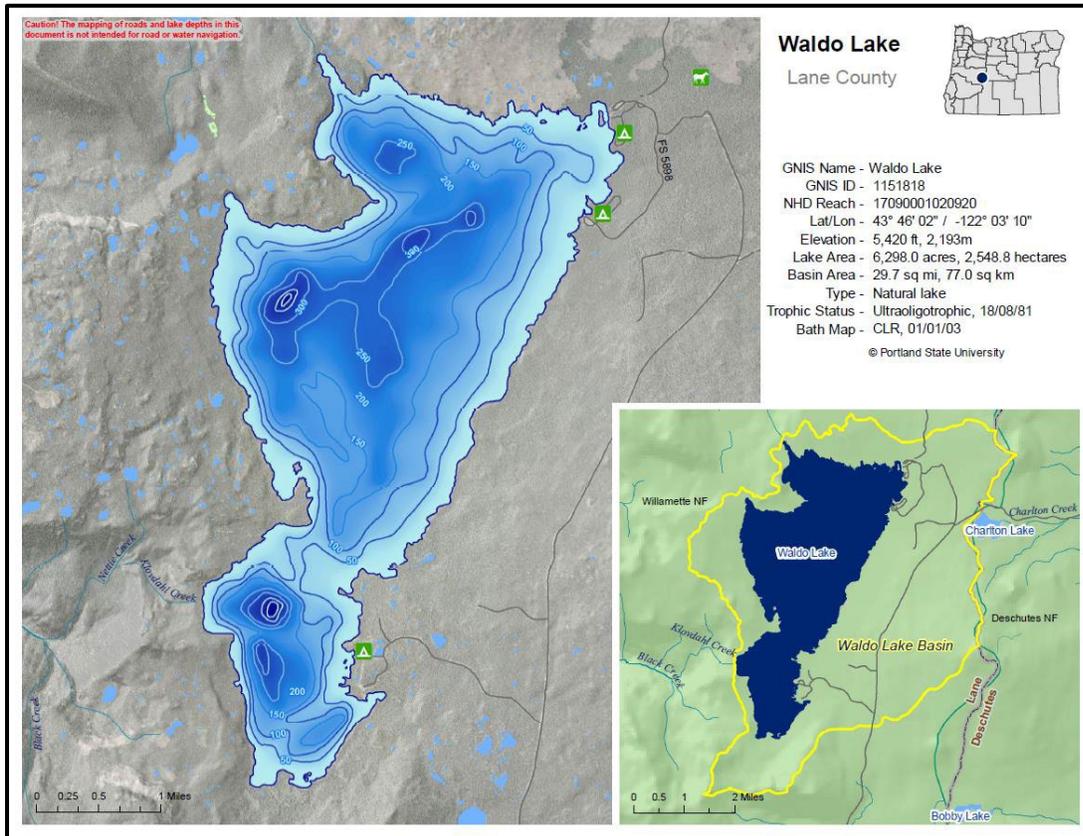


# Waldo Lake Outstanding Resource Waters Designation

## Support Document

Date: July 1, 2020



**Oregon Department of Environmental Quality**  
700 NE Multnomah St.  
Suite 600  
Portland, OR 97232  
Phone: 503-229-5696  
800-452-4011  
Fax: 503-229-6124  
Contact: Debra Sturdevant  
[www.oregon.gov/DEQ](http://www.oregon.gov/DEQ)

DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.



State of Oregon  
Department of Environmental Quality

This report prepared by:

Oregon Department of Environmental Quality  
700 NE Multnomah St.  
Portland, OR 97232  
1-800-452-4011  
[www.oregon.gov/deq](http://www.oregon.gov/deq)

Contact:  
Debra Sturdevant  
503-229-6691

**Alternative formats:** DEQ can provide documents in an alternate format or in a language other than English upon request. Call DEQ at 800-452-4011 or email [deqinfo@deq.state.or.us](mailto:deqinfo@deq.state.or.us).

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# Executive Summary

On April 22, 2019, the Northwest Environmental Defense Center (NEDC) petitioned the Oregon Environmental Quality Commission (the commission) and Oregon Department of Environmental Quality Director Richard Whitman, requesting that the commission adopt rules designating Waldo Lake and its associated wetlands as Outstanding Resource Waters (ORW) of Oregon. In July 2019, the commission granted the petition and directed DEQ to initiate the requested rulemaking. The commission, which oversees the department, also directed DEQ to adopt rules designating Crater Lake an ORW.

The petition also proposed that DEQ adopt a policy to protect the current high water quality and exceptional ecological values of Waldo Lake. The proposed rule amendments would prohibit new or expanded wastewater discharges and limits other activities that would degrade water quality. Exceptions are allowed to respond to emergencies and for restoration or enhancement activities.

Outstanding Resource Waters are high quality waters that have extraordinary or unique character or ecological value, or are critical habitat areas, such that they constitute an outstanding state or national resource. The special water quality and ecological values of these waters must then be protected in accordance with Oregon's antidegradation policy and federal regulations under the Clean Water Act.

Waldo Lake is located in Lane County, Oregon in the high Cascade Mountains. Waldo Lake is remote and has exceptionally high water quality. Classified as an ultra-oligotrophic lake, the waters are renowned for their outstanding clarity and low productivity. The basin is entirely on public land in the Willamette National Forest. A large portion of the lake basin is managed as wilderness and semi-primitive nonmotorized dispersed recreation. There are three developed campgrounds and one horse camping facility on the lake. Waldo Lake is the headwater source of the North Fork of the Middle Fork Willamette River, which is a Wild and Scenic river. Protecting Waldo Lake will also help protect the quality of water in this river.

# 1. Introduction and Background

This document provides background and supporting information for DEQ's recommendation to designate Waldo Lake an Outstanding Resource Water and to adopt a policy to protect the existing high water quality and ecological and recreational values of Waldo Lake, as proposed by a citizen petition.

Waldo Lake is remote and pristine. Its waters are renowned for their outstanding clarity. The lake water is chemically similar to distilled water. The lake's clarity has averaged 125 feet (38.1 meters) since 2001 and reached as deep as 160 feet (48.8 meters).<sup>i</sup> Designating Waldo Lake an ORW provides an opportunity to ensure that this unique lake is protected from degradation for future generations. Waldo Lake qualifies as an ORW because it has exceptionally high quality water, is essential habitat for many species, and provides exceptional opportunities for research and outdoor recreation.

DEQ worked with the U.S. Forest Service and other stakeholders to review the antidegradation policy to protect the lake's water quality, taking into consideration the Willamette National Forest's management responsibilities for Waldo Lake and its watershed.

This support document together with the proposed rule language and the fiscal impact statement will be available for public comment. Following public comment, DEQ will make a recommendation to the commission about whether to designate Waldo Lake an ORW and will propose a final water quality protection policy to accompany the designation.

## 1.1 Brief History

In April 2019, NEDC and several co-petitioners petitioned the EQC requesting that the commission designate Waldo Lake an ORW. There was overwhelming public support for the ORW designation. In July 2019, the commission granted the petition and directed DEQ to initiate a rulemaking process to consider the proposed rules. At the same time, the commission directed DEQ to include the designation of Crater Lake as an ORW in the rulemaking process. The citizen petition and the 2019 DEQ Staff Reports for Waldo Lake and for Crater Lake may be found on the following website:

<https://www.oregon.gov/deq/wq/Pages/WQ-Standards-ORWO.aspx>.

Oregon's first ORW is the North Fork of the Smith River in southwest Oregon. The commission designated this ORW in 2017, also in response to a citizen rulemaking petition. The rule language proposed in the petition for Waldo Lake is identical to the rule language that was adopted for the North Fork of the Smith River.

## 1.2 Outstanding Resource Waters

Oregon's water quality standards define three classifications of state waters: water quality limited, high quality, and Outstanding Resource Waters. ORWs are high quality waters that have extraordinary or unique character or ecological value, or are critical habitat areas, such that they constitute an outstanding state or national resource. Oregon's ORW rules may be found at [Oregon Administrative Rules 340-041-0004\(8\)](#) and [340-041-0002\(45\)](#).

Oregon rules identify the following as priority waters for ORW consideration: (A) those in state and national Parks; (B) National Wild and Scenic Rivers; (C) State Scenic Waterways; (D) those in state and national wildlife refuges; and (E) those in federally designated wilderness areas.

Waldo Lake is wholly within the Willamette National Forest and largely within a wilderness area. It is also the headwaters of a national wild and scenic river, the North Fork of the Middle Fork Willamette River.

The ORW designation may only be granted by the EQC through rulemaking. Along with the designation, the rules must also include a policy to protect and maintain the exceptional qualities and values of the waterbody.

### 1.3. Citizen Rulemaking Petition

Oregon law allows an interested person to petition an agency to promulgate, amend, or repeal a rule. [Oregon Revised Statute 183.390](#) and administrative rules at OAR [340-011-0046](#) and [137-001-0070](#) describe the requirements for the petition and for agency review. The petition to amend a rule must clearly show the proposed rule revisions and provide facts and arguments supporting the proposal. According to the statute, the agency must invite public comment on the petition and then act within 90 days of receiving the petition. Upon its review, the commission may:

1. Deny the petition,
2. Direct DEQ to initiate rulemaking proceedings based on the rules proposed by the petition, or
3. Deny the petition but direct DEQ to take some other action.

As OAR 137-001-0070(3) requires, DEQ invited public comment on the rule amendments the petition proposed and requested comment on whether options exist for achieving the rule's substantive goals in a way that reduces the negative economic impact on businesses. DEQ received 2,155 comments from 1,945 citizens and five organizations. The comments are summarized in the staff report on the petition, which may be found on the following website: <https://www.oregon.gov/deq/wq/Pages/WQ-Standards-ORWO.aspx>. In July 2019, the commission granted the petition and directed DEQ to initiate rulemaking.

The rulemaking process will include another opportunity for public comment on the petition's proposed rule language. DEQ may recommend revisions to the proposed rule language in response to public comment if the revisions are appropriate or clarifying.

The Waldo Lake ORW petition proposes to amend [OAR 340-041-0004\(8\)](#), the Outstanding Resource Waters Policy in Oregon's Antidegradation rule, to add Waldo Lake and its associated wetlands as Outstanding Resource Waters. The petition also proposes to amend [OAR 340-041-0345](#), Water Quality Standards and Policies for the Willamette Basin, to protect the current high water quality, exceptional ecological values, and existing and designated uses of these waters. The proposed rule amendments would prohibit new or expanded wastewater discharges and other activities that would degrade water quality. Exceptions are allowed to respond to emergencies and for restoration or enhancement activities.

## 2. Waldo Lake

### 2.1 Description and Location

Waldo Lake is located in Lane County, in west central Oregon, as shown in Figures 1. Occupying 9.8 square miles (6,298 acres) in the Willamette National Forest, Waldo Lake sits near the western crest of the Cascades range at 5,414 feet elevation. Waldo Lake is the second deepest lake in Oregon with a maximum depth of 420 feet. The lake is known for its clarity and pristine water quality. The Waldo Lake Wilderness area surrounds more than half of the lake. The wilderness designation helps to keep the forest ecosystems of the watershed healthy, which in turn protects the water quality of the lake. The lake is the source of the nationally designated Wild and Scenic North Fork of the Middle Fork Willamette River.<sup>ii</sup>

Waldo Lake is known as an exceptional recreational resource for locals and visitors alike. Tourists travel from around the nation and the world to enjoy the lake's pristine beauty and solitude of the lake. While gasoline motor boats have been banned from Waldo Lake, boating with electric motors and nonmotorized boats is still a common activity. Visitors also hike, camp, mountain bike, and enjoy other recreational activities.<sup>iii</sup>

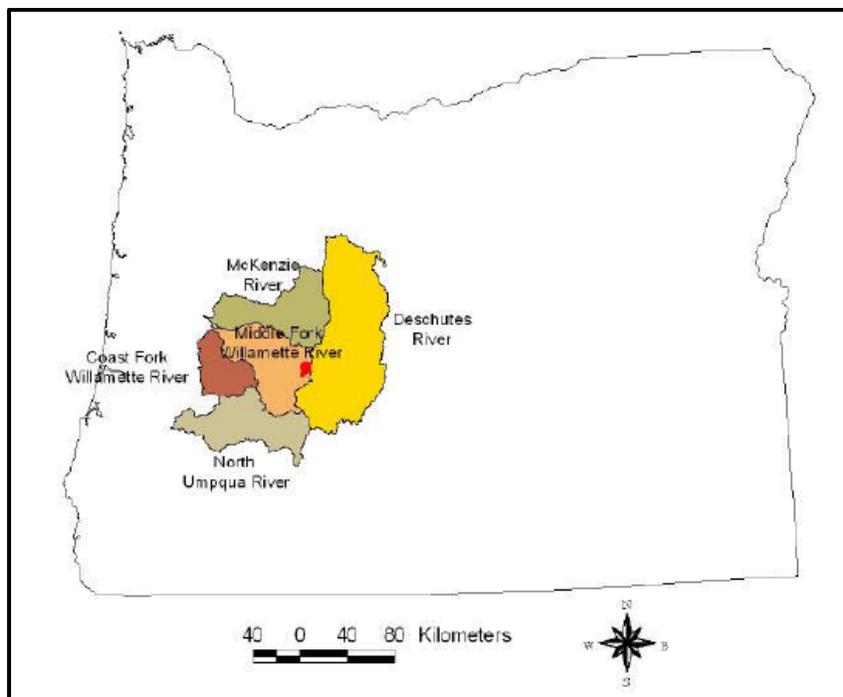


Figure 1: Location of Waldo Lake in Oregon.

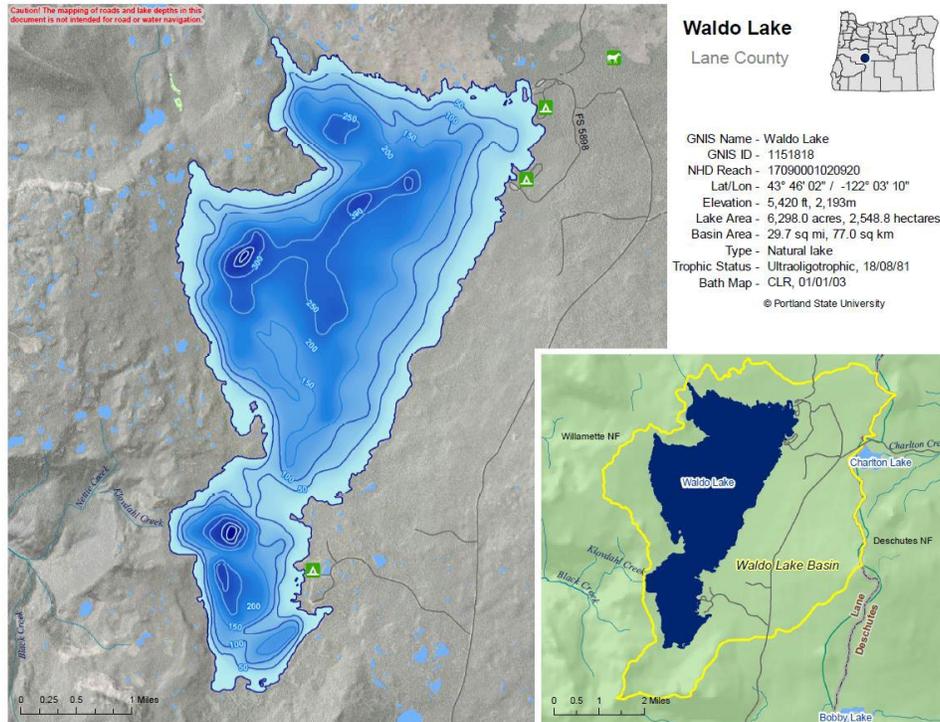


Figure 2: Waldo Lake depth and watershed maps. (From: Atlas of Oregon Lakes, PSU)

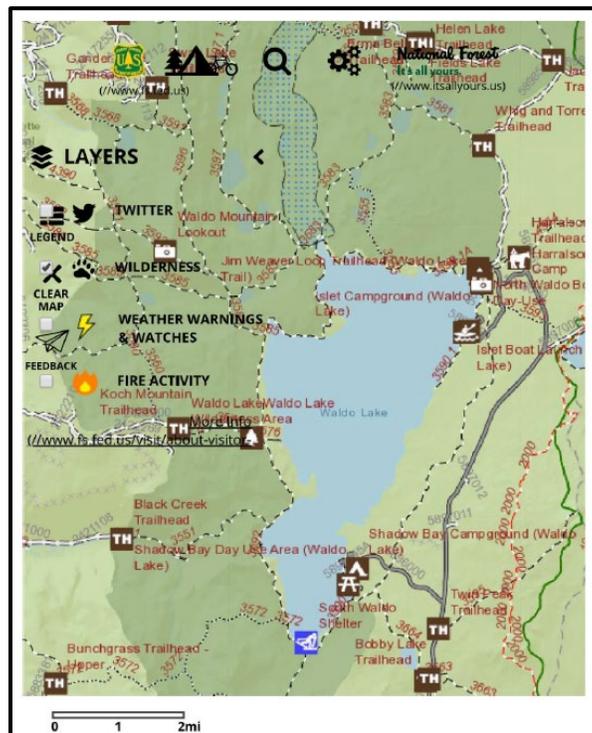


Figure 3: Detail of Waldo Lake, Oregon. (From: Willamette National Forest, online)  
 Note: the darker green shaded area is the Waldo Lake Wilderness area.

## 2.2 Water Quality

Waldo Lake is thought to be one of the most oligotrophic large lakes in the world. This is a term used for lakes with a scarcity of nutrients and low productivity, resulting in exceptional water clarity and outstanding water quality.<sup>iv</sup> A Secchi Transparency study was conducted from 1990 to 2003. On days where wave and sky conditions provided optimal weather conditions, transparency averaged 37 meters (121 feet). On days where cloud cover and waves due to winds produced more difficult weather conditions for measuring Secchi depth, transparency averaged 33 meters (108 feet) (see Table 1 and Figure 5 below).<sup>v</sup> A record Secchi depth of 47.9 meters (157 feet) was recorded in 1938.<sup>vi</sup> The lake's clarity is due to a low concentration of suspended particles and a low concentration of dissolved organic substances.<sup>vii</sup>

**Table 1: Secchi disk conditions of Waldo Lake between 1996 and 2003.**

"Good" conditions		"Bad" conditions	
Date	Secchi Disk Reading (m)	Date	Secchi Disk Reading (m)
6/20/1998	37.5	9/6/1996	20
6/20/1998	39.1	9/19/1999	35
8/16/1998	33	9/19/1999	35.5
7/26/1999	40	5/27/2001	33
7/26/1999	40.5	6/29/2002	32.2
8/31/1999	35	7/29/2002	36.2
10/9/1999	34	7/29/2002	36.5
10/9/1999	34.2	9/21/2003	34
7/7/2001	41.3	9/21/2003	35
8/19/2001	39.8	9/21/2003	36
9/9/2001	34.2		
8/19/2002	35.8		
Total days 9		Total days 6	
Average 37 m		Average 33.3 m	

Waldo Lake occupies about 32 percent of its watershed (see Figure 2), which means it has a small watershed relative to the size of the lake. A small watershed limits the amount of sediment and nutrients that are carried into the lake from the landscape. In addition, Waldo Lake has no permanent inlet to bring nutrients into the lake, which are needed for plant growth.<sup>viii</sup> The precipitation that falls on the watershed arrives indirectly to the lake by way of over land flow. This is significant because it means the condition of the surrounding watershed area plays an important role in the lake's health and quality. Related to the lake's low productivity, Waldo Lake is naturally fishless. In addition, the lack of algal growth likely contributes to the lake's stable pH. Measurements between 1998 and 2003 indicate the pH rarely exceeds 6.5 (Fig. 4).

An early investigation found that the lake's water was extremely dilute and chemically similar to distilled water.<sup>ix</sup> Waldo Lake has the lowest average water conductivity compared to other lakes in Oregon (Figure 5, Table 3). Because the watershed is only twice as large as the lake, the amount of water supplied to the lake each year is a small fraction of the lake's total volume. Replacing the lake's entire volume at this input rate would require roughly 30 years.<sup>x</sup> The lake's long residence time makes the lake vulnerable to

pollutants that may be introduced to the lake from outside the watershed or due to disturbance within the watershed.

In addition to scientists with the U.S. Forest Service, there are numerous partners involved in long-term research of Waldo Lake. Partners include scientists from the U.S. Geological Survey, Portland State University, and Oregon State University. Some of these studies were compiled into Volume 16 of *Lake and Reservoir Management* (2000), the Journal of the North American Lake Management Society. Long-term water quality monitoring parameters include: temperature, DO, pH, turbidity, transparency, Photosynthetically Active Radiation, and light absorption. Water chemistry parameters include total phosphorus, orthophosphate, and total nitrogen. From 1986 to 1995, the measured range of nitrite/nitrate was <1-3  $\mu\text{g/L}$ , total phosphorus was <1-13  $\mu\text{g/L}$ , and orthophosphate was <1-7  $\mu\text{g/L}$ .<sup>xi</sup> In addition, biological parameters including phytoplankton, zooplankton, chlorophyll, and primary productivity have also been monitored long-term.<sup>xii</sup> See Table 3 below for additional water quality data for Waldo Lake. These parameters and possibly others will continue to be measured and examined in the future.

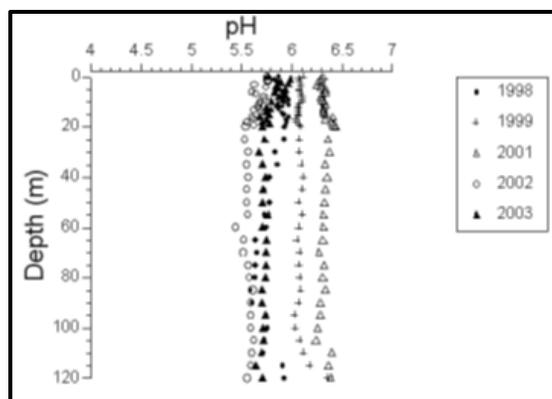


Figure 4: pH by depth in Waldo Lake from 1998 to 2003.

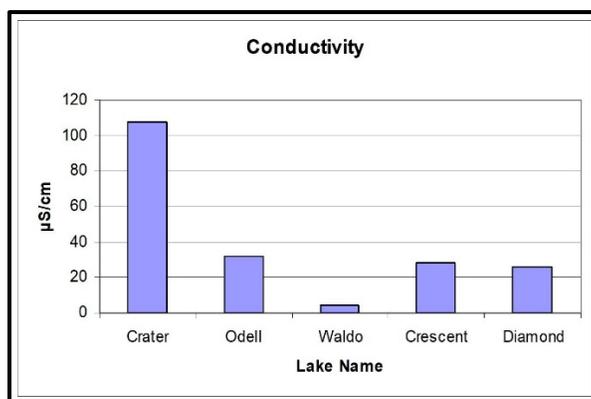


Figure 5: Comparison of water conductivity ( $\mu\text{S/cm}$ ) for different lakes in Oregon.

## 2.3 Water Quality of Oregon Lakes

There are over 6,000 lakes in Oregon, with a combined surface area of over 500,000 acres. There are more than 1,400 named lakes in the state and thousands of unnamed lakes, reservoirs, farm ponds, mill ponds, marshes and sloughs ranging in size from less than 1 acre to more than 90,000 acres (Klamath Lake). Oregon's lakes are found in a wide variety of geographic settings ranging from coastal dunes, river oxbows, mountain settings and high desert locations.

The classification system most widely applied to lakes and reservoirs is the trophic classification system. Lakes are ranked according to their biological productivity: unproductive lakes are termed oligotrophic (“little nourished”) and productive lakes are termed eutrophic (“well nourished”). The productivity of a lake is determined by a number of physical, biological and chemical characteristics – including light transparency (secchi depth), algal growth (chlorophyll a) and nutrients (phosphorus and nitrogen). Listed in Table 2 below is a summary of the trophic statuses for 201 of the larger lakes and reservoirs in Oregon based on data in the Atlas of Oregon Lakes.

**Table 2: Trophic Status of Significant Publicly Owned Lakes**  
From Atlas of Oregon Lakes (Johnson and others, 1985)

	<b>Number of Lakes</b>	<b>Acreage of Lakes</b>
Lakes Assessed	201	491,255
<b>Ultra-Oligotrophic</b>	<b>12</b>	<b>8,752</b>
Oligotrophic	46	26,528
Mesotrophic	72	75,212
Eutrophic	60	191,310
Hypereutrophic	11	189,453

Most of the ultra-oligotrophic and oligotrophic lakes are found in the Cascade and Willowa mountains. Of these high quality waters, Crater Lake and Waldo Lake stand out as being very unique, particularly for lakes of their size. Both are extremely clear (high secchi depths) with low productivity (see Figure 6 below). Waldo is further unique in its low ionic strength (specific conductivity), which is similar to distilled water.

Table 3 below shows specific conductivity data and other water quality data for a several Oregon lakes. The classifications for the lakes in this table are: Waldo = ultraoligotrophic, Crater = oligotrophic, Odell = mesotrophic, Diamond and Tenmile – eutrophic; and Klamath = hypereutrophic.



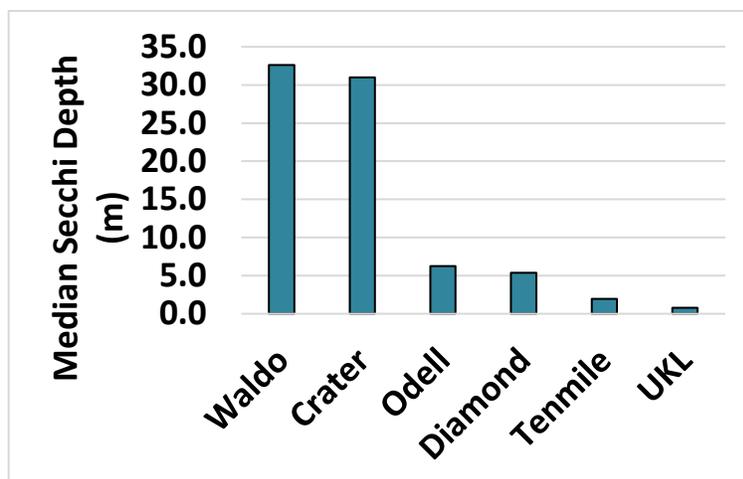
**Table 3: Water Quality Data for Selected Oregon Lakes**  
(median values unless otherwise indicated)

Lake	Basin	Water Clarity (Secchi depth)		Total Nitrogen		Total Phosphorus		Chlorophyll-a		Specific Conductivity	
		meters	Samples <sup>1</sup>	ug/l	Samples <sup>1</sup>	ug/l	Samples <sup>1</sup>	ug/l	Samples <sup>1</sup>	ug/l	Samples <sup>1</sup>
Waldo	Middle Fork Willamette	32.6	N=82 1986-2019	40	N=47 2001-2014	0.5	N=104 2001-2014	0.1	N=72 2001-2014	3	N=379 1986-2019
Crater	Klamath	31.1 mean	N=222 1978-2019 Jul-Sep	12 mean	N= 412 1985-2004 Jul-Sept	25 mean	N=572 1985-2019 Jul-Sep	0.12	N=1218 1990-2018 Upper 200 meters	116 mean	N=1164 1983-2019 Jul-Sep
Odell	Deschutes	6.3	N=22 2004, 2019	183	N=11 2019	20	N=27 2004, 2019	6.2	N=27 2004, 2019	33	N=148 2004, 2019
Diamond	Umpqua	5.4	N=279 2007-2019	340	N=76 2007-2019	24	N=76 2007-2019	3.7	N=45 2007-2019	37	N=75 2007-2019
Upper Klamath	Klamath	0.8	N=11,660 1990-2015	1830	N=2699 1990-2015	136	N=2772 1990-2015	54	N=2486 1990-2015	111	N=9329 1990-2015
Ten Mile	South Coast	1.2-2.7	N unknown 2013-2014	51	N unknown 2013-2014	27	N unknown 2013-2014	1-260	N unknown 2013-2014	55-75	N unknown 2013-2014

<sup>1</sup>Number of samples; date range of samples.

<sup>2</sup>Chlorophyll fluorescence

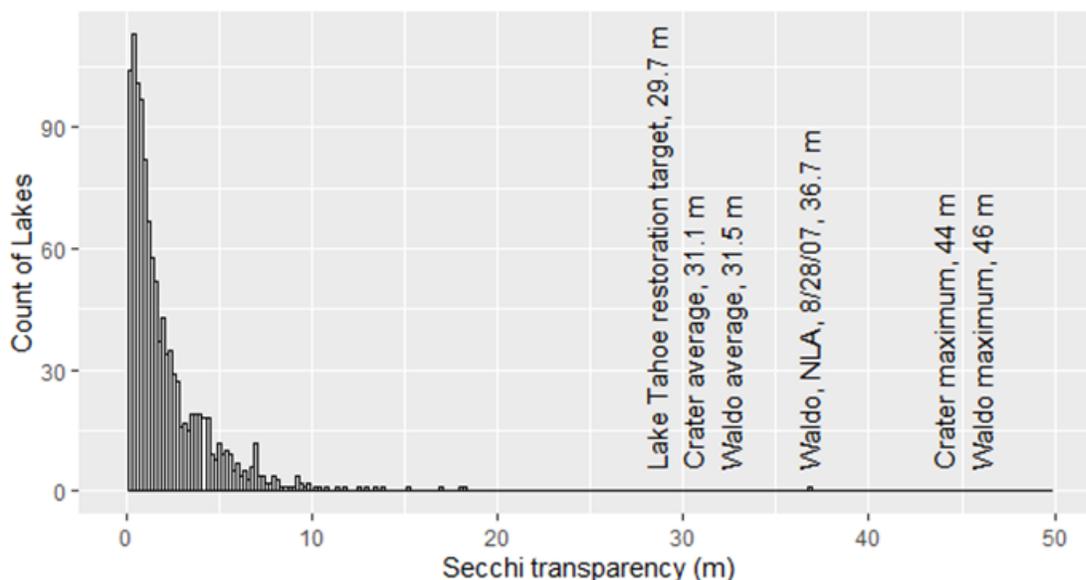
Data from: Rich Miller, PSU Center for Lakes; Scott Girdner, Crater Lake National Park.



**Figure 6: Secchi Depths of Selected Oregon Lakes.**  
From data provided by Rich Miller, PSU Center for Lakes.

Figure 6 shows how water clarity of selected Oregon lakes compare. This illustrates how extraordinarily clear Waldo and Crater Lakes compare even to other Cascade lakes, such as Odell and Diamond Lakes. The data are also shown in Table 3 above.

Figure 7 shows a histogram of Secchi data from the 2007 National Lakes Assessment, which includes 1184 lakes. This graph also shows how exceptional Waldo and Crater are in terms of clarity. The average secchi depth restoration target for Tahoe Lake is included for comparison. Tahoe Lake, in the Sierra Mountains in California is also known for its clarity and has been designated as an ORW by the state of California.



**Figure 7: Secchi Depths from the 2007 National Lakes Assessment**

From: Lahontan Regional Water Quality Control Board (Lahontan), Nevada Division of Environmental Protection (NDEP). Final Lake Tahoe Total Maximum Daily Load Report Lahontan Water Board, South Lake Tahoe. Carson City, NV: California, and Nevada Division of Environmental Protection; 2010 [340 pp., [http://www.waterboards.ca.gov/rwqcb6/water\\_issues/programs/tmdl/lake\\_tahoe/index.shtml](http://www.waterboards.ca.gov/rwqcb6/water_issues/programs/tmdl/lake_tahoe/index.shtml)].

U.S. Environmental Protection Agency. 2010. National Aquatic Resource Surveys. National Lakes Assessment 2007 (data and metadata files). Available from U.S. EPA website: <http://www.epa.gov/national-aquatic-resource-surveys/data-national-aquatic-resource-surveys>. Date accessed: 2020-06-17.

## 2.4 Ecological and Research Value

Waldo Lake is situated in the High Cascades in the Willamette National Forest. Congress protected the surrounding 39,000-acres of wilderness in 1984 to preserve the area's unspoiled forests, scenic mountains, and backcountry recreation.<sup>13</sup> This wilderness is approximately 98% forested, mostly made up of Douglas fir, Pacific silver fir,<sup>14</sup> and the largest old growth Mountain Hemlock stand in the state.<sup>15</sup> Waldo Lake, together with the surrounding forest environment, supports rare species of aquatic and land based species, including moss, unique birds, and a variety of threatened carnivores. Waldo Lake is the source of the North Fork of the Middle Fork of the Willamette River and therefore connected to additional organisms native to the Pacific Northwest.

Unlike fish, which are not native to the lake, the rare semi-aquatic leafy liverwort, *Marsupella emartinata* var. *aguatica*, naturally grows on rocks in the splash-zone of the Waldo Lake outlet. This is the only documented occurrence of this moss in Western North America. Other liverworts grow at incredible depths due to the lake's clarity, which allows light to penetrate deep into the lake. Two species of salamanders have also been observed in Waldo Lake: the northwestern salamander, *Ambystoma gracile*; and the rough skinned newt, *Trachia granulosa*. Only adults and larvae of these species were found in Waldo Lake. Small ponds adjacent to the lake are used as a place to lay eggs and for early larval development.<sup>16</sup> Frog and toad species are also abundant in the near shore areas of Waldo Lake. These include: the cascade frog, *Rana cascadae*; the western toad, *Bufo boreas*; and the tree frog, *Hyla regilla*.<sup>17</sup>

Waldo Lake is the source of the North Fork of the Middle Fork Willamette River which was designated as a Wild and Scenic river in 1988. Roosevelt elk use this extensive and ecologically diverse river corridor throughout the year, as well as blacktail deer, black bear, and cougar.<sup>18</sup> Protecting Waldo Lake will help protect the quality of water in the Willamette River.

## 2.5 Recreational Value

Waldo Lake is a recreation destination that supports the tourist economy of the surrounding communities. In addition to being a retreat for local families and outdoors enthusiasts, tourists come from around the region and the world to see Waldo Lake's uniquely clear and vibrant opal waters and experience fishing, swimming, and boating.<sup>19</sup> The lake's attraction for recreation is directly related to its exceptional water quality. In 2010, the Oregon State Marine Board banned motorboats on Waldo Lake in an effort to keep the lake's water quality pristine. Electric motors and human-powered boats are still allowed.

Around Waldo Lake, there are over 200 designated campsites in three different campgrounds: North Waldo, Islet, and Shadow Bay. Campsites are often reserved up to six months in advance and are typically full in August and September. Campgrounds are well maintained and equipped with sanitation stations and vault toilets to prevent polluting the groundwater.<sup>20</sup> The popular shoreline trail provides visitors with unique views of the lake and the High Cascades while meandering through a high-elevation forest. The Harralson Horse Camp and the North Waldo are popular trailheads because of their beauty and access to countless miles of trails.<sup>21</sup>

Waldo Lake's surrounding lands offer spectacular and accessible camping, horseback riding, mountain biking, and hiking. It is also a popular destination for wilderness enthusiasts since it is the main access

point for the Waldo Lake Wilderness area, which is 98% forested.<sup>22</sup> There are ten trailheads providing access to 70 miles of trails in the Wilderness area. The lake is located near the Pacific Crest Trail, which sees thousands of hikers every year.<sup>23</sup> The Pacific Crest Trail runs through the wilderness area, giving hikers from all over the world the opportunity to use Waldo Lakes' shores as a break from days of backpacking.

## 2.6 Importance to Native American Tribes

Thousands of years before white settlers arrived, Native American Tribes inhabited the area surrounding Waldo Lake. The tribes used various places in the surrounding area as temporary camps and food gathering sites.<sup>24</sup>

# 3. Lake Management

Waldo Lake is entirely contained within the Willamette National Forest and is managed by the U.S. Forest Service. The Waldo Lake Wilderness area, a 36,572 acre area, encompasses a large portion of the Waldo Lake watershed. The proposed ORW designation by the state will complement and reinforce the shared Forest Service management objectives to protect and maintain the lake's pristine nature while allowing for the enjoyment of the lake by the public. Waldo Lake and its watershed are managed for recreational opportunities that support the economy of surrounding communities. These activities include camping, boating, hiking, fishing, mountain biking, horseback riding and swimming.

In order to protect the pristine water quality of the lake, the Forest Service has installed vault toilets in the campgrounds so that human waste is pumped and removed rather than seeping into the ground where it could contribute nutrients to the lake. Forest Service regulations ban camping on islands, prohibit campfires on islands and ban the use of chainsaws and generators in the non-developed areas around the lake. In addition, fire management staff have been directed to not use Waldo Lake as a water source for aerial fire suppression purposes.

The state has banned internal combustion boat motors on Waldo Lake. The use of electric boat motors on Waldo Lake is allowed however there is a 10 mph speed limit for boats with electric motors over the majority of the lake with the exception of a 5 mph speed limit within 300 feet of boat ramps. Float planes are also banned from landing on the lake. These regulations may be found at OAR 250-020-0221 and ORS 830.187.

The Oregon Department of Fish and Wildlife no longer stocks the lake with fish. In addition, the lake is designated a State Scenic Waterway.

The ORW designation for Waldo Lake will reinforce the importance of management planning and monitoring by the Forest Service to ensure the lake is protected over time.

## 4. Proposed Rules

The proposed rule amendments for Waldo Lake were submitted through a citizen rulemaking petition. The proposed rules amend the Outstanding Resource Water policy within the state's antidegradation policy at OAR 340-041-0004(8) and the basin specific rules for the Willamette Basin at OAR 340-041-0345 to designate Waldo Lake an ORW and establish a policy to protect the lake's high water quality and ecological values. The proposed rule prohibits new or increased permitted discharges that would degrade water quality. DEQ can revise the proposed language in response to public comment.

DEQ's proposed rule language for the Crater Lake ORW is slightly different with the intent to recognize that current levels of recreation and tourism activity are part of the baseline and co-exist with current high water quality conditions and are one of the exceptional values of these lakes.. The rule establishes a policy to prevent degradation of the current conditions due to additional activity or development. The language proposed for Crater Lake also makes it clear that DEQ could allow short term construction stormwater permits where needed to maintain and improve recreation facilities and roads. Discharge permits are issued by DEQ, so DEQ would implement this portion of the rule. The US Forest Service manages activities on the lake and in the watershed. Therefore, the US Forest Service would meet the ORW policy through its lake and watershed management.

## 5. References

Lake and Reservoir Management, Volume 16. North American Lake Management Society. 2000.

Land and Resource Management Plan for the Willamette National Forest. U.S. Forest Service. 1990.

Waldo Lake Long-Term Monitoring Field Sampling Quality Assurance and Quality Control Project Plan. Prepared by Laura Johnson, Center for Lakes and Reservoirs, Portland State University. December 2003.

# Appendix A, Federal ORW Regulations

Code of Federal Regulations §131.12 Antidegradation policy and implementation methods.

(a) The State shall develop and adopt a statewide antidegradation policy. The antidegradation policy shall, at a minimum, be consistent with the following:

...(3) Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected....

(b) The State shall develop methods for implementing the antidegradation policy that are, at a minimum, consistent with the State's policy and with paragraph (a) of this section. The State shall provide an opportunity for public involvement during the development and any subsequent revisions of the implementation methods, and shall make the methods available to the public.

[48 FR 51405, Nov. 8, 1983, as amended at 80 FR 51047, Aug. 21, 2015]

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- <sup>i</sup> Center for Lakes and Rivers. Portland State University comment letter. 2019.
- <sup>ii</sup> Wild and Scenic Rivers. 16 USC 1274: Component rivers and adjacent lands.
- <sup>iii</sup> The Oregon Encyclopedia. *Waldo Lake*. [https://oregonencyclopedia.org/articles/waldo\\_lake/#.W-OFynpKiRs](https://oregonencyclopedia.org/articles/waldo_lake/#.W-OFynpKiRs). 2018.
- <sup>iv</sup> Atlas of Oregon Lakes. Waldo Lake. <https://aol.research.pdx.edu/lakes/17090001020920>. 2019.
- <sup>v</sup> Mark Sytsma, et al., Center for Lakes and Reservoirs Department of Environmental Sciences and Resources, Portland State University, *Waldo Lake Research in 2003*. 2004. p 48.
- <sup>vi</sup> Douglas W. Johnson. *Waldo Lake, Oregon: Eutrophication of a Rare, Ultraoligotrophic, High-Mountain Lake*. 2000. p 4.
- <sup>vii</sup> Mark Sytsma, et al., Center for Lakes and Reservoirs Department of Environmental Sciences and Resources, Portland State University, *Waldo Lake Research in 2003*. 2004. p 42.
- <sup>viii</sup> U.S. Forest Service, *Waldo Lake Area*. <https://www.fs.usda.gov/recarea/willamette/recarea/?recid=4528>. 2019.
- <sup>ix</sup> Douglas W. Johnson. *Waldo Lake, Oregon: Eutrophication of a Rare, Ultraoligotrophic, High-Mountain Lake*. 2000. p 2.
- <sup>x</sup> Douglas W. Johnson. *Waldo Lake, Oregon: Eutrophication of a Rare, Ultraoligotrophic, High-Mountain Lake*. 2000. p 5.
- <sup>xi</sup> Al Johnson, Willamette National Forest. *Waldo Lake, A Unique and Fragile Resource*. [https://www.fs.fed.us/air/documents/WesternLakesMonitoringWorkshop/Waldo\\_and\\_Diamond\\_Lake.pdf](https://www.fs.fed.us/air/documents/WesternLakesMonitoringWorkshop/Waldo_and_Diamond_Lake.pdf) 2020 .
- <sup>xii</sup> *Id.*
- <sup>13</sup> Oregon Wild, *Waldo Lake- Gem of the Cascades*. 2019.
- <sup>14</sup> U.S. Forest Service. *Waldo Lake Wilderness*. <https://www.fs.usda.gov/recarea/willamette/recreation/recarea/?recid=4482>. 2019.
- <sup>15</sup> Sierra Club. The Juniper Group. *Keep Waldo Wild: Our Campaign to Protect Lands Surrounding Oregon's Waldo Lake*. <https://oregon2.sierraclub.org/juniper-group/waldo/keep-waldo-wild>. 2018.
- <sup>16</sup> U.S Forest Service, *North Fork of the Middle Fork Willamette River Watershed Analysis*, 1995.
- <sup>17</sup> *Id.*
- <sup>18</sup> National Wild and Scenic Rivers System. *Willamette River*. <https://www.rivers.gov/rivers/willamette.php>. 2018.
- <sup>19</sup> United States Department of Agriculture Forest Service, *Waldo Lake Wilderness*, Willamette National Forest, <https://www.fs.usda.gov/recarea/willamette/recreation/recarea/?recid=4482> (last visited April 14th, 2019).
- <sup>20</sup> United States Department of Agriculture Forest Service, *Waldo Lake Area*, Willamette National Forest, 2019.
- <sup>21</sup> *Id.*
- <sup>22</sup> *Id.*
- <sup>23</sup> Pacific Crest Trail Association. Waldo Lake. <https://www.pcta.org/journalist/post/waldo-lake/>. 2014.
- <sup>24</sup> The Oregon Encyclopedia. *Waldo Lake*. [https://oregonencyclopedia.org/articles/waldo\\_lake/#.W-OFynpKiRs](https://oregonencyclopedia.org/articles/waldo_lake/#.W-OFynpKiRs). 2018.