October 2025

STUDY UPDATES NEWSLETTER

Hydraulic Properties of the Walla Walla River Basin Aquifer System

This Newsletter Highlights a New Study Report (OFR 2024-01)

Why This Report Matters?

With continued research, collaboration, and careful planning, the basin can move toward a sustainable groundwater future that supports both people and the environment.

Since 2019, the Oregon Water Resources Department (OWRD), the Washington Department of Ecology (Ecology), and the U.S. Geological Survey have analyzed data from more than 650 wells and many pumping tests. The data are being organized into a series of reports which will be released between 2024 and late 2026. These reports fill data gaps and give a clearer picture of how our communities' aquifer system works. As our communities' water demand continues, filling data gaps and applying adaptive management will be essential.

The Walla Walla River Basin, stretching across northeastern Oregon and southeastern Washington, has rich agriculture and communities. For decades, farms, cities, and rural homes have depended on groundwater to irrigate crops, provide drinking water, and support growing industries such as wineries. In recent years, however, the basin is facing water supply challenges. Groundwater levels in many parts of the basin are declining, and questions remain about how to manage the water resources. The Walla Walla River Basin Study and its study reports will be an important tool for future basin wide planning.

Photo: Irrigated apple orchards the Walla Walla River Basin.

This newsletter is based on newly released Open-File Report 2024-01 (OFR 2024-01), which is part of a multi-year study providing one of the most detailed looks ever at groundwater in the Walla Walla River Basin.

Find out more information: *https://owrd.info/WWHydraulicProperties*

2019

The study fills important information gaps to help us plan for our water futures through a series of reports.

Since early 2019, the study has been collecting data and is currently in the process of organizing information into a series of reports that will be released between 2024 and late 2026.

2024

Walla Walla River Basin Study Report Release Timeline

2025

"Hydraulic properties of stratigraphic units and geologic structures in the Walla Walla River Basin, Oregon and Washington"

Estimate how fast or slow water moves through local rock types and explain how geological features like faults separate or connect groups of basalt wells.

"Analysis of conveyance losses across the Walla Walla River Floodplain, Oregon"

Measure how much water the Little Walla Walla River and nearby irrigation canals contribute to the basin-fill groundwater system.

"Stream seepage analysis to quantify stream and groundwater interactions within the Walla Walla River Basin, Oregon and Washington"

Measure where and how much groundwater discharges into streams to better understand the groundwater flow system.

"Hydrogeologic framework of the Walla Walla River Basin, Oregon and Washington"

Explain the thickness and depth of underground rock layers and their water-bearing properties. Present basin groundwater level maps.

2026

"Water use and groundwater pumpage estimates in the Walla Walla River Basin, Oregon and Washington"

Estimate the amount of water used and pumped from the ground for irrigation, municipal, and other uses in the Walla Walla River Basin, including how the amount has changed in different areas through time from 1985-2022.

"Interpret groundwater sources, mixing, and flow paths across the basin"

Summarizes water chemistry data from water samples to identify the elevation where the water entered the groundwater system, to better understand the movement and timing of groundwater flows.

"Conceptual model of the Walla Walla groundwater system"

Combines results from other studies and adds new analysis of groundwater and chemistry. It explains how groundwater works, including where it comes from, how it moves, and where it flows out.

Denotes the newly completed study report (OFR 2024-01) that is highlighted in this newsletter.

A critical part of addressing our basin's water challenges is understanding the hydraulic properties of its aquifers. This report (OFR 2024-01) helps scientists and the community better understand how quickly water moves through layers of sediment and volcanic rock and how geologic features like faults affect groundwater levels.

What Did The Report Find?

This report (OFR 2024-01) provides new data about the hydraulic properties of our local aquifers, highlighting the importance of geologic structures and variability across the basin.

An analysis of water levels in wells under both static and pumping conditions was conducted to examine how local geology influences groundwater movement in the Walla Walla River Basin. Well records go back to the 1940s, with major expansions in the Oregon monitoring network after 2007 and a large joint effort between Oregon and Washington from 2020 to 2024. The research team analyzed well test data to quantify hydraulic properties of aquifers, which control the rate of groundwater flow, the extent of pumping influences, and the capacity to store water. These measurements allow scientists to describe how aquifers respond to pumping from wells. Long-term groundwater level data were also examined to describe aquifers. R**eport (OFR 2024-01) is part of a larger basin-wide study which will be completed in late 2026.**

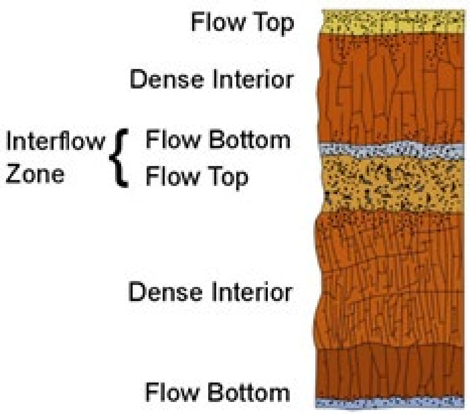
Want to learn more about other Walla Walla River Basin Study Reports?

Find out more information: https://owrd.info/wallawalla

Photo: Irrigation well being measured by OWRD staff.

Setting the Stage Through Geology

The Walla Walla River Basin has been shaped by many natural forces over millions of years. These include the movement of tectonic plates, the rise of the Blue Mountains, volcanic lava flows, earthquakes, river erosion, and massive floods caused by melting glaciers.



The entire basin sits on top of a huge layer of rock called the Columbia River Basalt Group (CRBG). These basalt rocks formed between 16 and 6 million years ago when more than 300 lava flows spread across parts of Washington, Oregon, and Idaho. In the Walla Walla River Valley, this rock layer can be more than 2,000 feet thick in many places.

Image to the left shows a common three-part flow structures of CRBG. CRBG aquifers typically occur in interflow zones.

Above the basalt in the basin is a layer of sediments containing sand, gravel, clay, and other loose materials, which are up to 800 feet thick. These sediments were mostly deposited by rivers starting about 5 million years ago and continuing to today. About 10,000 years ago, massive floods known as the Missoula Floods shaped much of the land. These floods filled the valley with water up to 1,200 feet above sea level and left behind fine sediments. Today, rivers continue to erode land and deposit new sediments.

The map to the right shows geological structures of the basin, which was compiled from several peer reviewed papers including:

Madin and Geitgey (2007); Madin et al. (2023); McClaughry and Azzopardi (2023), Derkey et al. (2007), and Washington Division of Geology and Earth Resources (2016)

LIST OF MAP UNITS

Cenozoic Surficial Deposits and Rocks

- Qa — alluvium
- Qaf — fan deposits
- Qf — modern fill
- Qlo — loess
- Qmf — Missoula flood deposits
- QTcg — conglomerate

Geologic Structure Symbology

- Fault, location certain
- Fault, location approximate
- Fault, concealed
- Down-dropped side of fault
- Fold axis

Miocene Columbia River Basalt Group

Saddle Mountains Basalt

- Tsi — Ice Harbor Member
- Tsu — Umatilla Member

Wanapum Basalt

Frenchman Springs Member

- Twfsl — Basalt of Sentinel Gap, low-phosphorous
- Twfsh — Basalt of Sentinel Gap, high-phosphorous
- Twfh — Basalt of Sand Hollow
- Twfg — Basalt of Gingko
- Tf — Frenchman Springs undifferentiated

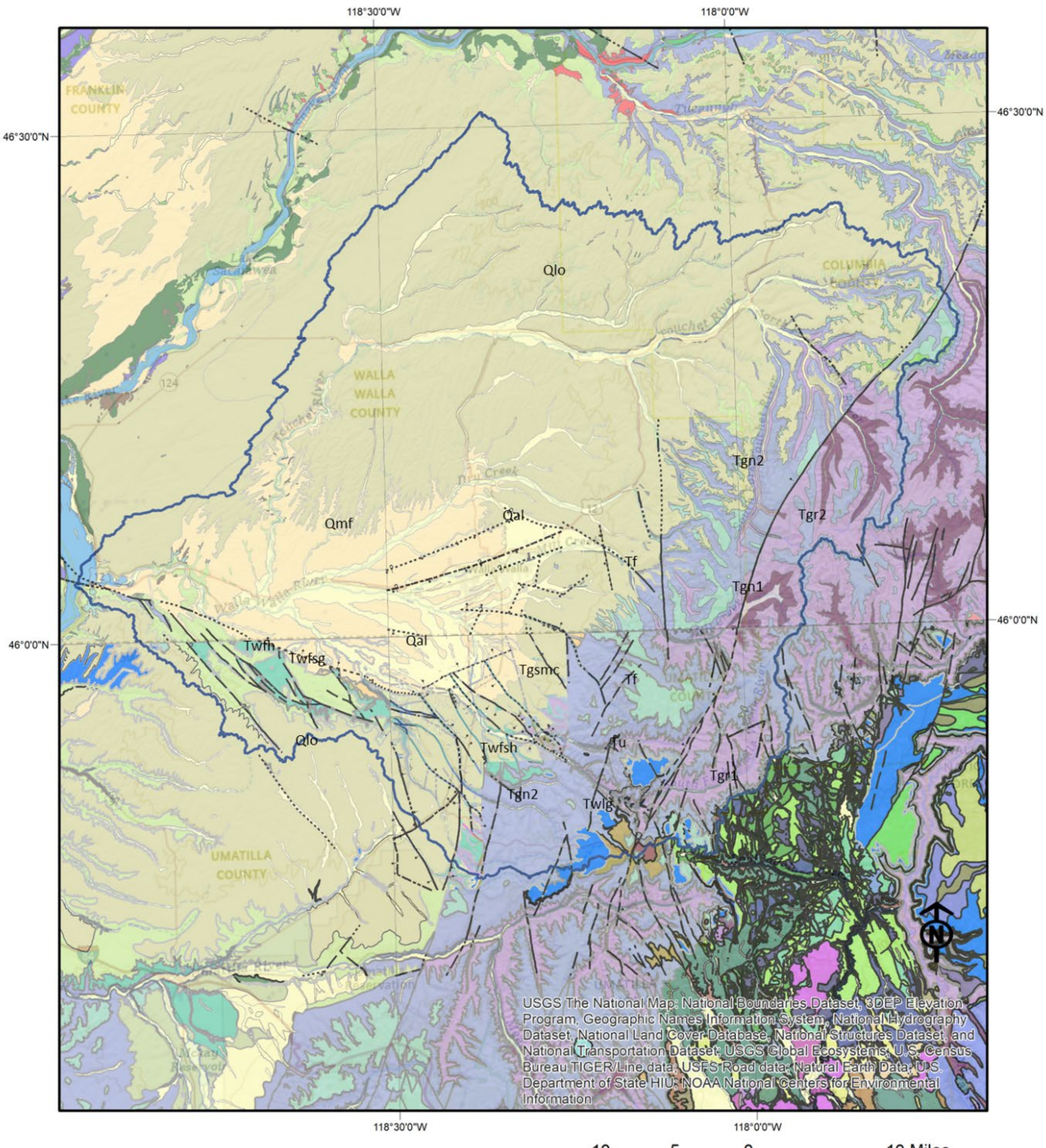
Lookingglass Member

- Twlg — Lookingglass

Grande Ronde Basalt

- Tgsmu — Sentinel Bluffs, basalt of Museum
- Tgsmc — Sentinel Bluffs, basalt of McCoy Canyon
- Tgww — Winter Water
- Tgir — Indian Ridge
- Tgo — Ortley
- Tgbc — Buttermilk Canyon
- Tgcc — Grouse Creek
- Tgn1 — Normal-polarity (N1)undifferentiated
- Tgn2 — Normal-polarity (N2) undifferentiated
- Tgr1 — Reverse-polarity (R1) undifferentiated
- Tgr2 — Reverse-polarity (R2) undifferentiated

The map below shows different rock types that occur at the land surface across the basin. Information such as this helps scientists better understand how water moves across the basin.



Map: Geologic map of the Walla Walla River Basin.

TERMS DEFINED

Cenozoic: The most recent era of geologic time (66 million years ago to today), known as the "Age of Mammals," when modern animals and humans evolved.

Miocene: An epoch of the Cenozoic (23–5.3 million years ago) marked by grassland expansion, cooler climate, and early human ancestors appearing.

Key Report Findings

Hydraulic Properties of the Walla Walla River Basin Aquifer System *(OFR 2024-01)*

By combining new data with historical data, this report provides the most comprehensive aquifer property dataset yet for the Walla Walla River Basin. This foundational data set is essential to ongoing community water planning and long-term management strategies.

Faults Strongly Influence Basalt Groundwater

In the basalt, faults are especially important, creating step-like changes in water levels across the basin. Faults separate the basalt aquifer into at least a dozen blocks that behave like distinct water systems. Over thousands of years, water moves between these blocks, but in human time frames they act independently. Wells within each block show similar water levels and responses to pumping, but wells in different blocks can act very differently. A few areas, like near Tollgate and in the Walla Walla River Canyon, show more typical basalt aquifer behavior, where water moves more freely within layers and shows changing levels with depth.

Aquifer Properties Vary Widely

Some wells show high capacity to transmit water, while others are much more limited, even within the same geologic unit. This variability reflects the complex geology of the basin. Groundwater in the Walla Walla River Basin moves through sediments and basalt rock that have been shaped and broken up by geologic forces. Near the surface are loose sands and gravels, below that are tighter layers of silt and clay, and at the bottom is the Columbia River Basalt Groups (CRBG). By looking at data from more than 650 wells, scientists identified six main types of underground water-bearing materials. Some, like the shallow gravels and the basalt, tend to carry water more easily. Others, like loess (windblown silt) and clay, slow water movement and store it less effectively.

TERMS DEFINED

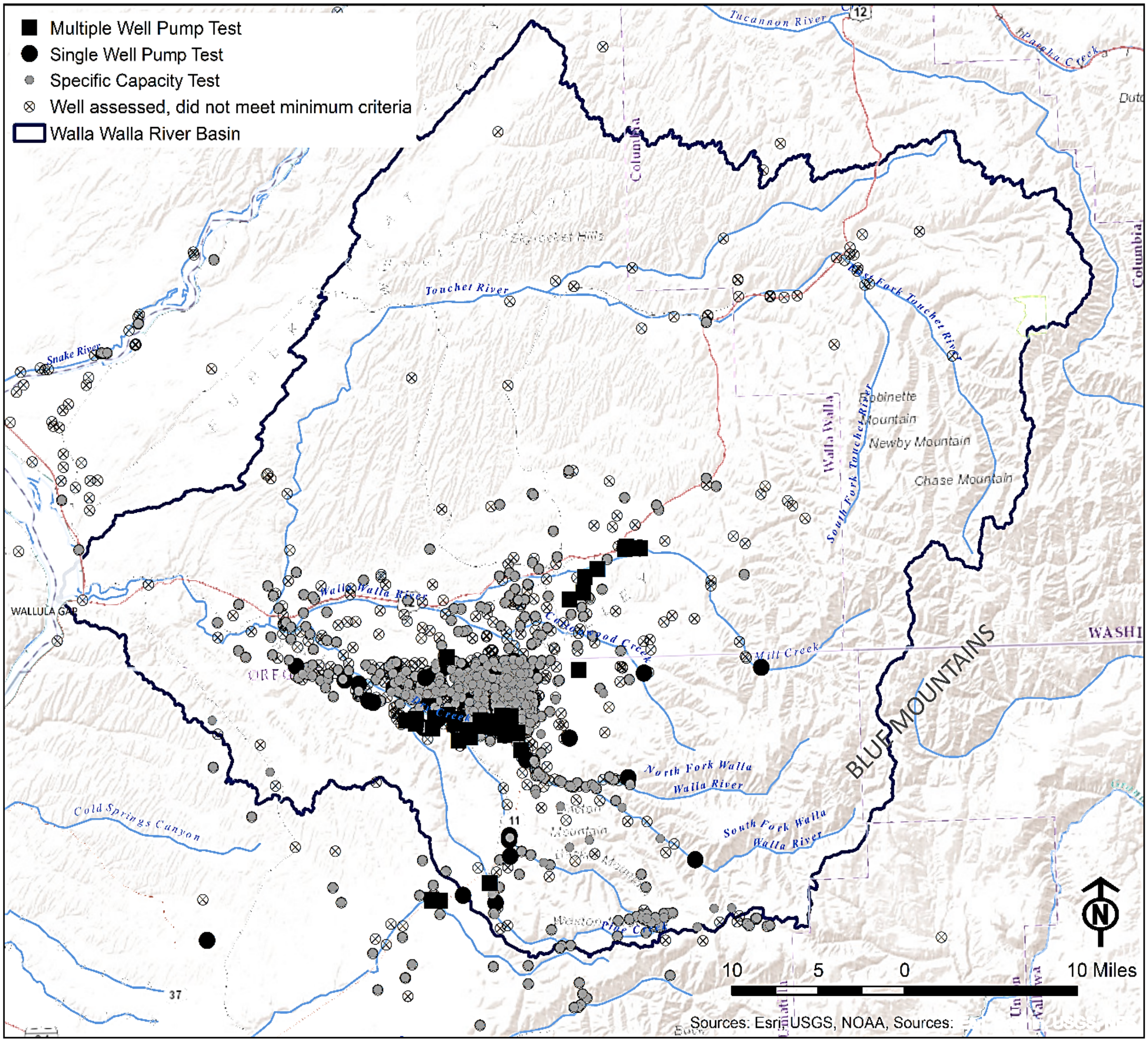
Transmissivity:
How fast water can move through rock per unit thickness.

Hydraulic Conductivity:
How fast water flows through a unit area of sediment or rock.

Storativity:
A measure of storage per unit volume of aquifer under a certain pressure change.

Well Group:
A set of basalt wells identified in this study with similar groundwater elevation, separated from other groups by geologic faults or structures. Well groups are likely hydraulically connected to each other over geological time scales (thousands of years) but respond independently over human time scales (days to tens of years).

Specific Capacity:
A measure of how much water a well can produce compared to how far the water level in the well drops while pumping.



Map: Walla Walla River Basin wells measured in the study.

The map above shows the locations of wells used in this report (OFR 2024-01) to estimate aquifer properties based on specific capacity, single-well, or multiple-well pumping tests.

To ensure reliable results, scientists compared only stable measurements from carefully reviewed wells. The analysis was done in TWO MAIN STAGES.

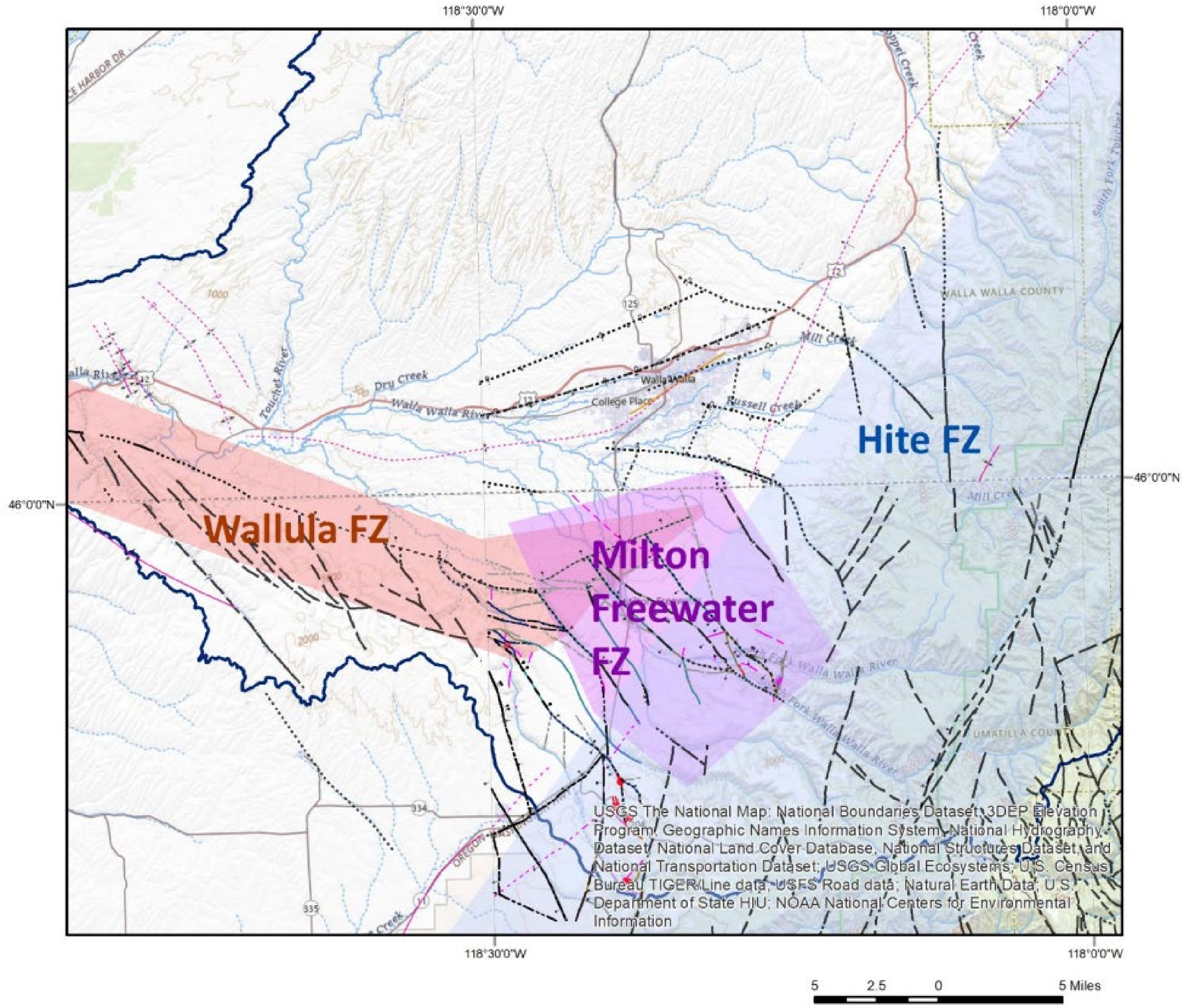
1. ***Water level records were compared to look for similarities in elevation, seasonal patterns, and timing of water levels changes. Only winter high-groundwater levels, when pumping and irrigation have less influence, were used in the analysis.***

2. ***Long-term average water levels were calculated where there were at least five years of data on either side of a gap. Historical data gaps were common, especially from 1980 to 2000.***

Three distinct fault zones (FZ) were described in the report:

Wallula, Milton-Freewater, and Hite

The basin has important geologic fault zones where the Earth's crust has cracked and shifted. Faults and folds break up the rock layers underground and influence how groundwater moves through the area. When viewed without great detail, the basalt groundwater system has highest water levels in the Blue Mountains, and lowest levels near the Columbia River. In a more detailed view, water level elevations shift sharply over short distances, especially in the Walla Walla Valley. Well construction, well depth, or stratigraphy do not explain the abrupt water level changes between most of the well groups.



Map: Walla Walla River Basin fault zones (FZ).

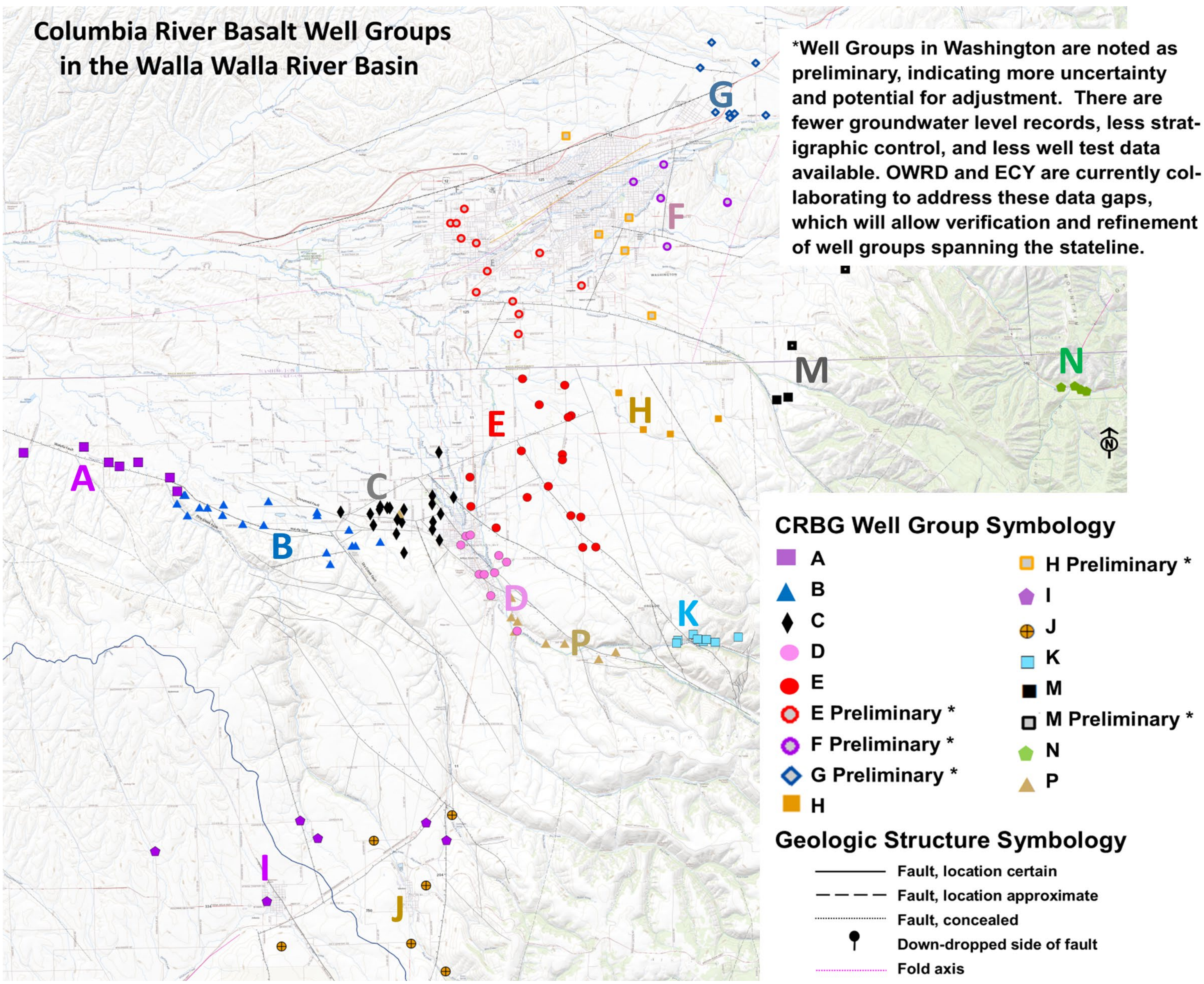
Well groups shown in the map to the right were created by the hydraulic properties of local fault zones (FZ) depicted in the map above as described by Madin et al. (2023) and McClaughry and Azzopardi (2023).

Groundwater level data and multiple-well pumping test results from basalt wells were used in this report (OFR 2024-01) to identify distinct basalt well groups shown in the map below.

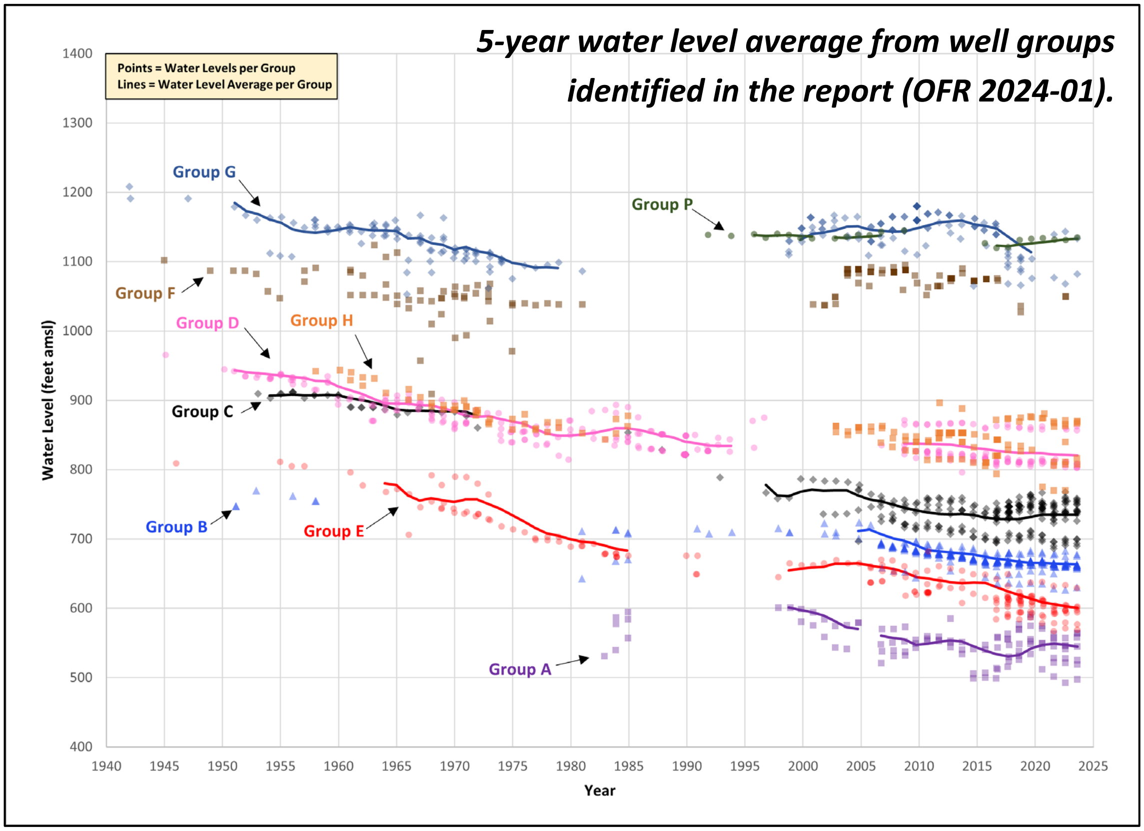
Using static winter groundwater levels, the report identified at least 12 distinct basalt well groups based on similar water level elevations and responses to pumping tests.

Groundwater levels in most wells across the basin rise and fall during the year due to changes in seasonal recharge and the pumping of well water. However, many wells have long-term declines in groundwater level because more water leaves the aquifer than enters it. When winter high CRBG groundwater levels are plotted in mass, groups of wells with similar water level elevation and trends are evident.

Line graphs in the subsequent two pages depict each well groups' water levels over time.



Map: Walla Walla River Basin map across the state lines of Oregon and Washington.



Group A – West Valley : Wells are in the Wallula Fault Zone (FZ). Top of basalt lies between 20 and 850 feet below land surface. Group A wells have groundwater levels 50 feet lower than Group B.

Group B – Umapine : Wells are in the Wallula FZ. Top of basalt lies between 10 and 280 feet below land surface. Group B wells have groundwater levels more than 50 feet lower than Group C.

Group C – Orchards : Wells are in the Wallula FZ. Top of basalt lies between 100 and 450 feet below land surface. Group C wells have groundwater levels more than 40 feet lower than Group D.

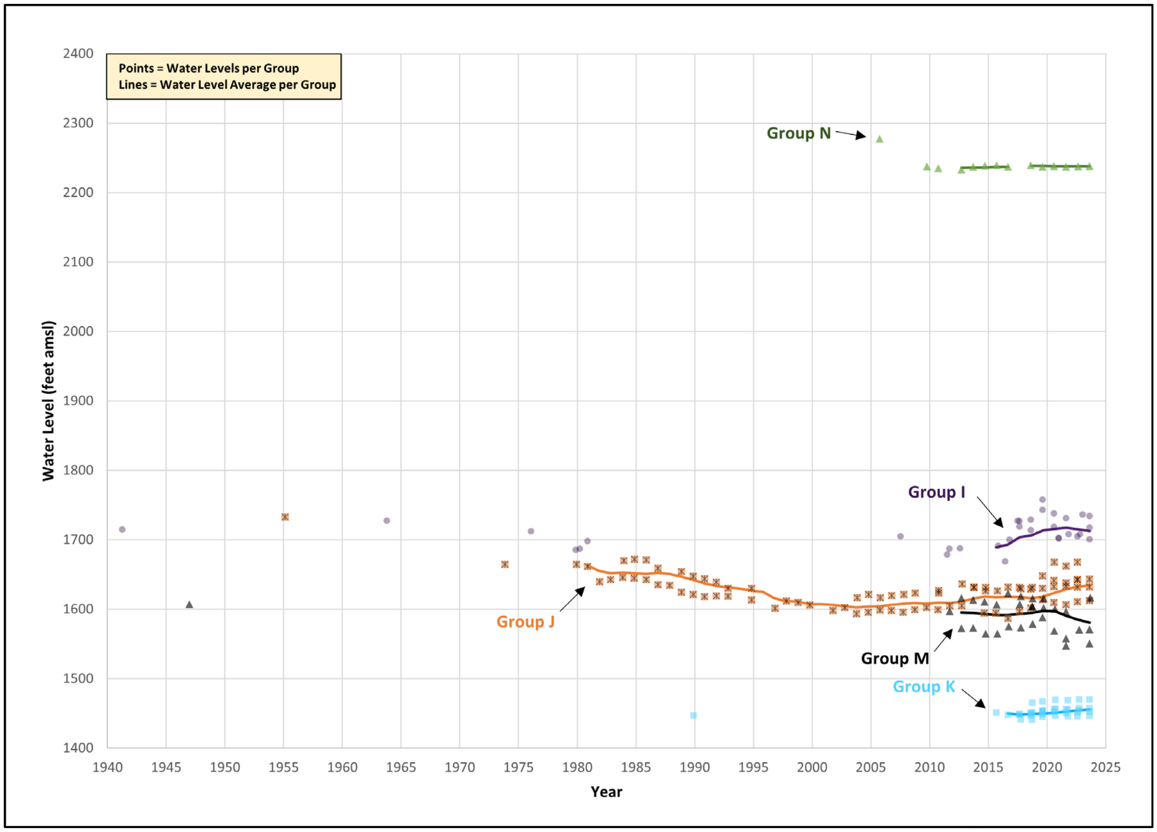
Group D – Milton-Freewater : Wells are in the Wallula FZ and Milton-Freewater FZ. Top of basalt lies between 30 and 125 feet below land surface. Group D wells have groundwater levels more than 200 feet higher than Group E.

Group E – East Valley & College Place : Wells extend across the Oregon-Washington state-line and include both municipal and irrigation wells. Top of basalt in this area lies between 200 and 600 feet below land surface. Group E wells have groundwater levels more than 400 feet lower than Group F. Additional data from ongoing studies may refine or change how these wells are grouped.

Group F – Central City of Walla Walla : Top of basalt is 400 feet below land surface. Group F wells have groundwater levels 25 to 100 feet lower than Group G. Additional data from ongoing studies may refine or change how these wells are grouped.

Group G – Walla Walla East : Top of basalt lies between 400 and 500 feet below land surface. Water levels show fluctuations since 2000 likely related to the City's aquifer storage and recovery. Additional data from ongoing studies may refine or change how these wells are grouped.

Group H – Stateline East : Top of the basalt lies between 400 to 500 feet below land surface. Water levels are up to 200 feet higher than Group E. Additional data from ongoing studies may refine or change how these wells are grouped.



Group I – Athena Weston Shallow : Wells are southwest of the fault zones in the study area. Top of basalt lies between 0 and 20 feet below land surface. Well Groups I and J appear to be in a part of the basin where basalt groundwater levels change with depth. Group I wells have groundwater levels about 100 feet higher than Group J.

Group J – Athena Weston Deep : Wells are southwest of the fault zones in the study area and overlap geographically with Group I. Top of basalt lies between 0 and 20 feet below land surface. Group J has groundwater levels about 100 feet lower than Group I.

Group K – North Fork : Wells are in the Hite FZ and Milton-Freewater FZ. Top of basalt lies between 0 and 10 feet below land surface. Well Group K has groundwater levels about 300 feet higher than Group P.

Group M – Cottonwood Creek : Wells are in the Hite FZ and the well group extends across the Oregon–Washington state-line. Top of basalt lies between 0 and 20 feet below land surface. Group M wells water levels are about 800 feet higher than Group H. Additional data from ongoing studies may refine or change how these wells are grouped.

Group N – Mill Creek : Wells are in or adjacent to the Hite FZ. Top of basalt lies between 0 and 50 feet below land surface. Groundwater levels at wells in Group N are flowing artesian as of 2024.

Group P – Walla Walla River Canyon : Wells are in or adjacent to the Milton-Freewater FZ and Hite FZ and overlap geographically with group D. Top of basalt lies between 25 and 50 feet below land surface. Groups D and P appear to be in a part of the basin where basalt groundwater levels change with depth. Well P has groundwater levels about 300 feet higher than Group D.

Well groups A, B, C, D, and E reach basalt layers from the Saddle Mountains and Wanapum Formations.

Well groups K, M, and N are in the Hite FZ and likely reach the Grande Ronde Formation.

Well groups I and J are near the Hite FZ, but there is not enough data to describe the rock layers in detail.

Faults can strongly influence how groundwater moves underground. The rocks along faults may be crushed into fine material, which reduces permeability and slows or blocks groundwater flow. In other cases, faults can create fractures in the surrounding rock, increasing permeability and allowing groundwater to move more easily. Whether a fault blocks or enhances flow depends on how it changes the rock structure around it.

Photo: Exposure of Touchet Beds, Washington.

Walla Walla River Basin Geologic Units:

By looking at data from more than 650 wells, this report (OFR 2024-01) identified SIX MAIN TYPES of underground water-bearing materials.

1. ***Upper Alluvium:*** *Coarse to fine-grained river deposits*
2. ***Missoula Flood Deposits:*** *Unconsolidated and repeating deposits of sand, silt, and clay rhythmites, also known in the Walla Walla Valley as Touchet Beds. The laminations record the periodicity and recurrence of catastrophic glacial ice dam outburst events.*
3. ***Loess:*** *Windblown sandy silt deposits, both above and below Missoula Flood Deposits.*
4. ***Lower Alluvium Coarse:*** *Poorly consolidated to cemented conglomerate interbedded with sandstone and claystone.*
5. ***Lower Alluvium Fine:*** *Consolidated sedimentary rocks including sandstone, claystone, siltstone and mudstone.*
6. ***Columbia River Basalt Group (CRBG):*** *Large-volume, stacked sheet flows of lava that have a characteristic three-part structure: flow top, dense flow interior, and flow bottom. The combination of a flow top and an overlying flow bottom make up a permeable "interflow zone" where groundwater storage and flow is usually concentrated.*

The water-conducting properties of local geologic units and structures summarized in this report will be incorporated into a three-dimensional conceptual groundwater framework currently in development by the USGS. The resulting hydrostratigraphic units are the layers within this framework. When completed, the community will be able to see a three-dimensional groundwater framework that can be viewed on a computer, rotated, and sliced to see cross sectional views of the underground basin features.

Data Gaps and Uncertainties in the Report

(OFR 2024-01)

In this report scientists analyzed data to better understand the hydraulic properties that govern groundwater movement through the Walla Walla River Basin. Highlighting how variables like permeability, porosity, and hydraulic conductivity interact to control water flow and storage, this report provides valuable information for our community's ongoing water planning.

OFR 2024-01 underscores a need for additional data collection to fill data gaps to better manage groundwater across the State-line.

The findings of this report point to several important next steps:

1) Foster cross-border collaboration

Because the basin spans Oregon and Washington, coordinated management is essential. Continued cooperation between agencies, tribes, and local water users will ensure consistent strategies.

2) Expand aquifer testing, well location, and well measurements

Conduct more water level measurements and pumping tests in underrepresented areas, especially targeting CRBG wells near the State-line.

3) Refine well groups that span the state-line

Incorporate new data to better understand how and where wells are connected.

Photo: Irrigated field in the Walla Walla River Basin.

OWRD and Ecology are looking for wells in specific areas highlighted in the map to the right.

Are you interested in volunteering your well?

Photo: Well water level survey by OWRD.

Future field efforts north of the State-line are needed to locate CRBG wells, describe their construction, lithology and stratigraphy, and measure groundwater level elevations and trends. By filling these data gaps scientists will be able to improve well grouping certainty and facilitate future site-specific groundwater management decisions.

Well measurements and pump tests will help the community better understand where groundwater is shared between wells so that we can make informed decisions about groundwater management.

Working together to Fill Data Gaps from the Report!

OWRD and Ecology are working together to enhance our understanding of the groundwater system along the shared border between Oregon and Washington.

If you decide to volunteer your well, OWRD will coordinate an appointment to meet you at the well. Wells have a variety of configurations, access points and clearance for measurement.

During an initial site visit, we examine the well to determine if it has access for measurement and collect information about its width, depth, and age to help tie it to the original driller's well log. If possible, we conduct a groundwater level measurement.

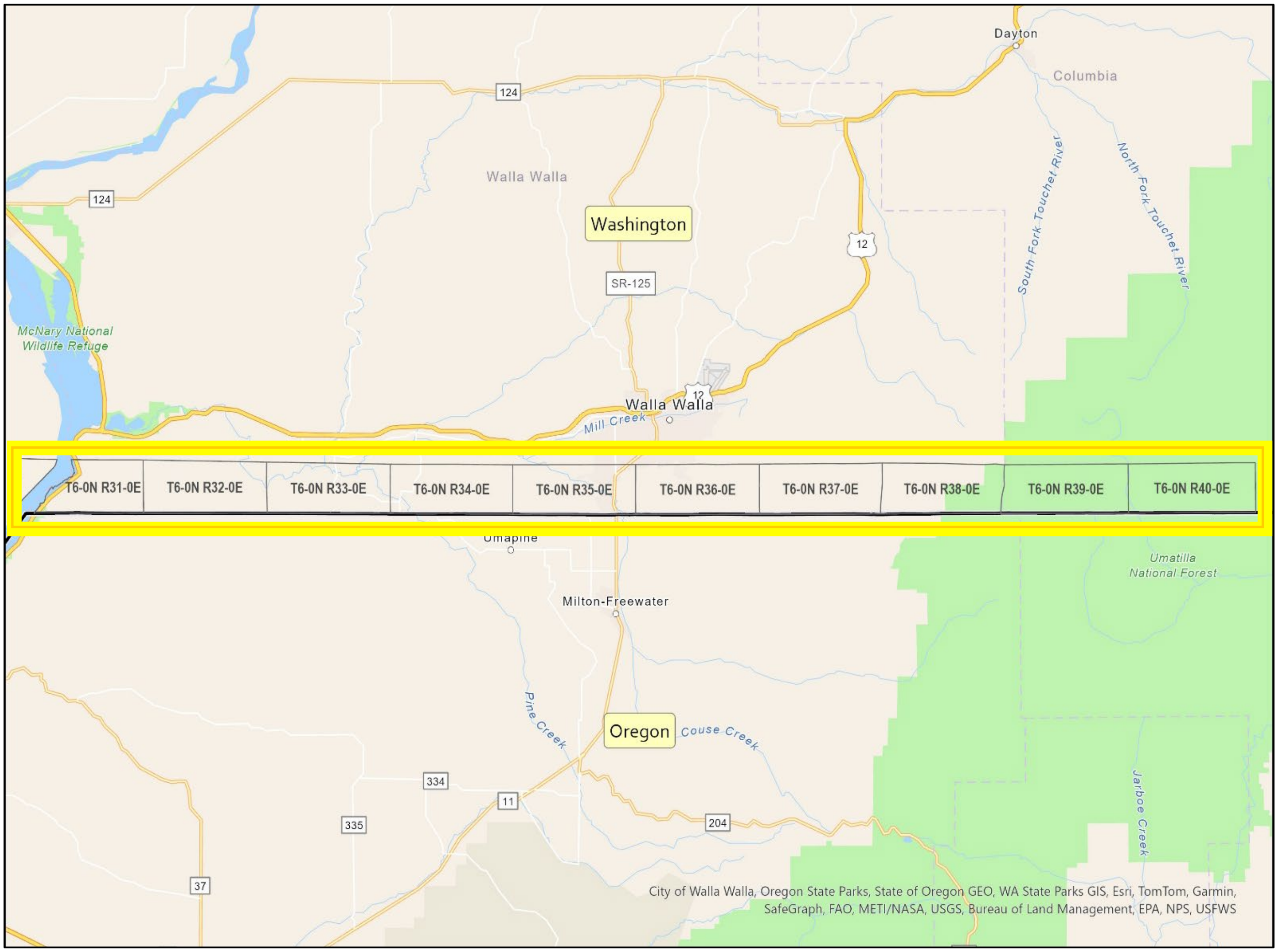
A groundwater level measurement is conducted by lowering a measuring tape into a well that is not pumping until it hits the top of the water in the well.

To assess area-wide conditions, wells will be visited one to four times annually, depending on the kind of data they provide. Each site visit will typically take 10 to 30 minutes. The data collected will be included in publicly available reports and accessible online.

Using funds provided by Ecology as part of the Walla Walla 2050 project funds, OWRD has hired a limited duration staff person for the next 2 years to focus on gathering information about wells along the State-line where the report identified data gaps.

Do you live in this area?

We are looking for wells in the Townships highlighted here.



Please contact us if you want more information about volunteering your well.

Online interest forms can be filled out online or downloaded and printed from here:
https://forms.office.com/g/tXHn3R0ER6

Printed forms can be mailed to:
Attn: Shauna Yeh TSD 725 Summer Street NE, Ste A Salem, Oregon 97301

OWRD and Ecology will be engaging with well owners to measure groundwater levels and perform pump tests between 2025 and late 2027.

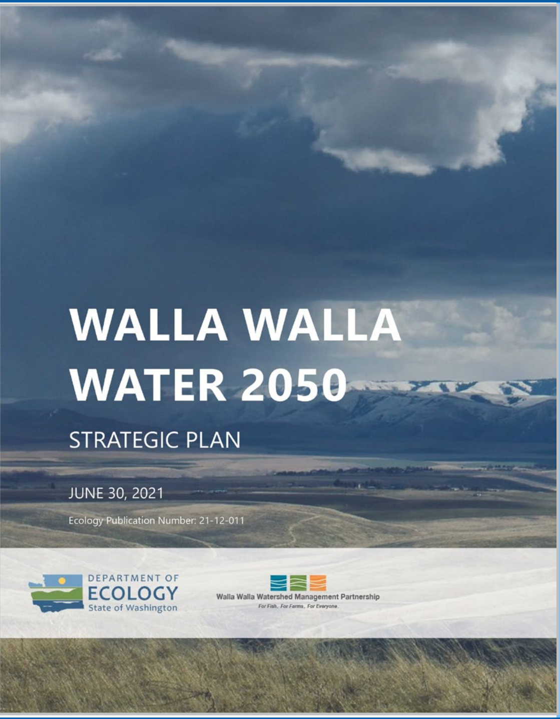
How Does This Report Relate to the Walla Walla 2050 Plan?

Oregon and Washington are working together to stabilize declining groundwater levels in the basalt aquifer and figure out how to co-manage the cross-border basalt well groups.

The Walla Walla River Basin depends on both groundwater and surface water to meet the needs of farms, communities, and the environment. During dry months, when river flows drop, groundwater becomes the lifeline that keeps crops growing and taps running. This new report provides essential data on how fast water moves underground and how different rock layers store and transmit water.

Learn more about Walla Walla River Basin community water planning efforts

Find more information at: www.WallaWallaWater.org



The Walla Walla Water 2050 plan calls for building a reliable water future through better science, stronger management tools, and coordinated action across state-lines. To succeed, the plan relies on accurate, site-specific information about the Basin's aquifers, the same kind of information contained in this report (OFR 2024-01).

By showing how aquifer properties differ across the Basin this report directly supports the plan's strategies for sustainable supply, habitat recovery, and long-term resilience. With science in hand, local leaders, landowners, and water managers have a clearer picture of the challenges ahead and the opportunities to protect water for the community and the environment through 2050 and beyond.

OREGON WATER RESOURCES DEPARTMENT

DEPARTMENT OF ECOLOGY State of Washington

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