Written Testimony Prepared by

Martin Doyle

Professor and Director of the Water Policy Program

Nicholas Institute for Environmental Policy Solutions, Duke University

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Regarding

Initial Findings of The Oregon Business Council Water Project

My name is Martin Doyle, and I am the Director of the Water Policy Program at Duke University's Nicholas Institute for Environmental Policy Solutions. I hold a Ph.D. in Earth Science from Purdue University, and a master's degree in environmental engineering from the University of Mississippi. I am a professor at Duke University's Nicholas School of Environment, and am also the Director for Water Policy at the Nicholas Institute for Environmental Policy Solutions, an organization focused on developing pragmatic approaches to environmental policy challenges at the community, state, and national levels.

Through a project co-convened by the Aspen Institute's Energy and Environment Program and Duke University's Nicholas Institute, annually I organize a water forum that serves as a platform for addressing US water challenges in the 21st century. The plethora of challenges in the US water sector—from the drought in California to the need for policy solutions that address water trading opportunities— will continue to be addressed at this convening as the Aspen Institute and Nicholas Institute collaborate to develop forward-thinking pathways to address the state of the US water system. Oregon and the Confederates Tribes of the Warms Springs own Direlle Calica will join us for this year's forum.

The Oregon Business Council Water Project

Why OBC? Why Water?

Since 2012, the Oregon Business Council (OBC) has made water quality and management one of its highest natural resource priorities.[1] For OBC, water is the basis for our economy, our communities, natural systems, and our very lives. While in the past, few Oregonians gave water availability and quality much thought, the state has seen a seeming relentless sequence of water crises: the ongoing ravages of wildfire, toxic algal blooms in Salem's water supply, flooding in Pendleton, severe droughts in many years of the past decade, aging infrastructure throughout the state, and severe water crises in basins like the Klamath and Harney, among many others. All of these, often with one coming on the heels of another, illustrate the importance of making water management in Oregon a top priority for our leaders. Governor Brown acknowledged this challenge when she launched the Water Vision project in 2019, and I believe this committee was created in part to consider her water priorities. One of the primary purposes of this Project is to keep the focus on water alive in Oregon – meeting this challenge is fundamental to the state's future.

The OBC Water Project

The key to OBC's effectiveness lies in the willingness of its directors to think beyond their own point of view to consider the broader implications for Oregon's future of an issue of critical importance. Directors volunteer their time and energy to guide the development of a set of policy recommendations designed to meet a major challenge to Oregon's prosperity. We followed this same approach with the Water Project; following an initial meeting in the fall of 2019, in January 2020 OBC hired me to guide this process.[2] We are guided by a volunteer group of directors, including Maria Pope (Portland General Electric), Mark Anderson, (Northwest Natural), Sam Tannahill (A to Z Vineyards), Joth Ricci (Dutch Bros), William and Daniel Thorndike (Medford Fabrication), Bob Levy, Windy River, Chris Mele-Wagner (Bank of America), David Filippi (Stoel Rives), and Scott Campbell (Silvies Valley Resort/Ranch).[3] As most of the OBC members are not steeped in Oregon water issues, our work has relied heavily on the input and expertise from as many as sixty people[4] from key Oregon water stakeholder communities. Most of the science underpinning our study was provided by scholars working within the Oregon university system.

Once we determined the key challenges facing Oregon's water future, using both local and national experts we organized a series of 'deep dives' on substantive matters that we believe are critical to the success of our work. As I will explain more fully later in the testimony, as we seek solutions to Oregon's water challenges we often refer to steps taken by other states facing

[1] For a list of Summit activities related to water, please go to www.orbusinessplan.org and review the annual Summit program agendas for 2012 – 2019. Every summit since 2012 has dedicated a portion of its focus to Oregon's water challenges.

[2] I am partnered with John Audley, a long-time consultant to OBC. John has organized each of the water events held at the Summit since 2015. You can contact John at john@jjaconsults.com, or 971-203-3248

[3] Jeff Grubb of the Murdoch Charitable Foundation, participates in an advisory capacity as well. Murdoch does not contribute to the project's budget.

[4] To maximize candor and honest dialogue, each interview was conducted with the explicit promise to not associate the interviewee with project. If you would like to discuss interviewees further, please contact John Audley directly.

similar environmental, economic, social and political circumstances. We are currently in this stage of our work, so while on behalf of OBC I am prepared to share with you our initial findings, I do so with an important caveat: ***The positions shared with you in this testimony are not necessarily a reflection of the Oregon Business Council, its members, or the many other people involved in this project. At present, the content of this testimony today is the sole responsibility of myself and John Audley.*** Our goal is to complete this project by the end of November, then distribute the final product as broadly as is possible.

INITIAL FINDINGS and CENTRAL THESIS

The primary purpose of my testimony is to share with you our initial findings, offer a thesis that we believe is central to finding a solution to our water management challenges, then seek your input on how we balance critical components of that solution to meet social, environmental, and political realities.

Long-Term Challenges (30-40 years)

There are two over-arching, predominant trends influencing water in Oregon to consider when planning for a sustainable water future: warming climate and demographic changes.

Climate Change Effects

A warming climate has several fundamental impacts on temperature, precipitation type (winter snow to rain), snow melt timing, greater sea level rise, and changes in the timing and amount of precipitation with extremes.[i] The effects of climate change will be greatest for frontline communities that are economically disadvantaged or are dependent on natural resources for their livelihood, such as agricultural communities, fisheries-dependent communities, and many tribal communities.

There are many climate change forecasts and methods. And while there is growing consensus on many aspects of climate change, I find that it is difficult to actually communicate what the future climate will actually be like. Thus, instead of using changes in degrees or inches of precipitation, I find it easier to envision climate change by our current sister cities. Using a simulation tool developed at the University of Maryland, we can identify what the climate sister cities are: The Portland of 2060 will be like Sacramento today; Medford will be like Chico today, and Pendleton will be like Reno. Clearly there are all manner of implications of these types of changes, whether for recreation or agriculture; the Oregon of the future is going to look very different from the Oregon of today.[ii] In terms of water supply, most regions have already experienced a decline in spring snowpack as more precipitation falls as rain instead of snow. The result is higher streamflow in the winter and spring, with much lower streamflow in the summer months.

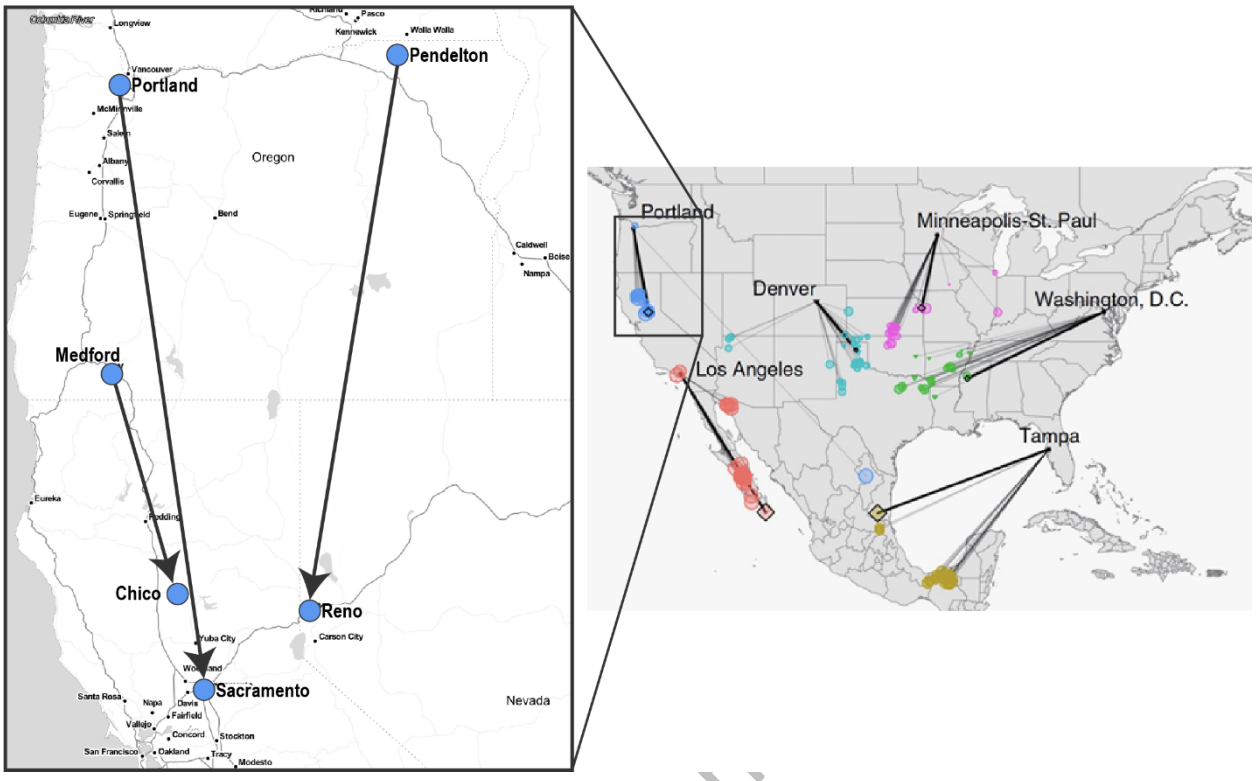

Figure 1. (Left) Portland cities will have the temperature of cities in California and Nevada by 2060. Taken from mapping application.

Oregon's Changing Demography

In terms of demographic changes, the number of people living in Oregon is projected to steadily increase from 4.22 million to 5.86 million by 2060 (a 38.9% increase, Figure 2); however, there is large variation in how population is projected to change across the state.[iii] Nine rural counties are projected to lose population while seven counties are predicted to increase by more than a 45% in population in the next four decades as populations concentrate in urban areas (Figure 3). In addition to these overall changes, the population of Oregon is also expected to become slightly older: those 65 and older will increase by 23.4%, and go from representing 18.7% of the population in 2020 to 23.1% in 2045. The state is also becoming more racially diverse, particularly with the Latinx community growing from 4% of the population to over 13% in 2019.

Finally, it is worth considering that as the demography of Oregon is changing, the social context for all types of management are changing, and often rapidly. Most notably, in Oregon there is rising awareness of disparities in resources and resource access across racial and ethnic groups has introduced considerable challenges and opportunities into the water sector. Only recently have water agencies, corporations, NGOs and utilities begun addressing how past practices, programs, and policies may have structured their communities' access to water services or natural ecosystems. Many people of color and disadvantaged communities have never experienced the many benefits of healthy ecosystems, irrigation-based agriculture, or water-related jobs and careers. Likewise, they have never experienced or had access to the wealth

that can be generated from water. Across the water sector, and society, there is growing recognition that these groups will be critical to guiding the decision-making of the future.[iv]

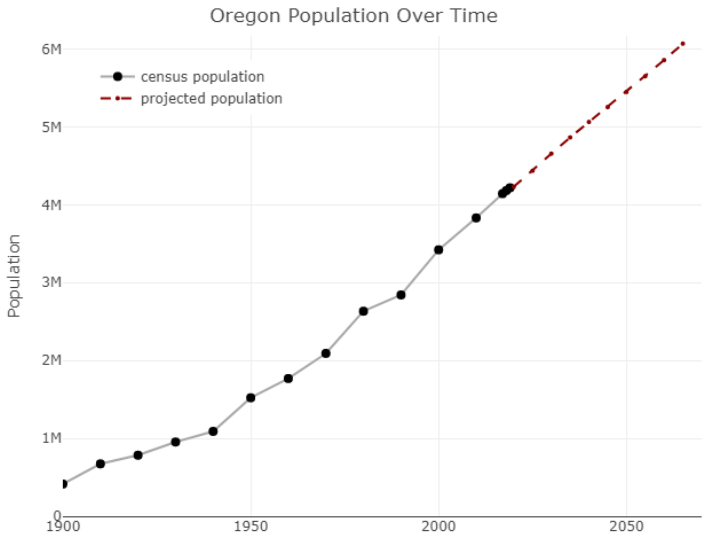

Figure 2. Population change in Oregon, 1990 – 2060. Note that the population in Oregon is projected to be ~6M by 2060. All data from Portland State University's Population Research Center.

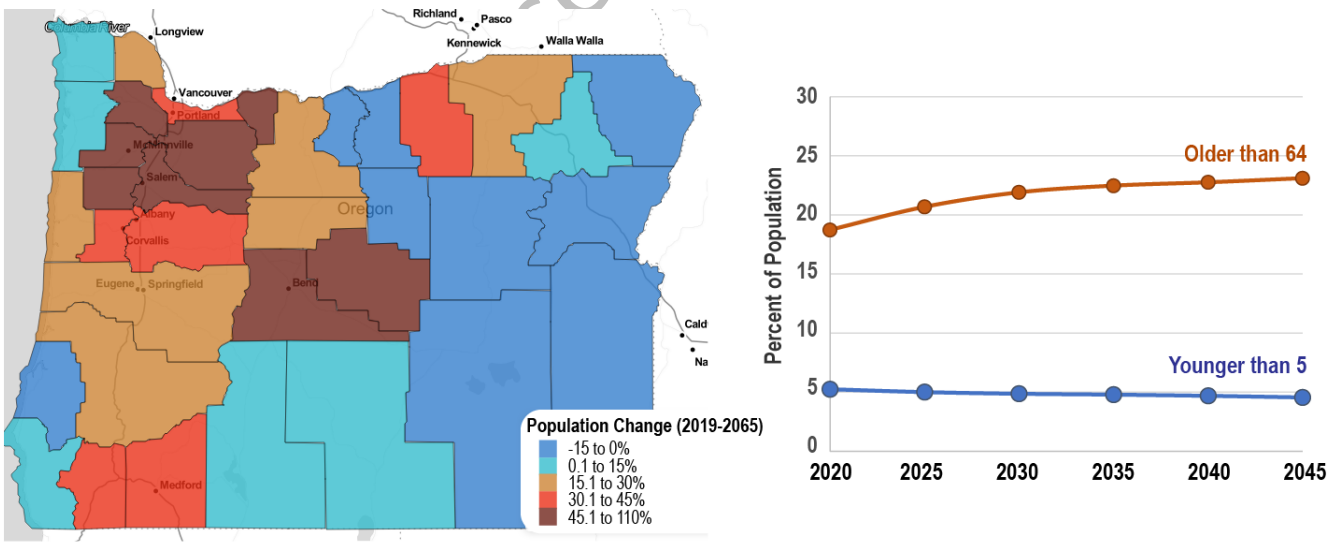

Figure 3. (Left) Projected population by county from 2019 to 2065. (Right) Projected change in age distribution from 2020 to 2045. All data from Portland State University's Population Research Center.

In summary, over the coming half-century, Oregon's climate will most likely have warmer temperatures (both air and water) with less snowpack and greater variability in the summer

months. During this period, Oregon's population will increase and concentrate in urban areas with a slightly aging population.

These macro-trends fundamentally shape the landscape within which other trends are emerging that will influence Oregon in the coming years, including water resources. Some communities may benefit from these trajectories, while others will face greater challenges. In instances where all communities face greater challenges, some will have the resources and capacity to adapt while others may lack those resources.

Three Hydrologic Realities of Oregon for the Long-term:
Despite these seemingly dire long-term contexts for water in Oregon, when thinking about water over the multi-decade timescale (i.e., 30+ years), it is important to take a more unvarnished look at Oregon's hydrologic setting, which can be thought about in the context of

"The Big Three Hydrologic Realities of Oregon"

- **It rains a lot in Oregon.**
- **There is a lot of rechargeable groundwater in Oregon.**
- **The Columbia River is enormous.**

As one person perhaps best captured it, "Over the very long-term, water is the primary product of the Pacific Northwest."

Hydrologic Reality 1: By western US standards, it rains a lot in Oregon.
To begin, Oregon needs to be compared to other western states, and compared as an entire state. In this context, Western Oregon receives extraordinary amounts of precipitation, with some areas receiving more than 100 inches per year, while much of eastern Oregon receives less than 10 inches a year. Aside from the Cascade Range in Washington and a small portion of northern California, most western states are more similar to the precipitation totals in the drier, eastern portions of Oregon (Figure 4).

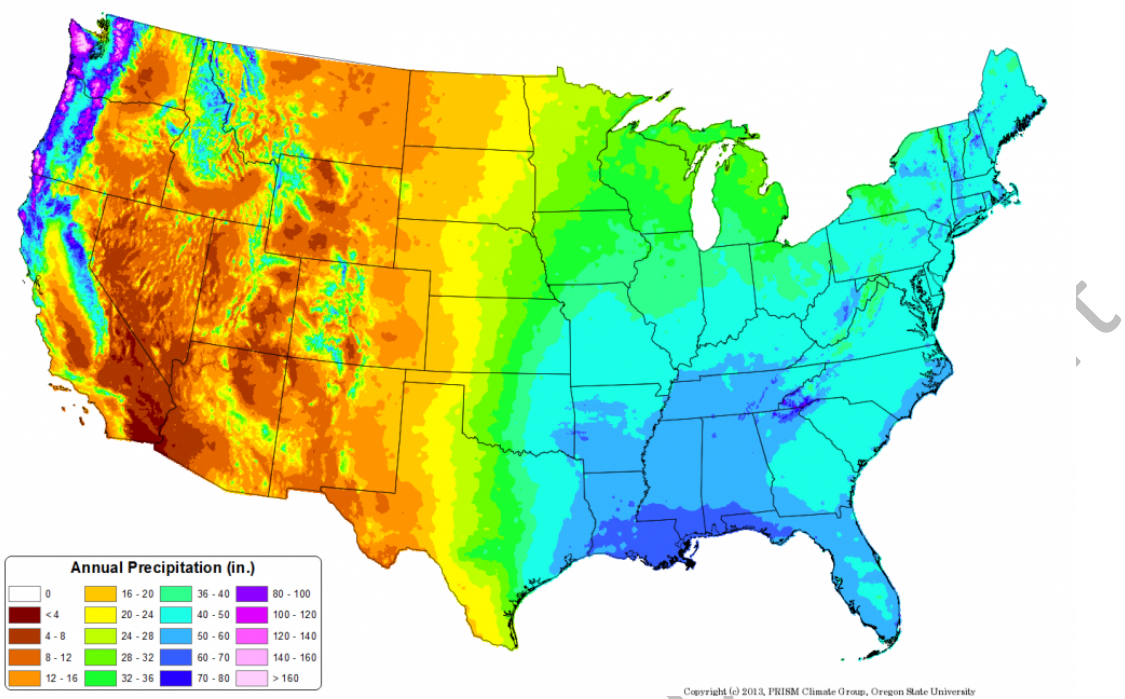

Figure 4. Average annual precipitation from 1974 to 2014.

Importantly, while forecasted temperatures will affect the form of precipitation (rain instead of snow), the total amounts are not necessarily expected to decrease. A climate simulation of 35 models had a mean increase in annual precipitation of 5% by 2050, although the range of models varied between -30 to 40% change in precipitation.[v] Thus, while there is considerable uncertainty, it is not entirely unreasonable to expect total precipitation in Oregon to remain consistent in the coming decades.

Hydrologic Reality 2: There is a lot of rechargeable groundwater in Oregon.

While Oregon is characterized by widely varying geology and associated hydrogeology, the state is also characterized by substantial aquifers including some with considerable recharging characteristics. The Cascade Mountains are a relatively young mountain range consisting of volcanic rocks and porous material. This allows melting snow and rainwater to quickly infiltrate and recharge the aquifer. This recharge is the main source of groundwater for much of central Oregon, as well as much of the surface water; water emerges from springs and contributes to the Metolius River, Deschutes River, and much of the Klamath Basin.[vi] This groundwater also contributes to the Willamette basin on the western slope of the Cascades. These characteristics (along with the fact that the aquifer sits largely beneath US Forest Service land, and so has remained unallocated to date) mean that the aquifer serves as a type of annually recharged hydrologic battery for several of Oregon's major river systems. The aquifer is regularly recharged, and subsequent emergent flows are consistent and cold, and thus sustain downstream summer flows in otherwise hot, dry conditions. Thus, over the long-term, assuming that this system is not significantly altered, Oregon has a consistent water source for two of its major basins.

The other significant regional groundwater system is the Columbia River Plateau. This aquifer covers 20 to 25% of the state and consists of several layers of lava flows that create a highly fractured groundwater system with isolated pockets of groundwater that are no longer recharged. While water pumped from fragmented sections cannot be recharged, they do provide opportunities for developing aquifer storage recovery projects (~20 projects currently exist) by refilling these natural reservoirs. This provides a natural infrastructure for storing water until needed. Recharge is slow because of low rainfall in this area and recharge zones are limited to a few areas.

This hydrologic condition requires, however, two caveats. First, the aquifers in Oregon are poorly understood in terms of basic hydrogeology; the full implications of how changes in precipitation (snow vs rain) will affect recharge are poorly understood. Second, the potential availability of groundwater resources does not mean to ignore the fact that most basins in Oregon suffer from seasonal shortages. Increased demand and impacts of climate change will only make already existing shortages more acute. Nor do I mean to imply that all basins in Oregon will enjoy a plentiful water future. The Harney and Klamath Basins bear difficult testimony of that reality.

While other western states have large aquifers, and have easily recharged aquifers, other western states (other than Washington and northern California) do not have consistent precipitation to naturally recharge these aquifers, nor do they have a large surface water supply (the Columbia River, see below) with which to potentially recharge aquifers. This combination of surface water and rechargeable aquifers is a significant resource for Oregon's long-term water future.

Hydrologic Reality 3: By any Standard, the Columbia River is Enormous.

It is important to bear in mind that the Columbia River is considerably larger than most any of its counterparts in the United States (except the Mississippi). Perhaps more relevant, the Columbia River dwarfs any other Pacific-draining river of the US, as well as the western rivers which drain eastward (i.e., Missouri, Arkansas). The average annual flow of the Columbia is 198 MAF compared to the 15 MAF of the Colorado. And this volume of flow on the Columbia makes tremendous hydropower possible (about 4200 MW on the Colorado compared to > 14,000 MW on the Columbia). International treaties, agreements between states, and important fish and other conservation goals affect Oregon's use of this water; that said, over the very long-term, the Columbia is a tremendous resource with significant implications for Oregon's future, i.e., ecologically and socially responsible use of Columbia River water creates an enormous resource for Oregon lacking for most other western states.

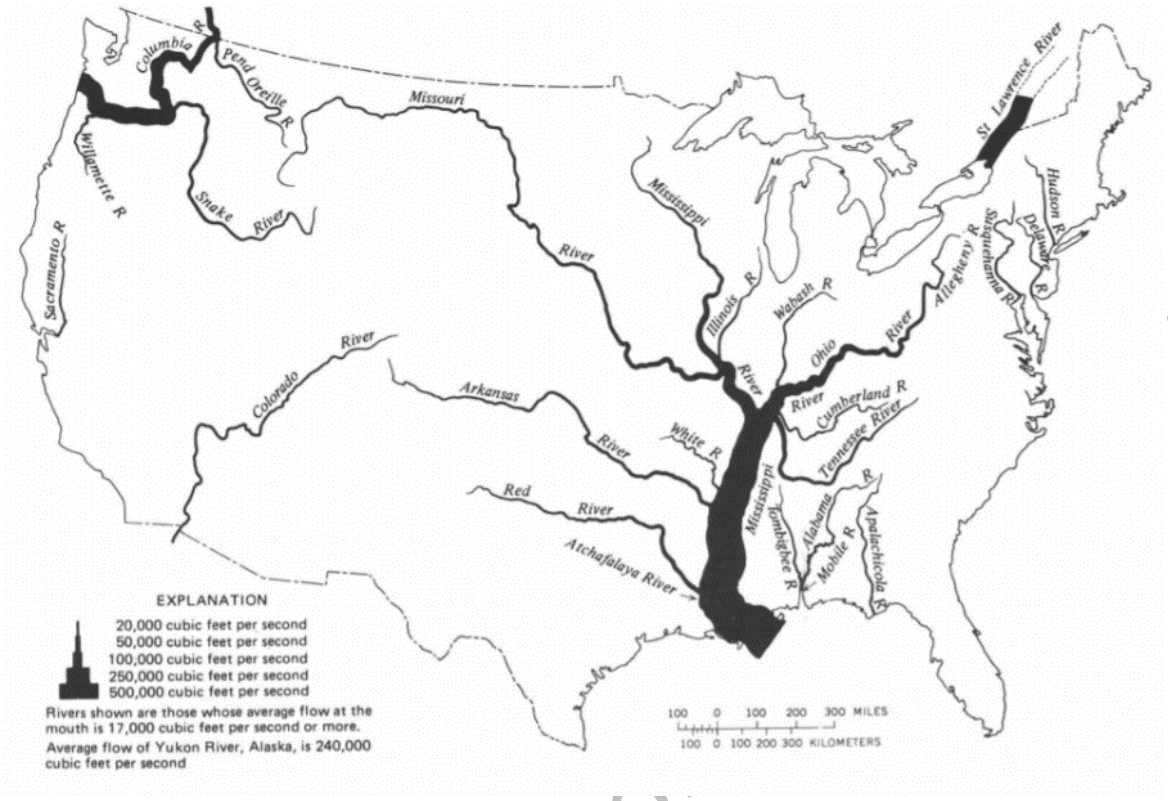

Figure 5. Relative size and location of the largest rivers in the United States (from Iseri and Langbein, Large Rivers of the United States, USGS Circular 686, Washington, DC, 1974).

Ten Themes for the Next Ten Years

Beyond these broadest trends over many decades, there are a series of more specific trends in Oregon and in society that will likely (but not certainly) affect Oregon's water resources and management opportunities.[vii] Several themes have emerged within the context of these broad trends that will inevitably influence Oregon's water resources.

1. **Rain not snow**: annual precipitation is not projected to change in terms of total/annual magnitude, but the timing and duration of rain events will change, and more precipitation coming as rain instead of snow. This could impact groundwater recharge (less water infiltrating slowly from snowmelt and more runoff in winter months) and summer streamflow availability (snowmelt is earlier or rain not captured in winter months). The trend will favor storage projects and senior appropriators, while putting late season growers and junior appropriators at a distinct disadvantage.

2. **Growing demand for over-allocated waters:** While most of Oregon's water resources are fully allocated, growing populations need more water resources. Access to groundwater and degrading surface water quality may further limit water availability and result in water

rights not being fulfilled (if for example water quality is too poor to meet water rights for their beneficial use). Antiquated water rights laws, fragmented administration of those laws between different state agencies, poor data, and the need for more flexible use of water under changing climate will drive the need for innovation and change. Beneficiaries under this scenario are those holding senior water rights, growing cities, and those engaged in water market transactions. Junior rights holders, those looking for new opportunities for business or pleasure, and communities with shrinking populations will struggle accessing water.

3. **Aging infrastructure**: Previous investments in infrastructure, from dams and levees to treatment plants and canals, continue to age beyond expected design lives. A potential lack of reinvestment leads to increased costs in O&M and repairs rather than replacement. Those able to access federal water funds or secure private investors will continue to update and modernize infrastructure. Utilities may tend to privatize, or consolidate to take advantage of economies of scale. Smaller utilities may suffer, as will those operating in grant-dependent districts.

4. **Affordability and equity:** Municipal water rates have been increasing faster than inflation, and when combined with growing social justice movements water affordability, access, and equity are central issues in today's society. While the primary focus has been on disadvantaged communities, the continued de-population in rural communities and shrinking industrial communities will broaden stakeholder groups and interests; businesses ignoring equity issues risk social license to operate and use resources. Beneficiaries of this trend will tend to be community/social-focused advocacy groups, modern infrastructure systems designed and built to meet their needs, and potentially new hiring/contracting practices designed to stimulate the growth of businesses owned and operated by black, indigenous, and people of color (BIPOC). Utilities will struggle with how to keep costs down while expanding services, perhaps conveying costs onto commercial and industrial water users. Traditional environmental groups may need to yield on their water priorities to rebalance water access for disadvantaged communities.

5. **Federalism and shrinking budgets**: While Oregon irrigators have been able to benefit from federal support programs, the trend in federal government investments will likely continue decline – as will any leadership from Washington on water management. By necessity, state and municipal governments will need to take greater leadership and step into the gap – just at a time when they must struggle to recover from the COVID pandemic – and the worst fire season in nearly one hundred years. While state-level regulatory developments are important to protect long-term public health and ecosystem health, any new regulatory or policy developments will be difficult given contracting budgets and growing needs. This challenge is likely to be amplified by the negative impacts of the COVID-19 pandemic on government budgets. Well-resourced cities and irrigation districts will continue to make progress, while grant-dependent projects or programs, poorly resourced interest groups, tribes, districts, or municipal governments will suffer.

6. **Groundwater, water quality, and natural infrastructure**: The increasing reliance on surface water combined with increasing uncertainty driven by climate change will result in greater pressure to use groundwater. The high costs and enormous regulatory barriers associated with traditional surface storage or treatment projects will result in more energy devoted to projects designed to achieve multiple benefits. Natural infrastructure (aquifer storage-recovery; floodplain-based recharge; green infrastructure) will become better recognized as sustainable and affordable, driving (or relying upon) innovations in groundwater and water quality. Greater emphasis will be placed on using and managing groundwater, or using aquifers for storage and recovery. Traditional infrastructure design/construction firms, surface water storage projects will be forced to innovate in response to new trends.

7. **Smart water and open water data:** Declining costs of sensors and satellites will increase information on everything about water. Drying creeks, lead service lines in cities, and algal blooms in reservoirs – all will lead to growing public demand to know what is in their water and how it is being used. "Open water data" is a trend that is being adopted across the nation, and can lead to improvements in the potential for water quantity and quality markets to emerge, enabling new management approaches through greater knowledge of where/when/how Oregon water is used. Technology and other firms that both use and monitor water carefully will benefit from this trend, as will new or existing infrastructure that can easily adopt to data collection. Water transparency advocates will consider this a huge victory. New and more accurate water data will contribute to the growing role for a water market. Inflexible legacy infrastructure systems won't fare well, and regulatory agencies could struggle with meeting these new data collection and dissemination requirements. Senior appropriators or those under-using their allocations could be at risk of water rights forfeiture.

8. **Pay-for-performance regulatory/compliance approaches:** high costs of regulatory compliance combined with inability to or uncertainty in demonstrable recovery of rare species or improved water quality will undermine traditional regulatory approaches such as species-centered conservation or activity-based regulations; conservation will pivot toward performance-based approaches, promoting innovation including innovative attempts to recreate healthy ecosystems. Beneficiaries of this trend include restoration firms, those willing to innovate to solve multiple water problems simultaneously, an those engaging in water markets. Traditional regulatory approaches will not work well, and, as regulators move towards different approaches to compliance, litigation-driven environmental activity and advocacy will be less effective.

9. **Impact investing:** Investors are more focused than ever on environmental and social factors in society, with an interest in achieving multiple objectives through investments, and broader pivot toward values-based investing. Possible beneficiaries of this trend tend to be mission-based investment funds, as well as communities with a good understanding of private capital. Innovative/crosscutting restoration projects or community projects would likely do well. Traditional approaches to capital construction financing will suffer.

10. **Rising cost of capital:** While the cost of capital is currently low, historic low treasury rates and associated low-cost debt is increasingly viewed as set to unwind, triggering inflationary cycle. Enormous public budget shortfalls caused by the COVID-19 pandemic will add to this trend, especially as businesses continue to fail and the commercial property suffers from a shift away from working in-offices. The cost of borrowing money will rise. Inflation will result, and those able to engage in water markets or public-private partnerships will benefit. Municipalities financing infrastructure with debt, new infrastructure projects, and shrinking towns and cities will struggle.

SHORT-COMINGS OF OREGON'S WATER MANAGEMENT TO ADAPT TO CHANGING CONDITIONS

These over-arching trends (demography, climate), when coupled with the more immediate trends (e.g., smart water/open data, rising cost of capital), create pressures on Oregon's water and Oregon's water management system. While one would hope that the management system was adaptive to the broader contexts that are rapidly changing, in fact, Oregon is facing the reality that many of the models and approaches that are the basis for water management were initially conceived, designed, and implemented for conditions and assumptions from a long bygone era. While these models and approaches met the needs for the time when they were conceived, they may now be unrealistic, inflexible for changing conditions, or entirely inappropriate for the future. In the past, our laws have been additive. In the future, regulations need to be adaptive, flexible, transparent, and part of an evidenced-based policy framework.

To put it bluntly, Oregon's water challenges will grow dramatically in pace and scale while the public funds available to meet this challenge continue to shrink. Can Oregon's water management system rise to this challenge? Based on our review of Oregon's approach to water management, given these short and long-term challenges we drew the following conclusions:

1. Oregon's biggest challenge is water management -- not scarcity. That does not mean that basins don't struggle with seasonal water shortages – they do. And we acknowledge that there are certain basins -- like Harney and Klamath, whose water levels will never be restored. What we do mean is that the long-term challenge for Oregon should focus on management as its highest priority. Management for people, for nature, for communities and the economy – but management.

2. Unfortunately, we do not feel that the State's water management system is up to the task of meeting these challenges. Oregon's water management system was designed to meet Oregon's first hundred and fifty years (founded in 1959), but is fundamentally unable to meet the pace and scale of the challenges we shared with you.

Some examples of how the current system in Oregon is unable to adapt at the pace or scale of change:

Water Storage: current water management system presumes investments will be in gray infrastructure-based, surface water storage (e.g., dams and reservoirs) combined with large delivery systems. However, surface storage is inordinately expensive, often unrealistic without subsidized financing or grant funding; many/most viable locations for surface storage have already been developed; environmental impacts are now highly regulated, creating regulatory challenges for new projects and operational changes of existing projects.

Funding and Finance: many current projects were conceived and built decades ago, when federal grants and subsidies enabled local and state governments to finance capital expenditures on new infrastructure. However, subsidized finance leads to low-cost water, and under-valuing of water overall; also declining appropriations from federal and state governments reduce subsidies and delay needed projects; the potential for inflation could cause debt-based financing of projects to become prohibitively expensive, leading to deferred maintenance and accumulation of aging infrastructure.

Perception, Communication and Value: Utilities and water managers have been risk adverse, preferring to remain in the background, with their primary goal being to provide low cost water to consumers, whether residential or industrial/commercial water users; this led to water being under-valued and under-appreciated, except in dry regions of state. The combination led to an "us" versus "them" mentality between water-scarce eastern Oregon and water-rich western Oregon.

Monitoring and Data: Much of water data remains based on paper forms and email-based data reporting, centralized data storage in spreadsheets or file cabinets, combined with different data formats or data architecture being used by different agencies or geographic regions. This has led to an inability to synthesize data into coherent understanding of water cycle, including ability to make near-real-time decisions, as well as a lack of transparency, which constrains the ability of broader stakeholders to engage: data are only available for those with the resources and expertise to find, clean, and analyze publicly collected data, meaning that only specialists or the most well-funded groups engage in water decisions.

Environmental Regulations: Most regulatory approaches are based on process-based approaches to compliance combined with state-wide planning and associated regulations. This has led to regulatory-based requirements that are inappropriate for specific geographic or geologic settings and realities, and limited innovations in environmental restoration. This is all combined with the limited success of species recovery, yet at very high costs.

Slow and inefficient decision-making: Permitting decisions related to water resources in Oregon is notoriously slow. Decisions have been made or influenced by a narrow group of experts, the largest rights holders, the most vocal interest groups, or the most funded interest groups. This has led to lack of innovation because the time and resources needed to move through the permitting process creates extreme uncertainty; it has also mean that

management practices or proposed solutions are not responsive to or reflective of local conditions or communities because of the over-influence of state-wide yet narrow interest groups. There has also been a lack of representation of minority groups or small rights holders, as well as a lack of representation by groups not traditionally aware of or invested in water issues.

Water law and policy: Water laws have primarily focused on surface water allocations, in-stream flows, and species protection, with significant focus on state-wide application of regulations. The current approach has led to over-allocation and unsustainability of regionally critical water resources, yet an inability to experiment with new approaches to innovate potentially more sustainable approaches to regionally specific challenges.

PROPOSED PILLARS FOR ADAPTING OREGON'S WATER MANAGEMENT

Oregon must adapt its water management system. The status quo is insufficient to meet the current challenges being faced, let alone those that are coming. To truly prepare for future generations of sustainable water, we are exploring recommendations designed to move Oregon towards new approach for water management. Old approaches must be redesigned, adopting a new model for water management that rewards innovation, reduces regulatory costs, while increasing accountability, and is more inclusive of voices traditionally not part of water management decisions. To move forward, water stakeholders must accept the shared responsibility of finding a balance among **four key pillars to water management:**

- **Regional approaches to water management that allow local stakeholders greater creativity in implementing water management programs designed to meet multiple benefits**
- **Greater transparency in the availability and use of water data**
- **Reform Oregon's water permitting process**
- **Ensure that a wider range of voices are part of ongoing water management**

Finding common ground among these four pillars will not be easy, and I am not prepared to offer you specific recommendations at this time; we do feel, however, that these four themes are necessary elements to a significant change in water management in Oregon. In follow-up meetings with key stakeholder groups, we are exploring how to frame these four pillars in ways that enable groups to move towards compromise and consensus. We invited water and legal experts from across the state and nation to meet with us to describe in detail 1) the nature of Oregon's challenges in these four areas and 2) how other states have approached similar challenges. We are making progress towards a set of steps we believe can help stakeholders find common ground, and our goal is to complete this exercise by November.

The water challenges that Oregon faces, and will continue to face, are truly incredible. But this committee must remember that water can be a strategic advantage for Oregon, if it is managed carefully and appropriately in the decades to come.

[i] Mote et al. 2019. Fourth Oregon Climate Assessment Report by the Oregon Climate Change Research Institute.
[ii] Fitzpatrick, M.C. and R.R. Dunn. 2019. Contemporary climatic analogs for 540 North American urban areas in the late 21st century. Nature Communications 614.
Note: https://fitzlab.shinyapps.io/cityapp/. The mapping tool provides a range of 'matched' cities for the future. We provide matched cities that have similar familiarity/size to those in Oregon, although they may be slightly different than what are initially provided in the mapping app.
[iii] Data obtained from Portland State University's Population Research Center. Population Forecasts.
[iv] US Water Alliance. 2017. An Equitable Water Future: A national briefing paper.
[v] Ibid.
[vi] OSU. Well Water Program. Underground Story of Water in Oregon.
[vii] While some of these are based on conversations with Oregon-based water managers and stakeholders, many are also based on reviews of trends as part of the Aspen Institute-Nicholas Institute annual water forum (www.aspeninstitute.org/programs/energy-and-environment-program/aspennicholaswaterforum/)