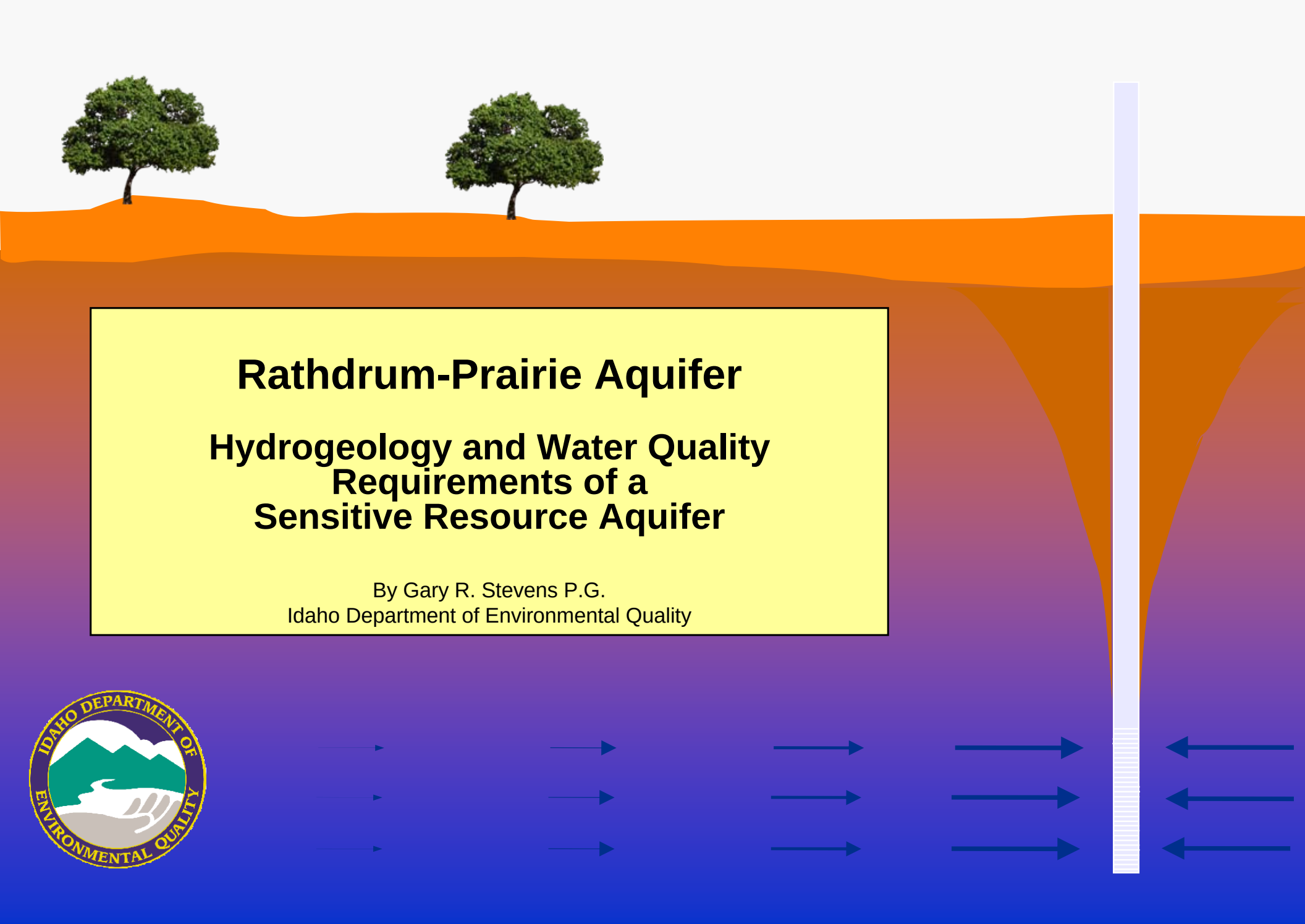




Rathdrum-Prairie Aquifer

Hydrogeology and Water Quality Requirements of a Sensitive Resource Aquifer

By Gary R. Stevens P.G.
Idaho Department of Environmental Quality



Rathdrum-Prairie Aquifer

Hydrogeology

- **Definitions**
- **What is the RPA and How Did it Get There**
- **What are the Boundaries of the RPA**
- **Where Did the Water Come From and Where is it Going**

Water Quality Requirements

- **Federal & State**
- **Ground Water Quality Rule**
- **Sensitive Resource Aquifer**
- **Application**



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➤ Definitions

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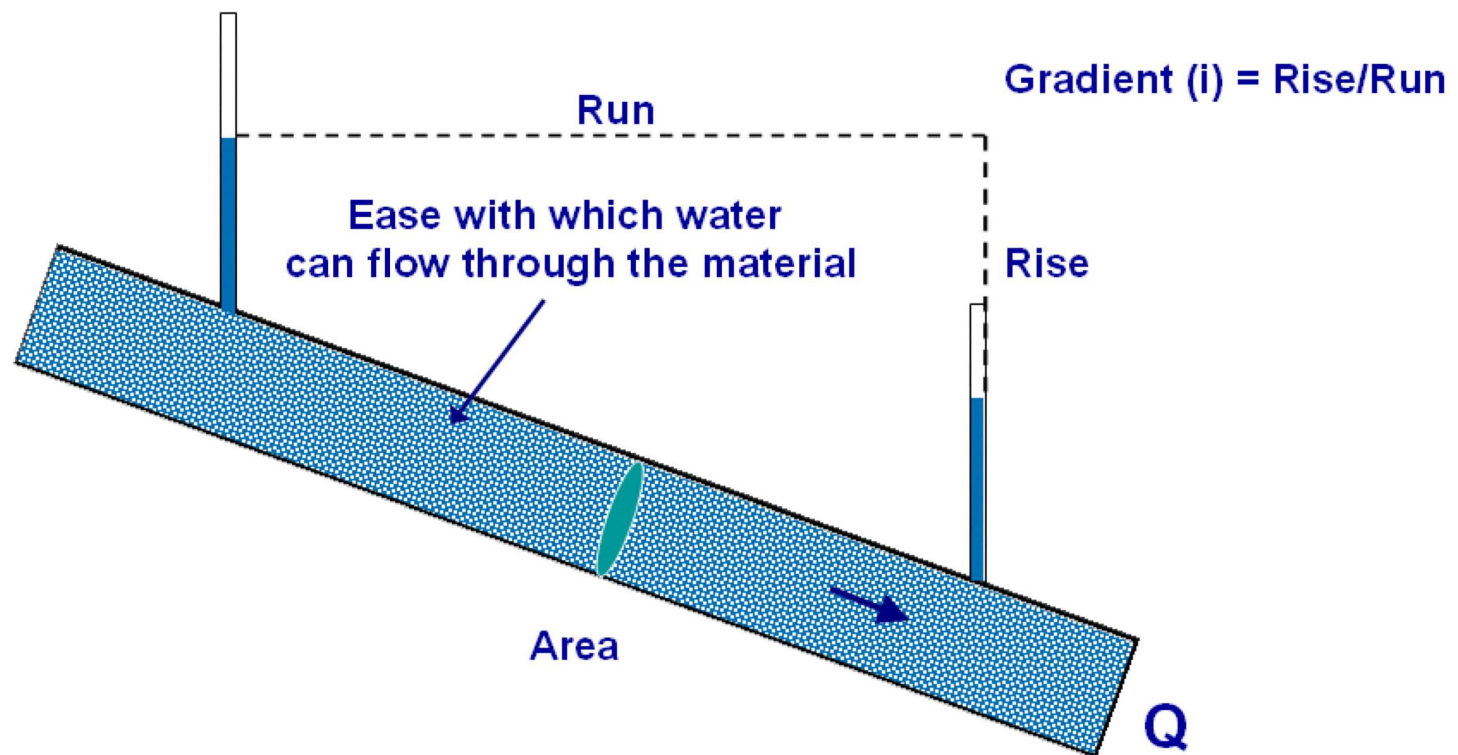
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Hydraulic Conductivity

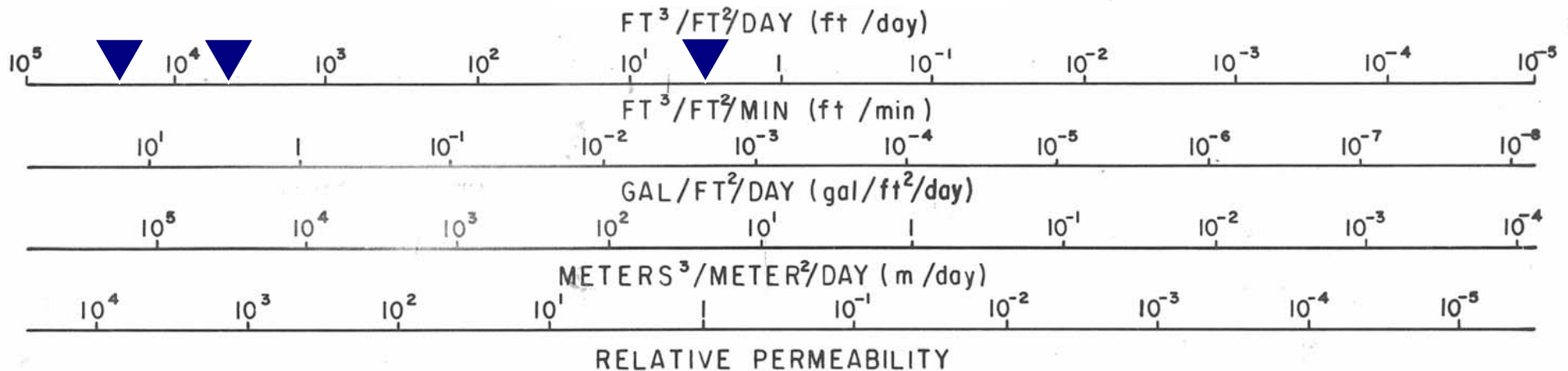
Darcy's Law

$$Q = k i A$$



7,200 feet per day

Hydraulic Conductivity



VERY HIGH HIGH MODERATE LOW VERY LOW

Representative Materials

Clean gravel	—	Clean sand and sand and gravel	—	Fine sand	—	Silt, clay and mixtures of sand, silt and clay	—	Massive clay
Vesicular and scoriaceous basalt and cavernous limestone and dolomite	—	Clean sandstone and fractured igneous and metamorphic rocks	—	Laminated sandstone shale, mudstone	—	Massive igneous and metamorphic rocks		

Transmissivity = kb

$$5000 \text{ (ft}^2 \text{ /day)} = 100 \text{ (ft/day)} * 50 \text{ (ft)} \quad \text{Aquifer 1}$$

$$5000 \text{ (ft}^2 \text{ /day)} = 25 \text{ (ft/day)} * 200 \text{ (ft)} \quad \text{Aquifer 2}$$

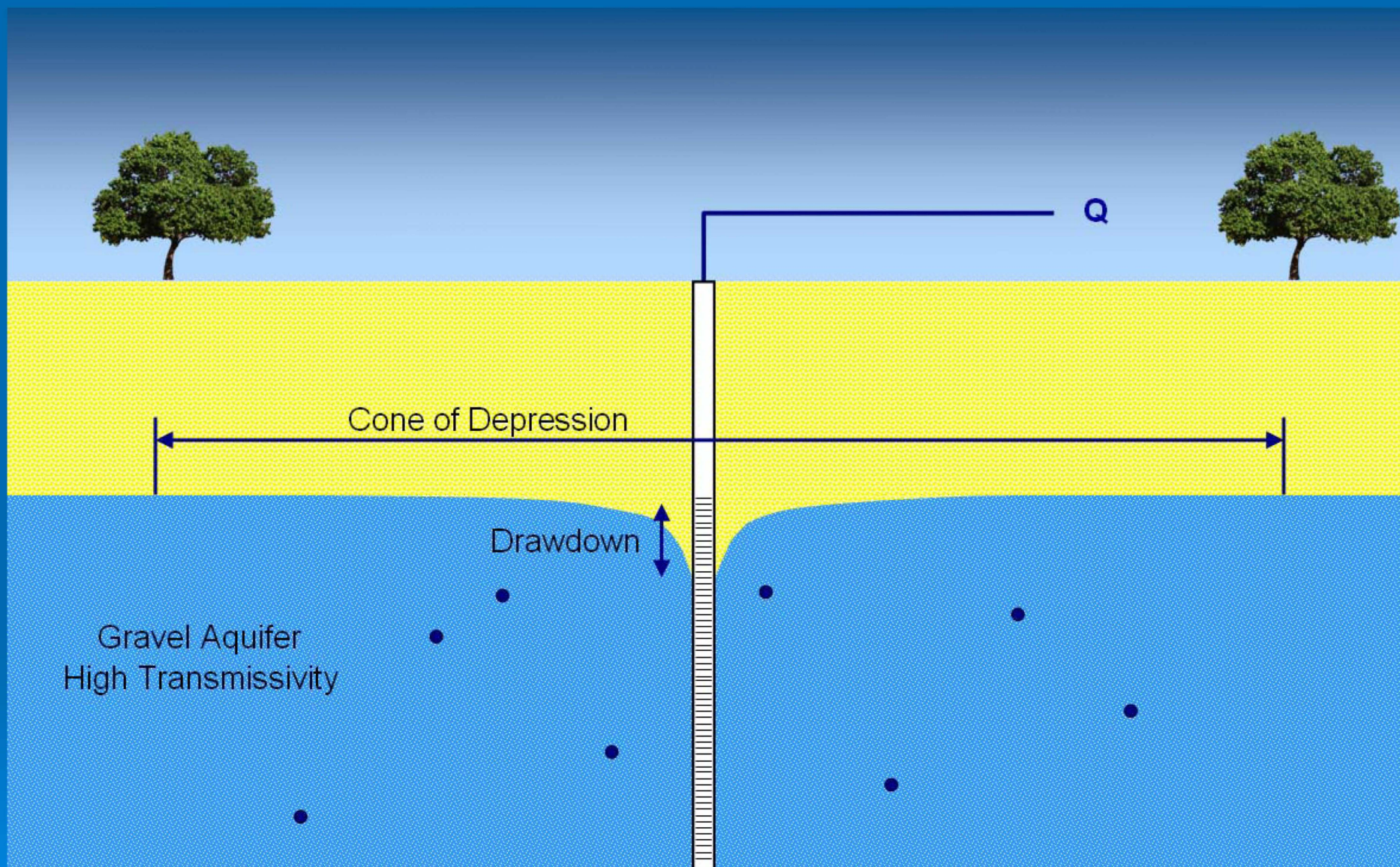
$$Q = Tiw$$

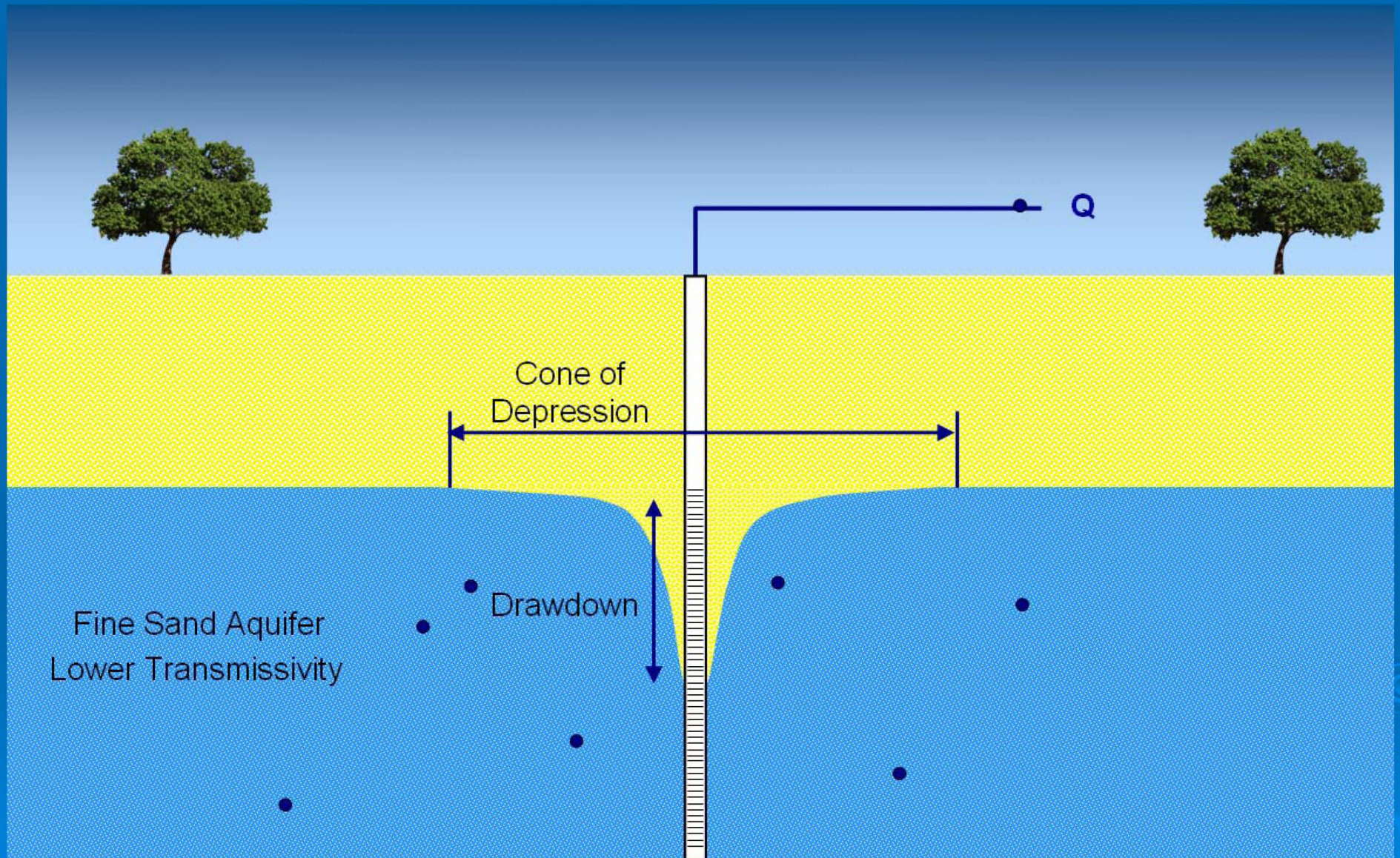
Unit Area = 1 ft²
and
Gradient = 1 ft/ft

b = 50 ft

Sand Aquifer







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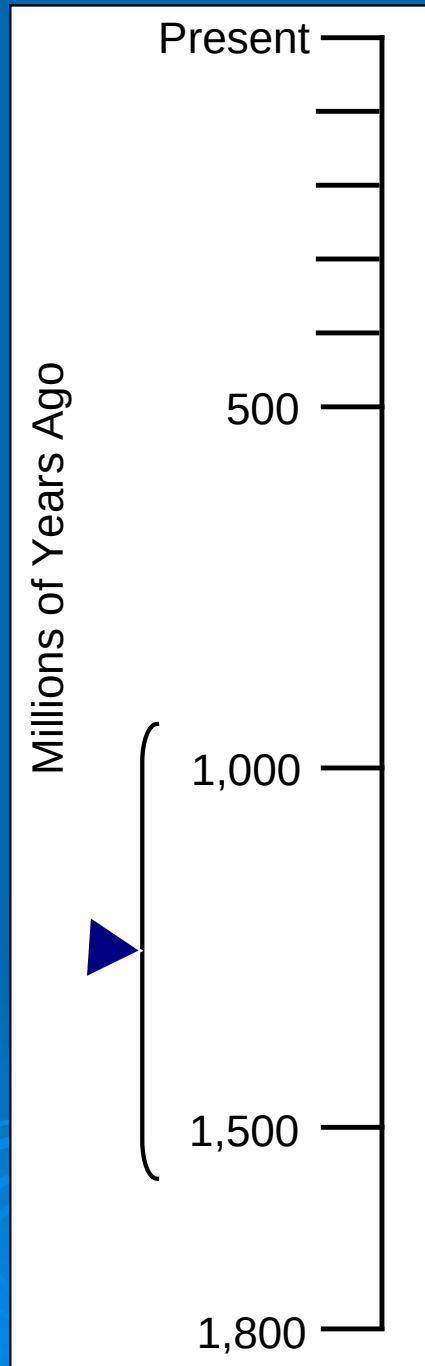
Water Quality Requirements

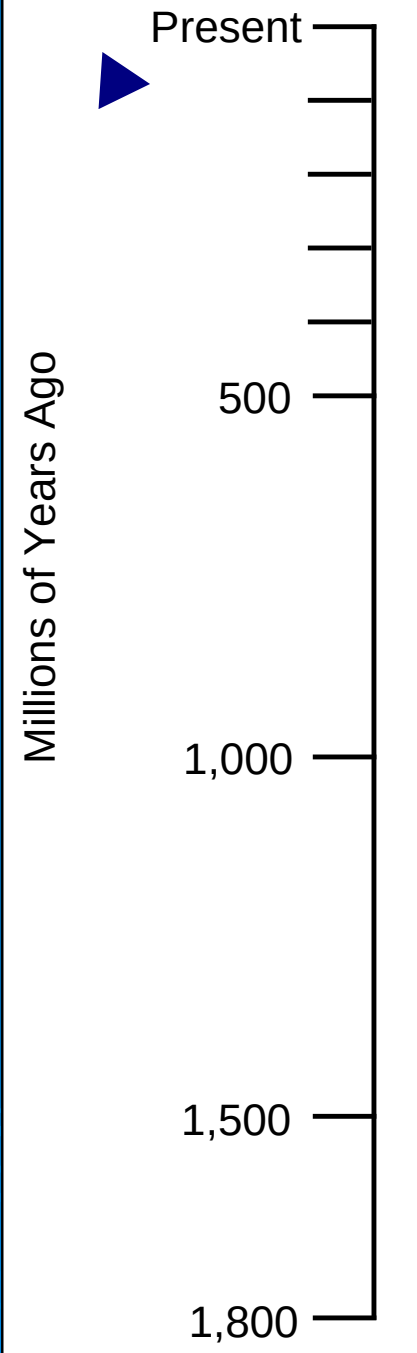
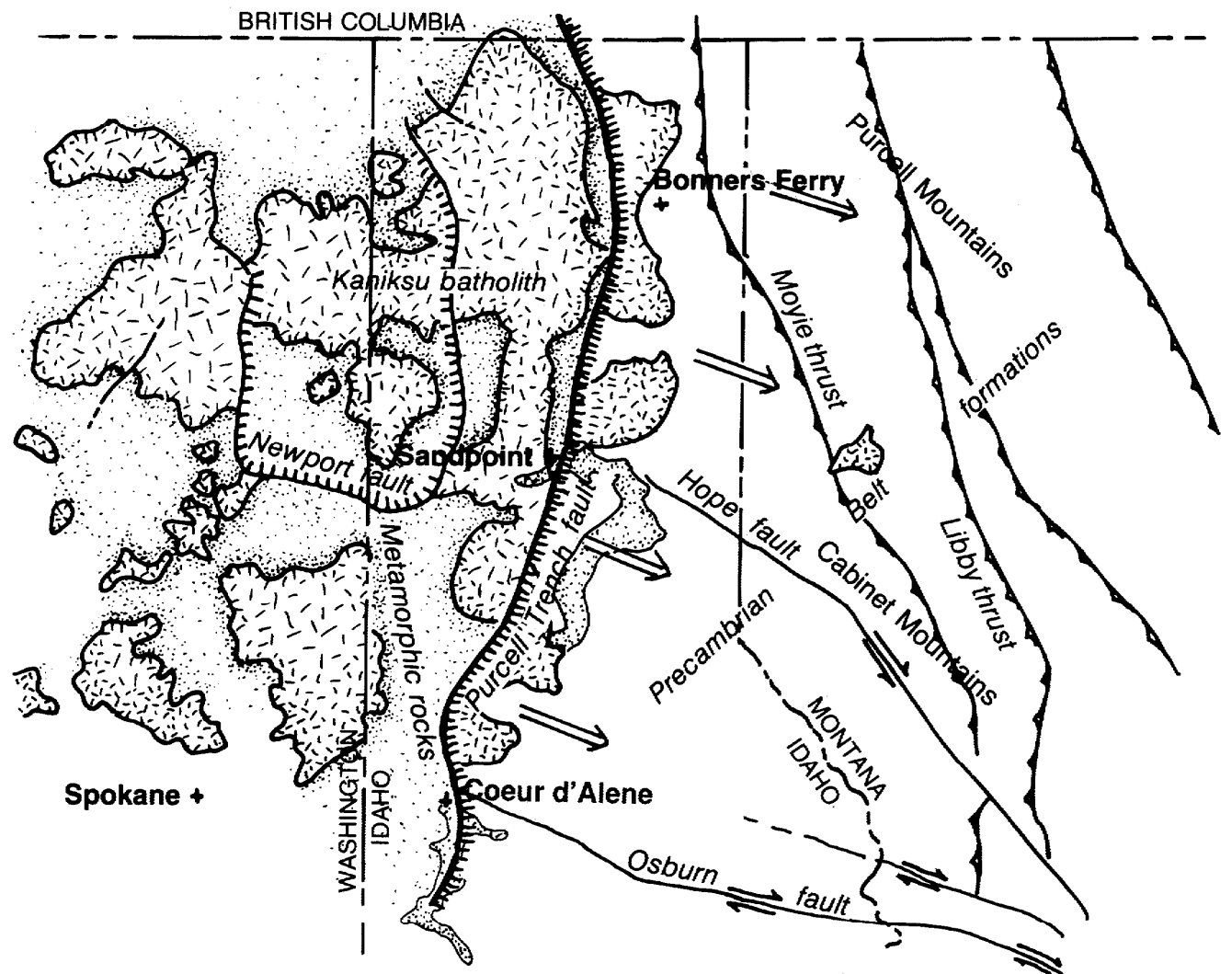
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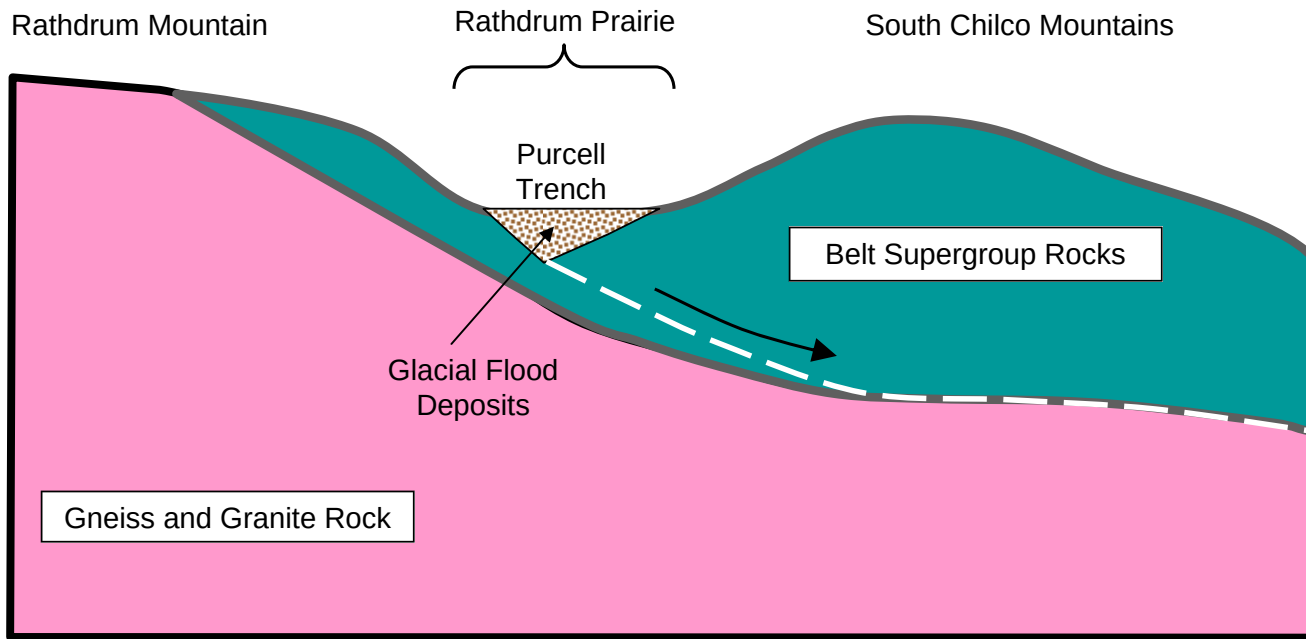
Major Geological Events

- 900-1,600 mya - Belt Supergroup Forms
- 70-80 mya – Kaniksu Batholith Forms
- 6-17 mya – Basalt flows into area and creates Lake Rathdrum (Latah Formation)
- 15-100 thousand years ago - Glaciation & Glacial Floods



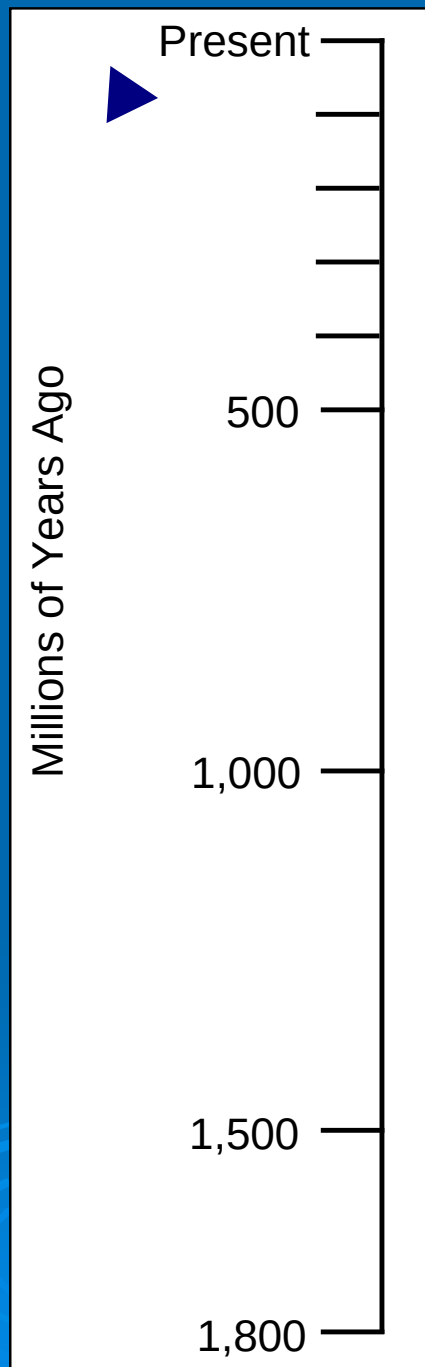


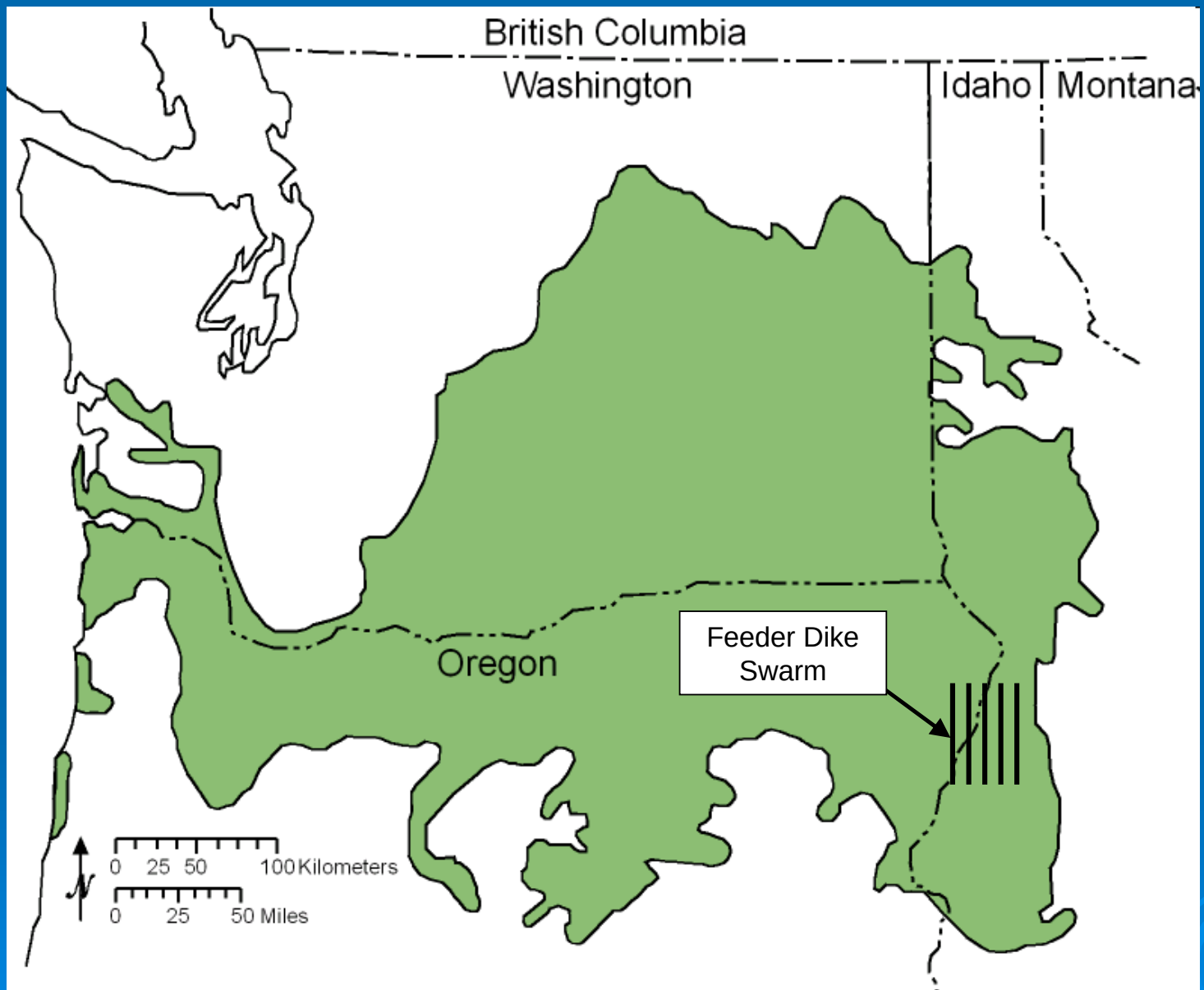
Reference: Alt, Hyndman, 1995



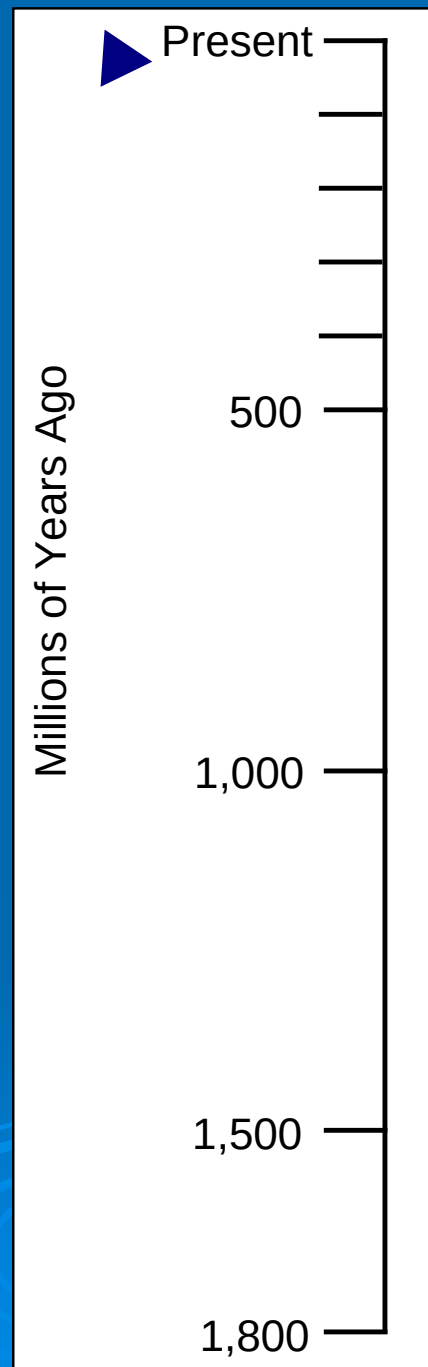
Modified from: Alt, 1989

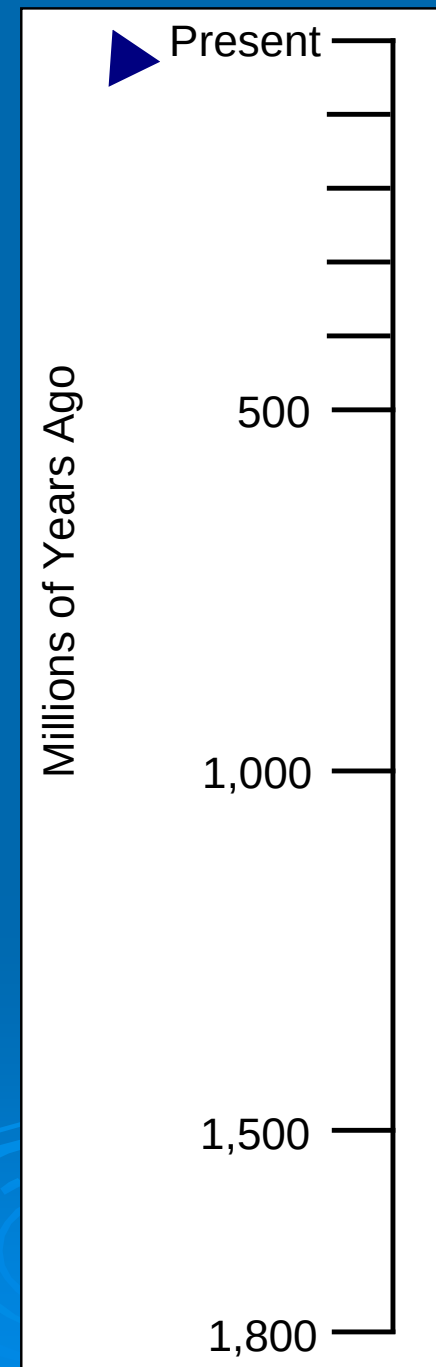
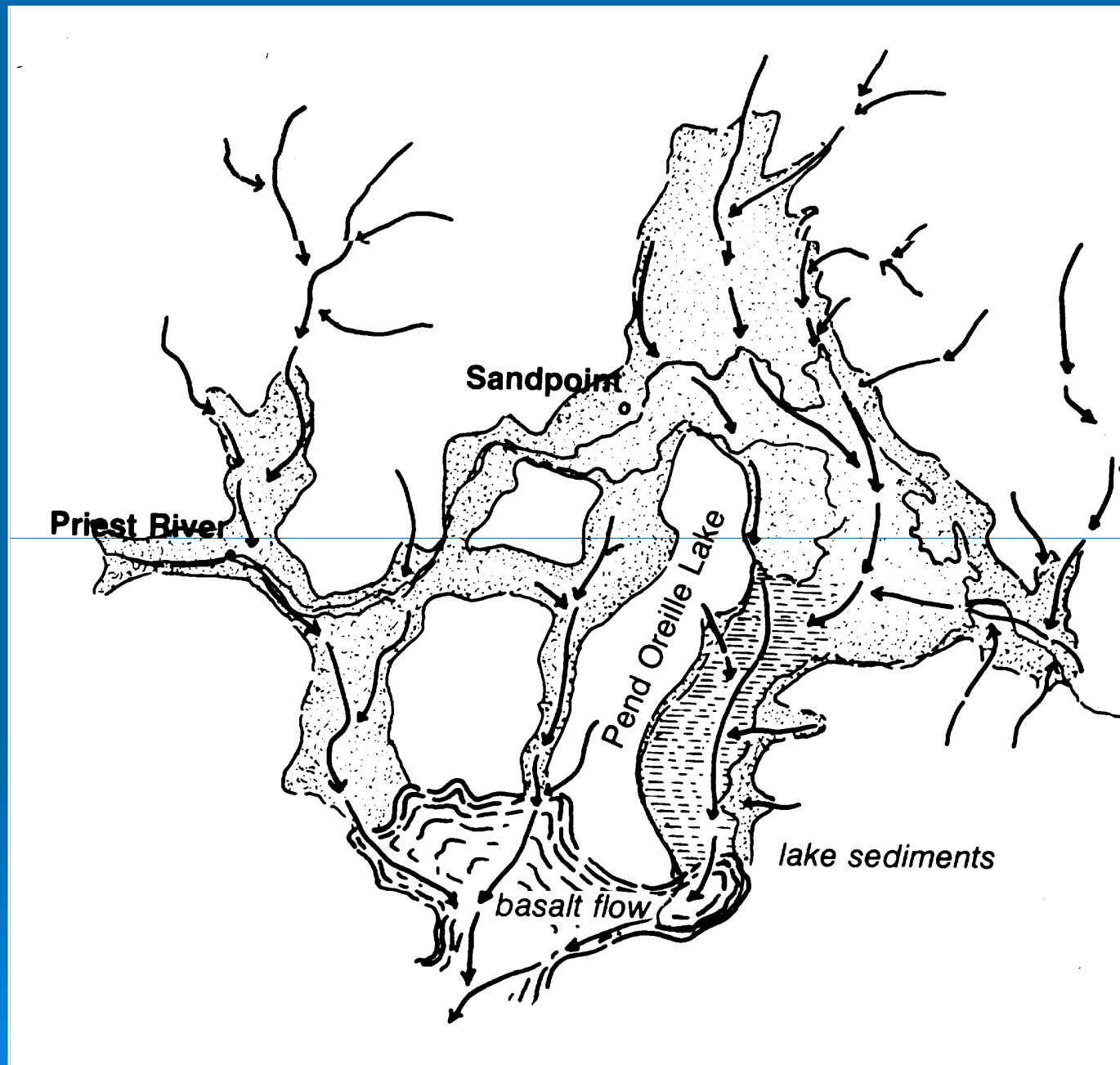
Reference: Alt, Hyndman, 1995

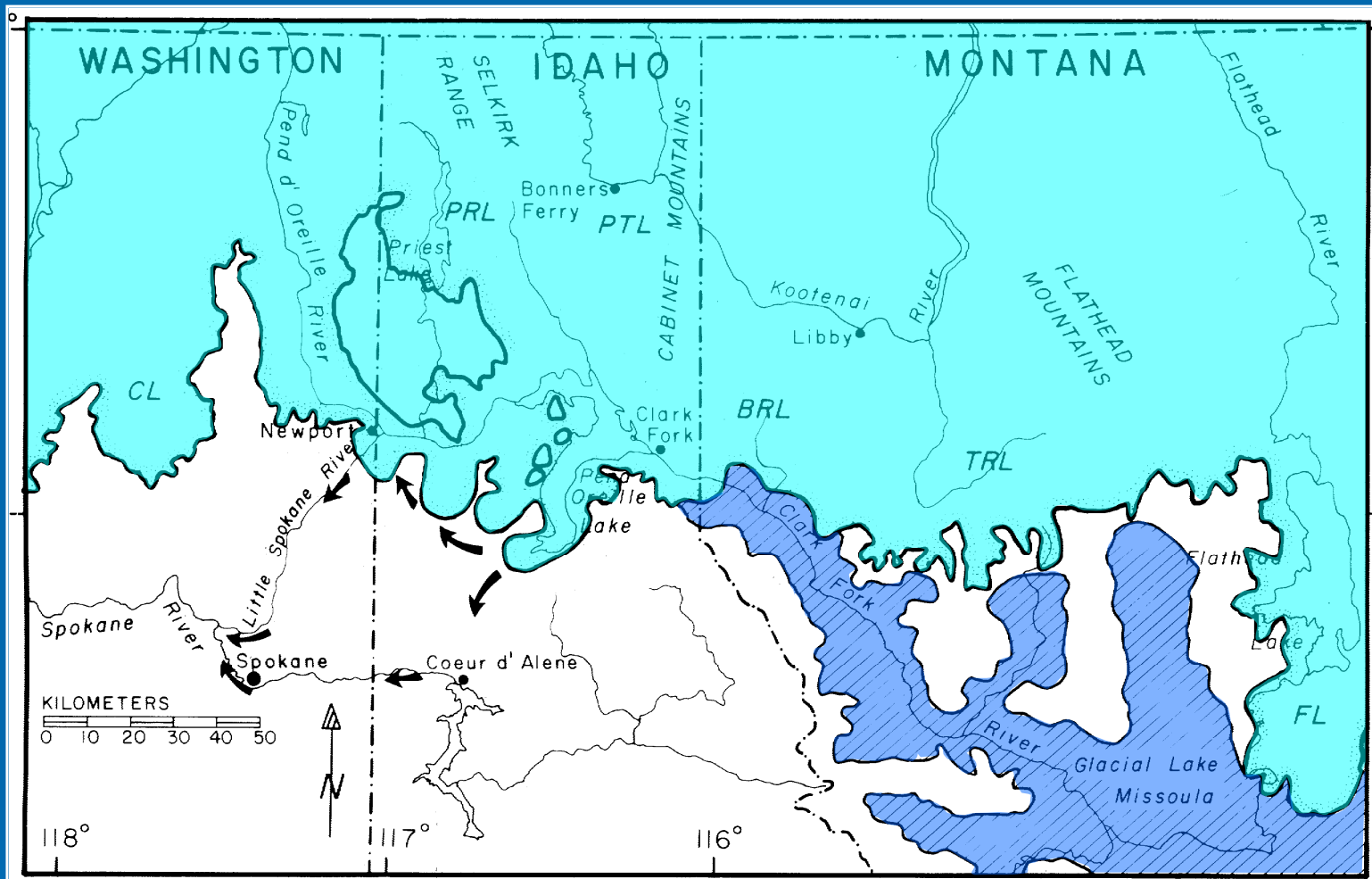




Reference: ISU Digital Geology







Reference: IGS, 1995

Glacial Outburst Floods

- Approximately 40 floods occurred
- Flood water about 2,000 ft high at dam with 500 cubic miles of water

Millions of Years Ago

► Present

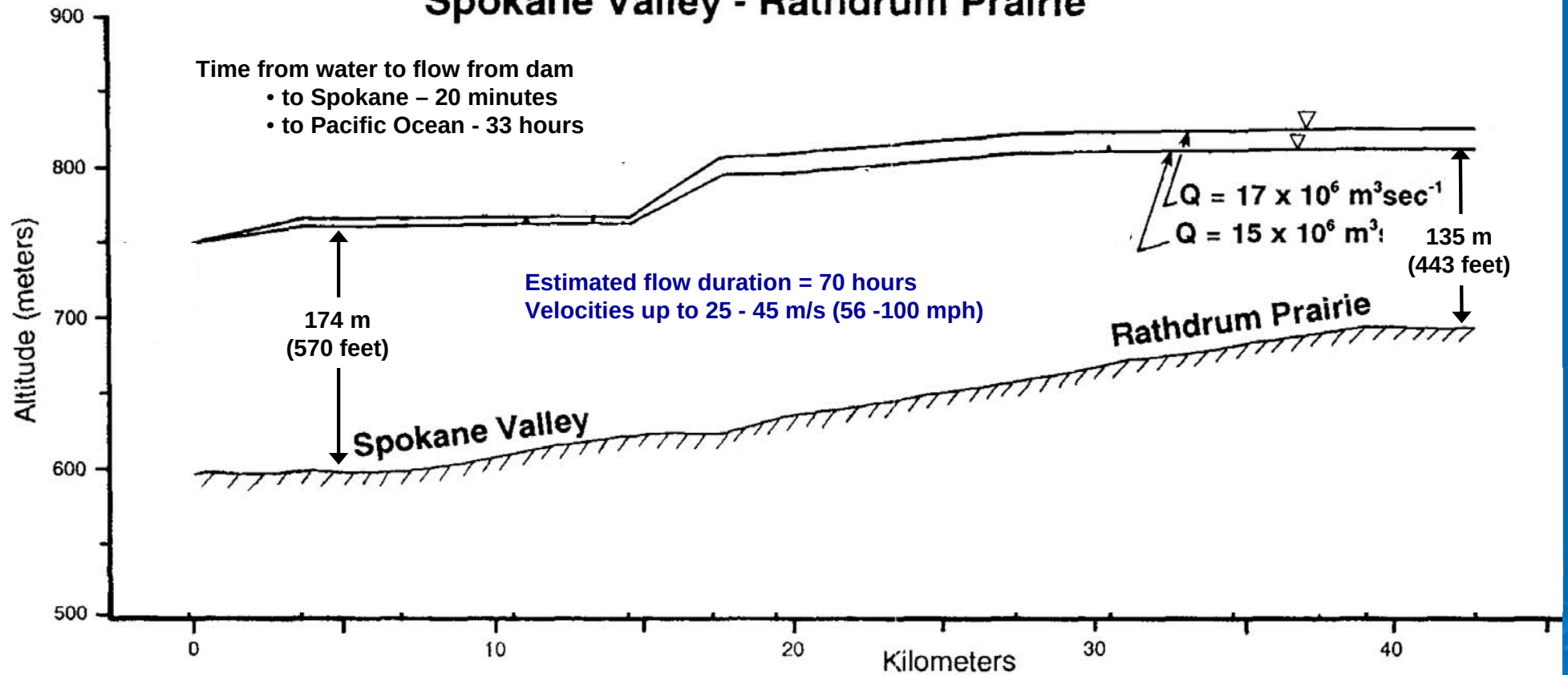
500

1,000

1,500

1,800

Spokane Valley - Rathdrum Prairie



Reference: Modified from O'Conner & Baker, 1992



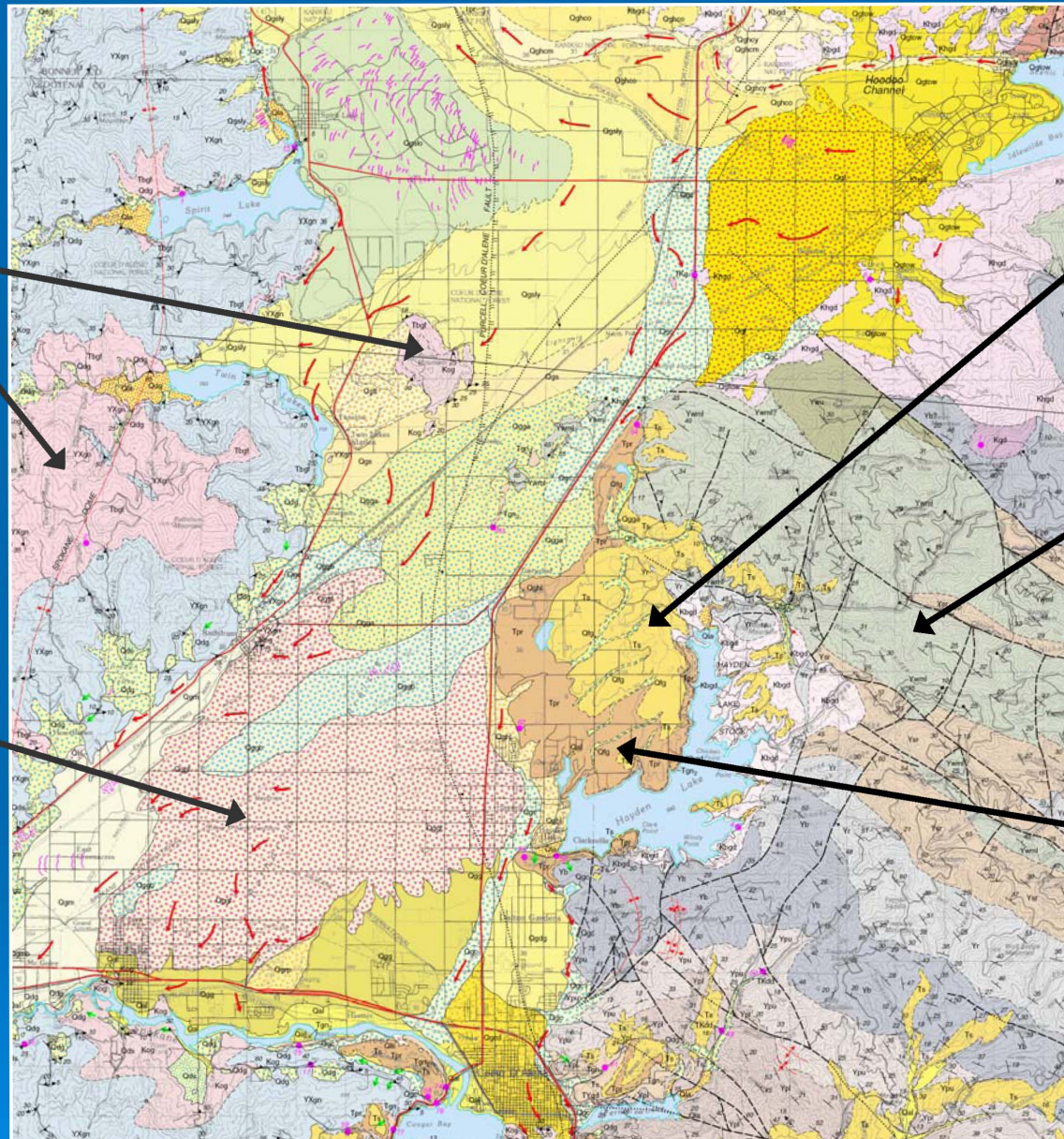
Granite

Latah Formation

Glacial Flood Deposits

Belt Super Group

Basalt



Reference: IGS, 2002

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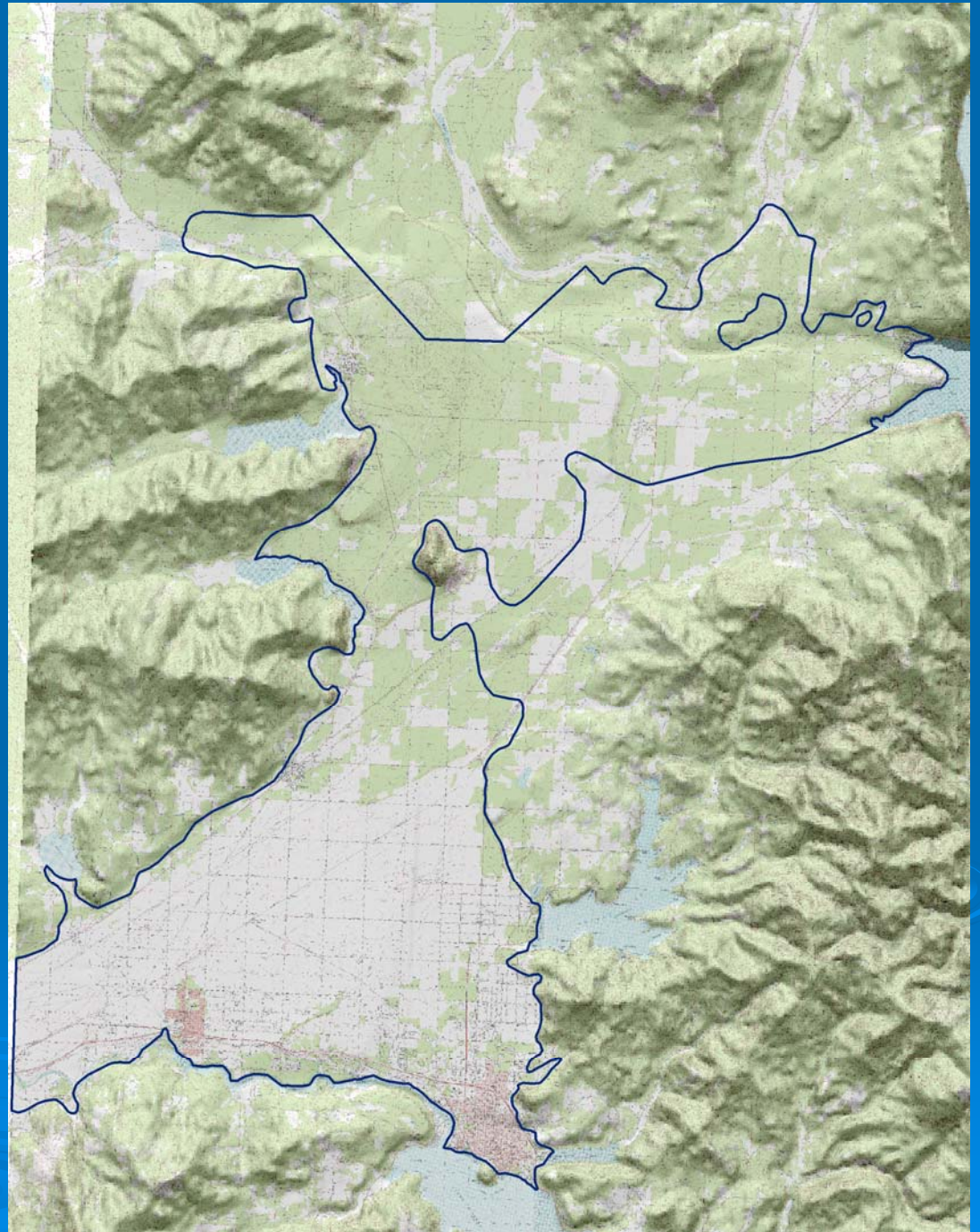
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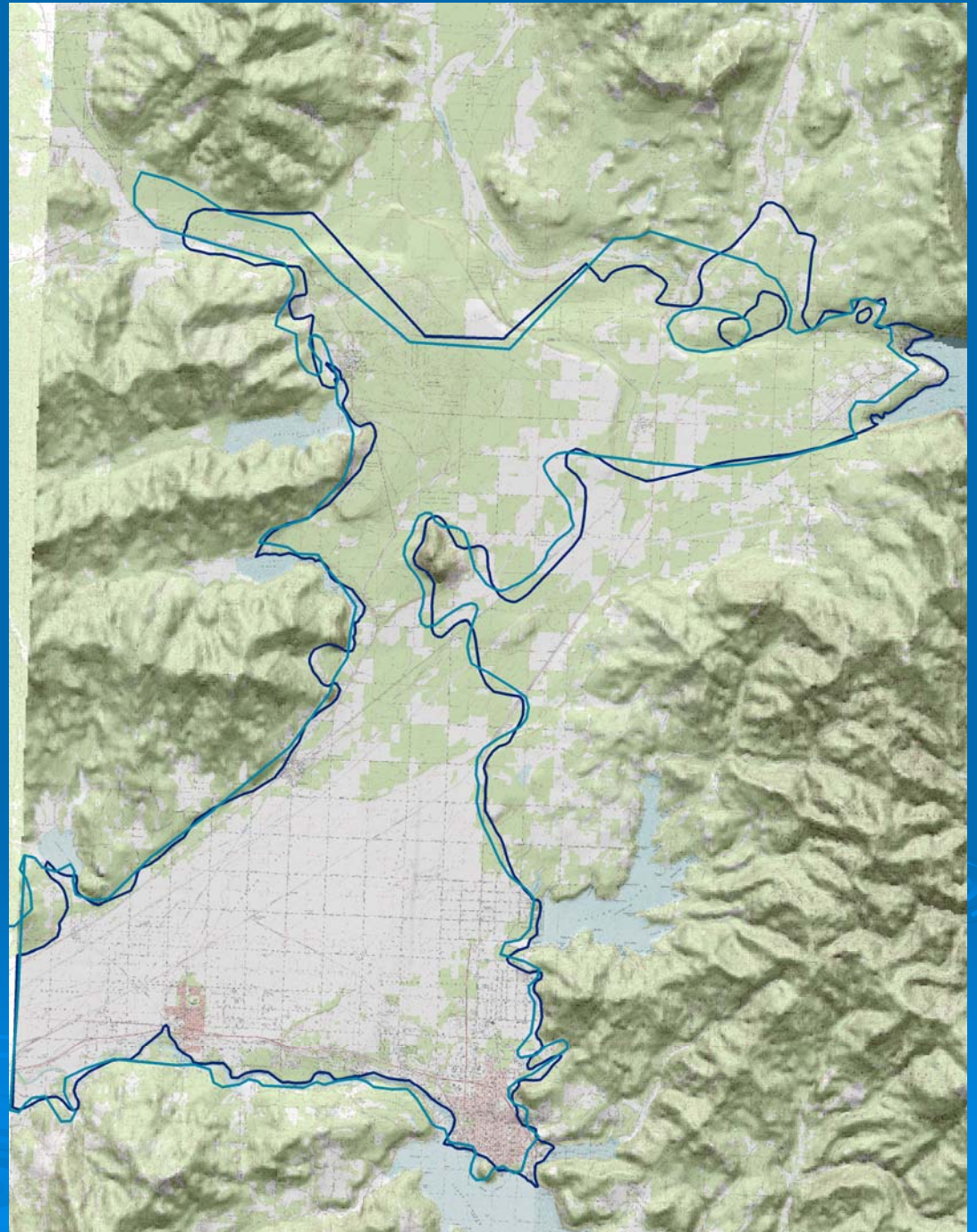


EPA Hydrogeologic
Boundary
1976-1977



EPA Hydrogeologic
Boundary
1976-1977

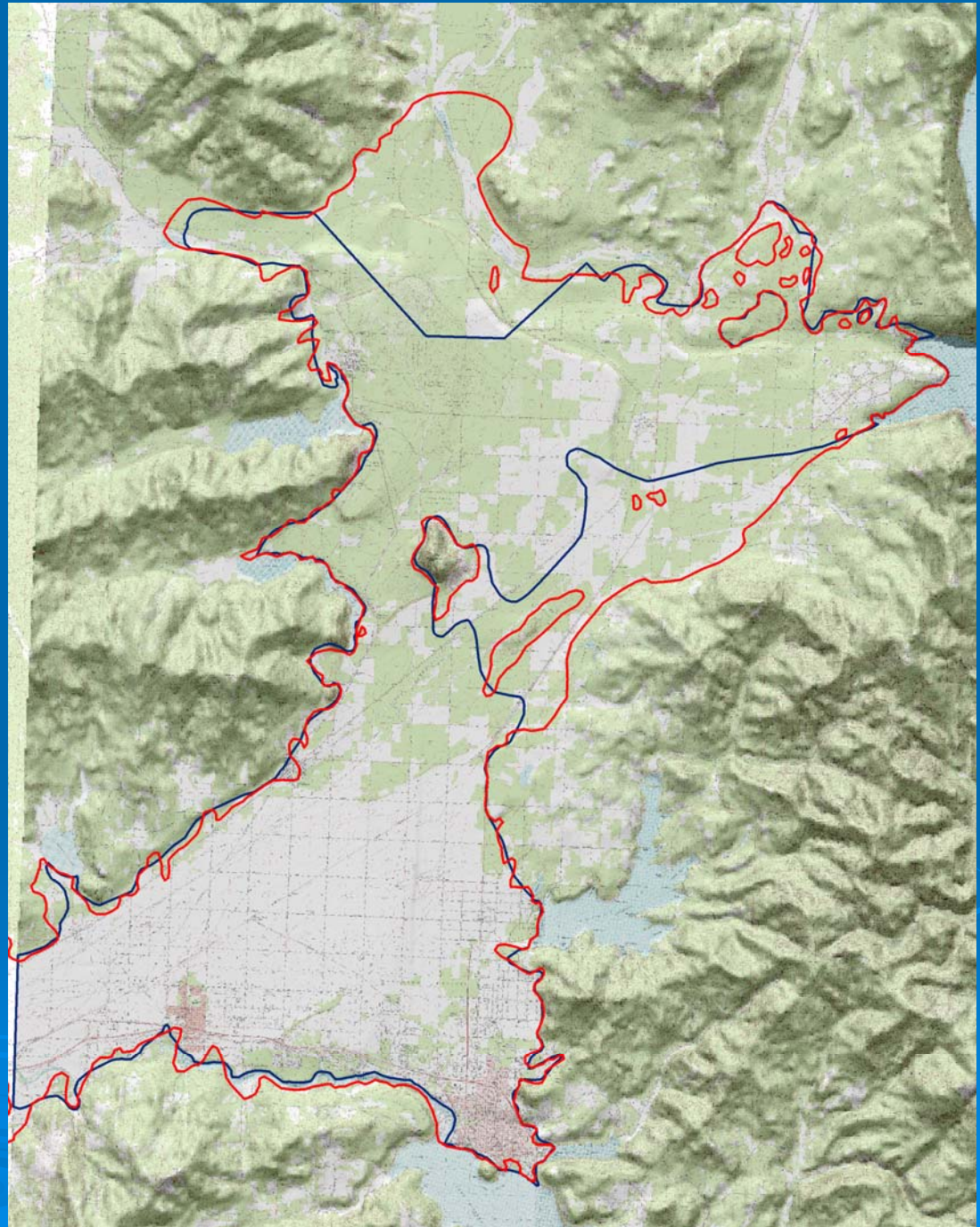
EPA Recharge Zone
1978



EPA Hydrogeologic
Boundary
1976-1977

EPA Recharge Zone
1978

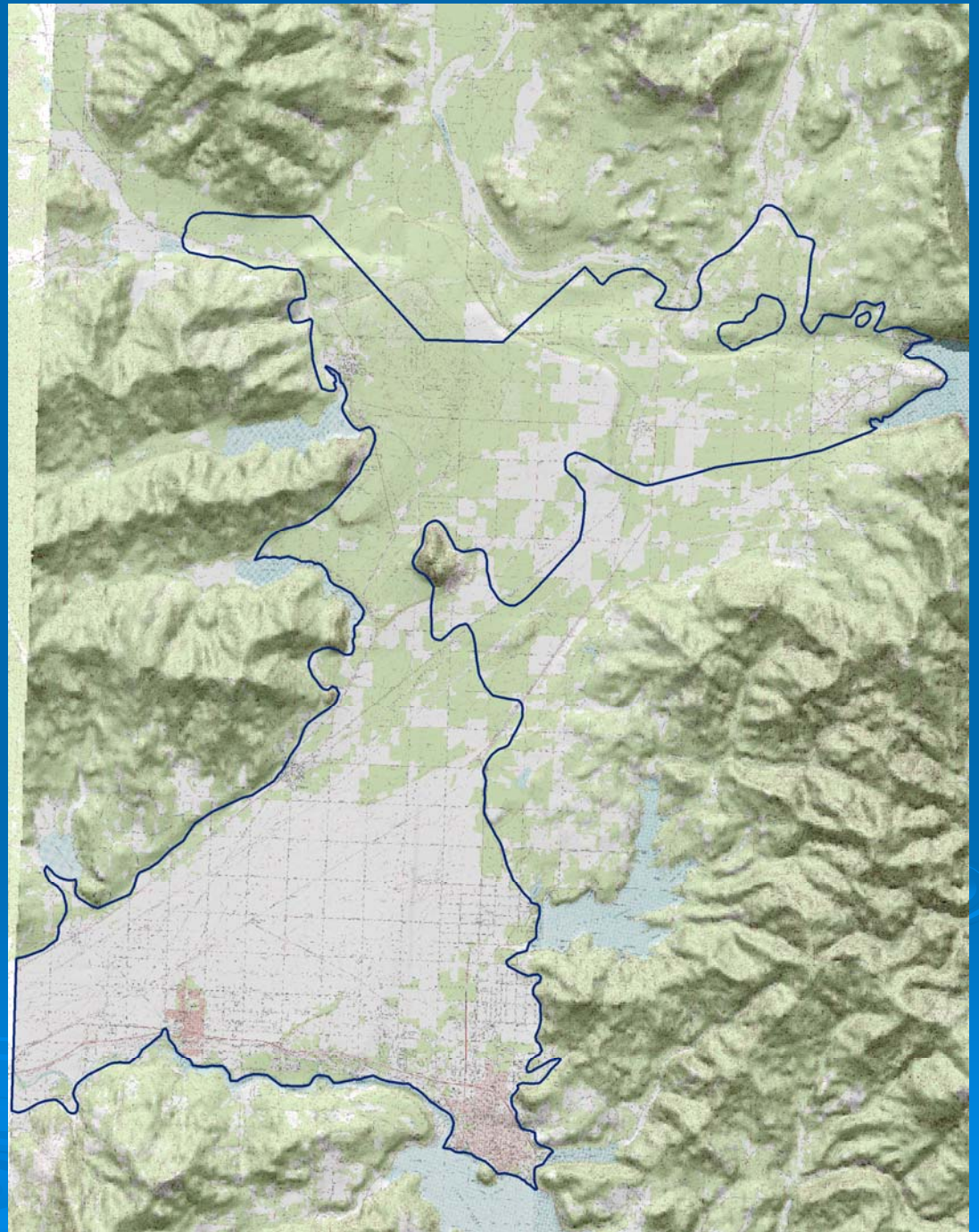
SVRP Study Aquifer Boundary
2007



EPA/USGS Hydrogeologic
Boundary
1976-1977

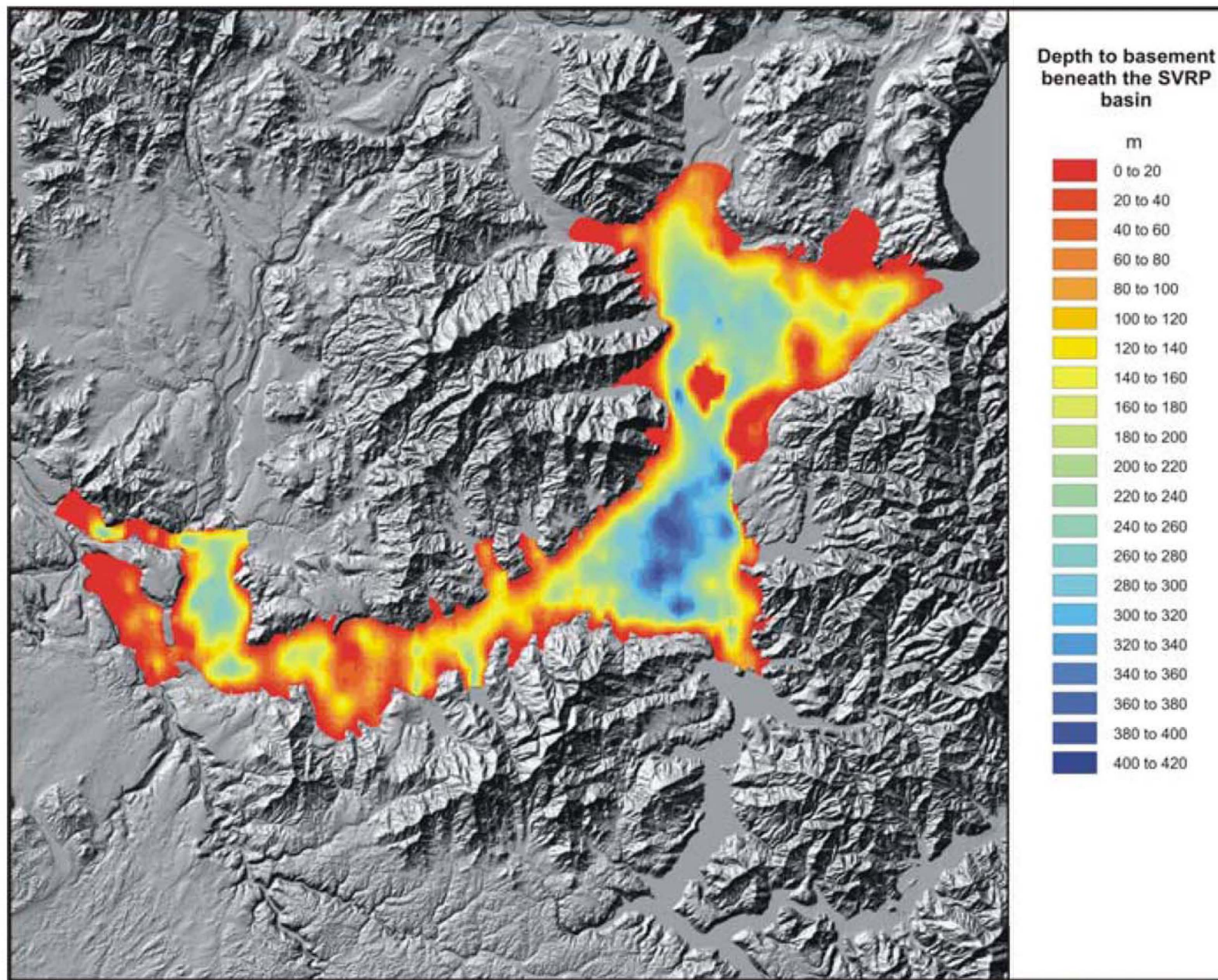
Is

Sensitive Resource Aquifer









Reference: Oldow & Sprenke, 2006

Rathdrum-Prairie Aquifer

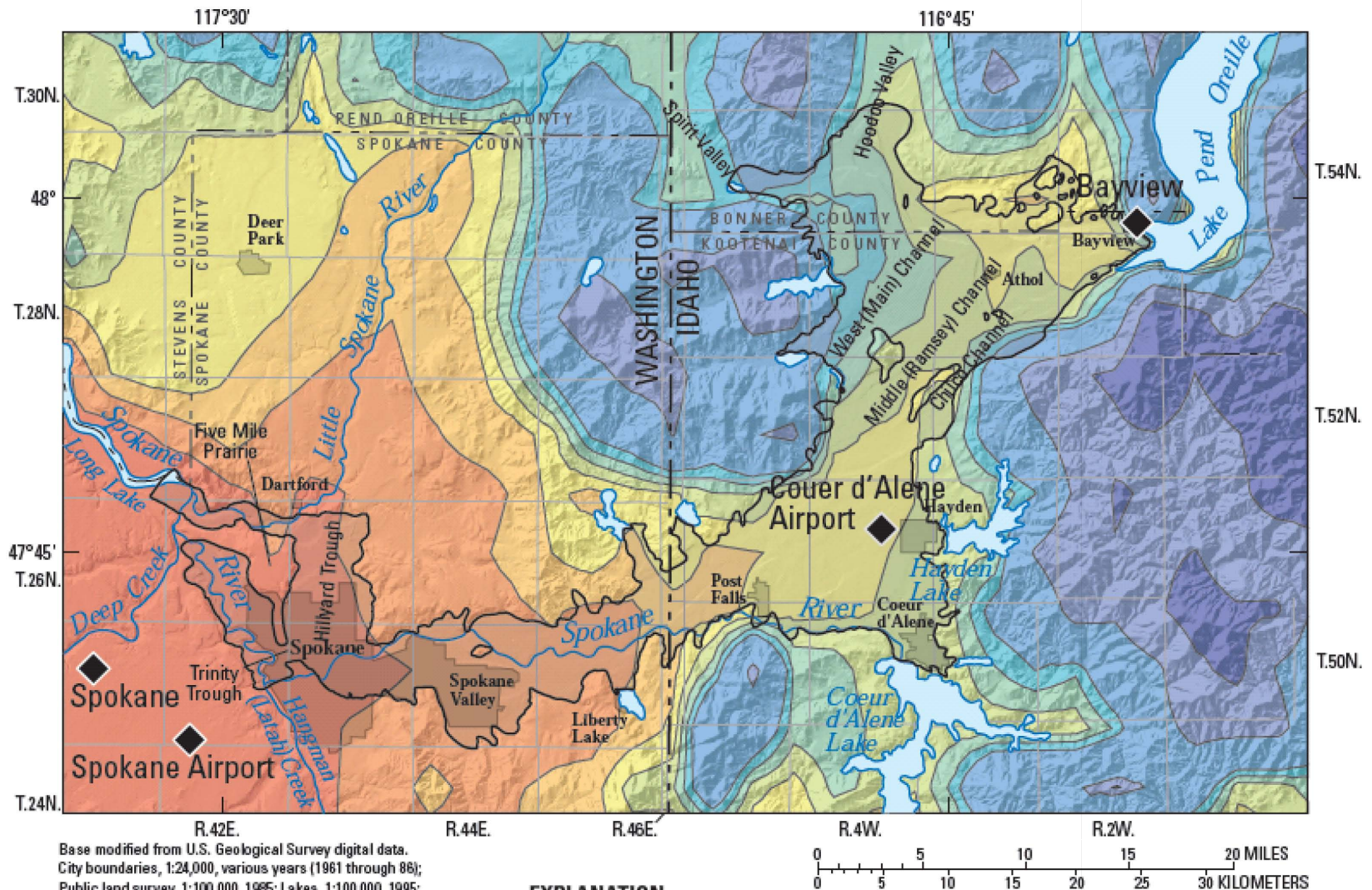
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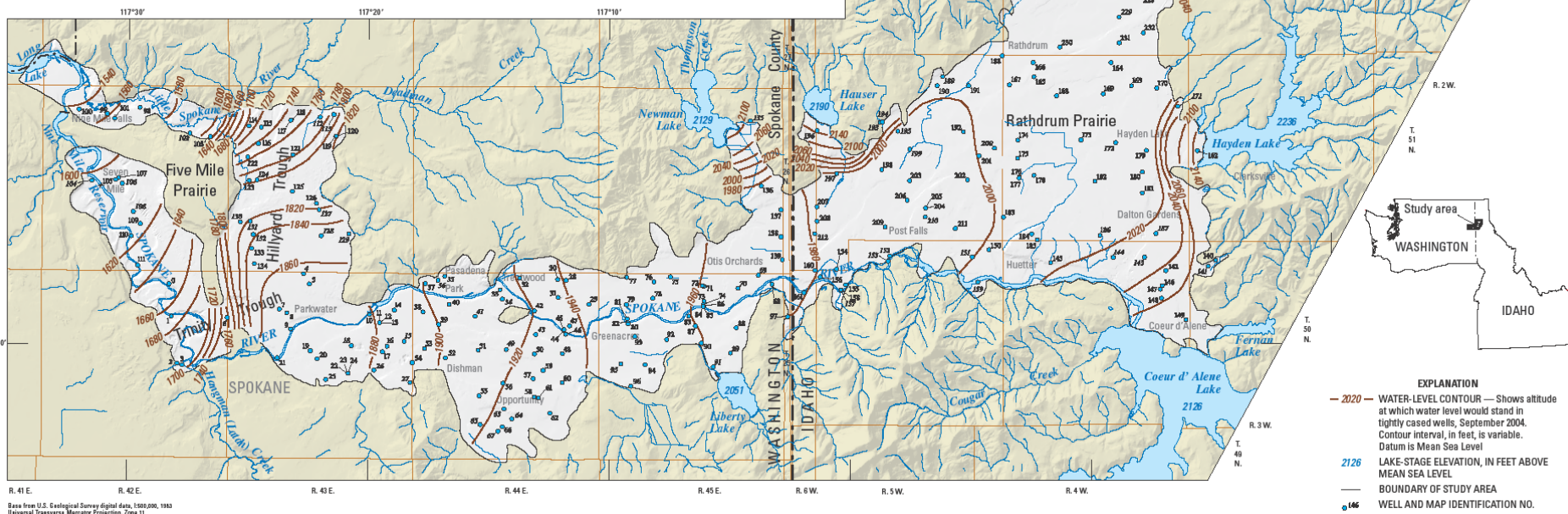
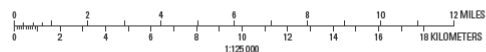
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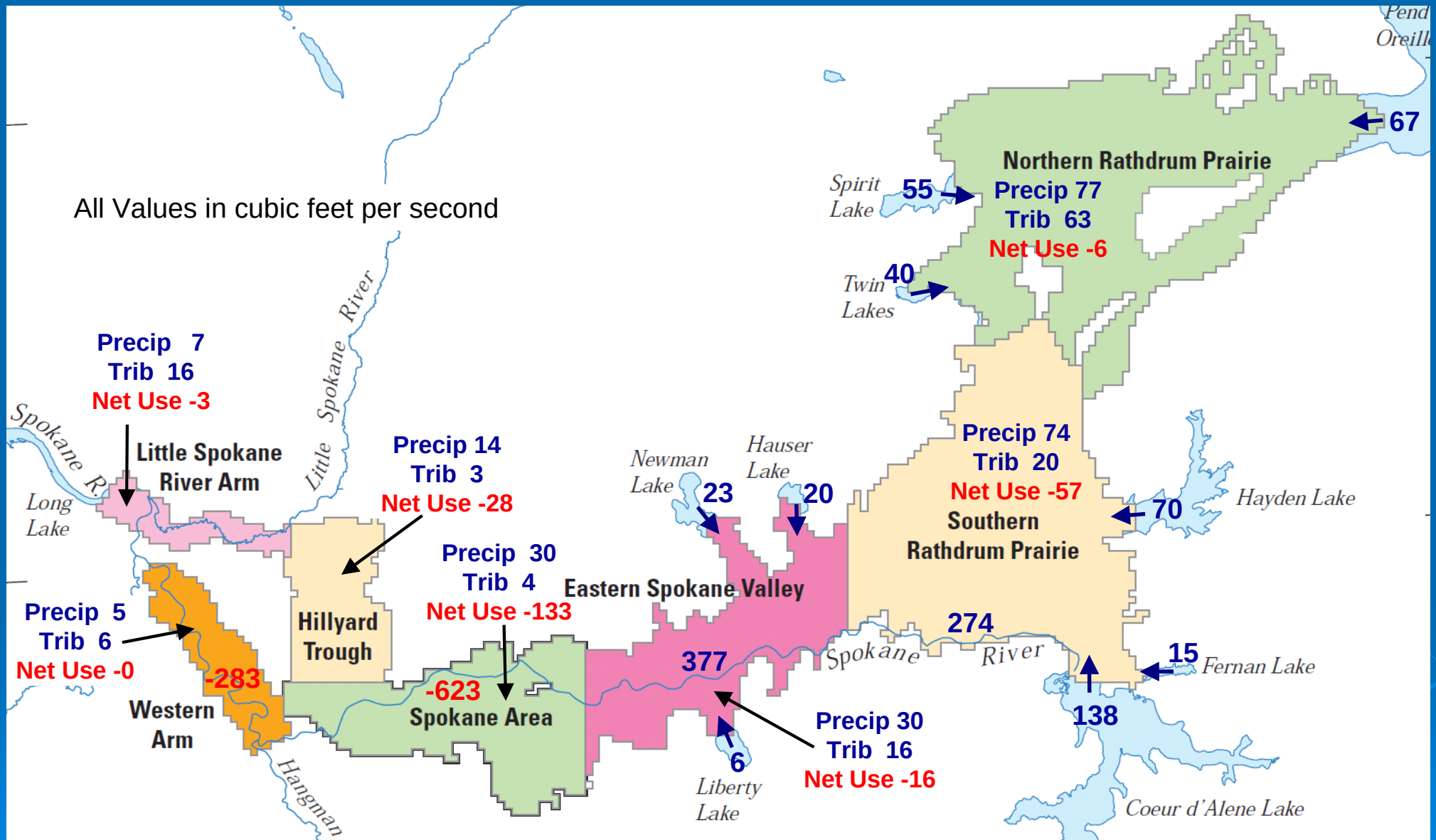
Ground Water levels in the Spokane Valley - Rathdrum Prairie Aquifer, Spokane County, Washington and Bonner and Kootenai Counties, Idaho September, 2004

By Annette M. Campbell



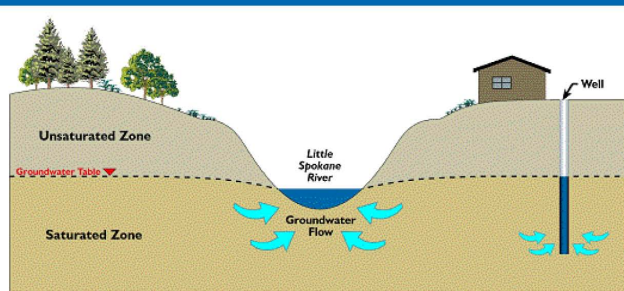
R. 41 E. R. 42 E. R. 43 E. R. 44 E. R. 45 E. R. 46 W. R. 47 W. R. 48 W.
T. 49 N. T. 50 N. T. 51 N. T. 52 N. T. 53 N. T. 54 N. T. 55 N.

Base from U.S. Geological Survey digital data, 1:500,000, 1983
Universal Transverse Mercator Projection, Zone 11

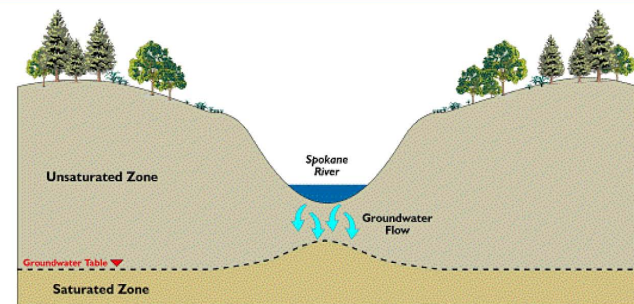


Spokane River Aquifer-River Interchange

-  Losing Section
-  Gaining Section
-  Transitional Section
-  Minimal Interaction

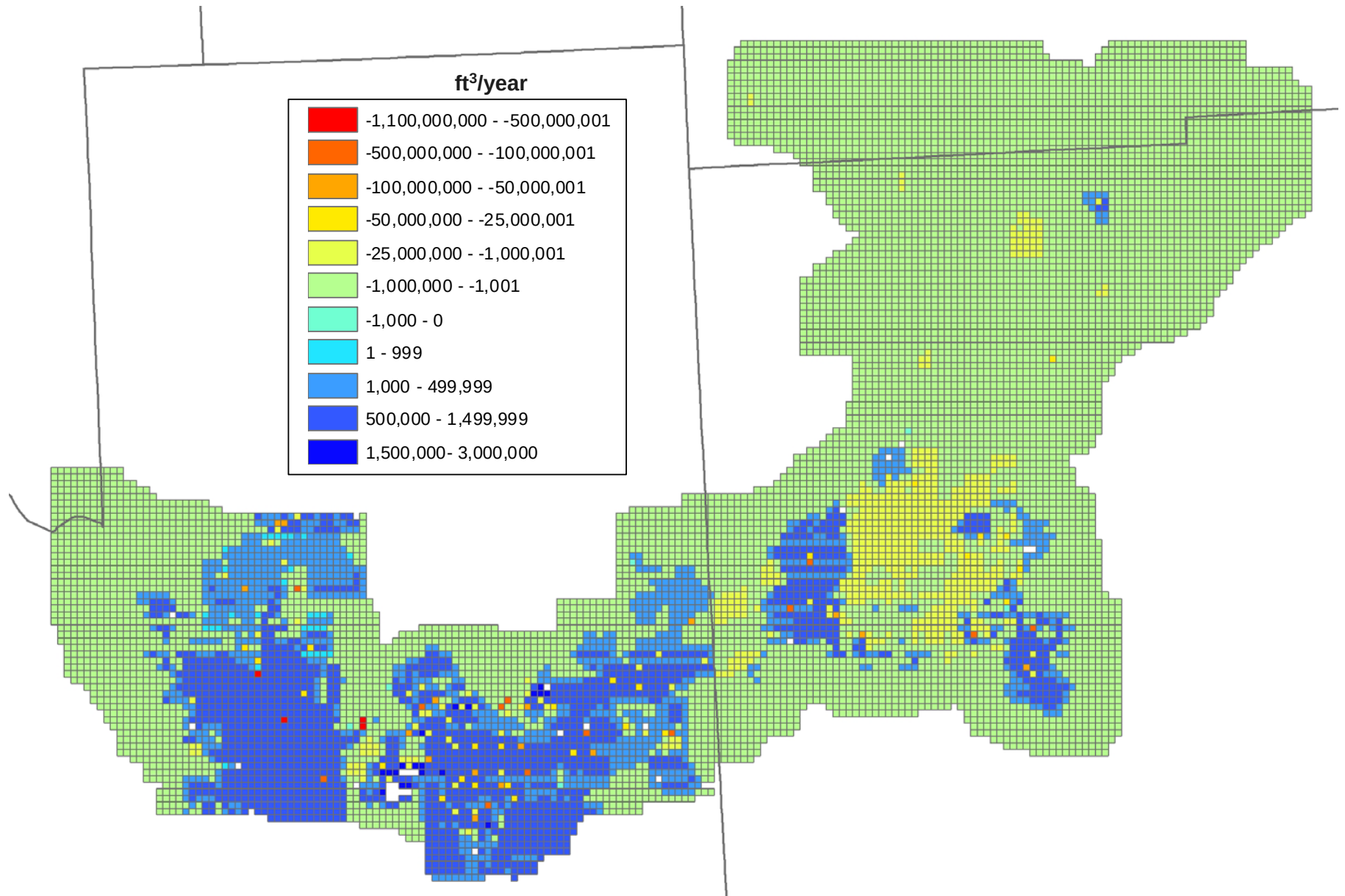


Gaining Section of River



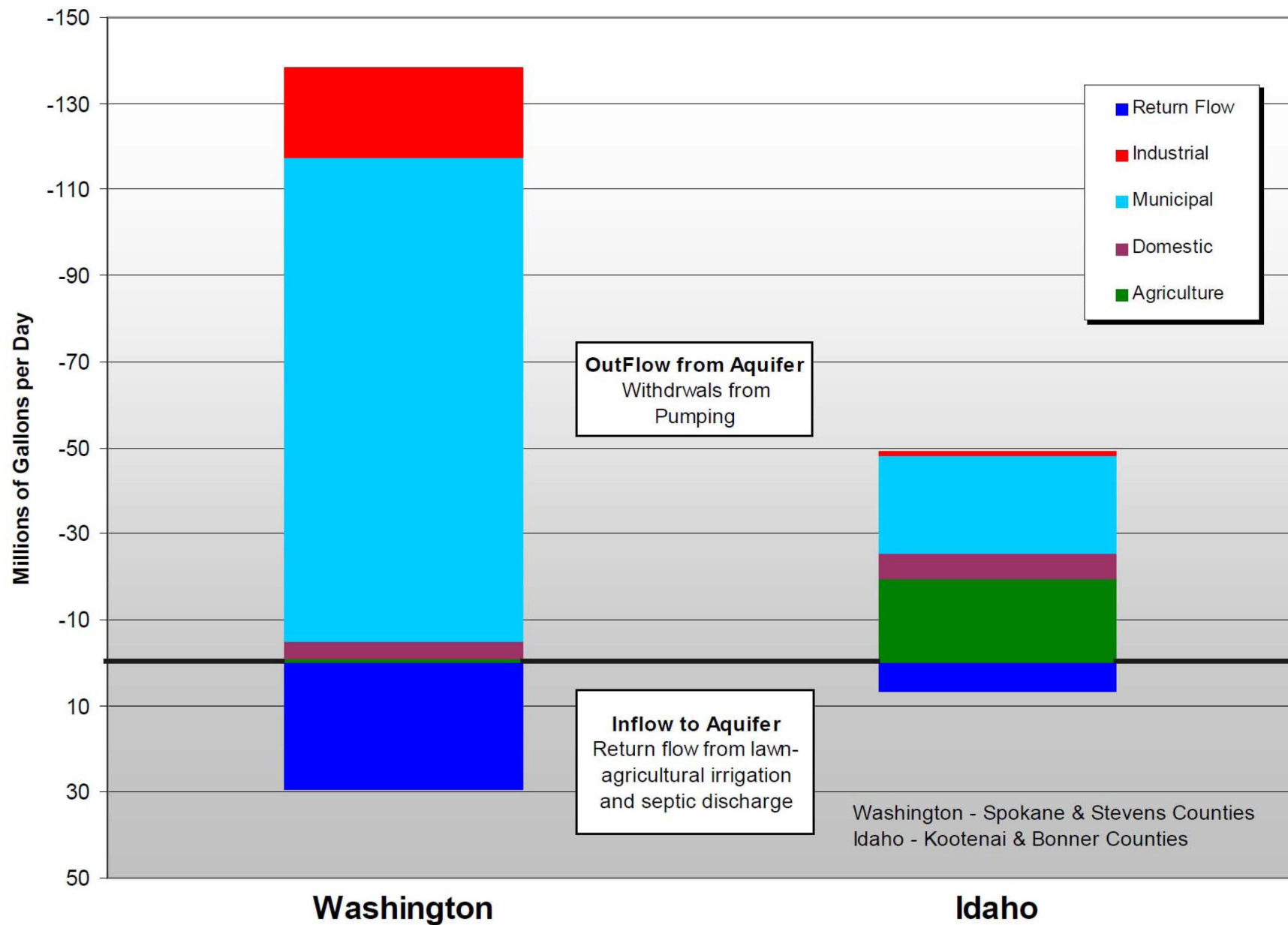
Losing Section of River

Net Flow per Cell 2004 SVRP Aquifer



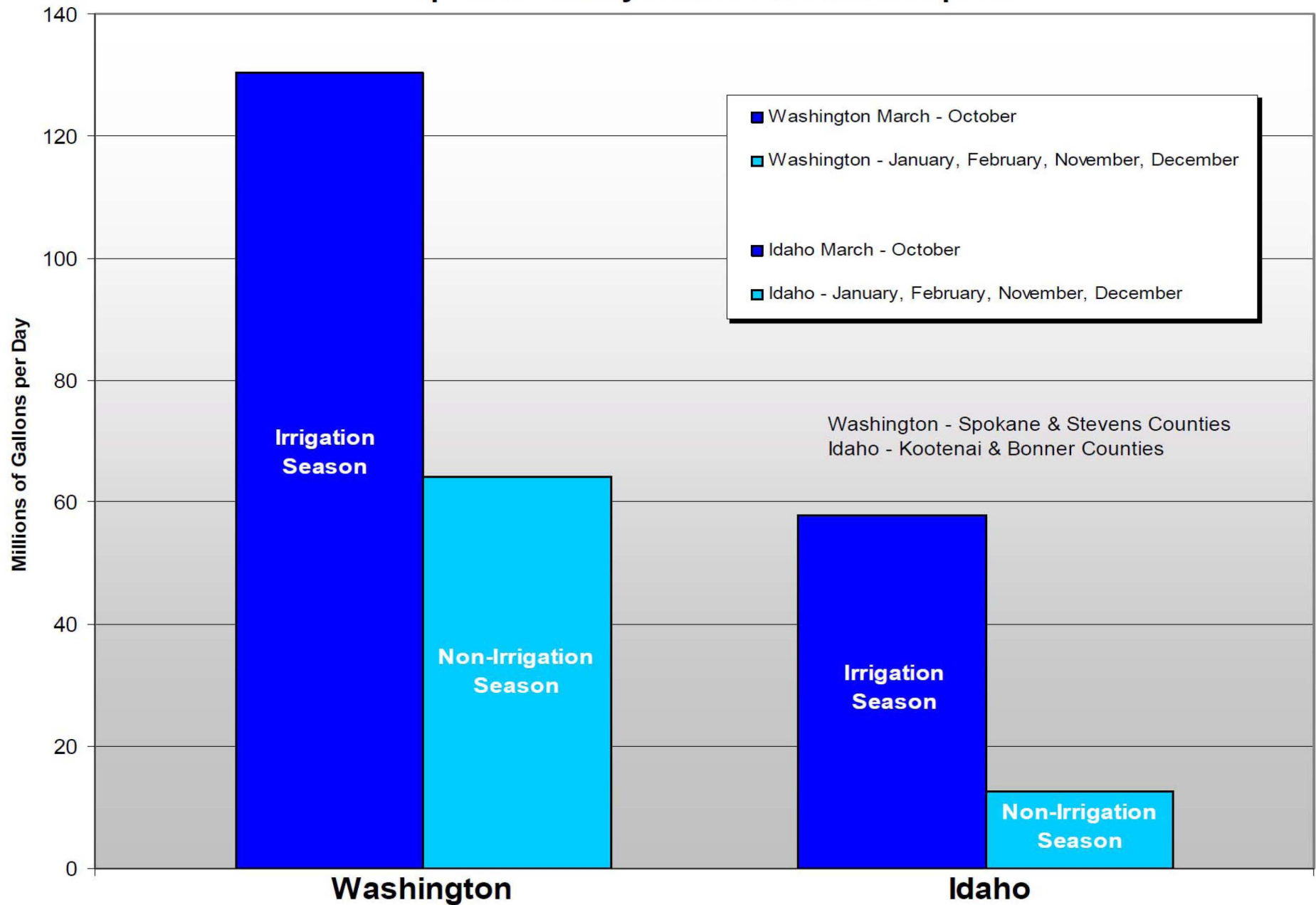
Human Water Usage 2004

Spokane-Valley Rathdrum-Prairie Aquifer



Net Withdrawal 2004

Spokane-Valley Rathdrum-Prairie Aquifer



Rathdrum-Prairie Aquifer

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Federal

Designation -Sole Source Aquifer (Federal Register Vol. 43, No. 28, 1978)

1978 Environmental Protection Agency designated the Spokane Valley-Rathdrum Prairie Aquifer as a Sole Source Aquifer

Determination/Finding -Sole Source Aquifer

- Sole or Principal Source of Drinking water for the area
- If contaminated would become a significant hazard to public health
- No alternative drinking water source(s)
- Aquifer is vulnerable to contamination
- Currently has good water quality

Project Review Authority/Coordination

- Proposed federal financially-assisted projects which have the potential to contaminate the aquifer are subject to EPA review
- Examples of federally funded projects which have been reviewed by EPA under the SSA protection program include:
 1. highway improvements and new road construction
 2. public water supply wells and transmission lines
 3. wastewater treatment facilities
 4. construction projects that involve disposal of storm water

Idaho State

Designation – Sensitive Resource Aquifer

In 1997 Board of Environmental Quality designated the Rathdrum Prairie Aquifer as a Sensitive Resource Aquifer

Criteria – Sensitive Resource Aquifer

- The water quality is better than the ground water quality standards and maintenance of quality is needed to protect beneficial uses
- The ground water in the aquifer is considered to be highly vulnerable
- The ground water in the aquifer represents an irreplaceable source for beneficial use
- The ground water within an aquifer is hydrologically interconnected with surface water and additional protection is needed to maintain the quality of either the surface or ground water. Hydrologic interconnection can include either natural or induced ground water recharge or discharge areas.

Project/Activity Review Authority

Any project/activity that has permit requirements that address ground water quality or has caused a release degrading ground water quality

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Ground Water Quality Rule – IDAPA 58.01.11

Water Quality Standards

Establishes minimum requirements for protection of ground water quality through

- Numerical and narrative standards
- Aquifer categorization process
- This rule does not in and of itself create a permit program

Permitted Activities

Any project/activity that has permit requirements that address ground water quality.

Examples include;

- Individual/Subsurface Sewage Disposal Rule –IDAPA 58.01.01
- Wastewater Rules – IDAPA 58.01.16
- Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater – IDAPA 58.0.17
- Idaho Rules for Public Drinking water Systems – IDAPA 58.01.08
- Rules of the Panhandle Health District 1 – IDAPA 41.01.01

Permit can contain ground water quality requirements for the project/activity as per IDAPA 58.01.11 to be demonstrated before implementation of activity

Requirements based on type of activity and aquifer categorization

Ground Water Quality Rule – IDAPA 58.01.11 ...Continued

Discovery of a Release of Contaminants to Ground Water

It is unlawful for any person to cause or allow a release of a contaminant into the environment that;

- Causes a ground water quality standard to be exceeded
- Injures a beneficial use of ground water
- Is not in accordance with permit, consent order, BMP, BPM or BAM.

Remedies if a Release of Contaminants is Detected

If numerical standard is NOT exceeded, but degradation is deemed significant;

- Modify activity to prevent degradation
- Allow limited degradation of primary constituents if it can be demonstrated that;
 1. BMP, BPM or BAM are being applied
 2. Degradation is justifiable based on necessary and widespread social and economic justification
- Allow degradation of secondary constituents up to numeric standards if it can be demonstrated that;
 1. BMP are being applied
 2. Degradation will not adversely affect a beneficial use

If numeric standard is exceeded then appropriate action shall be taken to prevent further contamination

Designation of a site specific ground water quality level or point of compliance

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Sensitive Resource Aquifer

❖ IDAPA 58.01.11.300 .01

Spokane Valley – Rathdrum Prairie Aquifer is Sensitive Resource Aquifer

❖ IDAPA 58.01.11.300.01.a

Spokane Valley – Rathdrum Prairie Aquifer

In addition to the ground water quality standards in section 200, the following narrative standard applies: the aquifer shall not be degraded, as it relates to beneficial users, as a result of point source or nonpoint source activity unless it is demonstrated by the person proposing the activity that such change is justifiable as a result of necessary economic or social development

❖ IDAPA 58.01.11.301.01.a

Sensitive Resource Category Aquifers

Activities with the potential to degrade sensitive resource aquifers shall be managed in a manner which maintains or exceeds existing ground water quality through the use of best management practices and best available methods.

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Example Project

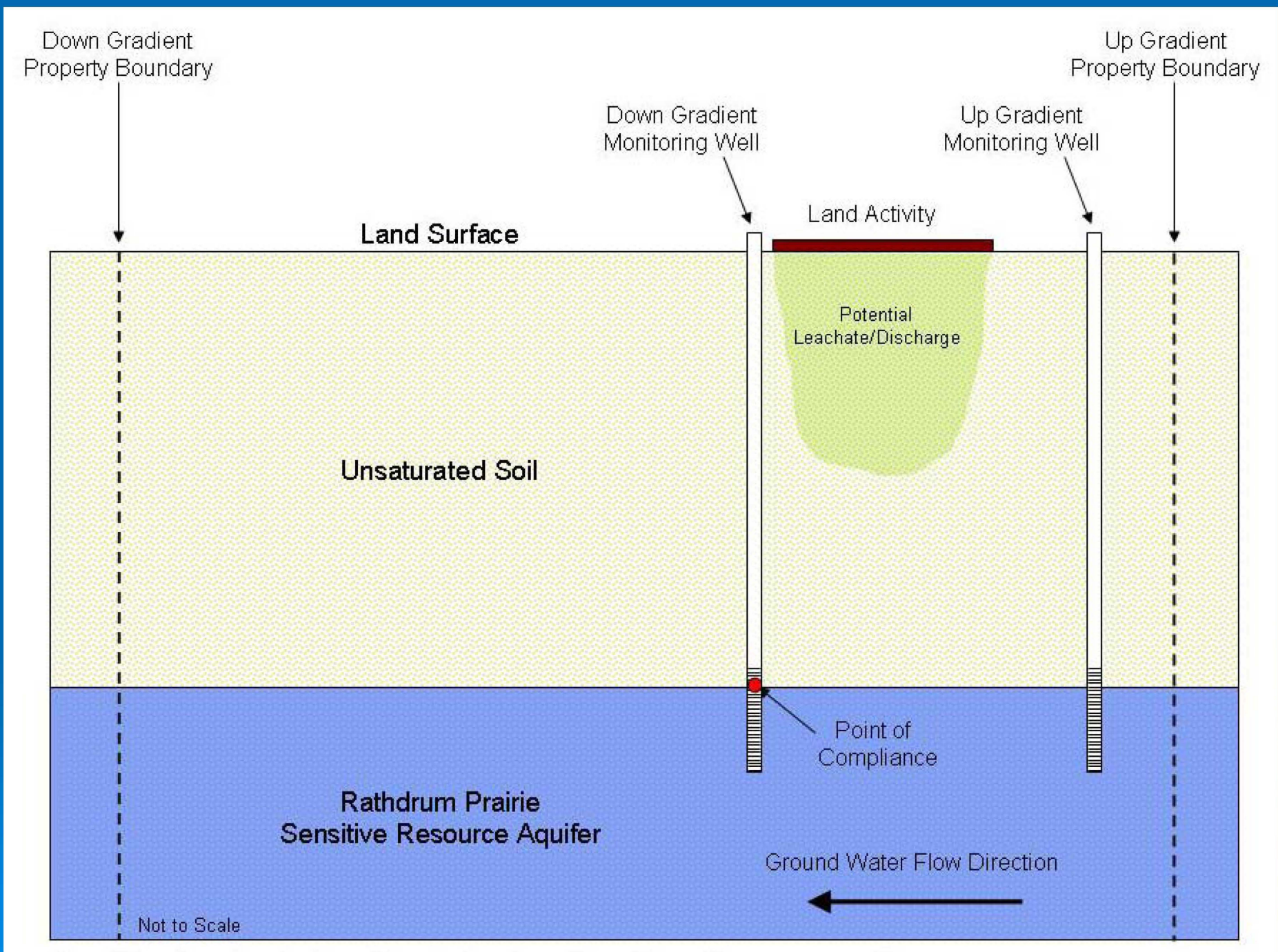
- 50 unit development over the Sensitive Resource Aquifer
 - Proposed on-site waste water disposal through septic tank and Large Soil Absorption System
 - Need permit
1. IDAPA 58.01.11.301.01.a Activities with the potential to degrade sensitive resource aquifers shall be managed in a manner which maintains or exceeds existing ground water quality through the use of best management practices and best available methods

Sewage Disposal Rules - IDAPA 58.01.03

Site Investigation – Site investigation to conclude that effluent will not adversely impact or harm waters of the state (Nutrient-Pathogen Evaluation)

Alternate method – wastewater reuse such as slow rate irrigation would be an example of method that would be acceptable or connecting to POTW.

2. Other methods or pre-treatment would be considered within the context of
 - a. GWQR - IDAPA 58.01.11
 - b. Wastewater Rules - IDAPA 58.01.16
 - Construction Standards - Plan and Specification Review
 - Demonstration of Technical, Financial and Managerial Capacity
 - c. Sewage Disposal Rules - IDAPA 58.01.03



Proposed Project

- Aquifer recharge from surface water body to maintain Spokane River flows/water levels
- Introduce 11,200 gpm for four months into RPA (Hydrogeology Journal, 2009; No. 17 p. 1459-1470, IWRRI, 2008, 2009)
- Introduce water through infiltration ponds
- Do not need a permit (if injection wells used need IDWR permit)
- DEQ would require ground water monitoring plan (IDAPA 58.01.16.600)

If ground water quality monitoring indicated that recharge activities maintained or improved existing water quality no action taken

If ground water quality monitoring indicated that recharge activities were causing degradation (i.e. presence of pathogens, chlorination by-products, increased conc. of arsenic, radionuclides or metals)

- a. Require modification of regulated activities to prevent continued degradation (recharge water treatment i.e. filtration, disinfection, dechlorination, oxygen removal)
- b. DEQ may allow site-specific ground water quality levels or points of compliance, based on consideration of the effects to human health and the environment. Considerations might include;
 1. Type of contamination
 2. Concentration of contamination
 3. Public health issues
 4. Existing and projected future beneficial uses
 3. Justifiable based on necessary and widespread social and economic consideration

Potential Constituent of Concern or Screening Constituent for Aquifer Recharge Projects Rathdrum Prairie Aquifer

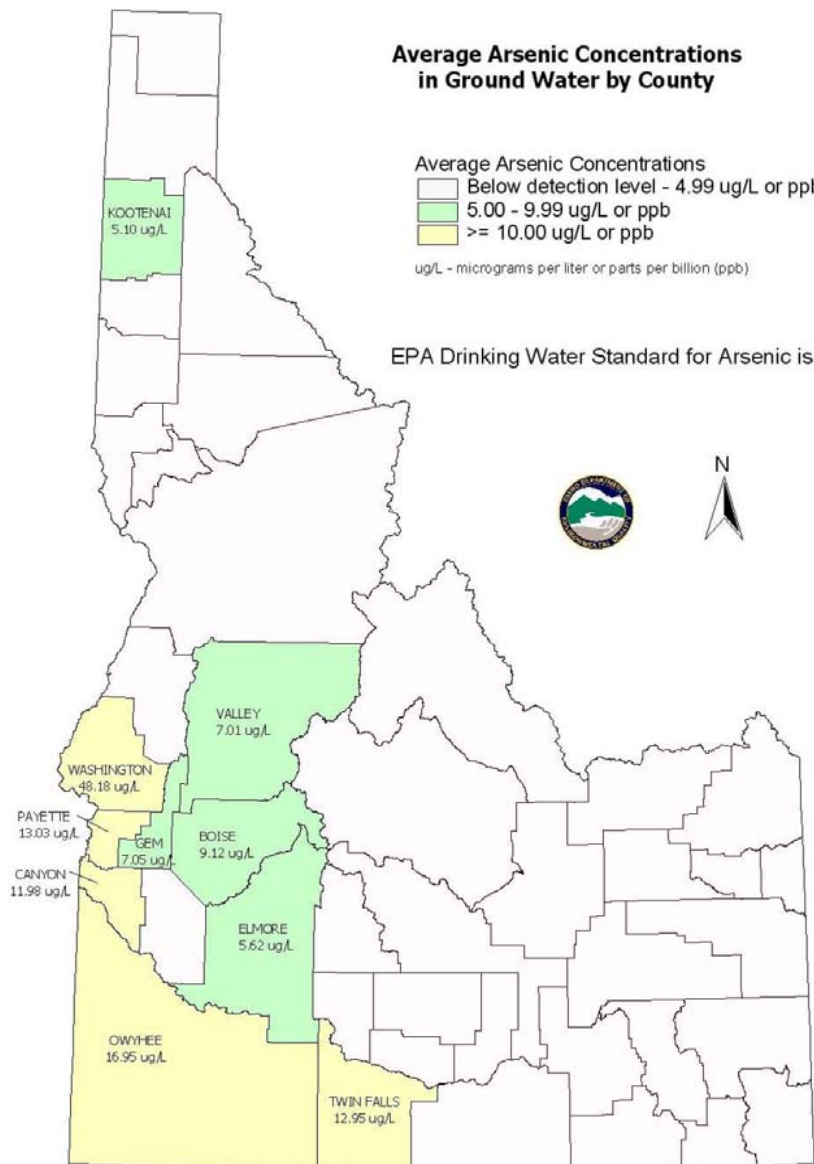
Average Arsenic Concentrations in Ground Water by County

Average Arsenic Concentrations

- Below detection level - 4.99 ug/L or ppb
- 5.00 - 9.99 ug/L or ppb
- ≥ 10.00 ug/L or ppb

ug/L - micrograms per liter or parts per billion (ppb)

EPA Drinking Water Standard for Arsenic is 10.00 ug/l

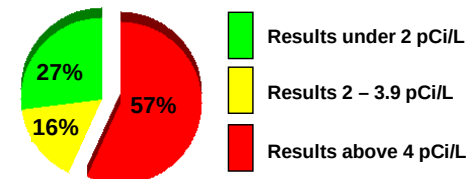


50 0 50 100 Miles

Idaho Map of Radon Zones

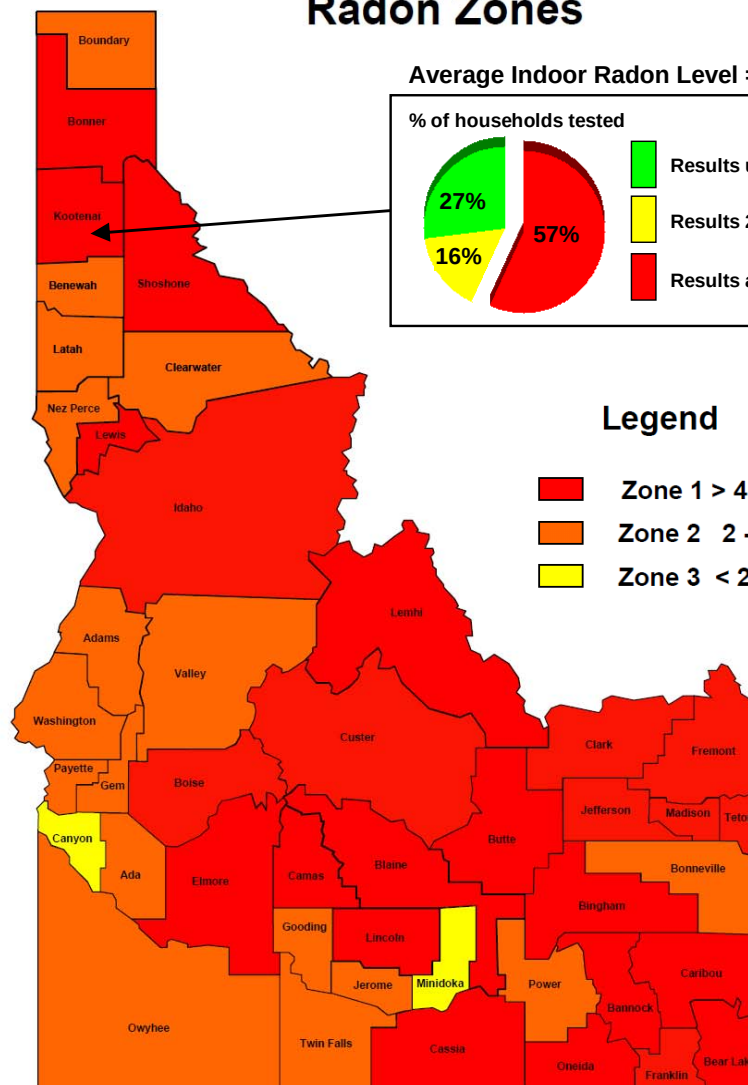
Average Indoor Radon Level = 11.9 pCi/L

% of households tested



Legend

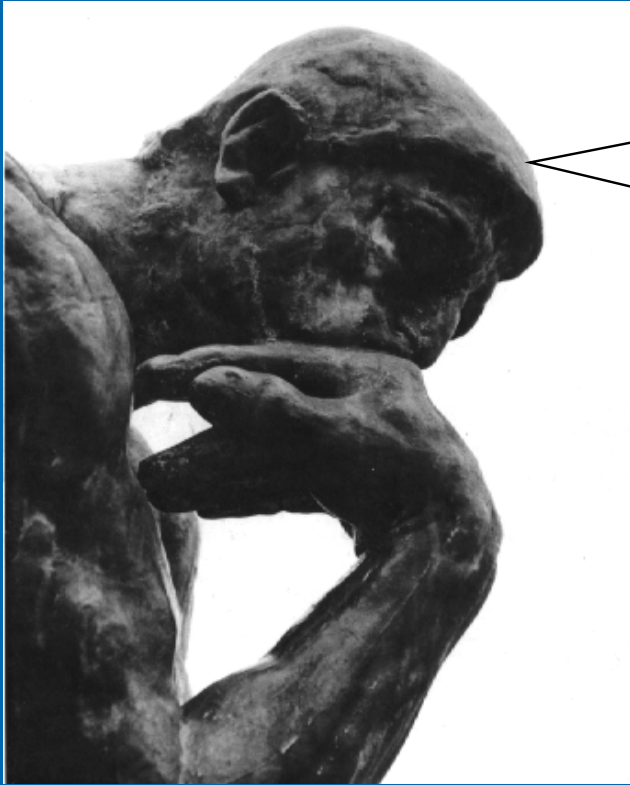
- Zone 1 > 4 pCi/L
- Zone 2 2 - 4 pCi/L
- Zone 3 < 2 pCi/L



Based on average radon test results reported since 1990

(Revised 8-14-08)

Idaho Indoor Environment Program



Your Question Here ?

Further Information

www.deq.idaho.gov/rathdrumprairieaquifer

Please call Gary Stevens at (208) 666-4627



Idaho Department of Environmental Quality