COMMUNITY DEVELOPMENT

DESCHUTES COUNTY PLANNING COMMISSION

5:30 PM, THURSDAY, MARCH 12, 2026
Barnes Sawyer Rooms - Deschutes Services Bldg - 1300 NW Wall St – Bend
(541) 388-6575|www.deschutes.org

AGENDA

MEETING FORMAT

The Planning Commission will conduct this meeting in person, electronically, and by phone.

Members of the public may view the Planning Commission meeting in real time via the Public Meeting Portal at www.deschutes.org/meetings.

Members of the public may listen, view, and/or participate in this meeting using Zoom. Using Zoom is free of charge. To login to the electronic meeting online using your computer, copy this link:

https://bit.ly/dcpczoom

Passcode: 764609

Using this option may require you to download the Zoom app to your device.

Members of the public can access the meeting via telephone, dial: 1-312-626-6799. When prompted, enter the following Webinar ID: 824 8646 7893 and Passcode: 764609. Written comments can also be provided for the public comment section to planningcommission@deschutes.org by 5:00 p.m. on March 12. They will be entered into the record.

I. CALL TO ORDER

II. APPROVAL OF MINUTES - February 12

III. PUBLIC COMMENT

IV. ACTION ITEMS

1. Water Presentations: "Water Year" and COID Operations & Piping Projects (*Nicole Mardell, Principal Planner*)

V. PLANNING COMMISSION AND STAFF COMMENTS

VI. ADJOURN

Deschutes County encourages persons with disabilities to participate in all programs and activities. This event/location is accessible to people with disabilities. If you need accommodations to make participation possible, please call (541) 617-4747.

MEMORANDUM

TO: Deschutes County Planning Commission

FROM: Nicole Mardell, AICP, Principal Planner

DATE: March 12, 2026

SUBJECT: Water Presentations: "Water Year" and COID Operations & Piping Projects

I. BACKGROUND

On March 12, 2026, the Planning Commission will receive two presentations related to water management and planning. The Commission has hosted several water panels in past years to receive a more thorough overview of the state of water management and planning within the Deschutes Basin.

In 2018, four panels were held on the following topics:

- Hydrology of the Upper Deschutes Basin
- Environmental and Economic Impacts
- Agricultural Water Consumption and Efficiency
- Projections and Planning

A summary report is included as an attachment, including links to video recordings of the presentations.

In 2022, the Commission held two additional panels on a variety of topics with the following panelists. Presentations are also attached, and video recordings are linked below.

- Panel #1 – 2/24/2022: Video Link
  - Kyle Gorman, OWRD
  - Stephen Gingerich, UGSG
  - Bridge Moran, USFWS
- Panel #2 – 4/14/2022: Video Link
  - Mike Buettner, City of Bend
  - Matt Cyrus, Farm Bureau
  - Craig Horell, COID
  - Kate Fitzpatrick, Deschutes River Conservancy

II. 2026 WATER PRESENTATIONS

The Commission will receive two presentations on relevant topics in water management and planning in the following format.

- Brief introduction by staff (5 min)

- Presentation on the "Water Year" (30 min)
    - Oregon Water Resources Department - Carolyn Sufit, Central Region Manager - Field Services and Jeremy Giffin, Deschutes Basin Watermaster

- Presentation on COID District Operations & Piping Projects (20 min)
    - Central Oregon Irrigation District - Jon Skidmore, Deputy Managing Director (30 min)

- Q&A with Panelists (20 min)

Staff requested Commissioners provide any comments or preferred discussion topics to staff prior to the meeting. The following information was requested.

- General water law – rights vs permits, exemptions, limitations, use requirements.
- Water use by type in Deschutes County – agricultural irrigation, golf irrigation, domestic, lawns/landscape, etc.
- Groundwater recharge – Juniper barrier, piping, precipitation, etc.
- Aquifer – depth, availability, impacts from irrigation, domestic use, ditch/canal leakage, Juniper use, etc.?
- Water supply, current and trends, flow changes at the mouth of the Deschutes? Precipitation measurements over time?
- Spotted Frog HCP – Impacts on irrigators and water availability? Current status and compliance among parties?
- Piping – amount conserved? What happens to conserved water? How is the interruption of groundwater recharge balanced against harm to certificated groundwater permits?
- How much irrigation water is being leased in-stream, and what is the impact on junior right holders who would otherwise be entitled to that water?

III. NEXT STEPS

At the February 12, 2026, meeting, Commissioners requested additional presentations and panels on water-related topics at future meetings. Staff will continue to work with the Commission to organize panels as staff capacity allows.

ATTACHMENTS

- 2018 Water Panel Summary Report
- 2022 Water Panel Presentations

COMMUNITY DEVELOPMENT

PLANNING COMMISSION
WATER PANEL SERIES REPORT

117 NW Lafayette Avenue
P.O. Box 6005
Bend, OR 97703-6005
www.deschutes.org/cd
(541) 388-6575

February 2019

Key Participants

PLANNING COMMISSION

Dale Crawford - At Large (Chair) - Water Panel Subcommittee
Maggie Kirby - Bend Area (Vice Chair) - Water Panel Subcommittee
Jim Beeger - Bend Area - Water Panel Subcommittee
Steve Swisher - Sisters Area
Hugh Palcic - South County
Jessica Kieras - Redmond Area
Les Hudson - At Large

PANELISTS

Kyle Gorman - Oregon Water Resource Department
Stephen B. Gingerich, Ph.D - U.S. Geological Survey Oregon Water Science Center
Bridget Moran - U.S. Fish and Wildlife Service
Brett Hodgson - Oregon Department of Fish and Wildlife
Mark Buckley - ECONorthwest
Mylen Bohle - Oregon State University Extension
Leslie Clark - Central Oregon Irrigation District
Margaret Matter - Oregon Department of Agriculture
Bill Duerden - City of Redmond
Craig Horell - Central Oregon Irrigation District
Mike Taylor - Coalition for the Deschutes
Adam Sussman - GSI Water Solutions

DESCHUTES COUNTY LONG RANGE PLANNING STAFF

Nick Lelack, AICP - Director
Peter Gutowsky, AICP - Planning Manager
Matt Martin - Associate Planner
Nicole Mardell - Associate Planner

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Photo Source: Central Oregon Irrigation District

Executive Summary

Purpose

The Deschutes County Planning Commission is the County's citizen involvement committee responsible for carrying out a comprehensive planning program, using public input to coordinate its activities with other jurisdictions, planning bodies, and districts. Their role is to advise the Board of County Commissioners on citizen involvement programs and study and propose such measures as are advisable for promotion of the public interest, health, safety, comfort, convenience, and welfare (DCC 2.52.100). Realizing the impact of water use and water law in land use and development proceedings, the Planning Commissioners requested staff to organize a series of expert panels within the field of water management. The information gained from each panel of experts could then be used to better inform the Planning Commission, general public, and Board of County Commissioners, in land use decision making. The Commission determined the need for four separate panels:

- Hydrology of the Upper Deschutes Basin
- Environmental and Economic Impacts
- Agricultural Water Consumption and Efficiency
- Projections and Planning

A Water Panel Subcommittee was formed to develop the agenda and identify speakers for each panel. Summaries and notes from each panel are found in pages 5 to 8 of this report. Although the panelists represented a diversity of individuals, bodies, and authorities within the agricultural industry, environmental nonprofits, and government entities, three key issues and themes rose to prominence throughout the series.

Key Issues and Themes

- **WATER LAW**
  Current laws regulating water strictly limit flexibility in water use and management, and are little changed in principle from the original regulations developed in the early twentieth century. Comments from almost all panelists denoted a need to revise Oregon's water laws to reflect current (and future) conditions; to re-examine the principles of allocation (for agriculture, fisheries, municipalities, environmental groups and other sectors), the efficiency of delivery, flexibility in use and monitoring and enforcement.

- **STATEWIDE WATER POLICY**
  Many stakeholders are involved in water management including sovereign tribal nations, governmental entities, nonprofits, irrigation districts, private consultants, and water users. Each group has identified interests and perspectives that may align or contradict others, particularly in the areas of advocacy regarding the current system for holding water rights and uses where water rights may be under– or over-allocated. Although improvements could be made in the current system by voluntary collaboration or specific litigation, a larger-scale systematic change is needed, potentially through a statewide governmental review to revisit and modernize water use priorities, allocation, regulation, and management.

- **EDUCATION AND FUNDING**
  Panelists offered examples of outreach and educational programs that have proven to be successful in promoting efficient water use in agricultural, commercial, and residential markets. In order to achieve larger-scale change, financial resources are needed, both to improve efficiency in water delivery to end uses (e.g. canal piping) but also to educate water users on efficient practices.

Meeting 1: Hydrology of the Upper Deschutes Basin

The Planning Commission convened the first panel to examine water availability and consumption in the Upper Deschutes River Basin. The group discussed aquifer structure, ground and surface water interaction, reservoir storage capacity, water law and water rights, impacts of climate change, monitoring data and mapping, and water projections. Additional background on Oregon's water use system can be found in the Upper Deschutes Basin Study funded by the Bureau of Reclamation in 2018.

A few key insights from this discussion include:

- **ROLE OF OREGON WATER RESOURCES DEPARTMENT**
  Oregon Water Resources Department (OWRD) regulates and measures water supply at a statewide scale. There are five regional managers in the basin; each region has two water masters responsible for regulating water use. As of 1988, no new water rights could be issued in the basin due to a lawsuit limiting water withdraws affecting the free flowing character of lower Deschutes River (Diack vs. City of Portland). Therefore, property owners seeking water rights must complete a water rights transfer, with expensive market rates per acre-foot.
- **ADVOCACY AND CONSERVATION**
  Oregon experiences water restoration achievements greater than any other state. The Deschutes River Conservancy, established in 1998, preserved the first instream flow right in Oregon along Whychus Creek. Recently, the Oregon Spotted Frog was listed to the federal Endangered Species Act (further details on page 6). This listing triggered a lawsuit against the Bureau of Reclamation and irrigation districts, which compelled the districts and the City of Prineville to prepare a Habitat Conservation Plan (HCP), consistent with the National Environmental Policy Act (NEPA).
- **WATER DEMAND AND SUPPLY**
  Per USGS reporting, municipal water use over a 50-year period is approximately 16,000 acre-feet. Comparatively, irrigation water use over a 50-year period is approximately 724,000 acre-feet. Water levels are declining primarily due to climate change (70% loss), pumping (20% loss), and lining of water transmission lines and canals (10%). Approximately 50% of diverted water is lost through seepage and only a fraction is recaptured instream. Moving forward, there is a need for upgrading irrigation delivery systems such as canals, on-site agricultural irrigation equipment and incentivizing efficient water practices.

DATE

March 8, 2018

PANELISTS

Kyle Gorman
South Central Region Manager,
Oregon Water Resources Department

Stephen B. Gingerich, Ph.D
Research Hydrologist,
U.S. Geological Survey
Oregon Water Science Center

VIDEO LINK

http://deschutescountyor.iqm2.com/Citizens/SplitView.aspx?Mode=Video&MeetingID=1963&Format=Agenda

BASIN STUDY LINK

https://www.deschutesriver.org/what-we-are-doing/upper-deschutes-basin-study/basin-study-documents/

Meeting 2: Environmental and Economic Impacts of Water Use

The second panel focused on the environmental and economic impacts of water use. Panelists discussed the relationship between water, wildlife habitat, recreational activities, and associated economic benefits within the Upper Deschutes River Basin.

A few key insights from this discussion include:

- **HABITAT CONSERVATION PLAN (HCP)**
  An HCP is a tool used between the federal government and cooperating partners to comply with the federal Endangered Species Act. The U.S. Fish and Wildlife Service (USFW) is working with eight irrigation districts and the City of Prineville on an HCP to prevent litigation associated with potential damage to Oregon Spotted Frog and Bull Trout populations and their habitats. USFW is responsible for monitoring and quantifying impacts to protected species, Oregon Department of Fish and Wildlife (ODFW) is responsible for protecting sensitive animals not listed as endangered. Panelists explained that restoration of an ecological system is 10-20 more expensive than initial preservation, therefore USFW and ODFW are proactive in promoting preservation of sensitive environments.
- **PARTNERSHIPS**
  A shared vision among all stakeholders is to modernize irrigation systems to reduce loss and promote higher instream flow return. Irrigation canals experience 40% to 60% loss. Upgrading systems can aid business operations of irrigation districts and stream flow for habitat preservation.
- **RECREATION**
  The Upper Deschutes Basin includes quality angling and hunting opportunities, including premier trout fishing near the upper section of the Deschutes River. Revenues from hunting permits primarily fund ODFW as it is a user based department. Moderating stream flow (to mitigate winter low water and summer wash out) and conserving native species can help maintain the outdoor recreation economy Central Oregon has built.

DATE

April 12, 2018

PANELISTS

Bridget Moran
Bend Field Officer Supervisor
U.S. Fish and Wildlife Service

Jennifer O'Reilly
Biologist
U.S. Fish and Wildlife Service

Brett Hodgson
Fish Biologist
Oregon Department of Fish and Wildlife

Mark Buckley, Ph.D
Partner, ECONorthwest

VIDEO LINK

http://deschutescountyor.iqm2.com/Citizens/SplitView.aspx?Mode=Video&MeetingID=2005&Format=Agenda

Meeting 3: Agricultural Water Consumption and Efficiency

The third panel of the series was originally slated to discuss water consumption and efficiency in all industries. Per information provided in the two previous panels, the Planning Commission decided to focus on water use within the agricultural industry, as it is the largest water consumer in Deschutes County and Central Oregon as a region.

A few key insights from this discussion include:

- **AGRICULTURE IN DESCHUTES COUNTY**
  Deschutes County has the highest number of individual farms in Central Oregon (1,000), compared to Crook (680) and Jefferson (480) counties. Most of these farms are between 0.5 and 10 acres. The oldest water rights in the area are from 1870-1880 and were initially allocated for the production of potato crops. Throughout time, crops have changed based on disease and popularity, including chickpeas, hemp, wheat, rye, alfalfa, marijuana, vineyards, etc. As water rights are tied to the original crop grown on the property, panelists described the difficulty in amending water rights to reflect water demands associated with new crops.
- **EFFICIENT IRRIGATION**
  Since no new water rights can be allocated, there is a premium for maintaining water rights on a property for future sale, even if the primary use of the property is not agriculture. A common issue in Deschutes County is misinformation on beneficial use, wherein many farmers use flood irrigation, water open pasture areas including rock and poor soils, and use irrigation systems incorrectly. Changes to water law could address some of the issues associated with water right transfers and beneficial use. Education could also lead to applying water efficiently to beneficial uses with modernized technology.
- **TRENDS IN EFFICIENCY**
  OSU Extension works with the Oregon Department of Agriculture and Central Oregon Irrigation District to provide onsite education to farmers as well as larger policy and programmatic elements. A traditional center pivot irrigation system averages 50-85% efficiency, whereas a dragline pivot system averages 98% efficiency. Even minor upgrades to older irrigation systems, such as replacement of valves, can result in an 18% increase in irrigation efficiency.

DATE

August 23, 2018

PANELISTS

Mylen Bohle
Area Extension Agronomist
Oregon State University Extension

Leslie Clark
Director of Water Rights
Central Oregon Irrigation District

Margaret Matter
Water Resource Specialist/Program Lead
Oregon Department of Agriculture

VIDEO LINK

http://deschutescountyor.iqm2.com/Citizens/SplitView.aspx?Mode=Video&MeetingID=2048&Format=Agenda

Meeting 4: Projections and Planning

The fourth and final panel of the series focused on planning for water use in growing communities. Panelists discussed their procedures for projecting water supply and demand, interagency collaboration, successes in innovative programming, and barriers preventing modernization of water management policies.

A few key insights from this discussion include:

- **PROGRAM EFFICIENCY**
  Municipal capital improvement plans (CIPs) estimate growth by using land use assumptions. The largest urban water uses are typically greenspace and park areas owned by a municipality, park district, or school district. Bend and Redmond utilize two of the top rated water efficiency programs in the state. Redmond has a WaterHawk program that detects leaks and water losses, while also helping users understand their consumption levels. Support from elected officials is needed to implement these programs as minimal grants are available.
- **BASIN STUDY WORK GROUP**
  Using Bureau of Reclamation funding, a 47-member working group recently completed the Upper Deschutes Basin Study (link on page 5) . The study provided a 'state of the basin' and a shared vision for the future, but the study is not designed as a plan to identify any specific actions or suggested partnerships. Previously, the Deschutes Water Alliance served as an impartial convener for all water management stakeholders, but the group is no longer able to serve in the role. Coordination and partnerships among irrigation districts, nonprofits, local governments, sovereign tribal nations, and other interested parties are needed to effectively advocate for changes to water law and to identify funding for system upgrades and efficiency programs.
- **CHALLENGES IN WATER MANAGEMENT**
  There is a scarcity of water rights in the Deschutes Basin. This drives up the price and value of existing water rights held by patrons. Existing irrigation canals are often seen as valuable aesthetic resources to abutting property owners. Piping projects have recently experienced opposition as owners pursue historic designations. Climate change is also impacting water levels in the Deschutes River, but there is very little room for adaptation at the local level. There is a need for state-led changes to water law.

DATE

December 13, 2018

PANELISTS

Bill Duerden
Public Works Director
City of Redmond

Craig Horrell
Manager
Central Oregon Irrigation District

Mike Taylor
Board President
Coalition for the Deschutes

Adam Sussman
Principal Water Resources Consultant
GSI Water Resources

VIDEO LINK

http://deschutescountyor.iqm2.com/Citizens/SplitView.aspx?Mode=Video&MeetingID=2194&Format=Agenda

Additional Resources

Meeting Notes:

Panel	Comments
Hydrology of the Upper Deschutes basin **(March 5, 2018)** Kyle Gorman – South Central Regional Manager, Oregon Water Resource Department Stephen B. Gingerich, Ph.D. - Research Hydrologist, U.S. Geological Survey Oregon Water Science Center	• OWRD regulates and measures water supply. • Mr. Gorman is 1 of 5 regional managers. He focuses on the Klamath, Deschutes, and Lake watersheds. There are two water masters in this area, each responsible for regulating water use based on the law of prior appropriation. • The Deschutes River is a managed system. There are three reservoirs: Crescent, Crane, and Wickiup and five irrigation districts. • From 1962 to the mid-1980s, the middle Deschutes River only had 30 cfs during the summer. • A USGS 1998 water study broadened everyone's understanding of how groundwater is tied to the Lower Deschutes River. • Starting in 1988, no new water rights could be issued in the Upper Deschutes basin due to a lawsuit brought against the state (Diack vs. City of Portland, 306 Or 287, 299. 1998), which obligated OWRD to limit water withdrawals if such use will diminish the free flowing character of Scenic Waterways (Lower Deschutes River). • As a result, in the Deschutes Basin, new water rights must first mitigate the use by improving surface water flows. OWRD quantifies general zones for mitigation. • The Deschutes River Conservancy was established in 1996. In 1998, they preserved the first instream flow right in Oregon along Whychus Creek. Oregon experiences restoration achievements are greater than any other state in the West. • Municipal groundwater sources are predominantly groundwater. • The listing of Oregon spotted frog to the federal Endangered Species Act triggered a lawsuit against the Bureau of Reclamation and irrigation districts. A federal judge issued a hold for the parties to explore collaboration. • Prior to the ESA listing, the outflow out of Wickiup was 20 cfs ,and 5 cfs at Crescent. Today, there is 1,000 cfs out of Wickiup and 20 to 30 cfs out of Crescent. Crane Prairie is being managed for the spotted frog for spring and fall nursery. The lake levels remain between 2 and 3 feet. • From 2000 to 2008, DRC promoted instream flows. Over the last 5 to 10 years, interest has leveled off. • Transferring irrigation rights for mitigation are held by irrigation districts based on a 2008 ruling, *Fort Vannoy Irrigation district v. Water Resources Commission*. The Oregon Supreme Court held that irrigation districts are the holders and owners of water rights beneficially applied by its members but certificated in the name of the district. The Court held that water rights, like legal title to other property, vests in the irrigation district and are held by it in trust, are dedicated and set apart for, the uses and purposes set forth in the Irrigation District law. The Court also held that the Board of Directors for the irrigation district is authorized and empowered to hold, use, acquire, manage and dispose of a water right as provided in the Irrigation District law. Private water rights are eligible for mitigation. However, there are few of them. • Facebook paid $15,000 (ac/ft) for mitigation credits in Crook County. In Deschutes, mitigation credits have sold for $2,000 (ac/ft). • DRC operates temporary mitigation credits. They are leases. Irrigation districts are supportive because patrons are still on their rolls.

Additional Resources

Meeting Notes:

Panel	Comments
Hydrology of the Upper Deschutes Basin continued	• USGS is a non-regulatory agency that is recognized as the nation's leading science agency. • In the mid-1990s, USGS published a series of reports addressing hydrology, geology and groundwater recharge. • First model in 2000/2001 identified groundwater and surface water relationship. • In 2017, USGS identified a state of the art model, examining different scenarios on groundwater pumping impacts to stream flow. • Basin study modeling revealed that municipal use over a 50-year period utilizes only 16,000 ac/ft, in contrast to irrigation use, which is 724,000 ac/ft. • The upper Deschutes basin aquifer recharges at 3,800 cubic feet per second. • Groundwater wells are measured every quarter. There are 25 to 30 wells. Trends show water levels declining. • The reason is due to climate change. It is estimated that 70% of the declines are due to climate, 20% to pumping; and 10% to lining (less water transmission loss) and other irrigation efficiency measures. • The federal Endangered Species Act represents the greatest threat to water use. • Irrigation districts need to improve delivery systems to aid upper and middle Deschutes River flows. • Patrons and Irrigation Districts will need to change their attitudes related to water consumption. Recognizing that about 50% of the diverted water is lost through seepage and is a net loss to the Upper and Middle Deschutes River (although a fraction is re-captured in the Lower Deschutes) it is important that water delivery and use adapts to future need rather than be bound by historic practice; move away from flood irrigation, improve efficiency of delivery and use to grow the same crop with less water but preserve the individual 'Water Right ' in whole, help under-capitalized end users meet the cost of upgrade, pipe to an on demand system (this alone will reduce water demand by 20%), establish incentives for users that improve their water use efficiency.The costs for upgrading irrigation delivery systems is expensive. • Carey Water Rights allow one to divert enough water to meet delivery demand.

Additional Resources

Meeting Notes:

Panel	Comments
Environmental and Economic Impacts of Water Use **(April 12, 2018)** Bridget Moran - Bend Field Office Supervisor, U.S. Fish and Wildlife Service; Jennifer O'Reilly – Biologist, U.S. Fish and Wildlife Service; Brett Hodgson - Fish Biologist, Oregon Department of Fish and Wildlife; and Mark Buckley, Ph.D – Partner, ECONorthwest	• USFWS working with 8 irrigation districts and Prineville on a Habitat Conservation Plan. An HCP is a tool to comply with the federal Endangered Species Act; it shields parties from litigation, in this case from injuring (take) the Oregon spotted frog and in the lower Deschutes River, bull trout. • An HCP lists activities that effect the listed species. For example, irrigation districts store and release water. Those two activities can harm the frog. It can take years of negotiation. The lifespan for an HCP can be 40 years. • It is a formal process that quantifies the effects of an operation following the National Environmental Policy Act (EIS, public comment, publish draft and ultimately final publication). • Once an HCP is final, it offers parties relief/regulatory assurance with an incidental take permit as long as they comply with the terms of the document. For irrigation districts, there is certainty as they invest in the long term maintenance and operation of their facilities. • Senator Merkley helped pass federal funding, PL5.66 that provides financial assistance to irrigation districts. For FY 2017 and 2018 there is a total of $300M to assist irrigation districts modernize their facilities. It requires a 50% match from outside sources, which can include state and other sources. • An HCP allows irrigation districts to "minimize and mitigate their impacts to spotted frog to the maximum extent possible." • Today, the Deschutes riverbed is 20% higher than normal (pre-irrigation). • USFWS is responsible for quantifying the impacts to the spotted frog to protect, enhance, and optimally, recover the species. • Each HCP has biological goals and objectives to establish biological function to the greatest degree possible. • There are benchmarks for federally listing species. The ESA has definitions for plants and animals. There is a five factor analysis/threat based approach. • ODFW is responsible for protecting sensitive plants and animals. When plants/animals experience significant threats, USFWS will analyze those threats, calling for data, and if necessary initiate a federal rule making process. • Oregon spotted frog is an indicator species for clean water, wetland viability, riparian health, and ecological function. • Prioritizing sensitive species is budget driven and can be political. Environmentalists sued USFWS for not protecting sensitive species. The lawsuit was eventually settled, which led to the process of listing the spotted frog under ESA. • Spotted frog habitat is located in Wickiup Reservoir, Crane Prairie Reservoir, and the upper Deschutes and Little Deschutes Rivers. • Bull frogs are a significant threat to the spotted frog. They are recognized as a top 10 invasive species. • USFWS has a safe harbor agreement with landowners to address impacts of bull frog listing.

Additional Resources

Meeting Notes:

Panel	Comments
Environmental and Economic Impacts of Water Use **Continued**	• It is more effective to protect ecological systems than to restore them. Restoration can be 10 to 20 times more expensive. • Protecting intact core areas for the spotted frog is essential. It is an extraordinary planning opportunity. • Irrigation canals experience 40% to 60% transmission loss. • One goal is to modernize irrigation systems which allows surface water to return as instream flow. • Conserving native species provides quality angling and hunting opportunities. • State conservation goals can conflict with recreational goals. • The upper Deschutes River is a premier trout fishery. There are a lot of opportunities to improve water quality and quantity for the whole ecosystem. • Moderating stream flows improve ecological function. • ODFW is a user based department. Revenue is focused on one spectrum, hunting, while there are significant demands associated with habitat conservation. • There are opportunities to share water and move it around. Thirty percent of COID's patrons flood irrigate. • Short term tools for irrigation districts are fallowing farms and leasing water for instream use.

Additional Resources

Meeting Notes:

Panel	Comments
Agricultural Water Consumption and Efficiency **(August 23, 2018)** Mylen Bohle - Area Extension Agronomist, Oregon State University Extension Leslie Clark - Director of Water Rights, Central Oregon Irrigation District Margaret Matter – Water Resource Specialist, Program Lead, Oregon Department of Agriculture	• OSU Extension works with Oregon Department of Agriculture (ODA) and Central Oregon Irrigation District (COID) and provides onsite services to farmers as well as developing larger policy and programmatic elements. • History: Oldest water rights in DC are from 1870/1880, first crop was largely potatoes. Throughout time, crops grown have changed based on disease and popularity: chickpeas, hemp, wheat, rye, hay grass, alfalfa, Marijuana, wineries etc. • Original water rights were tied to the crop (i.e. potatoes, alfalfa) which make them difficult to alter/change with new crops/new farming practices. • DC has over 1,000 individual farms, compared to Crook County (680) and Jefferson County (480). Majority are "small farms" and range from >0.5 acre to 10 acres. • Most efficient crops depend on the individual farm. Common practice for marijuana production is to use drip irrigation within greenhouses/indoor structures (100% efficient), dragline pivot irrigation (98% efficient), traditional center pivot (50-85% efficient). Even minor changes to pivots could result in an 18% increase in efficiency. • Greatest opportunity for change within water use would be pasture areas. Many areas in DC where owners are misinformed of irrigation maintenance/operations, some are still watering juniper and rock. • Alfalfa is the largest user of water, but in DC there's a limited ability of large acreage parcels. • ODA is researching how to adjust prior appropriate process to today – ie allocate enough water for farmers, fisheries, how to remap water to other irrigation districts, etc. Ex: Colorado is able to lease rural water to cities during droughts. • COID would like to be able to move water from district to district. Example: North Unit irrigation district serves highly productive farms in Jefferson County but have junior water rights compared to COI, so are the first to lose water in a shortage. • Changes to water law are needed but require action at the state level. • More education/outreach regarding ag and water is needed, COID and OSU lack funding for positions currently. Each would prefer to have a staff person who could specialize in irrigation efficiency/outreach. • Harney County recently undertook an initiative to switch all overhead pivots to Low Energy Sprinkler Application (LESA) pivots in response to over-allocation of water. Funding came from Energy Trust of Oregon and Bureau of Reclamation.

Additional Resources

Meeting Notes:

Panel	Comments
Projections and Planning **(December 13, 2018)** Bill Durden - Public Works Director, City of Redmond Craig Horell - Manager, Central Oregon Irrigation District Adam Sussman - Principal Water Resources Consultant Mike Taylor – Board President, Coalition for the Deschutes	• Coalition for the Deschutes established a new program recently called "A Shared Vision for the Deschutes" to engage a variety of project partners toward a unifying vision. • Although many wells in Deschutes County are relatively shallow, municipal wells in Redmond were dug to be quite deep and draw downs are not currently of concern. For Redmond, parks and green space are often the largest water consumers, but consumption is overall manageable. • The 47-member Upper Deschutes Basin Study work group has been highly effective in collaborating on a "state of the basin" report. The study is now complete, but it is only a study. There are not any action items or next steps proposed at this time. • Assessing water efficiency and consumption management is among the top priority of those managing water. COID has a System Improvement Plan to identify areas where losses can be curbed. Redmond has seen a decrease in water use due to low flow technology and metering. • Redmond's WaterHawk program is in place to detect leaks and water losses in their utility system, as well as helping consumers understand their water consumption in detail and offering rebates to incentivize conservation. • Redmond shared concerns regarding population growth and infrastructure—water pressure in wells may be impacted during high use seasons. • Proliferation of wells in Redmond may lead to a drawn down of the aquifer during high use season. • Greatest opportunity for change within water use would be pasture areas. Many areas in DC where owners are misinformed of irrigation maintenance/operations, some are still watering juniper and rock. • Alfalfa is the largest user of water, but in DC there's a limited ability of large acreage parcels. • ODA is researching how to adjust prior appropriate process to today – ie allocate enough water for farmers, fisheries, how to remap water to other irrigation districts, etc. Ex: Colorado is able to lease rural water to cities during droughts. • COID would like to be able to move water from district to district. Example: North Unit irrigation district serves highly productive farms in Jefferson County but have junior water rights compared to COI, so are the first to lose water in a shortage. • Changes to water law are needed but require action at the state level. • More education/outreach regarding ag and water is needed, COID and OSU lack funding for positions currently. Each would prefer to have a staff person who could specialize in irrigation efficiency/outreach. • Harney County recently undertook an initiate to switch all overhead pivots to Low Energy Sprinkler Application (LESA) pivots in response to over-allocation of water. Funding came from Energy Trust of Oregon and Bureau of Reclamation.

Deschutes Basin Water & Wildlife

Deschutes County Planning Commission
February 24, 2022
Bridget Moran, USFWS Field Supervisor, Bend

U.S. Fish & Wildlife Service

- Endangered Species Act implementation
- Bald & Golden Eagle Protection Act implementation
- Wildlife & habitat conservation programs
- Stream restoration programs
- Fish passage programs
- General wildlife technical assistance

Endangered Species Act (ESA)

Activities (new or ongoing) that harm or otherwise "take" protected (*listed*) species are prohibited under section 9 of the ESA.

ESA Compliance Strategies Habitat Conservation Plans

- Conservation plans that address non-federal actions that adversely affect ESA-listed species
- Designed to provide conservation to offset effects of impacts to species
- Provides legal mechanism to continue otherwise lawful activities
- Spelled out in Section 10 of the Endangered Species Act (ESA)
- Corollary to federal agency consultation process under Section 7 of the ESA

Deschutes Basin HCP

Approved 12/31/2020

30-year permit term

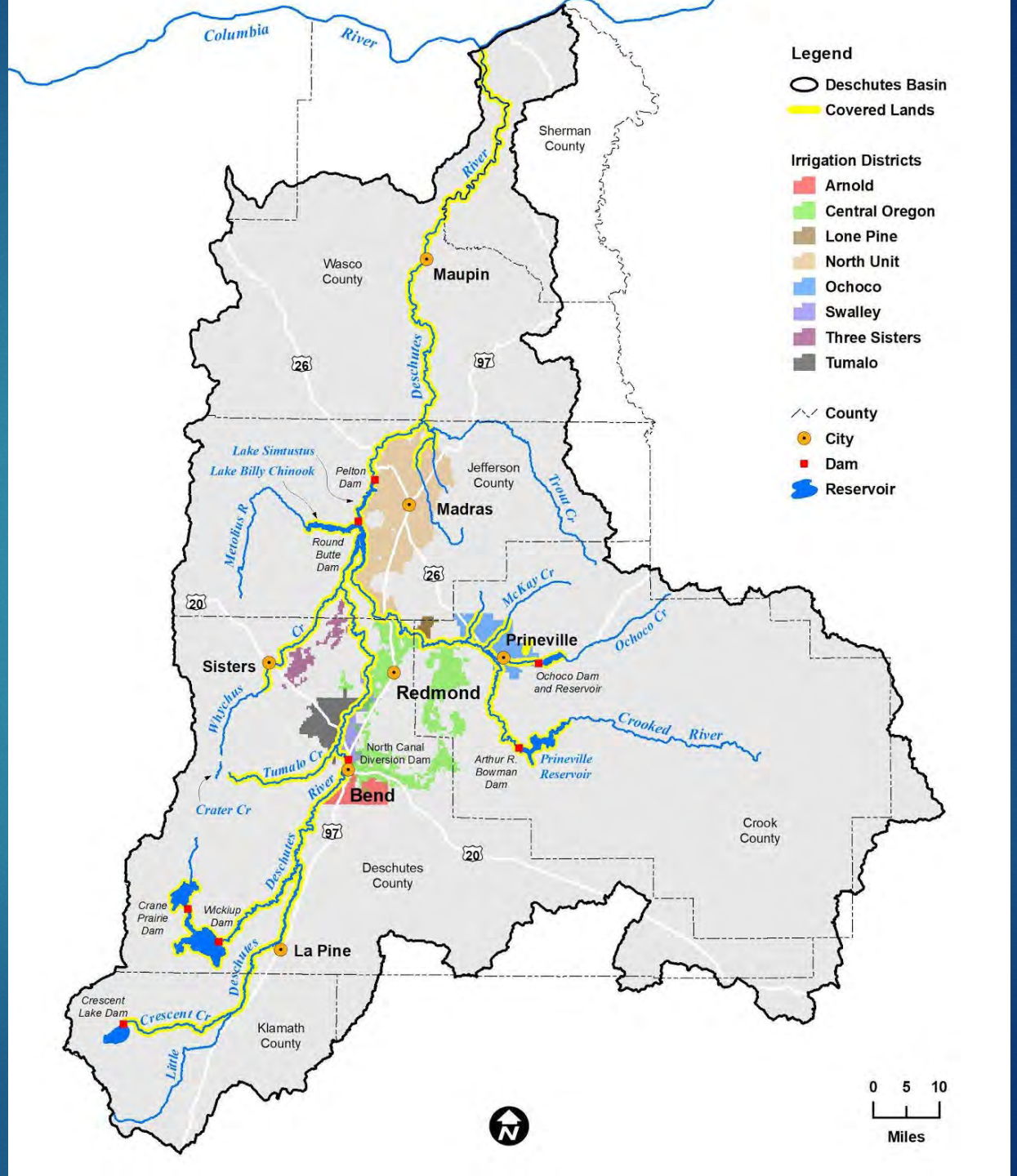
Deschutes Basin reservoirs and streams where ESA-listed species are present

Species included: Oregon spotted frog and bull trout

Permittees: Deschutes Basin Board of Control-member districts and the City of Prineville

Deschutes Basin HCP

- Arnold Irrigation District
- Central Oregon Irrigation District
- Lone Pine Irrigation District
- North Unit Irrigation District
- Ochoco Irrigation District
- Swalley Irrigation District
- Three Sisters Irrigation District
- Tumalo Irrigation District
- City of Prineville



Oregon spotted frog geography

Upper Deschutes River

Flow requirements from Wickiup Reservoir

Years	Winter Minimum	Summer Maximum
1-7	100 cfs	N/A
8-12	300 cfs	1400 cfs
13-30	400-500 cfs	1200 cfs

Current and Historic Bull Trout Distribution

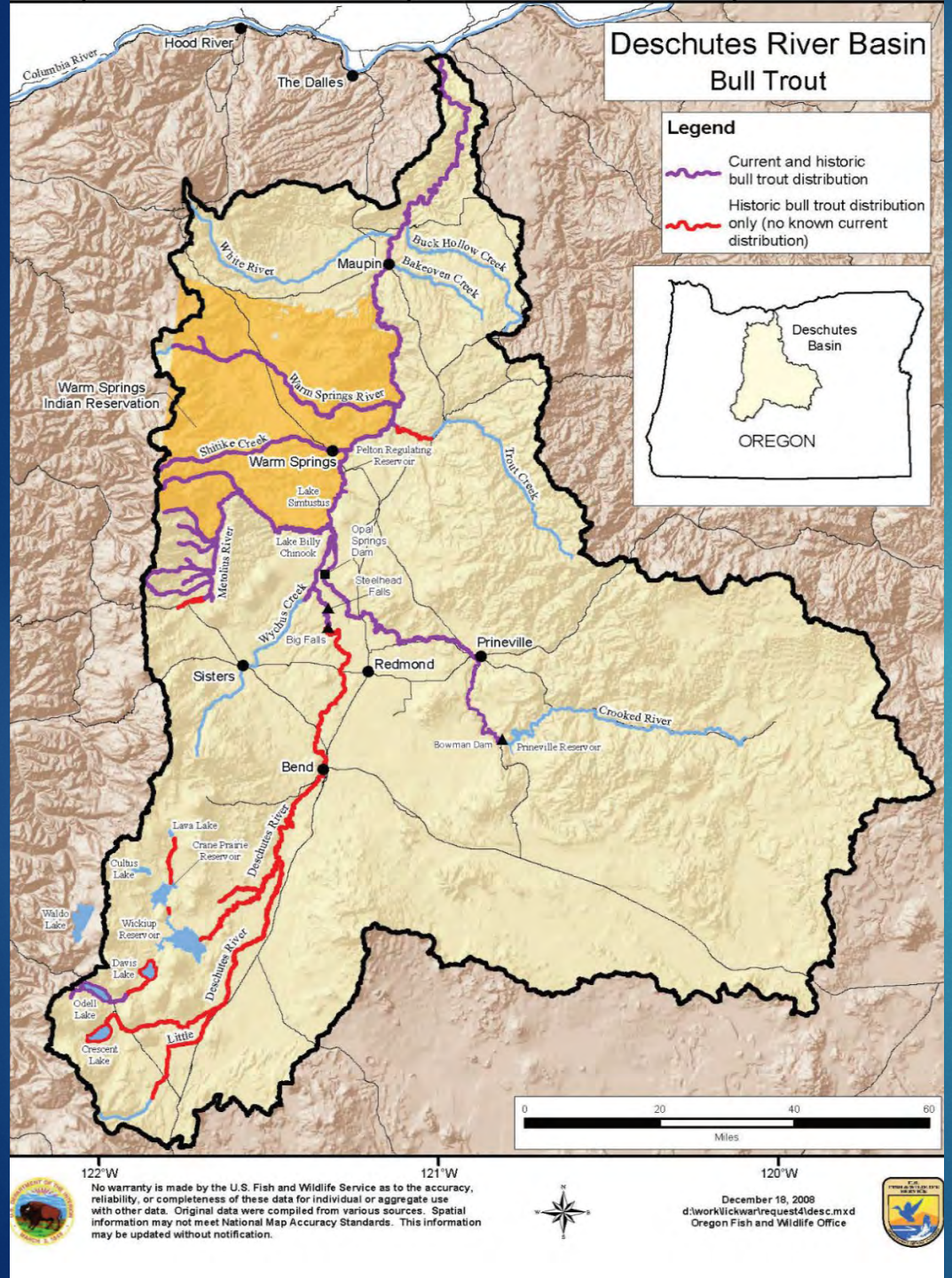


Photo: Joel Satore

Where can I learn more?

HTTPS://WWW.FWS.GOV/OREGONFWO/ARTICLES.CFM?ID=149489716

Kyle Collins

From: GORMAN Kyle G * WRD <Kyle.G.GORMAN@water.oregon.gov>
Sent: Friday, February 25, 2022 7:55 AM
To: Kyle Collins
Subject: RE: Deschutes County February 24 Water Panel - Agenda Framework
Attachments: USGS.442242121405501.115975.72019.00003.20010802.20220223..0..pres.gif

[EXTERNAL EMAIL]

Thank you. I enjoyed talking about the water conditions but I am concerned about the lack of snowpack. I was hoping for a turn around this year.

Here they are:

Wickiup Reservoir
https://www.usbr.gov/pn/hydromet/wygraph.html?list=wic%20af&daily=wic%20af

SNOTEL graph
https://www.nrcs.usda.gov/Internet/WCIS/AWS_PLOTS/basinCharts/POR/WTEQ/assocHUCor_8/upper_deschutes-crooked.html

Drought Page
https://droughtmonitor.unl.edu/

https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?OR

USGS Groundwater level near Black Butte Ranch
https://or.water.usgs.gov/projs_dir/or002cbr/waterlevels/cbr.html

https://waterdata.usgs.gov/or/nwis/dv?referred_module=sw&dd_cd=01_72019_00003&dd_cd=02_72020_00003&format=gif&period=548&site_no=442242121405501

I attached the copy of the well level graph as .gif for your convenience.

OWRD Monitoring well between Bend and Redmond
https://apps.wrd.state.or.us/apps/gw/gw_info/gw_hydrograph/Hydrograph.aspx?gw_logid=DESC0061863

I think that was everything.

Kyle

From: Kyle Collins <Kyle.Collins@deschutes.org>
Sent: Thursday, February 24, 2022 7:09 PM
To: GORMAN Kyle G * WRD <Kyle.G.GORMAN@water.oregon.gov>
Subject: RE: Deschutes County February 24 Water Panel - Agenda Framework

Kyle,

Would you mind sending me a copy of the resources you utilized during your presentation?
Just the web links and any other figures so I can pass them along to the Commissioners and interested members of the public.

Thanks so much again for the discussion!
It was great and I think all the Commissioners appreciated the education.

Kyle Collins | Associate Planner
DESCHUTES COUNTY COMMUNITY DEVELOPMENT
117 NW Lafayette Avenue | Bend, Oregon 97703
PO Box 6005 | Bend, Oregon 97708
Tel: (541) 383-4427 | www.deschutes.org/cd

Let us know how we're doing: ***Customer Feedback Survey***

From: GORMAN Kyle G * WRD <Kyle.G.GORMAN@water.oregon.gov>
Sent: Thursday, February 24, 2022 3:22 PM
To: Kyle Collins <Kyle.Collins@deschutes.org>; 'Moran, Bridget N' <bridget_moran@fws.gov>; 'sbginger@usgs.gov' <sbginger@usgs.gov>
Subject: RE: Deschutes County February 24 Water Panel - Agenda Framework

---

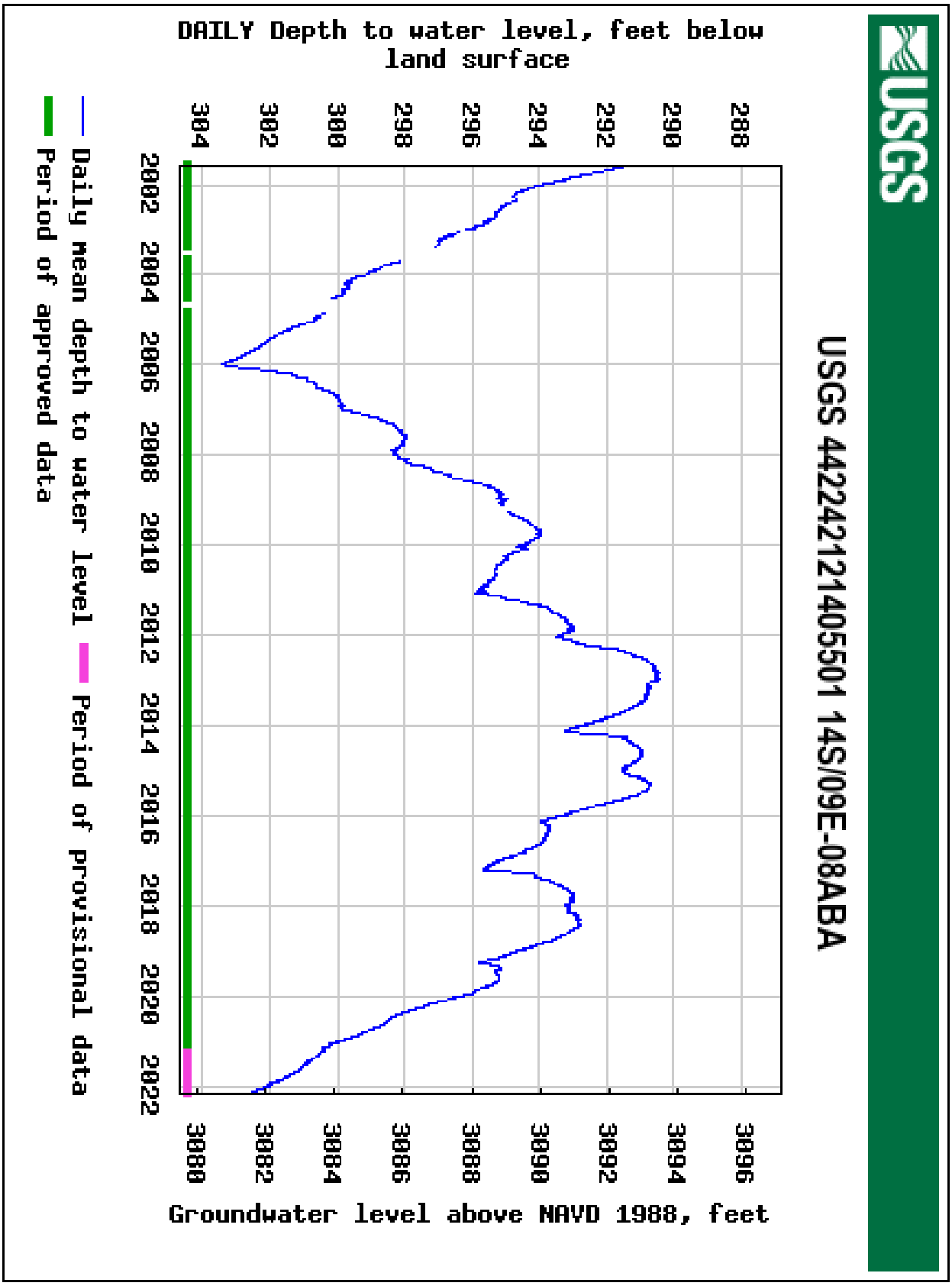
Kyle,

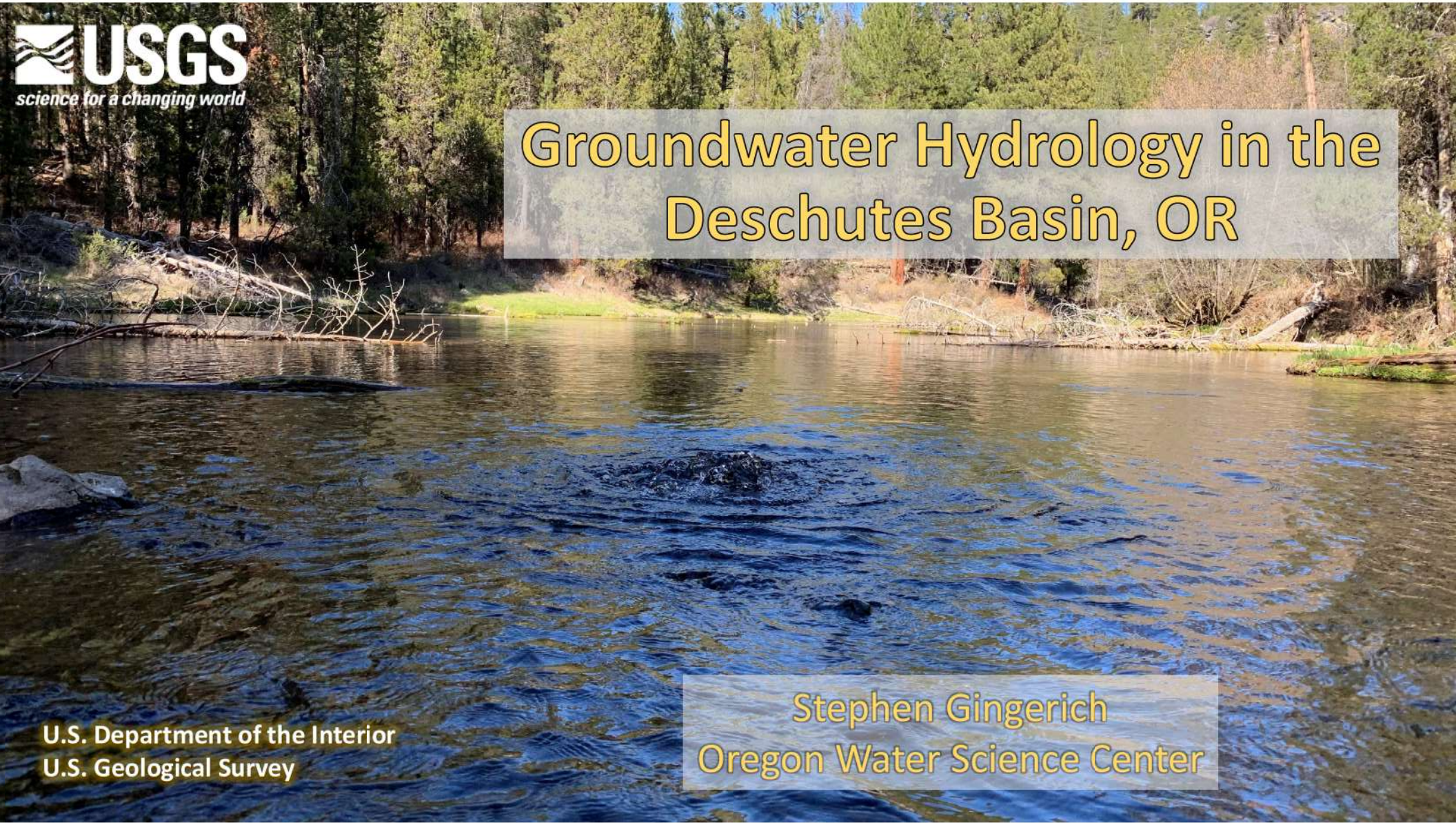
Will see you in a few hours and to confirm that I will be participating via zoom. Thank you.
Kyle

From: Kyle Collins <Kyle.Collins@deschutes.org>
Sent: Friday, February 18, 2022 6:16 PM
To: 'Moran, Bridget N' <bridget_moran@fws.gov>; GORMAN Kyle G * WRD <Kyle.G.GORMAN@water.oregon.gov>; 'sbginger@usgs.gov' <sbginger@usgs.gov>
Subject: RE: Deschutes County February 24 Water Panel - Agenda Framework

Water Panelists,

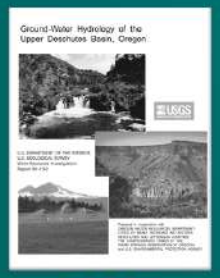
Please see attached for the February 24 Deschutes County Planning Commission meeting packet and below for Zoom info.


USGS 442421214055O1 14S/09E-08ABA
DAILY Depth to water level, feet below land surface
288
290
292
294
296
298
300
302
304
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022
3088
3090
3092
3094
3096
3086
3084
3082
3080
Groundwater level above NAVD 1988, feet
Daily mean depth to water level
Period of provisional data
Period of approved data


USGS
science for a changing world
Groundwater Hydrology in the Deschutes Basin, OR
U.S. Department of the Interior
U.S. Geological Survey
Stephen Gingerich
Oregon Water Science Center

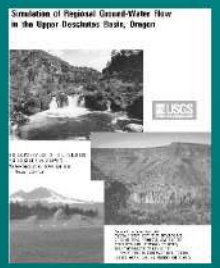
USGS Groundwater Studies in Deschutes Basin

- 1990s: Basic understanding of geologic framework and groundwater hydrology
- 2000s: Groundwater flow model—impacts of pumping, canals, climate
- 2010s: Enhanced surface water/groundwater model—effects of pumping on streams

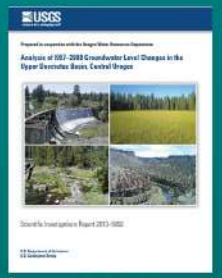


2001

2002

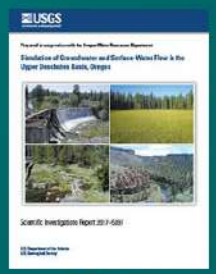


2004



2013


2013

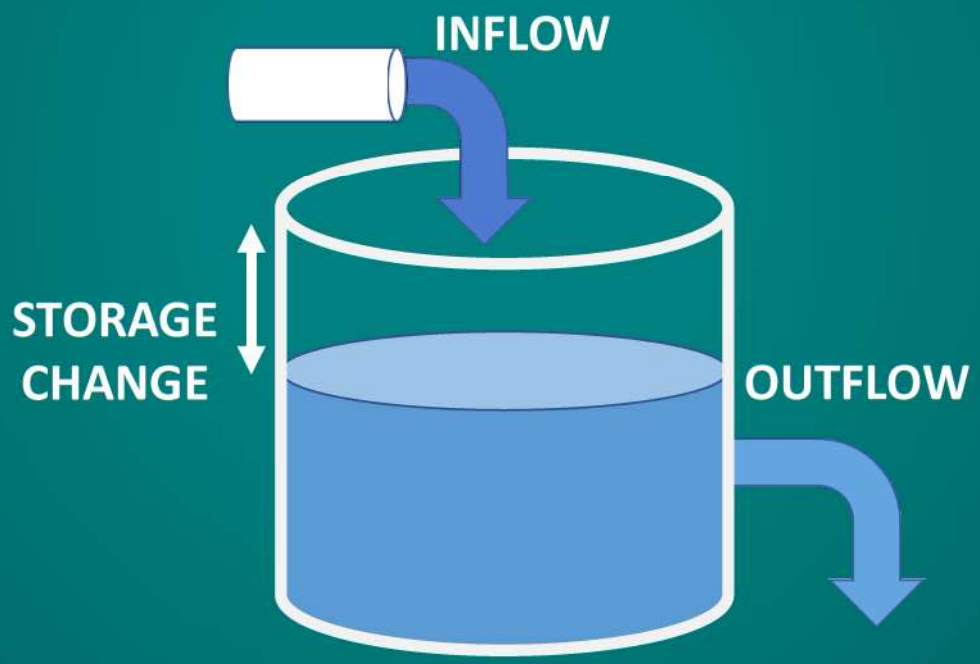


2017

USGS

Basin Groundwater Budget

↓INFLOW = ↑OUTFLOW ± CHANGE IN STORAGE

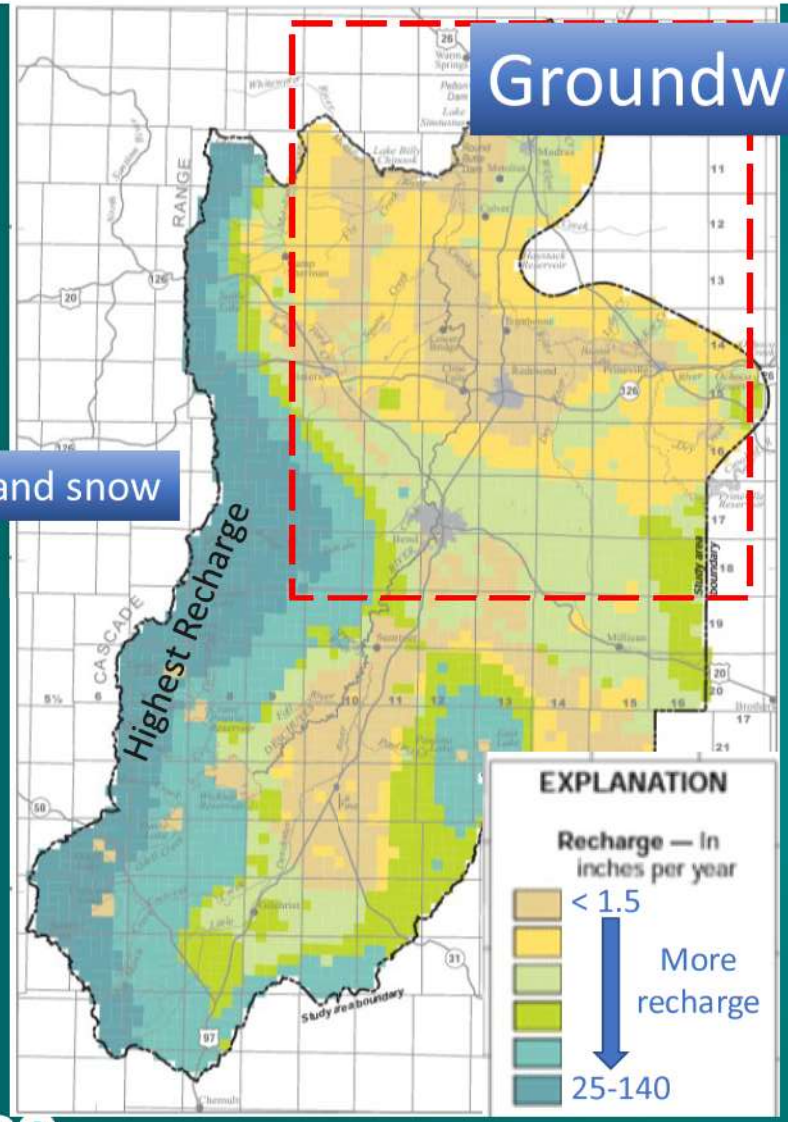


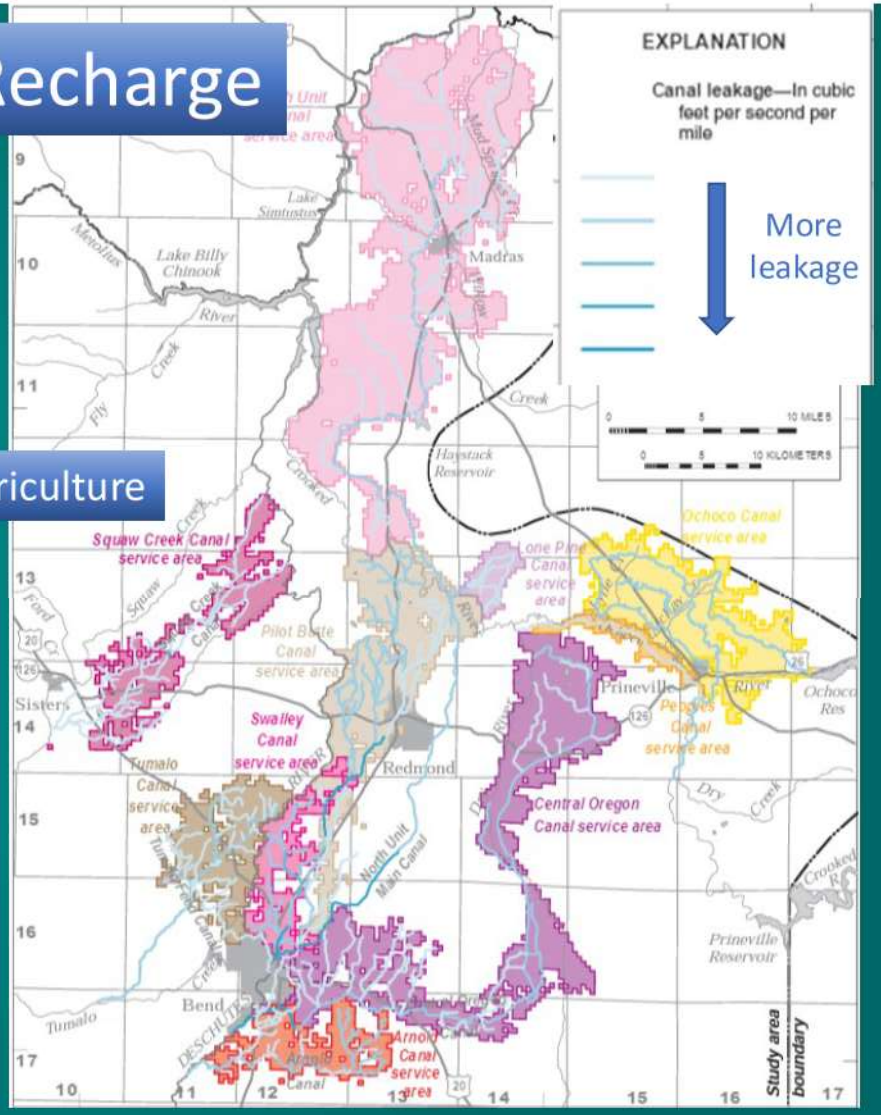
USGS

Groundwater Recharge

Rain and snow

Agriculture



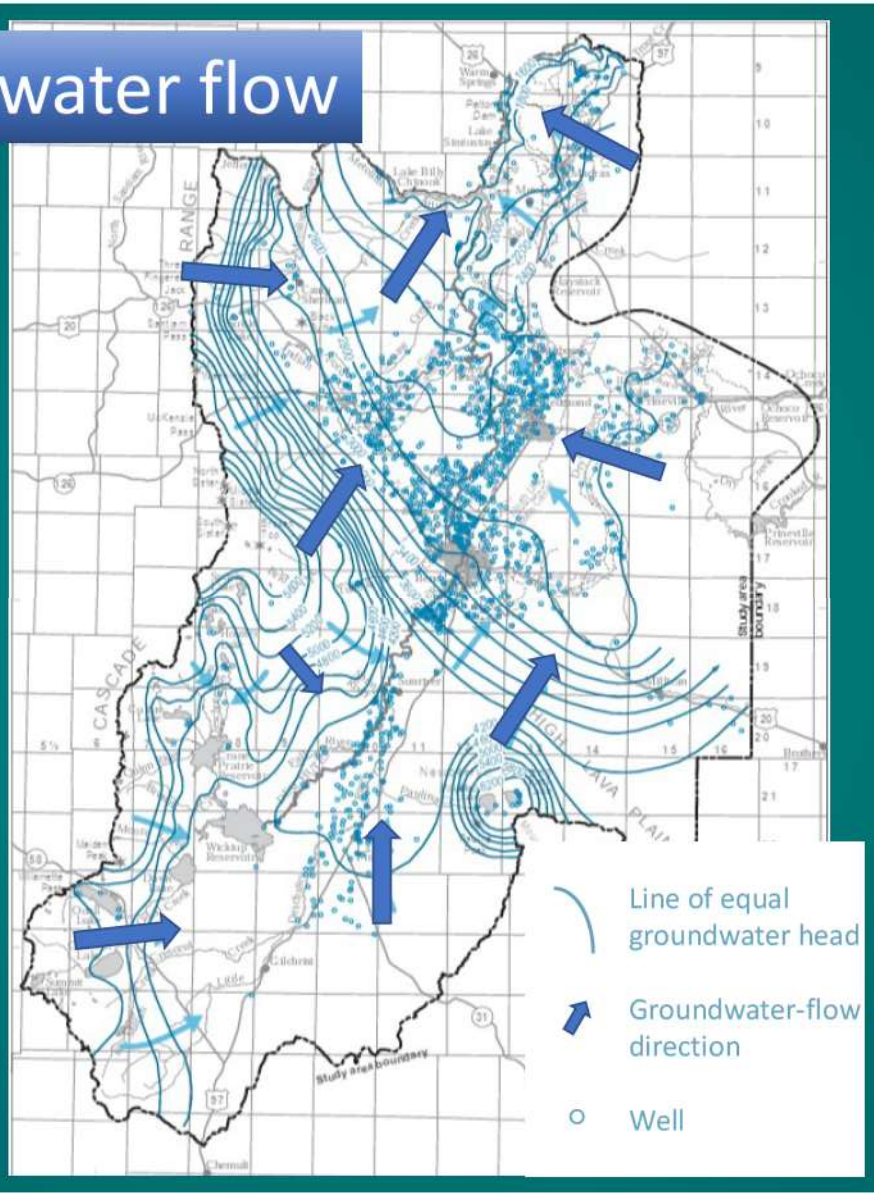


USGS

Gannett and others, 2001

Groundwater flow

A map of groundwater levels shows that groundwater generally flows northward from areas of recharge to discharge along the major streams and rivers



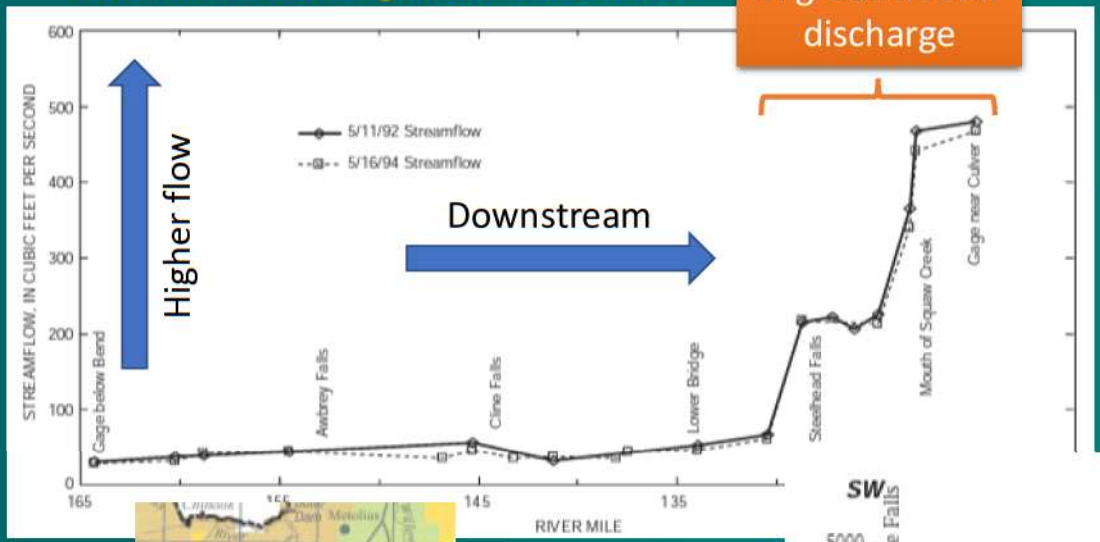
USGS

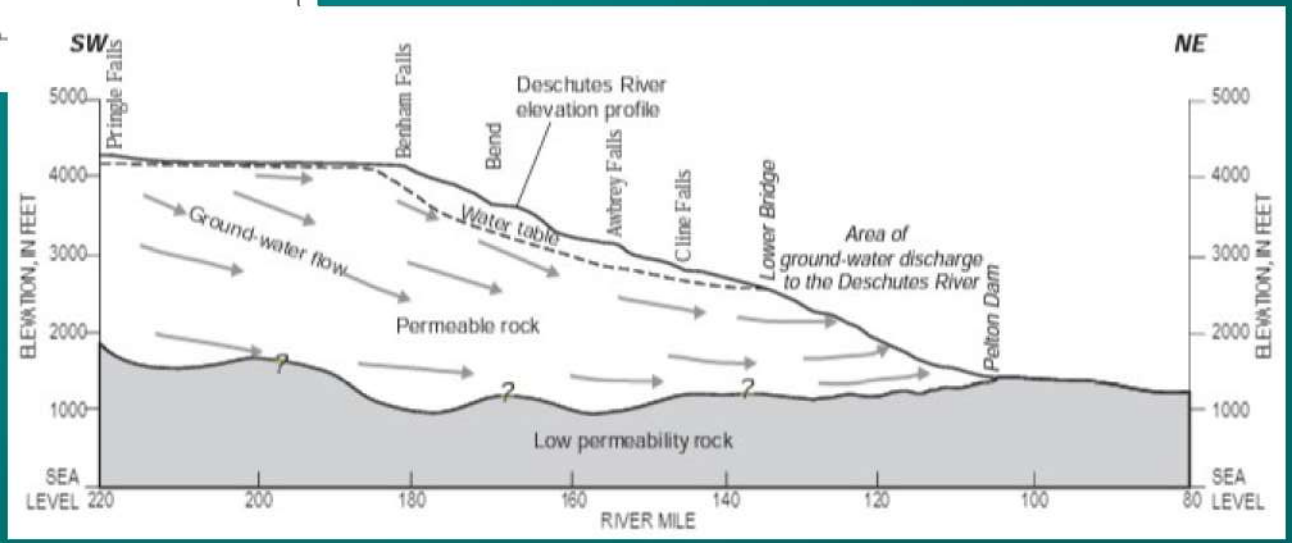
Gannett and others, 2001

Groundwater Discharge

Streamflow measurements and geochemistry help identify groundwater discharge

Streamflow along Deschutes River



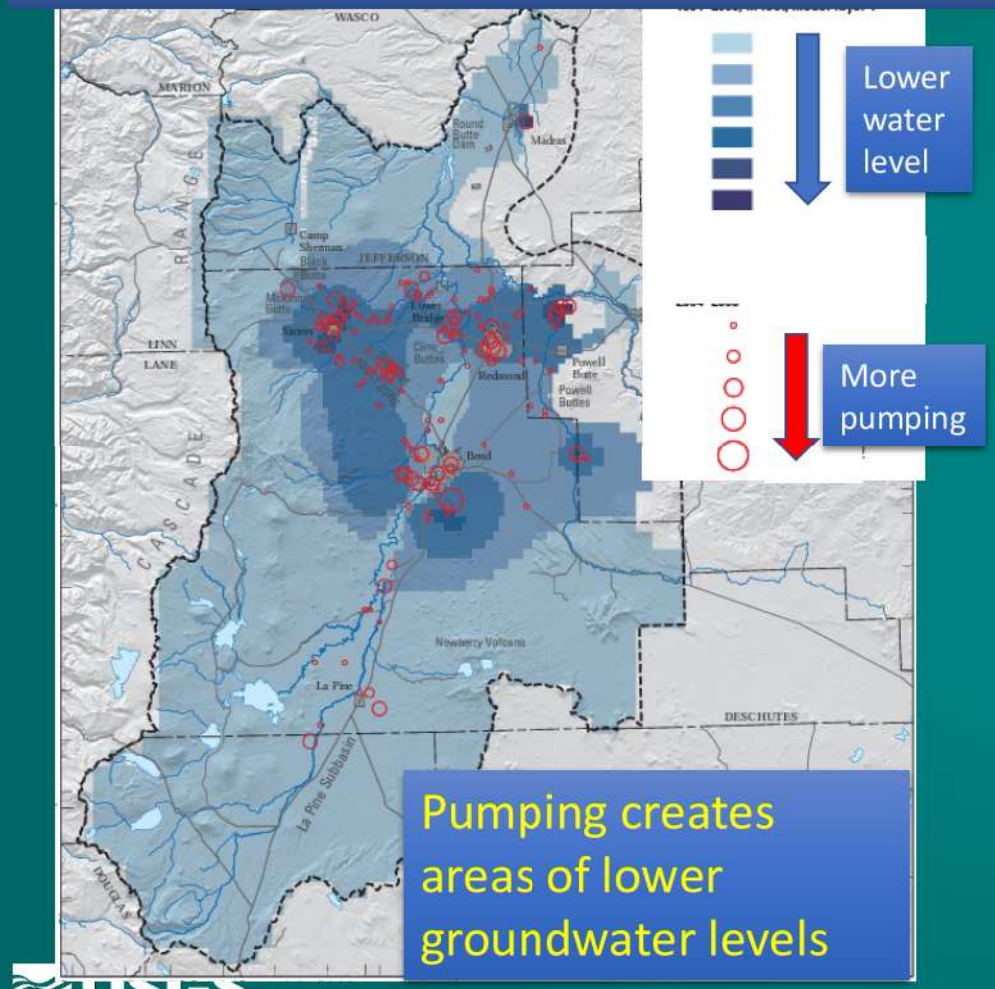


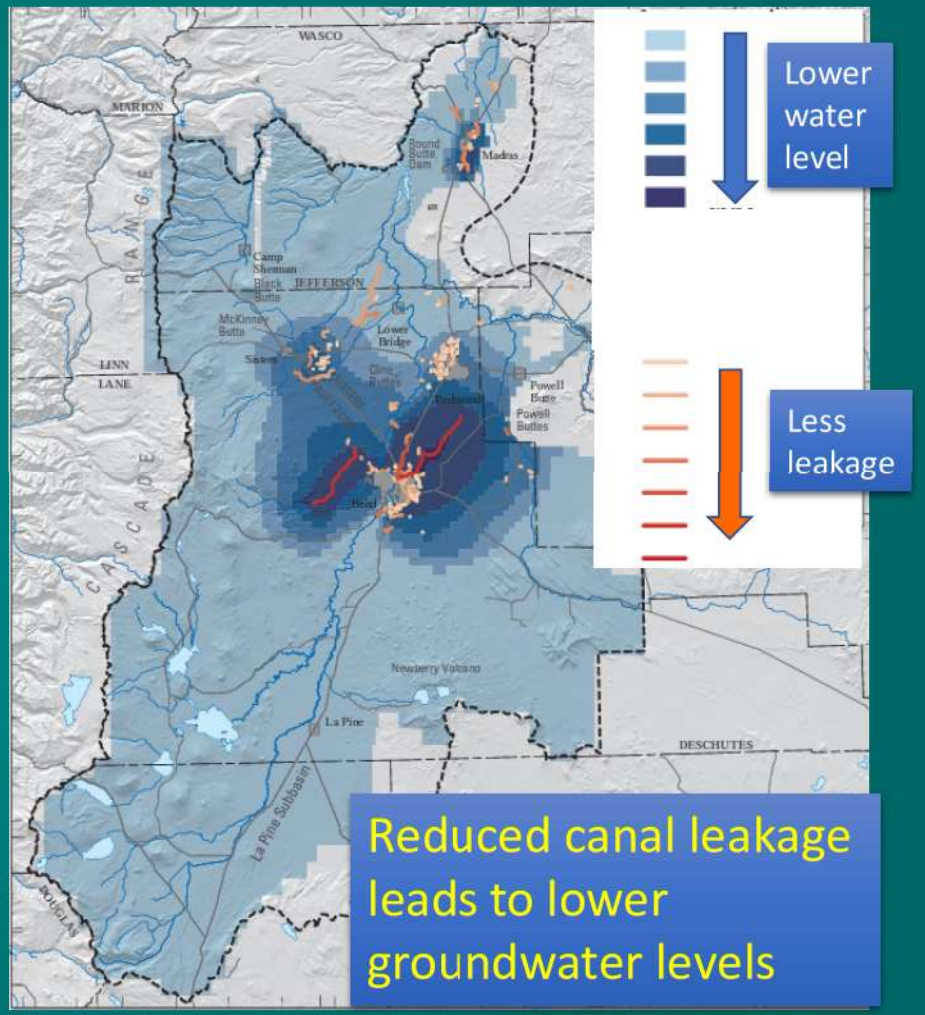
Gannett and others, 2001

Groundwater models help identify the importance of stressors (such as pumping) on the groundwater system

USGS

Change in groundwater storage



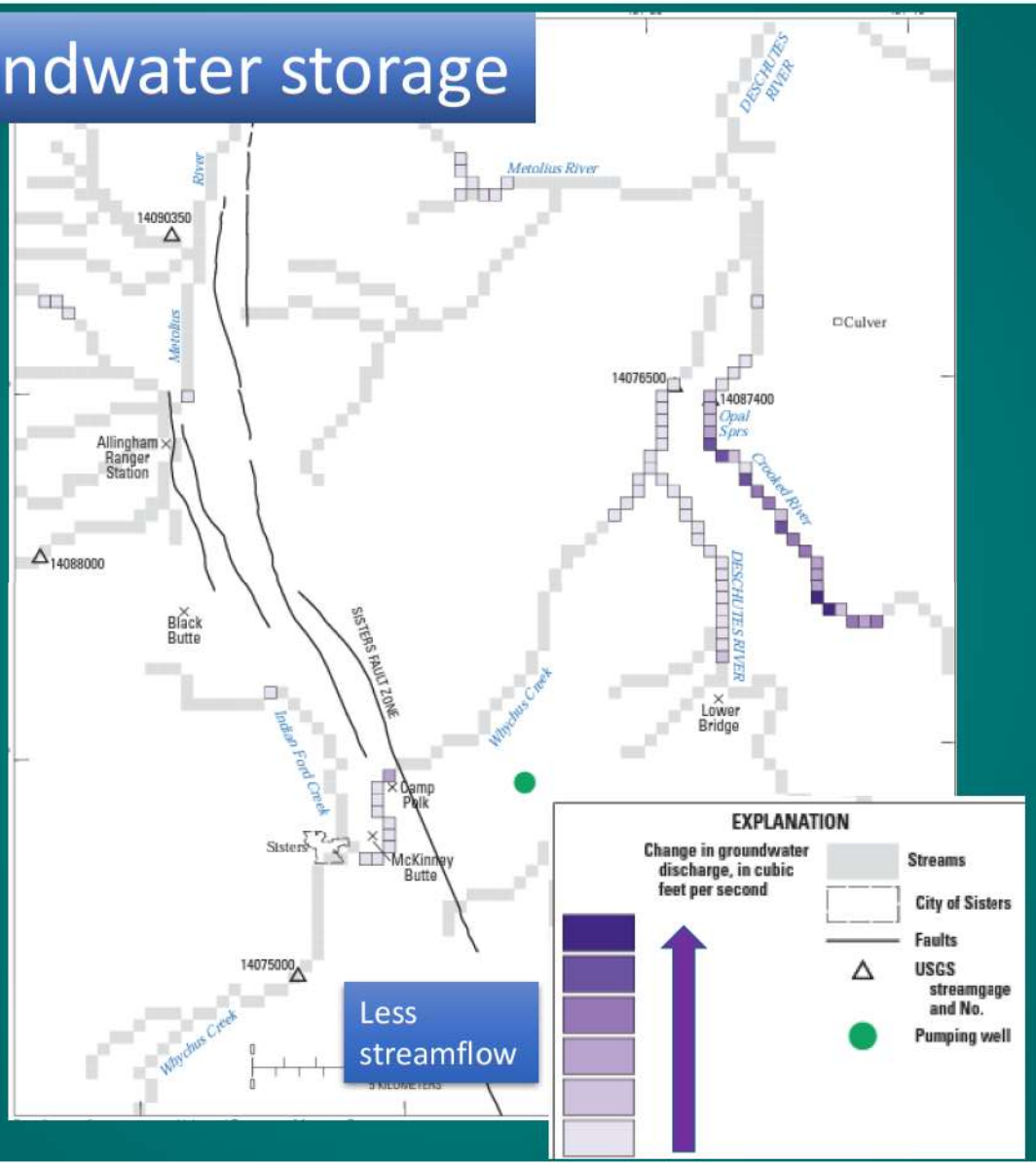


USGS

Gannett and Lite, 2004

Change in groundwater storage

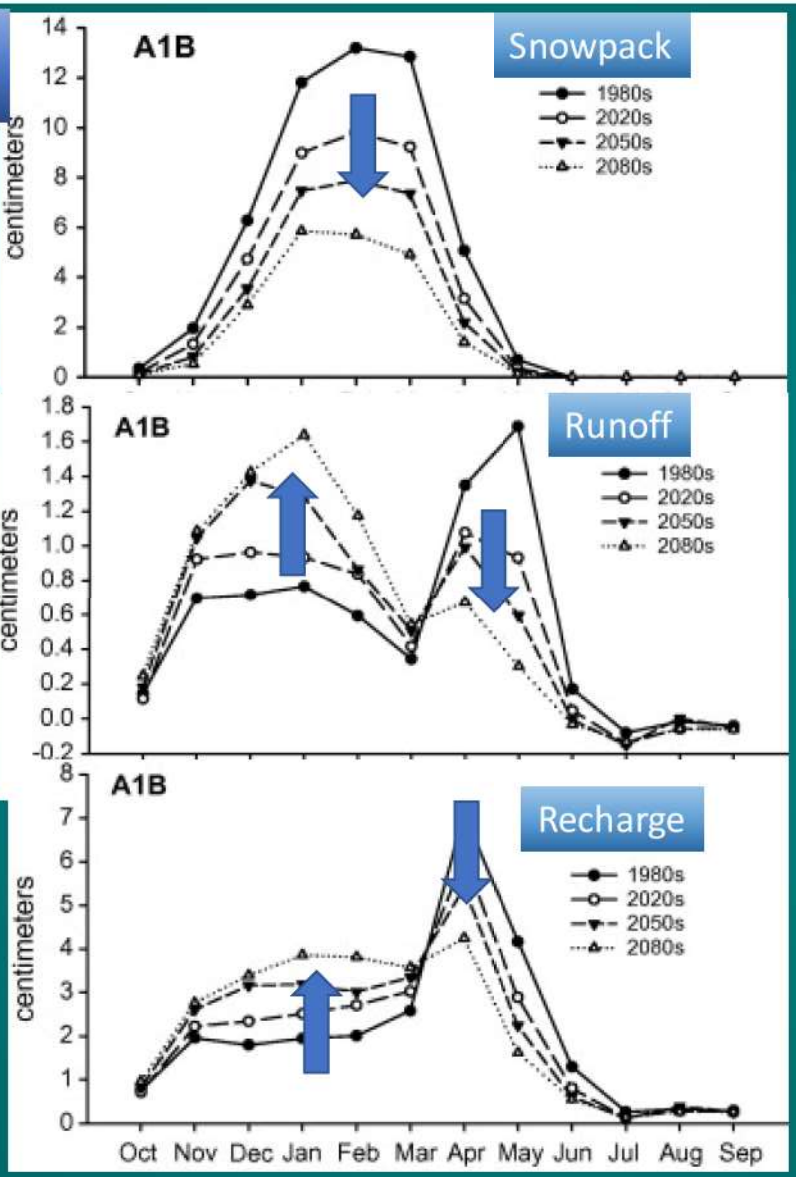
Groundwater pumping can reduce streamflow



Gannett and others, 2017

Future recharge

Timing and distribution of future recharge may change



Less snowpack

Earlier runoff

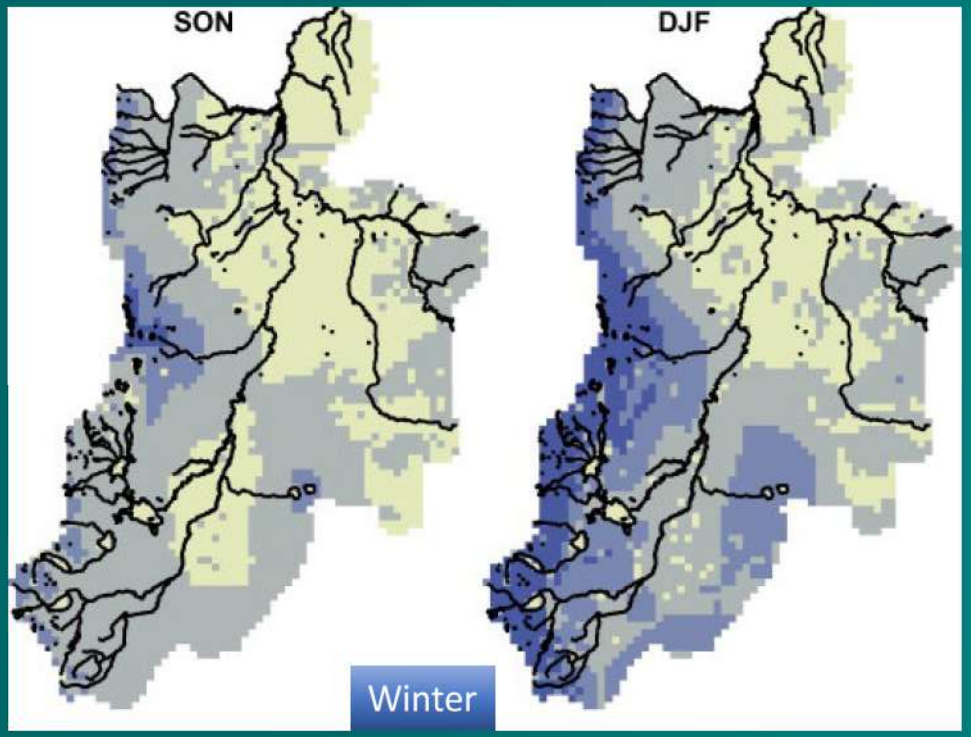
Earlier recharge

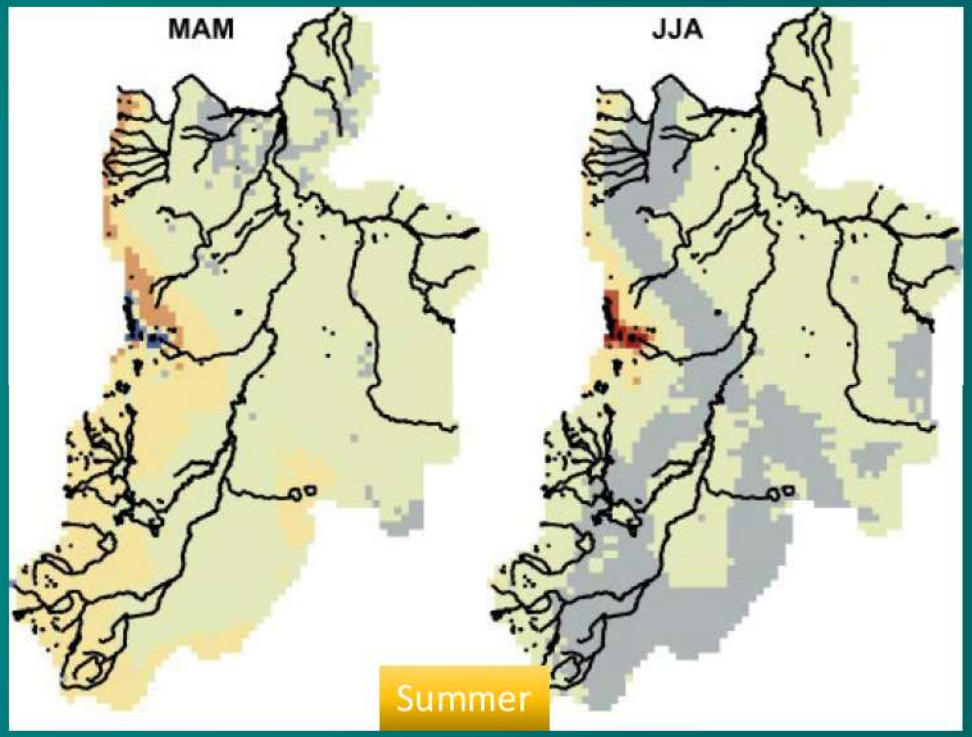
USGS

Waibel and others, 2013

Future recharge

Timing and distribution of future recharge may change





Change in Recharge (cm)

-80 - -49	-33 - -19	-3 - 0	4 - 12
-48 - -34	-18 - -4	1 - 3	13 - 43

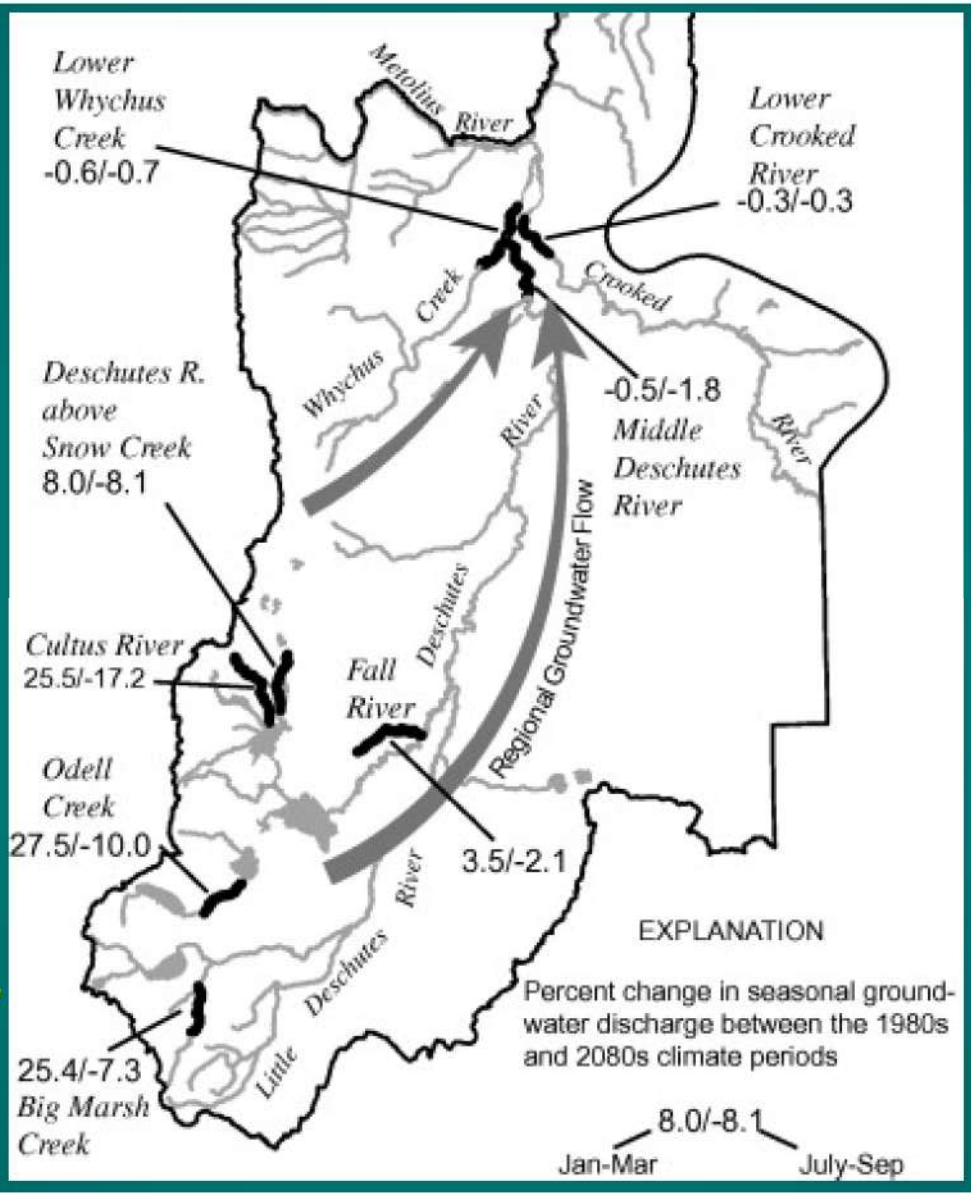
USGS

Waibel and others, 2013

Future recharge

Timing and distribution of future recharge may change

Upper watersheds may have more winter and less summer streamflow



Lower areas may have a more subdued response

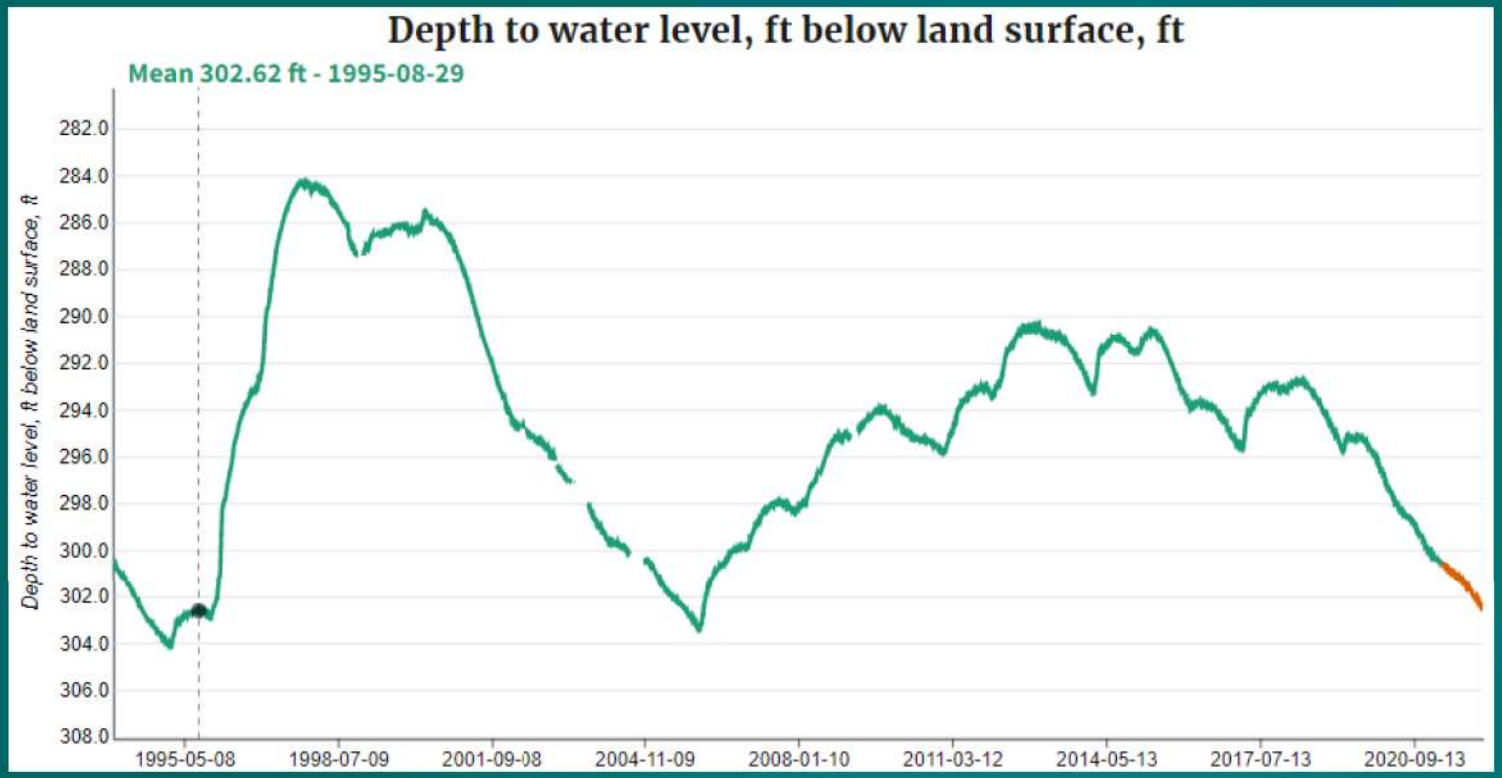
Waibel and others, 2013

USGS

On-going groundwater modeling in the basin

- Development of coupled Bureau of Reclamation MODSIM surface-water routing model with USGS surface water/groundwater model
- OWRD using USGS surface water/groundwater model to evaluate effects of new pumping on streamflow: for example near confluence of Deschutes and Crooked Rivers

USGS



Recent groundwater level in an upland area

https://waterdata.usgs.gov/monitoring-location/442242121405501/#parameterCode=72019&period=P365D

USGS

Recent USGS work in the Deschutes Basin

- Spring persistence study for BLM includes sites in the basin
- Crooked River—Water quality monitoring w/USFWS and BOR
- Bathymetric mapping, stage monitoring in Deschutes River above Bend in support of USFWS Habitat Conservation Plan development
- Whychus Creek restoration monitoring with Upper Deschutes Watershed Council
- Monitored turbidity with Oregon DEQ below Wickiup Dam
- Newberry Volcano geologic map soon to be published
  - Paper on recent gas emissions at East Lake
- City of Sisters flood inundation modeling for dam failure

USGS

References

- Caldwell, R.R., 1998, Chemical study of regional ground-water flow and ground-water/surface-water interaction in the Upper Deschutes Basin, Oregon: U.S. Geological Survey Water-Resources Investigations Report 97-4233, 49 p. https://doi.org/10.3133/wri974233.
- Gannett, M.W., Lite Jr, K.E., Morgan, D.S., and Collins, C.A., 2001, Ground-Water Hydrology of the Upper Deschutes Basin, Oregon: U.S. Geological Survey Water-Resources Investigations Report 2000-4162, 74 p. https://doi.org/10.3133/wri004162.
- Gannett, M.W., and Lite Jr, K.E., 2004, Simulation of regional ground-water flow in the Upper Deschutes Basin, Oregon: U. S. Geological Survey Water-Resources Investigations Report 2003-4195, 95 p. https://doi.org/10.3133/wri034195.
- Gannett, M.W., and Lite Jr, K.E., 2013, Analysis of 1997–2008 groundwater level changes in the upper Deschutes Basin, Central Oregon: U. S. Geological Survey Scientific Investigations Report 2013-5092, 44 p. https://doi.org/10.3133/sir20135092.
- Gannett, M.W., Lite Jr, K.E., Risley, J.C., Pischel, E.M., and La Marche, J.L., 2017, Simulation of groundwater and surface-water flow in the upper Deschutes Basin, Oregon: U. S. Geological Survey Scientific Investigations Report 2017-5097, 80 p. https://doi.org/10.3133/sir20175097.
- Lite Jr, K.E., and Gannett, M.W., 2002, Geologic framework of the regional ground-water flow system in the Upper Deschutes Basin, Oregon: U. S. Geological Survey Water-Resources Investigations Report 2002-4015, 44 p. https://doi.org/10.3133/wri024015.
- Waibel, M.S., Gannett, M.W., Chang, H., and Hulbe, C.L., 2013, Spatial variability of the response to climate change in regional groundwater systems – Examples from simulations in the Deschutes Basin, Oregon: Journal of Hydrology, v. 486, p. 187-201. https://doi.org/https://doi.org/10.1016/j.jhydrol.2013.01.019.

USGS

CENTRAL OREGON

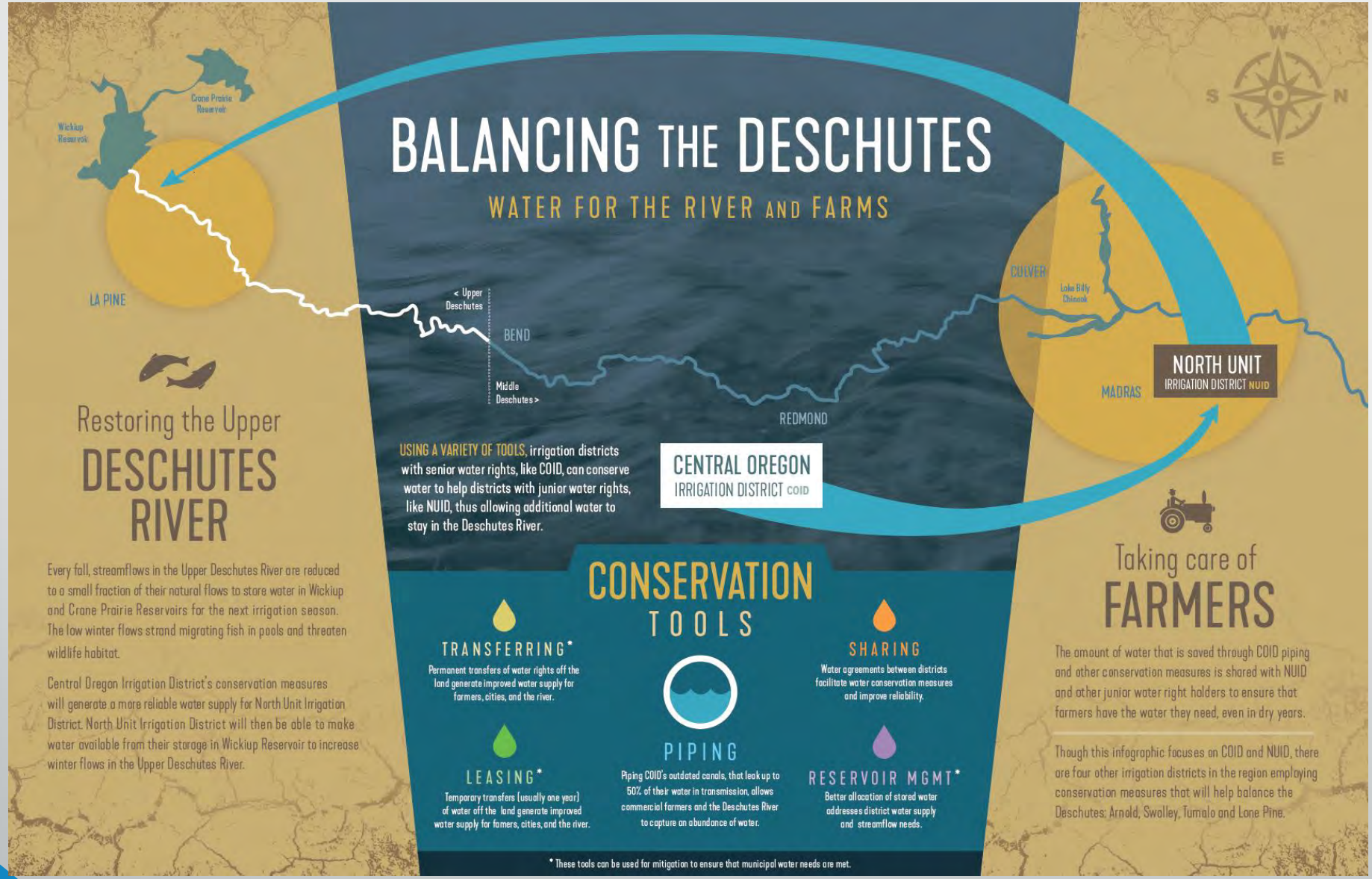
Irrigation

DISTRICT

Since 1918

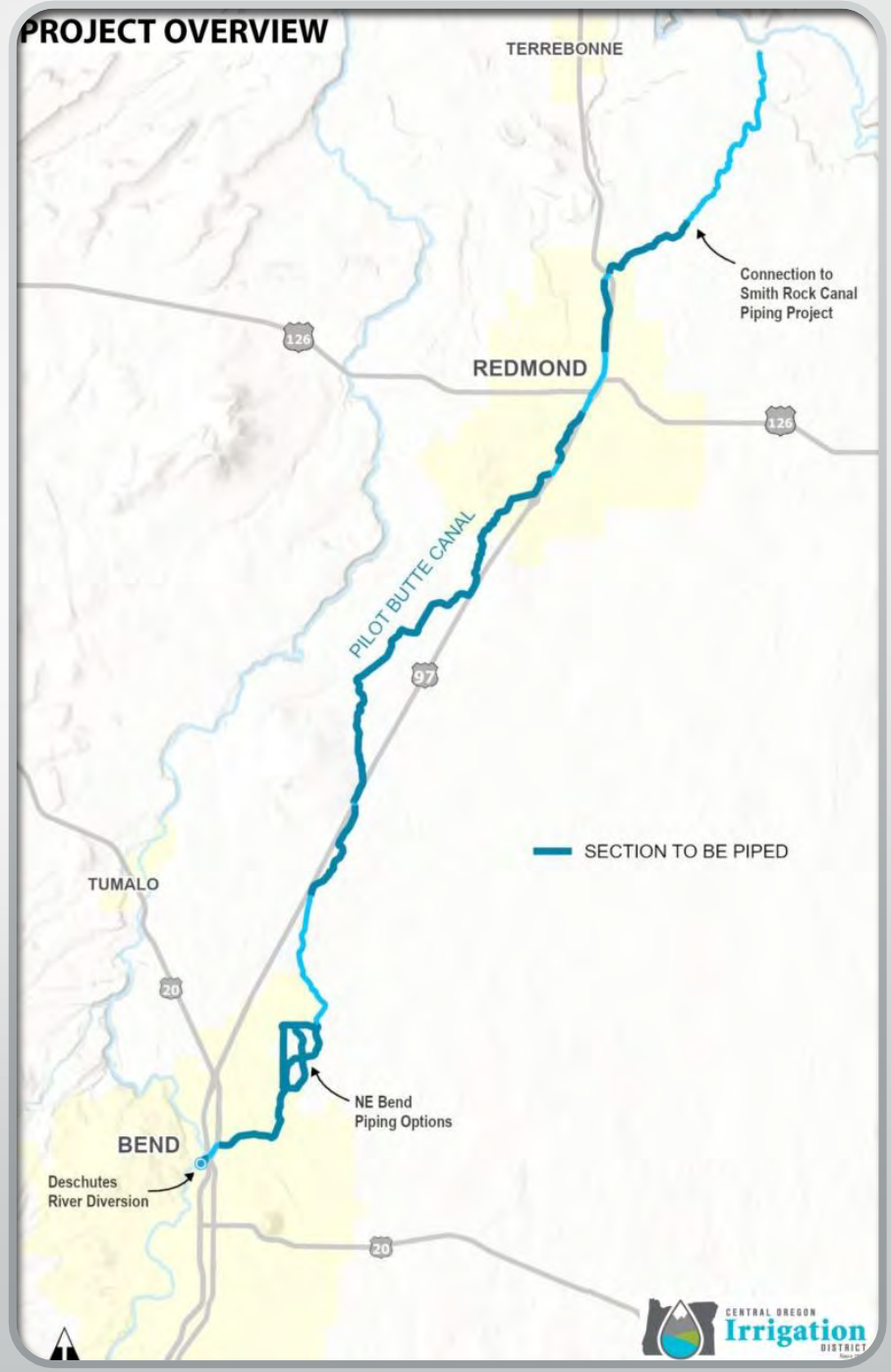
What Happens to COID Water Conserved by Piping?

- 2017 Agreement between COID and North Unit Irrigation District (NUID)
  - Conserved water delivered to NUID during the irrigation season
  - NUID releases an equal volume of water from Wickiup Reservoir during the winter months, improving Deschutes River flows, benefitting ESA and river health


BALANCING THE DESCHUTES
WATER FOR THE RIVER AND FARMS
Crane Prairie Reservoir
Wickiup Reservoir
LA PINE
< Upper Deschutes
BEND
Middle Deschutes >
REDMOND
CULVER
Lake Billy Chinook
MADRAS
NORTH UNIT IRRIGATION DISTRICT NUID
W
S
N
E
Restoring the Upper
DESCHUTES RIVER
Every fall, streamflows in the Upper Deschutes River are reduced to a small fraction of their natural flows to store water in Wickiup and Crane Prairie Reservoirs for the next irrigation season. The low winter flows strand migrating fish in pools and threaten wildlife habitat.
Central Oregon Irrigation District's conservation measures will generate a more reliable water supply for North Unit Irrigation District. North Unit Irrigation District will then be able to make water available from their storage in Wickiup Reservoir to increase winter flows in the Upper Deschutes River.
USING A VARIETY OF TOOLS, irrigation districts with senior water rights, like COID, can conserve water to help districts with junior water rights, like NUID, thus allowing additional water to stay in the Deschutes River.
CENTRAL OREGON IRRIGATION DISTRICT COID
CONSERVATION TOOLS
TRANSFERRING*
Permanent transfers of water rights off the land generate improved water supply for farmers, cities, and the river.
LEASING*
Temporary transfers (usually one year) of water off the land generate improved water supply for famers, cities, and the river.
PIPING
Piping COID's outdated canals, that leak up to 50% of their water in transmission, allows commercial farmers and the Deschutes River to capture an abundance of water.
SHARING
Water agreements between districts facilitate water conservation measures and improve reliability.
RESERVOIR MGMT*
Better allocation of stored water addresses district water supply and streamflow needs.
* These tools can be used for mitigation to ensure that municipal water needs are met.
Taking care of
FARMERS
The amount of water that is saved through COID piping and other conservation measures is shared with NUID and other junior water right holders to ensure that farmers have the water they need, even in dry years.
Though this infographic focuses on COID and NUID, there are four other irrigation districts in the region employing conservation measures that will help balance the Deschutes: Arnold, Swalley, Tumalo and Lone Pine.

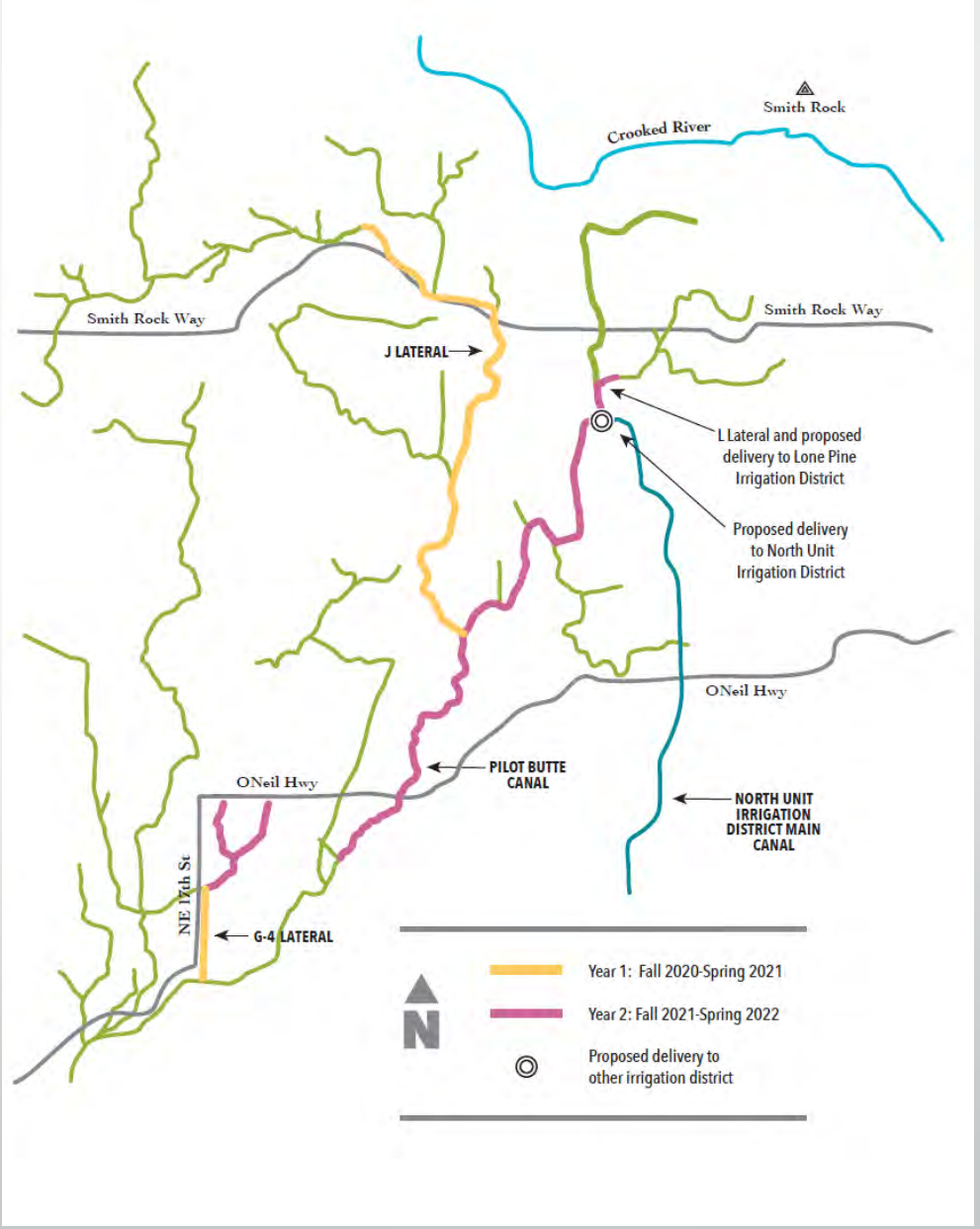
PIPING THE PILOT BUTTE CANAL

- Conveys 17,338 Acres of Water
- 25 Miles Long
- Approximately 156 cfs of Water Will be Saved Through Piping



PHASE I & II October 2020 – March 2022

Piping Smith Rock/King Way 29 cfs of Water Conserved



Installation of 102" Steel Pipe

Senator Merkley and Craig Horrell

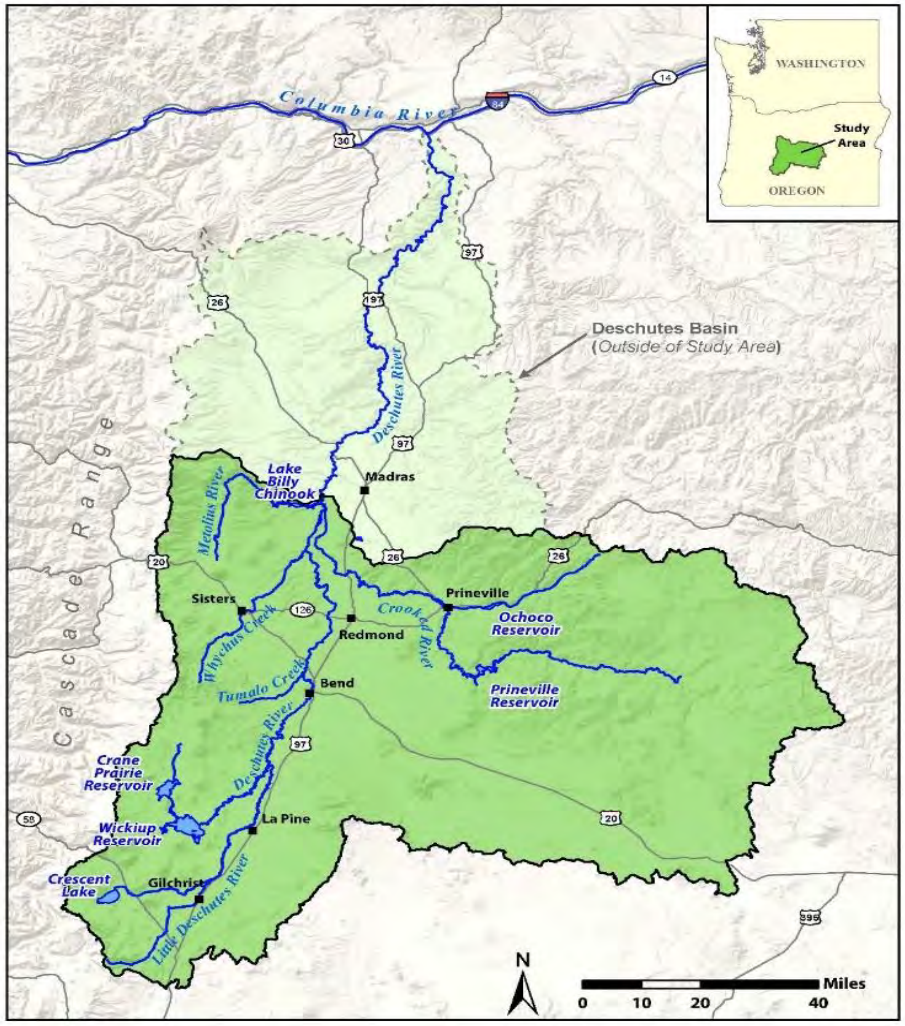
Water in the Deschutes

DESCHUTES RIVER
CONSERVANCY

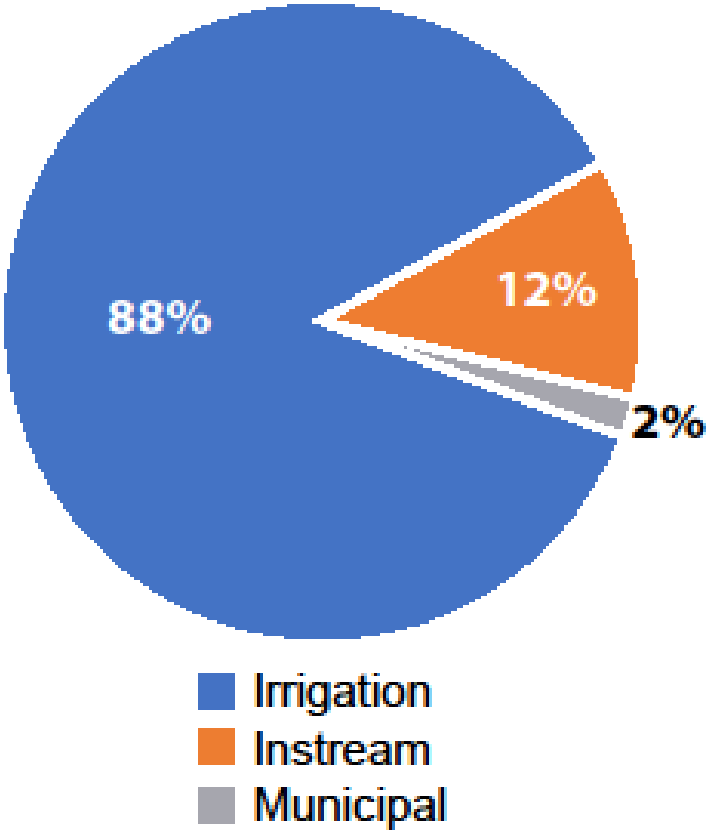
Outline

- Water supply & demand
- DRC role
- Solutions
- Deschutes Basin Water Collaborative

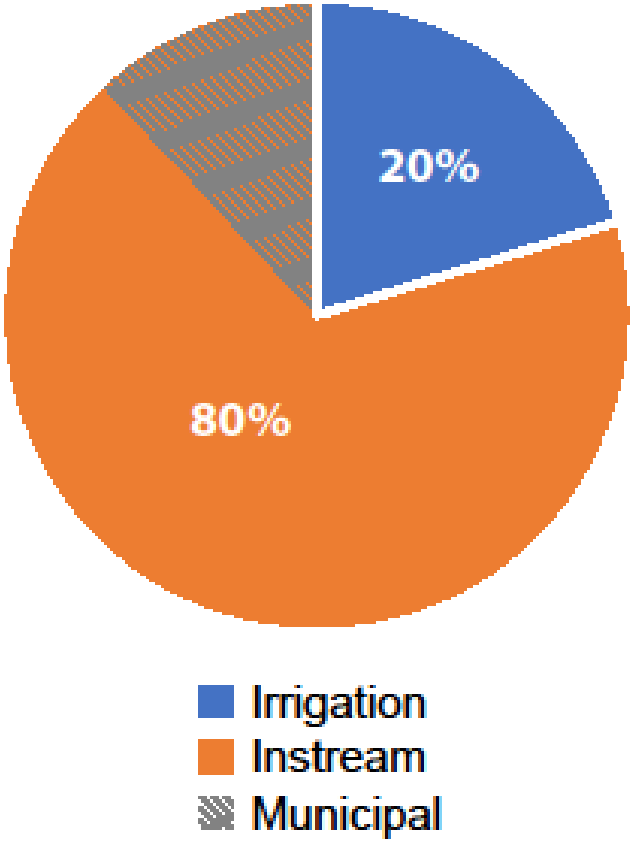
The Deschutes Basin



Basin Water Rights Distribution

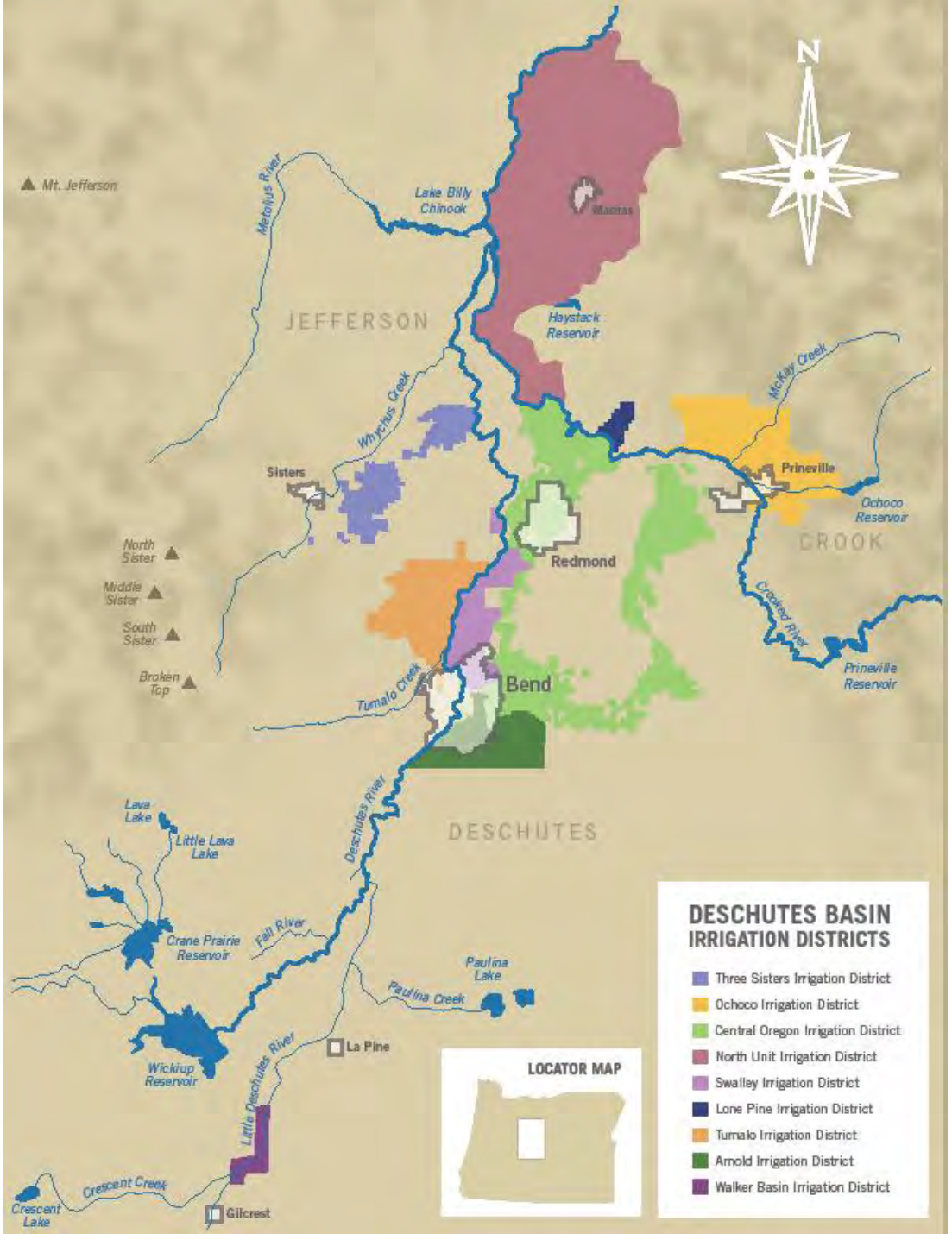


Estimated Supply Shortfalls



Geographic Water Distribution

Upper Deschutes Basin



Legal Distribution - Priority

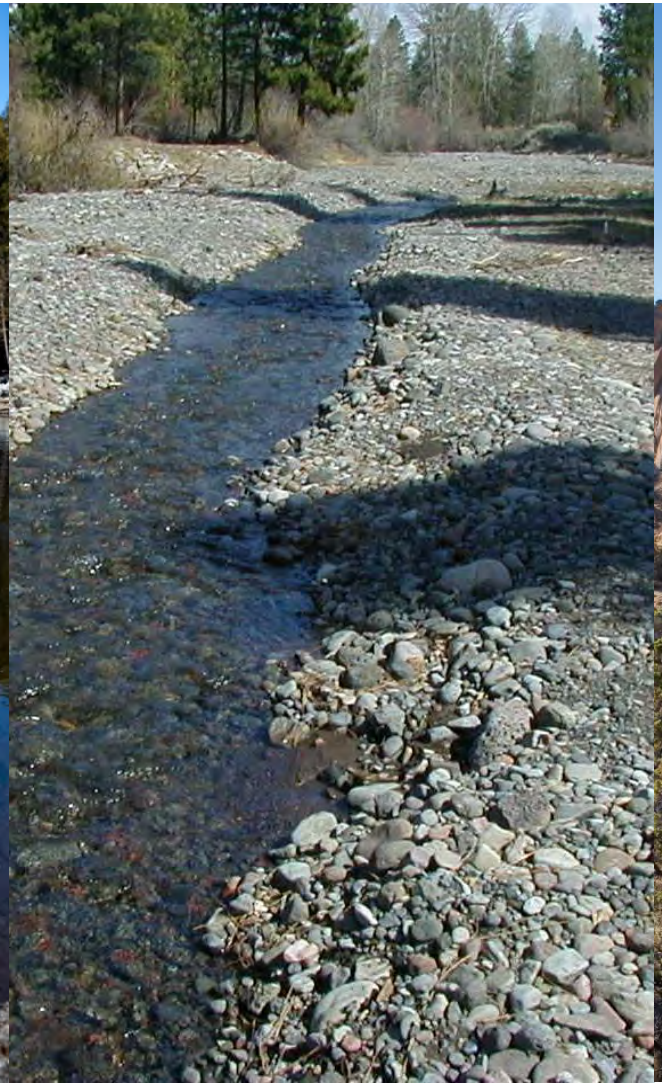
Swalley	1899
Central Oregon	1900, 1907
Lone Pine	1900
Tumalo	1905
Arnold	1905
North Unit	1913
Deschutes River	1983

Deschutes River

98% of flows were diverted for irrigation

Whychus Creek

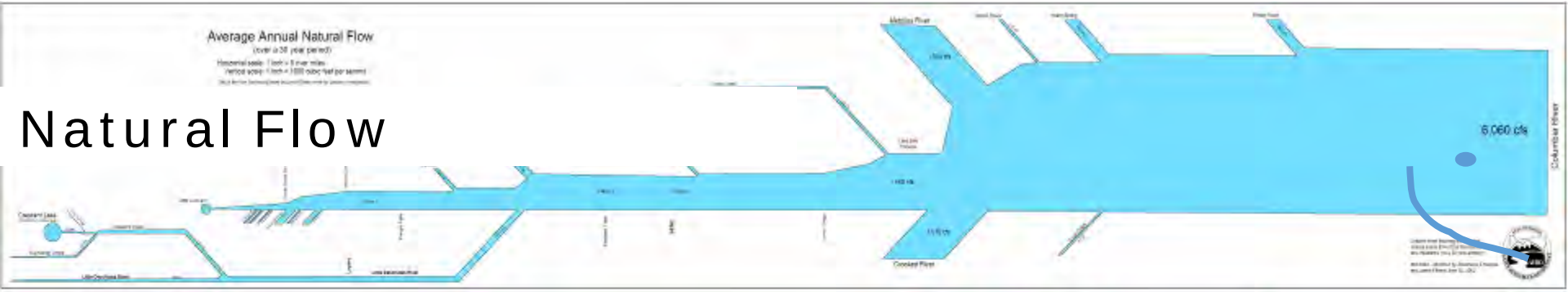
Every 2 out of 3 years, the creek would run dry



Crooked Riv

Extensively diverted flows would leave only a trickle of water at Smith Rock

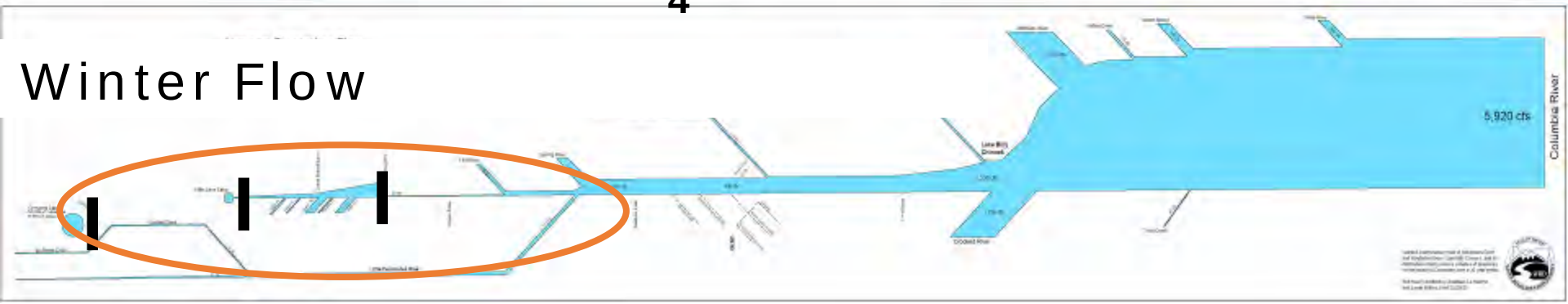
The Blue Whales



Natural Flow

Summer Flow

4

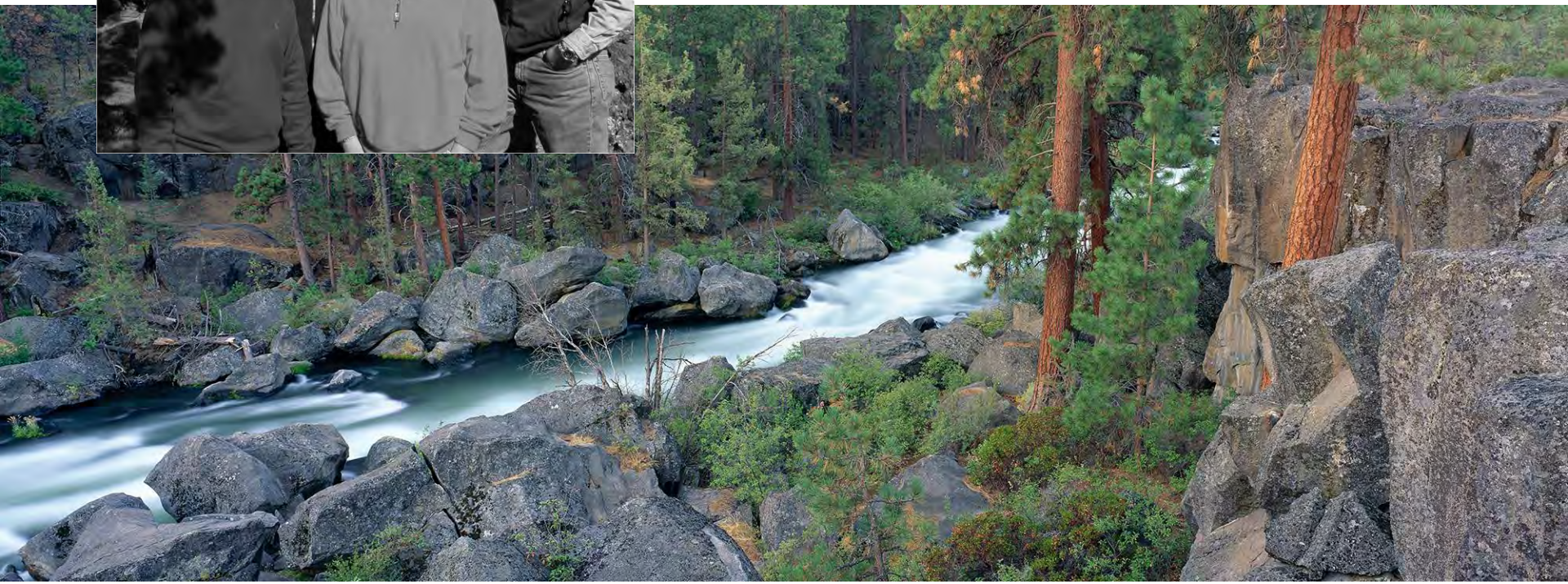


Winter Flow

Middle Deschutes below Bend in Summer

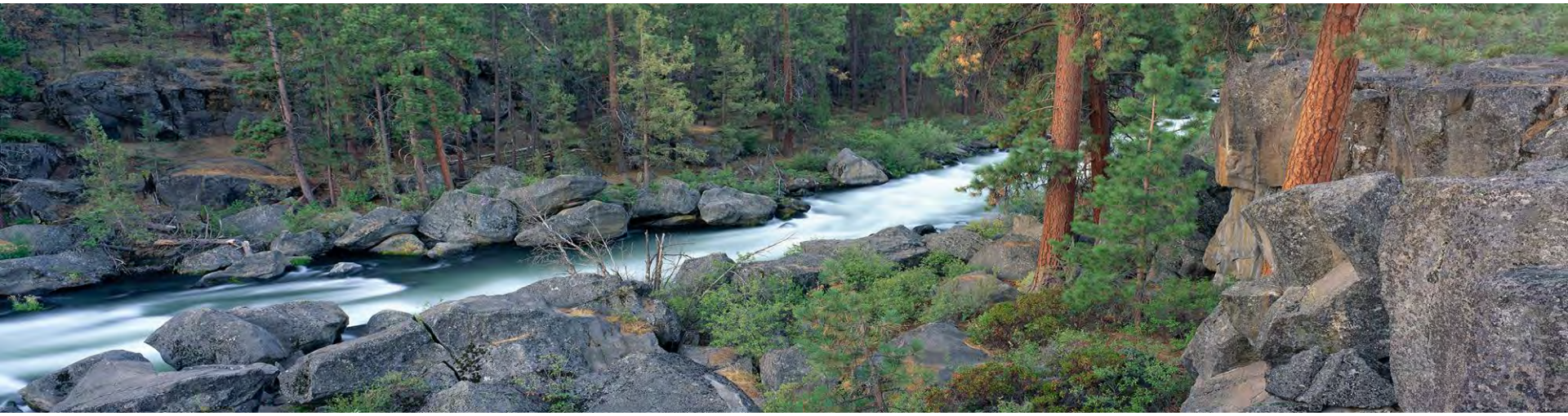
Upper Deschutes below Wickiup in Winter

DESCHUTES RIVER
CONSERVANCY



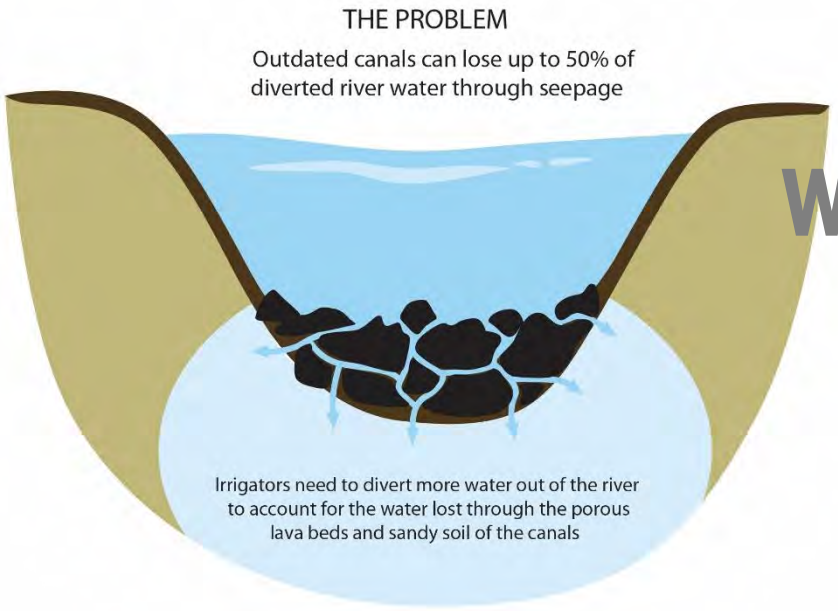
Mission:
To Restore Streamflow and Water Quality in the Deschutes Basin

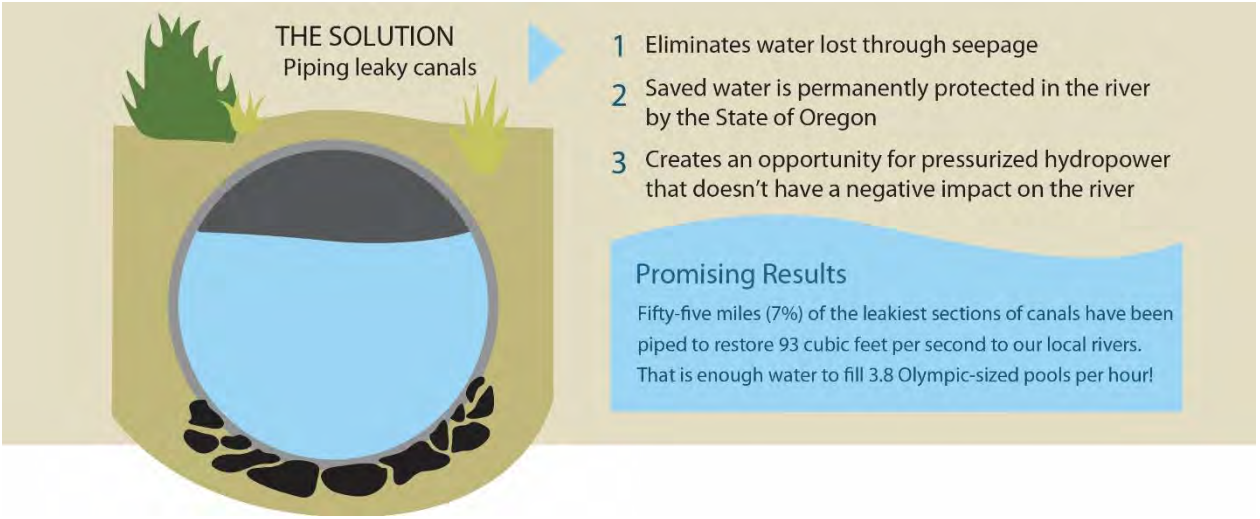
Our Tools



Using Collaboration & Consensus

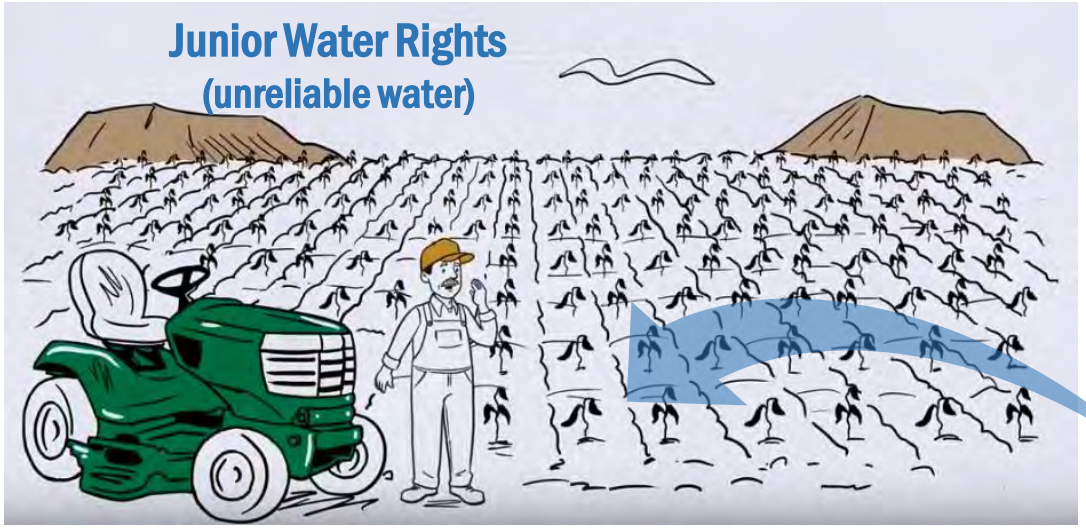
Water Conservation Projects (piping and lining canals)





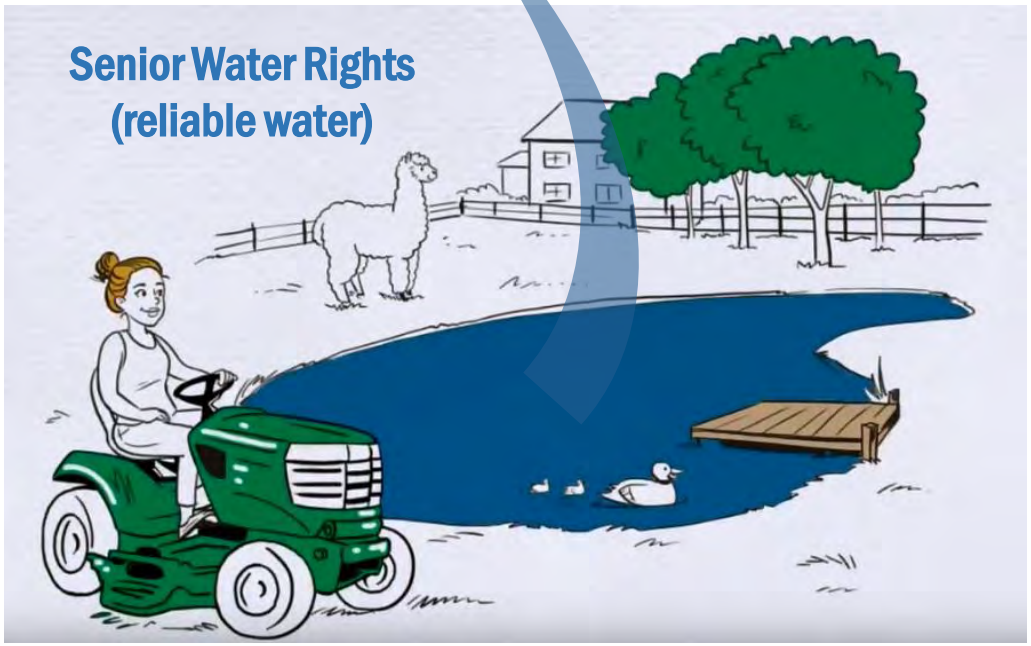
On-Farm Efficiency
Water Conservation Projects

Water Banking

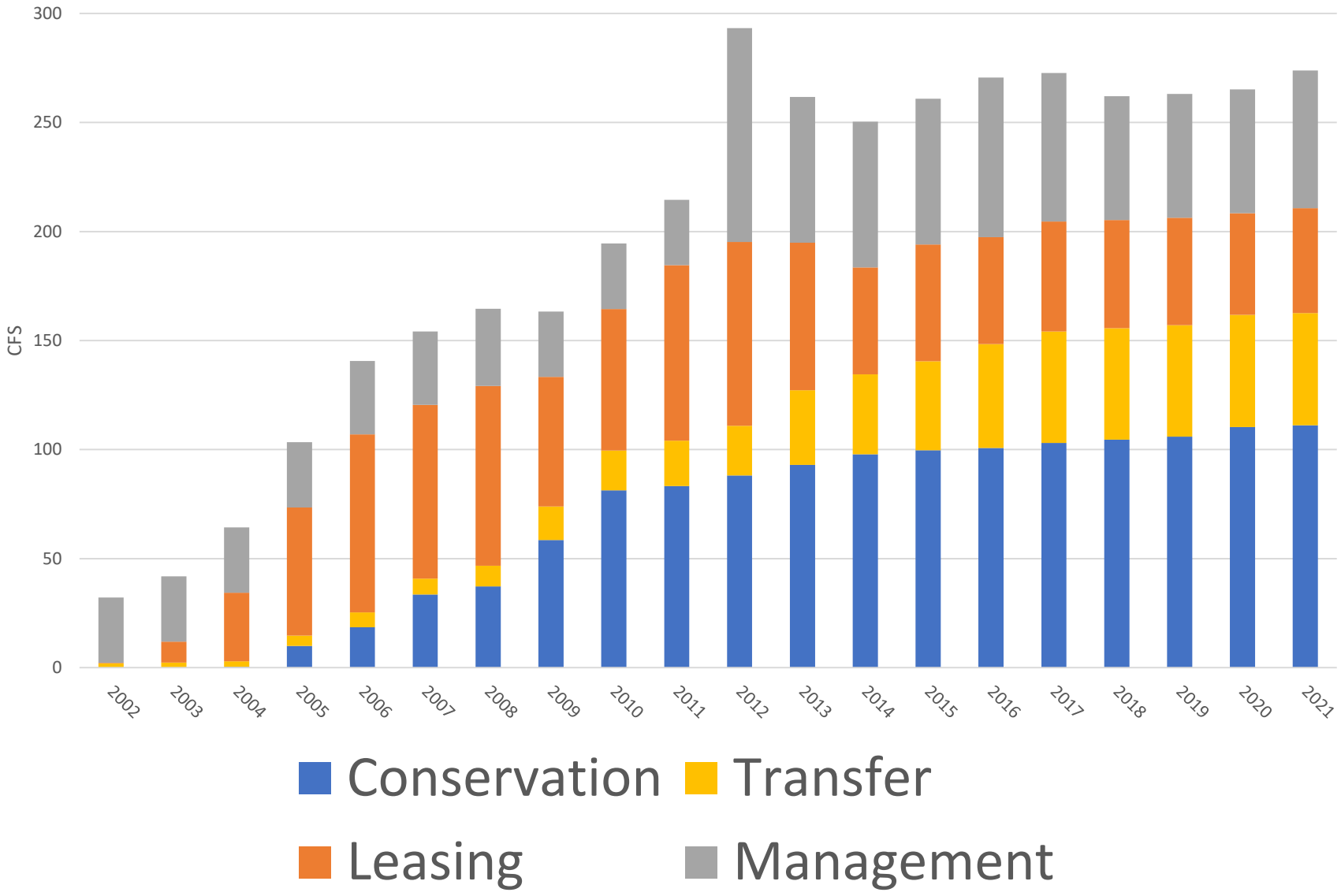


The DRC works with irrigation districts and landowners to **lease water** rights that are not currently being used to **stay instream**.

We are expanding programs to **move water** between irrigators to **benefit farms and flows**.



Flow Results



Flow Restoration Progress

Whychus Creek

0 cfs → 20 cfs

Middle Deschutes

30 cfs → 125 cfs

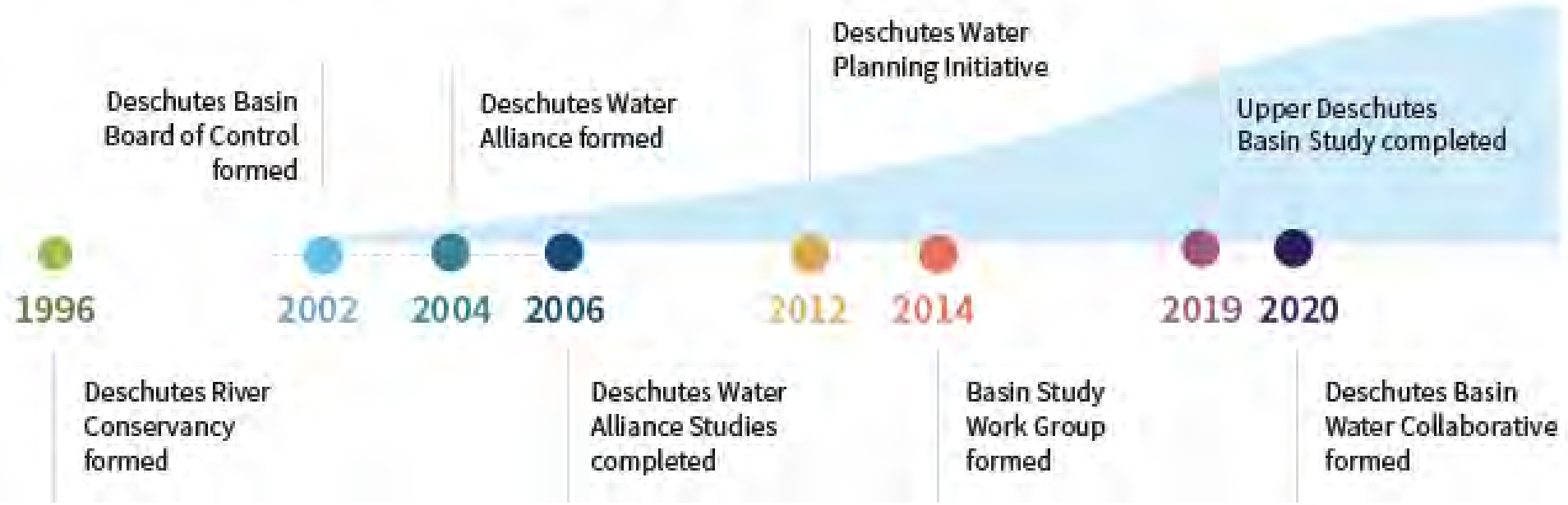
Balanced Results

Key Issues Remain

- Upper Deschutes River flow restoration
- Time-critical ESA issues & risk to agricultural issues
- Ongoing need for reliable groundwater mitigation for municipal water providers
- Extreme & extended drought


NO WATER
NO FARMS
NO FOOD
PERFECTBALANCEUSA.ORG

A HISTORY OF *Working Together*



Deschutes Basin WATER COLLABORATIVE

Water for Rivers, Agriculture and Communities

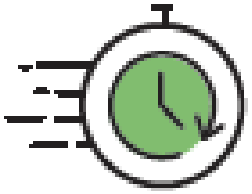
More than 40 member organizations

Deschutes Basin Water Collaborative **Members**

Oregon Governor's Office
Oregon Dept. of Agriculture
Oregon Dept. of Environmental Quality
Oregon Dept. of Fish & Wildlife
Oregon Water Resources Dept.
US Fish & Wildlife Service
US Forest Service
Oregon Environmental Council
Arnold Irrigation District
Central Oregon Irrigation District
Lone Pine Irrigation District
North Unit Irrigation District
Deschutes Soil & Water Conservation District
Central Oregon Intergovernmental Council
Confederated Tribes of Warm Springs
League of Women Voters – Deschutes County
Central Oregon Cities Organization
Avion Water Company
Ochoco Irrigation District
Water for Life
City of Bend
City of La Pine
City of Prineville
City of Redmond
Crook County
Jefferson County
Central Oregon LandWatch
Central Oregon Informed Angler
Crooked River Watershed Council
Deschutes River Conservancy
Great Old Broads for Wilderness
Oregon Natural Desert Association; Sunriver Anglers
Trout Unlimited – Deschutes Redband Chapter
Trout Unlimited (State Office)
Upper Deschutes Watershed Council
WaterWatch of Oregon
Portland General Electric
Coalition for the Deschutes

Deschutes Basin WATER COLLABORATIVE
Water for Rivers, Agriculture and Communities

DWBC Priority Actions



Accelerate Implementation

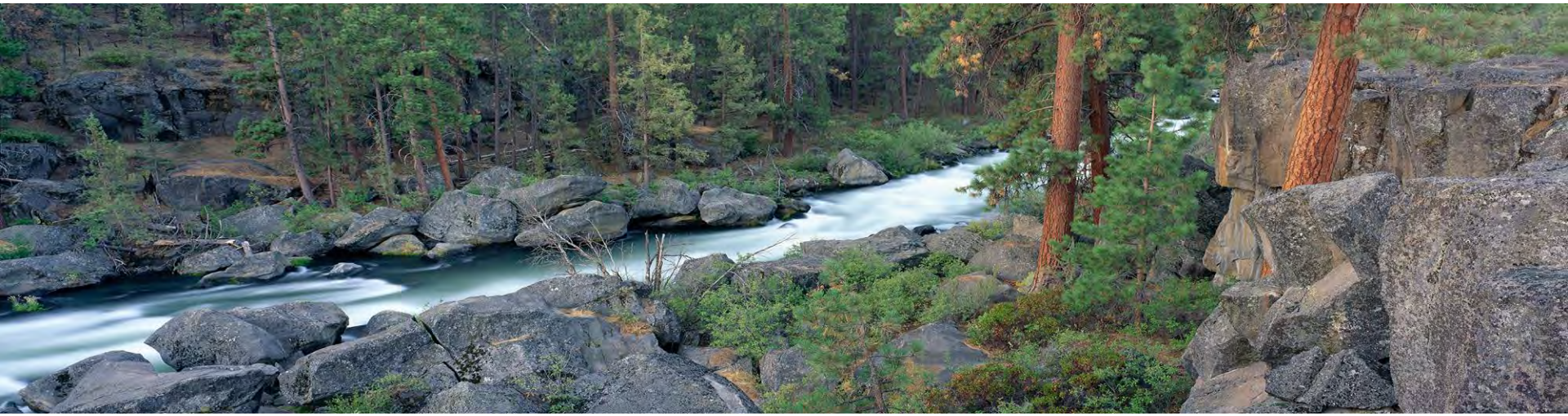
Develop a Comprehensive Water Management Plan

Leverage Funding

Support Policies that Advance DBWC Goals and Consensus Agreements

Moving Forward:
Expand forum to address issues in other river reaches and tributaries

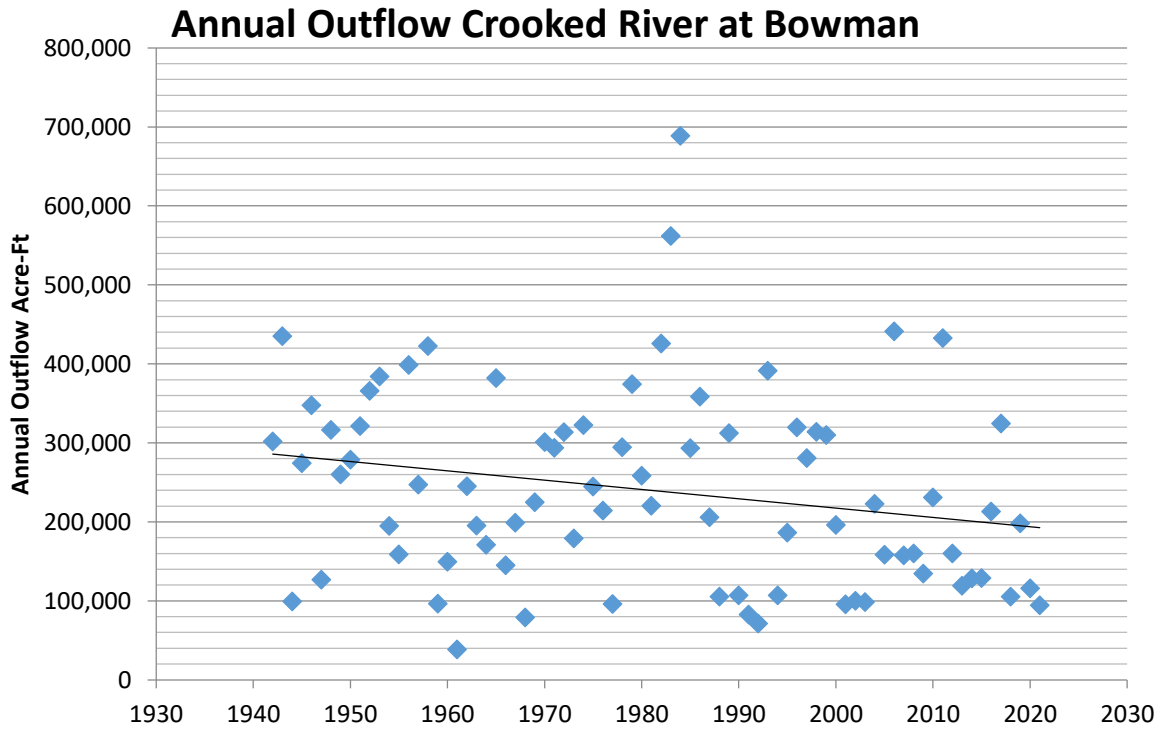
How Deschutes County can be involved



- Continued participation in and support of DBWC
- ARPA investment in helping farmers increase efficiencies—thank you for helping fund this program!
- Integrating water considerations into County planning and decision-making

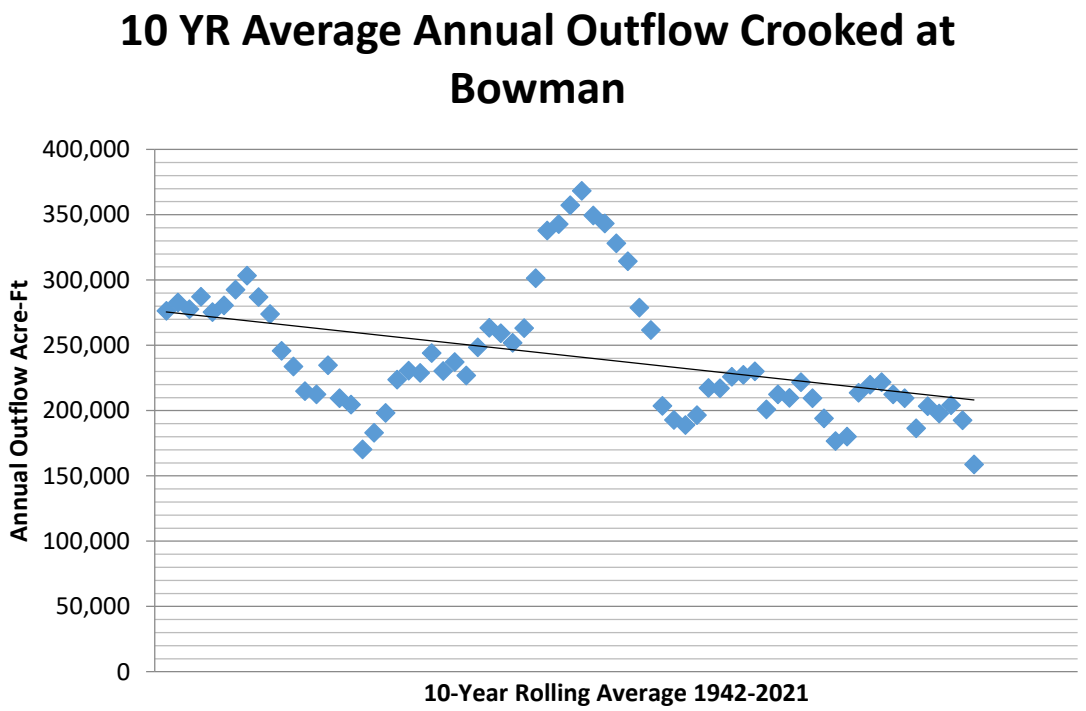
Improve Water Quality & Quantity

- Outflow from the Crooked River has been monitored since 1942
  - Maximum 689,000 acre1ft in 1984
  - Minimum 39,000 acre-ft in 1961
  - Fitted trend line shows a decrease of 85,000 acre-ft per year



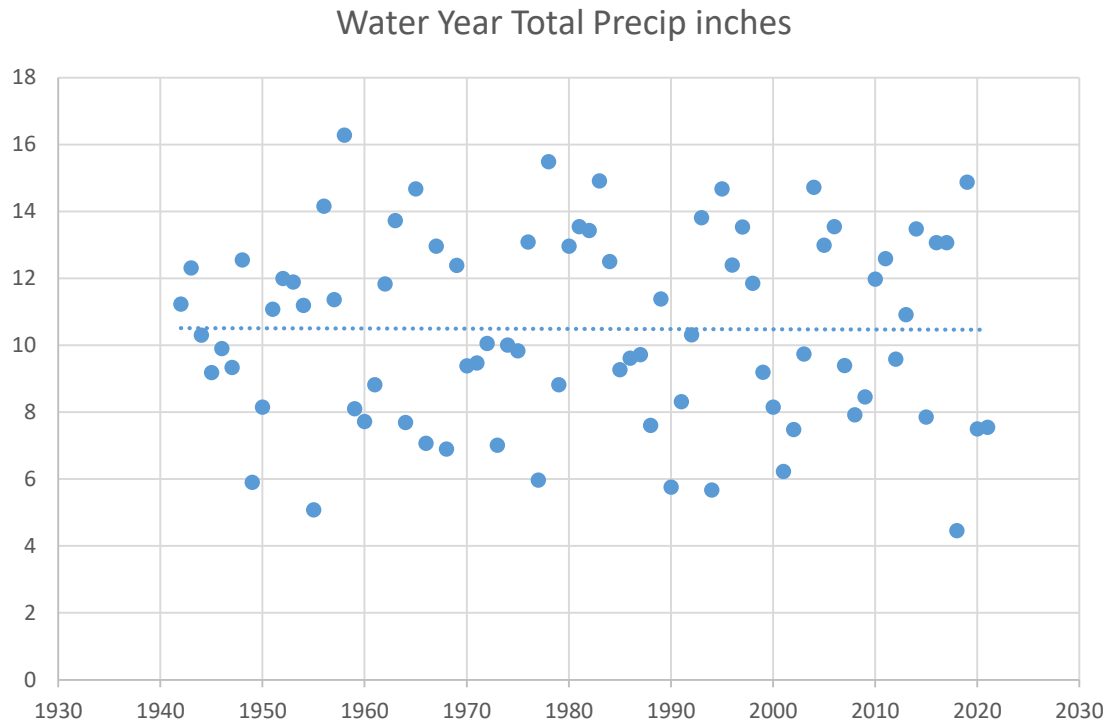
Improve Water Quality & Quantity

- 10 year rolling average is used to smooth the data
  - Cyclical climate patterns emerge
  - Fitted line shows a similar decrease in outflow

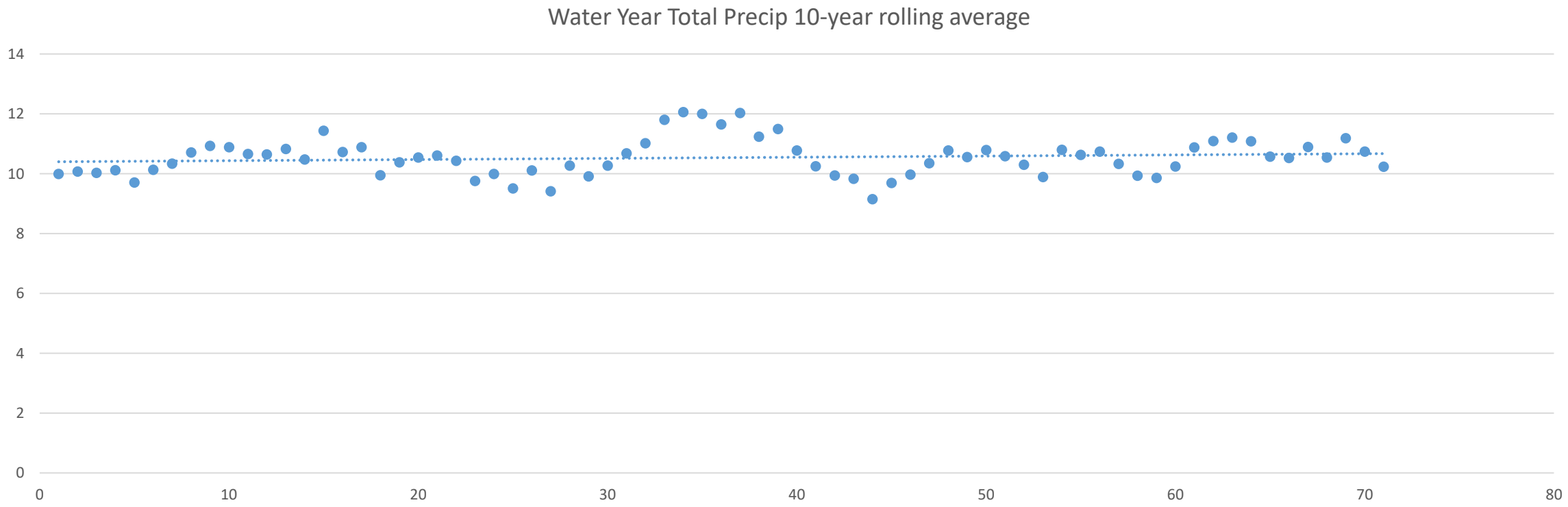


Improve Water Quality & Quantity

- What is the cause of the reduced outflow from the Crooked?
  - Climate change?
  - Additional irrigation?
- Precipitation is not decreasing



Improve Water Quality & Quantity



Improve Water Quality & Quantity

- Juniper will consume up to 75,000 gallons of water per year per acre
- Decrease in outflow likely related to juniper invasion
- PREP creates a market for juniper biomass!

- $280{,}000\frac{acreft}{year} - 195{,}000\frac{acreft}{year} = 85{,}000\frac{acreft}{year}$
- $\frac{85{,}000\ acreft}{year} * 325{,}851\frac{gallons}{acreft} = 27{,}697{,}335{,}000\frac{gallons}{year}$
- $\frac{27{,}697{,}335{,}000\frac{gallons}{year}}{75{,}000\frac{gallons}{acre}} = 370{,}000\ acres\ of\ Juniper\ increase$

An acre inch of water is the equivalent of 27,154 gallons of water. Acre Ft of water is 325,000 gallons

Assumptions:

Dr. Lee Eddleman, retired OSU juniper researcher statement: 9 -13 large trees (greater than 12" dbh) can use all the water delivered in a 13" precip zone. That's 353,002 gallons per acre.

Juniper tree interception alone accounts for an equal percent loss per percent of crown cover (what precipitation the tree canopy captures and holds until it evaporates back into the atmosphere without touching the soil surface). Therefore a 20 percent canopy cover of juniper per acre results in a direct loss of 20 percent of the annual precipitation. So in a 13" precip zone, canopy loss alone is 2.6 inches of annual precipitation. That's 70,600 gallons per acre.

Large juniper tree (>12" dbh) water use can be as high as 26 gallons per day if the soil moisture is available. Let's assume this water use model per tree for the year (my model):

26 gallons/day for 120 days = 3120 gallons
15 gallons/day for 100 days = 1500 gallons
5 gallons/day for 50 days = 250 gallons
0 gallons/day for 95 days = 0 gallons
total gallons = 4960 gallons per tree per year

Average tree density per acre = 13
Water consumption = 13 x 4960 = 64,480 gallons per year (doesn't include tree canopy interception and evaporation).

from 1936 to 1999, Juniper acres in Crook County alone increased by 627,000 acres.
600,000 ac. x 80,000 gallon/acre (water consumption and interception) = 48,000,000,000 gallons per year

48,000,000,000 = 147,692 ac ft of water annually.

Since 1936, juniper acreage increase

County	Acres increased since 1936	Annual water equivalent
Crook County	627,000	145,000 ac ft
Deschutes County	28,000	6,500 ac ft
Jefferson County	441,000	102,000 ac ft
Wheeler County	459,000	106,000 ac ft
Grant County	796,000	184,000 ac ft
Lake County	625,000	144,000 ac ft

Klamath County 172,000 40,000 ac ft

Here is the table those calculations come from so just removing what is above still leaves lots of acres of juniper:

Estimated Juniper Acres by County

County	Total Acres	1936[a]	1999	Percent Increase
Crook	1,964	509	1,136	223
Deschutes	1,932	329	357	108
Jefferson	1,140	63	504	800
Klamath	3,804	106	278	262
Lake	5,207	222	847	381
Harney	6,486	189	1,212	641
Wheeler	1,097	50	509	1010
Grant	2,898	41	837	2041
Baker	1,964	20	418	2090

[a] Estimates of juniper based on 1936 vegetation map from Oregon Department of Forestry
Source: The Western Juniper Resource of Eastern Oregon, PNW-RB249, 2005

1 cfs = 2 ac ft of storage

For the Crooked River,
145,000 ac ft / 2 = 72,500 cfs
72,500 cfs/365 days = 198 cfs/day year-round, a little more than twice the flow agreed to in the HCP for the Crooked River every day of the year. ☺

And these water calculations for the basin would be even higher if we accounted for our over dense national forest of pine and fir.

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tim.deboodt@co.crook.or.us

The reason that works for me is:

70 percent of our annual precipitation occurs from Oct 1 - April 30 (non growing season so you can't argue plant water use except for Juniper which is evergreen and can transpire water 12 months of the year)

70% of 12 inch precip is 8.5 inches

Soil water holding capacity (saturation) is 1"/ft of soil (less in pumice soils)

2 ft of soil depth is 2" of water holding capacity what happens to the other 6 inches of water (per acre)?

The majority goes to either ground water recharge or surface water run-off (a little goes to soil surface evaporation).
6"/ac multiplied by just the juniper acres gained since the early 1930's is a hell of a lot of water. If you go to the increase since the 1880's when expansion started, even more.

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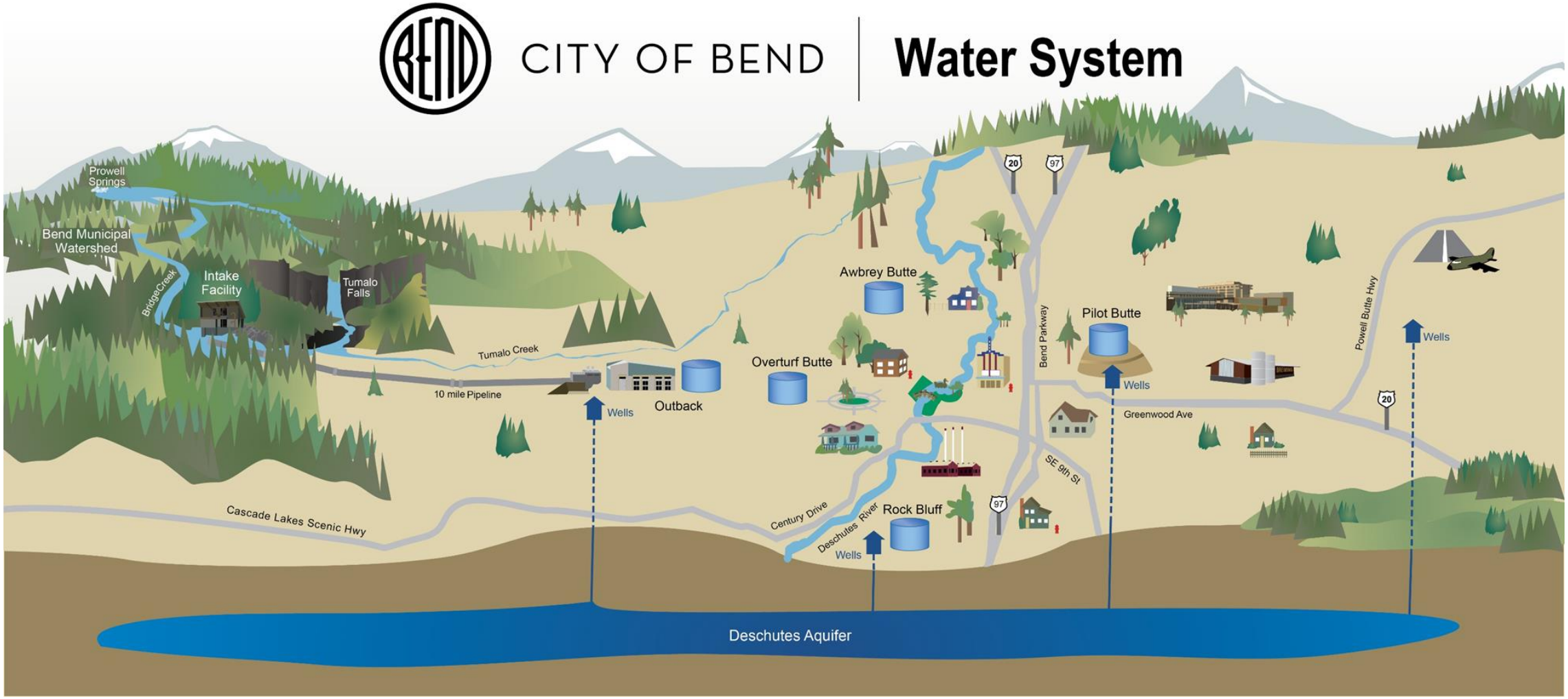
CITY OF BEND WATER SYSTEM OVERVIEW

Mike Buettner
Utility Director
mbuettner@bendoregon.gov

Looking ahead:

1. Brief introduction
2. Water system overview
3. How Bend uses water
4. Conservation in Bend
5. Future issues & projections

WATER SYSTEM OVERVIEW

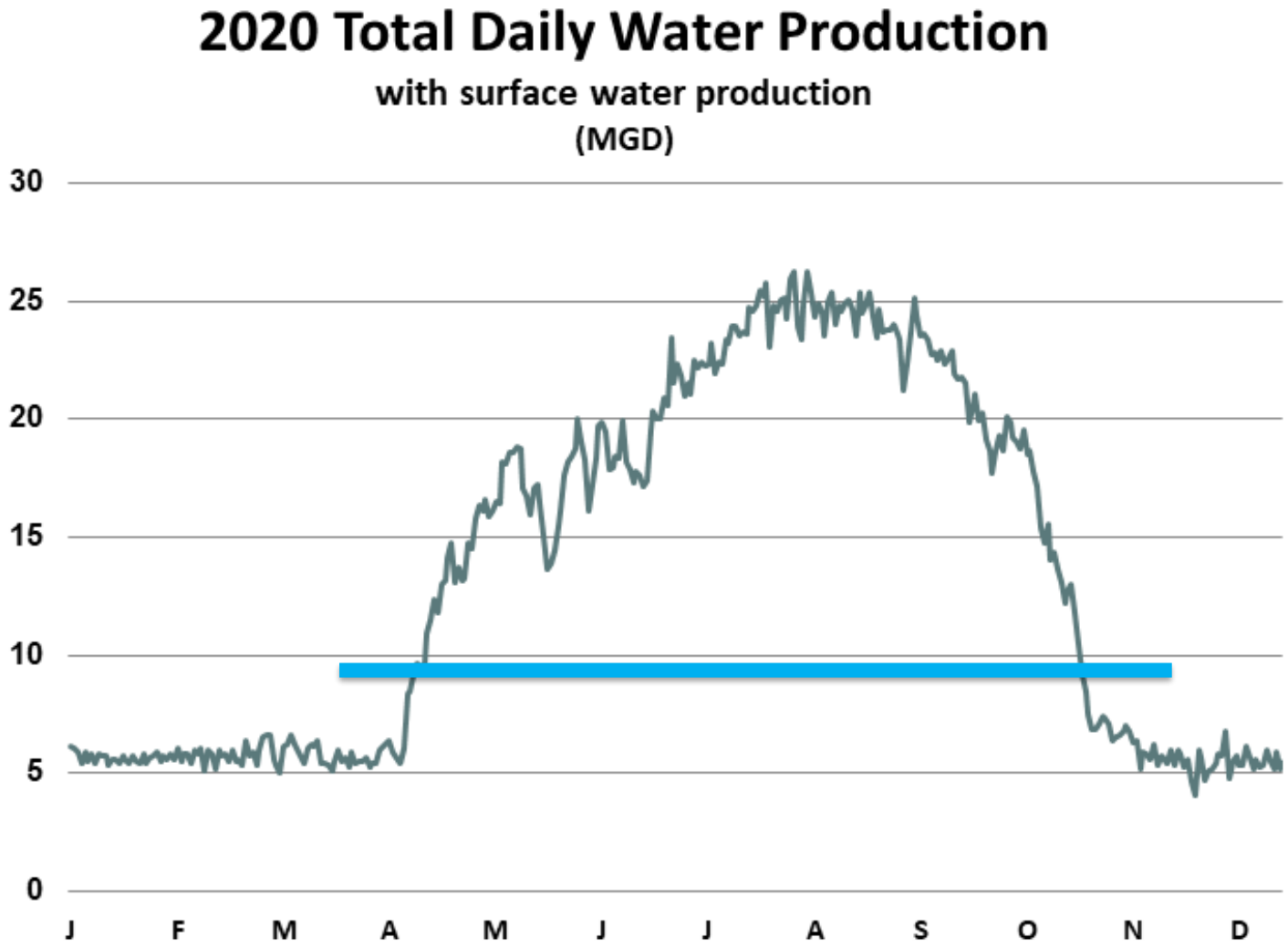


HOW BEND USES WATER

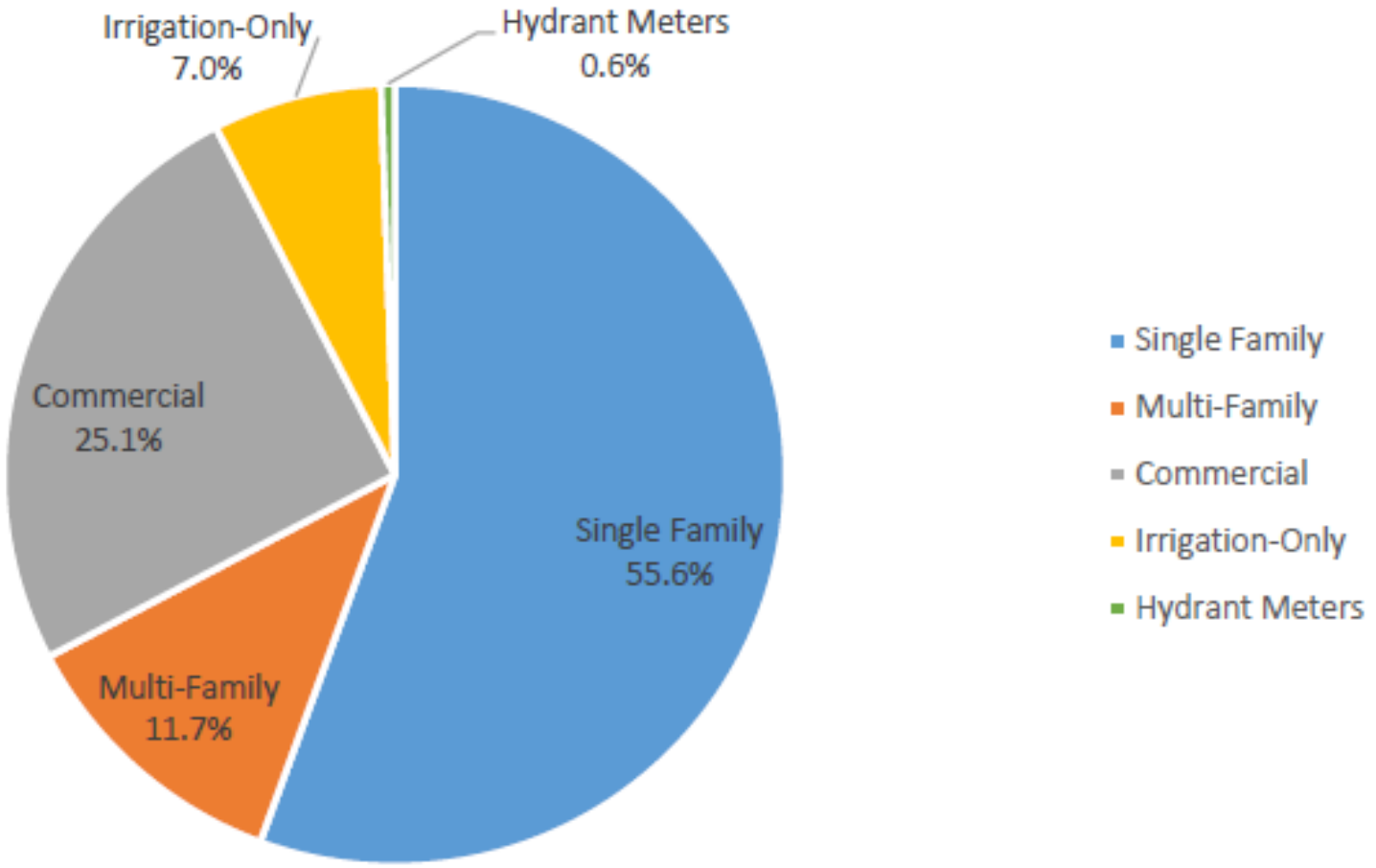
SURFACE WATER – 65%

GROUNDWATER – 35%

HOW BEND USES WATER

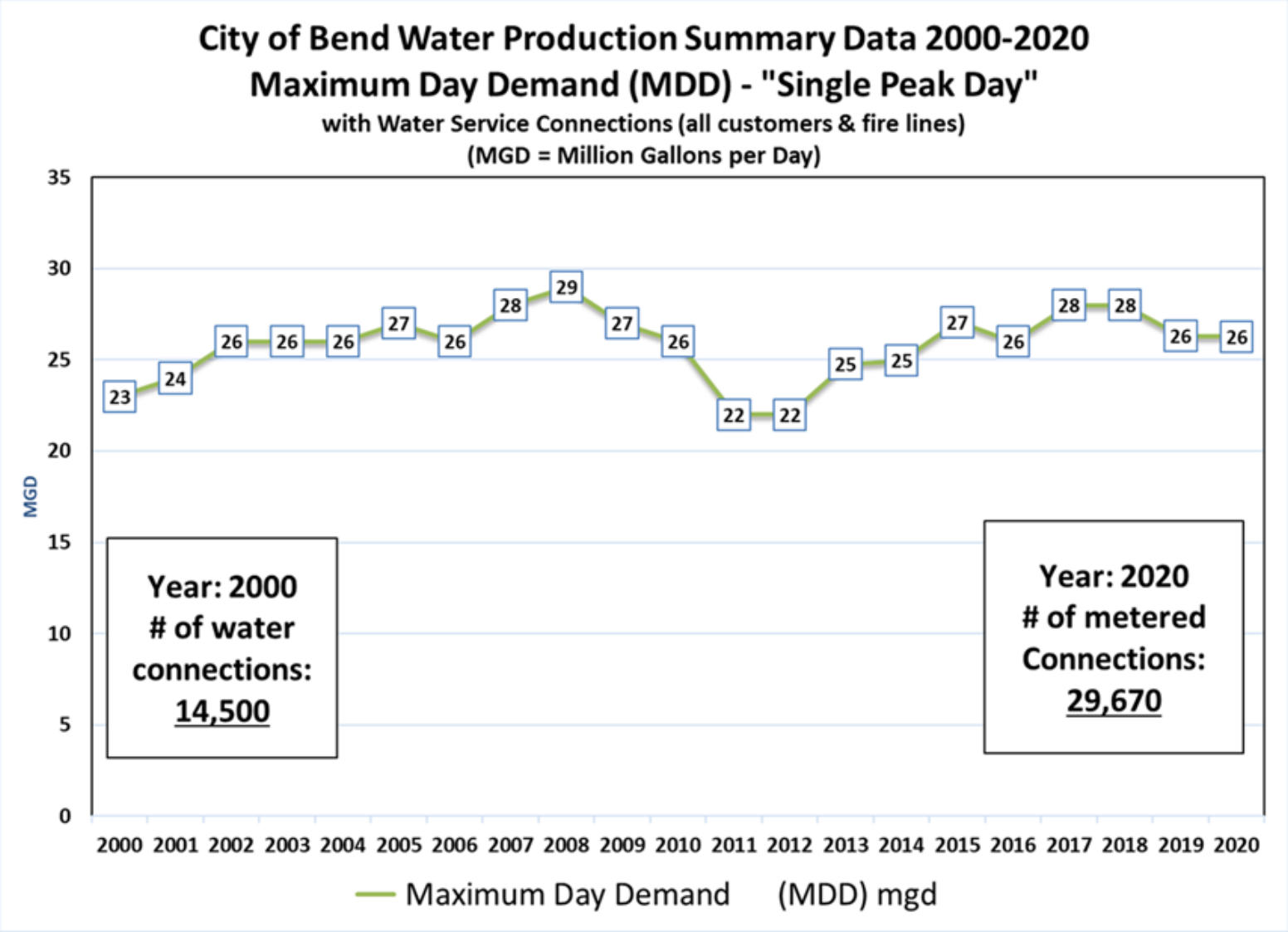


HOW BEND USES WATER



HOW BEND USES WATER

HOW BEND USES WATER



WATER CONSERVATION IN BEND

High Desert Water Reality

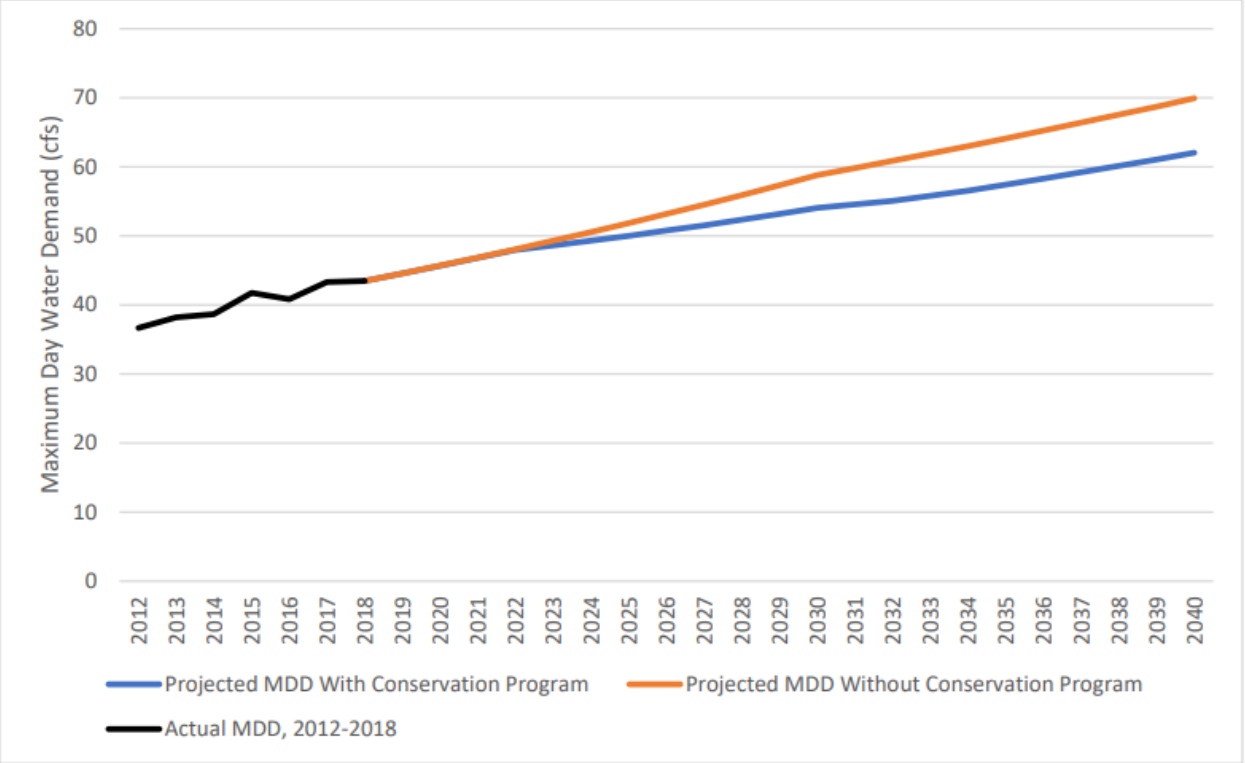
- Outlined in Water Management & Conservation Plan
- Integrated approach to conservation
- Awarded “Best Conservation Program”
- NEW conservation measures in 2022

www.bendoregon.gov/water

WATER CONSERVATION IN BEND

Investing in Water Conservation Over 20 Years:

Exhibit 5-5. Actual MDD, 2012-2018, and Projected MDD With and Without Implementation of Conservation Program, 2018-2040



FUTURE ISSUES & PROJECTIONS

Future Issues:

1. Continued drought
2. Regulatory certainty

Projections:

1. Greater water conservation ethic
2. Flexible water banking programs
3. More focus on transparency & equity
4. State leadership on 100 Year Vision

Questions?

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Utility Director
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Exhibit 2 2. City of Bend Water Service Area