

A Systems Approach to Expediting Groundwater Basin Studies

In some locations throughout the state, groundwater aquifers are no longer capable of sustaining additional development. As identified in Oregon's 2017 Integrated Water Resource Strategy and in the Water Resources Department's (WRD) 2019-2024 Strategic Plan, the Department, communities, and water users need better information to determine how to best utilize limited resources, while protecting existing and future uses. The State needs to know more about how much surface water and groundwater we have, if additional allocations can be made, and how the groundwater and surface water interact in each basin. This information is essential for communities in understanding the sustainability of current groundwater uses and their opportunities for future economic development. While the Groundwater Act of 1955 states the Oregon Legislature's policy that groundwater aquifers be characterized and studied (ORS 537.525(6)), the Department has had limited resources to do these studies.

There are twelve areas the Department has identified as a priority for groundwater basin study work. The highest priority basins are the Harney Basin (in progress, with initial study due in 2020 and management tools to follow), the upper Walla Walla Basin, and the sedimentary aquifer system of the Lower Umatilla Basin. These three basins present groundwater allocation and management challenges related to over-appropriation of water resources and declining groundwater level trends. This group is followed by subbasins or regionally important aquifer systems with documented declining groundwater level trends limiting availability of new groundwater permits or with emerging groundwater management challenges. This tier includes basalt aquifers in portions of the Hood, Lower John Day, and Umatilla basins, the Deschutes Basin aquifer system underlying the rapidly urbanizing Bend-Redmond-Prineville area, the sedimentary aquifer systems of the upper John Day Basin, and the northern Goose and Summer Lakes Subbasin. Finally, aquifer systems in the Grande Ronde Basin and the Rogue Basin are tributary to State Scenic Waterways, and local officials from the Powder Basin have asked the Department to identify potentially available groundwater.

The Department currently has resources to engage in one cooperative groundwater basin study with the U.S. Geological Survey (USGS) at any given time. This current approach involves engaging five to six Department staff to work with three to five staff from the USGS to intensify data collection in the study area over an approximate three-year period and then transition to data analysis and report publishing over an approximate two-year period. After conducting the initial study and report, a second step is to develop a tool (numerical groundwater flow model) to understand how the groundwater flows and test out water management scenarios.

To date, the WRD has assigned scientific staff to work on groundwater basin studies with one team gathering all the disparate information needed from throughout the agency—pump tests, well logs, groundwater level data, aquifer characteristics, etc.—assembling, performing quality control, analyzing, writing the text, creating the hydrographs, and producing a basin study. The alternative framework below takes an assembly-line production approach, recruiting and training staff who will specialize in each of these tasks to process a backlog of data, merge in new data, quality assure / quality control it, and serve it up to the scientists who will use it in the writing of each basin study. The overall process will be much faster, with specialists able to ground truth data and with information technology (IT) able to process it more rapidly along the way.

With its current budget resources, the Department estimates that it can complete basin studies one at a time in the 12 basins of concern, over a period of 60 years. If the Department's policy option package #102 is successful, the Department could complete studies twice as fast – 30 years in total. With the additional resources requested below, *in conjunction with package 102*, the Department believes the completion time would be cut to a total of about 15 years. It is critical to note, that the framework below relies on and is in addition to those staff in package 102.

Costs in the table are based 24 months. State budgeting is based on biennium.

Purpose	Contribution to Groundwater Studies	Positions	Cost
<p>Technical review of well logs for stratigraphy (rock layers) and geology. Review and enter relevant well log data into the database.</p>	<p>Historical well log information available only as scanned paper documents needs to be input into database to make it available for analysis in a basin study. Well locations are often imprecise and require verification for use in scientific studies. Driller's descriptions of cuttings need to be interpreted and transposed into a uniform set of stratigraphy descriptions and recognized geologic or hydrogeologic units.</p>	<p>1 administrative specialist (AS1 \$140k) 1 NRS2 well log analyst (\$205k) 1 NRS3 senior well log analyst (\$230k)</p>	<p>\$575k</p>
<p>Groundwater recharge study. Update USGS's 1968 statewide study.</p>	<p>This is a cooperative study with the U.S. Geological Survey that updates run-off and groundwater recharge estimates by taking into account land development, baseflow, pumping, declining snowpack, and modernized state-wide precipitation datasets.</p>	<p>1 NRS4 (\$260K) baseflow specialist</p>	<p>\$260k</p>
<p>Improved information technology (IT). Improve data collection efficiency in the field and improve access to data for analysis during basin studies and to support the core functions of the Department. Information technology staff are essential to developing and maintaining mobile device data collection applications, data management applications, online mapping/reporting systems, ensuring data is backed up and protected, optimizing database performance, and database designs and structures.</p>	<p>Basin studies and ongoing work of the Department require the collection and analysis of large amounts of data, both new data that is being collected in the field and decades worth of old data that may still be in paper format.</p>	<p>1 ISS6 developer (\$225k) 1 ISS6 database administrator (\$225k) 1 ISS4 help desk support (\$200k)</p>	<p>\$650k</p>
<p>Digitizing water right records and irrigated field mapping within study areas. Historical water right places of use have not been digitized in many areas of the state. This data tech will address legacy water rights within the priority study areas, correcting any information errors, bringing the data up to current standards, and improving mapping completeness and accuracy.</p>	<p>Development of a water budget requires detailed knowledge of groundwater use in space and time.</p>	<p>1 data tech 1 (\$155)</p>	<p>\$155k</p>

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<p>Modernize pump test program to improve data collection and quality. The existing pump test program is not funded and currently operates with minimal oversight. Coordinate with permit holders required to conduct tests, enter and assess data to describe aquifer parameters adjacent to tested wells. Plan, coordinate, implement, and analyze multi-well pumping tests in priority basins.</p>	<p>Basin studies rely on pumping test data to quantify aquifer properties. This package would improve data collection and quality to allow scientists to analyze the data within priority basins develop statistics of aquifer parameters within the basin</p>	<p>1 NRS3 pump test coordinator (\$230k) Pump test costs (\$50k)</p>	<p>\$280k</p>
<p>Administrative support for technical staff. POP #102 and the positions in this table will increase the number of staff engaged in basin studies, necessitating administrative support.</p>	<p>This position will support technical staff with coordination of site visits and travel reimbursements, gaining landowner access permissions, scheduling public meetings, and coordinating travel logistics.</p>	<p>1 Groundwater Administrative Specialist 2 (\$155K)</p>	<p>\$155k</p>
<p>Groundwater water-use measurement. This position will interface with groundwater users to support installation and maintenance of appropriate flow meters and facilitate accurate record keeping and reporting to the Department. This position will QA/QC data and enter it into a database for analysis by basin study teams.</p>	<p>The Department relies on user-reported data to quantify groundwater pumping – a critical component of the water budget and the foundation for groundwater studies.</p>	<p>1 NRS2 water use measurement specialist (\$205k)</p>	<p>\$205k</p>
<p>Geophysical borehole assessments. This will allow the Department to visit and perform down-hole geophysical inspections of wells to gather data regarding geology, inter-borehole flow, and well construction. <i>(A position to do this work is in POP# 102).</i></p>	<p>Basin studies rely on geophysical assessment of boreholes to develop a more accurate understanding of subsurface conditions.</p>	<p>\$50k per biennium to maintain and upgrade geophysical equipment.</p>	<p>\$50k</p>
<p>Groundwater policy and public outreach. This staff will help the Department classify groundwater in areas where over appropriation has been identified, set up CGWAs/SWMPAs to increase water use data collection, and follow up with rule revisions as warranted based on the results of in-depth studies and a strong public engagement process.</p>	<p>Many prioritized basins for study are already exhibiting signs of stress. Rulemaking ahead of basin studies will help prevent problems from getting worse (classifications) and improve data collection (SWAMPAs) in preparation for basin studies. Rulemaking after basin studies are completed may be necessary depending on study results.</p>	<p>1 PM2 project manager (\$250k) 1 OPA3 policy specialist (\$220k) 1 NRS3 GW-SW transfer specialist (\$230k) 1 OPA 3 outreach specialist (\$220k)</p>	<p>\$920k</p>

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<p>Geological framework. Contract with DOGAMI to understand the geological framework and map entire quadrangles in target areas, as well as to coordinate and conduct LiDAR elevation surveys.</p>	<p>Basin studies benefit from modern mapping and age-dating methods in many target basin study areas to understand the geological framework. LiDAR surveys of surface elevation support both detailed geologic mapping and elevation control of water level data.</p>	<p>\$320k per biennium for two quadrangles (~55 sq.mi. each) or one LiDAR survey (>100 sq.mi.)</p>	<p>\$320k</p>
<p>Conduct seepage runs to characterize and quantify SW-GW interaction and process stream gage data. Currently, the state lacks sufficient capacity to process and QA/QC stream gage data that has been collected by hydrotechs. Groundwater studies require surface water data inputs in order to understand how the two interact and how much water is available.</p>	<p>In order to understand the groundwater budget, basin studies require surface water data. This includes measuring groundwater discharge to or recharge from surface water to support description of groundwater flow regimes.</p>	<p>1 NRS4 (\$255k) hydrologist 1 NRS 2 hydrographer (\$205k) 1 NRS3 hydrographer (\$225k)</p>	<p>\$685k</p>
<p>Quantifying evapotranspiration. ET data are vital for accurate water management, planning, and conservation efforts. Through a satellite-based model called METRIC, they can quantify and confirm the amount of water consumed by irrigated agriculture and on other lands. Proper use of the technology requires an initial investment in software, technically trained staff, and complete and up-to-date and geographically accurate water right records.</p>	<p>Recent advances in remote sensing allow interpretation of historical evapotranspiration from satellite images, quantifying historical, unmetereed groundwater use on irrigated fields.</p>	<p>2 NRS4s (\$255k/position)</p>	<p>\$510k</p>
<p>Office space and facilities. Office space, workshop, wash facility, warehouse/storage to house everything. Cubicle costs and equipment are already built into position pricing.</p>			<p>\$75k</p>
<p>Surface water/Groundwater data collection. The staff will collect bi-monthly to quarterly water level measurements in observation wells; measure and maintain existing surface water data collection sites used in support of basin studies; work with basin hydrogeologist and hydrologist to expand observation well and surface water monitoring networks. Install and maintain continuous water level monitoring equipment.</p>	<p>Collection of quarterly water levels from a large number of spatially distributed wells is critical to understanding groundwater flow directions and analyzing the response of flow systems to stress. In addition, coordinated collection of surface water data is imperative in defining surface water/groundwater interaction.</p>	<p>5 NRS2 Hydrotechs (\$205k / position)</p>	<p>\$1M</p>

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Payroll and Human Resources Support. Central administration support including recruitment, payroll and benefits administration, fiscal support, procurement and contracting assistance, safety, training, performance management, risk management, central business services and employee development.	Additional foundational staff are necessary to support the new staff necessary for the systems approach to groundwater studies.	0.50 FTE HRA1 human resources analyst (\$90k) 0.50 FTE AT3 accounting technician (\$75k)	\$165k
	TOTAL IN THIS TABLE	26 positions/FTE	\$6M
	+PACKAGE #102	9	\$2.8M
	=TOTAL COST PER BIENNA (<i>table+POP 102</i>)	35	\$8.9M