Meeting Summary October 28, 2024 - 10am - 4pm

Meeting Recording: https://media.pdx.edu/media/t/1_48gzcv8t

Attendees

Alexandria Scott (OWRD), Barbara Howard (Farmer), Barbara Cannady (Burns Times Herald), Bobby Cochran (Oregon Consensus), Brandon Haslick (Burns Paiute Tribe), Breanna O'Connor (NRCS/SWCD), Brenda Smith (High Desert Partnership), Christopher Hall (Water League), Cole Hendrickson (Department of Environmental Quality), Curt Blackburn (Real Estate Broker), Darrick Boschmann (OWRD), Debbie Gouveia (Farmer), Don Cody (Farmer), Drew Cody (Irrigator), Fred Flippence (Harney Electric), Harmony Burright (High Desert Partnership), Jake Blackburn (Real Estate Broker), Jake Davis (Farmer), Jason Spriet (OWRD), Jay Weiner (Klamath Tribes Lawyer), Jerry Grondin (Retired Hydrogeologist), John Rowell (Harney County Court - Elect), John Short (Water Rights Specialist), Karen Moon (Harney County Watershed Council), Kelly Meinz (OWRD), Ken Bierly (Consultant), Kristen Shelman (Harney County Court), Lorissa Singhose (Farmer), Mario Petrelli (Public), Mark Owens (Farmer/Legislator), Melissa Petchauer (High Desert Partnership), Patty Dorroh (Harney County Court), Sheena Miltenberger (Department of State Lands), Travis Singhose (Farmer), Tom Davis (Farmer)

Meeting Notes

Bobby provided an overview of discussion group topics and progress to-date. Concern was expressed regarding the deadline and whether there would be sufficient opportunity to engage at the depth needed on these topics, especially the modeling results. The group spent the day discussing potential indicators of success, options around monitoring for groundwater trends and pumpage volume, and options for incorporating adaptive management into groundwater management.

Action Items

- Send to Bobby and Harmony risks and uncertainties to include in the risks and uncertainties tables. What is missing? What would you emphasize?
- Oregon Consensus will work with HDP, OWRD (Graham), and NRCS to organize an information session on CREP (preceded by some outreach and an updated 1-pager)
- Oregon Consensus will work with OWRD and others to answer outstanding questions.
- HDP will work with a volunteer landowner, OWRD, and Harney Electric to gather results for different methods of measuring groundwater pumping/use (power consumption, pumping records, OpenET).
- Oregon Consensus will work with HDP and OWRD to research and explore adaptive management approaches in other states and other state agencies in Oregon.
- OWRD will share the results of the groundwater level trends analysis performed with only the wells in the OWRD monitoring network.
- Oregon Consensus and HDP will work with OWRD to identify the relative accuracy (margin of error) for the three potential datasets and identify ways to increase accuracy.
- Oregon Consensus and HDP will consult with OWRD to understand the extent of cost-share that can be offered for measurement devices (especially as it relates to system changes).
- OWRD will share with the group what happens with the customer service survey.

A Framework for Adaptive Management

The group discussed the adaptive management cycle (Figure 1) and added some additional considerations for adaptive management, generally speaking. Some of those considerations include:

- Be clear about the baseline from which "adaptive management" begins, especially if "success" is defined as a changing trend between time A and time B.
- How would OWRD even consider adaptive management? What is possible?
- How would adaptive management be realistic in some subareas that are facing significant cuts (e.g., if there is a significant reduction in pumpage and agriculture, is there anything left to adaptively manage in some areas)?
- Pay attention to variables (e.g., the timing of reductions, where those actions begin, and what actions are taken) and what happens with that information (e.g., it is looked at, it is acted on, and when those adaptive actions take effect)?
- Don't lose tracking the larger community picture, even if what's included in the rules gets narrower. There is a desire to assess everything in a holistic manner, looking at the social, economic, and environmental tradeoffs.
- Is there a way to "pilot" actions and see how the basin responds in some places or some instances? The Harney has been very effective at piloting new and innovative approaches.
- Adaptive management is challenging within a regulatory and legal context, because it can be harder to adapt. For example, implementation of the rules will likely include a contested case, and so how would it work to go back and reset permitted total withdrawals (PTW) in either a voluntary agreement or contested case context?
- A number of irrigators are interested in voluntary agreements, and will want some certainty (e.g., for 20 years) that their reduction plans will stay predictable. Can adaptive management provide that?
- How will water rights transactions (e.g., transfers) and the changing spatial distribution of water use be accounted for in future management? There is a desire for equitable consideration of impacts.
- Take a look at what they are doing in Christmas Valley. They might have some successes we can learn from.
- There has been ample experience with adaptive management in the Harney Basin, but not via a regulatory context. Adaptive management has primarily been used in a restoration context. Still, there may be important lessons learned.
- What data or information should be used to "trigger" certain actions? At what timesteps?
- We can minimize how much adapting needs to happen by having a gradual enough reduction to assess impacts over time. This approach is less likely to make a "big" irreversible mistakes.
- Some agencies (e.g., Department of State Lands) use "resource management plans" where the rule authorizes the use of a "plan" and the contents of the plan itself remain flexible. For DSL this gives authority to the plan and the plan is used to perform adaptive management. There is an opportunity to learn from DSL and other state agencies.

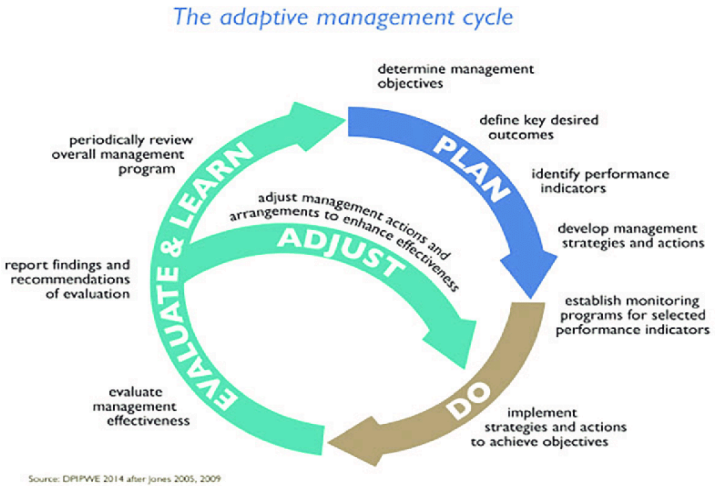

Figure 1. Example of an adaptive management process.

Potential Indicators of Success

The group reviewed and refined an "inventory" of indicators of success, which is captured in an updated Appendix A (attached). The language modified based on the discussion of the group is indicated in purple. Additional feedback is continuously welcome. Comments can be added to the Google document.

Monitoring and Measuring Success – Groundwater Levels

The group discussed considerations for a monitoring approach for groundwater levels. The updated options, questions, and considerations are captured in Appendix B (attached). Comments can be added to the Google document.

Monitoring and Measuring Success - Groundwater Pumping and Use

The group discussed considerations for a monitoring approach for groundwater pumping and use. The updated options, questions, and considerations are captured in Appendix C (attached). Comments can be added to the Google document.

Risk and Uncertainty Management

The group did not have time to discuss the risk and uncertainty matrices. Oregon Consensus and High Desert Partnership will continue to glean this from past meetings and invites ongoing contributions. Comments can be added to the Google document.

Applying Adaptive Management to Groundwater in the Harney Basin

The group discussed how to apply an adaptive management approach to groundwater. Participants discussed a mix of principles, questions, and considerations.

Overarching Questions and Considerations

Some of the bigger questions included:

How can OWRD actually implement adaptive management given its authorities and the connections between rule, water law, and the flexibility needed for adaptive management? What can OWRD learn from other states and sister agencies about how they perform adaptive management and what is included in rule to facilitate adaptive management?

General Principles

The group discussed some general principles as well:

- Adaptive management should incorporate the lag time in response between A) actions take above by water users, B) how those actions affect the hydrologic response in the groundwater system, C) and how those interact with other indicators of success
- There needs to be adaptive management, AND water users need some certainty/predictability around groundwater reduction goals so they can plan operations over time (e.g., stable reduction goals for 20 or 10 years over the life of a voluntary agreement); and
- It will be easier to ease reduction goals, and increase the extent and/or pacing of reductions. Rather than the other way around of over-reducing too soon, and finding the basin has additional water and figuring out how to distribute that.

Timelines and Engagement

Participants discussed some options for an adaptive management timelines. There are different adaptive steps from "looking at information to learn", "using those learnings to make a decision to adapt", then "choosing a time in the future where those decisions take effect".

Participants like the concept of an annual groundwater meeting to share information, get updates on indicators of success, and learn. Particpants had different ideas on whether "decisions to adapt" should happen at 3, 5, or 10 yr increments, or provide longer (e.g., 20 yr) windows. The balance was adapting quickly to new information and providing a longer time for certainty in water use.

For surface water, there was a Harney County request for an annual post-irrigation season meeting. Would there be a way to combine those annual surface and groundwater meetings?

Participants mentioned that "looking" at annual information on A) the groundwater management actions being taken above ground, B) the groundwater level trends (rate and magnitude) by subarea, and C) any changes in patterns in groundwater uses and hydrology would be helpful. OWRD reviews the rules every 3 years, with an opportunity for public comment. OWRD reviews groundwater conditions at 10 years.

Participants also talked about interest in some kind of "advisory group" of diverse interests participating in reviewing and advising decisions on adaptive management with OWRD.

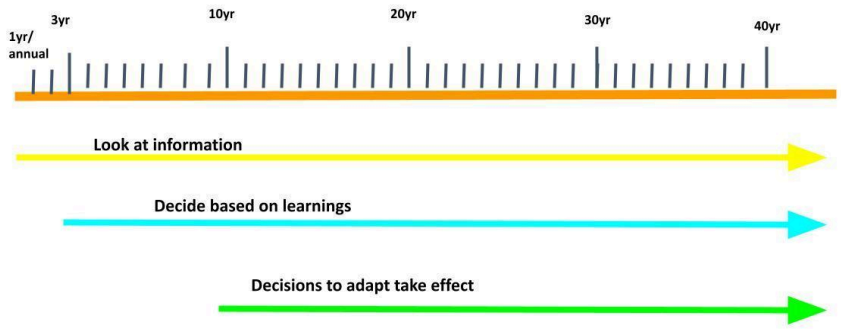

Figure 2. Considering timelines for actions and responses

Appendix A: Inventory of Potential Indicators of Success

Inventory of Potential Indicators of Success

Table A. Includes a list of potential indicators of success that have been identified in various RAC and discussion group meetings. The indicators are not prioritized in any way. Indicators of success are an important component of any adaptive management plan. Some of the indicators are relevant to the OWRD rulemaking, and some of them connect more broadly to groundwater management. The highlighted indicators are those that are most likely within the scope of the rulemaking and may be addressed in rule language. This inventory was prepared for the Discussion Group meeting on 10/28. The purple language indicates where changes were made based on feedback provided at that meeting. Inclusion in the inventory is a starting point for further discussion but does not ensure further discussion. In order to be useful indicators of success will need quantifiable metrics that can be tracked over time as well as data that can be used to inform management. Please review the list to identify any missing indicators. What is missing? What would you add? What are the various considerations for each indicator?

Table 1. Potential Indicators of Success - *Working*

Note: Recognizing that there is variability across the basin, many of these indicators may need spatially explicit metrics that are specific to the conditions of each subarea (especially recharge and discharge estimates). Additionally, the time dimension is important to consider and there may be different near-term and long-term indicators of success.

Potential Indicators of Success	Considerations
Hydrology	
Rate of decline decreases and eventually stabilizes (rate of decline = 0) and/or recovers over a specified period of time (TBD) by geography	Groundwater levels were generally considered the most important indicator.
Magnitude of decline does not exceed some groundwater elevation or level in a particular geography [from some start year X and measurement year Y]	Groundwater levels were generally considered the most important indicator. "Magnitude" depends a lot on which year you measure from (the age of the well and its depth will matter a lot).
Magnitude of decline does not exceed some groundwater elevation or level in a particular well [from some start year X and measurement year Y]	
Prevalence and effect of "comingling" wells on groundwater quantity/movement of groundwater is understood and minimized	
Recharge to groundwater is maximized	
Groundwater Use/Users	

Groundwater pumping stays within authorized and "sustainable" limits within a particular geography (direct and indirect measurements)	
Groundwater pumping and use stays within authorized limits (rate and duty) for all groundwater right holders	
Permitted groundwater use is monitored and enforced	
Groundwater pumping and use stays within reasonable limits for all exempt users (domestic, stockwater, commercial and industrial)	
All groundwater use is monitored and enforced	
Near-term and long-term impacts to exempt (domestic and stockwater) wells are understood and minimized	Propose to discuss further
Exempt groundwater users (specifically domestic and stockwater users) have long-term water security	Propose to discuss further
Municipal and non-municipal community water systems have long-term water security	
The footprint of groundwater irrigated agriculture is "sustainably" maximized relative to available supplies in different geographies	
There is no unauthorized or illegal water use in the basin	
Additional development of the undeveloped portion of groundwater rights is limited	
Transfers of groundwater rights limit or prevent effects on existing uses and users	
Environment and Recreation	
Near-term and long-term impacts of groundwater declines on spring discharge are understood and minimized	Propose to discuss further
Near-term and long-term impacts of groundwater declines on groundwater contributions to streams are understood and minimized	Propose to discuss further
Groundwater dependent ecosystems are protected, restored, and maintained over the long-term	Propose to discuss further
The relationship between groundwater levels and overall ecological health is understood and groundwater is managed to maintain ecological health	What aspects of ecological health are specifically tied to groundwater?
The relationship between groundwater management and thriving bird and wildlife habitats and populations is understood and managed effectively	What aspects of bird and wildlife habitats are specifically tied to groundwater?
~~Vibrant opportunities to hunt and fish are maintained~~	~~May be more closely tied to surface water~~
~~A thriving recreation economy is maintained~~	~~May be more closely tied to surface water~~
Groundwater Conditions/Quality	
Groundwater quality and its relationship with groundwater levels and depth to groundwater is better understood across the basin	
Groundwater quality does not deteriorate further due to groundwater level declines	
Domestic users have access to information and resources to ensure their drinking water is safe for consumption	

Thermal properties of groundwater are not negatively affected by groundwater declines	
Abandoned and poorly constructed wells are identified and addressed to reduce impacts to groundwater quality (including potential for comingling)	
Economy and Community	
Near-term economic disasters are avoided in the near-term	
Facilitation of an economic transition that achieves long-term economic stability is prioritized	
Near-term and long-term impacts to the local economy are minimized	
Impacts to small businesses are minimized	
Impacts on payroll and tax revenue are minimized	
Community cohesion and wellbeing are maintained	
Cultural heritage and values are maintained and enhanced	
Opportunities for future economic development are not inadvertently prevented or foreclosed	
System Dynamics Affecting Success	
Impacts of management actions within and between different geographies (how actions in one area have the potential to affect another area) are understood and accounted for	
Lag time of management actions on outcomes (when we "observe" impacts) is understood and accounted for	
Upland management and impacts to water budget (recharge and discharge) are understood and accounted for	
Changes in climate and impacts on water budget (recharge and discharge) are understood and accounted for	
Larger economic drivers of change (state, regional, national, international) are identified and considered	
Surface water management impacts to groundwater recharge are understood and accounted for	
The effects of population change on groundwater management	
Process Indicators	
Decisions about groundwater management are made holistically, considering the social, economic, and environmental tradeoffs	
The community and public are invited and involved in decisions that affect them	
Decisions provide some degree of stability and security for all affected users	
Benefits and burdens are equitably distributed across all groundwater users	
There is public process for water rights transactions in the basin that might affect existing users (e.g., transfers)	
Public welfare, health, and safety are protected	
The interests of future generations are considered and protected	

Appendix B: Monitoring and Measuring Success - Groundwater Levels

Groundwater Levels (Rate and Magnitude of Change)

Dataset(s)

- OWRD groundwater level measurements (maintained in the OWRD Groundwater Information System).
- Groundwater level measurements submitted to the Department (maintained in the OWRD Groundwater Information System).

DRAFT High-Level Indicator(s) of Success

- Rate of decline decreases and eventually stabilizes (rate of decline = 0) and/or recovers over a specified period of time (TBD) by geography.
- Magnitude of decline does not exceed some groundwater elevation or level in a particular geography.

Use Cases and Considerations

- Groundwater level data (rate and magnitude of change) will be the primary indicator of whether management objectives are being achieved.
- Groundwater level data may be used to curtail water use in individual wells that have exceeded decline conditions set in their permit.

Background

- OWRD maintains a groundwater level monitoring network, which currently includes 93 wells (22 dedicated observation wells with recorders and 71 wells primarily used for other purposes that are measured on a quarterly basis). See maps.
- There are ~301 water rights that are currently conditioned to require annual groundwater level measurements, which are taken in the spring. See maps.
- OWRD has provided a summary of groundwater level trends, including the wells used for the analysis and considerations when performing the analysis. See memo.

Actions

- Consult with OWRD to generate answers to outstanding questions.
- OWRD will share the results of the groundwater level trends analysis performed with only the wells in the OWRD monitoring network.

Options

Data Included in Analyses	**Option A.** Use all available data (where quality can be ensured by OWRD) and find opportunities to expand available data **Option B.** Use the existing OWRD monitoring network data and permit condition spring groundwater level measurements (potential to identify and fill gaps) **Option C.** Use the existing OWRD monitoring network data (potential to identify and fill gaps)

	Option D. Identify a set of "sentinel" wells to use in each subarea **Option E.** Other options?
Summary Statistics	**Option A.** All wells analyzed achieve a defined metric **Option B.** Some wells analyzed achieve a defined metric **Option C.** A mean or average of the wells analyzed achieve a defined metric **Option D.** A median of wells analyzed achieve a defined metric **Option E.** A median of wells analyzed achieve a defined metric and there are additional considerations for "anomalies" or "outliers" in the analysis **Option F.** Other options?
Frequency of Analysis	**Option A.** Analyses performed and reported on an annual basis **Option B.** Analyses performed and reported every three years **Option C.** Analyses performed and reported every five years **Option D.** Other options?

Data Collection

Additional Considerations and Questions (10/28 Discussion Group)

- Different wells have helped OWRD answer different questions.
- "More data is better" generally speaking to account for variability across the basin.
- Find and discuss opportunities to expand the monitoring network now and over time.
- Including non-state entities in data collection will increase involvement and improve trust.
- If investments are made in data collection, it should be ensured that the data will be trusted and used by OWRD. Data needs to be credible with the State.
- The Department maintains a list of qualified professionals to measure groundwater levels.
- Well locations need to be "representative" both horizontally (across the basin) and vertically (at different depths).
- There is a need to be honest about the ability to sustain the monitoring network over time. What is a realistic expectation for the size of the monitoring network and how it might change over time?
- Data used for decision-making should be publicly available and accessible. There is a desire to make data *more* accessible (use of the groundwater mapping tool has been appreciated).
- What would it take for groundwater levels at every point of appropriation to be measured?
- There are likely subarea specific considerations for monitoring. Some subareas are more likely to have "anomalies" or "deviations" than other areas.
- Even if a well that has been monitored via spring groundwater level measurements is no longer used there should be an effort to maintain the record.
- Are there more opportunities for citizen science? Can individuals be trained and certified to measure groundwater levels?
- Is there technology available that would allow for these measurements to be made and automatically reported continuously?
- OWRD has a need to continuously assess and adjust its capacity to support statewide work and work in each basin (future capacity to support monitoring is not assured).

Table 1. Data Collection Questions and Responses

Data Collection Questions	DRAFT Responses
What is OWRD's current groundwater level monitoring network?	See maps provided by OWRD. OWRD currently has 93 wells in its monitoring network.
What are the gaps in the existing network?	Further discussion needed. Inquire with OWRD to identify if there are horizontal and vertical gaps in water level data.
What are the considerations for well selection (inclusion/exclusion criteria)?	Document inclusion/exclusion criteria for well selection.
What are OWRD's authorities/limitations for measuring groundwater levels in wells or requiring groundwater level measurements?	OWRD does not have authority to perform groundwater level measurements on private property without landowner permission.
Are there opportunities to expand the monitoring network beyond the existing network? How would this be accomplished?	Discuss further with OWRD.
How should the different well depths be accounted for in the monitoring network?	This need may vary by subarea. Inquire with OWRD to identify if the different depths are accounted for and if there are any gaps.
What is the optimal monitoring network for each geography/subarea?	Facilitate subarea specific discussion and capture subarea specific considerations.
Should data from all wells be included in an analysis or data from a subset of wells (e.g., "sentinel wells" or "representative" monitoring sites)?	Including all of the wells captures greater variability across the basin. The number of wells and what wells are included affects the summary statistics. General preference stated to include all available data (OWRD monitoring network plus permit condition measurements).
How can we ensure that the monitoring network is sufficiently representative?	This may benefit from further discussion.
Under what conditions would a well be dropped from the monitoring network?	A well might be dropped for numerous reasons that will be documented along with the inclusion/exclusion criteria (see above).
How can the monitoring network be adapted over time to make sure monitoring leads to effective management?	Discuss further with OWRD.
How many wells currently require spring groundwater level measurements?	301 groundwater rights holders are required to measure and report groundwater levels on an annual basis each spring.
Can groundwater users be required to submit groundwater level measurements each spring even if they do not have it as a permit condition?	OWRD does not currently have authority to require groundwater level measurements.
How will data quality be ensured?	This depends on who collects the data. OWRD will follow its established protocols to ensure data quality. For data submitted by an external entity, OWRD reviews the data to ensure quality as capacity allows.

Table 2. Groundwater Level Measurement Data Collection

	OWRD Quarterly Measurements	OWRD Continuous Monitoring	Permit Condition Spring Groundwater Level Measurements
Overview	Wells primarily used for other purposes (irrigation, domestic, stockwater, other) that are measured by OWRD on a quarterly basis as a part of ongoing monitoring	Wells used for the specific purpose of monitoring groundwater levels and not used for other purposes	Wells with permit conditions requiring annual measurements
Who collects?	OWRD	OWRD	Certified water professionals (CWREs, PEs, RGs)
Who is responsible for quality assurance?	OWRD	OWRD	Certified water professionals (CWREs, PEs, RGs)
Number of wells monitored/measured?	71	22	301
Frequency of measurements?	Quarterly	Continuous (data collected continuously and uploaded quarterly)	Once per year in the spring
Where is data stored?	OWRD Groundwater Information System (uploaded quarterly)	OWRD Groundwater Information System (uploaded quarterly)	Data is transmitted to OWRD to store in the Groundwater Information System (uploaded annually)
How is data quality ensured?	OWRD ensures data quality by following established USGS protocols and best practices	OWRD ensures data quality by following established USGS protocols and best practices	Data quality is the responsibility of the individual collecting and transmitting the data - OWRD reviews data as capacity allows

Data Analysis

Additional Considerations and Questions (10/28 Discussion Group)

- Use all available data to increase the ability to monitor and understand variability across the basin.
- For analyzing year on year change, it makes sense to use spring groundwater level measurements. Quarterly measurements allow for a better understanding of potential interference.
- If there is a slow run-off year (late thaw) is there a way to account for that?

- Use all available groundwater level measurements to capture variability across the basin.
- Ensure transparency of what wells are and are not included in analysis, along with the rationale.
- Include the depth of the well and group wells in the same "layer" when performing an analysis. Develop a shared understanding of these different "layers" in each subarea for analysis purposes.
- Clarify the geographic areas to be analyzed. Will it follow the subarea boundaries? Some indicated that the subareas would be the right geography and some indicated that the subareas may be too big and the conditions might be too variable if the geographic area is big.
- For individuals performing analyses, experience and appreciation for the overall basin context is important to get a sense of what is consistent or inconsistent with past observations.
- "Anomalies" or "deviations" that are not included in the analysis or that may skew the results if they are included should be noted.
- Change in the groundwater rate of change should be monitored and reported, with a desire to achieve a set reduction in the rate of decline over a set period of time (*proposal*: achieve reduction in the rate of decline by 33% every 10 years until a rate of 0 ft/yr of decline is achieved around year 30).
- The methods for performing analysis should be documented along with any results and considerations for interpreting results.

Table 3. Data analysis questions and responses

Data Analysis Questions	**DRAFT Responses**
How often should data be analysed?	Various timesteps have been discussed, including 1, 3, and 5 years. This may be presented as options for consideration by the RAC (see above).
What summary statistics should be used? All or some wells show a particular result, the mean of all wells show a particular result, the median shows a particular result, or some variation.	This may be presented as options for consideration by the RAC (see above).
When calculating "rate of change" how much data is necessary to make this determination over time?	Discuss further with OWRD.
When calculating "magnitude of change" what starting point should be used?	Discuss further with OWRD.
What time period should be used to assess whether groundwater levels in a well or geography are "stable" (e.g., 3 years, 5 years, 10 years)?	Discuss further with OWRD.
How should the different well depths be accounted for in the analysis?	Discuss further with OWRD.
Is it possible to set a groundwater level that cannot be exceeded in a particular geography? A particular well?	Some permit conditions limit the overall amount of decline that is allowed for a particular water right.
Is it possible to actively measure the impacts that current and future groundwater levels have on groundwater dependent ecosystems and exempt users (e.g., the relationship between these indicators)?	Discuss further with OWRD.

Reporting and Communication

Additional Considerations and Questions (10/28 Discussion Group)

- In order to effectively inform ongoing management it would be helpful if analyses were performed and reported on an annual basis.
- Providing opportunities for discussion with/within the community to understand the results and their implications would be helpful on an annual basis.
- Reports should be made publicly available by OWRD and shared with partners.

Table 4. Reporting and communication questions and responses

Reporting and Communication Questions	DRAFT Responses
When and how should analysis of data be publicly communicated?	This may be presented as options for consideration by the RAC (see above).

Adaptive Management

Additional Considerations and Questions (10/28 Discussion Group)

- Consider the potential to refer to a monitoring, adaptive management, or resource management plan in rule rather than including specifics that might need to change over time (see DSL examples).
- Groundwater level data is a critical indicator of success that will inform ongoing adaptive management at predetermined timesteps.

Table 5. Adaptive management questions and responses

Adaptive Management Questions	DRAFT Responses
At what frequency should analyses be used to assess progress and inform potential adjustments?	Further discussion required.
What are the mechanisms to change management actions based on monitoring results?	Further discussion required.

Rules

Additional Considerations and Questions (10/28

- Consider the right amount of information to include in rule that provides sufficient structure but also allows for adaptation.
- Consider the potential to refer to a monitoring or adaptive management plan in rule rather than including specifics that might need to change over time (see DSL examples).

Table 6. Rule language questions and responses

Rule Language Questions	DRAFT Responses
What level of specificity needs to be captured in rule with regards to specifying the approach to monitoring?	Discuss further with OWRD.
How is groundwater level monitoring handled in other rules and other basins?	Discuss further with OWRD.

Appendix C: Monitoring and Measuring Success – Groundwater Pumping/Use

Groundwater Pumping and Use

Dataset(s)

- Reported groundwater pumping from flowmeters or other in situ measurement devices
- OpenET (estimated evapotranspiration using satellite imagery).
- Metered electricity usage

DRAFT High-Level Indicator(s) of Success:

- Groundwater pumping levels stay within authorized/"sustainable" limits within a geography.
- Individual groundwater use does not exceed allowable limits.
- No illegal or unauthorized use of groundwater is allowed to occur.

Use Cases and Considerations

- The relationship between groundwater pumping and use and changes in groundwater levels will inform what amount of groundwater use can be sustained while achieving the management objectives.
- Increasing accuracy of these assessments will improve the effectiveness of management actions over time.
- Measuring groundwater use can also improve individual management and be used to ensure that groundwater users do not use more than their legally entitled amount.

Background

- OWRD has authority under ORS 540.435 to require measurement and reporting and the RAC has discussed and reached a preliminary recommendation to delineate the boundary for this requirement to the entire Harney Basin (known as a Serious Water Management Problem Area).
- Acceptable methods for collecting water use data are specified in OAR 690-085-0015.
- The Division 512 rules may specify who is required to install measuring devices, specifications for the types of measuring devices and annual reports, and timelines for implementation (see OAR 690-085-0020).

Actions

- Perform an analysis at a field scale (and potentially other scales) that compares results of the different potential datasets (volunteer from the Donner Und Blitzen).
- Identify relative accuracy (margin of error) for the three potential datasets and identify ways to increase accuracy.
- Consult with OWRD to generate responses to outstanding questions.
- Consult with OWRD to understand the extent of cost-share that can be offered for measurement devices (especially as it relates to system changes).

Options

Datasets Allowed/Used	**Option 1.** Only measured and reported groundwater pumping (using flowmeters) is used by OWRD to estimate groundwater use. **Option 2.** Only OpenET is used by OWRD to estimate groundwater use. **Option 3.** Some combination of data sets (reported pumping, OpenET, electricity usage) is used by OWRD to estimate groundwater use. **Option 4.** Another option?
Geographic Extent (Basin-wide authority	**Option 1.** There is basin-wide authority to require measurement and reporting and all subareas are required to measure and report groundwater pumping. **Option 2.** There is basin-wide authority to require measurement and reporting, but only some subareas are currently required to measure and report groundwater. **Option 3.** Another option?
Included Water Users	**Option 1.** All groundwater users are required to measure and report groundwater use (including permit exempt groundwater uses). **Option 2.** All permitted groundwater users are required to measure and report groundwater use (excluding permit exempt groundwater use). **Option 3.** Who is required to measure and report groundwater use varies by subarea depending on severity of declines. **Option 4.** Other options?
Sequencing of Implementation	**Informed by above options** **Option 1.** Users required to measure and report groundwater use have one year to implement the requirement. **Option 2.** Users required to measure and report groundwater pumping have differing times by subarea to implement the requirement (timeline to implement varies by subarea). **Option 3.** Measurement and reporting of groundwater pumping varies by subarea and is assessed in an ongoing manner to determine the value and necessity of this data compared to other currently available data. **Option 4.** Other options?
Implementation Considerations	Other options might consider the following: ● Uniformity of measurement devices. ● Level of specificity for certifying/calibrating measurement devices. ● Potential prioritization of cost-share measurement. ● Alternative options to measure and report use if a flowmeter continues to fail. ● Opportunities for technology improvements.

Data Collection

Additional Considerations and Questions (10/28 Discussion Group)

- General
    - Data used for analysis should be accessible.

    - It makes sense to use multiple tools/data sources to verify groundwater pumping and use rather than just relying on one dataset.
    - We may come to find over time that one particular dataset performs better than the others depending on the specific use case.
    - The accuracy and margin of error should be assessed for each dataset.
    - Use existing data effectively before imposing new potentially onerous requirements. There should be confidence that the data is and will be used.
    - Could there be a tool online for groundwater users to estimate their groundwater use with existing data?
- Flow Measurement Devices
    - Is there a possibility to incentivize the use of uniform meters?
    - Pulse meters generally perform better than other measurement devices and should be encouraged/incentivized.
    - Non-intrusive flow meters need to be regularly calibrated.
    - Flow meters can pose challenges, especially with sand. Some landowners continuously have problems with flow meters that they cannot seem to resolve and there are concerns about what will happen if they cannot get a flow meter working.
    - Installing a flowmeter oftentimes requires larger system changes (it's not just just a matter of adding a flowmeter) that can be difficult and costly to implement. This should be considered and accounted for. It is especially difficult to justify the expense for this type of undertaking in the face of uncertainty.
    - Monitoring at the well can help identify what is being extracted from different depths whereas monitoring at the field identifies what water is being applied. There is a preference for understanding what is being extracted especially if it can be correlated to different depths.
    - Reporting of groundwater use can be inconsistent with a high likelihood for user error.
    - The same well/same meter may be simultaneously serving both junior and senior water rights. These complications need to be taken into consideration. For some wells, there may be fractional reductions in use.
    - There are questions and concerns about the reliability of reported water pumping data, especially for estimating groundwater use at scale. For some it makes more sense to use this data to verify/calibrate other tools rather than relying on it as the primary source of data.
    - If meters are required there needs to be some reassurances that the data will be used and useful. Measurement devices may require a significant investment of time and money (and headaches) and there is a desire to makes sure that it would be "worth it."
    - If someone has the high potential to be regulated off, it may not be worth the investment to add a measurement device. How will this be taken into consideration?
    - For some areas it may make sense to rely on existing data (power consumption, OpenET and reported pumping based on permit conditions) and make the best use of that data before requiring additional data.
    - Consider the need for groundwater measurement and reporting for each subareas. Some subareas may have a greater or more urgent need.
- Power Consumption

    - Use power consumption (kw/hr) as a potential backup to measurement devices and/or to verify usage.
    - It would be helpful to develop a correlation between kw/hrs and amount of water – this relationships could be established and tracked over time and may be an appropriate proxy.
    - Right now everyone gets their power bill and this could be widely used to estimate groundwater pumping. It makes sense to take a stepwise approach to requiring new data, first making the best use of the data we already have.
    - There may need to be well specific calculations/considerations if energy consumption is used.
- OpenET
    - There is a desire to understand and improve the accuracy of OpenET.
    - Using OpenET is easier than individual metering and the accuracy is comparable.
    - OpenET may be a more appropriate tool for assessing groundwater use at scale.
    - Pumping data can be used to improve the accuracy of OpenET over time.

Table 1. Data Collection Questions and Responses

Data Collection Questions	**DRAFT Responses**
How often should water use be measured and recorded by water users? How often should it be transmitted to the Department?	Right now where water measurement is required, it is recorded on a monthly basis and reported to the Department on an annual basis.
What are the requirements for individual water users? How will these requirements be enforced? What are the consequences of not meeting the requirements?	See Options above.
What happens if a water user is unable to consistently meet the requirements? Can there be any flexiblity?	Discuss further with OWRD.
What are the quality assurance/quality control measures for reported water use data?	Discuss further with OWRD.
What is the estimated investment associated with any requirement to measure water use?	Discuss further with local water professionals.
Can OpenET be used to estimate groundwater use and pumping in addition to or in lieu of measurements of groundwater pumping?	See Options above.
Will all water users (including exempt users) be required to measure and report their water use?	See Options above.
Will all geographies be required to measure and report their water use on the same timeline/timeframe? Will the same methods be required for each geography or will different methods be considered/allowed? Will certain areas be prioritized over other areas?	See Options above.
How can accuracy of OpenET be assessed and improved over time?	Discuss further with OWRD.

Analysis

Additional Considerations and Questions (10/28 Discussion Group)

- What are the strengths and weaknesses of using each of the datasets for analysis? What questions are each dataset good at answering?
- Compare the results of each dataset for a particular field as well as a defined geography.
- Perform analysis on an annual basis using all available datasets/tools to improve accuracy of estimates.
- What is the response time between groundwater use and groundwater levels? If use is reduced or recharge is increased how long until that shows up in groundwater levels?

Table 2. Data analysis questions and responses

Data Analysis Questions	DRAFT Responses
How does the Department propose to use reported groundwater use data for management purposes?	Further discussion needed.
How can groundwater pumping data be most useful and effective in analyses?	Further discussion needed.
What are the benefits and drawbacks of measured and reported groundwater use from individual users versus using a platform like OpenET or electricity usage?	Further discussion needed.

Reporting and Communication

Additional Considerations and Questions (10/28 Discussion Group)

- Support for monthly measurement with annual reporting under a regulatory framework (current approach for water rights with measurement and reporting permit conditions).
- There may be need for more frequent measurement and reporting under a Voluntary Agreement.
- When would the Department have data ready to share with the community?

Reporting and Communication Questions	DRAFT Responses
When and how should analysis of reported water use data be publicly communicated?	Further discussion needed.
When and how should analysis of reported water use data be publicly communicated?	Further discussion needed.
Will OWRD analyze and present OpenET data? At what frequency?	Discuss further with OWRD.

Adaptive Management

Additional Considerations and Questions (10/28 Discussion Group)

- Need to refine and improve tools over time to improve accuracy.
- For some areas it may make sense to rely on existing data (power consumption, OpenET and reported pumping based on permit conditions) and make the best use of that data before requiring additional data.

- Consider the need for groundwater measurement and reporting for each subareas. Some subareas may have a greater or more urgent need.

Adaptive Management Questions	DRAFT Responses
At what frequency should analyses be used to assess progress and inform potential adjustments?	Further discussion needed.
How can groundwater pumping and use data be used to inform management actions?	Further discussion needed.

Rule Language

Additional Considerations and Questions (10/28 Discussion Group)

- No considerations or questions raised.

Rule Language Questions	DRAFT Responses
What level of specificity needs to be captured in rule with regards to specifying water use measurement and reporting? How is this handled in other basins?	Look into lessons learned and best practices from the Umatilla and Walla Walla Basins.
How can tools like OpenET be incorporated into rules?	Further discussion needed.

Appendix D: Identifying and Managing for Risk and Uncertainty

Risk and Uncertainties in Groundwater Management

Table 1 below is designed to understand how some of the uncertainties in Harney groundwater management can be articulated in terms of risk. Not all uncertainties pose a risk. Risk is a probabilistic estimate of how likely an event or exposure will be (e.g., low, moderate, or high likelihood) and the impact of that event occurring.[1] As risk managers, one might pay attention to moderate and high likelihood events with significant impacts, but not worry as much about low likelihood and low impact events. Table 1 is intended to guide discussions around A) what are the risks that are most important to manage for, and B) are there approaches to reduce or manage for those risks. Table 2 is intended to guide discussions around uncertainties that, if they were reduced, could improve management actions but may not pose a risk. The risks and uncertainties are not prioritized in any way. Some of the indicators are relevant to the OWRD rulemaking, and some of them connect more broadly to groundwater management.

Table 1. Risk Matrix - Working

Risk	Likelihood	Impacts	Potential Management Actions to Reduce or Manage Risk	Monitoring and Thresholds for Action
The amount of necessary reductions in groundwater pumping are underestimated and more significant pumping reductions are needed	Moderate?	It takes longer to achieve reasonably stable groundwater levels which may negatively affect some exempt users and groundwater dependent ecosystems	Monitor groundwater level conditions and groundwater use Consider adjustments to permissible total withdrawals in subareas at established intervals (allow for a "ramp up")	
The amount of necessary reductions in groundwater pumping are overestimated in some places and pumping reductions are too aggressive	Moderate?	Negative economic ramifications to individuals and the local economy and community	Monitor groundwater level conditions and groundwater use Consider adjustments to permissible total withdrawals in	

[1] Available at https://web.pdx.edu/~rueterj/CCC/v7-Rueter-chap9.pdf.

Risk	Likelihood	Impacts	Potential Management Actions to Reduce or Manage Risk	Monitoring and Thresholds for Action
		Difficult to "undo" or "reverse" impacts	subareas at established intervals (create an "off ramp")	
The wells initially selected for the monitoring network are not sufficiently representative of conditions	Moderate?			
Fallowing irrigated acres without a transition plan in place can result in other environmental problems (weeds, reduced quantity and quality of habitat, erosion, dust, etc)	High?			
Declining groundwater levels continue to impact shallow exempt wells, including domestic and stockwater wells in some parts of the basin	High?		Understand the geographic distribution of impacts Estimate/track current and future impacts to domestic wells in each subarea	
Some parts of the basin do not stabilize or recover as quickly as other parts of the basin	High?			
Declining groundwater levels continue to impact springs and other groundwater fed ecosystems in some parts of the basin	High?			

Table 2. Uncertainty Matrix - Working

Uncertainty	Expected Condition	Potential Deviations	Impact(s) of Uncertainty	Information and Actions to Reduce Uncertainty
Factors affecting groundwater levels/supply in addition to pumping rates (precipitation/recharge, upland management, etc)				
Variability in precipitation patterns and the potential impacts to groundwater recharge over time	Precipitation patterns will not deviate significantly from historical patterns/averages	1. There is much more precipitation than average in the future 2. There is much less precipitation than average in the future	The amount of precipitation to the basin controls water available for groundwater recharge, and affects how much water is available for groundwater pumping	
Effect of upland management on surface water runoff and groundwater recharge in the near-term and long-term (effect of forest fires)				Monitor surface water flows over time (additional stream gauges?)
Effect of upland management on groundwater recharge in the near-term and long-term (juniper encroachment and management)				Monitor range and density of juniper over time

Uncertainty	Expected Condition	Potential Deviations	Impact(s) of Uncertainty	Information and Actions to Reduce Uncertainty
Effect of declining groundwater levels on native vegetation (phreatophytic communities)				
Effect of changing climate on groundwater use by crops				
Effect of changing climate on the growing season and types of crops				
Current and future extent of impacts to exempt wells				
Current and future extent of impacts to springs and other groundwater fed ecosystems				