77" N 123°12'50.00" W
elev 0 ft
Mar 13, 2006


CLOUDS &
WATER VAPOR
WATER STORAGE IN
ICE AND SNOW
RADIATIVE
EXCHANGE
TRANSPORT
CONDENSATION
(LATENT HEATING
OF ATMOSPHERE)
PRECIPITATION
EVAPOTRANSPIRATION
EVAPORATION
SURFACE
RUNOFF
INFILTRATION
WATER
MANAGEMENT
PERCOLATION
SOIL MOISTURE
BOUNDARY LAYER
(AND EXCHANGE
WITH FREE ATMOSPHERE)
SOIL
HETEROGENEITY
OCEAN
STREAM FLOW
WATER TABLE
RIVER DISCHARGE
GROUND-WATER FLOW
BEDROCK



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ECOLOGY

Dungeness River Flow & Precipitation

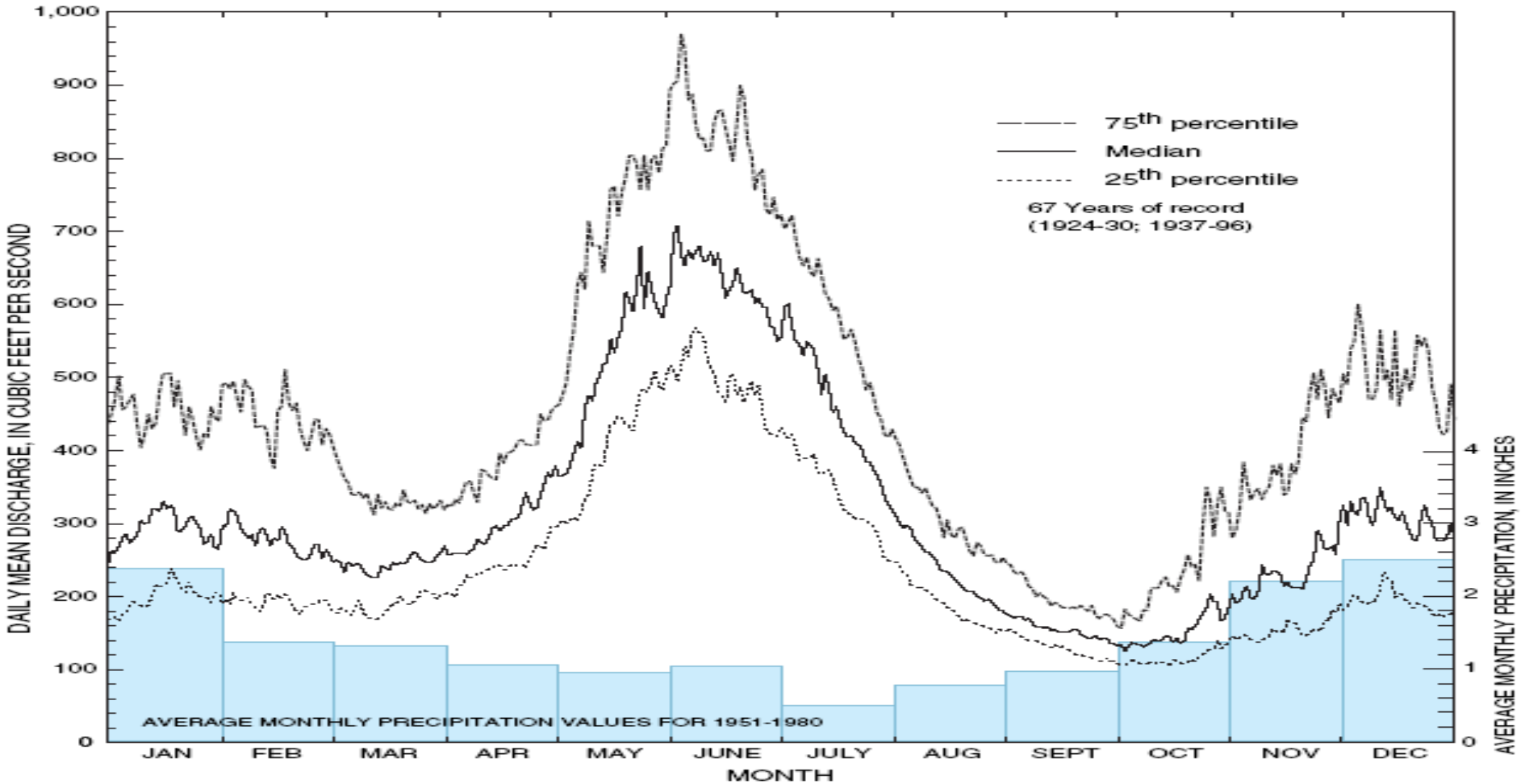
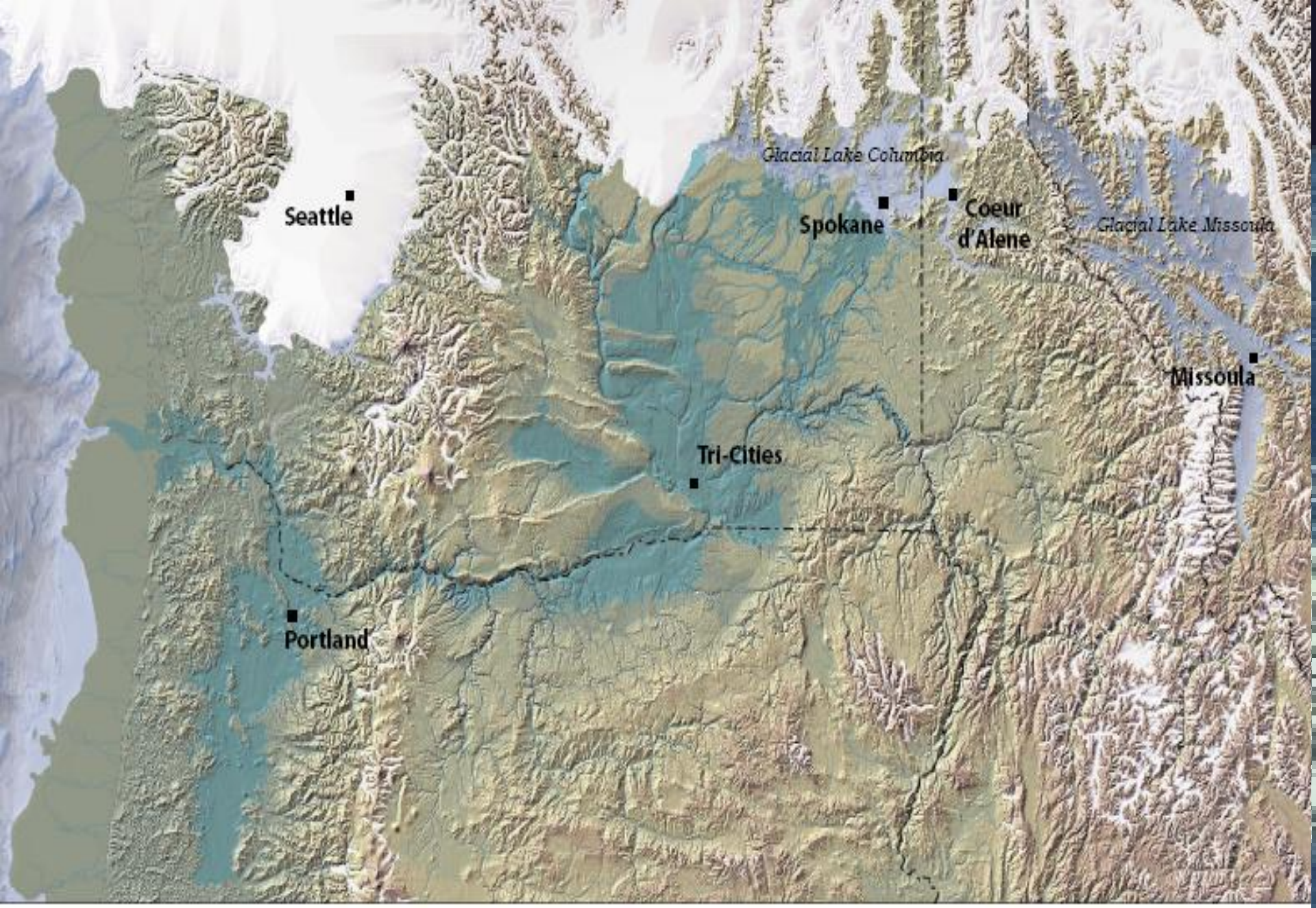


Figure 5. Mean daily discharge for the Dungeness River and average monthly precipitation near Sequim, Washington.
Discharge data are from U. S. Geological Survey streamgaging station 12048000 and precipitation data are from the National Oceanic and Atmospheric (1982).



The Pacific Northwest During the Last Ice Age: 15,000 to 12,000 Years Ago

Ground Water Flow System

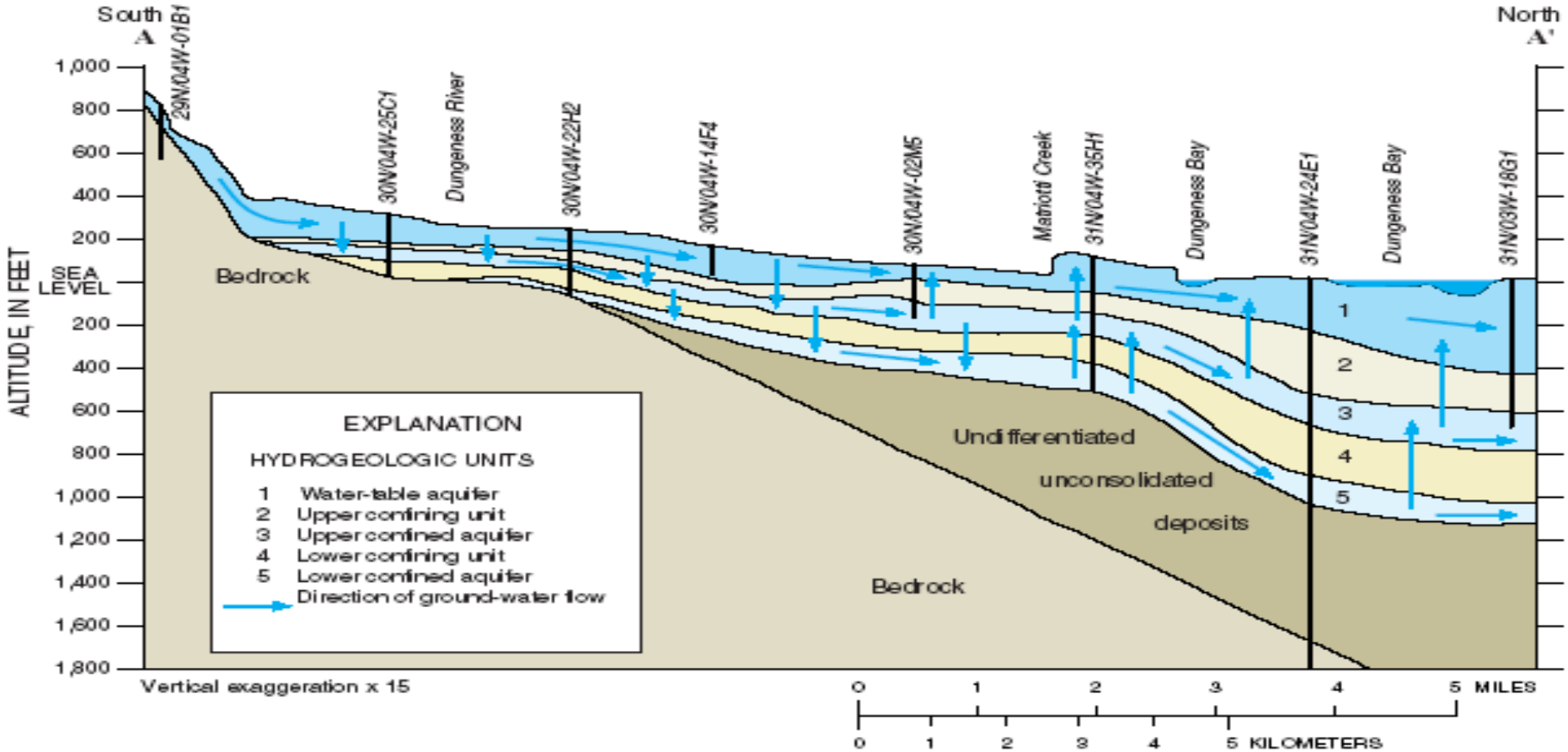
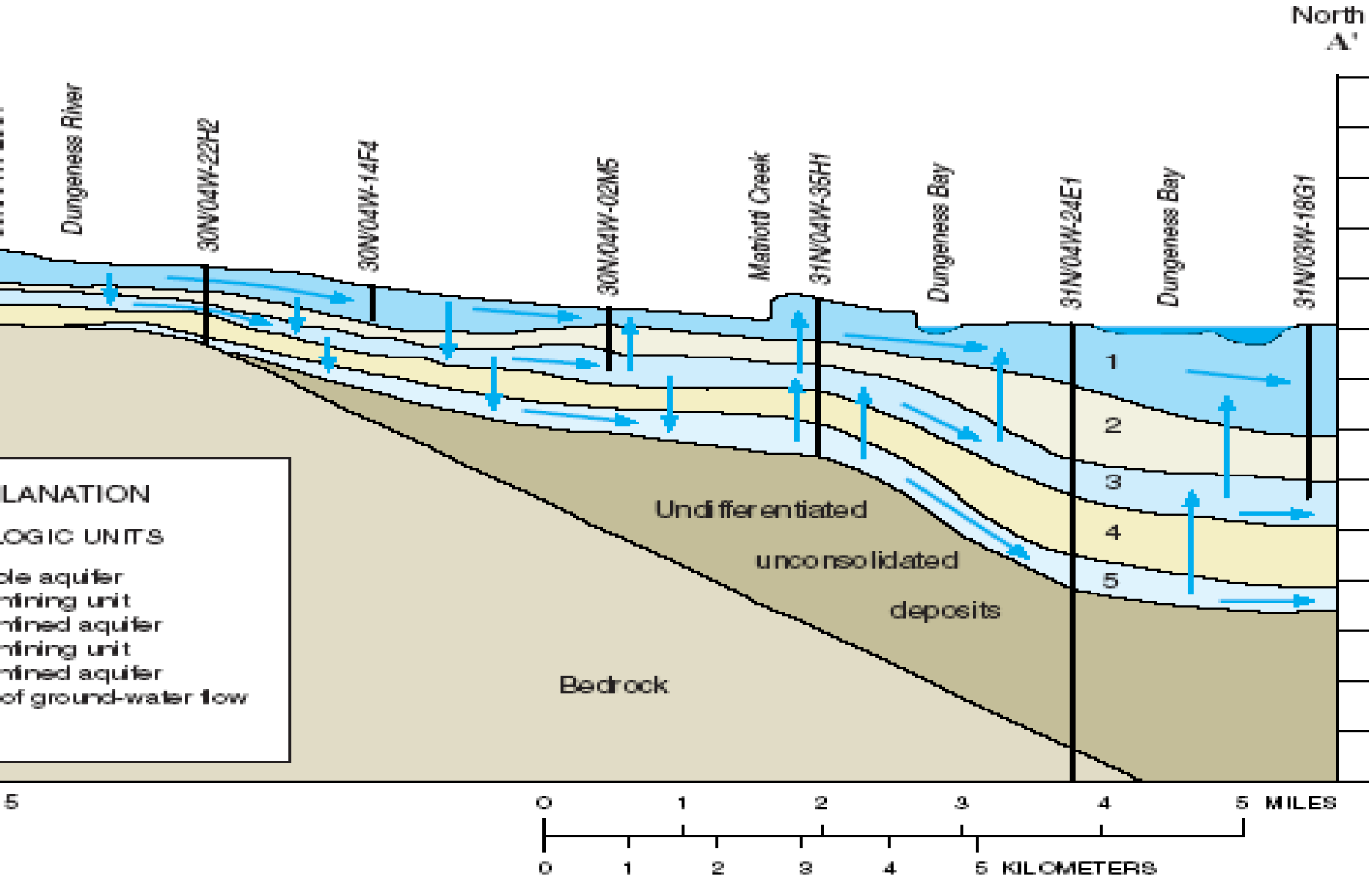


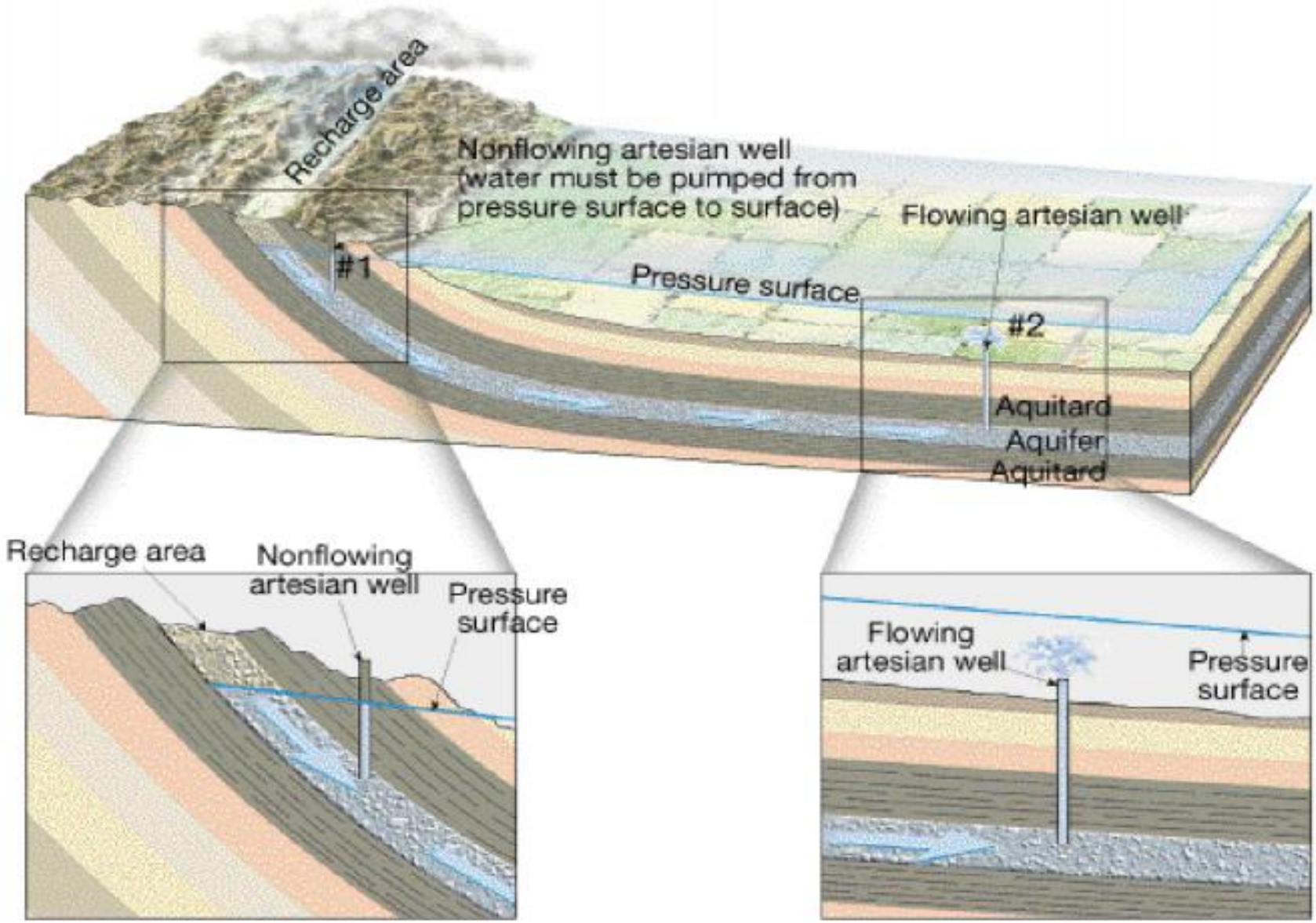
Figure 4. Hydrogeologic section showing the principal aquifer and confining units and directions of ground-water flow on the Sequim-Dungeness peninsula, Clallam County, Washington.
(Modified from Drost, 1983) See figure 1 for the trace of the section.



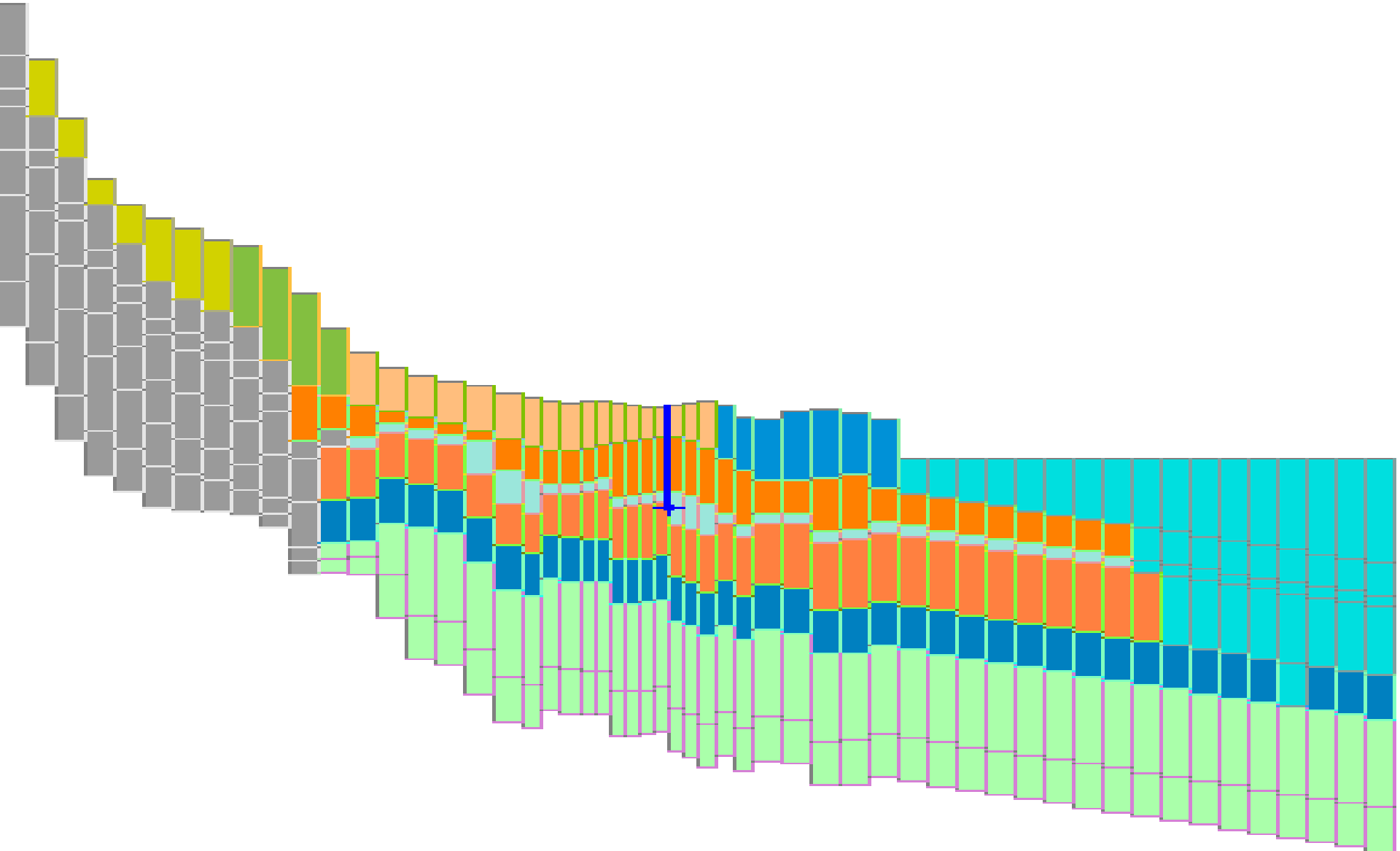
owing the principal aquifer and confining units and directions of ground-water flow on the Sequim-Dungeness
ton.

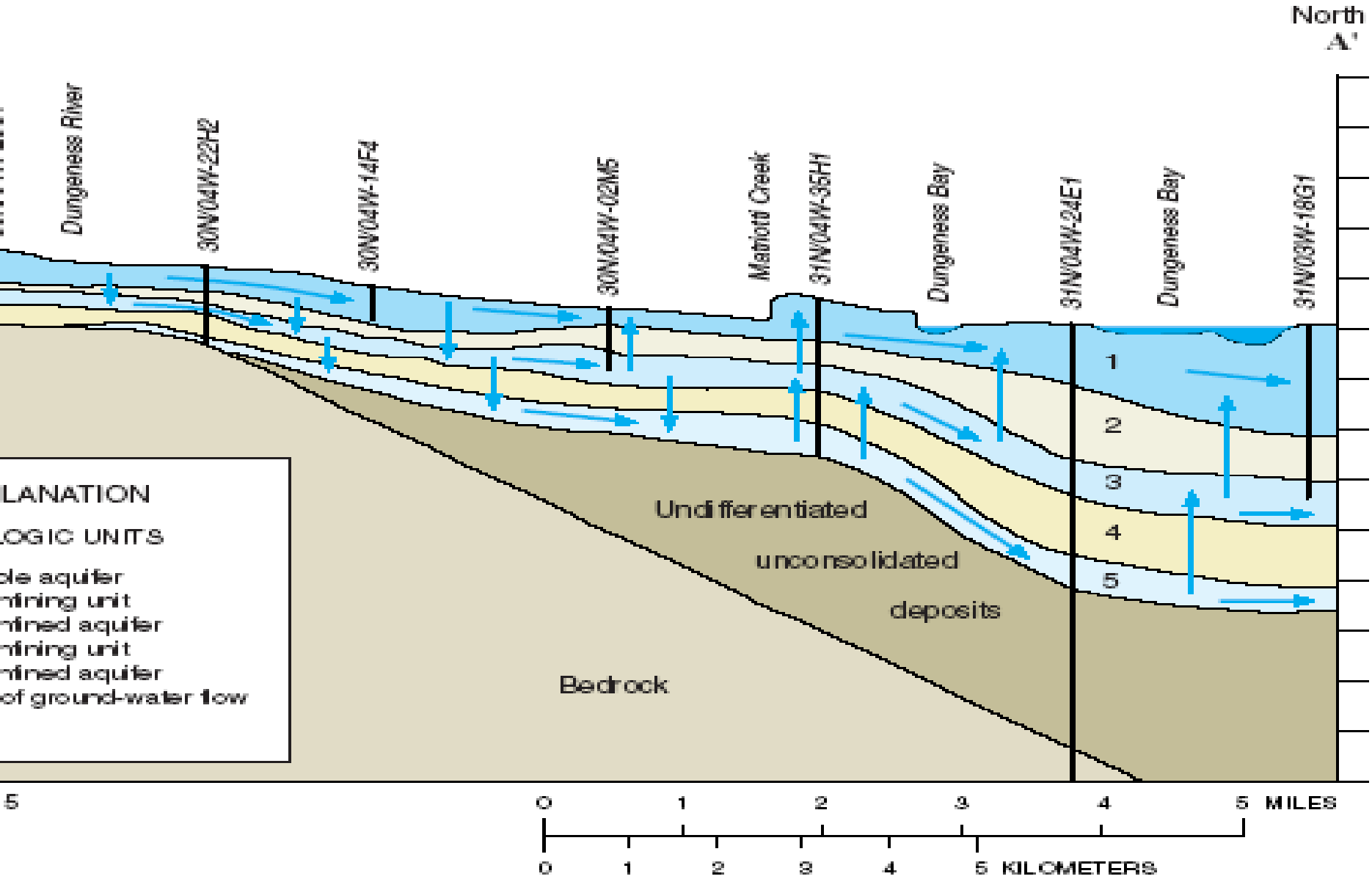
re 1 for the trace of the section.

Confined (Artesian) Aquifers



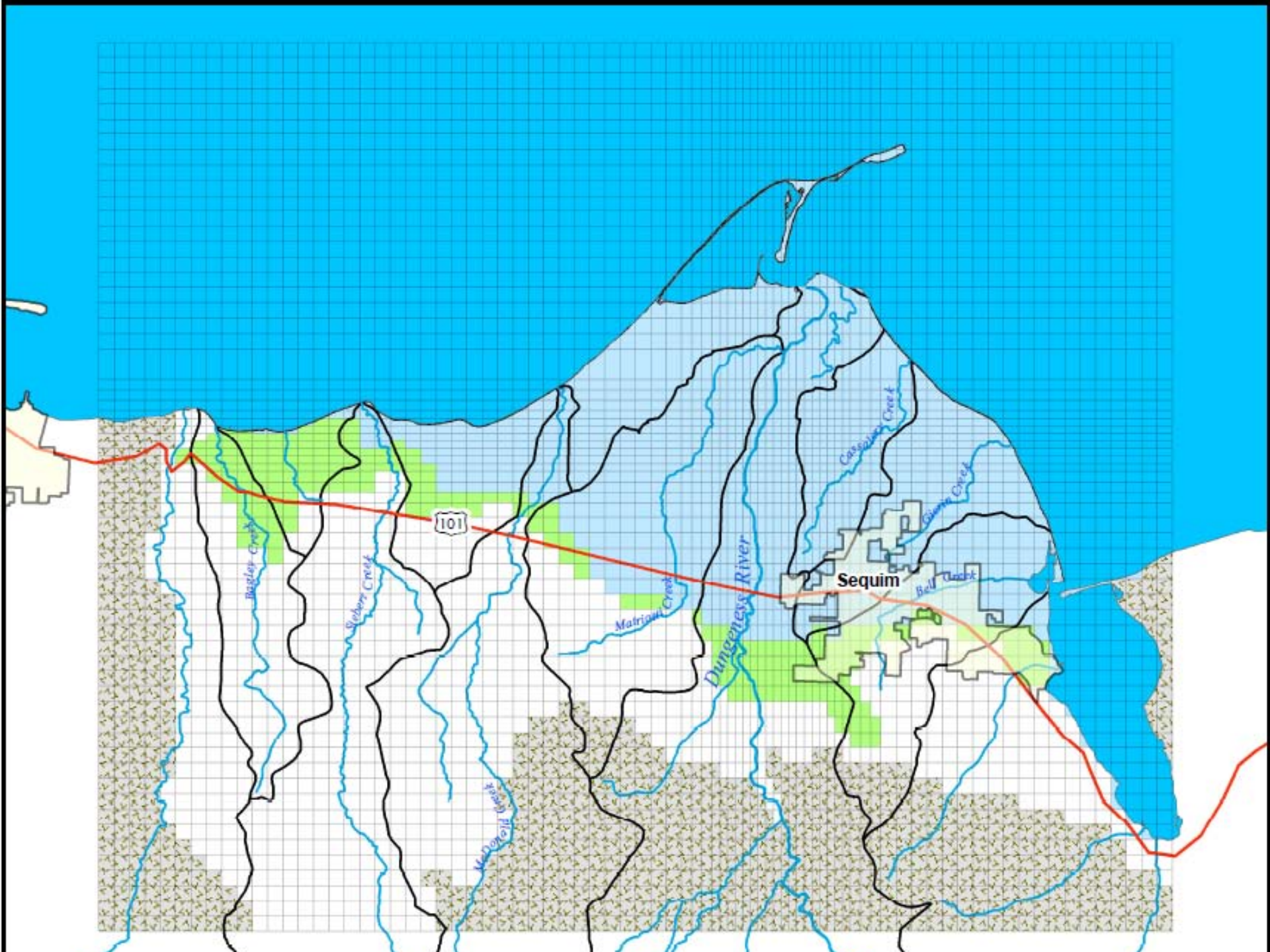
Groundwater Model Layers



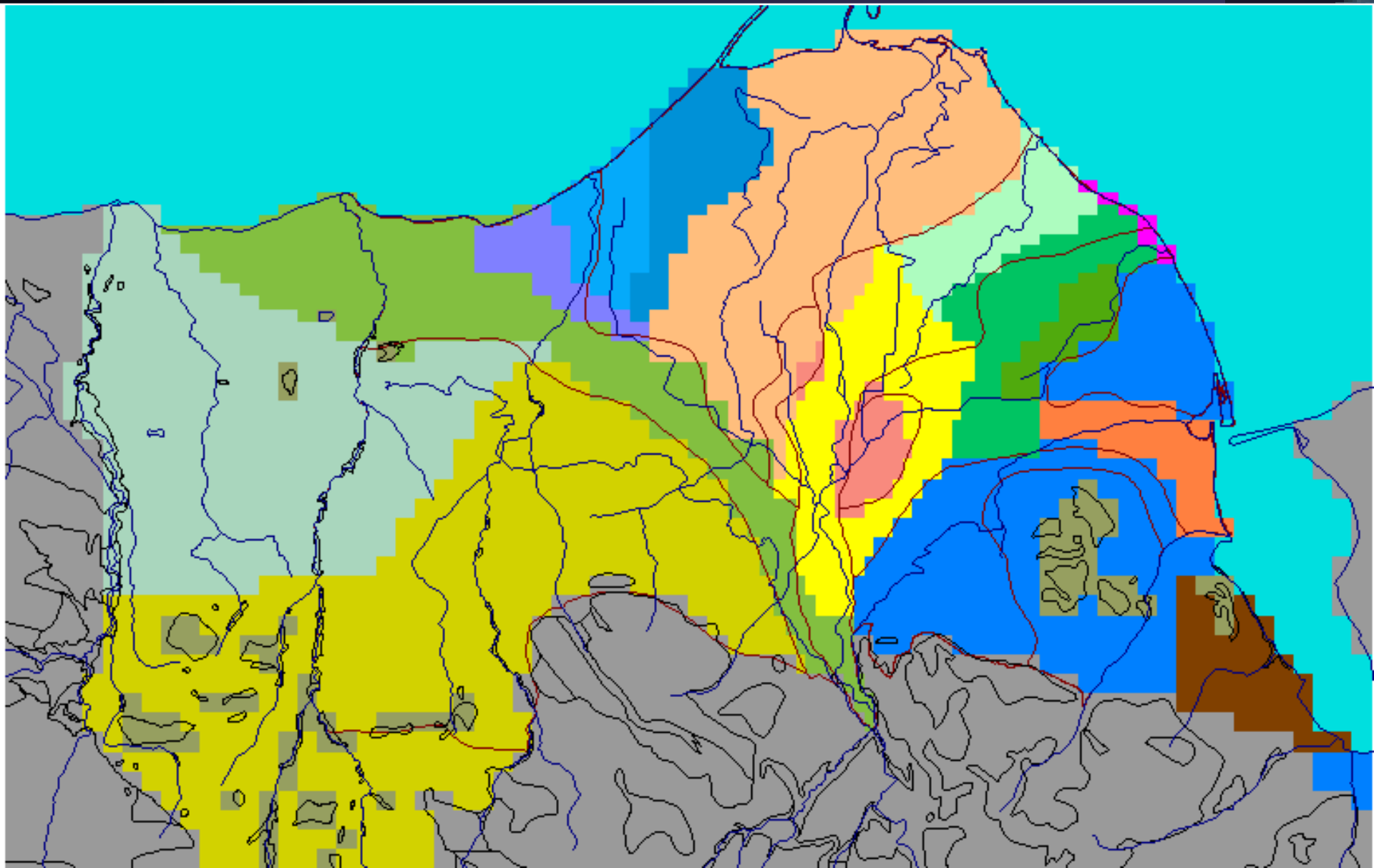


owing the principal aquifer and confining units and directions of ground-water flow on the Sequim-Dungeness
ton.

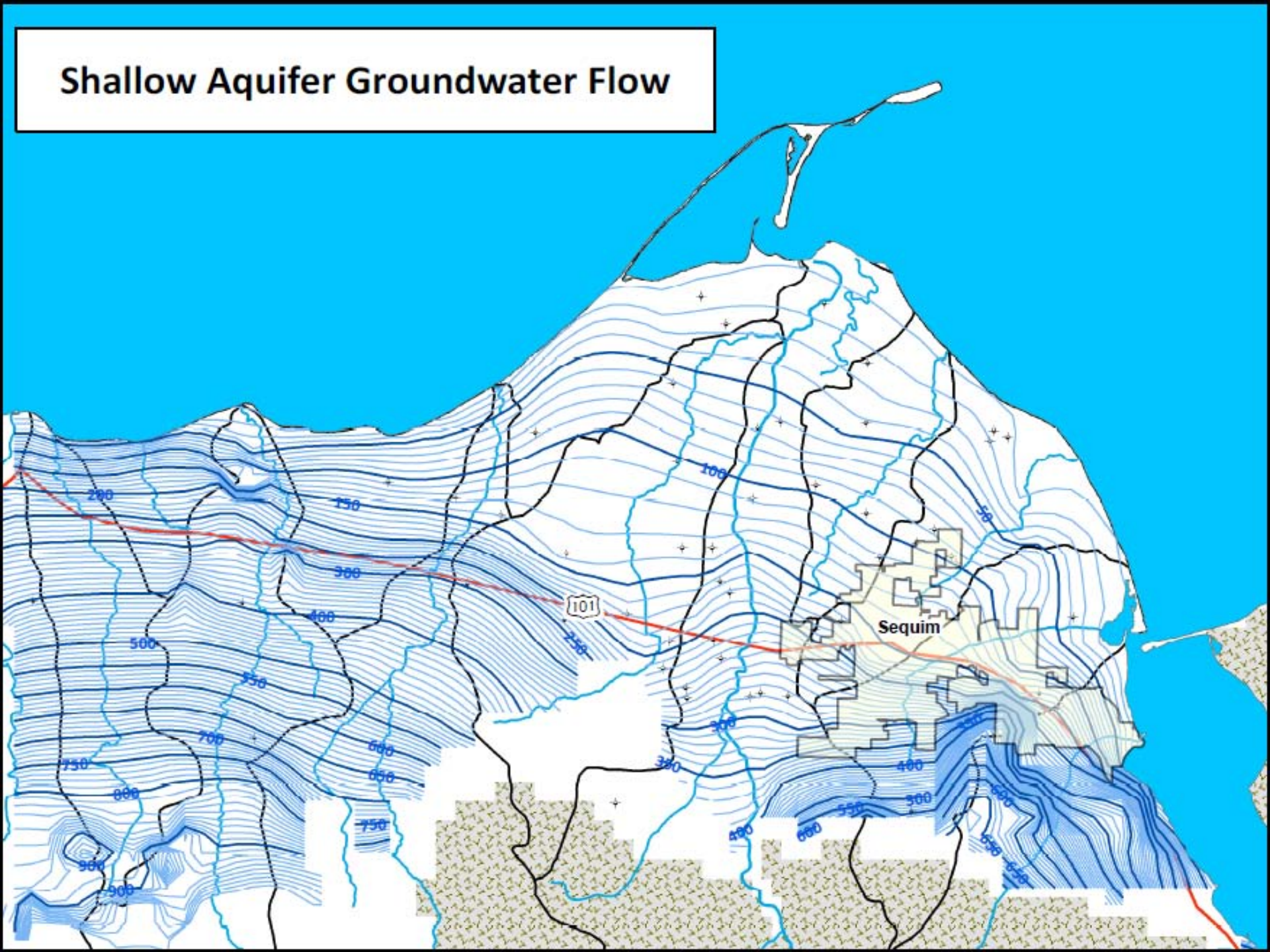
re 1 for the trace of the section.


101
Sequim
Dungeness River
Bagley Creek
Siebert Creek
Matriotti Creek
McDonald Creek
Cassalery Creek
Gierin Creek
Bell Creek

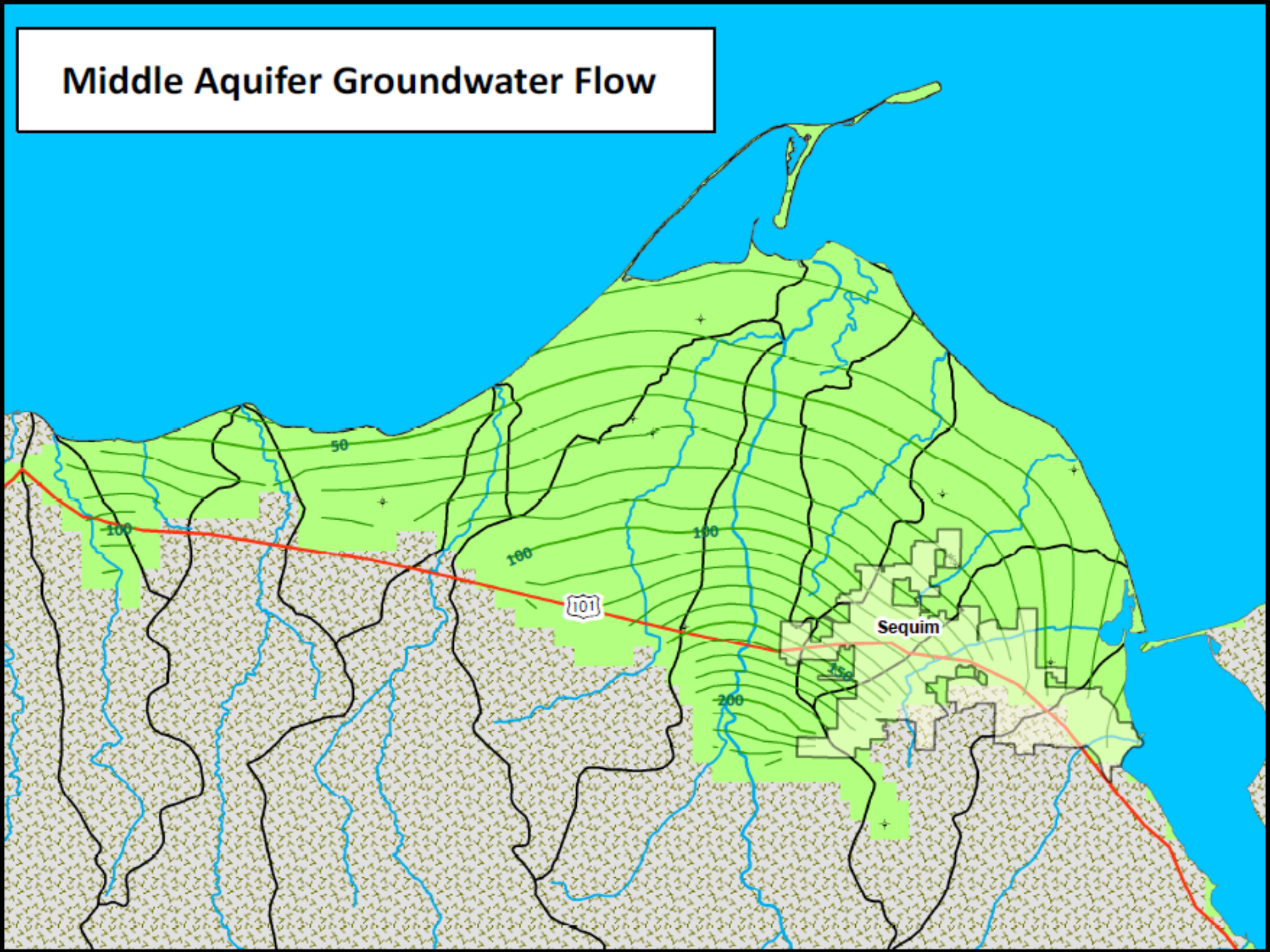
Aquifer Properties



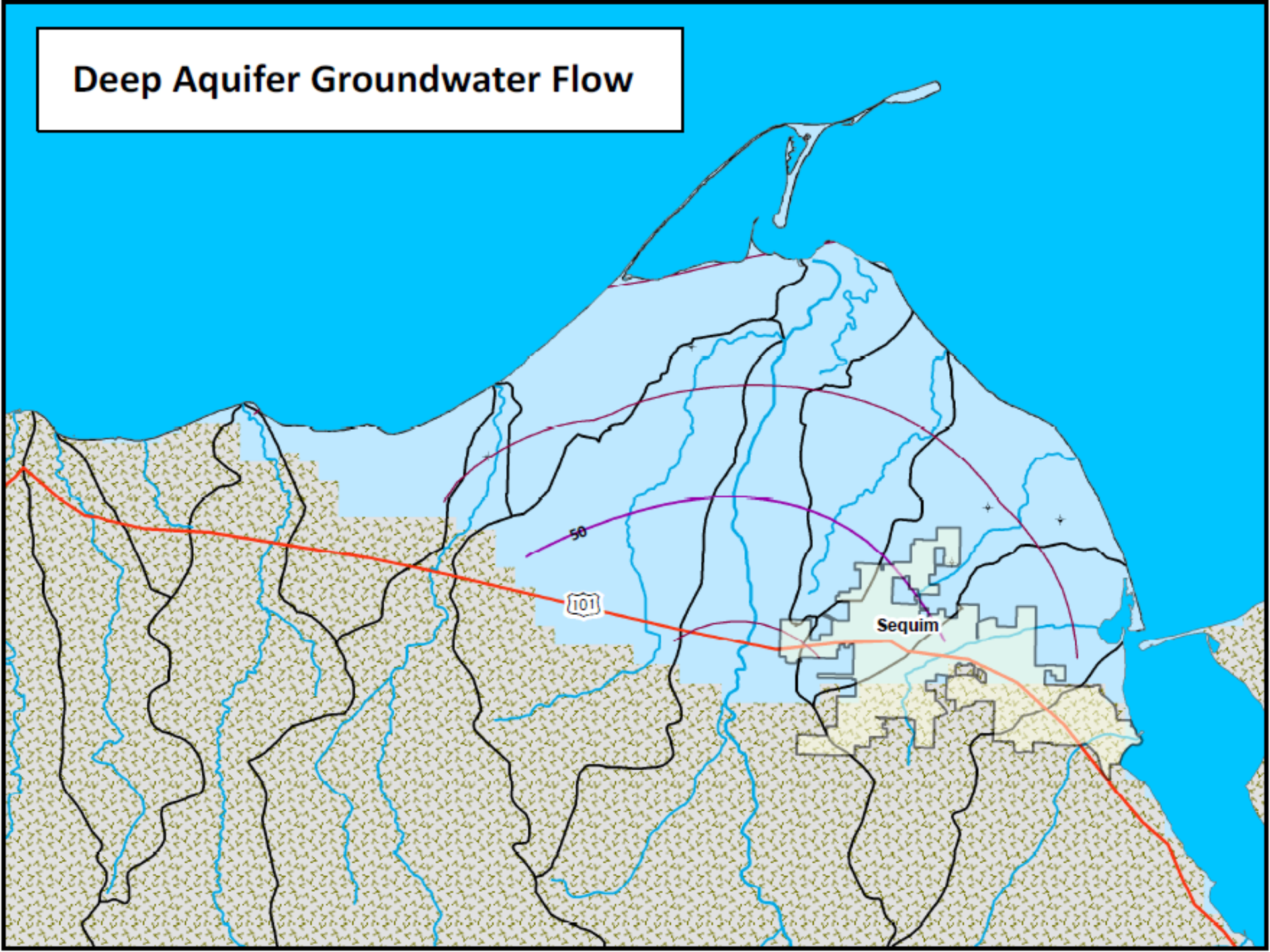
Shallow Aquifer Groundwater Flow

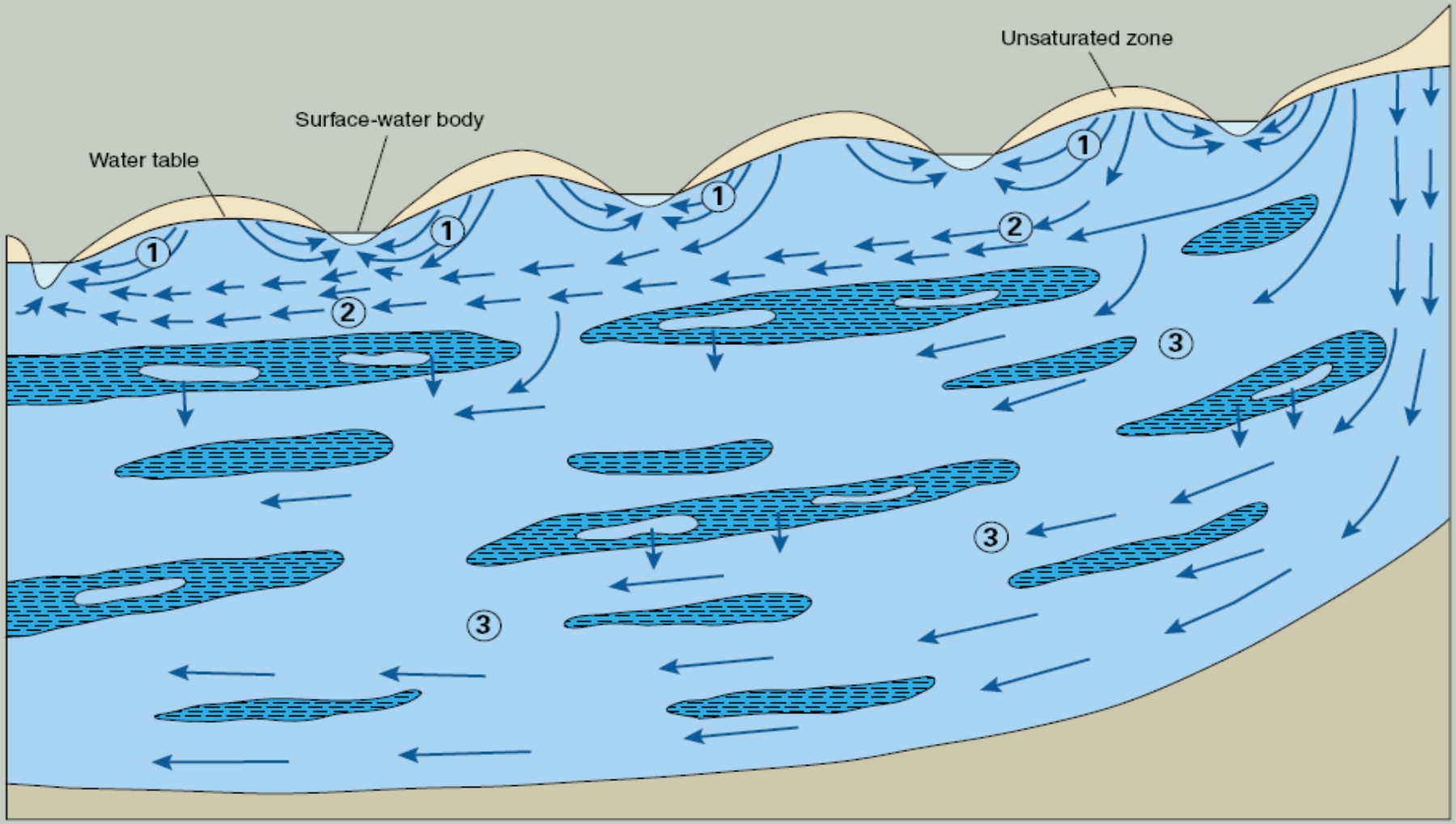


Middle Aquifer Groundwater Flow



Deep Aquifer Groundwater Flow

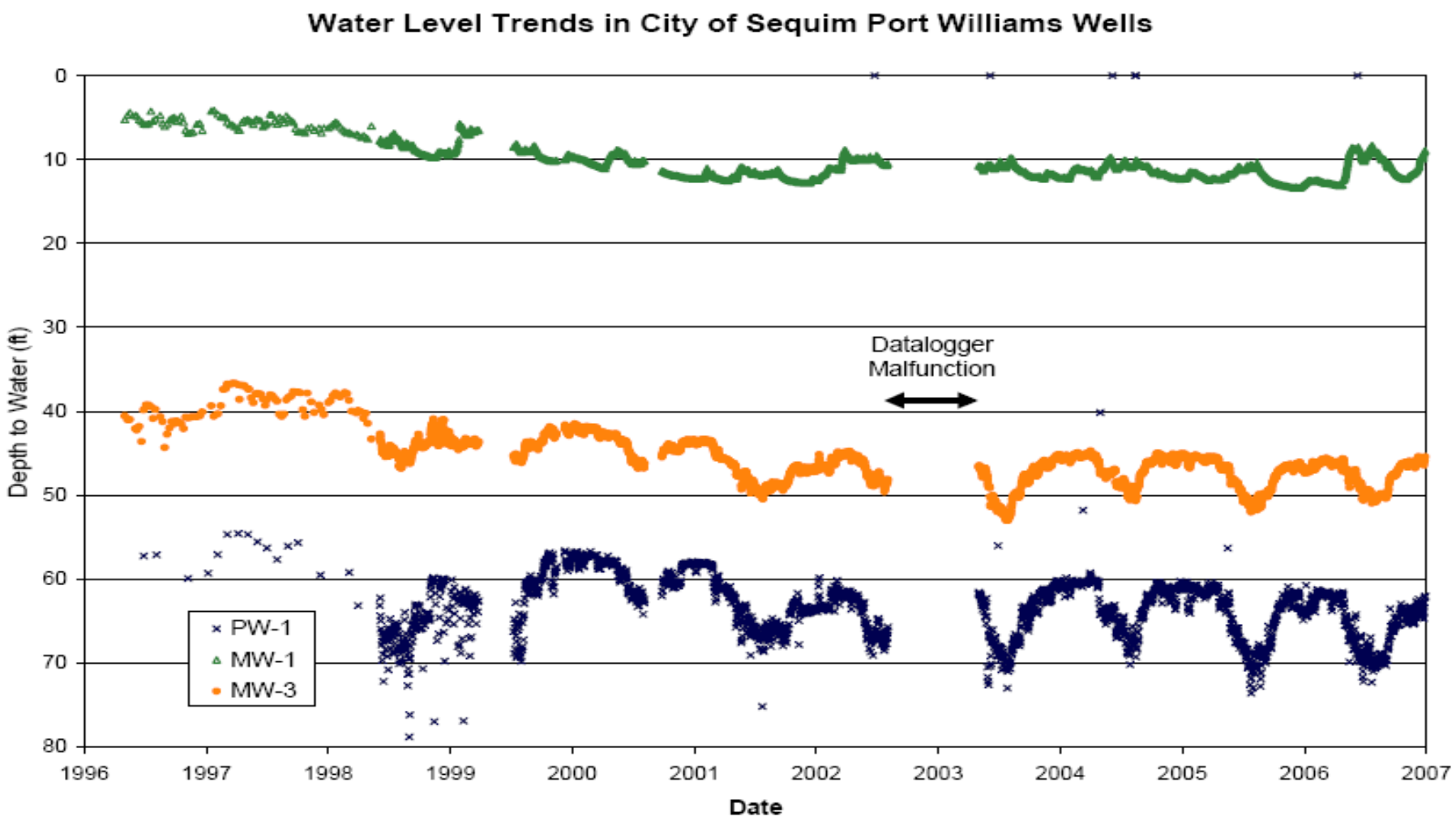




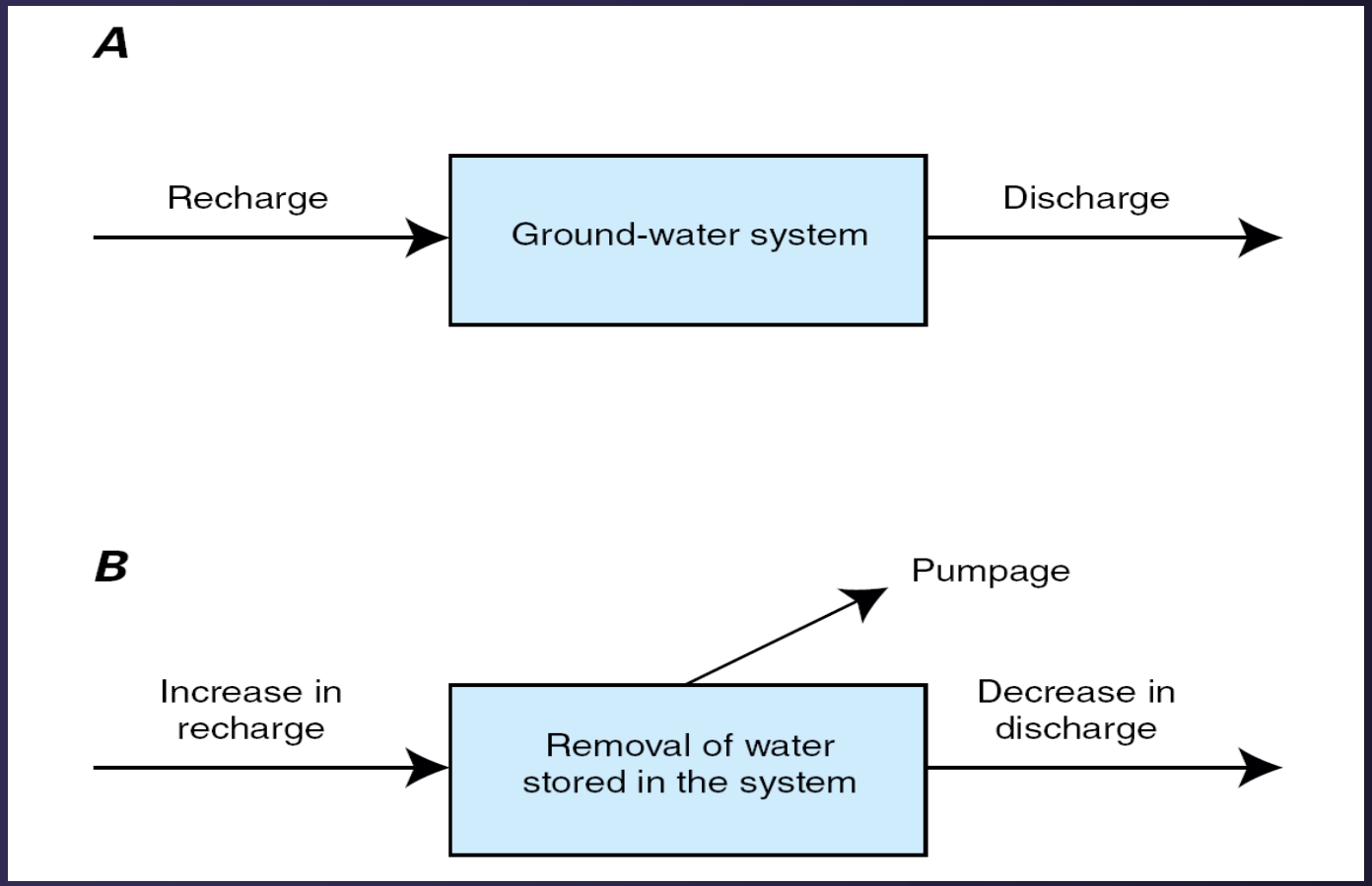
EXPLANATION

- High hydraulic-conductivity aquifer
- Low hydraulic-conductivity confining unit
- Very low hydraulic-conductivity bedrock
- Direction of ground-water flow
- (1) Local ground-water subsystem
- (2) Subregional ground-water subsystem
- (3) Regional ground-water subsystem

Connection Between Aquifers



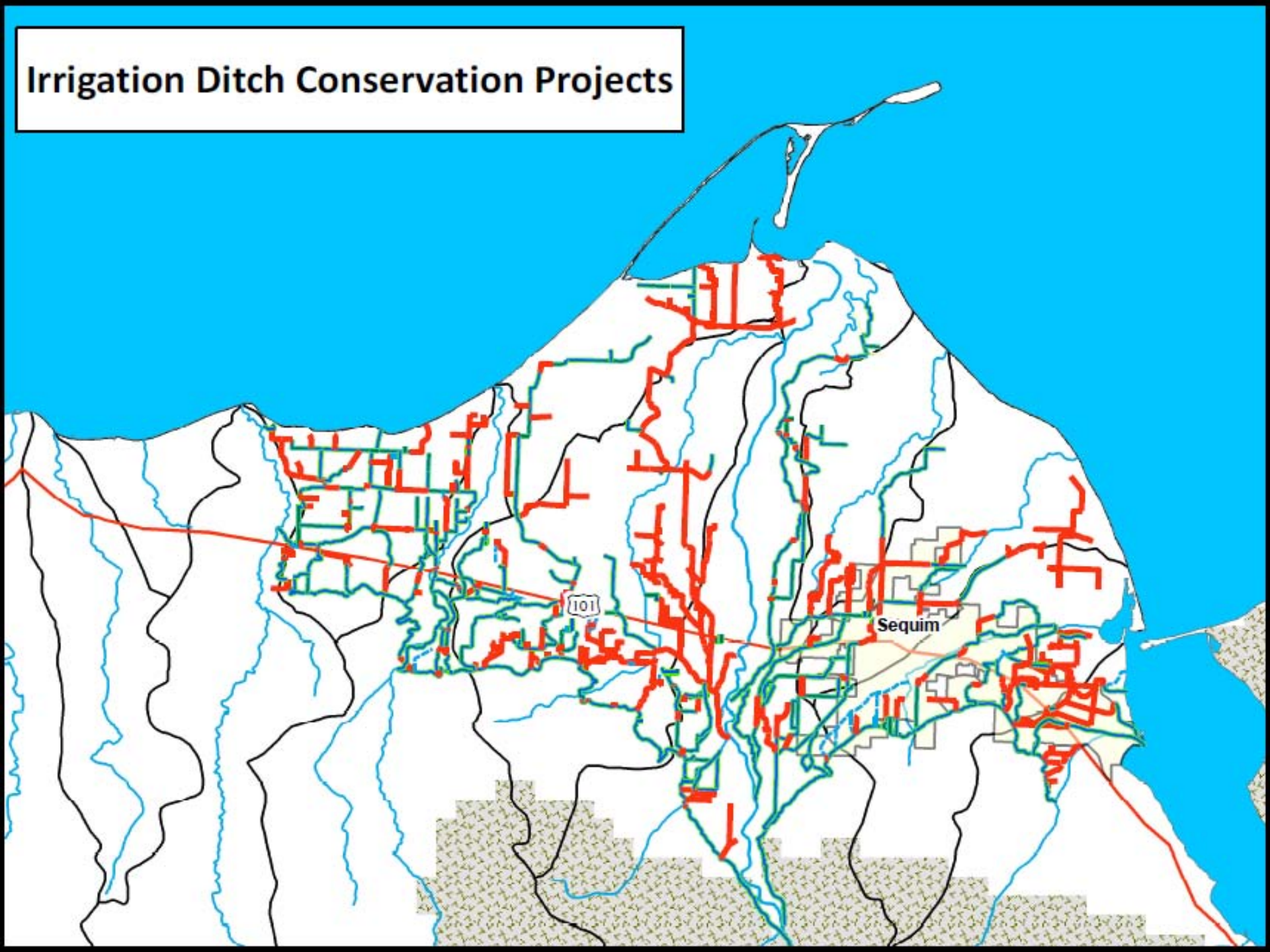
Possible Sources of Water Withdrawn by Wells



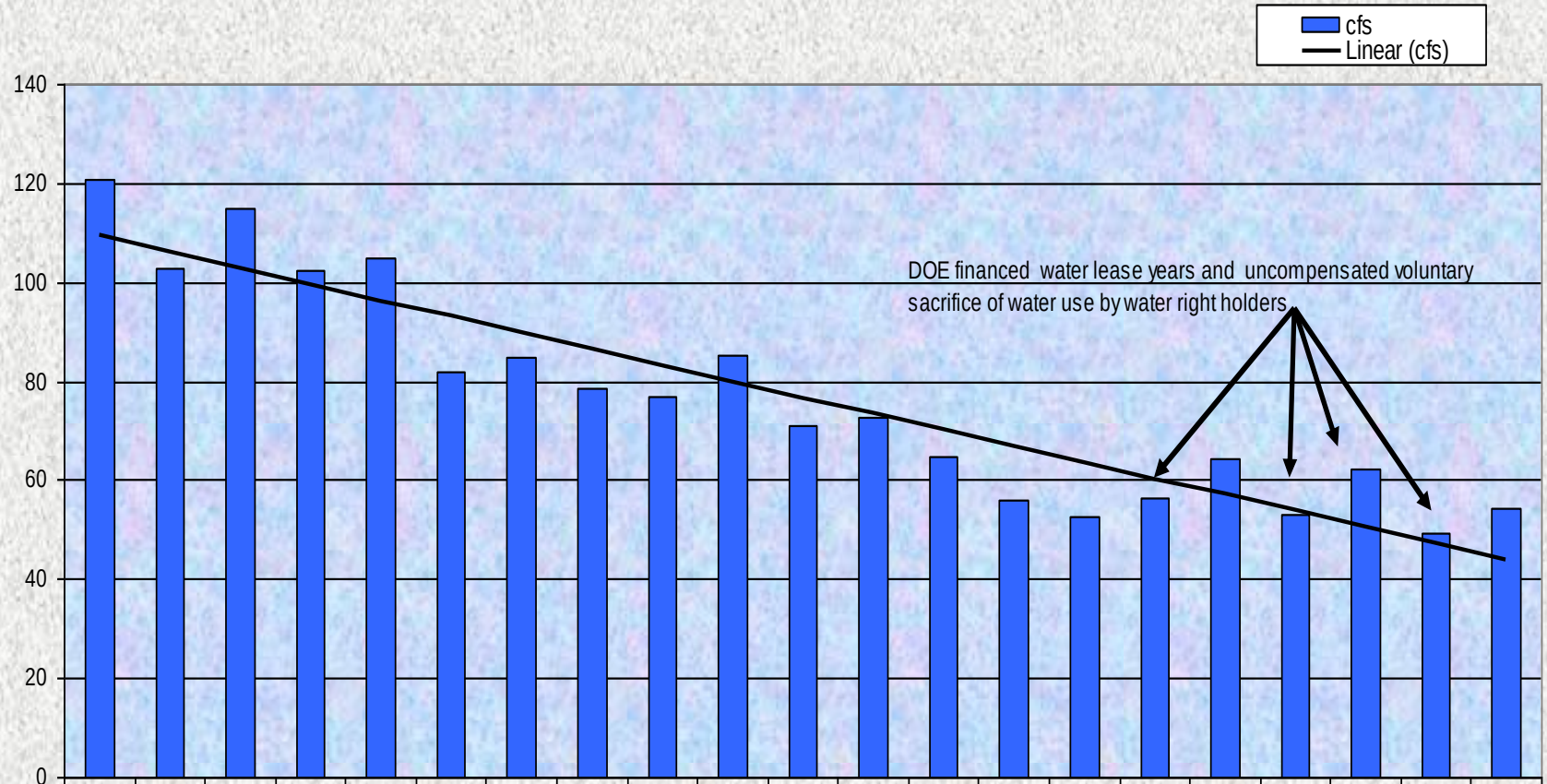
WASHINGTON STATE DEPARTMENT OF ECOLOGY

USGS C1186

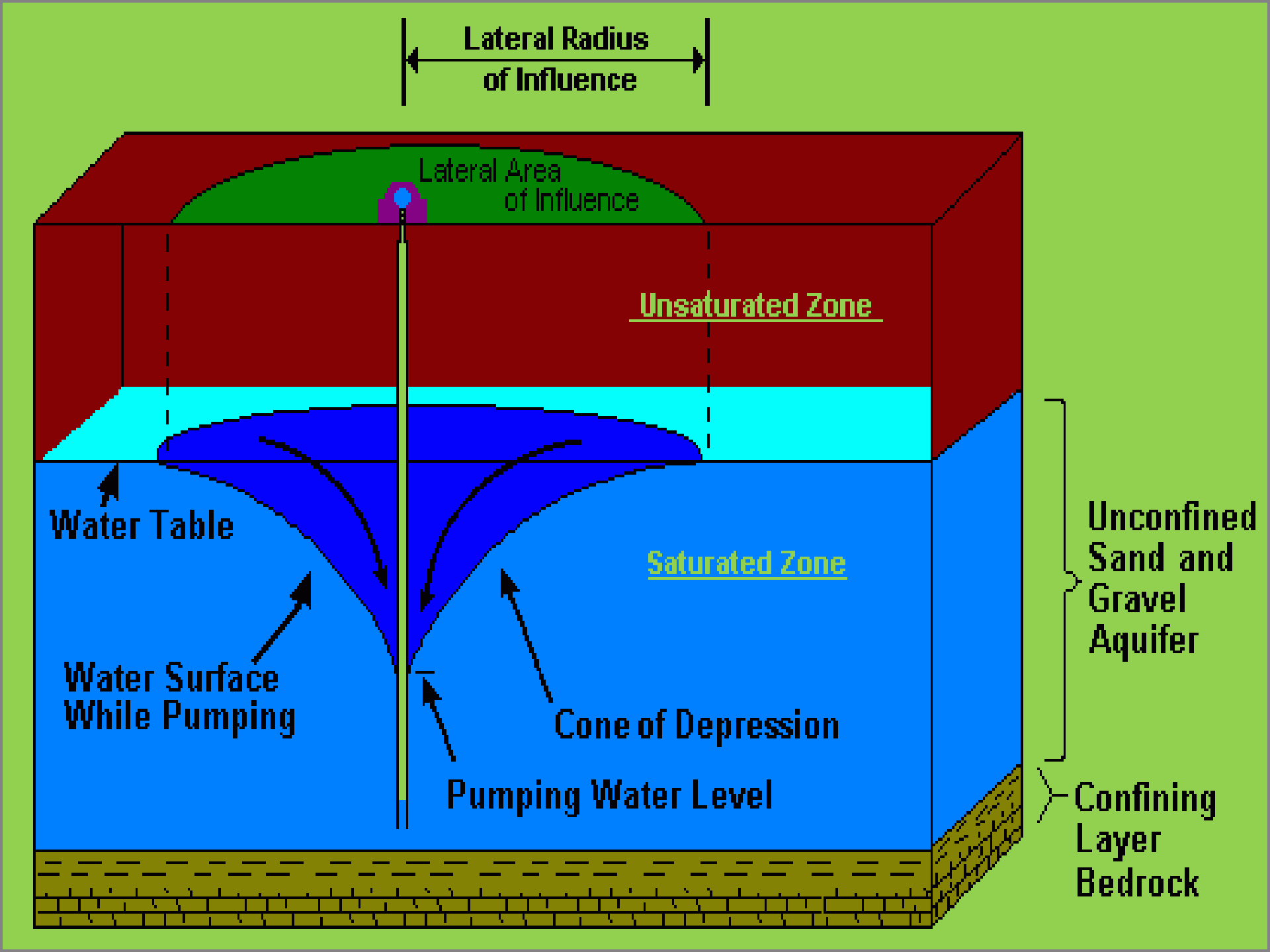
Irrigation Ditch Conservation Projects



Dungeness River Water Users Association
Average Annual Diversion Rates in Cubic Feet Per Second (cfs)

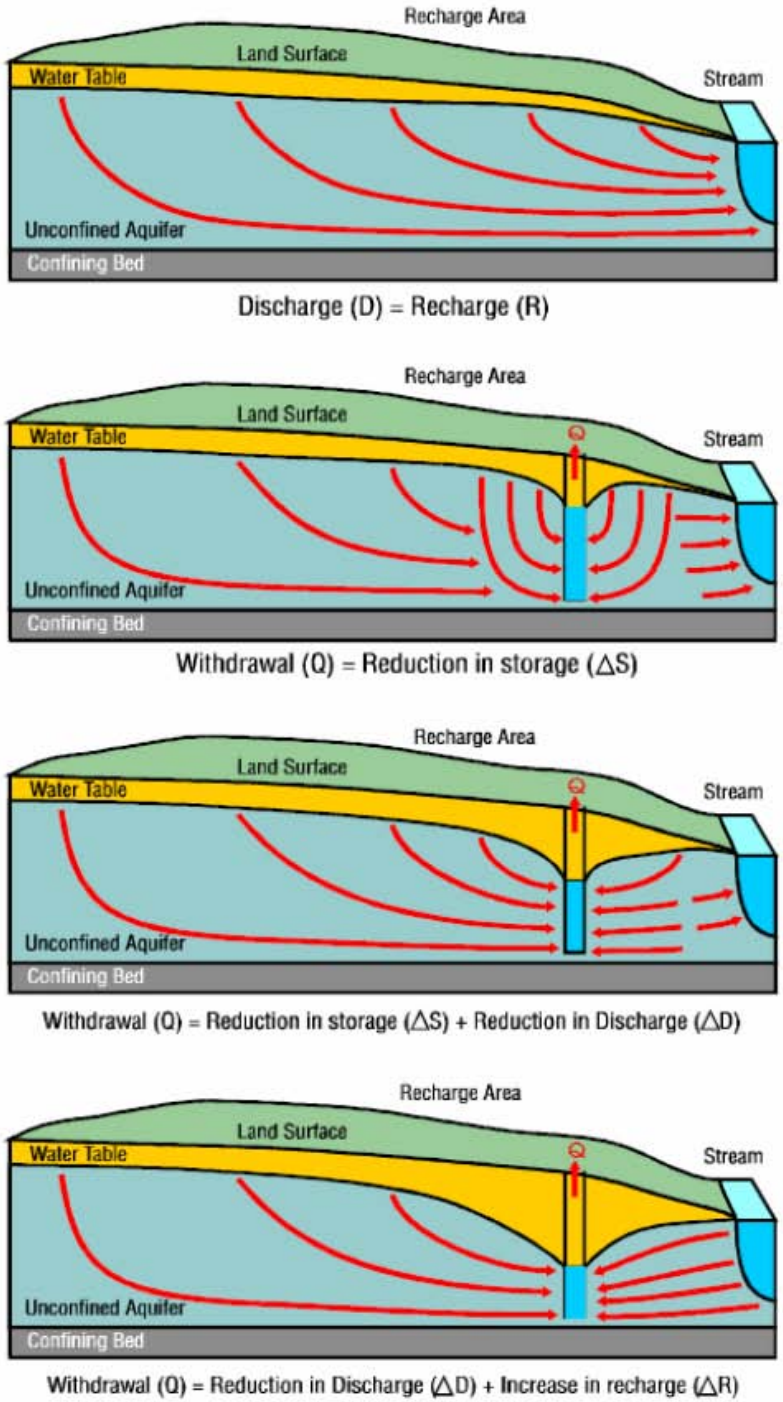


	1979	1980	1987	1988	1989	1990	1991	1992	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
cfs	120.64	102.75	114.9	102.5	105.02	81.8	84.925	78.725	76.7	85.17	70.86	72.6	64.86	55.83	52.65	56.35	64.35	53.22	62.08	49.43	54.44


Lateral Radius
of Influence
Lateral Area
of Influence
Unsaturated Zone
Water Table
Saturated Zone
Water Surface
While Pumping
Cone of Depression
Pumping Water Level
Unconfined
Sand and
Gravel
Aquifer
Confining
Layer
Bedrock

Source of Water Derived From Wells

From Heath, 1983



Rivers and aquifers exchange water

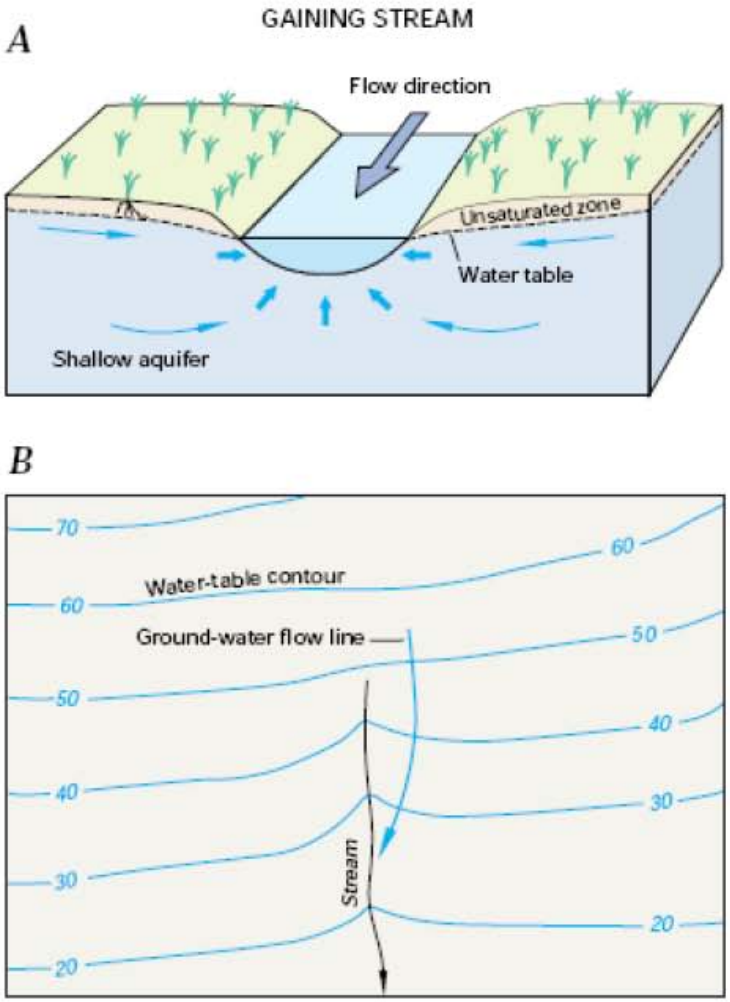


Figure 8. Gaining streams receive water from the ground-water system (A). This can be determined from water-table contour maps because the contour lines point in the upstream direction where they cross the stream (B).

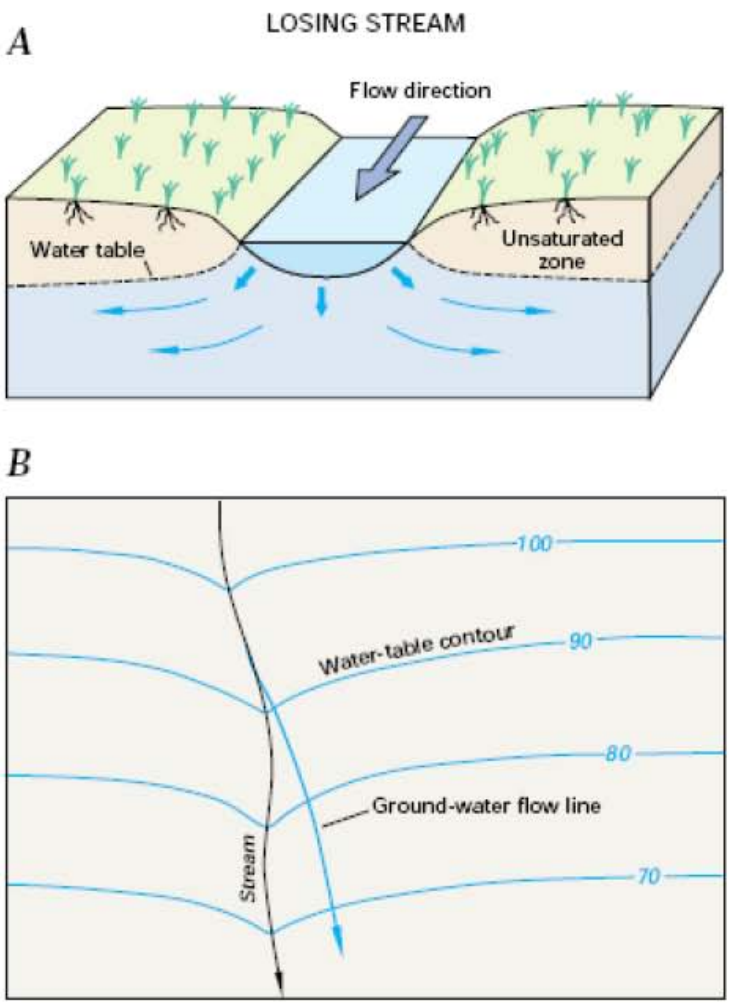
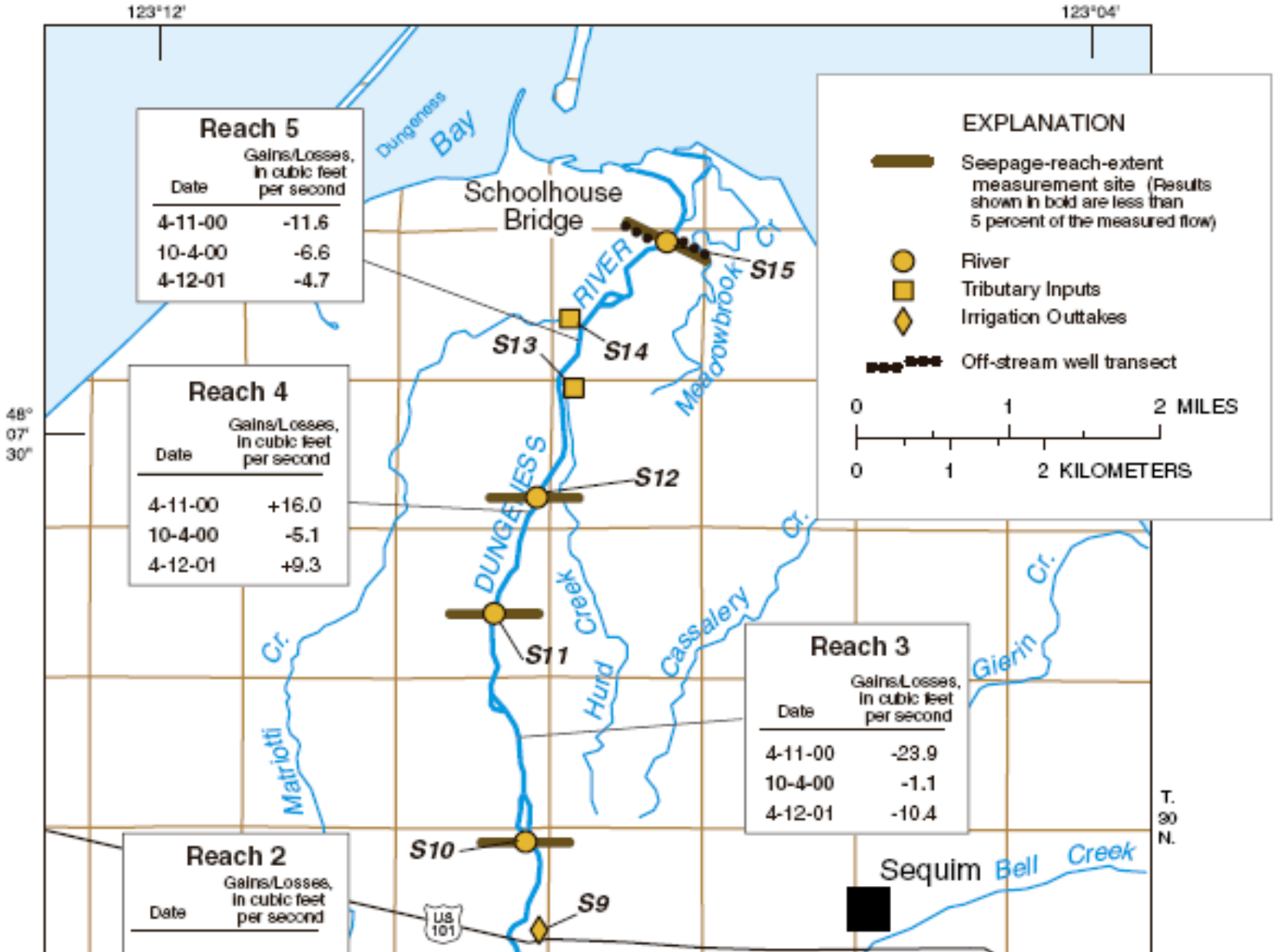


Figure 9. Losing streams lose water to the ground-water system (A). This can be determined from water-table contour maps because the contour lines point in the downstream direction where they cross the stream (B).

Gains and Loses along River



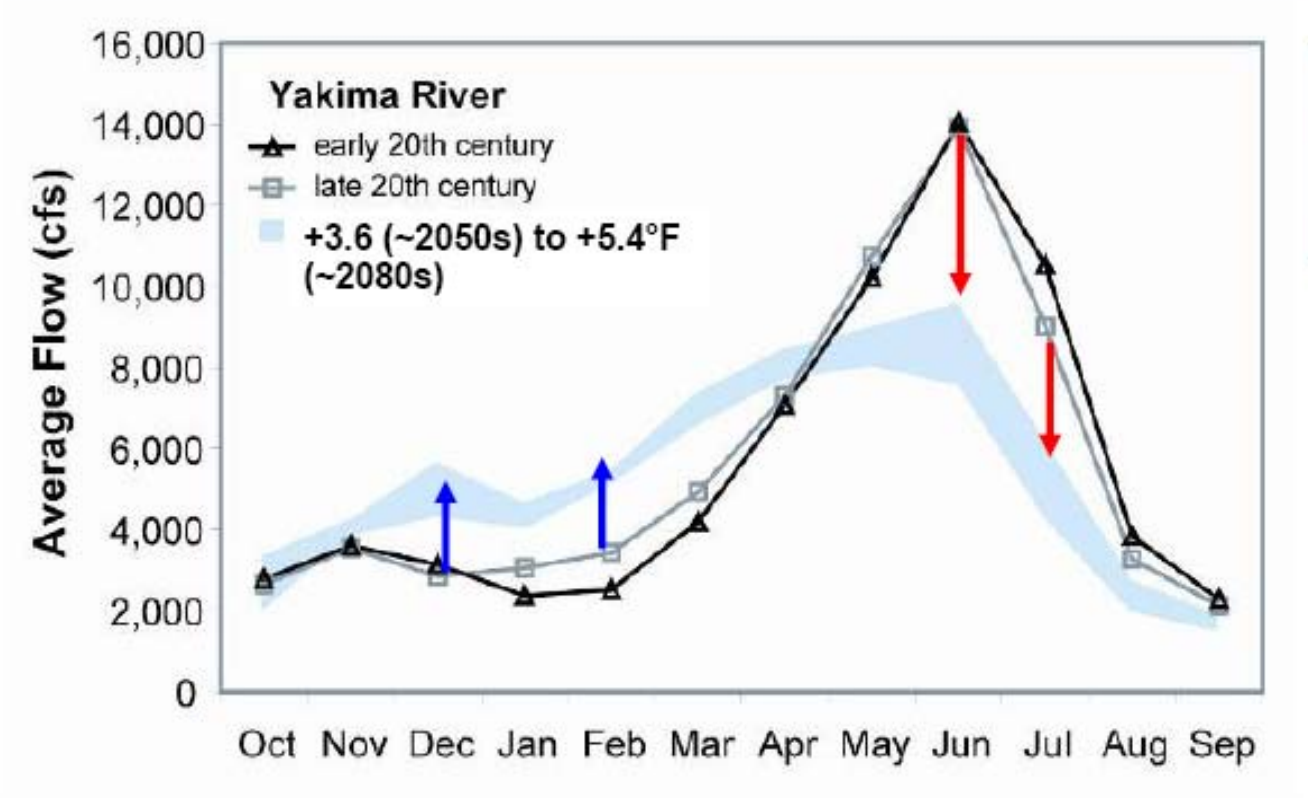
Nearly every glacier in the Cascades and Olympics has retreated during the past 50-150 years

South Cascade Glacier, 1928 (top) and 2000 (right)

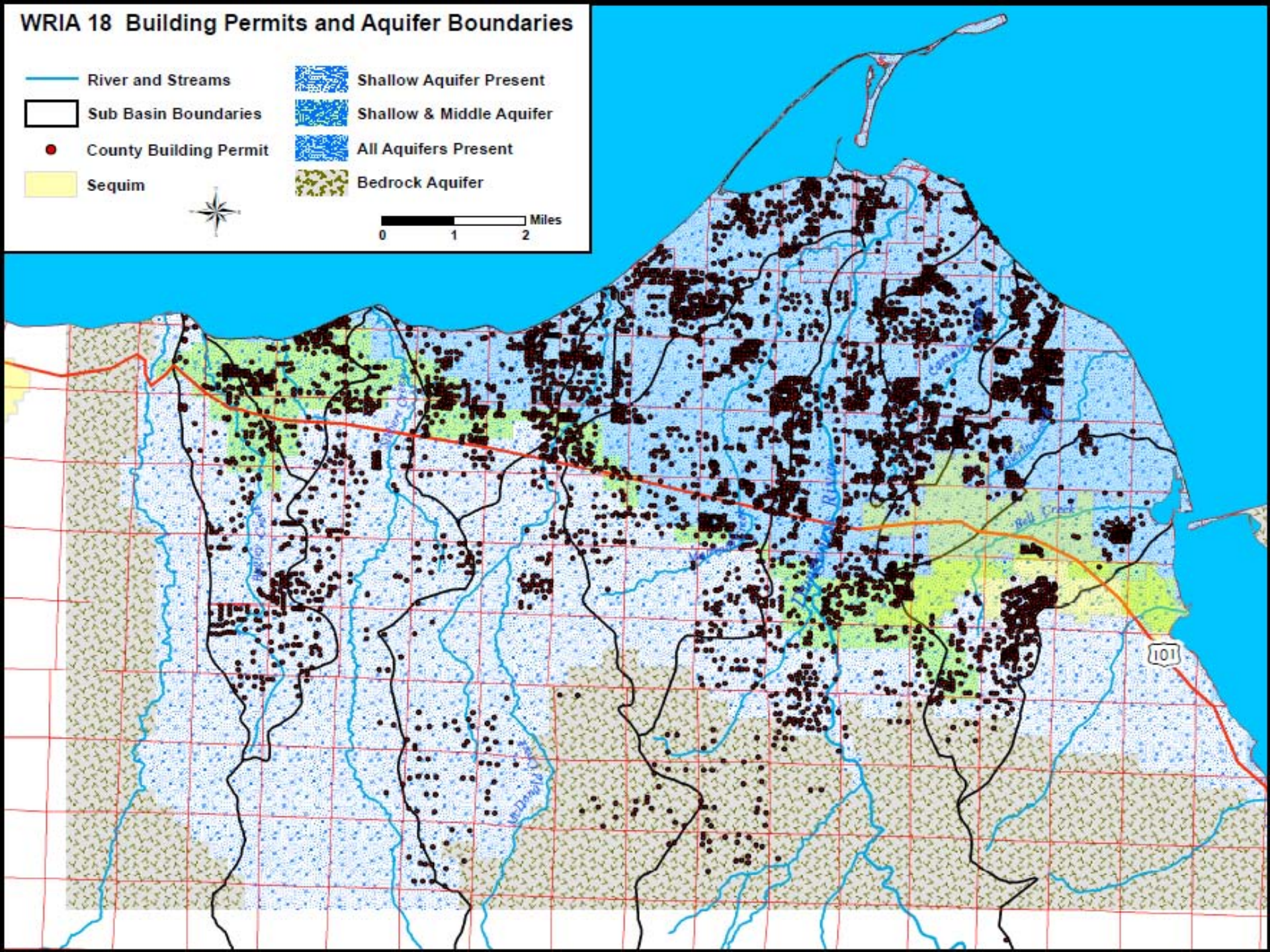
Photos courtesy of Dr. Ed Josberger, USGS Glacier Group, Tacoma, WA

Shifts in Streamflow

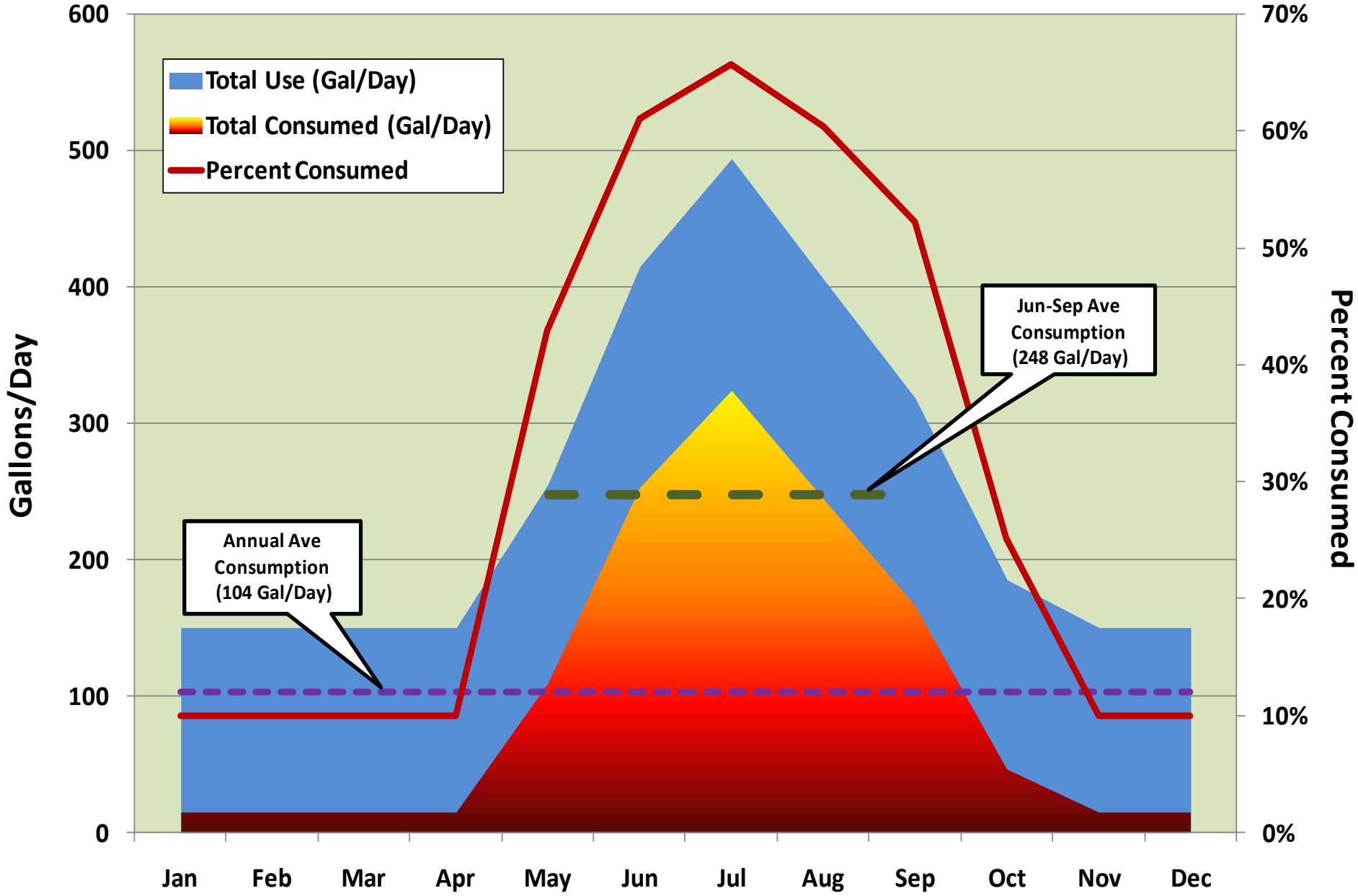
- More winter rain → **higher winter streamflows**
- Warmer temperatures → **earlier snowmelt** and a **shift in the timing** of peak runoff
- Lower winter snowpack → **lower spring and summer flows**



Sensitivity analysis for the Yakima River basin

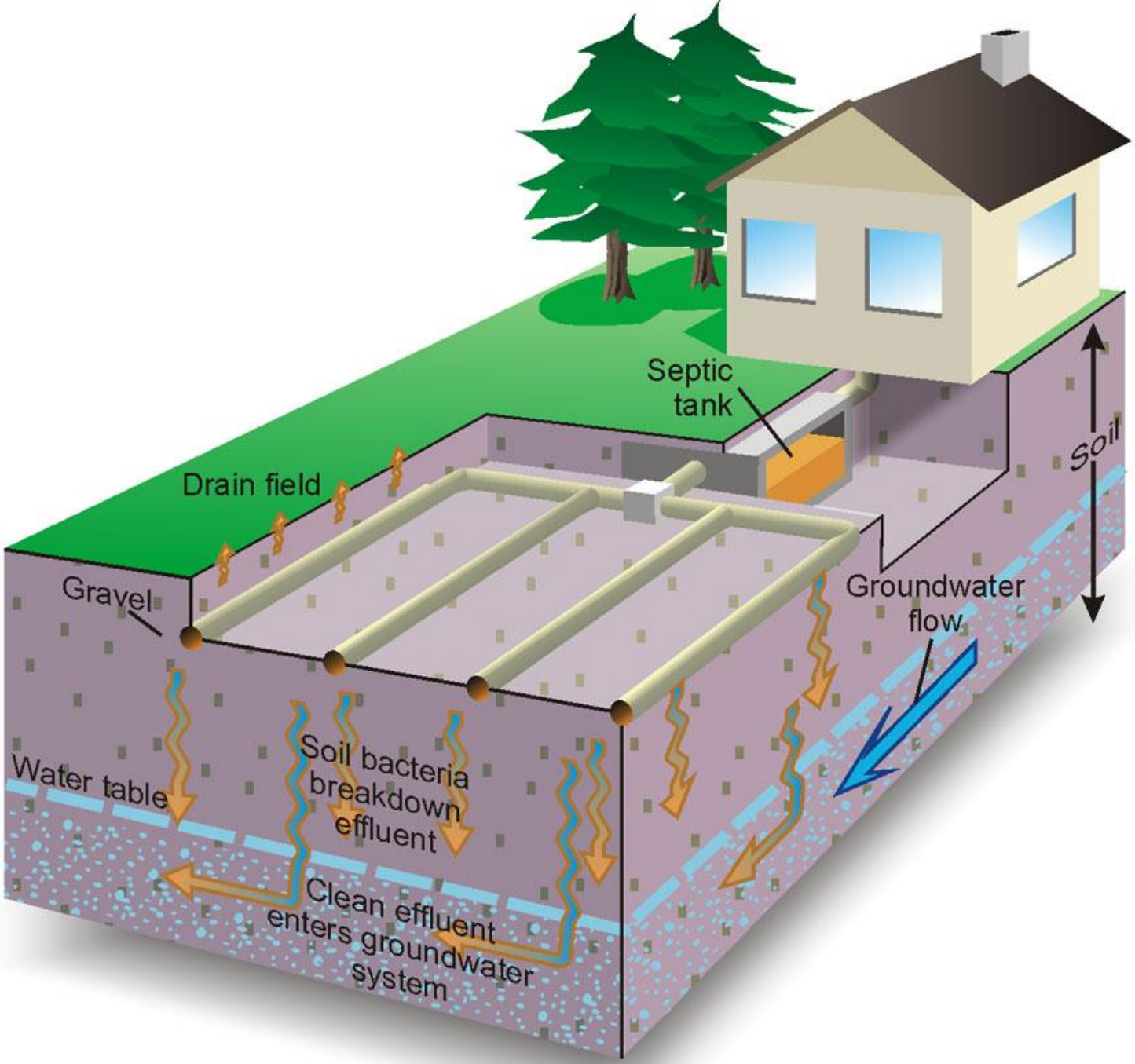

WRIA 18 Building Permits and Aquifer Boundaries
River and Streams
Sub Basin Boundaries
County Building Permit
Sequim
Shallow Aquifer Present
Shallow & Middle Aquifer
All Aquifers Present
Bedrock Aquifer
Miles
0
1
2
101

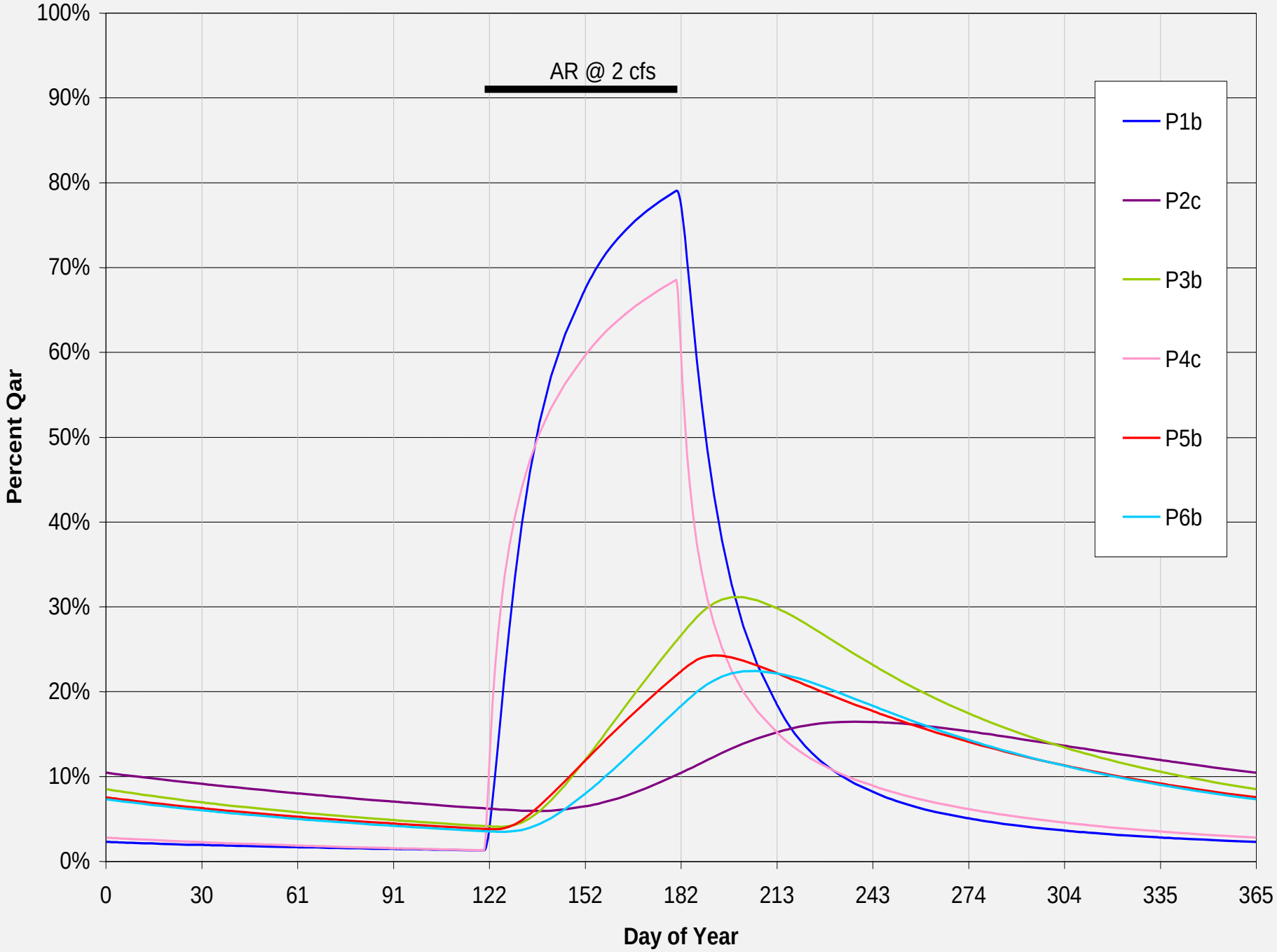
Domestic Water Use with $^{1}/_{12}$ Acre Irrigation*- Sequim, Washington



* Assumptions: 2.31 people per home, irrigation of pasture/turf, 10% indoor, 90% outdoor consumed

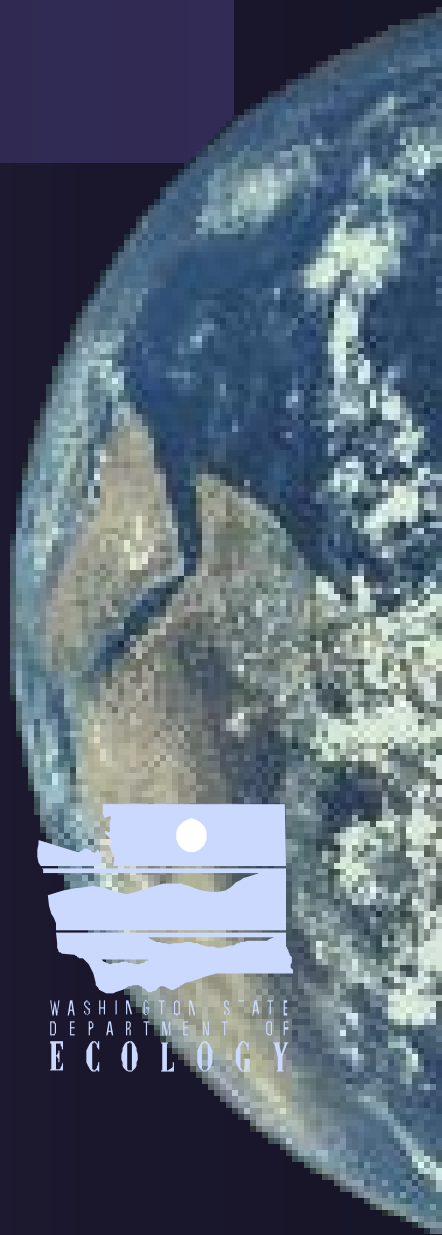
* Sources: of Data: Washington Irrigation Guide, US Census Bureau, AWWA


Septic tank
Soil
Drain field
Gravel
Groundwater flow
Water table
Soil bacteria breakdown effluent
Clean effluent enters groundwater system


AR @ 2 cfs
P1b
P2c
P3b
P4c
P5b
P6b
Percent Qar
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
30
61
91
122
152
182
213
243
274
304
335
365
Day of Year

Prediction is very difficult, especially about the future.

(Niels Bohr)

More information:

Dave Nazy
Department of Ecology
360-407-6038
dnaz461@ecy.wa.gov