Attachment 2

Draft

OREGON

INTEGRATED WATER RESOURCES STRATEGY

ISSUE PAPERS

DRAFT

September 10, 2009

Oregon Water Resources Department

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Forward

During Summer 2009, four Water Resources Commissioners—Mary Meloy, Jeanne LeJeune, John Jackson, and John Roberts—took the lead researching and writing seven "issue papers" as part of Oregon's Integrated Water Resources Strategy. They received assistance in these early endeavors from several colleagues and other project team members, listed in "Acknowledgements."

These papers are designed to convey the urgency of planning for the future of Oregon's water resources. The papers cover several topics from an Oregon perspective, describing the lost opportunities we may face if we do not act today, and the benefits we may see if we do act right away. They serve as the "problem statement" portion of the Integrated Water Resources Strategy. The papers contain suggestions related to future research and technical needs, as well as key challenges that may emerge.

These papers are open to public review and comment throughout the remainder of 2009. The project team welcomes your comments and invites you to send any written comments you care to make to waterstrategy@wrd.state.or.us, with "Issue Paper Comments" in the title of the email. Please include your name and contact information, and indicate if you do not want your comments to be made public.

We are in the initial stages of developing a long-term integrated water resources strategy for the state of Oregon. We appreciate your interest and involvement as we move forward.

~ Brenda Bateman, Project Manager

1. Introduction:

the Need for an Integrated Water Resources Strategy

"A problem well stated is a problem half solved."
Charles F. Kettering

Oregon is currently one of two western states without a formal water management strategy. It is one of many without an integrated strategy that takes into account water quantity, water quality, and ecosystem needs. An integrated water resources strategy is needed, as we develop a vision of what Oregon's livability and economic viability will look like for future generations based upon adequate high quality water supplies. While no two basins are identical, they all have similar hydrologic elements, such as river systems, aquifers, springs, ecosystems and human settlement patterns. They have other similarities too, including a need to coordinate with neighbors, a need for local solutions to local challenges, and a need for funding. An integrated strategy should provide relevant and consistent guidance to each of the basins, despite their differing characteristics. Implementation of such a strategy should consistently move Oregon toward the preservation, restoration, and development that is necessary to achieve the desired vision of healthy water supplies from all available sources.

A Limited Supply of Clean and Abundant Water

While water supply is renewable, it is also limited, and should be managed on a sustainable-use basis. The water cycle is scientifically accepted and verifies that no additional or "new" water can be found or produced. Water is a finite resource, much like gold, coal, oil and natural gas, and pundits have begun to characterize water as the "new oil." There are many gripping examples of water scarcity throughout the United States and around the world. Although the state of Oregon, in general, is not in a state of immediate water crisis, some parts of the state are already experiencing water shortages.

Many Oregon communities and economies, along with Oregon's fish and wildlife, face water scarcity today. Most of the state's surface waters are fully allocated during summer months, and there are several areas that have been designated as "critical groundwater areas," or **"**ground water limited areas." These pressures will likely be intensified, given the projected

increase in Oregon's population growth, and change in the form and timing of precipitation forecast by climate change researchers.

The degradation of ground water and surface water quality also decreases the volume of fresh water available to consumers, and to replenish streams and aquifers. Freshwater bodies have limited capacity to process the pollutant load from expanding urban, industrial, and agricultural uses. Water quality degradation can be a contributing cause of water scarcity.

Without planning our future use of water in balanced and judicious ways, Oregonians will likely cross a water scarcity boundary without even knowing it.

The Value of a Strategy

An integrated strategy would provide a blueprint for the state to follow as it prepares to meet Oregon's water needs: instream and out-of-stream; above ground and below ground; now and in the future.

An integrated water resources strategy will need to recognize the inextricable link between water quantity and water quality by addressing economic and environmental needs. Water is an important element in Oregon's economy. The state's industrial and commercial sectors, agriculture, recreation, tourism, electric power, and residential development are all dependent on reliable, clean water. Oregon's ecological needs come from the fish and wildlife that depend on clean and abundant water and healthy habitat found in watersheds (drainage basins), rivers and their tributaries, wetlands, floodplains, aquifers, lakes, estuaries, and the ocean.

An integrated plan or strategy serves several purposes:

- Encourages planning and management on a natural water systems basis; gains a higher level of commitment through a dynamic process that adapts to changing conditions;
- Balances competing uses of water through efficient allocation that addresses social values, cost effectiveness, and environmental benefits and costs;
- Promotes water conservation, reuse, source protection, and supply development to enhance water quality and quantity;
- Encourages participation of all units of government and stakeholders in decision-making through a process of coordination and conflict resolution;
- Fosters public health, safety, and community goodwill; and
- Addresses the institutional barriers that exist which reduce the ability to effectively manage water resources.

Building on a Foundation of Data

The public and private sectors in Oregon have produced a plethora of plans and studies focused on water quantity, water quality, and other water-related issues from environmental, business, socio-economic, hydrological, and geological perspectives. The Water Resources Department has begun to pull this collection of data into a centralized, usable format, through its on-line inventory of potential storage sites, potential conservation programs, and its 50-year water demand forecast. In addition, the Department has made many of its quantitative tools available on-line. An integrated water resources strategy would continue to build upon this existing information as well as new information to help determine how to meet Oregon's long-term water needs.

Developing a Strategy through Collaboration

The Water Resources Commission has the statutory authority to develop an integrated water resources strategy, with the Department as the implementing agency. But another essential part of an integrated water resources strategy is the collaborative process of building the plan. Water is a subject in which everyone is a stakeholder and must be given an opportunity to participate in and shape the process. A participatory approach is an effective means for achieving consensus and long-lasting agreement. Real collaboration takes place only when stakeholders and the interested public are part of the decision-making process. Incorporating the views of a wide variety of governmental agencies, special interest groups, and the public will be a challenge, but is key to the success of such a strategy.

Conclusion

A successful integrated water resources strategy would result in a persuasive visualization of what Oregon's water and landscape should look like and be like for future generations. Such a strategy should have as a starting point, clear and compelling goals and a vision. It should develop tools with statewide relevance, and options for local implementation.

2. Water Quantity

Understanding water needs, sources of supply, and water availability are necessary building blocks for developing a statewide integrated water resources strategy. The purpose of this paper is to describe in general terms the context and current understanding of water quantity in Oregon for all beneficial uses, and the need to constantly improve upon this understanding. The paper briefly highlights the problems Oregonians face with current use and the increasing demands on a limited resource into the future. Further information related to data and technical information requirements, research needs, goals and objectives, and potential solutions will be addressed in future steps in the development of Oregon's Integrated Water Resources Strategy.

Background Information

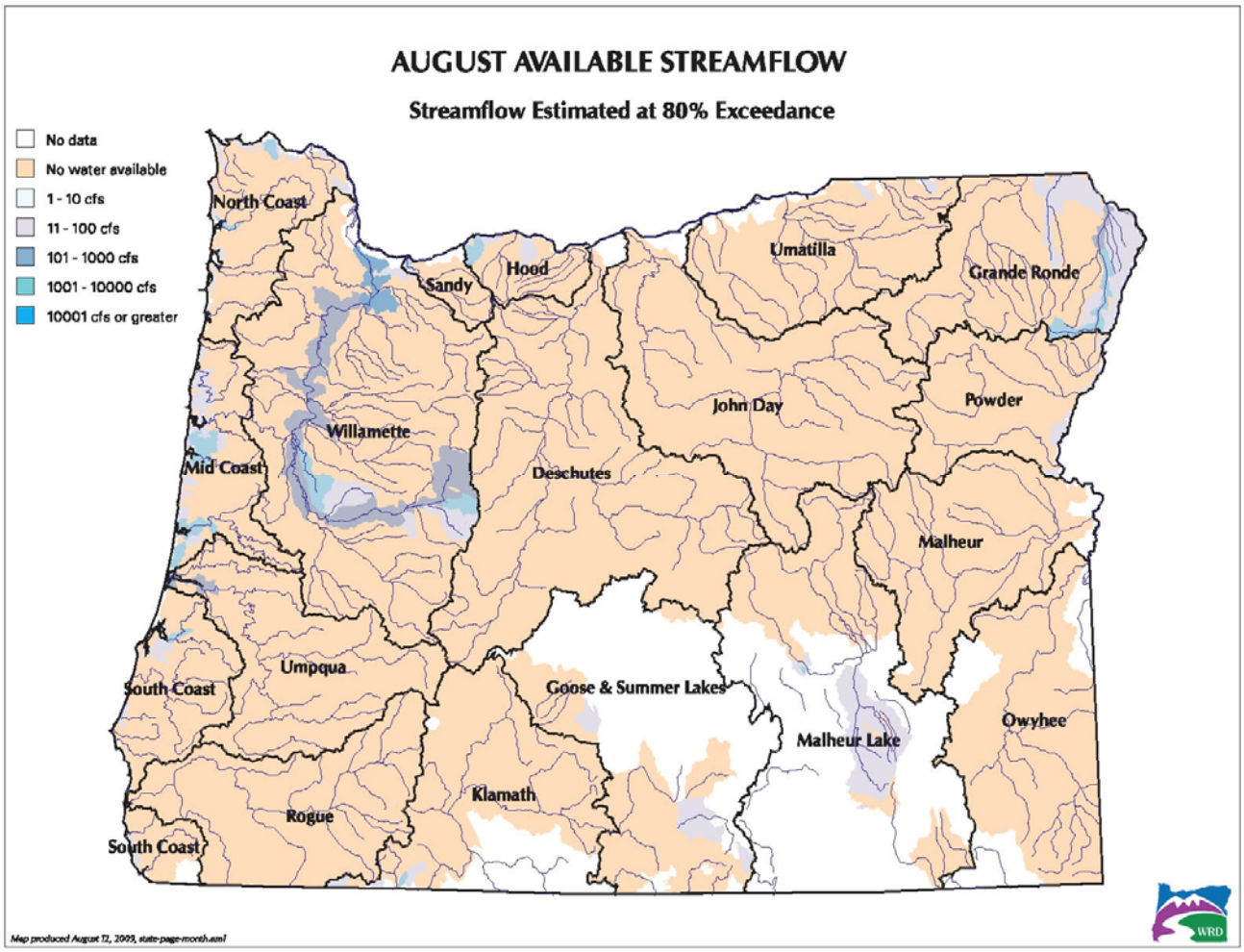
Oregon's municipal, business and agricultural communities, along with Oregon's fish and wildlife, are already facing limited water supplies today. Surface water is almost completely allocated, and as we rely increasingly on our ground water resources, water levels have dropped precipitously in some areas of the state. Oregon has critical ground water areas in the Umatilla Basin, in the Willamette Valley, and in Eastern Oregon. Without solutions in place, water supply shortages will multiply in future years because of a population projected to grow by another one million people by 2030, and the potential changes in precipitation predicted by climate change researchers.

In fact, the state commissioned a water demand forecast in 2008 to estimate demands out to the year 2050. According to the study, *Statewide Water Needs Assessment* (September, 2008), total demand will increase 12.6 percent over the next 40 years, from 9.1 million acre feet to 10.3 million acre feet per year. With the influx of population that is projected, the study projects that municipal demand could increase 55 percent, domestic demand (exempt well use) could increase 57 percent, industrial demand will remain static, and agricultural demand could increase 10 percent. The same study also evaluated instream needs related to fish and fish habitat and found that these needs compared favorably with existing flow protections in some basins, such as the Sandy, Deschutes, Grand Ronde, Klamath and John Day However, the remaining basins demonstrate significant deficiencies in flow protection.

The Oregon Water Resources Department has developed methodology and data to determine water availability in the context of allocating new water rights. This information determines when and where water for future allocation is limited or unavailable. Water quantity is affected by hydrologic and climatic conditions. Administratively, authority for allocation of water supplies rests with the state Water Resources Department.

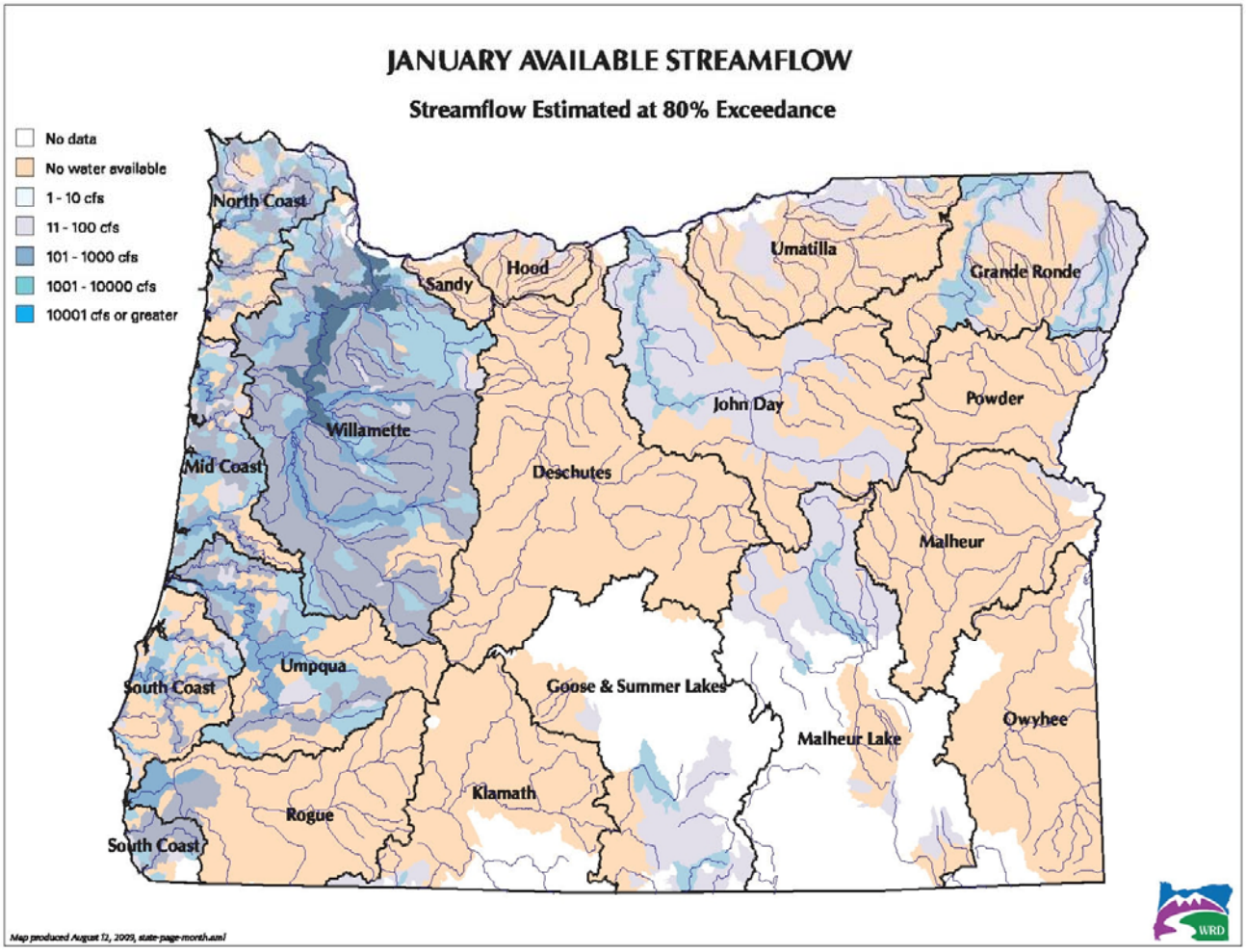
Surface Water. There are 18 river basins in Oregon, as illustrated in the following maps. Oregon shares three major rivers with other states, the Columbia, Snake, and Klamath Rivers. Most of the state's surface waters are fully allocated during the summer months. The August map in Figure 1 shows in blue where water is available for live flow allocation during August (the month most representative of low summer flows and peak out of stream uses). With some exceptions in the Willamette Valley, the map indicates that throughout the state very little water is available for new live flow allocations. (Most of the map is color coded brown, meaning no water is available.)

Figure 1


AUGUST AVAILABLE STREAMFLOW
Streamflow Estimated at 80% Exceedance
No data
No water available
1 - 10 cfs
11 - 100 cfs
101 - 1000 cfs
1001 - 10000 cfs
10001 cfs or greater
North Coast
Sandy
Hood
Umatilla
Grande Ronde
John Day
Powder
Willamette
Mid Coast
Deschutes
Malheur
Umpqua
South Coast
Goose & Summer Lakes
Malheur Lake
Owyhee
Klamath
Rogue
South Coast
WRD
Map produced August 12, 2009, state-page-month.aml

By contrast, the map in Figure 2 shows where water is available for allocation during January (the month most representative of higher winter flows and less out-of-stream demand). The map indicates in brown where no water is available, mostly east of the Cascades, but there is a large part of the state where water is available for winter time allocation, denoted in blue.

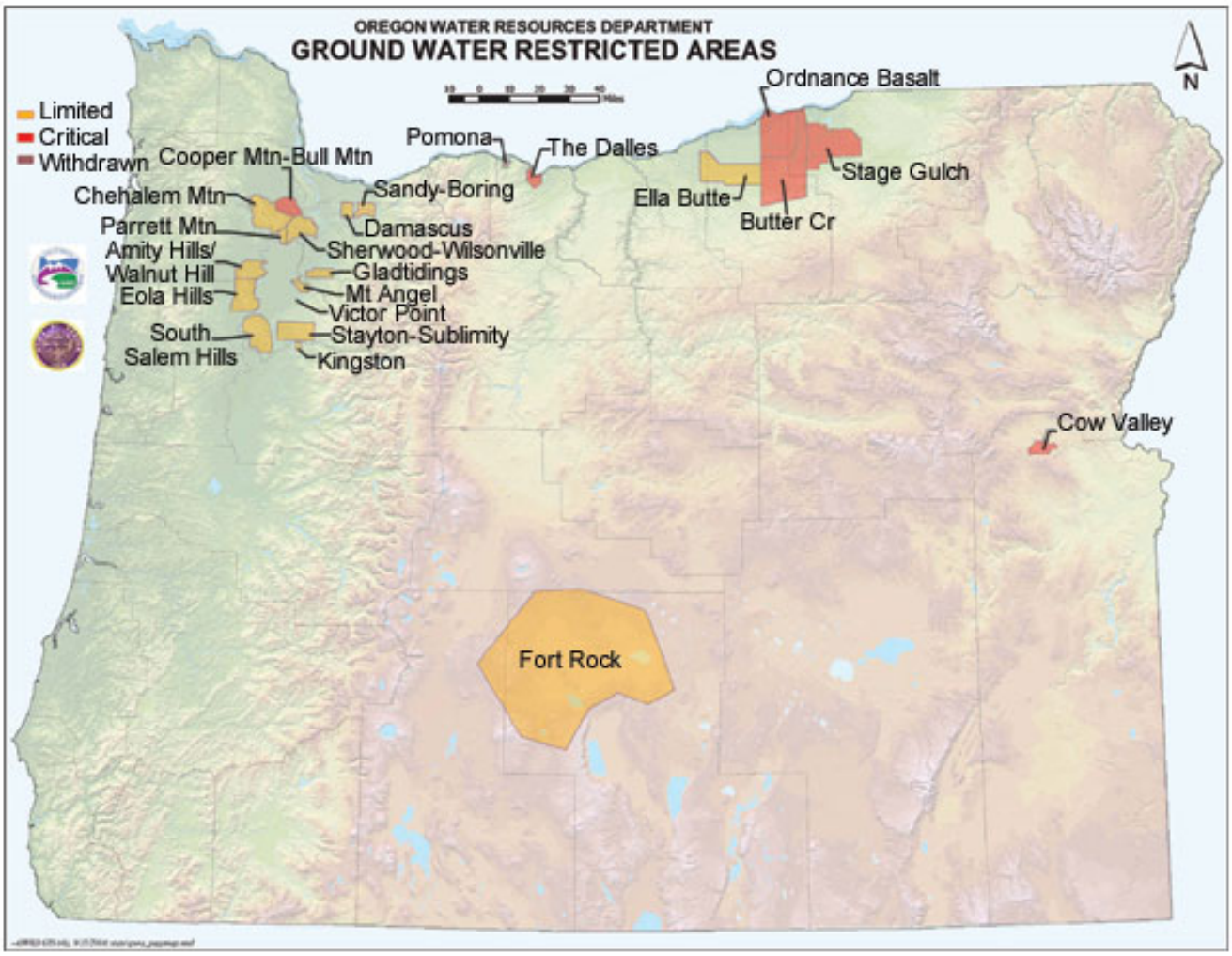
Figure 2



Groundwater. As a result of increasingly allocated surface water quantities, Oregon has become heavily reliant on ground water resources. This reliance has resulted in the depletion of ground water levels in several areas of the state. In many instances applicants for new groundwater appropriations are proposing use from groundwater aquifers that are hydraulically connected to surface water.

There are 14 designated *"ground water classified areas*" or *"groundwater limited areas"* in Oregon, 12 of which are in the Willamette Valley. These areas, shown in yellow in Figure 3, specifically designate the purposes for which unallocated water can be developed in the future, but do not affect existing rights at the time of adoption.

Figure 3



There are seven existing *"critical groundwater areas,"* four in Umatilla and Morrow counties, and one each in Wasco, Washington and Malheur counties. These areas shown in orange specify how much total water may be appropriated within the area. They can redistribute and reduce groundwater use, even for existing water rights holders.

There are two *"areas of withdrawal"* in Oregon, the Pomona and Priest Rapids aquifers in the Mosier area of Wasco County and the Columbia River Basalt aquifer in the Victor Point area of Marion County. This designation prevents any future development of the resource, but

does not affect existing water rights. The Columbia River Basalt is the Water Resources Department's foremost *"aquifer of concern"* for long-term supplies, extending from Eastern Oregon, through The Dalles, and south into the Willamette Valley.

Key Challenges, Research, and Technical Questions

- The Water Resources Department has long sought funding to conduct "basin yield" analyses (i.e., how much surface water each basin yields and how much is available for allocation and storage).
- Additional research needs to determine how climate change will affect the timing and quantity of water availability (both surface and ground) in Oregon.
- Comparison and reconciliation of out-of-stream needs (usually in units of volume), and in-stream needs (usually measured in units of flow, and measured in more than one place in the river) is difficult, given the current tools and data available.
- Identify political, economic, or regulatory tools that address any gaps between water needs and water supplies.
- There is a need to identify and prioritize the possibilities for other sources of available water that Oregon should be considering/developing (i.e., re-use, re-charge, conservation/efficiency efforts, desalination, etc.) and then determine the extent future water quantity needs can be met through these potential sources.

Conclusions and Next Steps

Nearly all of Oregon's surface water is fully appropriated during the irrigation season (April-September). Opportunities for new groundwater uses are limited either by hydrologic connection to fully appropriated surface water, or a lack of water quantity due to declining water tables. Although winter water may be available for storage, those opportunities may be limited by the need to protect ecological flows, including peak flows or for other environmental reasons.

Completed groundwater investigations and basin yield analyses are needed statewide to determine what naturally occurring water may be available for planning purposes. Climate change analysis is needed to relate changing water availability conditions to existing use patterns.

Sources

- "Water Needs and Strategies for a Sustainable Future: Next Steps" Western Governors' Association, June, 2008

- "*OWRD Strategic Outlook 2009-2011, Strategy 2 – Increase our understanding of the resource and the demands on it.*" Also, please note that the WRD water demand forecasts to 2050 by county and state are available through http://www.wrd.state.or.us/OWRD/LAW/owsci_info.shtml.
- Oregon Water Management Program. The Program establishes statewide policies and principles related to a wide range of water-related topics including storage and water allocation. These policy and principle documents can be found in Administrative Rule OAR 690-400-000 through OAR 690-410-080.

3. Water Quality

The purpose of this paper is to discuss the quality of Oregon's waters and how management of water quality and quantity interact. This paper describes some of the unintended consequences that occur when trying to manage water quality and water quantity separately, for there are frequent conflicts in the management of the two.

Background Information

Clean water is fundamental to protect health, environment, and quality of life in Oregon. High quality water is of benefit to fish and wildlife habitat, human health, high tech manufacturers and myriad other users. Pollutants degrade water quality and include chemicals, fertilizer, sediment, and high temperature. Other variables, such as withdrawals of water and removal of streamside shade, can also have a detrimental physical or chemical affect on water quality.

The choices we make in the management of water resources affect the balance between water quality and water quantity. For instance, protecting greater quantities of water instream allow Oregon to more easily satisfy state and federal water quality requirements. If climate change, drought, increased demands, or other factors reduce the quantity of water in our watersheds, then Oregon will have greater difficulty complying with state and Federal water quality requirements. The ability to comply with water quality standards is further hampered by increasingly sensitive technology that can detect pollutants at low levels—and the increasingly stringent water quality standards designed to protect against these pollutants.

Institutional Structures. Water managers operate in an institutional and regulatory environment that make coordination difficult, and lends itself to conflict. Responsibility for water quality resides at the Federal level with the U.S. Environmental Protection Agency, which sets and approves water quality standards for each state. While states have the ability to develop water quality, they can only be as strict or more strict than Federal Standards. There are two sets of Federal laws governing water quality—the Clean Water Act and the Safe Drinking Water Act. The authority to implement and enforce these laws is delegated to the states. In Oregon, the Department of Human Services has authority to implement the Safe Drinking Water Act, and the Department of Environmental Quality has authority to implement the Clean Water Act. The

Department of Environmental Quality further delegates responsibility for water quality protection on agricultural lands to the Oregon Department of Agriculture and on forest lands to the Oregon Department of Forestry.

Water allocation, on the other hand, is an authority that resides with individual states. In Oregon, the Water Resources Department has this responsibility. These responsibilities are enumerated more fully in the Water Quantity issue paper.

Finally, land-use management, with all of its implications for water resources, is a function that resides with local planners. Each of these institutions in Oregon takes its responsibility seriously, and coordinates decision-making through a combination of formal comment, work groups, and staff correspondence. Still, decision-making in one of these areas invariably leads to ripple effects in the others.

Beneficial Uses of Water. The term "beneficial use" provides a good example of how difficult it can be to coordinate between the world of water quality and water quantity. Both the Oregon Department of Environmental Quality (DEQ) and the Oregon Water Resources Department use the term "beneficial use" as defined in their statutes and rules. By necessity, these terms are applied differently in a water quality context than in a water quantity context. As a result, these Departments have to be very clear when talking to each other and to stakeholders. In this chapter, "beneficial use" reflects DEQ's terminology.

Put simply, The Environmental Quality Commission (EQC) determines the beneficial uses for which each water body will be used, and then sets water quality standards for a variety of pollutants, in order to protect the most sensitive use. Beneficial uses include:

- domestic water supply
- fishing
- industrial water supply
- boating
- irrigation
- water contact recreation
- livestock watering
- aesthetic quality
- fish and aquatic life
- hydropower
- wildlife and hunting
- commercial navigation and transportation

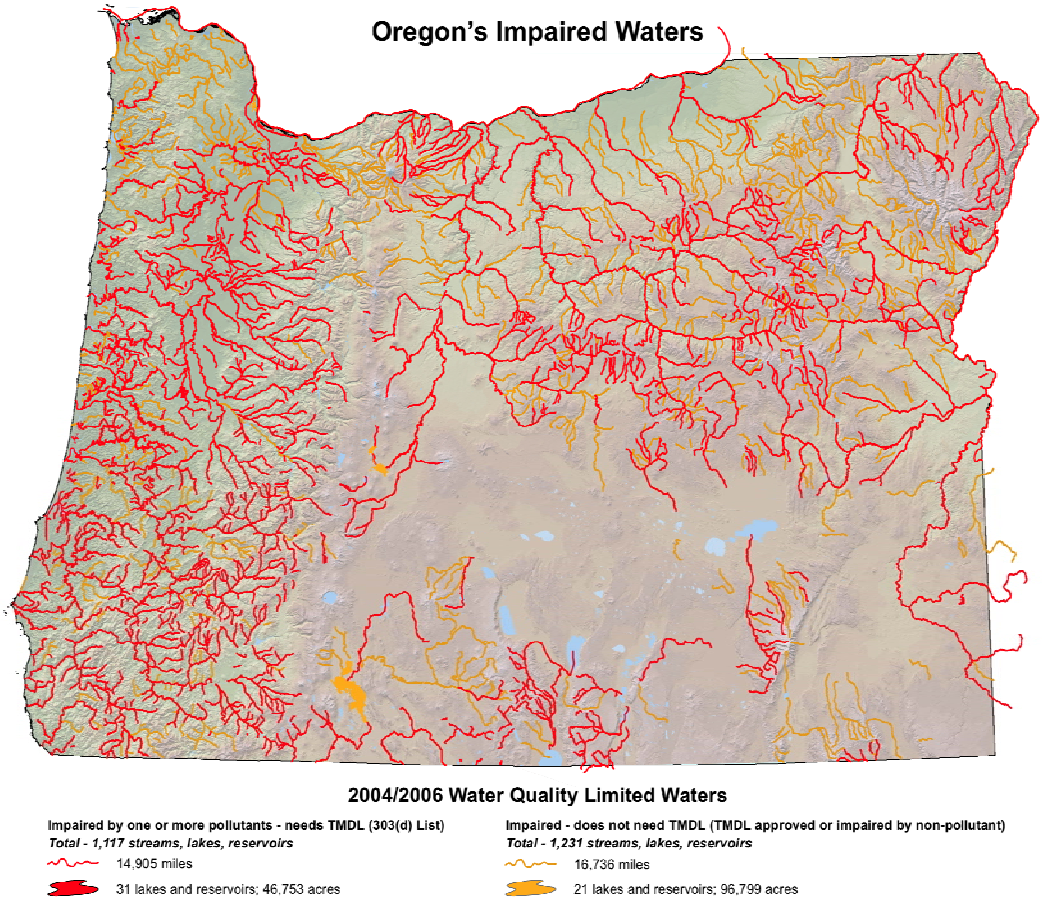
Matching beneficial use to water quality is a management strategy that the EQC and DEQ employ in recognition that not all beneficial uses require the same water quality. Take for example a water body where swimming and fishing is expected. Here, DEQ would set bacteria standards to meet human health standards; it would set toxics for both human health and aquatic life, and would set dissolved oxygen, pH, temperature, and turbidity standards for aquatic life.

For another water body, designated for other uses, water quality standards would differ substantially.

Setting Water Quality Standards. Oregon sets water quality standards for each pollutant as required by the Federal Clean Water Act. These standards can be narrative and/or quantitative criteria and they serve as the basis for Oregon's pollution control programs. They set limits on the discharge of waste into Oregon's waters. Standards also set requirements for nonpoint source control and land management programs, such as agriculture runoff, forest practices, and urban runoff. Failure to set and implement sufficiently protective standards can result in harm to fish and other aquatic life, human health, or recreational opportunities. These impacts, in turn, can have a negative effect on quality of life and economic development.

Surface Water. Figure 1 shows surface water quality conditions in Oregon. In accordance with the Federal Clean Water Act, the Oregon Department of Environmental Quality assesses the state's water quality and reports to the U.S. Environmental Protection Agency (EPA) on the condition of Oregon's waters, identifying waters that do not meet water quality standards and where a Total Maximum Daily Load (TMDL) then needs to be developed. DEQ is currently working on a report due to be submitted to EPA in April 2010.

Figure 1



Groundwater. If area-wide contamination is found at consistently high enough levels, DEQ can declare a Groundwater Management Area (GWMA) under Oregon law. Oregon has three such areas, including the Northern Malheur County GWMA, the Lower Umatilla Basin GWMA, and the Southern Willamette Valley GWMA. DEQ declared all three GWMAs because of widespread nitrate contamination. DEQ is currently helping communities implement action plans that require groundwater quality monitoring, review of existing data to assess groundwater quality trends, and support of local efforts to implement best management practices (BMPs) to maintain and restore groundwater quality. DEQ does not have the resources to continue to conduct a statewide groundwater assessment and monitoring program. Consequently, DEQ's Groundwater program conducts on-going monitoring only within the existing GWMAs.

The Potential Consequences of Neglecting Water Quality in Planning

Water quality will tend to degrade with low streamflows. Traditionally, states have relied on the old adage "the solution to pollution is dilution," meaning that greater volumes of water will help dilute pollutants and help water bodies meet water quality standards. Increasingly, however, this technique is falling out of favor. What happens if we neglect water quality in the process of planning? In Oregon, we already see some early results:

- Water quality is degraded to the detriment of water users. As one example in 2008, Wapato Lake experienced water quality problems and discharged into the Tualatin River, further causing water quality problems for users downstream.
- "Water-quality limited" designations and Total Maximum Daily Load (TMDL) designations, which put in motion regulatory water quality improvement actions by the State. Solutions can include more stringent water quality standards or more restrictions on the use of the water.
- We see stricter federal regulations via the Clean Water Act and/or Safe Drinking Water Act.
- We see further reductions in available "usable" water due to water quality degradation of sources.
- We get into costly arguments about how best to resolve the problem *after* the water quality has degraded. This can be very expensive and disruptive to communities and businesses.

The Benefits of Integrating Water Quality and Water Quantity Planning

Various techniques, such as point source pollution management, non-point source pollution management, and restoration efforts can protect and restore water quality over time. Keeping pollutants out of the water to begin with is certainly the easiest way to protect water

quality and help keep water treatment costs down. This approach can be expensive, however, and raises the age-old question, "Who should pay?". One good example of this quandary is preventing the disposal of pharmaceuticals into down the drain and into municipal wastewater treatment plants, where they require very expensive treatment processes before being released back into rivers and streams. Yet, the legal collection and disposal of pharmaceuticals is costly and time consuming, posing funding and logistical hurdles that have stymied most communities.

Integrated planning efforts could alter how we characterize water that was previously viewed as a "liability" to communities. Treated effluent, gray water, and storm water could be re-used and could supply certain beneficial uses before discharge. Already these conversations have started to develop in Oregon.

Key Challenges, Research, and Technical Questions

- Coordination among various levels of government and between agencies. Though DEQ and WRD already coordinate closely regarding "on-the-ground" projects, there are institutional, legal, and policy barriers in place to managing water resources even better.
- Increasingly Strict Water Quality Standards. As society changes, water quality needs and standards will change as well. These will have direct impacts on water bodies, beneficial uses, cost, communities and businesses.
- Emerging Contaminants. New data, detection limits, and industrial/consumer products mean that water quality standards will continue to change, even after initial water quality/quantity management decisions have been made.
- Resilience. Water bodies' resilience may change along with the climate. This is a multi-dimensional challenge caused by many factors, including: the timing of precipitation and snowmelt, change in use of water in response to hotter climate, changes in streamflow and groundwater aquifers levels, and changes in economic and demographic patterns.
- Assimilative capacity of water bodies to accept changes to water quality and quantity. This is part of the decision process to reduce pollutant loadings in a water body or increase/maintain the volume of water in the receiving water body.
- "Natural conditions". What is "natural" in a basin where human intervention has already occurred? Could and should we return to a truly "natural" condition in most of our water bodies?
- Barriers to safe, effective use of "reuse water." These may be real, perceived, public reactions to the reuse of treated effluent from wastewater treatment plants.
- Cumulative affects from multiple sources in one water body often times require stricter restrictions on water quality and quantity.

- Coordination with State Land Use Planning goals/procedures. Is this a real or perceived problem in water quality/quantity management? "Oregon's planning laws apply not only to local governments but also to special districts and state agencies. The laws strongly emphasize coordination -- keeping plans and programs consistent with each other, with the goals, and with acknowledged local plans." (DLCD website, Introduction to Statewide Planning Goals section)
- Ensuring good water quality requires significant funding, which brings with it equity issues. Who should for clean water?

Conclusion

Water management decisions must always be made considering both water quantity and water quality.

Sources

- Oregon Water Management Program. The Program establishes statewide policies and principles related to a wide range of water-related topics including storage and water allocation. These policy and principle documents can be found in Administrative Rule OAR 690-400-000 through OAR 690-410-080.
- For more information about DEQ's Beneficial Uses and water quality standards, visit: For more information see: http://www.deq.state.or.us/wq/standards/uses.htm.

4. Ecology

[Placeholder. Paper scheduled for production in November 2009.]

5. Economy

The purpose of this issue paper is to discuss linkage between water supply and Oregon's economy. This paper is not intended to cover all the aspects regarding the economics of water within Oregon, but will deal with major business segments that rely on clean and adequate supplies to prosper and maintain their presence in Oregon.

Background Information

Water and Agriculture. A 2008 water demand forecast commissioned by the Water Resources Department notes that irrigated agriculture uses more than 85 of the water that is diverted in Oregon. The largest demand (66 percent of agricultural demands) is in the eastern and southeastern counties of the state where large areas of irrigated agriculture exist. These include Malheur, Lake, Baker, Klamath, Harney, Umatilla, and Morrow counties. Oregon agriculture depends greatly on water delivery. Specifically,

- About 78 percent of Oregon's agricultural irrigation water comes from rivers and streams, fed by snow pack runoff.
- Nearly two million acres of Oregon agriculture is irrigated and nearly 45 percent of Oregon farms irrigate some or all of their land.
- Oregon ranks third of all states in the number of farms that use irrigation, and ninth of all states in the number of acres irrigated.
- Irrigated farms produce 77 percent of the total value of harvested Oregon crops.
- Virtually all fruits and vegetables grown in Oregon are produced with irrigation.
- Yields of other crops, including grains, can increase up to 500 percent with irrigation.

In turn, Oregon's economy relies heavily on the viability of its agricultural sector, which constitutes roughly ten percent of the state's gross domestic product. In Oregon, agriculture represents nearly $5 billion in farm gate value (farm gate refers to the value of the crop or livestock when it leaves the farm, minus any marketing cost incurred). There are 14 commodity categories that represent annual sales of at least $100 million each, with nursery crops representing the leading sector in terms of value at nearly $1 billion. In 2006, approximately 36,000 people were employed in agriculture, representing about one in ten Oregon jobs.

Oregon's 200 food processors account for an additional $3 billion in value-added sales revenue. According to the Oregon Business Plan Agriculture Cluster data, nearly 17,000 workers are employed in Oregon's food processing sector, generating a payroll of more than

$500 million annually. Processors produce everything from dairy products to wine, seafood items to fruit and vegetable products. Food processing is a water intensive industry because of the vast amounts of water required to wash and process the food.

Water and Recreation and Tourism. There are several categories of recreational activities related to the lakes, rivers and streams, snow, and the ocean in Oregon. Results of the 2008 Oregon State Marine Board survey for the period between October 1, 2006 and September 30, 2007 showed:

- 2,967,350 boat-use days.
- Fishing remains the highest use activity for boaters at 63 percent of all activity days.
- According to the American Sportfishing Association, in 2006 there were 7,053,000 fishing days spent by resident and non-resident fresh water fisherman and 846,000 fishing days spent by resident and non-resident saltwater fisherman which generated $453,752,389 in retail sales and provided 8,193 related jobs in Oregon.
- Water sports such as sailing, waterskiing and wakeboarding have declined about 20 percent since 2004, while non-motorized boating such as kayaking, rafting and canoeing activities have continued to increase and involved an estimated 386,000 people in Oregon in 2005 according to an Outdoor Industry Foundation report.
- Rivers are a clear favorite, primarily due to the accessibility and popularity of the Columbia and Willamette Rivers for boaters.

Oregon's scenic wonders, outdoor recreation opportunities, and cultural assets are highly valued by those who live in and visit Oregon. Recreation-related spending on hotels, restaurant meals, and recreational activities helps stimulate the Oregon economy. Tourism is particularly important on the Oregon Coast and in Central Oregon. According to the Oregon Travel Impacts Report, direct travel spending totals $8.3 billion dollars annually, and the tourism and hospitality industry account for 132,000 direct and indirect jobs providing $3.3 billion in employee earnings in Oregon.

Water and Municipal Use. Municipal systems in Oregon account for about six percent of diverted water, according to a 2008 water demand forecast completed for the Water Resources Department. The largest municipal demands are in Multnomah, Washington, Clackamas, Lane, Jackson, Marion, and Deschutes Counties, which have the fastest population growth rates in the state. These same counties are projected to continue to have the greatest increase in municipal water demand through the year 2050. Municipal systems deliver potable drinking water supplies, and typically have their own source of funding (ratepayers). Municipal suppliers can function as independent special districts or as part of larger cities.

Water and Manufacturing. While many manufacturers purchase their water from municipalities described above, others "self supply" their own water. Self-supplied manufacturers represent approximately six percent of water diverted in Oregon, and are located in counties with larger population centers that can provide the work force and ports to support such industries. These counties include Multnomah, Lane, Columbia, Clatsop, Clackamas, Marion, and Linn Counties. (Although Washington County has significant manufacturing use, most of those sites are served by municipal water providers.)

Manufacturing plays a prominent role in Oregon's economy; its annualized growth rate of 10.7 percent between 2003 and 2007 helped to solidify its position as the largest single contributor ($30.2 billion) to Oregon's 2007 $138.9 billion private sector gross domestic product.

Computer and electronic products, wood products, and food manufacturing account for almost half (46 percent) of Oregon's private sector manufacturing employment (203,242) in 2007. The high tech manufacturing sector, the focus of intense recruiting efforts in Oregon, is a water-intensive industry because of the volume of water required for cleaning and cooling. (One of the largest semiconductor chip manufacturers in Oregon reports the use of almost 10 gallons of water to produce a semiconductor chip one square centimeter in size.) In addition, the highly toxic chemicals used in the manufacturing process pose a challenge for wastewater treatment and disposal.

Although a clean, adequate, and reliable supply of water is essential for manufacturing and industry, in 2009, an Oregon Business Development Department official noted that in all his years of recruiting businesses to Oregon, he has never heard water quantity or water pricing mentioned as a "deal-breaker." Companies are much more inclined to base their siting decisions on the price of energy, tax breaks, or other inputs, but not water.

Water and Energy. Water resources and energy resources are interdependent. In most cases, energy is required to divert and distribute surface water and groundwater. And water, in turn, is required for energy production—either as "cooling" water, or as the source of renewable energy itself.

Reliable and affordable energy is essential for Oregon's economy and communities. As fossil fuel supplies decrease, it becomes a prudent investment to increase our ability to produce energy from renewable resources. Among Oregon's potential renewable energy sources, ocean

wave and thermal energy, micro hydro (turbines installed inside water transmission lines) and hydropower are likely to play a significant role. According to the Federal Energy Information Administration, in 2006 Oregon had a net capacity exceeding 8,300 megawatts in conventional hydroelectric power generation. Hydropower continues to be a controversial source of electricity because of its potential to harm aquatic environments, restrictions under the Federal Endangered Species Act, and its potential susceptibility to changes in the form and timing of precipitation.

The Benefits of Integrating Economics into Water Planning

Water is a key input for many goods and services produced in Oregon, and reliable, high quality water supplies can provide a key driver for economic development, with benefits visible throughout many sectors of Oregon's economy.

Sources

- Oregon Business Plan "Keeping Focus in Tough Times"
- Oregon Department of Agriculture "State of Oregon Agriculture"
- Bureau of Economic Analysis, March 2009 Oregon Economic and Community Development Department Innovation and Economic Strategies Division
- Bureau of Labor Statistics March 2009, Oregon Employment Department
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6. Social Issues

The purpose of this paper is to discuss the social issues related to the management of Oregon's water resources. This paper is intended to identify how water use affects society in Oregon. All living things need water. People, animals, and plants will live and survive where water is available and abundant for them to function through their life cycle. Water is also an underpinning for quality of life in our society. It is used for bathing, washing, cooking, and drinking. People use it for cultural and religious ceremonies, and for recreational purposes, such as fishing, boating, and swimming. They also use it for aesthetic reasons, such as watering lawns, washing their cars, swimming in pools, and to enjoy the landscape that water features provide. But, when it comes to surviving, a human can only go without water for several days. Then they have a choice: move to where there is enough water to survive or perish.

Background Information

It is first necessary to define the term "Social" in the context of water management. "Social" can be defined in terms of the *need* for water, the *use* of water in society, and how various cultures *view* water. At some point we must address the issue of whether or not water is a "human right" which is also closely tied to the social/culture issue of water management. Should water always be free? Is it a "commodity" whose volume, treatment, and delivery must be paid for? Or, is it something in between?

Need for Water. It is also important to differentiate between the "need" for water and the "demand" for water. These terms have very different meanings from one another, but they also have very different implications at the household level, at the city level, at the watershed, and at the state level. An Integrated Water Resources Strategy should define these terms and use them carefully.

Lack of water can have a devastating effect on the cultures and livelihoods of those who depend on it. For example, in the recent past, policy skirmishes in the Klamath Basin decimated first agricultural production and the communities that depend on this agricultural income, and then endangered fish populations and the Indian Tribes, and commercial and recreational fishing industries that depend on healthy fish runs. In another example, irrigated agriculture in "critical

groundwater areas," as designated by the Water Resources Department, experience reduced acreage and crop yields whenever their water use is reduced or curtailed.

With increased competition for water, economic costs of treatment and distribution will also increase, creating more financial pressures and environmental justice issues for households and businesses. This is increasingly true in both rural and urban communities.

Use of Water. In Oregon, water users have the flexibility to use water for any activity allowed under their water rights. When supplies are scarce, however, the state allocates water based on the seniority of the water right. Many municipal water providers and irrigation districts offer conservation programs to help their customers become more efficient and decrease their overall water use. Under certain emergency situations, individual water right holders, such as municipalities or irrigation districts, can implement their own curtailment plans that impose even further restrictions on their own customers. In the case of municipalities, one example of this could include the prohibition of outdoor uses such as watering lawns, washing cars, or running water features.

In a Governor-declared drought declaration, the Governor has additional tools available to restrict water use to essential uses, such as drinking and stock watering. This suggests there already exists a hierarchy of priorities for water use in our communities.

View of Water. Many cultures use water in their rituals, ceremonies, and other religious activities. Important cultures that bear particular attention in Oregon are the Indian Tribes, which are recognized as sovereign nations.

Tribes. Oregon has nine federally recognized Indian Tribes throughout the State. Legally binding treaties, federal statutes, and numerous court decisions explicitly or implicitly acknowledge the central role water and related resources play in promoting the effective self-determination and self-governance of tribal nations because they form the base of the tribal cultural and natural resources pyramid. From the tribal perspective, natural and cultural resources were plentiful and in a healthy condition during the 10,000 years of history, prior to the formation of the State of Oregon 150 years ago.

Tribes need to be able to participate in and practice the traditions that define who they are as a people, as a society; water is central to many of these traditions. As one example, elders teach young tribal members basket making techniques, which entail gathering grasses found in wetlands and pulling the grasses through their teeth to create basket string. If the water is

polluted, the grasses and these traditional lessons may sicken both the tribal elders and their young students. As another example, tribal diets are heavily dependent on fish consumption, making water quality a fundamental concern of the Tribes. The quality of tribal traditions and diet depends on the quality of water in Oregon. As one tribal leader has noted, "the beginning and end of all life is *water."*

Cultural Resources. By law, the State of Oregon is steward of the state's cultural resources including archaeological sites. A significant number of archaeological sites and sacred sites are located on or near waterways and water bodies within the State.

Land-Use Planning. Finally, Oregon's Land Use planning laws identify water quality and quantity in a number of the Planning Goals. A particularly important codified land use decision process is the Economic, Social, Environmental, and Energy (ESEE) Consequences process required under Goal 5, Natural Resources, Scenic, and Historic areas and Open Spaces, when dealing with water issues that may conflict with land uses.

The Potential Consequences of Neglecting Social Considerations

It is sometimes easy to take for granted the abundance of clean water to drink, wash, recreate, and conduct business. If we do not pay attention to social aspects when we make decisions that affect water quality and water quantity, we can harm our cultures, our neighborhoods (creating environmental justice issues), and our livelihoods. And, since water knows no boundaries, a decision made upstream may have lasting direct or indirect detrimental effects on those persons and communities downstream.

The Benefits of Integrating Social Considerations into Water Planning

As our Tribal partners have reminded us, we have a shared interest in the health, well being, and public safety of our state's waters.

Key Challenges, Research, and Technical Questions

- Ensure equity in access to safe, reliable supplies.
- Better define and quantify "needs" compared to "demands" in the context of statewide planning.
- Conduct a survey of statewide conservation programs, resources, and incentives.
- Account for environmental justice issues when making decisions that affect both water quality and water quantity.

- Coordinate with the Oregon Land-Use Planning System when conflicts occur between water management and land uses.
- Better understand Tribal governments' priorities for water in their long range planning. Interview tribal elders and tribal leaders to capture in their own words the social significance of water; what it means to them, to their tribe and by extension, to all Oregonians as Oregon's cultural heritage. For Tribes in particular, the social value of water is tied up with other issues: water quantity, quality, ecological needs, economic needs and the interaction between climate change and water. The Hoh Tribe in Washington State has had to relocate infrastructure and housing because of climate changes affecting the rise of the bordering river/ocean. At least two Alaskan villages so far have had to totally relocate because of rising sea level. These events have tremendous social/societal implications.
- Recognize the value of water as an integral part of societal needs; catalogue the range of social needs related to water.

Conclusion

Decisions that affect water quantity and water quality often have unintended consequences for our social fabric, culture, and livelihoods. As we move through the process of developing an integrated water resources strategy, we should continue to bear these social aspects in mind.

7. The Implications of Climate Change

The purpose of this Climate Change issue paper is to explore the implications that climate change may have on water resources in Oregon. One important point to note is that while quite a bit of work has focused on the Pacific Northwest there is very little information available that relates to Oregon specifically. More research is required to understand how Oregonians, our water supplies, and our environment will be affected by climate change over the decades to come. The Water Resources Commission identified this as an important emerging issue for the state and adopted its initial climate change policy in February 2009.

Background Information

The consensus among climate scientists is that climate shift is occurring more rapidly than can be attributed to natural causes and that significant impact to the environment will be felt in this century. For instance, the annual average temperature over the Northwest United States (Oregon, Washington, Idaho and western Montana) is projected to rise 3 to 10 degrees Fahrenheit during this century (visit www.globalchange.gov/usimpacts). Another critical impact will be the changes in precipitation patterns in the Western United States. This will affect water availability, not just for agriculture and food production, but also for the most basic drinking water and domestic water needs of populations in many areas. Impacts related to changes in snowpack, stream flows, sea level, forests, and other important aspects of life in the Northwest are already visible, with more severe impacts expected over the coming decades in response to continued and more rapid warming.

There has not been a great deal of climate change study conducted in Oregon, or in its administrative basins. Models for the Pacific Northwest must be "downscaled" to regional, watershed, and local areas. Although the new Oregon Climate Change Research Institute at Oregon State University has been tasked with these studies, it has inadequate funding.

The Potential Consequences of Neglecting Climate Change

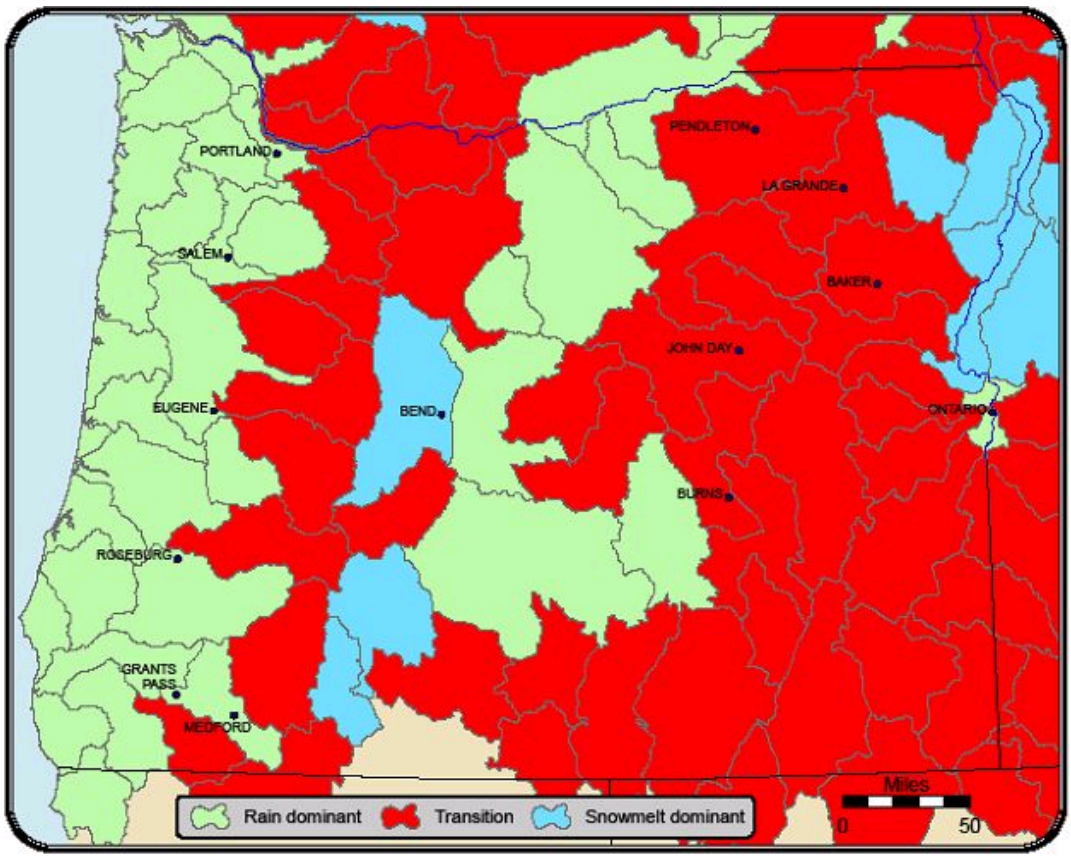
Declining springtime snow packs could lead to reduced summer stream flows, straining water supplies. Oregon and all the Northwest is highly dependent on temperature sensitive springtime snowpack to meet growing and often competing water demands such as

municipal use, industrial use, irrigation for agriculture, hydropower production, navigation, recreation, and in-stream flows that protect aquatic ecosystems including threatened and endangered species. Higher temperatures are causing more winter precipitation to fall as rain rather than snow and are contributing to earlier snowmelt. Further declines in snowpack are projected, reducing the amount of water available during the warm season. The amounts of flow reduction, for a given amount of warming in winter or spring, are highly variable from one part of the state to another, depending in part on the mean elevation of the river basin in question.

Most climate models suggest that amounts of winter precipitation will continue to arrive—but as rain rather than snow. The rainfall patterns under some of the Global Climate Model outputs indicate that rainfall, even if it increases, will come in a more concentrated period in the winter months (Dec-Feb). In addition, most models suggest decreases in the amount of summer precipitation. Most critically, for stream flow, regardless of the changes in seasonality of precipitation, runoff will almost certainly increase in winter and decrease in summer in any basin with a significant snowmelt component. This timing change will likely increase the need for natural and man-made storage areas, and it will also likely increase the risk of incidences of extreme or peak flow events that cause flooding, erosion, and less capability to recharge groundwater aquifers in some parts of Oregon.

In 2007, the Water Resources Department partnered with the University of Oregon and University of Washington to assess the impacts of climate change on municipal water providers. They produced a map that demonstrates how important snow pack is to Oregon's water supply, and depicts areas in Oregon most sensitive to mid-elevation snowpack changes. The areas highlighted in red in Figure 1 indicate those parts of Oregon that are dependent on mid-level, or "transition" snow pack that melts in the spring and provides much of the state's irrigation water. The areas in red are not snowpack itself, but the areas that are dependent on snowpack for summertime stream flows. These areas cover about 57 percent of the state's land mass. The other areas are more dependent on rain or ground water. Mid-level snowpack is what the climate change models and forecasts are highlighting as most vulnerable to climate change.

Figure 1



Rising water temperatures and declining summer stream flows could seriously stress salmon and other coldwater species. Northwest salmon populations are already at historically low levels due to a variety of human-induced stresses. Climate change affects salmon throughout their life stages. Studies suggest that about a third of the current habitat for the Northwest's salmon and other coldwater fish will no longer be suitable by the end of this century because of climate change. Areas particularly at risk in Oregon are the southwest and southeast, and north central area along the Columbia River. Projected temperatures through 2040 suggest that the habitat for these species is likely to decrease dramatically.

Sea-level rise along vulnerable coastlines will likely result in increased erosion and the loss of land. Climate change is expected to exacerbate many of the stresses and hazards facing the Oregon coastal zone. Rising sea-levels will increase the erosion of the coast and cause loss of beaches and significant coastal land areas. A number of populated areas and towns along the Oregon coast are also at potential risk Sea level rise also will increase the impacts of severe storm events through both wind erosion and flooding. Rising sea level and increasing storm

intensity will increasingly stress infrastructure facilities built under different engineering standards. For water resources these include water treatment plants, diversion facilities, and wastewater plants. The intrusion of salt water to those facilities built close to the coast will be a factor as well as potentially to groundwater wells that are close to the coast.

Increased insect outbreaks, wildfires, and changing species composition in forests will pose challenges for ecosystems. Higher summer temperatures and earlier spring snowmelt are expected to increase the risk of forest fires by increasing summer moisture deficits; this pattern has been observed in recent decades. (e.g., McKenzie et al., 2004; Westerling et al., 2006; Littell et al. 2009.) The ability of vegetative species to adapt to changing conditions is slower than that for more adaptive and mobile animal species. Stress on vegetative patterns will present significant challenges and hazards for water management. Drought stress and higher temperatures will decrease tree growth in most low and mid elevation forests and will also increase the frequency and intensity of mountain pine beetle and other insect attacks, further increasing fire risk and reducing timber production, an important part of Oregon's economy. Tree growth at higher elevations will likely be enhanced owing to longer growing seasons, currently limited by snowfall.

Key Challenges, Research, and Technical Questions

Research and Technical Questions. "Actionable science" is necessary for successful future decision-making at the State and local levels. While significant research has been done on climate change both globally and within the United States, and specifically with the Pacific Northwest, there is still a significant lack of clarity on the specific impacts at the regional and local level. In order to gain more clarity from the Global Climate Modeling (GCM) downscaling process and regional modeling, improvements are needed within the models themselves, and further research is needed on the extreme events such as intensity of precipitation during short periods of time that present significant challenges to water resource managers. In Oregon, more research and studies are needed to project climate change impacts throughout the state using the best available science.

Public Awareness and Education. The media has dominated the public's perception of climate change to the point that polarized positions still remain about the type and severity of climate change impacts. There are some generally accepted conclusions about climate change

that need to be refined and more effectively communicated to stakeholders including the general public. The use of more relevant Pacific Northwest research to inform the stakeholders would be better received and incorporated into the dialogue on this issue. Outreach should emphasize the need to move forward on developing reasonable adaptation strategies now rather than waiting for "perfect science."

Objective Stakeholder Involvement. There is a strong need to achieve mutually beneficial solutions through no and low regret strategies. This process will identify potential climate change impacts and solutions without the need to reach a consensus on the specific local impacts of climate change on water resources. It is important to stress the need to address adaptation to a future that is not created by the historic past. No and low regrets strategies can be developed and implemented that don't solely rely on climate change factors, but address multiple objectives simultaneously.

Conclusion

Building partnerships to address the issue of climate change will be vital if Oregon is to be successful in dealing with the risks of climate change. Oregon should position itself to take advantage of the increasing awareness of the risks of climate change and the resources that are now becoming available to address the issues. Specifically, Oregon should look at adopting no and low regret strategies that will adapt to the risks of potential climate impacts without waiting for higher degrees of probability within the existing science.

Finally, the Water Resources Commission should review and update its policy statement on Climate Change, adopted February 25, 2009, and should include a climate change element in the Integrated Water Resources Strategy.

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8. Observations / Possible Next Steps

[Placeholder. Scheduled for production in November 2009.]

9. Glossary of Acronyms and Terms

This document uses certain terms that may require explanation.

acre feet	one acre-foot is the volume of water that will cover one acre to a depth of one foot and is equal to 325,851 gallons.
cfs	the rate of water flow that will supply one cubic foot of water in one second and is equivalent to a flow rate of 7.48 gallons per second (448.8 gallons per minute or 646,272 gallons per day).
DEQ	Department of Environmental Quality
EQC	Environmental Quality Commission
mgd	million gallons per day.
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rule
ORS	Oregon Revised Statutes
TMDLs	Total Maximum Daily Load
US EPA	U.S. Environmental Protection Agency
WRC	Water Resources Commission
WRD	Water Resources Department

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