Greater Harney Valley – Groundwater Study Advisory Committee Meeting
Thursday, January 18, 2018
10:00am – 4:00pm
Harney County Community Center – 484 Broadway St., Burns, OR

January 18, 2018 - Meeting Summary

Participants

Advisory Committee Members
Zach Freed (sitting in for Allison Aldous), The Nature Conservancy
~~Angie Ketscher, Citizen/Landowner (not present)~~
Brandon Haslick, Burns Paiute Tribe
Brenda Smith, High Desert Partnership
Erin Maupin, Citizen/Landowner
Fred Otley, Citizen/Landowner
~~Herb Vloedman, Citizen/Landowner (not present)~~
Carey Goss (sitting in for Gary Ball), US Fish and Wildlife Services
JR Johnson, OWRD
Karen Moon, Harney County Watershed Council
Mark Owens, County Commission and Landowner
Steve Rickman, Landowner/Business Owner
~~Tony Hackett, Downright Drilling (not present)~~
~~Wayne Evans, Citizen/Landowner (not present)~~

Groundwater Study Team
Darrick Boschmann, OWRD
Jerry Grondin, OWRD
Justin Iverson, OWRD
~~Halley Barnett, OWRD~~
Steve Gingerich, USGS
Hank Johnson, USGS
~~Esther Pischel, USGS (not present)~~
Amanda Garcia, USGS (not present)
~~Nick Dosch, USGS (not present)~~

Others
Harmony Burright, OWRD (Facilitator)
Jason Spriet, OWRD

Meeting Overview, Action Items, Recommendations, and Updates

The purpose of this meeting was to learn about key components of the groundwater study, provide updates on activities since the last Advisory Committee meeting, and brief the Committee on upcoming activities. Fred Otley, a Groundwater Study Advisory Committee member delivered a presentation on factors affecting capture, storage, and recharge of water in the Donner Und Blitzen watershed with a focus on Steens Mountain. During the work session, OWRD and USGS updated the Committee on activities since October as well as upcoming activities. OWRD provided an overview of key hydrogeological terms, which was followed by a demonstration by USGS using a sand box model of a groundwater system. USGS delivered a presentation on the road map to developing a water budget, including methods for estimating inflow.

Figure 1 and 2. Reviewing groundwater concepts.

Action Items

Who	What	When
Justin I	Respond to Mark's request to get an updated water budget to the community for consideration in planning efforts	April 17
Justin I	Distribute water measurement cost share information to the Advisory Committee	April 17
Harmony B	Send out a link to USGS's glossary describing key hydrogeological terms, OWRD's online groundwater system, and USGS's groundwater level mapper	March 20
Fred O	Send the Bear Valley Study to OWRD and USGS and follow-up with its author to see if she could present at a future meeting	March 20
OWRD and USGS	Work on a brief handout describing methods to estimate ET	April 17
Advisory Committee	Members of the Advisory Committee will think of information/feedback they would like to share with the Water Resources Commission at their June meeting	May 20
Harmony B, Karen M, Angie K, and Halley B	Work on a brief handout describing the groundwater study	Outstanding
Harmony B and Karen M	Update the Harney County Watershed Council website with Groundwater Study information	Outstanding
Harmony B, Karen M and Angie K	Develop a draft outreach strategy for the Advisory Committee to consider at a future meeting	Outstanding
Mark O	Convene additional meetings of the sub-committee to continue working on local monitoring efforts	Ongoing

Decisions/Recommendations

- None

Proposed Future Discussions

- Placing methods in context – understanding what methods are available, what methods have been used in the past, where advances have been made, and where the best available method is being used (incorporate into future presentations/discussions to the extent practical)
- Uncertainty in estimates – describing the level of certainty or confidence associated with different methods/estimates to help put the information in context (incorporate into future presentations/discussions to the extent practical)
- Vegetation management and how it is incorporated into estimates and the model (how is the study accounting for the impact of juniper and overstocked forests on water supply)?

Updates

The next meeting is scheduled for Tuesday, April 17 from 10am - 4pm at the Harney County Community Center. The chair (Mark Owens) and facilitator (Harmony Burright) will develop and distribute an agenda for review prior to the next meeting. If you would like to propose discussion topics, email them to: harmony.s.burright@wrd.state.or.us.

Detailed Meeting Notes

PRESENTATION

The meeting began with a 1 hour community presentation, followed by an opportunity for members of the public to make comments for the Advisory Committee to consider during their meeting.

Fred Otley, a local landowner and rancher whose family has worked the land in the Donner Und Blitzen watershed since the late 1800s, delivered a presentation on what he has observed during 30+ years of traveling and photographing the same transect up Steens Mountain. He has collected thousands of photographs that show the upstream and downstream conditions every 200 feet over 30+ years, as well as photographs at key monitoring sites. During this time he has made observations about factors affecting the capture, storage, and recharge of water in the watershed that he shared with the group. Some of his key observations are:

- The watershed is a disturbance driven system that responds to floods, fires, snow events, wildlife interactions, etc.
- Factors affecting capture, storage, and recharge include:
    - Local geology
    - Stream morphology (the shape of river channels and how they change in shape and direction over time)
    - Vegetation management activities (e.g., juniper and forest stand density)
    - Wildlife interaction with the environment (e.g., beavers)
    - Snow accumulation on key landscape features
- Over time juniper encroachment has intensified as a result of fire suppression and forests are becoming overstocked. This vegetation intercepts precipitation and snow and also contributes to increased evapotranspiration.
- There are areas that are likely recharge zones, including areas with a rocky surface area and healthy plant communities, losing reaches in streams, as well as fractures in canyon areas.
- Allowing streams and rivers to access their floodplains helps to increase recharge. Flood irrigation and ponds help to slow the water down and allow it to percolate.
- Over time the population of beavers have changed, which has in turn changed the shape of the streams. The introduction/increase of cougars has led to predation of beavers.

Key Discussion Topics/Questions:

- Density of juniper in some of the areas displayed in the photographs and how much water each juniper tree uses.
    - Fred estimates that there are 100-200 stems per acre and that each tree uses 25 gallons per day.
- Springs that have stopped running and then started running again.

- Fred has observed some springs come and go – the cold water springs are the most persistent and have the most consistent flows. Other springs that are wet weather springs can fluctuate and are more dependent on precipitation in any given year.

Decisions Points/Recommendations: None

Action Items: None

Proposed Future Discussion Topics: None

PROJECT MANAGEMENT UPDATES

OWRD will be presenting an update to the Water Resources Commission at their June meeting on the Basin Program Rules (512 Rules), the Groundwater Study, and the Groundwater Study Advisory Committee. Committee members are welcome to attend this meeting. If committee members cannot attend they are encouraged to share their thoughts in writing that can be incorporated into a presentation to the Commission. Mark, Angie, and Steve will likely travel to the Commission meeting.

Decisions Points/Recommendations: None

Action Items:

- Members of the Advisory Committee will think of information/feedback they would like to share with the Water Resources Commission at their June meeting.
- Harmony will send information to Advisory Committee members on date/time.

Proposed Future Discussion Topics: None

HYDROGEOLOGIC TERMS AND CONCEPTS

Jerry Grondin (OWRD) provided a brief overview of key hydrogeologic terms and concepts that were brought up at the last Advisory Committee meeting. The presentation is available here. Jerry began by describing Darcy's Law, which is an equation that describes groundwater flow through a porous aquifer. Darcy found that water flows from high elevation to low elevation and from high pressure to low pressure (taken together from high "head" to low "head"). Gradients in potential energy ("head") drive groundwater flow. The law is very similar to Ohm's law for electrical curcuits I = 1/R * U (current = voltage divided by resistance).

The key terms Jerry described are as follows:

- **Total Hydraulic Head** – The total height of water in a well above a datum; it is a combination of elevation head (height due to elevation) and pressure head (height due to pressure).
- **Hydraulic Gradient** - Change in total head per unit distance measured (can also be understood as "slope" – groundwater will flow downhill and towards lower pressure).

- **Hydraulic Conductivity** - Describes how easily groundwater flows through a particular type of rock or soil. If the hydraulic conductivity is low (K is small): The material has less capacity to transmit water and a larger hydraulic gradient is needed to move the same volume of water. If the hydraulic conductivity is high (K is large) then the material has more capacity to transmit water and a smaller hydraulic gradient is needed to move the same volume of water.
- **Groundwater Level Contours (Hydraulic Head Contour Line / Equipotential Line)** - A line on a map or a cross-section along which the total heads are the same. Used to visualize the hydraulic gradient and groundwater flow paths.
- **Hydraulic Connectivity** - From a hydrologic science perspective, hydraulic connectivity refers to the connection between water within different parts of a hydrologic system and the ability of water to communicate via movement and/or pressure response from one part of the system to another. It includes the vertical and horizontal connection between water within different geologic units in the subsurface, and it includes the connection between water at the surface (lakes, streams, etc.) and water within the sub-surface. The connection and mobility can range from very efficient to poorly efficient. In the sub-surface, water is generally mobile and moves from areas of recharge to areas of discharge. Known cases of water being static (no movement) or completely isolated is very limited. From an Oregon legal perspective, hydraulic connectivity is defined in Oregon Revised Statutes (ORS 537.505–ORS 537.795) and Oregon Administrative Rule (OAR 690-008--OAR 690-009). The OWRD-USGS Harney Basin Groundwater Investigation uses hydraulic connectivity from a strictly science perspective.

Definitions of hydrologic terms can be found in the USGS Glossary of Hydrologic Terms at: https://or.water.usgs.gov/projs_dir/willgw/glossary.html.

The Study Team brought a sandbox groundwater sandbox model to demonstrate some of the principles. A brief demonstration of this model can be viewed online (note that this video was not produced by the Groundwater Study Team, it is someone from the internet demonstrating the model): https://www.youtube.com/watch?v=T8HZvfKgZOg.

Decisions Points/Recommendations: None

Action Items:

- OWRD will send the USGS Glossary link to the mailing list.

Proposed Future Discussion Topics: na

OWRD Technical Updates

Jerry Grondin and Darrick Boschmann with OWRD updated the Committee on activities they have accomplished since October as well as upcoming activities, including:

- **Synoptic** – The fall synoptic was done in late October-early November. The spring synoptic will occur in late February-early March (250 wells). For groundwater studies it is standard practice to

get two synoptic measurements (one in spring and one in fall) – meant to show a snapshot of hydraulic head over a large area (to create a contour map), but is not meant for tracking groundwater levels over time. For this study OWRD was able to do synoptic measurements over three years (6 total events), which is much more than a typical study. This spring synoptic is the last synoptic. OWRD will select a representative number of wells (~80) to continue measuring on a quarterly basis. Quarterly monitoring is meant to show long-term trends in the data.

  - **Question – What are the criteria for selecting representative wells?** If wells in the same area are showing the same thing, pick a representative well from that collection of wells. Need to consider staff capacity (time management) as well as access issues. Have spent significant resources on water level measurements over the past few years and need to allocate additional resources to analysis or other aspects of the study.

- **Well Elevation** – A priority for the Study Team is to confirm the elevation of wells. Some wells are using 1929 datum, some wells are using 1988 datum. Elevation can vary from 1-6 feet. Need consistent datum for plotting out data. In some areas water levels are very flat and a difference in elevation is important to understanding flow direction. The Study Team wants to have a consistent elevation to interpret flow directions in areas with a flat gradient. Proposing to use a GPS unit with a base station, which can measure elevation within an inch.
- **Characterize Aquifers/Aquifer Properties** – Using existing information (well logs, aquifer tests, etc) and collecting additional information (well cuttings, additional aquifer tests, etc) to characterize different geologic materials and their ability to store and transmit water.
- **Geologic Map Compilation** – Compiling information from multiple sources into basin-wide maps that will be available in the next few months. This compilation map will provide information on hydrostratigraphic units. Some of the ongoing studies that support this work are as follows:
  - DOGAMI map of the Harney Quad (discussed at the last meeting).
  - PSU student mapping unit north of Harney QUAD.
  - Additional mapping in the Crane area by DOGAMI to better understand the stratigraphy of rock units.
- **Groundwater Data System** – OWRD is in the process of updating its groundwater data system. It is restructured and available online. This is a new way to access groundwater data, including well log data, well locations, and water level data. This tool is available at: http://apps.wrd.state.or.us/apps/gw/gw_info/gw_info_report/Default.aspx.
- **Observation Wells** – OWRD has put out a bid to drill an observation well at the Agricultural Research Station. Looking at three wells – shallow, intermediate, and deep wells. The wells will likely be drilled later in the summer.
  - **Question** – **How do you determine how deep to drill the shallow well?** Drill until the well makes water – case and seal there. Expecting to make water at ~30 feet.

Decisions Points/Recommendations: None

Action Items:

- OWRD will send a link to the updated Groundwater Data System to the mailing list.

Proposed Future Discussion Topics: na

USGS TECHNICAL UPDATES

Hank Johnson and Steve Gingerich with the USGS updated the Committee on activities they have accomplished since July as well as upcoming activities, including:

- **Water Elevation** - USGS is helping OWRD get accurate water elevations – this is especially important where the water tables appear to be flat – Virginia Valley is one area where water tables appear to be flat.
- **Geochemistry** - Continuing to collect and analyze stable isotopes and may be able to present as early as April with preliminary observations. Samples from around Crane, Steens, and Warm Springs. These isotopic analyses are helpful for understanding where water came from and where it is going. Tritium can be used as a fingerprint that tells us the age of the water and where it came from.
- **Upcoming –** USGS is planning their summer field season. The budget includes money for tracer work as well as carbon dating of water (older water).
    - Fred Otley offered up his well to the USGS for sampling.
    - **Question – Have you identified data holes and gaps and what do you do about that?** OWRD and USGS are continually having conversations about the data that is being collected and where the study might need additional information. OWRD is focused on water level data and subsurface geology. OWRD has located additional wells to fill in holes and Angie (with the Watershed Council) has collected data from additional areas is beneficial. USGS is focused on water chemistry and the water budget. DEQ's monitoring will add additional information. It is an iterative process and will continue even into analysis – continual assessments and conversations about what the Study Team is seeing and what additional data/information is needed. In some instances the Study Geam may be able to collect that information through this study – in some instances it may need to be tackled in a future study – all depends on time and resources.
- **Groundwater Level Map** – USGS has been developing an interactive groundwater level mapper (online tool to view groundwater level data). This is now available online: https://or.water.usgs.gov/projs_dir/harney_gw/.
- Amanda Garcia has been working on developing the water budget and delivered a presentation on how a basin water budget can be developed using different methodologies (see below).

Decisions Points/Recommendations: None

Action Items:

- OWRD will send a link to the Groundwater Level Mapper to the mailing list.

Proposed Future Discussion Topics:

- Steps and methods to develop a water budget

ROAD MAP TO A WATER BUDGET

- Amanda Garcia with the USGS delivered a presentation describing a "road map" to developing a basin-wide water budget. The presentation can be found here.
    - A basin-wide water budget is developed by looking at the inflow to the basin, the outflow, and changes in storage.
        - The primary source of inflow is precipitation. A secondary source is of inflow is from irrigation. Inter-basin flow is also a potential source of inflow.
        - The primary sources of outflow are evapotranspiration (from native vegetation and crops) as well as discharge to springs and rivers. Other consumptive uses (e.g., domestic and stockwater use) can account for outflow. Inter-basin flow is also a potential source of outflow.
        - Storage change can be observed through groundwater level changes and lake volume changes.
    - The USGS is proposing to use different methods to understand different components of the water budget. Amanda provided an overview of the methods and inputs that will go into each component of the water budget and focused on the methods for estimating inflow.
- **Discussion**:
    - Mark Owens, the Advisory Committee chair requested to see an updated estimate of recharge as soon as possible to inform basin-wide planning efforts. Justin Iverson agreed to follow-up with USGS to determine when this information might be available to share with the Advisory Committee. This was flagged as an action item.
    - Several Advisory Committee members were very interested in the impacts of forest and juniper density on water consumption in the uplands – they want to make sure this is accounted for in the water budget. USGS indicated that they are looking at the research and will include it in the estimates. The model may be used to look at how altering stand density affects the water budget. This was flagged for future discussion.
    - An advisory committee member wondered at the confidence interval/margin of error on ET estimates. Amanda informed the group that the margin of error would be provided with the ET estimates. This was flagged as a future discussion topic.
    - A member of the public wondered if the methods used to estimate different components of the water budget are the best available methods. For future presentations and discussions they noted it would be helpful if OWRD and USGS provided context on the available methods, what methods have been used in the past, and where the Study Team is using the best available method. This was flagged for future discussion.

Decisions Points/Recommendations: None

Action Items:

- OWRD will respond to Mark's request to get an updated estimate of recharge for consideration in planning efforts.

Proposed Future Discussion Topics:

- Placing methods in context – understanding what methods are available, what methods have been used in the past, where advances have been made, and where the best available method is being used (incorporate into future presentations/discussions to the extent practical)
- Uncertainty in estimates – describing the level of certainty or confidence associated with different methods/estimates to help put the information in context (incorporate into future presentations/discussions to the extent practical)
- Vegetation management and how it is incorporated into estimates and the model (how is the study accounting for the impact of juniper and overstocked forests on water supply)?

PARTNER UPDATES

- **Community Based Water Planning (CBWP)** – The meeting of the full Community Based Water Planning collaborative was held on January 17. At this meeting Mark discussed the potential that recommendations from the Community Based Water Planning effort would be an input into future rulemaking.
- **Sure Tap Springs – Drip Irrigation** – Jay Nelson with Suretap Springs provided pamphlets on mobile drip irrigation. Four pivots have been upgraded to drip near Weaver Springs reducing water from 900 gallons per minute to 475 gallons per minute. They have already seen energy savings and increased yield. Overall it requires less water to grow more hay. AgSense donated products to collect data on soil moisture – including 40'' probes. Jay is interested in collecting additional information about crop water needs and irrigation technologies that can grow the highest quality product with the least amount of water. Jay and others in the basin would like to see state support for conversion programs that can help to stabilize water levels and bring them back up over time.

Decisions Points/Recommendations: None

Action Items: None

Proposed Future Discussion Topics:

- Regular check-ins on other monitoring/data collection efforts.

DISCUSSION ON OUTLIERS AND ANOMALIES

At past meetings members of the Advisory Committee expressed interest in learning more about what OWRD and USGS consider to be anomalies/outliers and how they are considered in the study. Jerry Grondin with OWRD provided a brief overview to the group on how this information is used in the study:

- All available data will be gathered and analyzed
- Data identified as differing and/or unique will be explained/interpreted in the context of other available overlapping or adjacent data, or identified as a subject for future study and explanation

Each member of the Advisory Committee and Study Team were invited to reflect on what these terms mean and why they are important. The group shared the following observations/reflections:

- What is the definition of an outlier? How do you determine if something is an outlier? Something that doesn't fit with what all we're seeing.
- There are different types of outliers, all of which have different values and should be treated differently. Important to identify what type of outlier you're working with because that will determine how you treat it in your analysis.
    - Statistical outliers – in statistics, an outlier is an observation point that is far removed and numerically distant from the rest of the points.
    - Error outliers – error outliers emerge as a result of instrument or human error and can affect analyses.
    - Systematic outliers – data are systematically different and may warrant further investigation to understand what the data say about the system.
- All data are used and useful, but not all data are of the same quality. Some data are more prone to instrument or human error. Need to consider this in the analyses.
- The Study Team is doing the best they can to reduce error outliers – taking great care in collecting data.
- Need to acknowledge that we will have outliers and anomalous data – they will be a part of this process. Need to prioritize systematic outliers that may point to system differences. Spend time on the outliers that may point to something important to the system.
- Desire to understand adjustments in data collection based on what is learned about the system over time.
- Some anomalies we may be able to explain and some we may need to make a note of and set aside for someone to potentially explain at a later date. Some anomalies may need to be a topic for a future study – we will not have the ability to explain every aspect of the system in as much detail as some might want.
- When the Study Team identifies data that are anomalous, would like to see the data and know why it's considered anomalous and figure out how to help – would like to help make sense of data or collect additional data if needed. This could be a role the community helps with.
- Example of an outlier – good well in the middle of declines – presents an opportunity to learn about the system.
- More curious about anomalies/outliers – source of curiosity, not a source of stress.
- Study Team will do the best they can to understand and explain data in the context of all the information we have. Intent to be fully transparent with the data collection and analysis.
- Don't dismiss data because it is inconvenient or inconsistent with current understanding.
- Need to build trust in the scientists and their approach to understanding the system.

- Some anomalies may point to separations (hydrogeologically separate units) – need to look at the available data and see where it points us – sometimes we may need to take a fresh look at the data to see what it is telling us.
- How we look at and handle outliers and anomalies will build credibility in the study.
- Interest in geothermal activity – more of a curiosity – location of hotsprings – why are they there?
- Don't get caught up in outliers – pay attention but don't get sidetracked or sucked in – don't forget the big picture.
- What happens if on-the-ground observations differ from the model outputs? Need to understand what data and assumptions go into the model and understand how the model can be used. What is the appropriate scale for analysis? What are the appropriate uses for a model?
- Don't know what the final picture looks like – need to look at all of the pieces of the puzzle together and let the data tell us the story – follow the data.
- "We are going to sit down and do a lot of head scratching together."
- Need to consider the scale of the study and what it will tell us about the system – we are looking at the broad scale function of the basin and may not be able to zoom in on every issue or concern that is of interest. Improving our understanding of the system and increasing the resolution of our knowledge.
- This is a deeply personal issue for many people in the basin and there is a lot of fear about the outcome. Need to acknowledge this.
- The Study Team members are personally and professionally invested in making sure that this study is scientifically sound and produces the best information possible to better understand the system and inform future management. They are dedicated to making sure the Department and community have the best information possible for future decision-making.

Decisions Points/Recommendations: None

Action Items: None

Proposed Future Discussion Topics:

- Revisit discussion about outliers at future meetings.