



National Groundwater Monitoring  
Network (NGWMN) Data Providers  
Meeting, Las Vegas

December 2016

Kirk Sinclair



DEPARTMENT OF  
**ECOLOGY**  
State of Washington

## Ecology Programs

### ECOLOGY PROGRAMS

- [Air Quality](#)
- [Environmental Assessment](#)
- [Hazardous Waste & Toxics Reduction](#)
- [Nuclear Waste](#)
- [Shorelands & Environmental Assistance](#)
- [Spills](#)
- [Toxics Cleanup](#)
- [Waste 2 Resources](#)
- [Water Quality](#)
- [Water Resources](#)

*Also see [Ecology Services](#)*

Ecology consists of ten major environmental management programs. If you are not familiar with Ecology's statutory authorities and organization, the [Services page](#) may be more helpful.

### Water Quality & Supply



[Water Quality Program](#)

[Water Resources Program](#)

[Shorelands & Environmental Assistance Program](#)

[Office of the Columbia River](#)

[Environmental Assessment Program](#)

### Waste & Toxics



[Waste 2 Resources Program](#)

[Hazardous Waste & Toxics Reduction Program](#)

[Nuclear Waste Program](#)

[Environmental Assessment Program](#)

### Air & Climate



[Air Quality Program](#)

[Climate Change](#)

### Cleanup & Spills



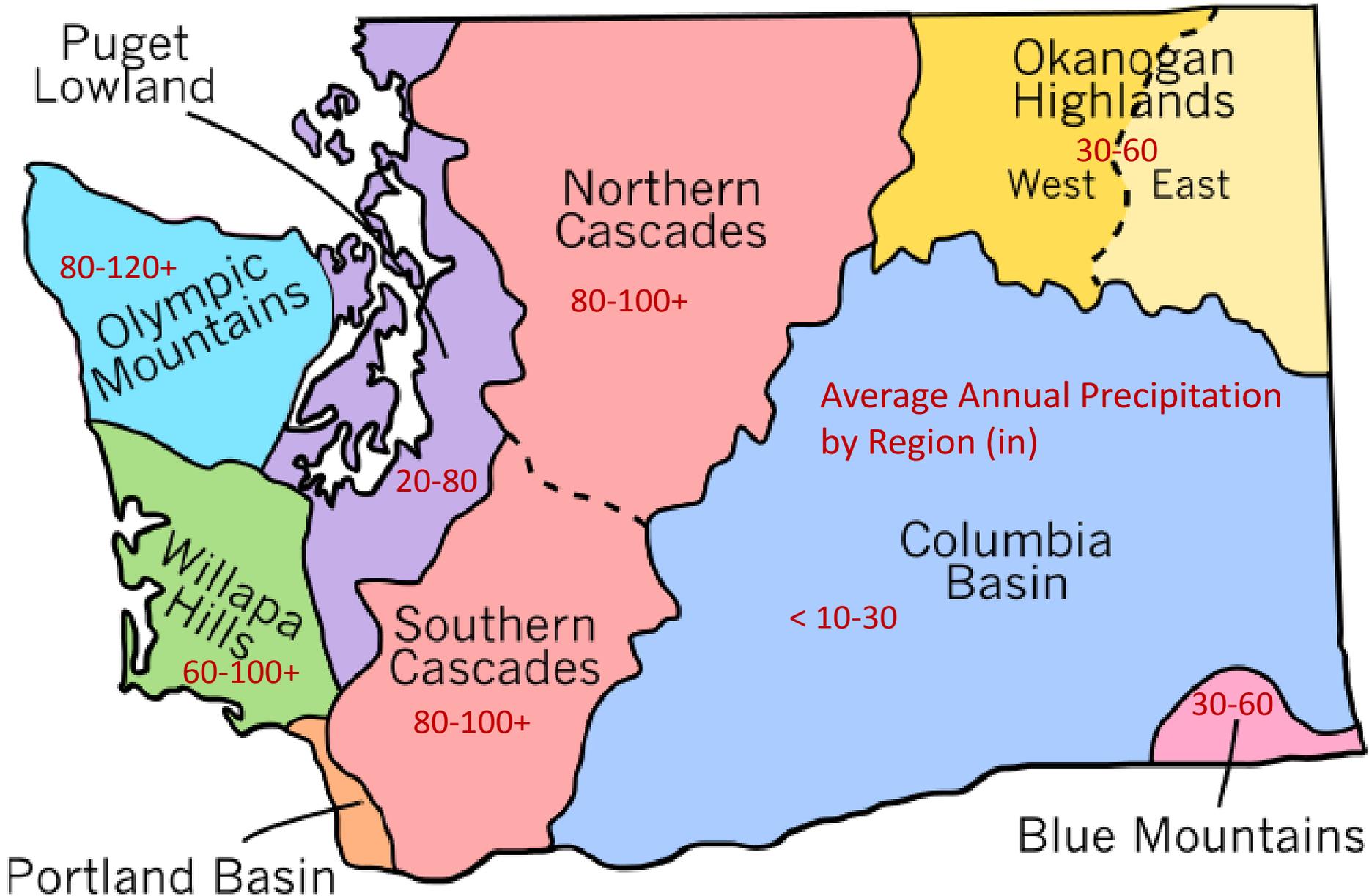
[Toxics Cleanup Program](#)

[Spills Program](#)

[Nuclear Waste Program](#)

Ecology's  
NGWMN  
contributors

# Physiographic regions of Washington





# A Quick Overview of Ecology's Environmental Information Management (EIM) system

Search:

[ALL](#)     [Studies + Locations + Results](#)

[Studies](#)     Example: Study ID AODE6815

[Locations](#)     Example: Nooksack River

[Results](#)     Example: Copper



Search does not include physical habitat data - see Watershed Health below.

## Search Focus Areas within EIM

Focus Areas are specific datasets within EIM. All data below is in EIM Search above, except physical habitat data.

**Groundwater Data Center** Groundwater-specific search and tools for those interested only in groundwater quality and levels. Does not contain other media, except well boring soil data.

[More info](#) [Get Data](#)

**Ecology Monitoring Programs** Data collected by Ecology and affiliates with specific monitoring objectives; usually long-term and regularly-scheduled, using consistent protocols. Each Monitoring Program only contains data from the EIM Studies associated with it.

### Watershed Health

Physical habitat, biological field, and chemistry data; physical and biological metrics. Includes only EIM Studies with habitat data, 2009 to present

[More info](#) [Get Data](#)

### Marine Sediments

Chemistry, bioassay, and benthic invertebrate data measuring Puget Sound sediment quality, 1989 to present

[More info](#) [Get Data](#)

### Freshwater Fish Contaminants

Characterization of toxic chemicals in freshwater fish, 2001 to present

[More info](#) [Get Data](#)

### BEACH Program

Weekly bacteria data from Puget Sound and coastal beaches, Memorial Day through Labor Day, 2004 to present

[More info](#) [Get Data](#)

### River and Stream Water Quality

Monthly water quality monitoring at hundreds of stream stations, 1960s to present

[More info](#) [Get Data](#)

### Persistent, Bioaccumulative Toxics (PBTs)

Assessment of PBTs in environmental media, including mercury in fish and organic PBTs in sediment cores, 2005 to present

[More info](#) [Get Data](#)

EIM Groundwater Search
Environmental Information Management System

Home
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Help
About
Contact EIM

[EIM Groundwater Home](#)

Search Groundwater Data

| Clear

Search by Map

Well

Only wells:  with logs  with tags  with aquifer tests  with completion depth  upgradient of a facility or site

Location ID  Contains ▾  Include aliases

Location Name  Contains ▾

Well Tag ID  Contains ▾

Well Completion Depth between  and  FT ▾

Well Maximum Casing Diameter equals ▾  IN ▾

Groundwater Location Type 

Dewatering Well  
 Geothermal Well  
 Injection Well - Aquifer Storage and Recovery  
 Injection Well - Carbon Sequestration

Well Owner Organization  Contains ▾

Well Owner Last Name  Contains ▾

Location

Field Collection

Parameter

Water Level 

Water level in well (unable to measure)  
 Water level in well (depth below top of well casing)  
 Water level in well (depth below measuring point, daily minimum)  
 Water level in well (depth below measuring point, daily maximum)

Accuracy -Select- ▾

Parameter  Name  Group  CAS Number

Parameter Name  Equals ▾  Include synonyms

Sample Source -Any- ▾ Sample Fraction -Any- ▾

Result Method Code  Equals ▾

Study

Search Groundwater Data

| Clear

Ecology | [EIM Home](#) | [Search Database](#) | [Submit Data](#) | [MyEIM](#) | [Help](#) | [About](#) | [Contact EIM](#)

EIM Database Search 2015 [Data Disclaimer](#) [Privacy Notice](#)

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EIM Database Search Version: 2.0.0.0

# The EIM Groundwater “Module”

DEPARTMENT OF ECOLOGY  
State of Washington

## EIM Groundwater Map Search

Map Layers Legend Tools Find Search Home Share Print Guide Help

Basemap

Current Groundwater Related Content:

- ~22K total wells (mapped at left)
- ~ 9K wells with groundwater levels:
  - ~150K manual WL measurements
  - ~744K transducer measurements
- ~19K wells with WQ data:
  - ~ 4.1 million GW quality results
  - ~ 3 million GW temperature results

Access EIM here:  
<https://fortress.wa.gov/ecy/eimreporting/>

View Data View in EIM Map Download All Zoom to Selection 0 locations selected Filter records:

Search Criteria: collapse results ▼

Find	Location ID	Location Name	Well	Well Log	Chart Hydrograph and Well Data	Associated Facility	Studies	Downloads
No data available in table								

Show 5 entries Showing 0 to 0 of 0 entries First Previous Next Last

# Example query return: wells that have been sampled for parameter group "Nutrients"

**EIM Groundwater Map Search**

Map Layers Legend Tools Find Search

Home Share Print Guide Help

**EIM Search** Environmental Information Management System

Home Data Loader Data Editor Help

**Navigation Options:**

Edit/Show Search Criteria Map All Download All

**Parameter List**

Studies	Locations	Parameters
		Result Parameter
		Result Count
		Time Series Result Count
<input checked="" type="checkbox"/>		Ammonia
<input checked="" type="checkbox"/>		Nitrate
<input checked="" type="checkbox"/>		Nitrite
<input checked="" type="checkbox"/>		Nitrite-Nitrate
<input checked="" type="checkbox"/>		Nitrogen
<input checked="" type="checkbox"/>		Nitrogen compounds, inorganic
<input checked="" type="checkbox"/>		Organic Nitrogen
<input checked="" type="checkbox"/>		Ortho-Phosphate
<input checked="" type="checkbox"/>		Phosphate
<input checked="" type="checkbox"/>		Phosphorus
<input checked="" type="checkbox"/>		Total Kjeldahl Nitrogen
<input checked="" type="checkbox"/>		Total Persulfate Nitrogen
<input checked="" type="checkbox"/>		Total Phosphorus

First Prev Page 1 of 1 (13 Items) Next Last

[EIM Home](#) | [Search Database](#) | [Data Loader](#) | [Data Editor](#) | [Help](#) | [Report Bugs/Suggestions](#)

EIM Database Search 2015 Data Disclaimer Privacy Notice

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EIM Database Search Version: 2.0.0.0

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[View Data](#) [View in EIM Map](#) [Download All](#) [Zoom to Selection](#) **4,439 locations selected**

**Search Criteria:** Only well locations and Result Parameter is in the Parameter Group **Nutrients**

[collapse results](#)

Find	Location ID	Location Name	Well	Well Log	Chart Hydrograph and Well Data	Associated Facility	Studies	Downloads
	<a href="#">001THR</a>	001THR	Y	None	<a href="#">Link</a>	None	<a href="#">Link</a>	<a href="#">Download</a>
	<a href="#">011THR</a>	011THR	Y	<a href="#">link</a>	<a href="#">Link</a>	None	<a href="#">Link</a>	<a href="#">Download</a>
	<a href="#">013THR</a>	013THR	Y	None	<a href="#">Link</a>	None	<a href="#">Link</a>	<a href="#">Download</a>
	<a href="#">014THR</a>	014THR	Y	None	<a href="#">Link</a>	None	<a href="#">Link</a>	<a href="#">Download</a>

Show 5 entries Showing 1 to 5 of 4,439 entries

Filter records:

First Previous 1 2 3 4 5 Next Last

# Ecology's Data Collection Methods .....and Quality Assurance Protocols

Environmental Assessment > Quality Assurance  
**Quality Assurance at Ecology**

The Department of Ecology relies on Quality Assurance (QA) to monitor, improve, and assess its scientific practices, especially those involving generation and assessment of environmental data. Ecology's QA system is based on requirements established by the U.S. Environmental Protection Agency and incorporates guidance and methodology from many standards-setting organizations worldwide.

Ecology uses established QA principles to plan, execute and assess all of its data-generation projects. Additionally, QA planning is often required for businesses or agencies submitting data to Ecology.

**Standard Operating Procedures (SOPs) for sampling, auditing, and field methodology**  
**Environmental Assessment Program**

General EAP SOPs

- [EAP070 - Minimizing the Spread of Aquatic Invasive Species](#)

Ambient Freshwater Biological and Water Quality Monitoring SOPs

- [EAP011 - Instantaneous Measurement of Temperature in Water](#)
- [EAP023 - Collection and Analysis of Dissolved Oxygen \(Winkler Method\)](#)
- [EAP029 - Metals Sampling](#)
- [EAP030 - Fecal Coliform Sampling](#)
- [EAP031 - Collection and Analysis of pH Samples](#)
- [EAP032 - Collection and Analysis of Conductivity Samples](#)
- [EAP034 - Collection, Processing, and Analysis of Stream Samples](#)
- [EAP072 - Basic Use and Maintenance of WaterLOG @ Data Loggers and Peripheral Equipment](#)
- [EAP073 - Collecting Freshwater Benthic Macroinvertebrate Data in Wadeable Streams and Rivers](#)
- [EAP080 - Continuous Temperature Monitoring of Fresh Water Rivers and Streams](#)

Ambient River and Stream Flow Monitoring SOPs

- [EAP042 - Measuring Gage Height of Streams](#)
- [EAP055 - Operation of Teledyne Instruments Stream-Pro Acoustic Doppler Current Profiler](#)
- [EAP056 - Measuring and Calculating Stream Discharge](#)
- [EAP057 - Conducting Stream Hydrology Site Visits](#)
- [EAP058 - Operating SonTek® FlowTracker® Handheld Acoustic Doppler Velocimeter \(FlowTracker\)](#)
- [EAP059 - Operating Mechanical Velocity Indicators](#)
- [EAP060 - Measuring Stream Discharge from a Bridge](#)
- [EAP072 - Basic use and maintenance of Design Analysis® Data Loggers and Peripheral Equipment](#)
- [EAP082 - Correction of Continuous Stage Records Subject to Instrument Drift, Analysis of Instrument Drift, and Calculation of Potential Error](#)

Forest Practices Effectiveness Monitoring SOPs

- [EAP016 - Freshwater Drift Collection, Processing and Analysis](#)
- [EAP017 - Litterfall Collection, Processing, and Analysis](#)
- [EAP018 - Turbidity Threshold Sampling](#)
- [EAP019 - Estimating Streamflows Using a Flume](#)
- [EAP045 - Hemispherical Digital Photography Field Surveys Collected as part of a Temperature Total Maximum Daily Load \(TMDL\) or Forests and Fish Unit Technical Study](#)
- [EAP046 - Computer Analysis of Hemispherical Digital Images Collected as part of a Temperature Total Maximum Daily Load \(TMDL\) or Forests and Fish Unit Technical Study](#)
- [EAP064 - Determining Canopy Closure using a Concave Spherical Densimeter - Model C](#)
- [EAP069 - Whole Stream Metabolism Survey Using a Non-Toxic Gas and Conservative Dye Tracer](#)
- [EAP083 - Collection and Processing of Samples for Stable Isotope Analysis](#)

Groundwater Monitoring SOPs

- [EAP052 - Manual Well Depth and Depth-to-Water Measurements](#)
- [EAP061 - Installing, Monitoring, and Decommissioning Hand-driven In-water Piezometers](#)
- [EAP074 - Use of Submersible Pressure Transducers during Groundwater Studies](#)
- [EAP077 - Purging and Sampling Water Supply Wells](#)
- [EAP078 - Purging and Sampling Monitoring Wells](#)
- [EAP081 - Procedures for Tagging Wells](#)
- [EAP086 - Purging and Sampling Water Supply Wells for General Chemistry Parameters](#)
- [EAP098 - Collecting Groundwater Samples for Metals Analysis from Water Supply Wells](#)
- [EAP099 - Purging and Sampling Monitoring Wells for General Chemistry Parameters](#)
- [EAP100 - Collecting Groundwater Samples for Metals Analysis from Monitoring Wells](#)

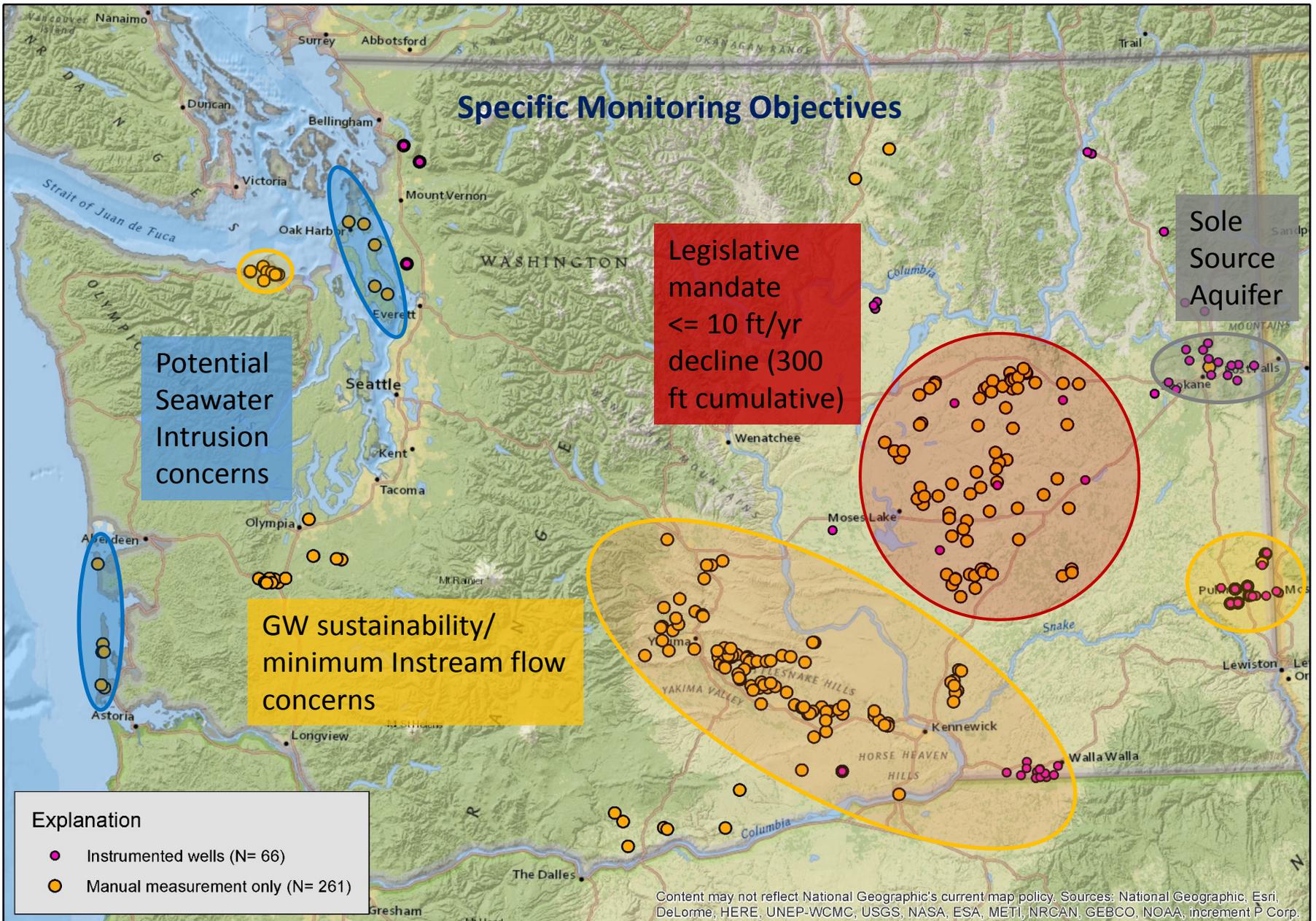
Marine Monitoring SOPs

- [EAP025 - Seawater Sampling](#)

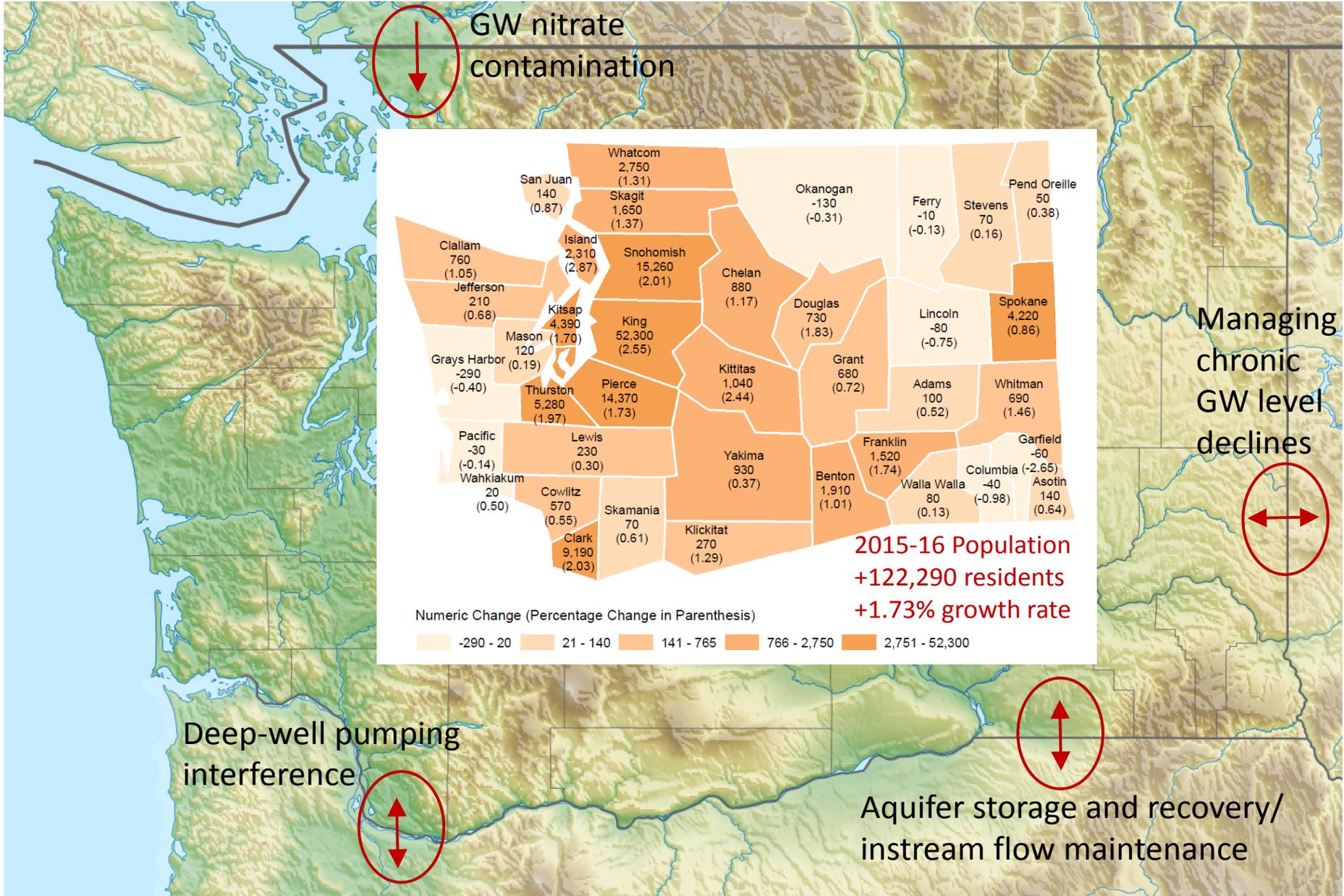
## Study Basics

Study ID	CHPI001
Study Name	Moses Lake TMDL Groundwater Study
EIM Data Entry Review Status	<b>Reviewed</b>
Study Type	Total Maximum Daily Load (TMDL) development
Study Purpose	To investigate the nutrient content of the groundwater inflow to Moses Lake in support of the Moses Lake Phosphorus TMDL study
Field Collection Date Range	5/8/2001 - 10/3/2001
First/Last Loaded Date Range (First/Last updated)	date not available (3/26/2003) - date not available (5/24/2013)
Ecology Contact	Charles Pitz
Ecology Program or Other Responsible Entity	Ecy Environmental Assessment Program
Ecology Monitoring Program	
Submitting Organization	
Study QA Planning Level	LEVEL 4: Approved QAPP or SAP.
Study QA Project Plan Description	There is an approved Quality Assurance Project Plan QAPP available for review that describes the procedures used for this study.
Study QA Assessment Level	Level 5 - Data Verified and Assessed for Usability in a Peer-Reviewed Study Report
Study Result Description	
Study Comment	
Ecology Funding Number	
Ecology Facility/Site ID	
Ecology Cleanup Site ID	
Study ID Aliases (Alias Type)	
Study Security (User Name / Access Level)	CHPI461 / Update
▼ Study Publications	
	<a href="#">Quality Assurance Project Plan: Characterization of the Groundwater Discharge to Moses Lake, Washington</a>
	<a href="#">Moses Lake Total Maximum Daily Load Groundwater Study</a>

# Location of Wells Currently Monitored by Ecology as of April 2015



# Additional Transboundary Water Management Challenges



# Recent Example of data use

## Washington Groundwater Level Status and Trends - Spring 2016

A story map [f](#) [t](#) [s](#)

Introduction

2015-16 Climate Summary

Spring 2016 Groundwater Level Status

Spring 2015 / 2016 Groundwater Level Comparison

WA Groundwater Level Trends

☰

✎ EDIT

+ ADD

☰ ORGANIZE



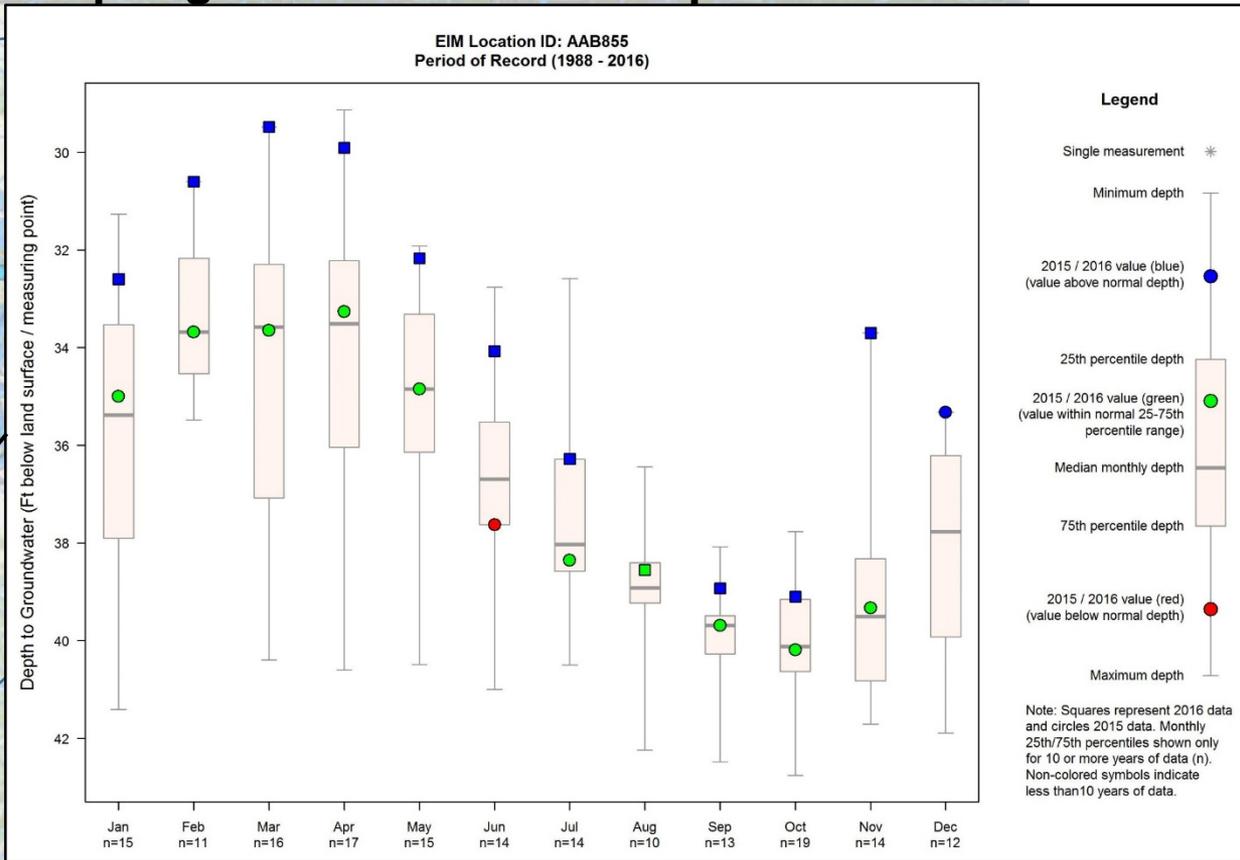
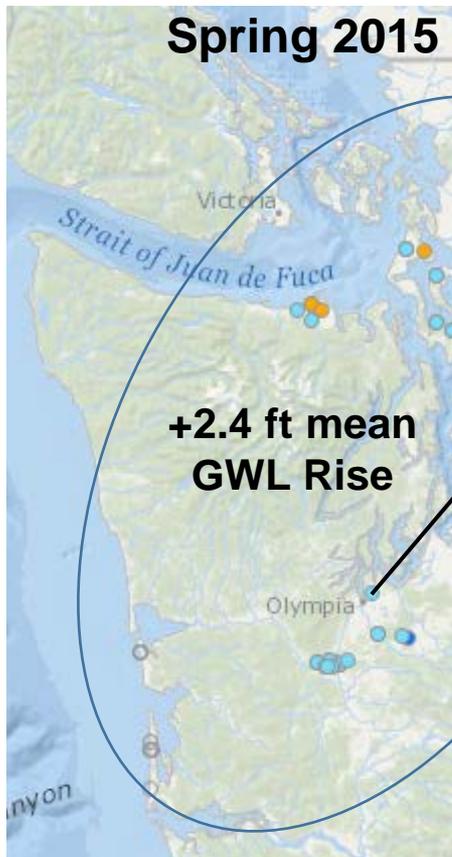
### Groundwater Monitoring and Management in Washington

The Washington State Department of Ecology (Ecology) has primary responsibility for managing Washington's water resources. In this role, Ecology conducts a variety of environmental monitoring activities to obtain the data and information needed to support agency water management decisions and long-term planning.

As part of this data collection effort, [Ecology's Water Resources Program](#) maintains groundwater level monitoring networks in each of the agency's four regions. Information from these networks are compiled annually by Ecology to assess both the status (i.e. current year conditions) and longer-term groundwater level/storage trends in State aquifers. This story map summarizes the results of the most recent evaluation which was conducted in Spring 2016.



# Spring 2015 to Spring 2016 GW Level Comparison



## Western WA Summary:

43 wells monitored

- 39 were above 2015 level
- 4 were below 2015 level

WL differences averaged +2.4 feet overall and ranged from -2.25 to +12.5 feet in individual wells

## Spring 2016 groundwater level relative to spring 2015

- Much above 2015 level (> +10 ft) N=9
- Above 2015 level (+0.01 to +9.99 ft) N=69
- Below 2015 level (-0.01 to -9.99 ft) N=60
- Much below 2015 level (> -10 ft) N=19
- Same as 2015 level (N=1)
- Missing 2015 measurement (N=54)

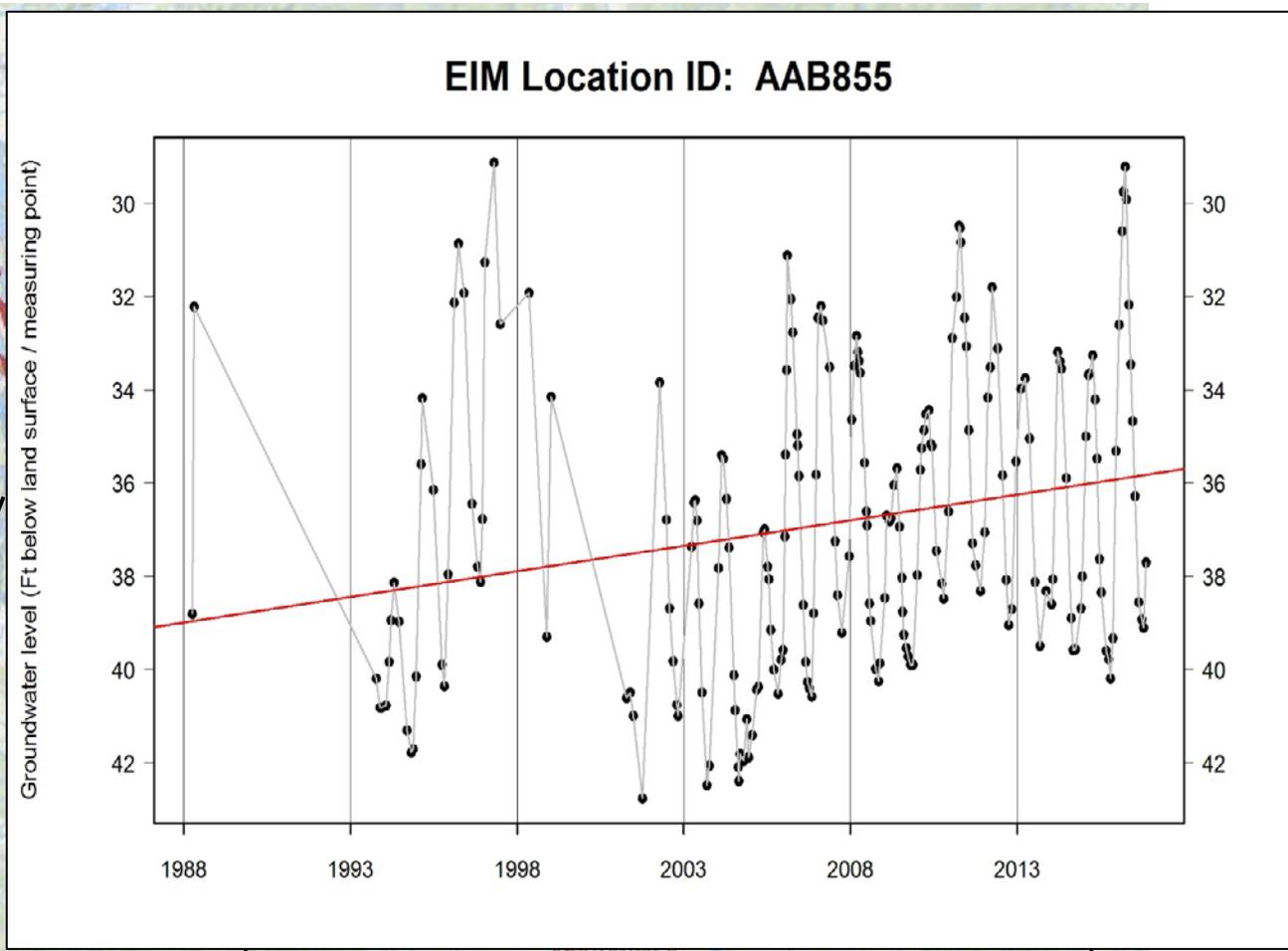
## Eastern WA Summary:

115 wells monitored

- 39 were above 2015 level
- 75 were below 2015 level
- 1 same as 2015 level

WL differences averaged -1.43 feet overall and ranged from -28.4 to +58.9 feet in individual wells

# Period of Record Groundwater Level Trends for Ecology Monitored Wells - Spring 2016



## Washington Groundwater Level Trends

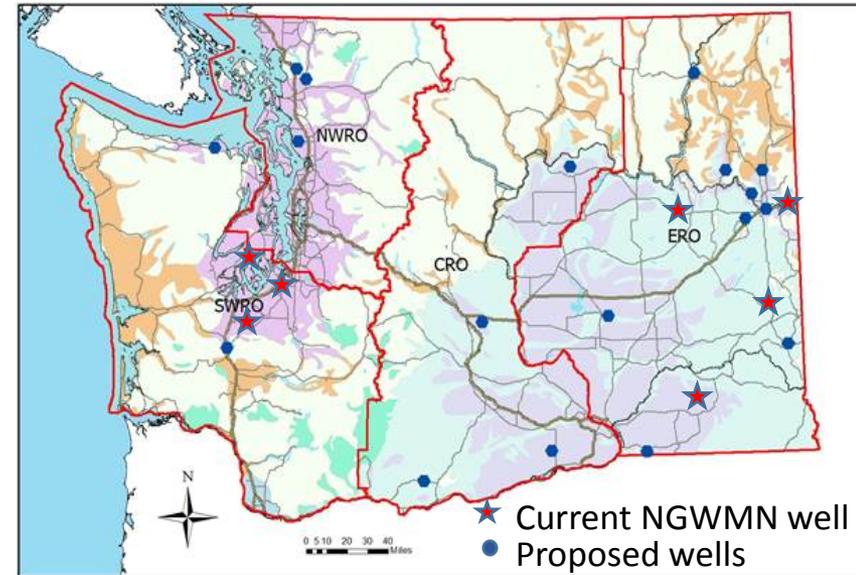
- ▼ Downward trend (N=138)
- ▲ Upward trend (N=62)
- No trend (N=10)
- Insufficient data (N=2)

\* Burns, E.R, Snyder, D.T, Haynes, J.V., and Waibel, M.S., 2012, Groundwater status and trends for the Columbia Plateau Regional Aquifer System, Washington, Oregon, and Idaho: U.S. Geological Survey Scientific Investigations Report 2012-5261, 52 p., <http://pubs.er.usgs.gov/publication/sir20125261>.

# Planned Activities for Year 1 of Washington's NGWMN Grant (Oct 2016 - Sept 2017)

## 1) Begin Populating Well Registry (24 wells proposed by June 2017)

NGWMN element	EIM equivalent
<b>Required data for all sites</b>	
Name of Agency that collects data (R)	NA (Field collector at result level in EIM)
Site Number (R, C, wL, wQ, L) - Database key	Well Tag ID? or Location ID?
Site Name (R)	Location Name? or Location ID?
Country (R)	none
State (R)	State
County (R)	County
Latitude (decimal degrees) (R)	Latitude Decimal Degrees
Longitude (decimal degrees) (R)	Longitude Decimal Degrees
Horizontal Datum (R)	Horizontal Datum
Horizontal Location method (R)	Horizontal Coordinate Collection Method
Horizontal Location Accuracy (R)	Horizontal Coordinate Accuracy
National Aquifer Code (R)	none
Local Aquifer Code (R)	none
Type of site; Well/Spring (R)	Groundwater Location Type
Confinement Status; Confined/unconfined (R)	none
<b>Lithology (L)</b>	
Lithology ID (L)	none
Description of Lithology of the unit (L)	none
Observation Method (L)	none
Beginning depth of lithologic unit (L)	none
Ending depth of lithologic unit (L)	none
<b>Well Construction Information</b>	
Land Surface Altitude (R)	Elevation of, and Elevation
Vertical Datum (R)	Elevation Datum
Well Depth (R)	Well Completion Depth
Well Depth Units (R)	Well Completion Depth Units
Top depth of Screen interval (C)	Well Open Interval Upper Depth
Bottom depth of Screen interval (C)	Well Open Interval Lower Depth
Depth of Screen interval unit of measure (C)	Well Open Interval Units
Screen interval material (C)	none
Top depth of Casing interval (C)	none
Bottom depth of Casing interval (C)	none
Depth of Casing interval unit of measure (C)	none
Casing interval material (C)	Well Casing Material
<b>Required data for Water-level Sites</b>	
Land surface altitude with Metadata (R)	Elevation of, and Elevation
Altitude Units (R)	Elevation Units
Altitude Accuracy (R)	Elevation Accuracy
Method of altitude measurement (R)	Elevation Collection Method
Date/Time/Time Zone of water-level measurement (wL)	Field collection start date / field collection start time / NA
Depth to Water (wL)	Result value
Water-level units (wL)	Result value units
Method of water-level measurement (wL)	Result method
Accuracy of water-level measurement (wL)	Water level accuracy
<b>Required data for Water-Quality Sites</b>	
o Date/Time/Time Zone of sample (wQ)	Field collection start date / field collection start time / NA
o Analyte Name (wQ)	Result Parameter Name
o Analyte value (wQ)	Result value
o Parameter unit (wQ)	Result value units
o Sample Fraction (wQ)	Fraction analyzed
o Chemical Identification Number (wQ)	Result parameter CAS number????
o Chemical Classification System (wQ)	Result parameter CAS number????
o Method (wQ)	Result method???
o Analytical Method System (wQ)	?????



## 2) Develop web services to supply water levels to the NGWMN (June 2017)

## Planned Activities for Grant Year 2 (Oct 2017 - Sep 2018):

NGWMN element	EIM equivalent
<b>Required data for all sites</b>	
Name of Agency that collects data (R)	NA (Field collector at result level in EIM)
Site Number (R, C, W/L, W/Q, L) - Database key	Well Tag ID? or Location ID?
Site Name (R)	Location Name? or Location ID?
Country (R)	none
State (R)	State
County (R)	County
Latitude (decimal degrees) (R)	Latitude Decimal Degrees
Longitude (decimal degrees) (R)	Longitude Decimal Degrees
Horizontal Datum (R)	Horizontal Datum
Horizontal Location method (R)	Horizontal Coordinate Collection Method
Horizontal Location Accuracy (R)	Horizontal Coordinate Accuracy
National Aquifer Code (R)	none
Local Aquifer Code (R)	none
Type of site; Well/Spring (R)	Groundwater Location Type
Confinement Status; Confined/unconfined (R)	none
<b>Lithology (L)</b>	
Lithology ID (L)	none
Description of Lithology of the unit (L)	none
Observation Method (L)	none
Beginning depth of lithologic unit (L)	none
Ending depth of lithologic unit (L)	none
<b>Well Construction Information</b>	
Land Surface Altitude (R)	Elevation of, and Elevation
Vertical Datum (R)	Elevation Datum
Well Depth (R)	Well Completion Depth
Well Depth Units (R)	Well Completion Depth Units
Top depth of Screen interval (C)	Well Open Interval Upper Depth
Bottom depth of Screen interval (C)	Well Open Interval Lower Depth
Depth of Screen interval unit of measure (C)	Well Open Interval Units
Screen interval material (C)	none
Top depth of Casing interval (C)	none
Bottom depth of Casing interval (C)	none
Depth of Casing interval unit of measure (C)	none
Casing interval material (C)	Well Casing Material
<b>Required data for Water-level Sites</b>	
Land surface altitude with Metadata (R)	Elevation of, and Elevation
Altitude Units (R)	Elevation Units
Altitude Accuracy (R)	Elevation Accuracy
Method of altitude measurement (R)	Elevation Collection Method
Date/Time/Time Zone of water-level measurement (W/L)	Field collection start date / field collection start time / NA
Depth to water (W/L)	Result value
Water-level units (W/L)	Result value units
Method of water-level measurement (W/L)	Result method
Accuracy of water-level measurement (W/L)	Water level accuracy
<b>Required data for Water-Quality Sites</b>	
o Date/Time/Time Zone of sample (W/Q)	Field collection start date / field collection start time / NA
o Analyte Name (W/Q)	Result Parameter Name
o Analyte value (W/Q)	Result value
o Parameter unit (W/Q)	Result value units
o Sample Fraction (W/Q)	Fraction analyzed
o Chemical Identification Number (W/Q)	Result parameter CAS number????
o Chemical Classification System (W/Q)	Result parameter CAS number????
o Method (W/Q)	Result method???
o Analytical Method System (W/Q)	????

- Provide continued support for water level web services/enhancements
- Develop web services for well construction and lithology data
- Continue ongoing work to migrate our backlog of transducer results to EIM and NGWNM
- Add additional wells to NGWMN as time and funding allow

Thank You!



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