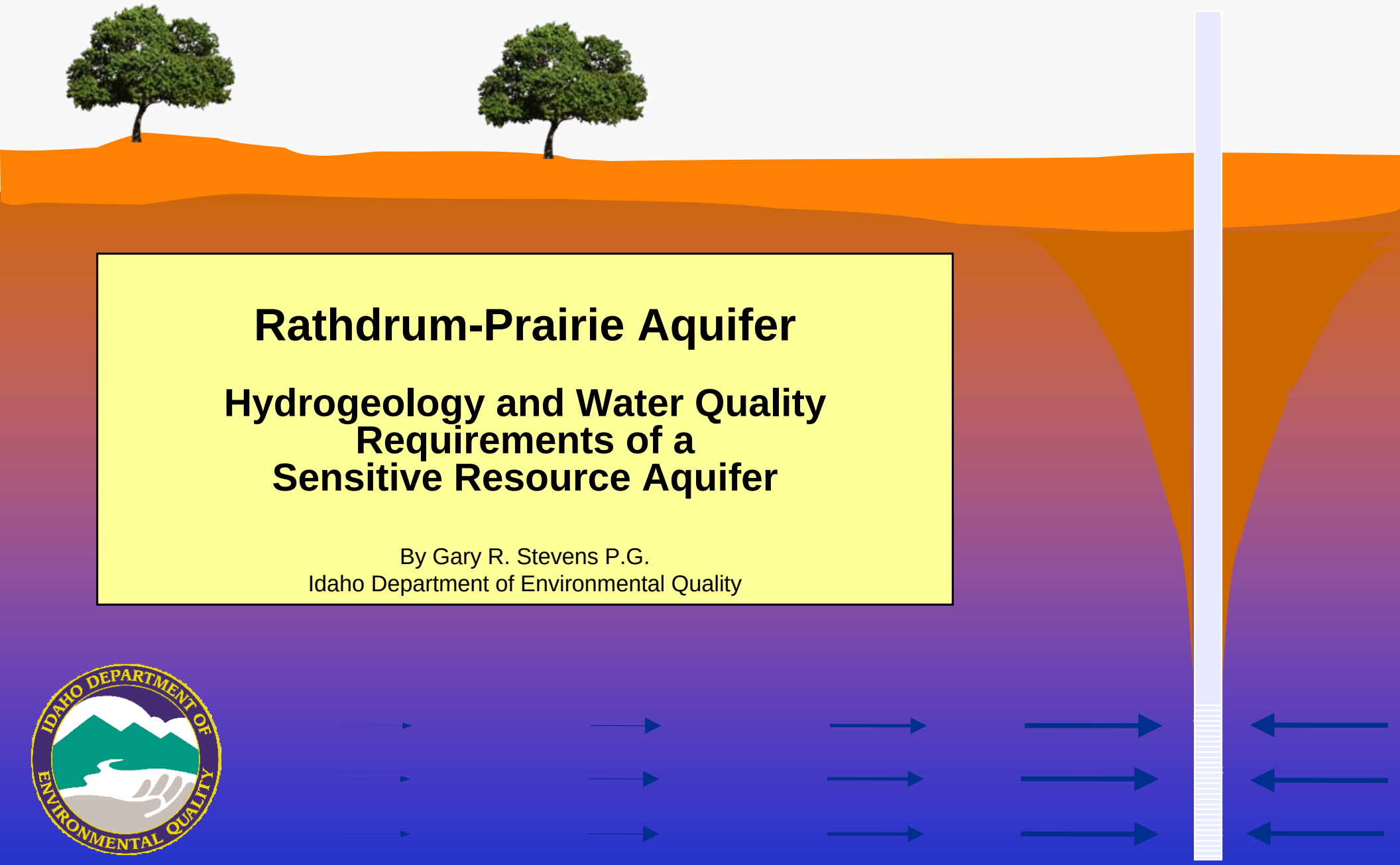

Rathdrum-Prairie Aquifer

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

Rathdrum-Prairie Aquifer

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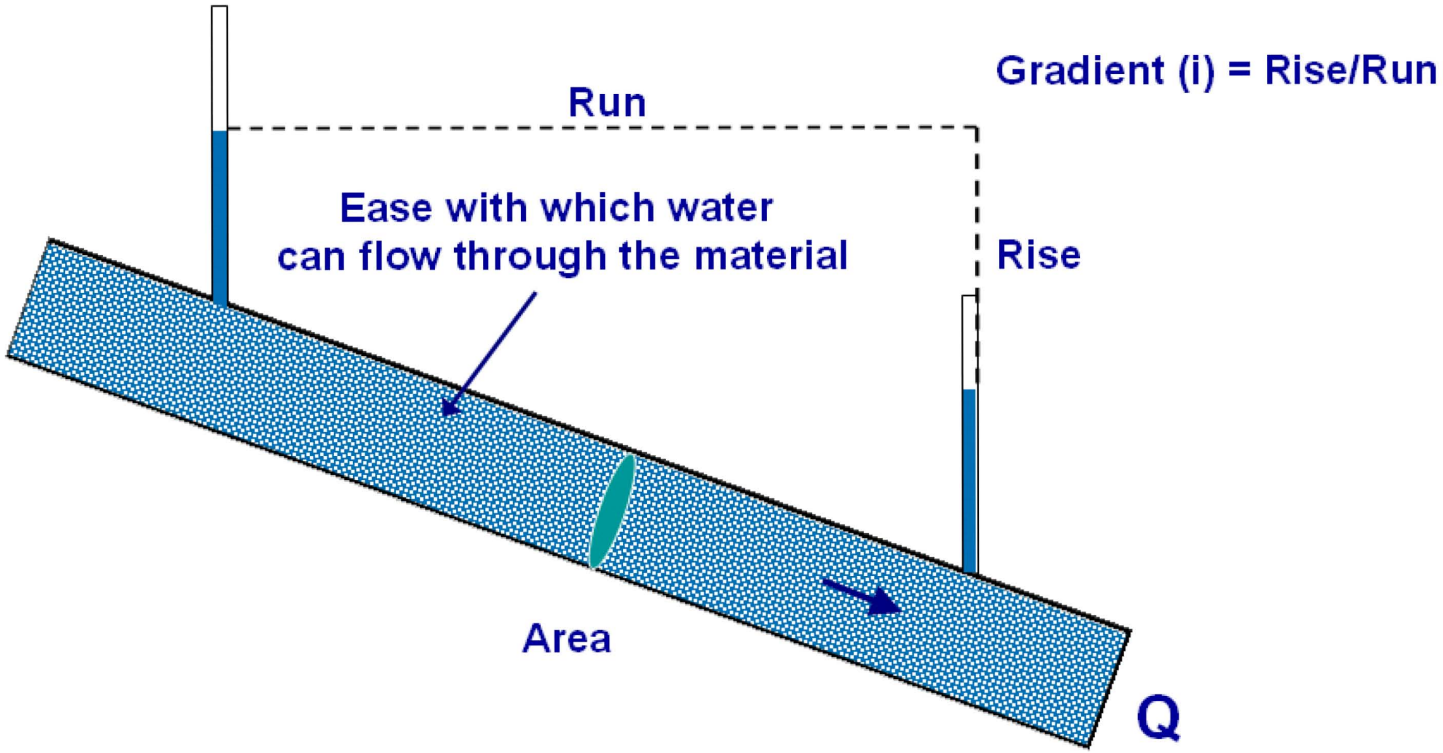
Hydraulic Conductivity

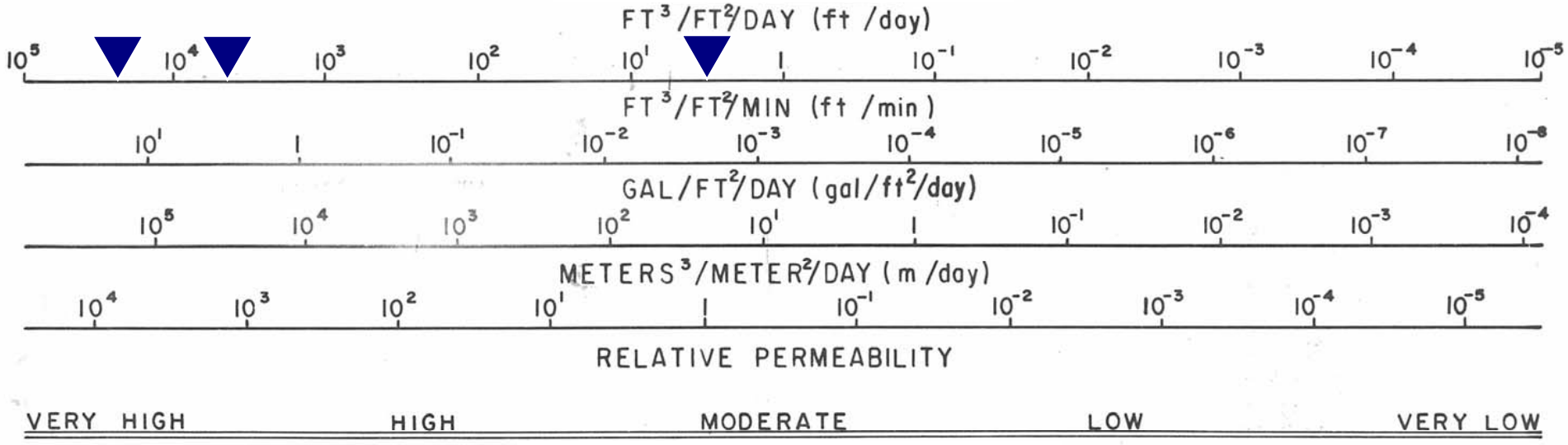
Darcy's Law

$$Q = k\,i\,A$$



7,200 feet per day

Hydraulic Conductivity



Representative Materials

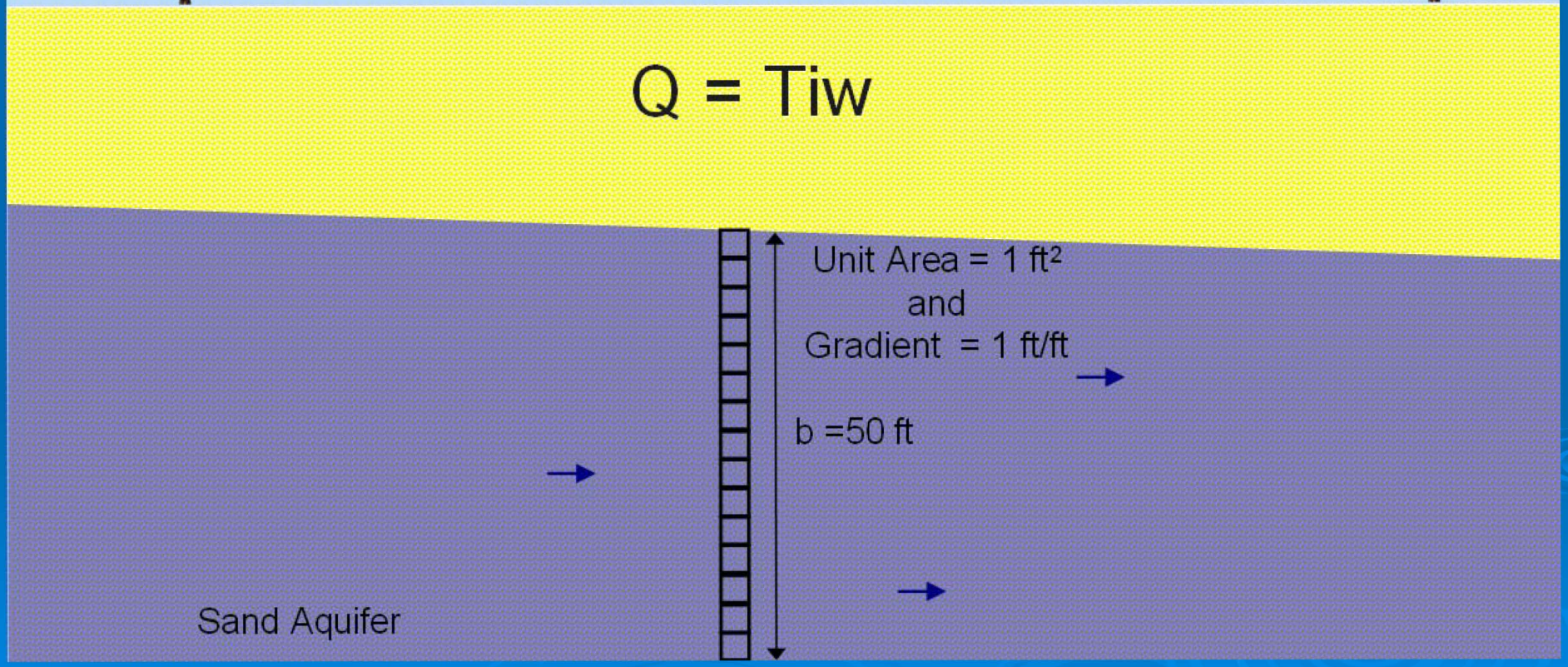
Clean gravel	Clean sand and sand and gravel	Fine sand	Silt, clay and mixtures of sand, silt and clay	Massive clay
Vesicular and scoriaceous basalt and cavernous limestone and dolomite	Clean sandstone and fractured igneous and metamorphic rocks	Laminated sandstone shale, mudstone		Massive igneous and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

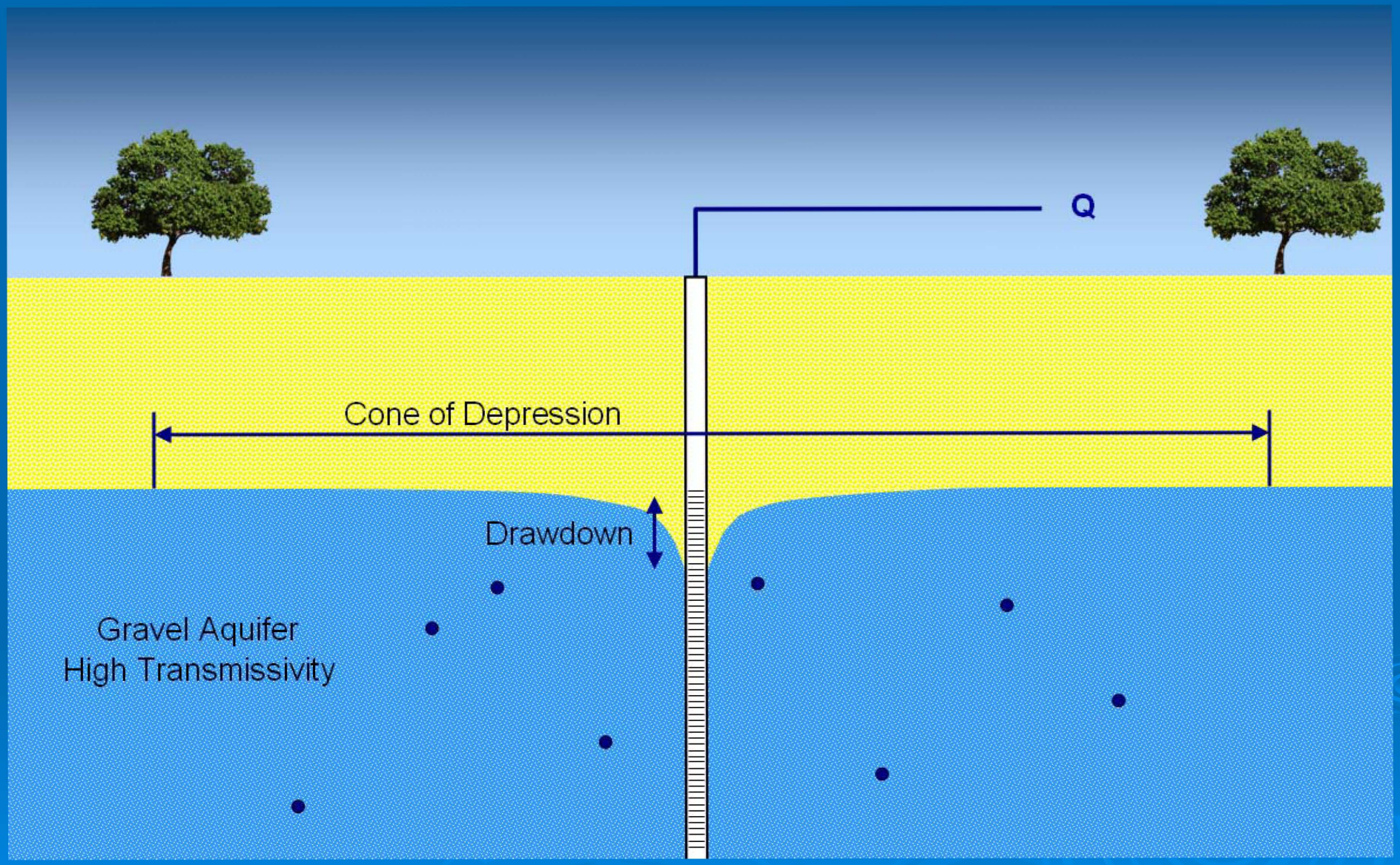
Transmissivity = kb

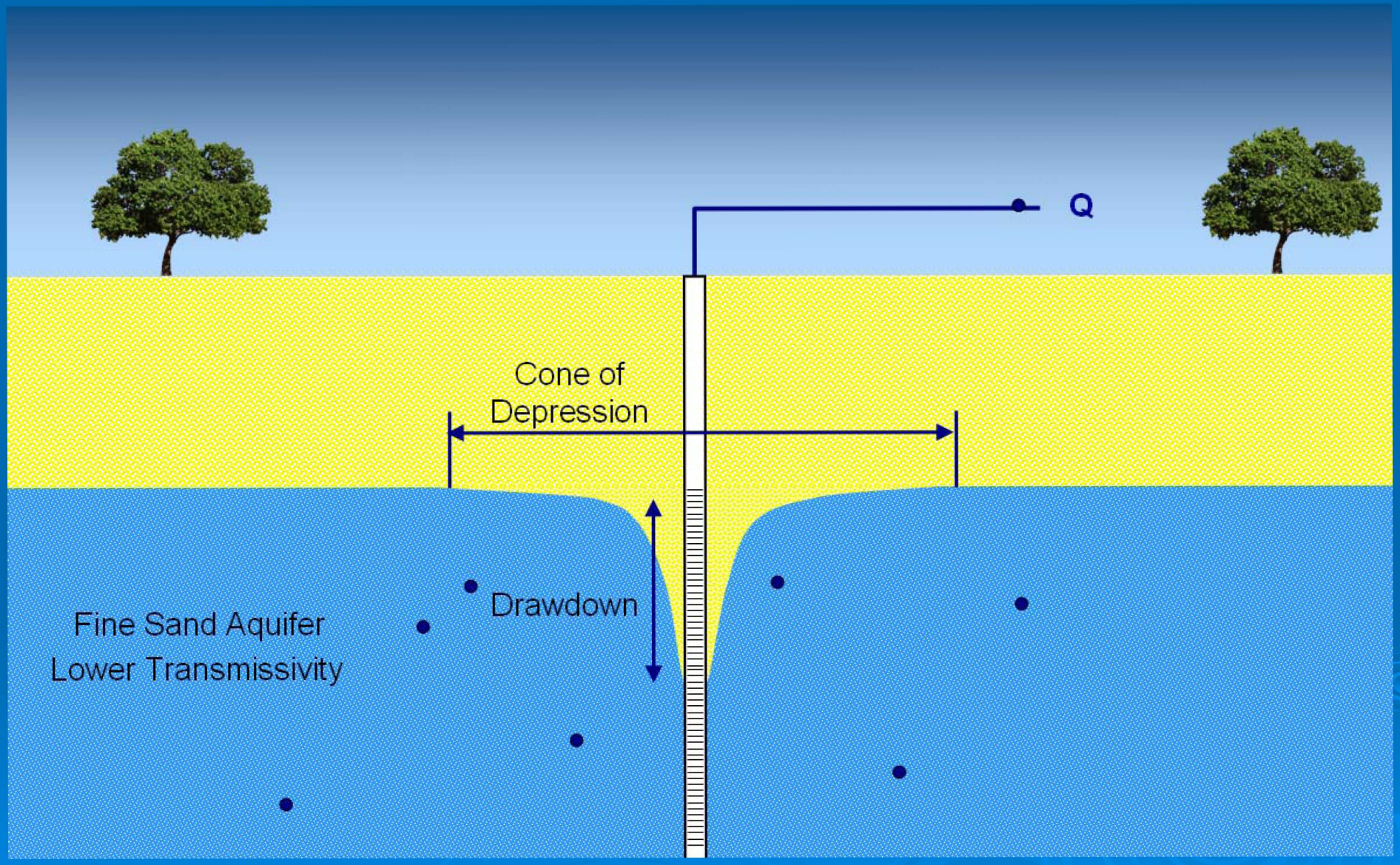
5000 (ft^2 /day) = 100 (ft/day) * 50 (ft) Aquifer 1

5000 (ft^2 /day) = 25 (ft/day) * 200 (ft) Aquifer 2

Q = Tiw




Q
Cone of Depression
Drawdown
Gravel Aquifer
High Transmissivity


Q
Cone of
Depression
Drawdown
Fine Sand Aquifer
Lower Transmissivity

Rathdrum-Prairie Aquifer

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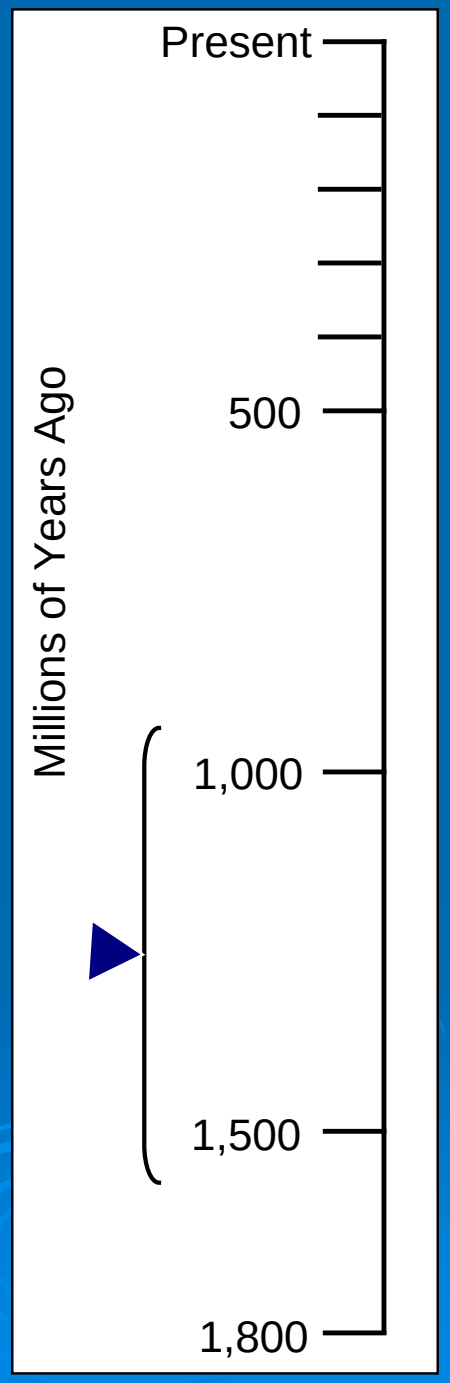
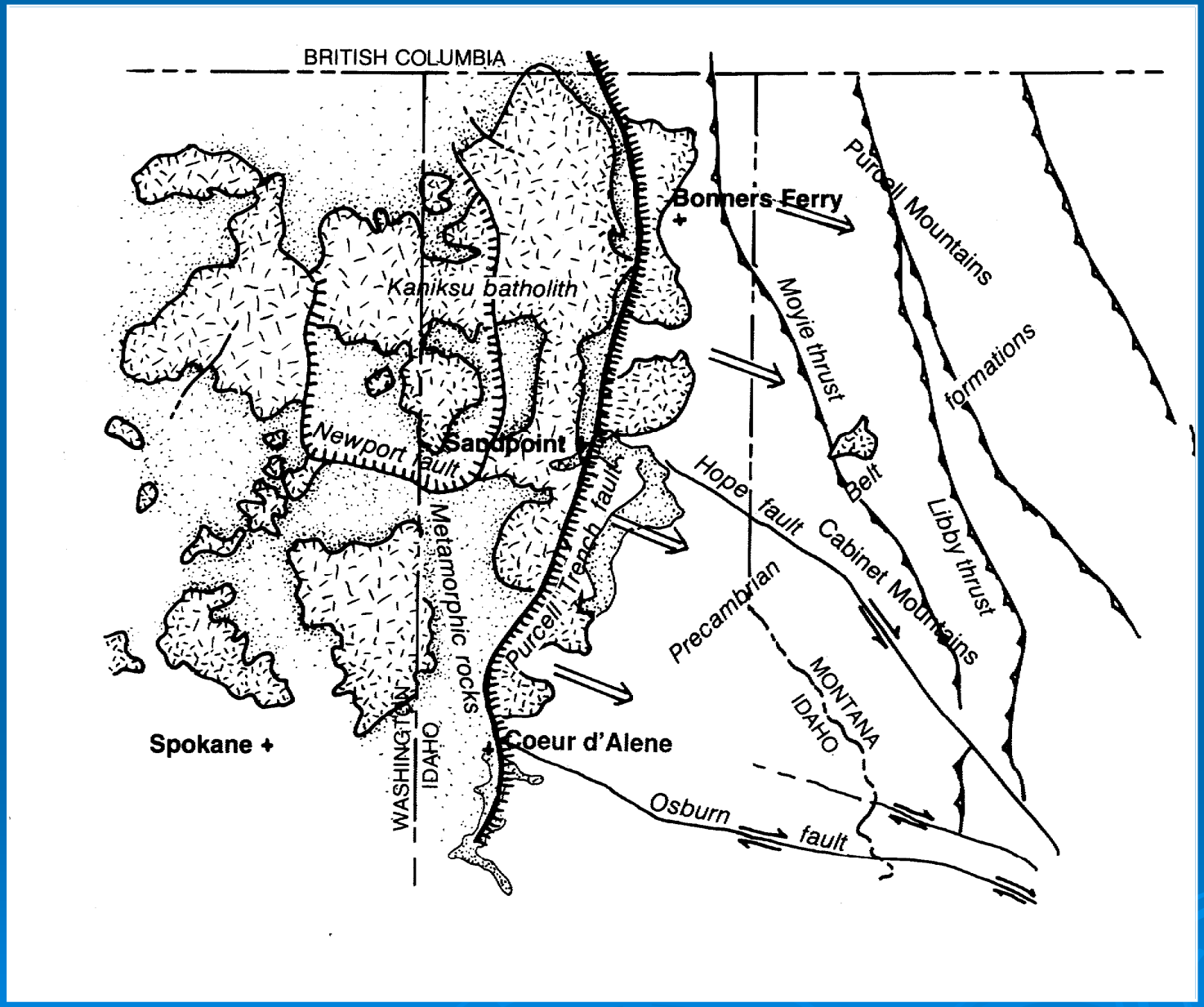
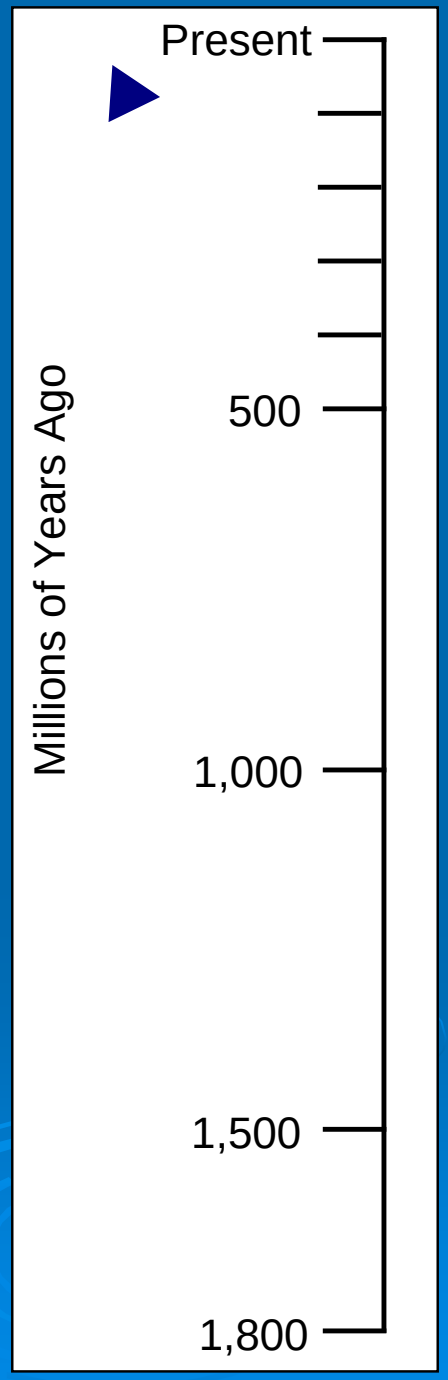
Major Geological Events

- 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

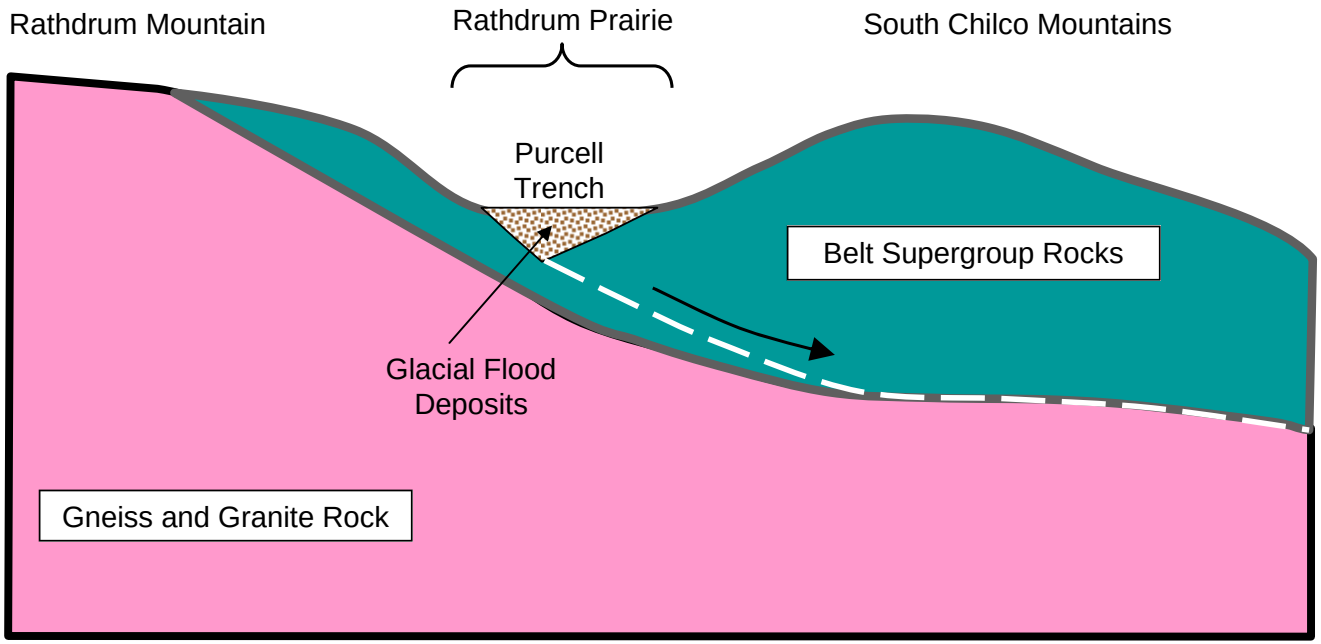

Alaska
Precambrian
Coast Line
North
American
Craton
Canada
U.S.
Pacific
Ocean
Cordilleran Mobile Belt
Belt
Basin
Uinta
Basin
Apache
Basin


Present
500
1,000
1,500
1,800
Millions of Years Ago



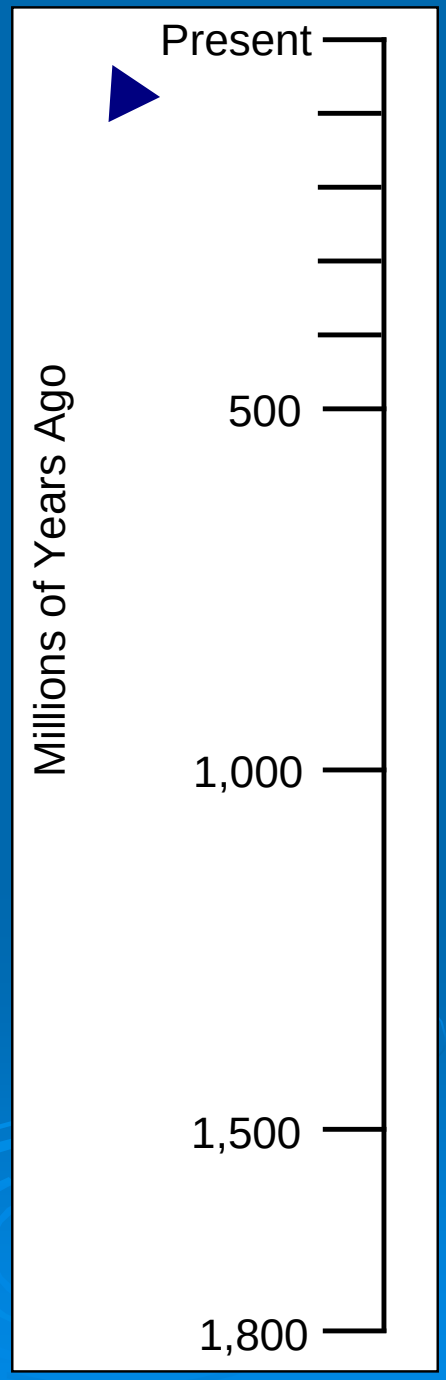


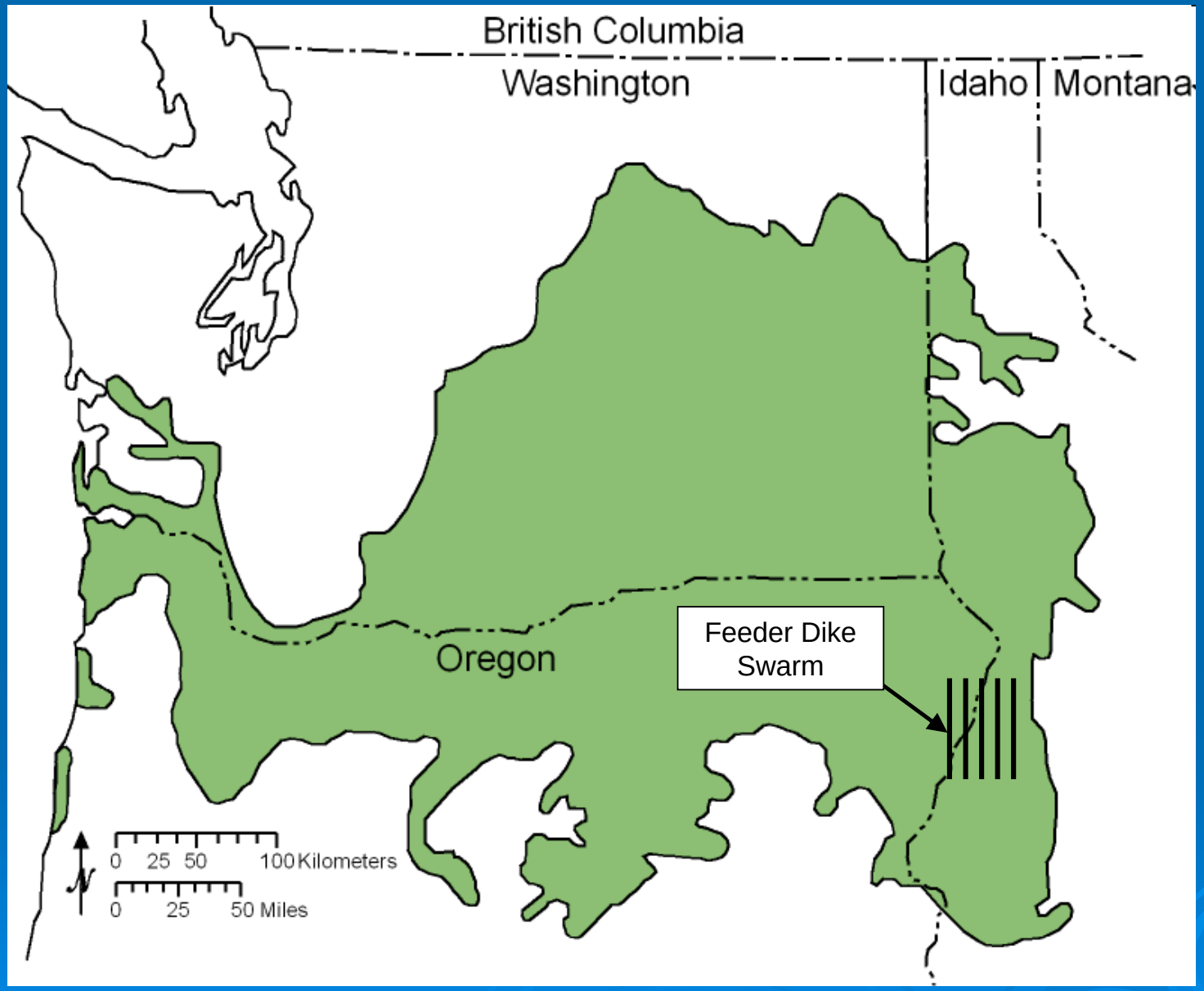
Reference: Alt, Hyndman, 1995

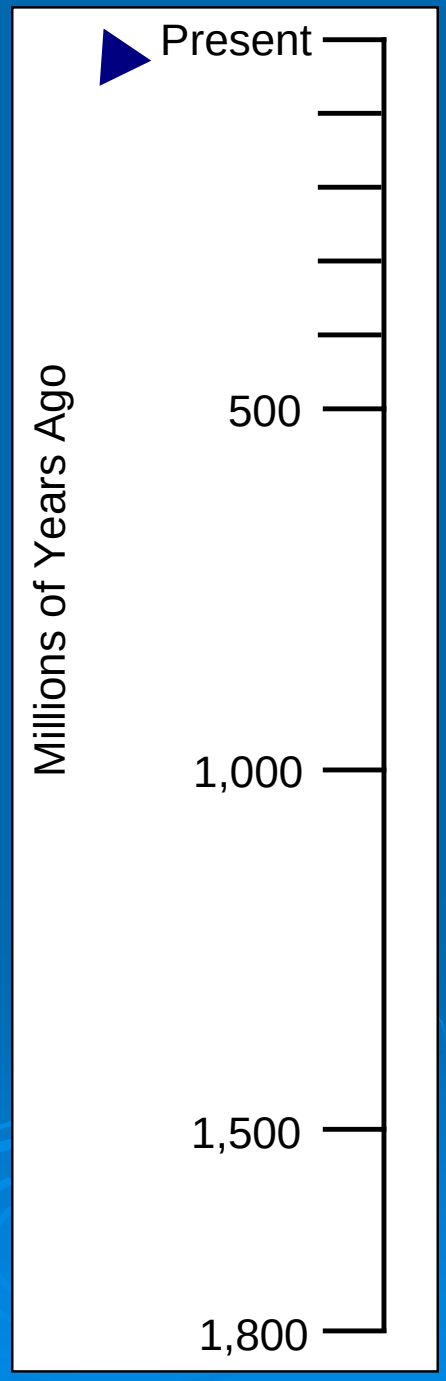


Modified from: Alt, 1989

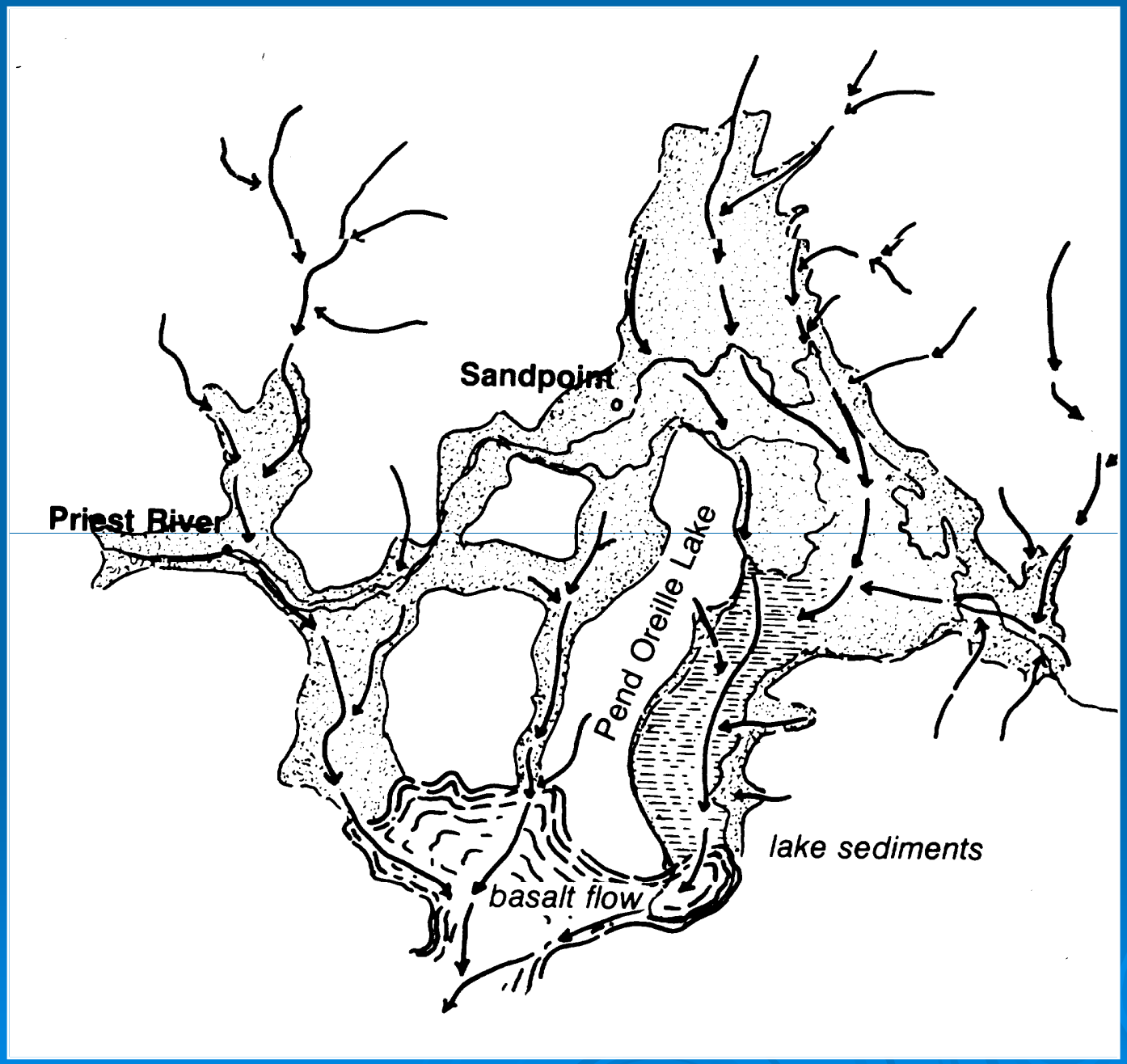
Reference: Alt, Hyndman, 1995



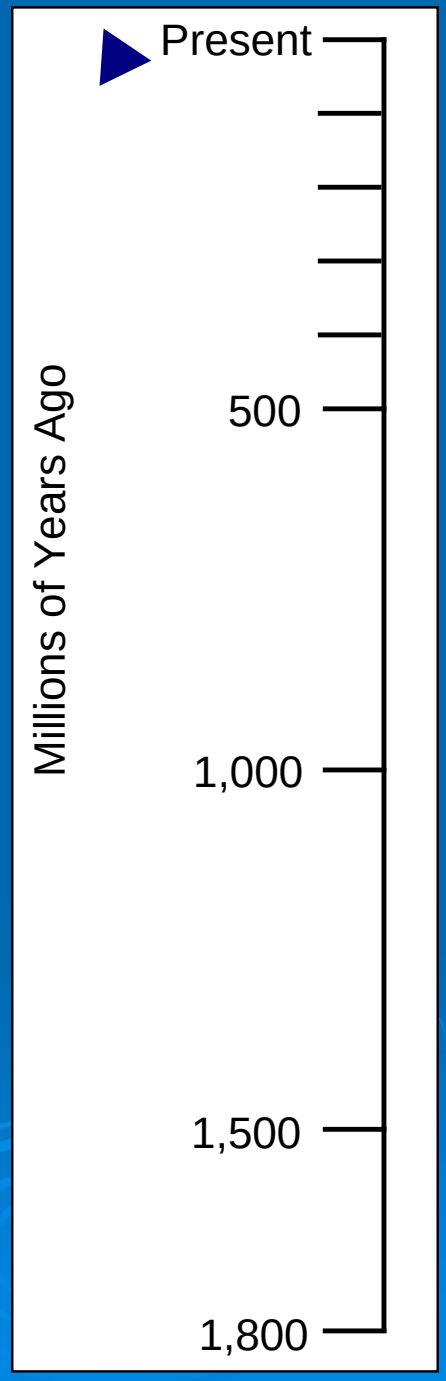


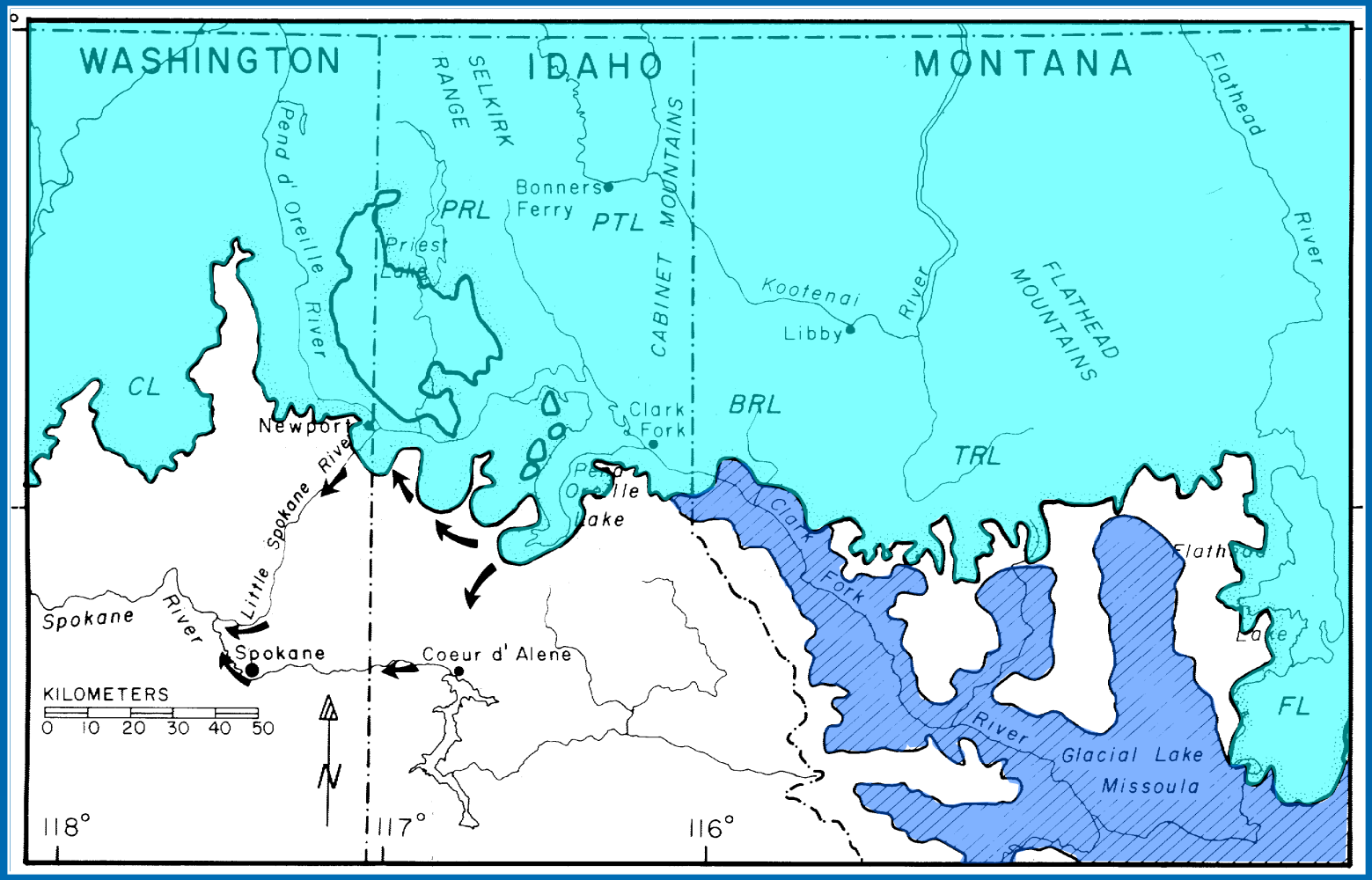


Reference: ISU Digital Geology

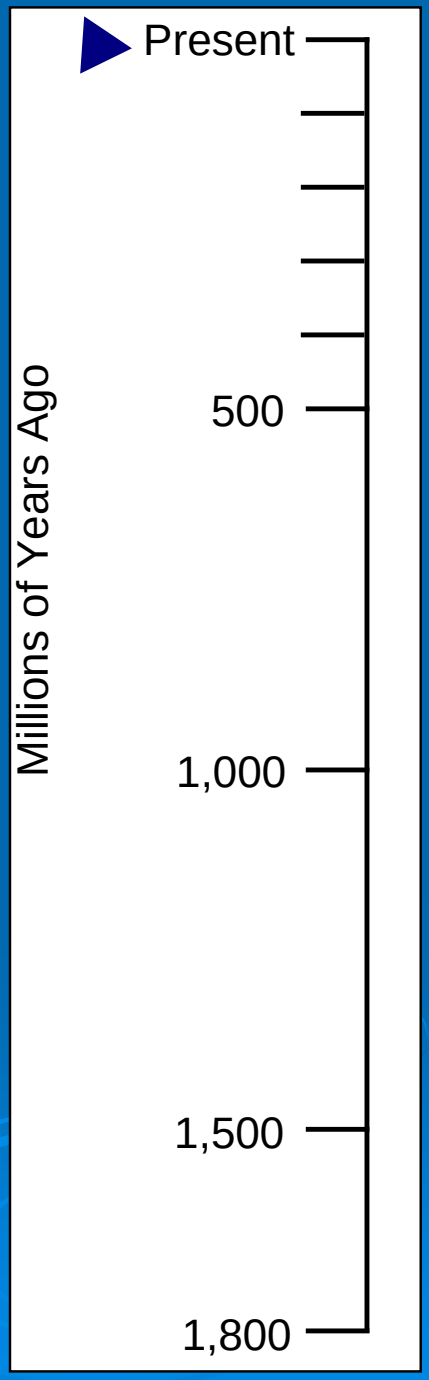


Reference: Alt, Hyndman, 1995



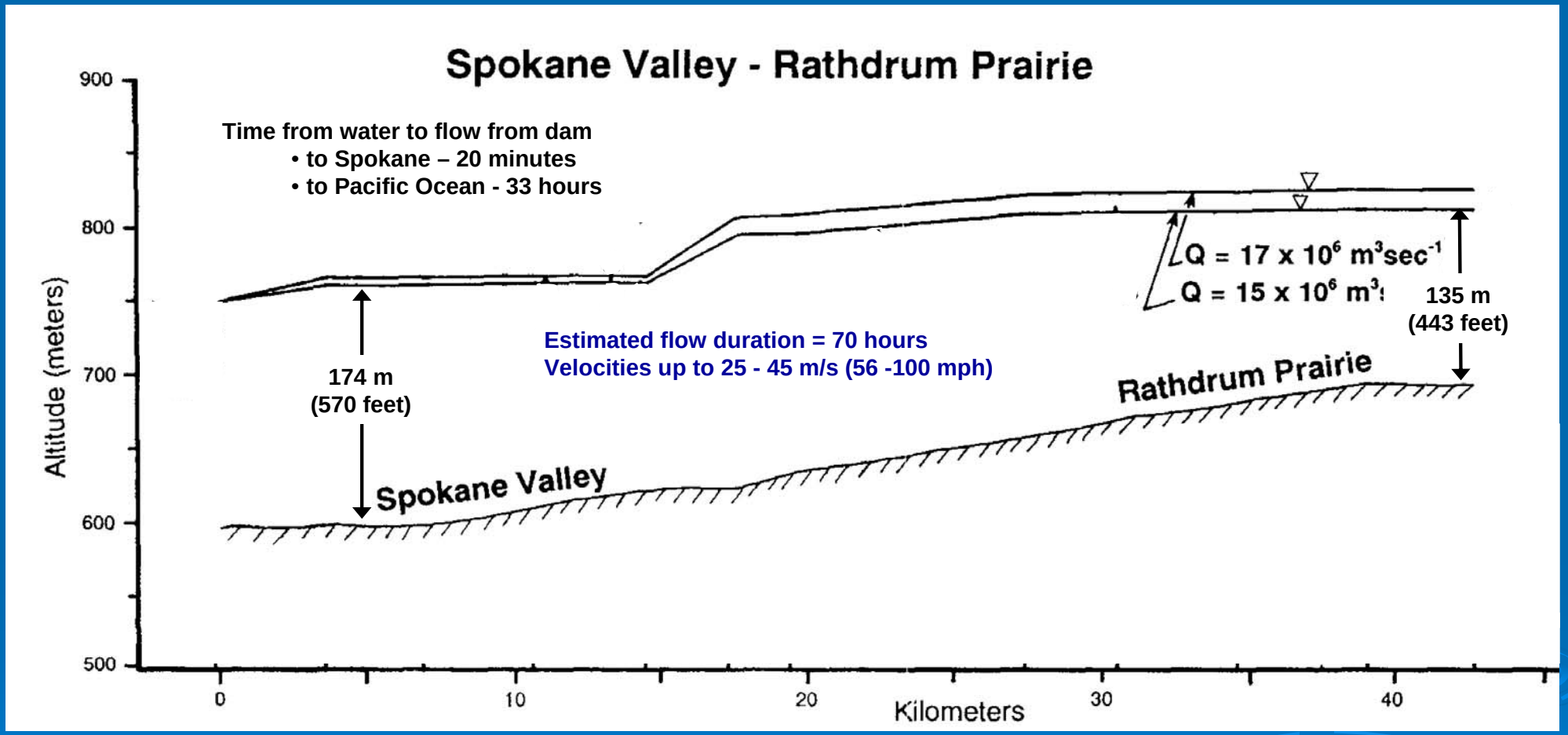


Reference: IGS, 1995



Glacial Outburst Floods

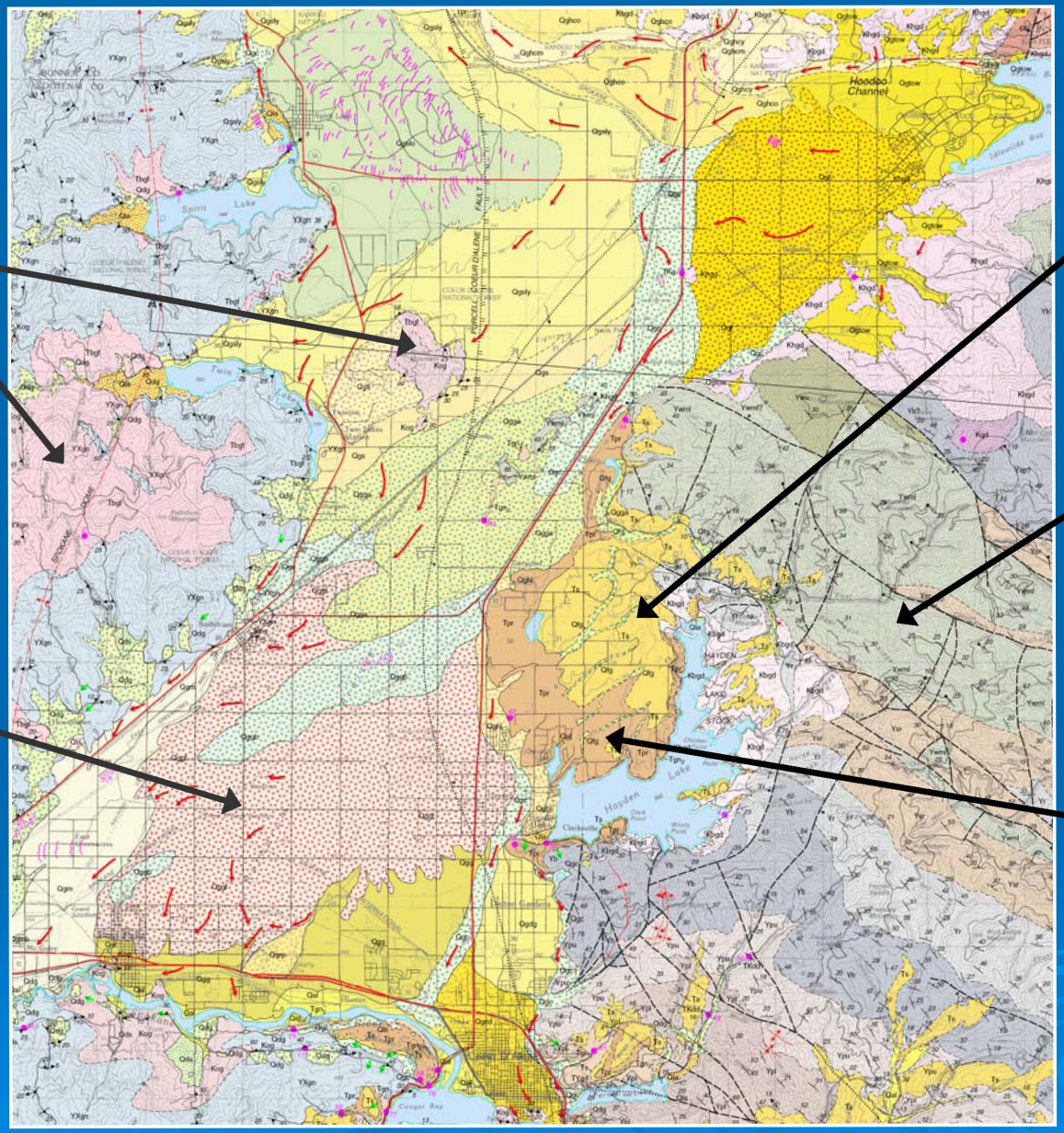
- Approximately 40 floods occurred
- Flood water about 2,000 ft high at dam with 500 cubic miles of water



Reference: Modified from O'Conner & Baker, 1992

Granite

Glacial Flood Deposits



Latah Formation

Belt Super Group

Basalt

Reference: IGS, 2002

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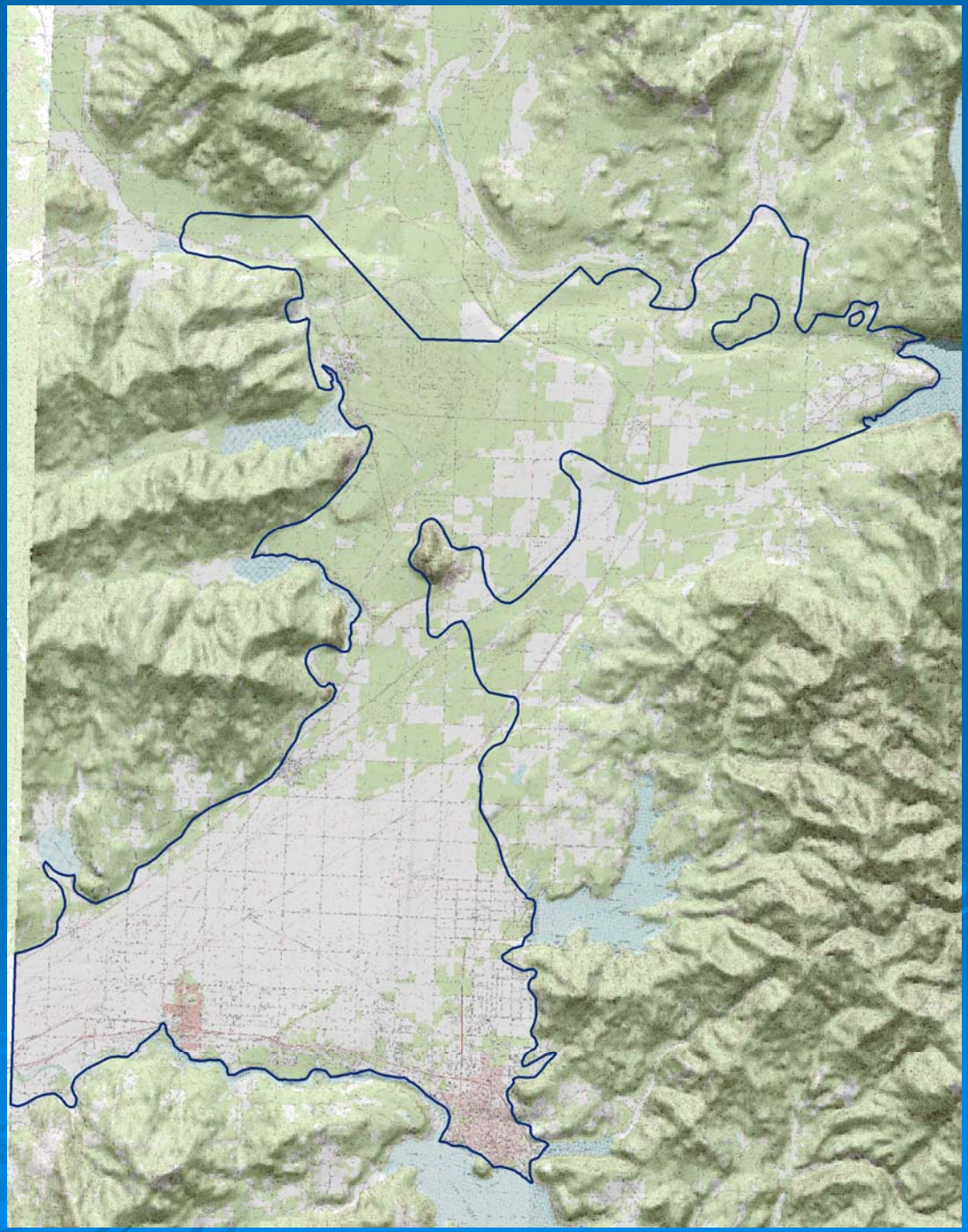
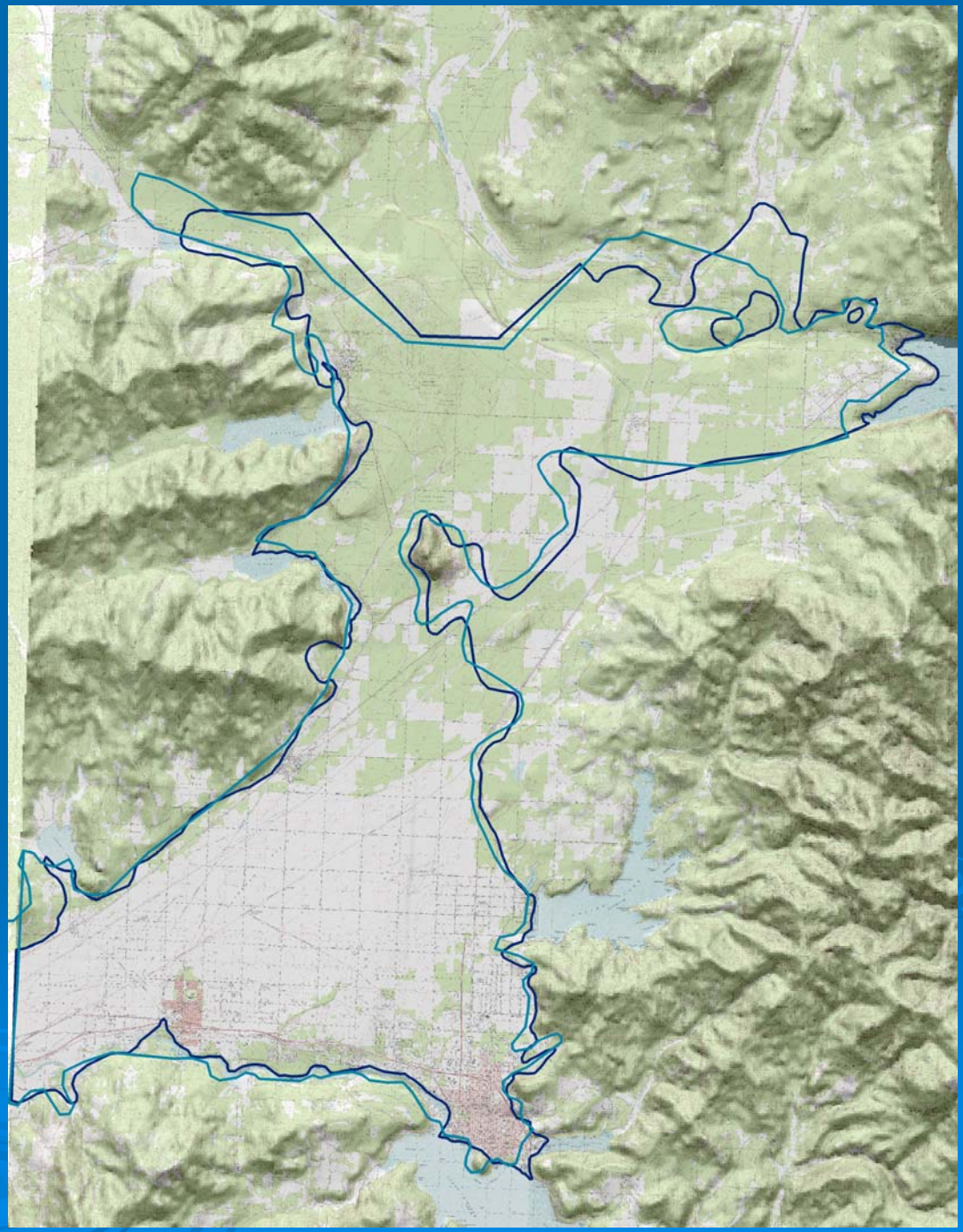
EPA Hydrogeologic Boundary
1976-1977



EPA Hydrogeologic Boundary
1976-1977

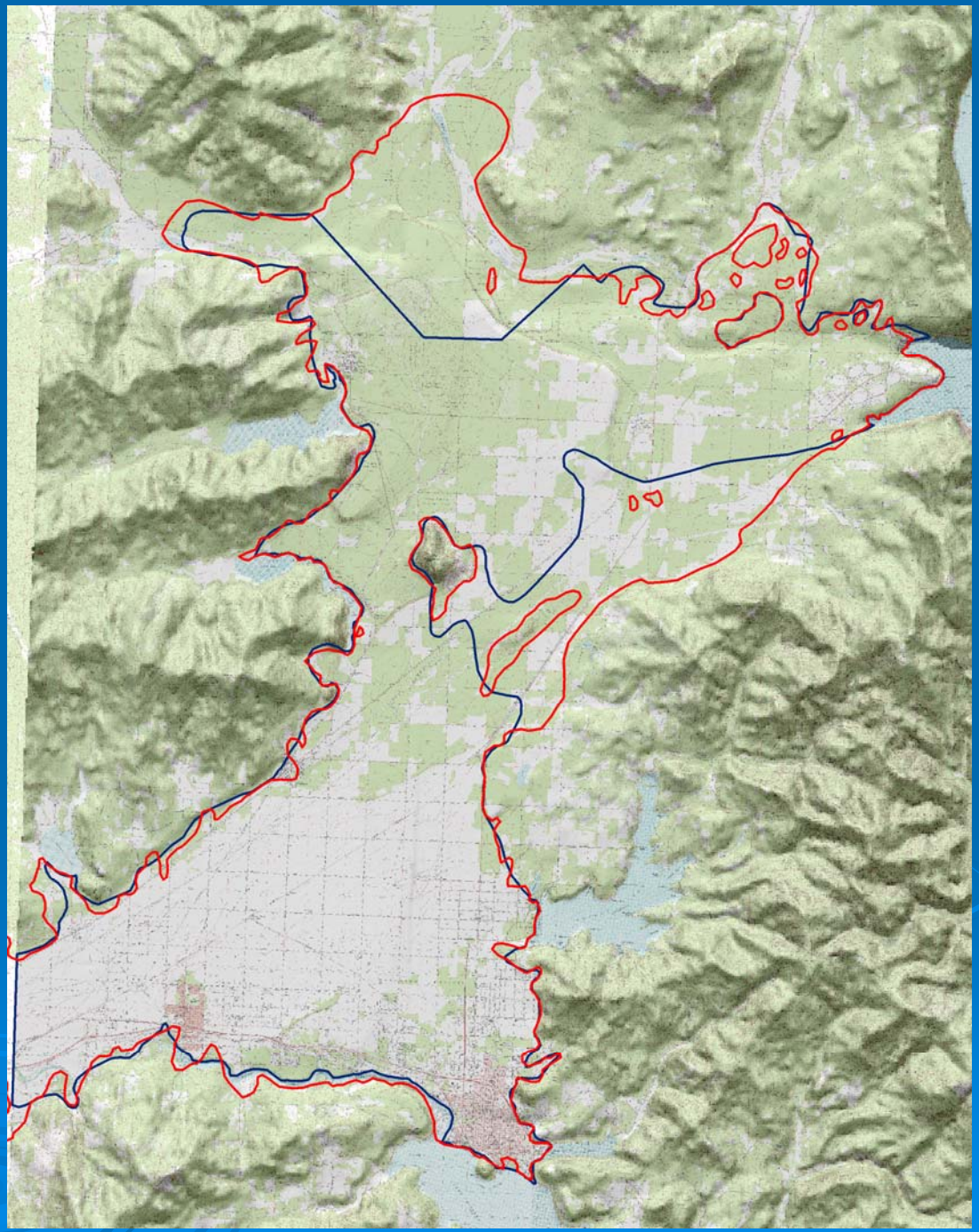
EPA Recharge Zone
1978



EPA Hydrogeologic Boundary 1976-1977

EPA Recharge Zone 1978

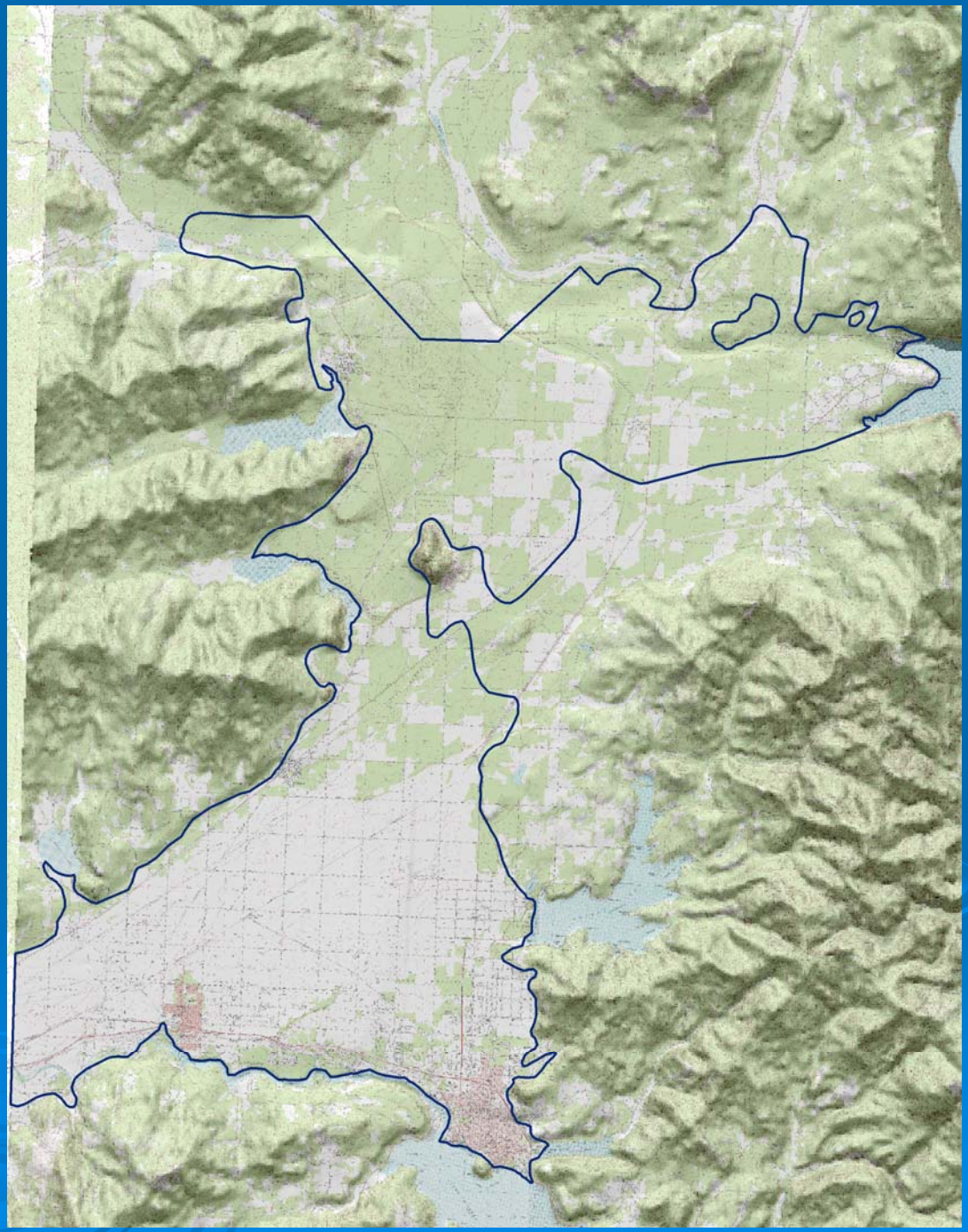
SVRP Study Aquifer Boundary 2007



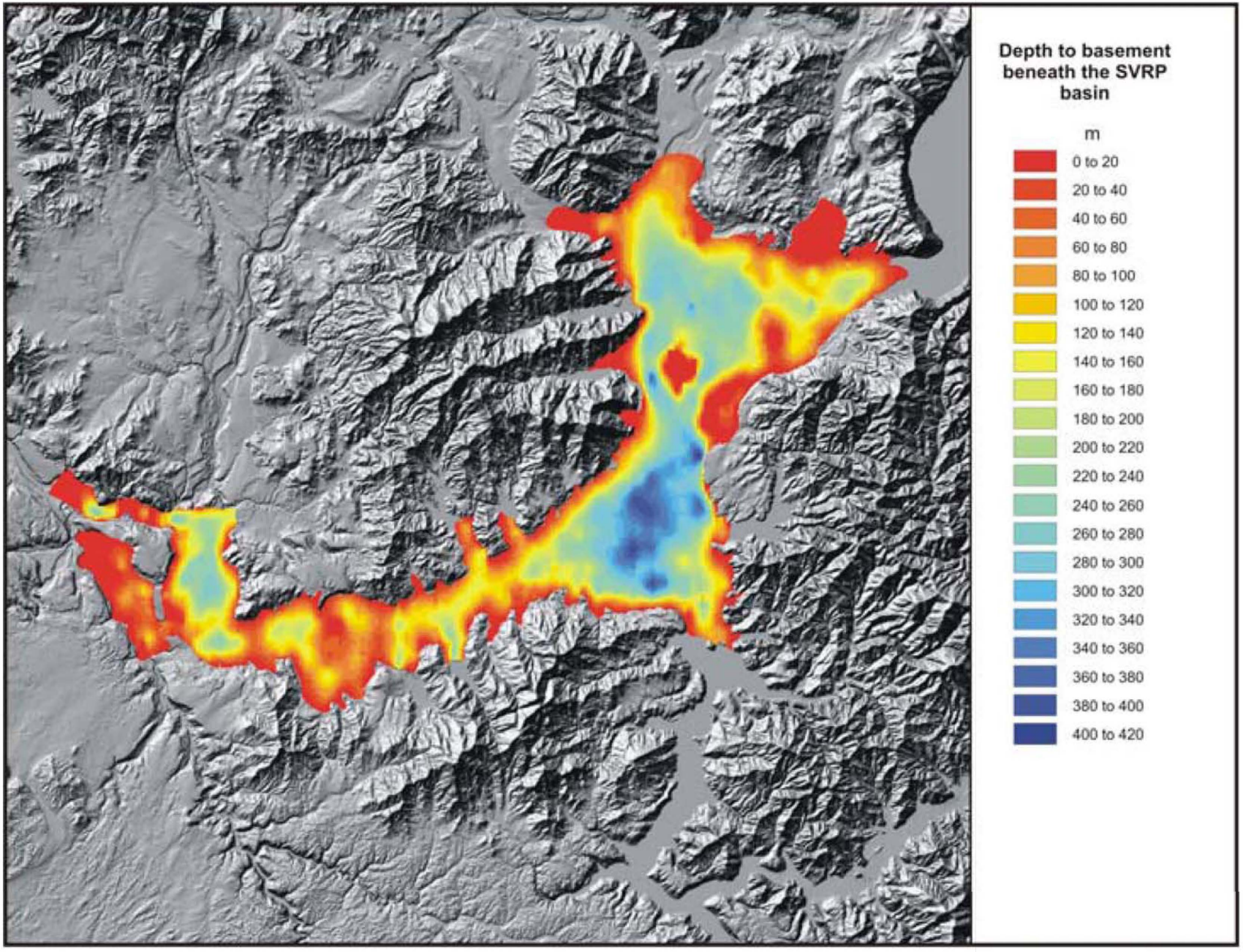
EPA/USGS Hydrogeologic Boundary
1976-1977

Is

Sensitive Resource Aquifer




SENS
ZERO
OFF
DCV
21.6



Reference: Oldow & Sprenke, 2006

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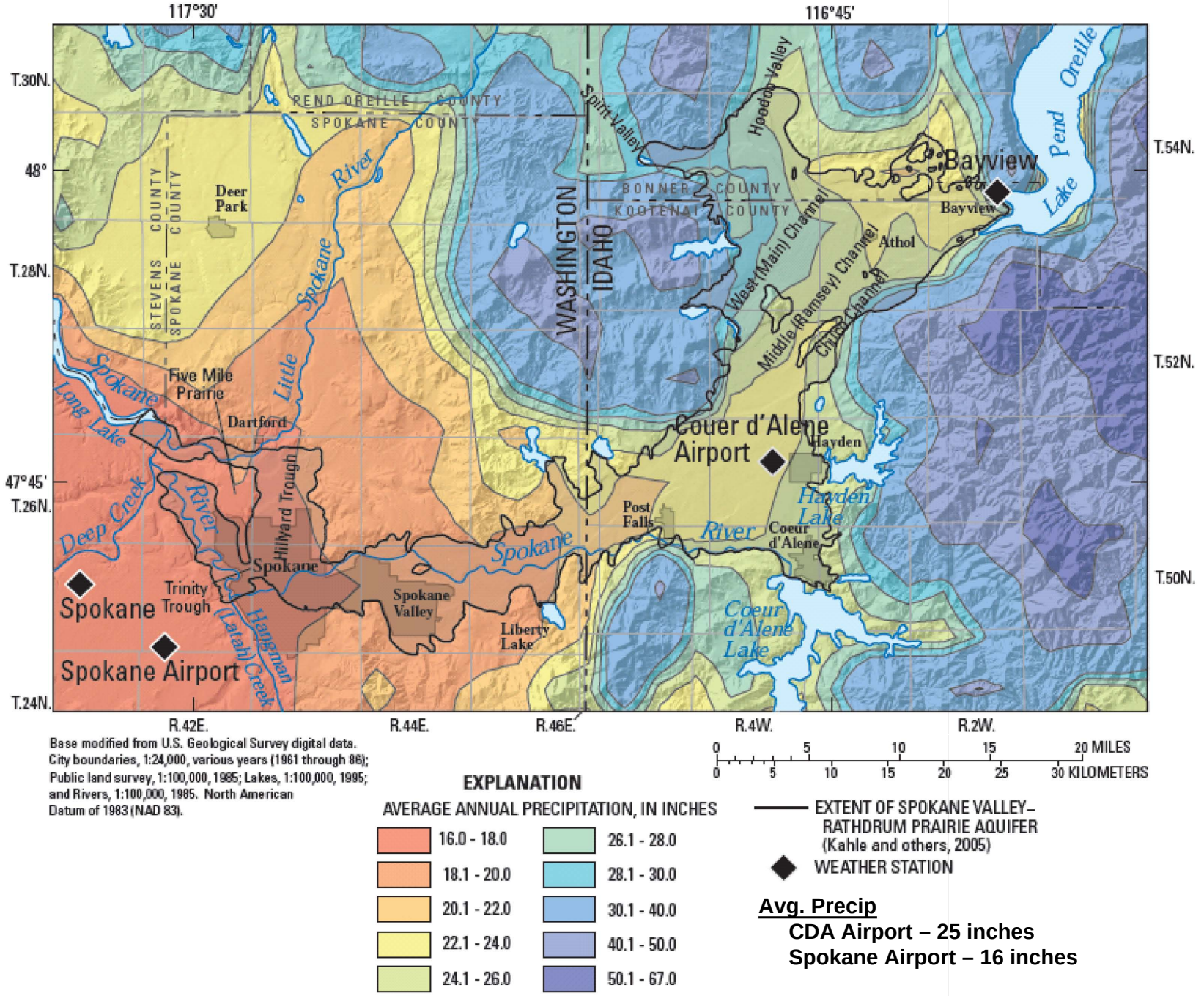


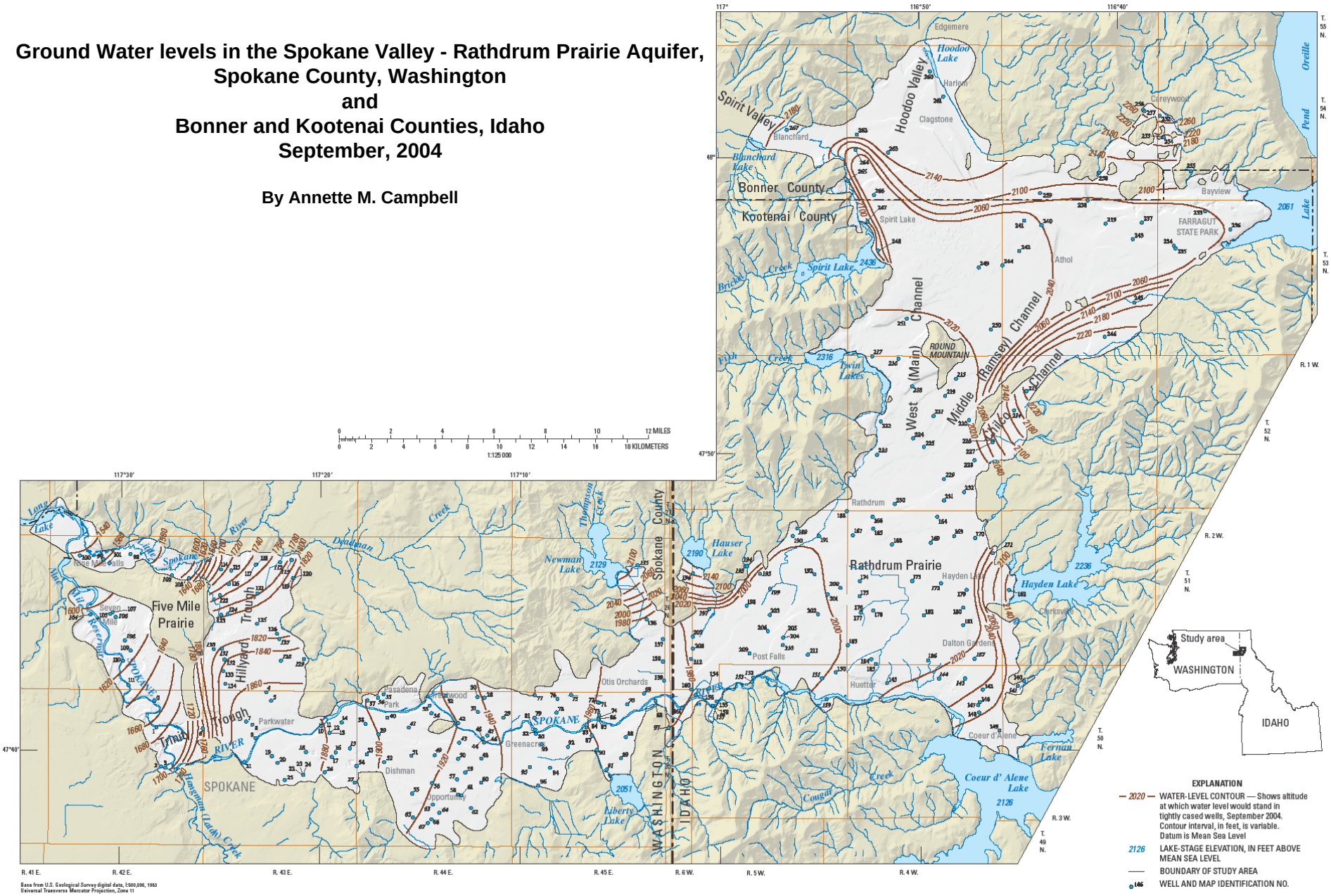
Avg. Precip

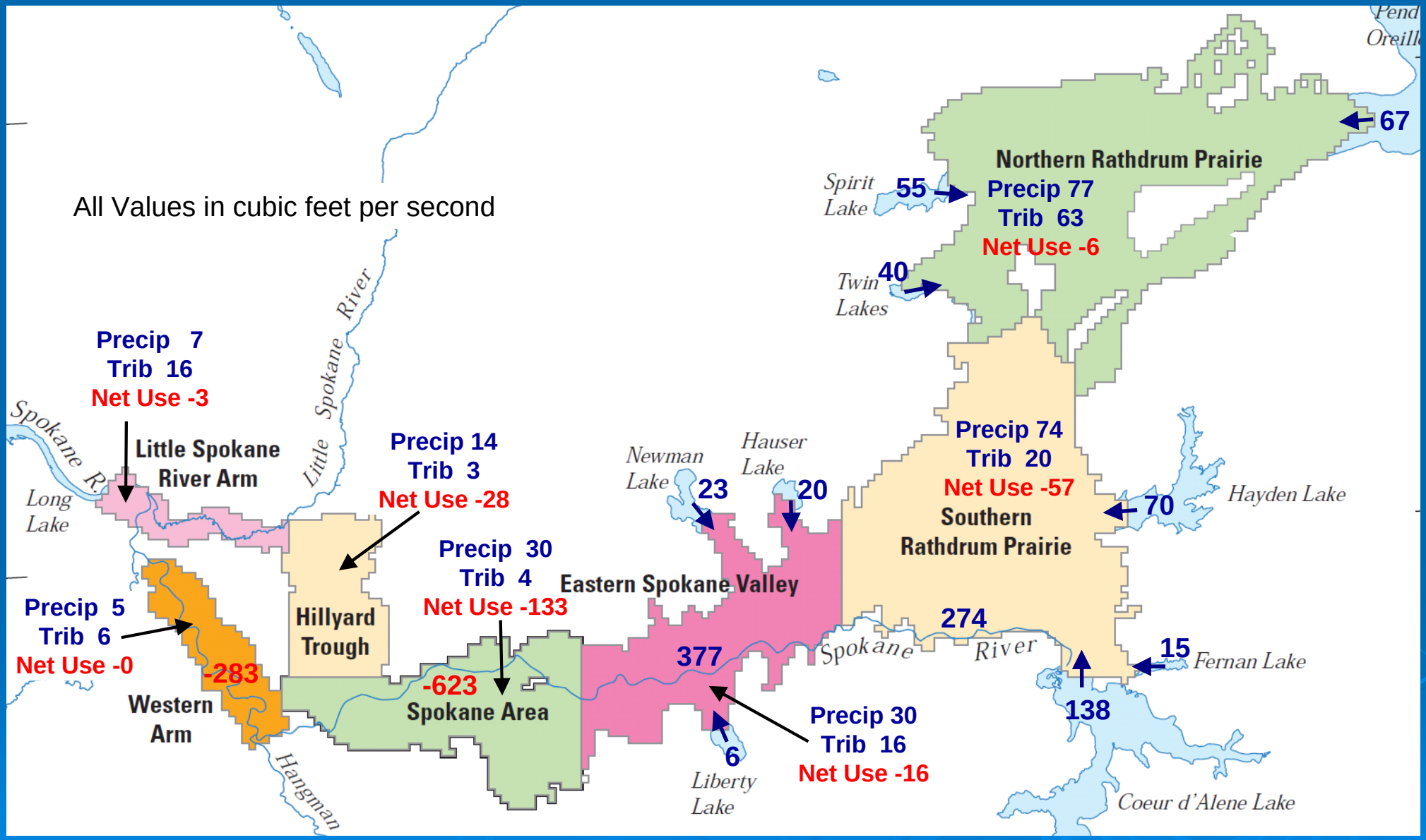
CDA Airport – 25 inches

Spokane Airport – 16 inches

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





Modified from Hsieh et. Al., 2007

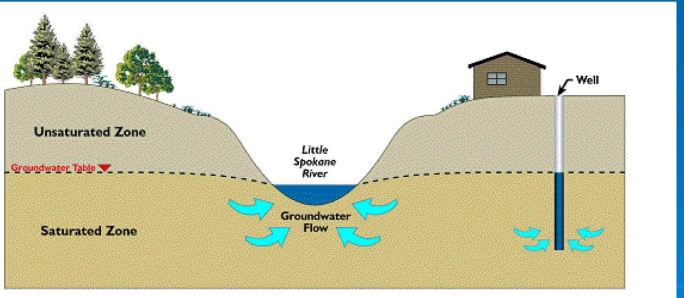
Spokane River
Aquifer-River Interchange

Losing Section

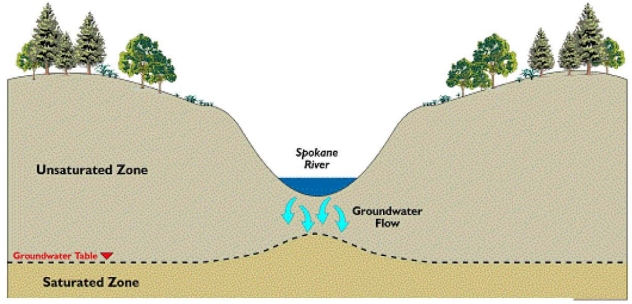
Gaining Section

Transitional Section

Minimal Interaction



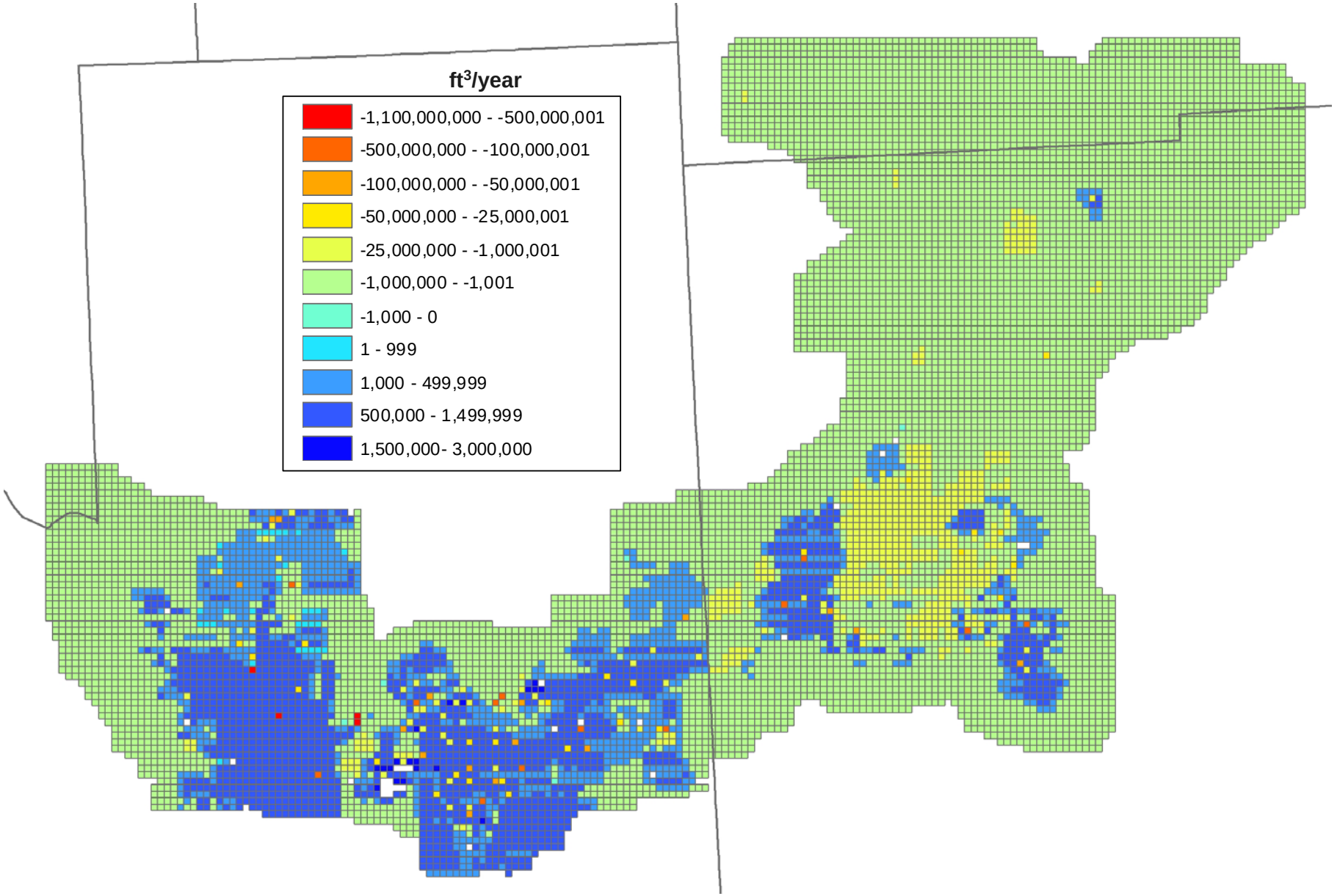
Gaining Section of River



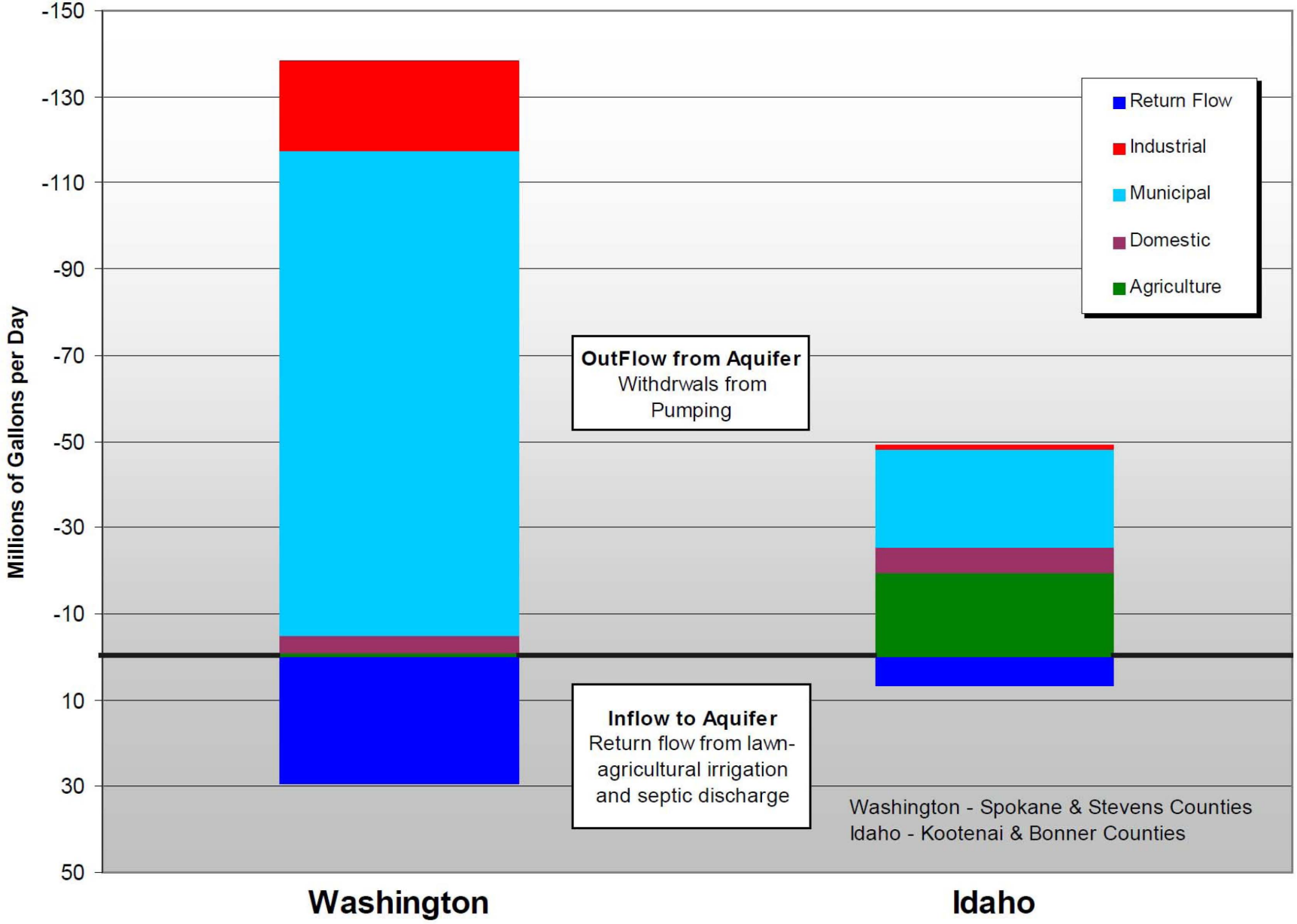
Losing Section of River

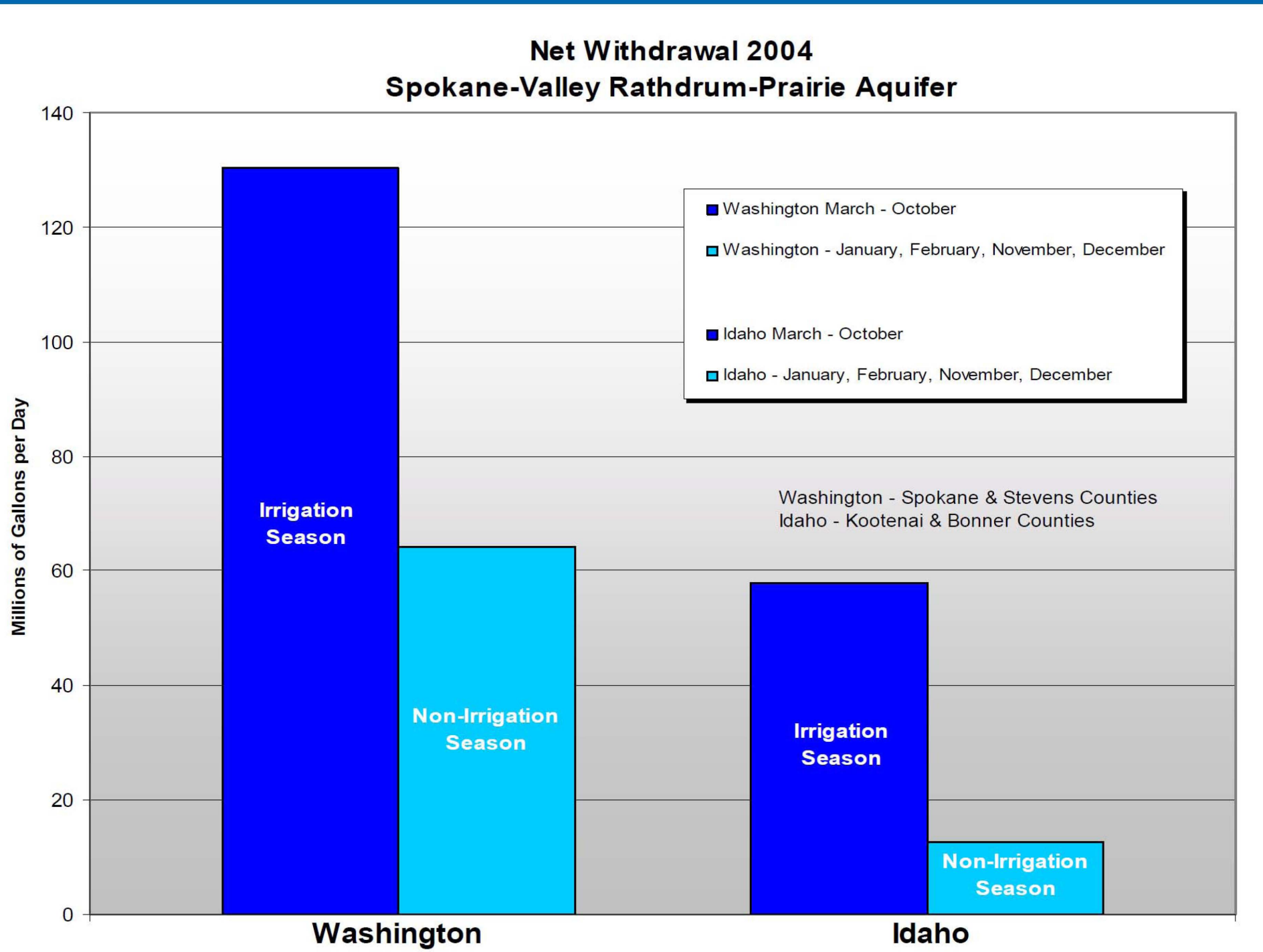
Reference: Spokane Co., 2004

Net Flow per Cell 2004
SVRP Aquifer



Human Water Usage 2004
Spokane-Valley Rathdrum-Prairie Aquifer




Net Withdrawal 2004
Spokane-Valley Rathdrum-Prairie Aquifer
Millions of Gallons per Day
140
120
100
80
60
40
20
0
Washington March - October
Washington - January, February, November, December
Idaho March - October
Idaho - January, February, November, December
Washington - Spokane & Stevens Counties
Idaho - Kootenai & Bonner Counties
Irrigation Season
Non-Irrigation Season
Irrigation Season
Non-Irrigation Season
Washington
Idaho

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

Rathdrum-Prairie Aquifer

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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)

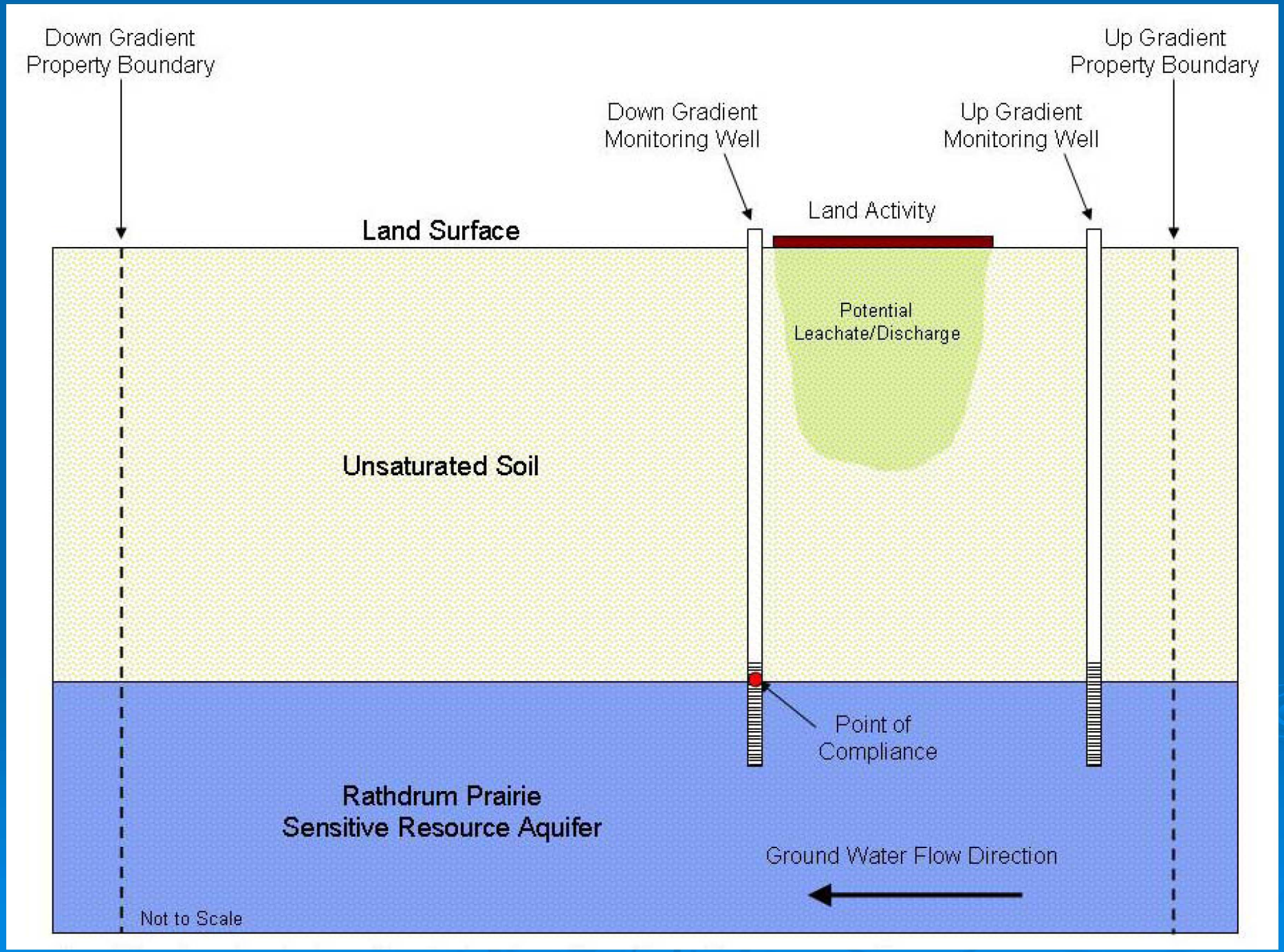
   Alternate method – wastewater reuse such as slow rate irrigation would be an example of method that would be acceptable or connecting to POTW.

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


Down Gradient
Property Boundary
Up Gradient
Property Boundary
Down Gradient
Monitoring Well
Up Gradient
Monitoring Well
Land Activity
Land Surface
Potential
Leachate/Discharge
Unsaturated Soil
Point of
Compliance
Rathdrum Prairie
Sensitive Resource Aquifer
Ground Water Flow Direction
Not to Scale

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 though 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

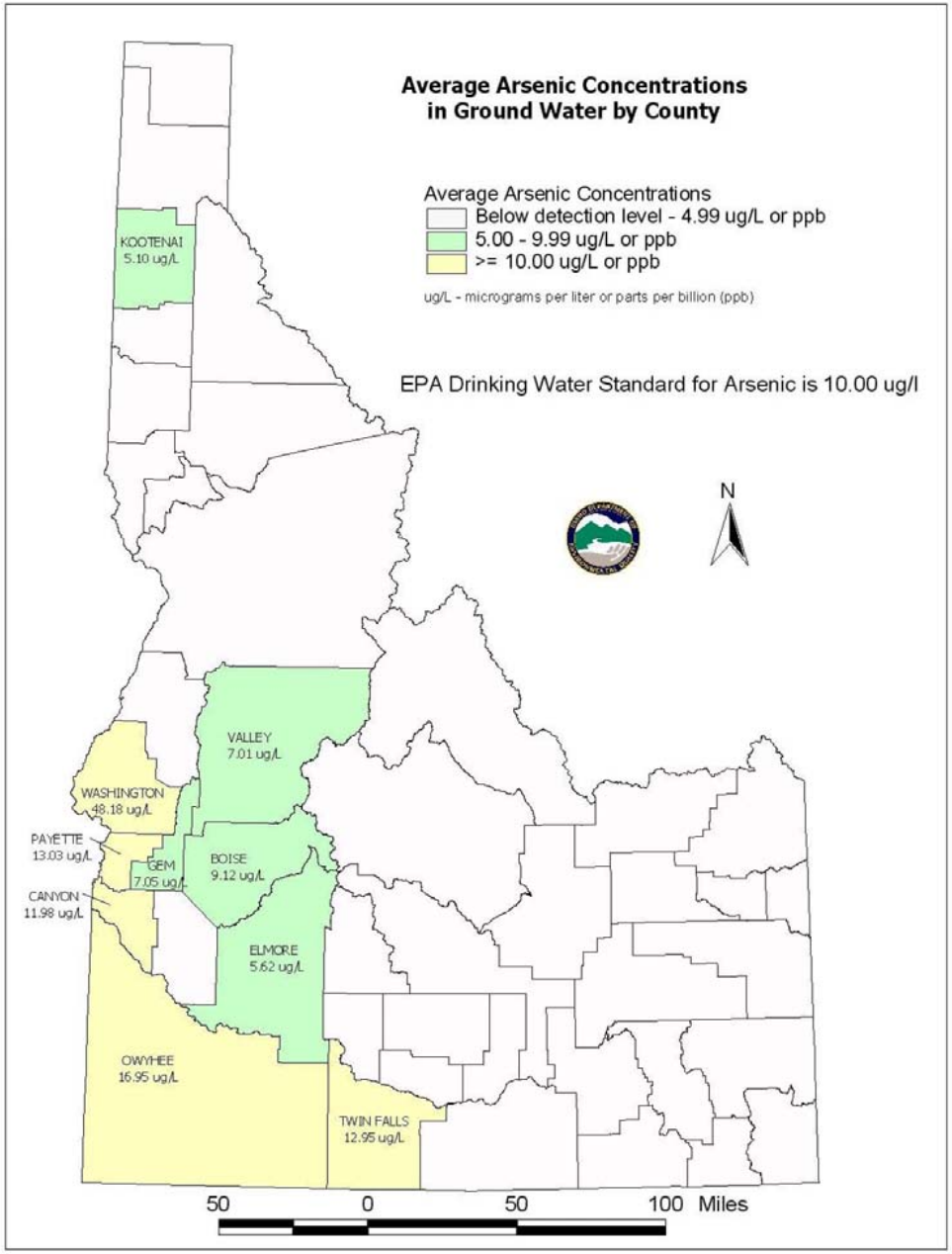
If ground water quality monitoring indicated that recharge activities were causing degradation (i.e. presence of pathogens, chlorination by-products, increased conc. of arsenic, radionuclides or metals)

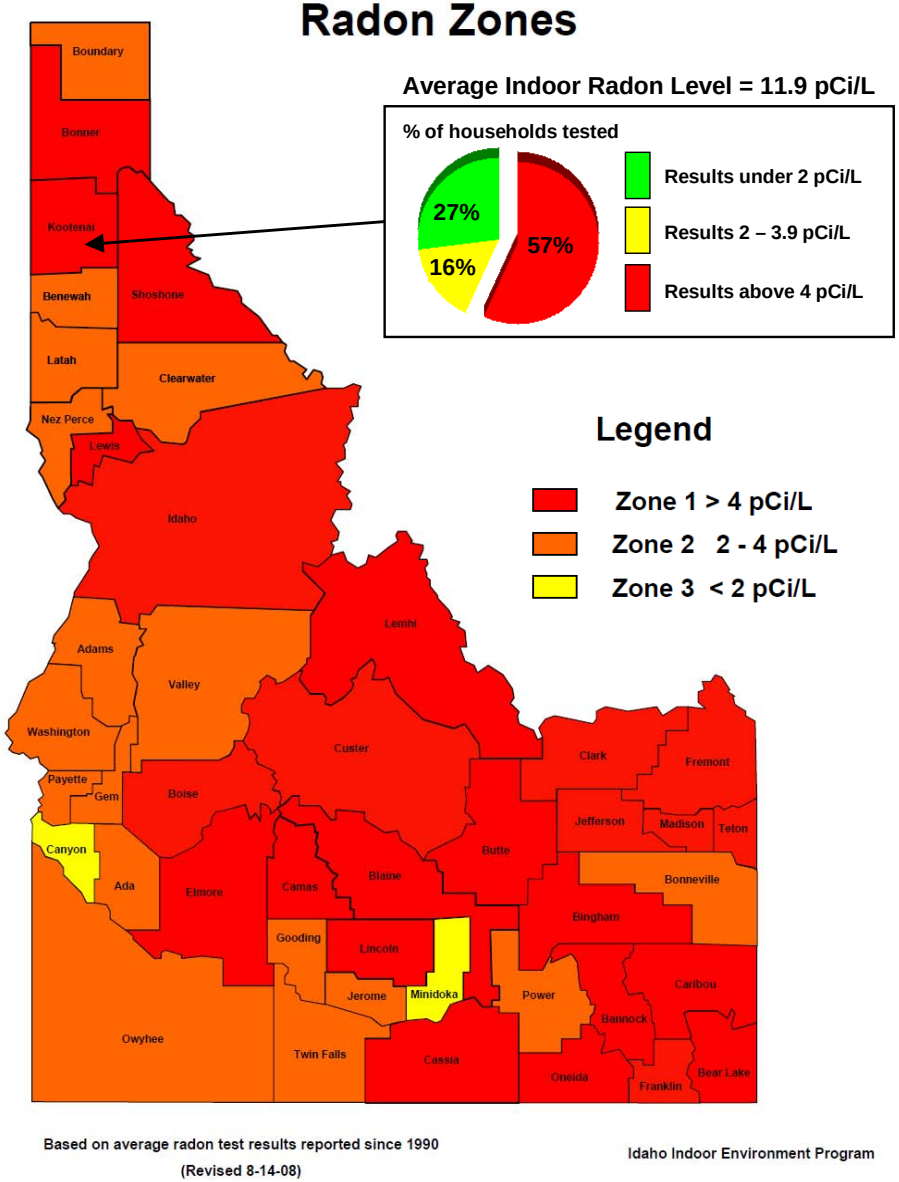
a. Require modification of regulated activities to prevent continued degradation (recharge water treatment i.e. filtration, disinfection, dechlorination, oxygen removal)

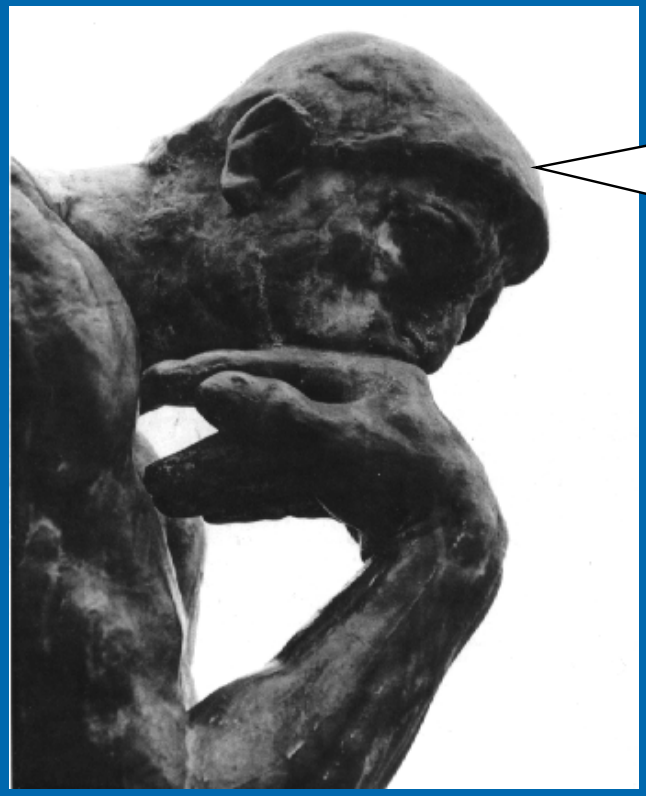
b. DEQ may allow site-specific ground water quality levels or points of compliance, based on consideration of the effects to human health and the environment. Considerations might include;

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







Your Question Here ?

Further Information

www.deq.idaho.gov/rathdrumprairieaquifer

Please call Gary Stevens at (208) 666-4627

Idaho Department of Environmental Quality