



# **2015 Drought Response**

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## **Summary Report**



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For more information contact:

Water Resources Program  
P.O. Box 47600  
Olympia, WA 98504-7600  
Phone: (360) 407-6872

Washington State Department of Ecology - <http://www.ecy.wa.gov>

Headquarters (HQ), Olympia	360-407-6000
Northwest Regional Office (NWRO), Bellevue	425-649-7000
Bellingham Field Office (BFO), Bellingham	360-715-5200
Southwest Regional Office (SWRO), Olympia	360-407-6300
Central Regional Office (CRO), Yakima	509-575-2490
Eastern Regional Office (ERO), Spokane	509-329-3400

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## **Summary Report**

*by*

*Barbara Anderson*

*Chris Anderson*

*Dave Christensen*

*Rebecca Inman*

*Jeff Marti*

Water Resources Program  
Washington State Department of Ecology  
Olympia, Washington



# Washington State Drought Regulations

RCW [43.83B.400](#) Drought conditions — Defined — Intent.

RCW [43.83B.405](#)  
Drought conditions — Withdrawals and diversions — Orders, procedure.

RCW [43.83B.410](#)  
Drought conditions — Withdrawals and diversions — Orders, authority granted.

RCW [43.83B.415](#)  
Drought conditions — Loans and grants.

RCW [43.83B.420](#)  
Rules.

RCW [43.83B.425](#)  
Applicability — Construction.

RCW [43.83B.430](#)  
State drought preparedness account.

RCW [43.83B.900](#)  
Severability — 1975 1st ex.s. c 295.

RCW [43.83B.901](#)  
Severability — 1977 ex.s. c 1.

WAC [173-166-010](#)  
Purpose.

WAC [173-166-020](#)  
Authority.

WAC [173-166-030](#)  
Definitions.

WAC [173-166-040](#)  
General eligibility rule.

WAC [173-166-050](#)  
Forecast of drought conditions.

WAC [173-166-060](#)  
Orders declaring drought conditions.

WAC [173-166-070](#)  
Emergency drought permits.

WAC [173-166-080](#)  
Temporary transfers of water rights.

WAC [173-166-090](#)  
Funding assistance—General criteria.

WAC [173-166-100](#)  
Funding assistance—Agricultural criteria.

WAC [173-166-110](#)  
Funding assistance—Fisheries criteria.

WAC [173-166-120](#)  
Requests for drought relief—Contacts—Applications.

WAC [173-166-130](#)  
Appeals.

WAC [173-166-140](#)  
Regulation review



# Table of Contents

	<u>Page</u>
<b>Summary</b> .....	<b>ii</b>
<b>Background</b> .....	<b>1</b>
Water Supply Availability Committee .....	1
Executive Water Emergency Committee.....	1
Drought Planning.....	2
<b>2015 Drought – Ecology Response</b> .....	<b>3</b>
Timeline.....	3
Drought in the Yakima Basin .....	7
Drought Funding.....	7
Drought Emergency Rule.....	8
Drought Relief Grant Program.....	8
Emergency Drought Permits .....	11
Curtailment Orders .....	11
A System of Priority.....	11
Water Leases.....	12
Dungeness River Basin .....	12
Yakima Basin .....	12
Boosting Stream flows without Leases .....	13
<b>Other Agencies’ Activities</b> .....	<b>14</b>
Department of Agriculture.....	14
Wheat .....	14
Apples .....	14
Blueberries .....	15
Red Raspberries.....	15
Cherries .....	15
Pears .....	16
Washington State Conservation Commission .....	16
Department of Commerce .....	17
Drought Effects on Energy Supplies.....	17
Department of Fish and Wildlife .....	18
Fish Passage .....	18
Columbia Basin Impacts .....	19
Puget Sound Impacts.....	20
Hatcheries.....	20
Wildlife and Lands .....	20
Expenditures.....	21
Department of Health .....	22
Department of Natural Resources.....	23
Wildfires.....	23
Drought Impact on Groundwater Levels .....	23
State Agency Coordination.....	23
Potential for Continued Drought Conditions .....	24
<b>Looking Ahead</b> .....	<b>25</b>
Challenges and Considerations.....	25
Update to Drought Contingency Plan .....	27

# Summary

Unlike classic droughts, characterized by extended precipitation deficits, 2015 was the year of the “snowpack drought.” Washington State had normal or near-normal precipitation over the 2014-2015 winter season. However, October through March the average statewide temperature was 40.5 degrees Fahrenheit, 4.7 degrees above the 20th century long-term average and ranking as the warmest October through March on record. Washington experienced record low snowpack because mountain precipitation that normally fell as snow instead fell as rain.

The snowpack deficit then was compounded as precipitation began to lag behind normal levels in early spring and into the summer. With record spring and summer temperatures, and little to no precipitation over many parts of the state, the snowpack drought morphed into a traditional precipitation drought, causing injury to crops and aquatic species. Many rivers and streams experienced record low flows.

The Governor declared drought on March 13, 2015, for three regions of the state—the Olympic Peninsula, the east slopes of the central Cascades and the Walla Walla Basin. The drought declaration was extended on April 17, 2015, to include more watersheds, and then was extended statewide on May 15, 2015. In July 2015, the Washington State Legislature approved \$16 million for Ecology to support drought relief work for the biennium.

## ***Funding Drought Relief Projects***

Ecology approved 15 grants to public entities and entered into 12 other agreements to support drought response work. Overall, Ecology committed \$6.7 million in funding during the drought declaration. Funding was provided to help communities obtain reliable public water supplies, augment reduced water supplies for farmers, and to provide water to support stream flows.

## ***Emergency Drought Permitting***

Under law, Ecology must make decisions on emergency drought water right permits within 15 days. Ecology approved 76 emergency drought permits during the year, primarily to allow irrigators that usually get surface water to use groundwater. Ecology approves the emergency drought permits only when the use does not impair senior water rights.

## ***Curtailing junior users***

Ecology curtailed water use by 883 junior water right holders in 2015. Curtailment is required when senior water rights, or adopted instream flows, are impaired by the junior users. This total is the largest number of curtailment orders Ecology has issued in any one year.

## ***Boosting Stream Flows***

Water was leased from irrigators to boost stream flows in several areas from the state. In the Dungeness Basin, Washington Water Trust leased 5.6 cubic feet per second (cfs) for a month in late summer that increased flows by about 7.5 percent. In the Yakima Basin, Ecology leased a total of 4.7 cfs for the entire summer, improving stream flows for several smaller tributaries.

Ecology also supported the Kittitas Reclamation District with its efforts to boost stream flows in a number of tributaries. In total, the district delivered 45.5 cfs to seven streams that were either completely dry, or were at risk of being dewatered.

### ***Agricultural impacts***

The Department of Agriculture issued an interim report on December 31, 2015, summarizing the economic impacts from drought on apples, wheat, cherries, raspberries and blueberries as totaling \$336 million. Most of that impact, about \$212 million, is associated with a non-irrigated crop - dryland wheat. The interim report concluded that impacts were widespread and are ongoing. The full scale of the impact will not be understood for two to four years, and that is only if another drought does not occur during this time. A final report will be completed on December 31, 2016, after all harvest data are available and analyzed.

The Washington State Conservation Commission (Commission) provided technical and funding assistance to landowners and land managers. The Commission funded five projects that included supporting stream monitoring and assisting with response to wildfires.

### ***Fish and wildlife impacts***

The drought was directly responsible for widespread fish die-offs, and impacts to wildlife. Hundreds of thousands of Columbia/Snake River Basin sockeye salmon perished in July. There was confirmed mortality of 182 sturgeon, most were large, breeding sized fish, in the Columbia River. Widespread reports of fish strandings occurred throughout the state, including federally-listed species such as bull trout. Also, more than 1.5 million juvenile salmon, steelhead, and rainbow trout died at 11 Washington hatcheries due to drought conditions.

### ***What did we learn from the 2015 drought?***

- Drought conditions have abated, but due to current strong El Niño conditions, Ecology is closely monitoring water supply conditions to be prepared to respond if needed.
- It has been a decade since our state's last drought. To be better prepared for the next drought, the state is updating our drought contingency plan.
- Drought funding was not available until July 1, 2015. It was difficult for many entities to design and construct projects that provided timely drought relief.
- Uncertainty associated with the Bureau of Reclamation's water supply forecast created uncertainty for Ecology as to whether an emergency well program would be necessary.
- Although we did not measure a specific impact from the drought to groundwater levels, more extensive monitoring has identified significant groundwater level declines in several areas of the state, primarily in the Columbia River basin.
- Planning for climate change should use the lessons learned from this year's drought to identify potential impacts, needs and uncertainties. Successfully adapting to changes may be required to protect our state's farms, communities and natural environment.



# Background

Drought conditions are defined in Washington State law when:

- A geographic area is experiencing, or projected to experience, a water supply that is below 75 percent of normal; and
- Water users within the area will likely incur undue hardships as a result of the water shortage.

The state Water Supply Availability Committee (WSAC) monitors water supply conditions throughout the state to identify possible drought conditions as early as possible. If they determine current or projected water supplies in all or a portion of the state will meet drought conditions, the Executive Water Emergency Committee (EWEC) is convened to review their information and assess whether the reduced water supply will cause undue hardships. They may then recommend that the Governor direct Ecology to declare a drought emergency for the affected area.

## Water Supply Availability Committee

Chaired by Ecology, the WSAC consists primarily of representatives from federal agencies involved in monitoring, forecasting, or managing state water supplies. Membership includes representatives from:

- Department of Ecology (chair)
- Office of Washington State Climatologist
- U.S. Geological Survey
- National Weather Service
- Natural Resources Conservation Service
- U.S. Bureau of Reclamation
- U.S. Army Corps of Engineers
- Bonneville Power Administration

## Executive Water Emergency Committee

Chaired by the Governor's Office, the EWEC assesses the information provided by the Water Supply Availability Committee, and determines whether water users within the water-short areas will likely incur undue hardships.

Participation on the committee this past year included representatives from the following agencies:

- Governor's Office (chair)
- Washington State Conservation Commission (WCC)
- Washington Department of Agriculture (WSDA)
- Washington Department of Commerce (Commerce)
- Washington Department of Ecology (Ecology)
- Washington Department of Fish and Wildlife (WDFW)
- Washington Department of Health (DOH)
- Washington Department of Natural Resources (DNR)
- Washington State Military Department, Emergency Management Division (EMD)

## **Drought Planning**

Once a drought is declared, Ecology is the lead agency for drought response and follows a comprehensive [Drought Contingency Plan](#).. Drought response efforts include:

- Aiding state agriculture
- Protecting public water supplies
- Safeguarding fish and boosting stream flows
- Maintaining critical energy supplies
- Preparing to fight wildfires (DNR)

# 2015 Drought – Ecology Response

## Timeline

There were early indications that 2015 would be a poor water supply year. Washington State experienced record warmth throughout winter, and by February there was concern that the severely low snowpack conditions would not rebound substantially.

Ecology closely monitored snowpack and water supply conditions, preparing for the possibility of drought. Ecology convened regular WSAC meetings beginning in February to discuss the water supply outlook. In early March, the WSAC identified three areas in Washington that were likely to have water supply conditions below 75 percent of normal, based upon information for the April-September forecast period.

Based on the recommendation of the EWEC, Governor Inslee directed Ecology to declare drought on March 13 in four water resource inventory areas (WRIAs) on the east slopes of the central Cascades, five WRIAs on the Olympic Peninsula, and the Walla Walla Basin.

### East Slope of the Central Cascades

- Lower Yakima - WRIA 37 (Yakima, Benton and Klickitat counties)
- Upper Yakima - WRIA 38 (Kittitas and Yakima counties?)
- Entiat - WRIA 39 (Chelan County)
- Wenatchee - WRIA 45 (Wenatchee and Chelan counties)

### Olympic Peninsula

- Quilcene/Snow - WRIA 17 (Jefferson and Clallam counties)
- Elwha/Dungeness - WRIA 18 (Clallam County)
- Lyre/Hoko - WRIA 19 (Clallam County)
- Sol Duc/Hoh - WRIA 20 (Jefferson and Clallam counties)
- Queets/Quinault - WRIA 21 (Jefferson and Grays Harbor counties)

### Walla Walla Basin

- Walla Walla - WRIA 32 (Walla Walla and Columbia counties)

A timeline of significant events during the 2015 drought is shown in Figure 1, below.

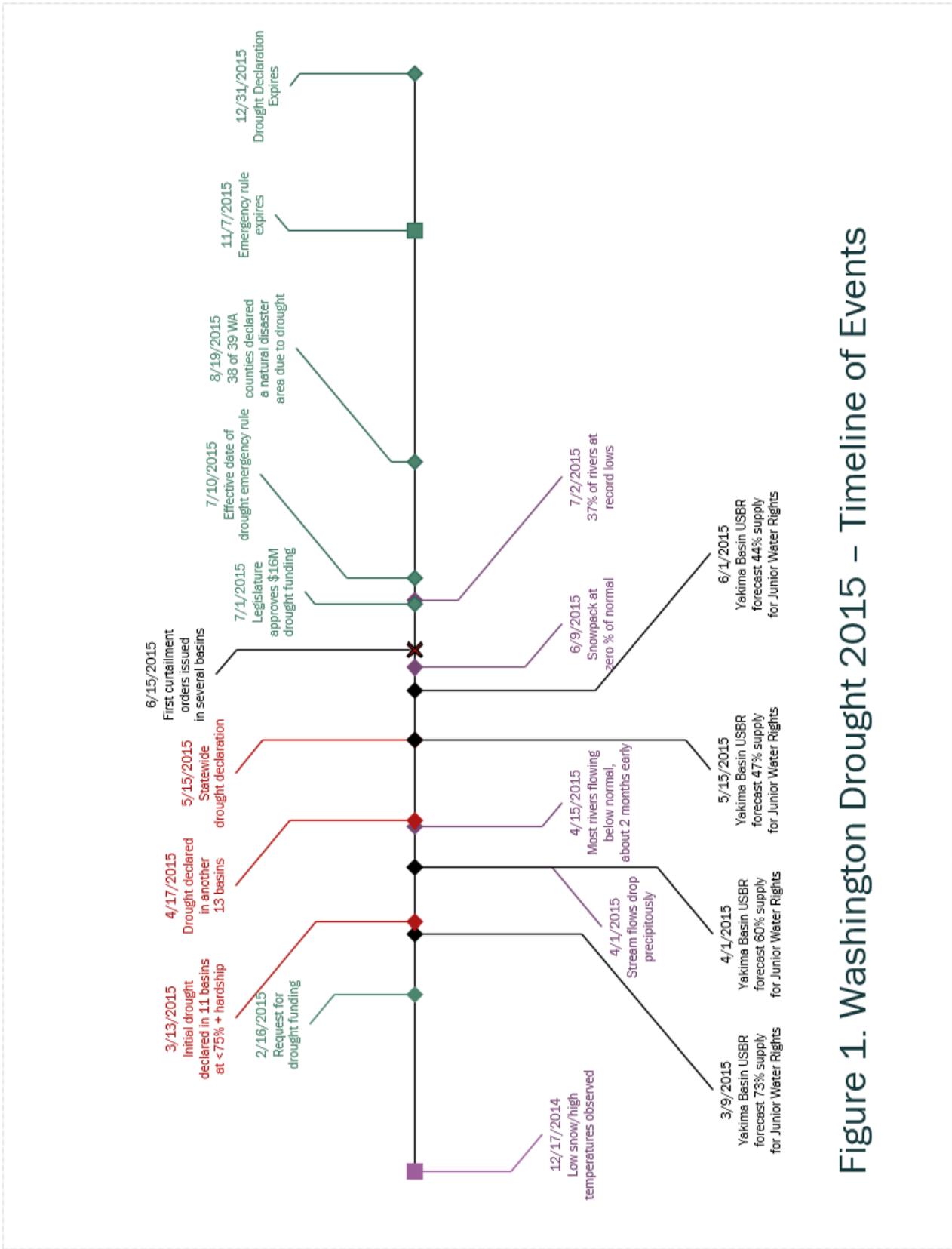


Figure 1. Washington Drought 2015 – Timeline of Events

As spring progressed, it became apparent that what started as a “snowpack drought” that primarily affected watersheds dependent on snowpack, was transitioning to a broader precipitation-deficit drought. Many rain-dominant watersheds were then forecasted to have water supply below 75 percent of normal.

The WSAC and EWEC met in early April. On April 17, 2015, another 13 WRIAs were added to the drought declaration (Figure 2):

- Nooksack - WRIA 1 (Whatcom County)
- Lower Skagit-Samish – WRIA 3 (Skagit, Snohomish, Whatcom counties)
- Upper Skagit – WRIA 4 (Skagit, Snohomish, Whatcom counties)
- Stillaguamish – WRIA 5 (Skagit and Snohomish counties)
- Puyallup-White – WRIA 10 (King, Pierce counties)
- Skokomish-Dosewallips – WRIA 16 (Jefferson and Mason counties)
- Cowlitz – WRIA 26 (Cowlitz, Lewis, Pierce, Skamania and Yakima counties)
- Lewis – WRIA 27 (Clark, Cowlitz, Skamania and Yakima counties)
- Salmon-Washougal – WRIA 28 (Clark, Skamania counties)
- Wind-White Salmon – WRIA 29 (Klickitat, Skamania and Yakima counties)
- Klickitat – WRIA 30 (Klickitat and Yakima counties)
- Alkali-Squilchuck – WRIA 40 (Kittitas, Benton, Chelan and Yakima counties)
- Okanogan – WRIA 49 (Okanogan County)

In May, the Water Supply Availability and Emergency Water Executive committees determined that 48 of the 62 watersheds would have water supply conditions below 75 percent of normal, an area representing 85 percent of the state’s geographic area. The drought declaration was extended statewide on May 15, 2015.



## Drought in the Yakima Basin

The Yakima Watershed (WRIAs 37 and 38) is a key agriculture production area for Washington State. The U.S. Bureau of Reclamation (Bureau) owns and manages the Yakima Project, consisting of five reservoirs. Each year in early March the Bureau publishes an official water supply forecast for users in the Yakima Basin. This forecast determines how much water will be available for junior water users and proratable irrigation districts for the coming irrigation season. Proratable water right holders are entitled to a percentage determined by the Bureau. If the available water supply is less than 100%, junior water right holders receive nothing.

When the Bureau made their first water supply forecast for the Yakima Basin on March 9, 2015, the mountain snowpack in the Upper Yakima basin was 23 percent of normal. The Upper Yakima Basin includes the Yakima and Cle Elum rivers, and their tributaries.

At that time, snowpack in the Lower Yakima Basin was 35 percent of normal. The Lower Yakima Basin includes the Naches and Tieton rivers, and their tributaries which feed the lower Yakima River. Still, the storage reservoirs were full after a warm winter of rain-runoff and the forecast called for normal spring precipitation. Therefore, despite the low snowpack conditions, the Bureau forecasted that proratable water users would receive 73 percent of their normal water supply.

The Bureau's later forecasts reduced water supply estimates significantly. By mid-May, the Bureau forecast that proratable water users would only receive 44 percent of their normal water supply. That number was raised to 47 percent later in the summer, largely due to August rains and aggressive water savings by the affected irrigation districts.

## Drought Funding

In July 2015, the Washington State Legislature approved the 2015-17 biennial budget, which included \$16 million for Ecology to support drought relief work during the biennium. The funding was provided to help communities obtain reliable public water supplies, augment water supplies for farmers, and to provide water to support stream flows for fish. A portion of the money allowed Ecology to provide grants to state and federal agencies, cities, counties, other

### Junior Water Rights

*A right to use water is conditioned by its priority date. Under Washington's "first-in-time, first in right" legal framework, a person who established a water right first has a senior water right to those rights issued afterward. This gives them the right to withdraw all their water before the next person in line, who holds a right "junior" to their senior right.*

### Proratable Water Rights

*Certain irrigators in the Yakima basin that obtain their water supply from the Bureau of Reclamation have been issued "proratable" rights. In water short years, these water rights holders are entitled to a percentage of their water right, prorated by the Bureau based on water supply available.*

public entities, and Tribes for projects such as developing alternative water resources, purchasing or leasing water or water rights, and building water transmission pipelines. Ecology committed \$6.7 million in funding to support drought projects.

### **Drought Emergency Rule**

To implement the drought relief grant program, Ecology adopted an emergency funding rule, [Chapter 173-167 WAC](#), to describe eligibility requirements and the criteria for funding decisions. The rule was adopted on July 10, 2015. To publicize the program, Ecology provided information to the Water Resource Advisory Committee and on Ecology's pre-existing drought emergency webpage, issued a news release, and sent notice to entities on the Water Resources Program's email notification lists.

### **Drought Relief Grant Program**

Ecology used a portion of the \$16 million allocated by the 2015 Legislature to fund grants to public entities for projects that would reduce drought hardships. The drought funding supported projects that ensured reliable public water supplies, augmented water supplies for farmers, and improved fish passage to preserve anadromous fish populations.

Applicants were required to provide 50 percent matching funds, except for drinking water projects for economically depressed communities.<sup>1</sup>

Ecology approved 16 of 44 total grant applications received. One of the approved projects was withdrawn by the applicant because they found they could not implement the project as approved. Table 1 shows a list of applicants receiving grant funds. Figure 3 depicts a map showing the distribution of drought funding.

The primary reasons that projects were not approved was failure to show evidence of drought hardship, or a project could not be completed in a timely manner, or did not otherwise meet the funding criteria. Three applications were withdrawn before a decision was made.

The Water Resources Program Funding website has more information on the grant program, as well as the applications filed:

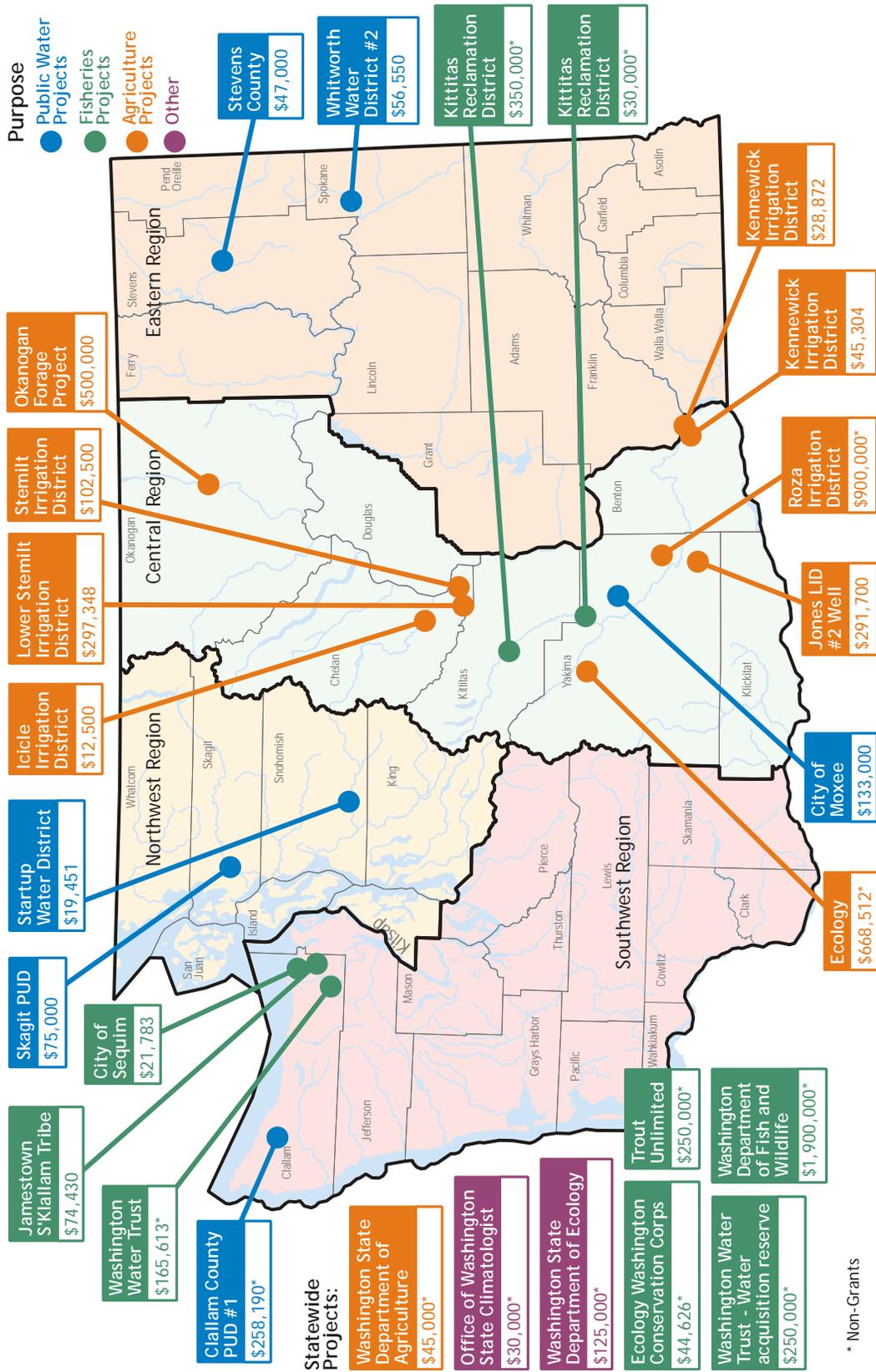
<http://www.ecy.wa.gov/programs/wr/funding/fo-2015drought.html>

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<sup>1</sup> Where the median household income was 80 percent or less of the statewide median household income.

Table 1. 2015 Drought Funding.

Type	Applicant - Activity	Amount \$	Purpose	Location
Grant	Okanogan Forage Project - Drought related feed program	500,000	Agriculture	Central Region (Okanogan County)
Grant	Lower Stemilt Irrigation District - Water Diversion transfer from Stemilt Creek to Columbia River	297,348	Agriculture	Central Region (Chelan County)
Grant	Jones LID #2 Well - Develop emergency well as alternative/ supplemental source	291,700	Agriculture	Central Region (Yakima County)
Grant	Clallam County PUD #1 - Domestic water supply change of source & booster pump installation	258,190	Public Water Supply	Southwest Region (Clallam County)
Grant	City of Moxee - Well Improvements - replace pump, piping, valves, fittings & electrical, etc.	133,000	Public Water Supply	Central Region (Yakima County)
Grant	Stemilt Irrigation District - Pipe replacement & gravity feed improvements	102,500	Agriculture	Central Region (Chelan County)
Grant	Skagit PUD - Watering stations	75,000	Public Water Supply	Northwest Region (Skagit County)
Grant	Jamestown S'Klallam Tribe - Fish Passage - acquire & install temporary diversion dams	74,430	Fisheries	Southwest Region (Clallam County)
Grant	Whitworth Water District #2 - Water station upgrades to offset dry wells	56,550	Public Water Supply	Eastern Region (Spokane County)
Grant	Stevens County - Drinking water project, new well for domestic supply	47,000	Public Water Supply	Eastern Region (Stevens County)
Grant	Kennewick Irrigation District - Pump rental and capture of return flows	45,304	Agriculture	Central Region (Benton County)
Grant	Kennewick Irrigation District - Residential conservation	28,872	Agriculture	Central Region (Benton County)
Grant	City of Sequim - Reclaimed water delivery for irrigation and aquifer recharge	21,783	Fisheries	Southwest Region (Clallam County)
Grant	Startup Water District - Well Rehab. - pull pump, scrub screen, remove debris, install new pump, etc.	19,451	Public Water Supply	Northwest Region (Snohomish County)
Grant	Icicle Irrigation District - Channel modification to access 8Mile Lake and Colchuck Lake	12,500	Agriculture	Central Region (Chelan County)
Non-grant	Washington Department of Fish and Wildlife - Fish passage and health, Tribal fish projects	1,900,000	Fisheries	Statewide
Non-grant	Roza Irrigation District - Water leasing and pump-back	900,000	Agriculture	Central Region (Yakima County)
Non-grant	Ecology - Emergency drought wells, 50% match to overall cost for drought related mitigation	668,512	Agriculture	Central Region (Yakima County)
Non-grant	Kittitas Reclamation District - Water acquisition reverse auction	350,000	Fisheries	Central Region (Kittitas County)
Non-grant	Washington Water Trust - Water acquisition reserve funding to acquire water for drought purposes	250,000	Fisheries	Statewide
Non-grant	Trout Unlimited - Reserve funding to acquire water for drought purposes	250,000	Fisheries	Statewide
Non-grant	Washington Water Trust - Dungeness basin water acquisition (water leases)	165,643	Fisheries	Southwest Region (Clallam County)
Non-grant	Ecology - Temporary staffing and equipment (gages, meters, data loggers) for enforcement and compliance	125,000	Other	Statewide
Non-grant	Washington State Department of Agriculture - Economic impact analysis of 2015 drought	45,000	Agriculture	Statewide
Non-grant	Ecology Washington Conservation Corps - Crew staffing for project work includes supporting WDFW fish passage efforts, removing rock dams, etc.	44,626	Fisheries	Statewide
Non-grant	Office of Washington State Climatologist - Climate related information, updates, forecasts	30,000	Other	Statewide
Non-grant	Kittitas Reclamation District - Deliver BOR water through KRD facilities to benefit 8 creeks tributary to the Yakima River for fisheries	30,000	Fisheries	Central Region (Yakima County)
	<b>Total</b>	<b>6,722,379</b>		



**Figure 3. Distribution of 2015 Drought Funding.**  
Dollar values represent amount of contract. Actual expenditure may vary from these amounts.

## Emergency Drought Permits

Ecology may allow water users to obtain water from alternate sources during drought conditions. Emergency drought permits may be issued after an expedited 15-day review period. These permits are exempt from the State Environmental Policy Act (SEPA) and public notice requirements. The distribution of drought permits by Ecology region is shown below. For a list of conditions that apply to emergency drought permits, refer to [WAC 173-166-080](#).

### Emergency drought permits by Ecology Region:

- Central Region 60
- Eastern Region 5
- Northwest Region 10
- Southwest Region 1

## Curtailment Orders

### A System of Priority

During drought years, less water is available for both instream and out-of-stream needs. Ecology may curtail junior (also known as “interruptible”) water right holders’ withdrawals (see sidebar on page 7):

- **To protect senior water right holders** from having their water use impaired by the withdrawals of **junior water right holders**. In any river basin, the water use of junior water right holders can be interrupted if they are impairing the water use of senior water right holders, or there is a risk of impairment because a water source is insufficient to meet all the water demands on it.
- **To help prevent further decline in river flows** in rivers protected by [instream flow rules](#). An instream flow rule establishes specific stream flow levels that will protect and preserve adequate water in streams for people and the environment. The instream flows function as a water right for the public, held by the State.

Although Ecology must curtail at least some junior water users most years, in 2015 Ecology had to curtail more water users than ever before, including in areas where curtailment had never previously occurred. In addition, curtailment orders were issued weeks, or even months, earlier than normal because flows had dropped earlier in the season. Table 3 shows the number of curtailment orders issued for 2015.

Table 3. 2015 Curtailment Orders by Region

Activity	NWRO/ BFO	SWRO	CRO	ERO	Total
Early warning curtailment letters	4	93	262	218	577
Actual water rights curtailments issued	9	93	446	335	883
Cease and Desist orders to stop diversions	1	1	1	34	37

## Water Leases

Leasing water from irrigators was a key component of Ecology’s drought response. Leases are voluntary agreements by landowners to not irrigate all or part of their fields for all or part of the irrigation season. The unused water remains in the stream to boost stream flows to benefit fish passage and instream habitat.

Ecology employs a strategic leasing approach, focusing on areas where improvements to stream flows would significantly benefit fisheries such as on smaller rivers and tributaries.

The seniority of the leased rights is important. Older rights in regulated basins like the Yakima Basin are much more valuable and benefit streams more than junior rights that would have been curtailed anyway.

### Dungeness River Basin

To address the extreme low flows in the Dungeness River, Ecology asked the Washington Water Trust (WWT) to implement a program to accept bids from water right holders willing to lease their water. Participation is entirely voluntary, and the water right holder sets the price. WWT and Ecology then decide which bids to accept.

Ecology funded the WWT to lease water during the critical low flow period from August 15 through September 15, 2015. All irrigation withdrawals stop at the end of irrigation season on September 15. WWT leased 5.6 cubic feet per second of water in the river from 13 irrigators, who ceased irrigation on 350 acres for 30 days. The leased water boosted the mean daily Dungeness River flow by approximately 7.45 percent over the August 15 to September 15 period. Rain brought by a series of frontal systems passing over Western Washington the last week of August also improved flows.

### Yakima Basin

A similar leasing program was also conducted in the Yakima Basin. Unlike the drought of 2005, participation was limited. Ecology received only ten bids, and accepted six. The lower number of bids is attributed to the timing of the lease program, which occurred in April, by which time many growers had already made commitments and investments for the year. The accepted bids represent as much as 4.7 cfs, 878 acre-feet/year divided between the Teanaway River, and Big, Taneum, and Roslyn creeks. These instream flow increases resulted from the fallowing of 302 acres.

## Boosting Stream flows without Leases

One of the more significant success stories of this year's drought response was the collaboration between the Kittitas Reclamation District (KRD), Ecology, Yakama Nation, Bureau of Reclamation and Department of Fish and Wildlife. With funding from Ecology, KRD installed siphons and discharge pipes at five different locations where the KRD main canal crosses key tributary streams in the Yakima Basin (Tinker Creek, Big Creek, Little Creek, Spex Arth Creek, Tillman Creek, Taneum Creek, and Manastash Creek). Together, these projects added 45.5 cfs to creeks, which were either completely dry or were at risk of being essentially dewatered.

### Before



Extremely low flows in Little Creek for the first week in June

### After



Little Creek Flow Enhancement

# Other Agencies' Activities

## Department of Agriculture

On December 31, 2015, the Department of Agriculture issued an interim report summarizing the economic impacts from drought on agriculture. A final report will be completed on December 31, 2016, after all harvest data are available and analyzed. The interim report includes the results of three different data collection efforts:

- Targeted mapping
- Meetings with commodity groups
- An online survey

The impacts of this year's drought were not limited to certain crops, or certain regions, or even certain times of the year. Every farmer in the state felt some type of impact in 2015, whether it was yield or quality reduction, crop rotation related, a shortened harvest period (due to fast ripening during extreme heat), or some other effect. Many of these impacts will not be quantifiable even with more data collection in 2016, as contacting all of Washington's 37,249 farms (2012 USDA Agricultural Census) is not feasible.

The interim report concluded that impacts were widespread and are ongoing. In the agricultural industry, a drought is not a single point of impact, as crop growing periods, seeding, drought damaged plants, and other issues take time to resolve. The full scale of the impact will not be understood for two to four years, and that is only if another drought does not occur during this time.

## Wheat

Wheat is a major crop in Washington State, grown in all areas of the state and covering a total of 2,294,279 acres (2014). The 2013 crop value for wheat was just over \$1 billion and Washington ranked 4th in the nation for wheat production with 5.4 percent of the total national production. This year's drought was a continuation of 2014 drought conditions in dryland wheat growing areas.

The final harvest (from National Agricultural Statistics Service (NASS)) for all wheat crops in Washington in 2015 was 111,540,000 bushels, 22% below the previous five-year average. The low soil moisture, coupled with drier than normal spring and hotter than normal summer conditions led to reduced yield, heat shriveled kernels, and elevated protein levels (which affects marketability of the crop).

Known loss: Using the NASS five-year price average of \$6.92/bushel, the estimated known loss at this time in wheat is approximately \$212.4 million.

## Apples

Apples are the most valuable crop in Washington State, with 180,000 acres in production and a 2013 crop value of \$2.19 billion. NASS conducts analysis of expected apple yields prior to the

start of each harvest season. This estimate combines an analysis of typical average yield per acre and total acres in production, while attempting to take into account any expected external stressors on the crop.

Harvest estimates in the early summer were around 125 million boxes. In contrast, late summer harvest totals dropped to 118 million boxes. Early harvest varieties were most affected by low water availability and high temperatures in the Yakima basin. Tree fruit growing regions to the north (in Chelan, Okanogan, and Douglas counties) were less impacted by the drought. Based on conversations with industry representatives, the 7 million box loss presented here is all attributed to either drought or extreme heat.

Known loss: 7 million boxes, 40 lbs. each. = 280 million lbs. With a 2014 marketing year average price of \$0.309/lb., there was approximately \$86.52 million known loss to Apples.

### **Blueberries**

Washington is third in the nation for blueberry production. The majority of production, about 65 percent, occurs in northwest Washington (Whatcom and Skagit counties). In recent years, significant certified organic blueberry operations have been established in eastern Washington, primarily in Benton County. The 2014 crop value of Washington's blueberry harvest was \$112 million.

Western Washington growers reported impacts on yield, size, and quality. Prior to harvest, growers estimated that in a normal year, production would have been approximately 112 million pounds. The final harvest totals were only 104 million pounds, a loss of 8 million pounds. Meetings with producers attributed all of that loss to high temperatures immediately before and during harvest.

Known loss: 8 million pound loss (based on data received from commodity commission on lost yield) and \$1.32/lb. price based on NASS 5-year price average, there was approximately \$12.0 million known loss to Blueberries.

### **Red Raspberries**

Washington State is the second largest grower of red raspberries in the United States. In 2014, Washington State recorded 12,596 acres planted in red raspberries or other caneberries. Of this acreage, 84 percent is in northwest Washington (Skagit and Whatcom counties). Red raspberry growers in this region reported both size and quality impacts from this year's drought and extreme heat.

Known loss: 26 percent crop loss (based on 2014 yield of 72.6 million pounds) at an average price of \$0.735/lb., based on NASS 5-year price average, there was approximately \$13.9 million known loss to Red Raspberries.

### **Cherries**

The cherry harvest started almost three weeks early in 2015 mostly due to high temperatures in prime fruit growing regions of the state (central Washington and the Columbia Basin). The crop itself sustained little damage from the low water and high temperatures in 2015 although the fruit

was smaller than normal. This did impact some Asian export markets which prefers large, brightly colored cherries.

## **Pears**

Pear harvest also began 10 to 14 days early this year, but growers did not report crop yield impacts. Due to long storage needs, pears are often harvested prior to being fully ripe, which eliminates some of the quality and storage issues seen in other fruit harvested during this same time period.

## **Washington State Conservation Commission**

The Washington State Conservation Commission (Commission) addresses natural resource concerns on private lands through Washington's conservation districts. During a drought, assistance to landowners and land managers focuses on technical assistance to mitigate for hardship due to the lack of water. Hardships can include a lack of soil moisture in dry land agriculture, limited surface and groundwater availability for irrigation, a lack of quality feed and forage for livestock, reduced stream flows and increased water temperatures in fish-critical tributaries, and the threat of catastrophic wildfire due to reduced fuel moisture.

In response, the Commission coordinates a prioritization and budget process to focus technical assistance for private lands and local concerns. The Commission also continues to manage and promote the future of programs, such as 1) the Irrigation Efficiencies Grants Program, which reduces demand on water-short streams, and 2) Firewise, which partners conservation districts and landowners with the Washington Department of Natural Resources to reduce the risk of catastrophic wildfire, primarily in the wildland-urban interface. The Commission has also expressed interest in being part of a long-range, coordinated, multi-agency drought response plan, to aid in addressing future droughts.

Drought response included:

- Hay/feed for livestock to replace forage lost because of drought conditions
- USDA Farm Service Agency (FSA) drought relief program referrals
- Irrigation water management technical assistance
- Water conservation workshops Irrigation efficiency upgrades

During the 2015 drought year, the Commission received 20 requests for Drought Funding Assistance. Through a request negotiated and approved by Ecology, five projects were funded in four conservation districts. Due to the late nature of the drought funding and a positive change in project area stream conditions, one district returned the funding.

Projects that were funded include:

- Lower Yakima River – Master Streamkeeper Program
- Lower Yakima River Temperature Monitoring
- Alpowa Creek – Monitoring temperature and assessing fish passage
- White Salmon River Basin – Monitoring water temperature and flow

## Office of Washington State Climatologist

The Office of Washington State Climatologist is a member of the Water Supply Availability Committee. This year Ecology provided \$30,000 to the State Climatologist to support the publication of weekly drought monitoring reports. These reports reviewed the previous week's weather conditions and synthesized the statewide drought conditions. An example of the weekly report is provided below (Figure 4).

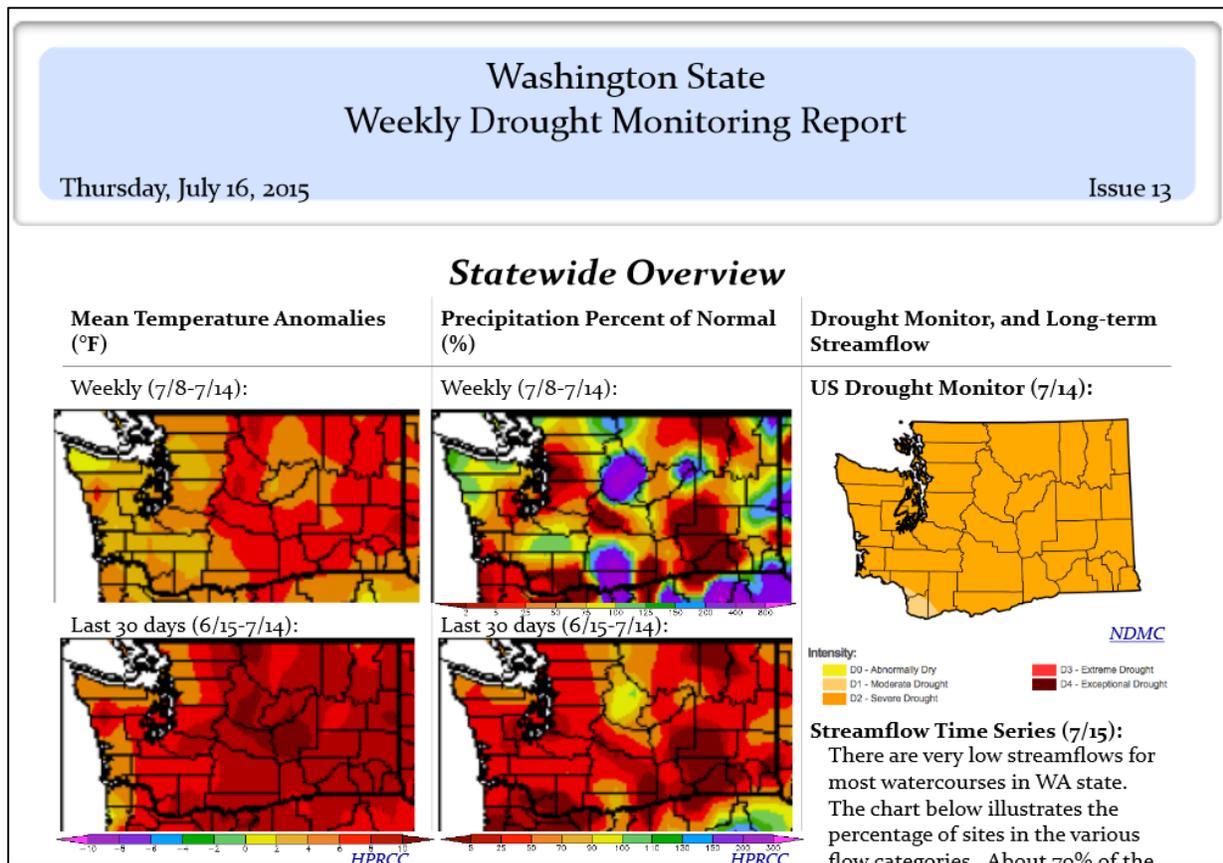


Figure 4 Example of Weekly Drought Monitoring Report

## Department of Commerce

### Drought Effects on Energy Supplies

Leading up to and during the drought, the Department of Commerce consulted with the Bonneville Power Administration and major hydropower utilities to understand how the critically low snowpack conditions would affect their ability to meet customer power demand. Insufficient power supply was never a risk during this year's drought.

Because of relatively good snowpack conditions in the headwaters of the Columbia and Snake Rivers, the Columbia River did not experience the record low flows which characterized most other Washington rivers, although April– September runoff volume was still below normal (71 percent of normal).

The state’s power system resilience during drought is due to utility power planning – utilities plan for low water. They build alternative generation capability, invest in efficiency and conservation, and sign supply contracts to cover the lowest historical water flows, and therefore the lowest historical hydropower generation, on the Columbia River. The risk that low water represents for power production, is that it makes it more vulnerable to other contingencies. For example, drought in 2000-2001, during the Western Energy Crisis, increased the risk of power outages here because normal supplies transmitted from California to Washington were at risk.

## **Department of Fish and Wildlife**

WDFW used drought funding adopted in the 2015-2017 biennial budget passed by the Legislature to improve drought resiliency at State hatcheries and to complete a number of successful drought relief projects.

### **Fish Passage**

- Three stream channel modification projects were implemented in 2015 in response to low flow blockages to fish migration. Projects included several sites on the lower Dungeness River, the confluence of Rattlesnake Creek with the Naches River (9/4), and where Box Canyon Creek flows into Lake Kachess (9/28). Species accommodated in the Dungeness included Chinook, pink, and Coho salmon. Rattlesnake Creek work benefitted Chinook, and Box Canyon Creek is a stronghold for bull trout which are ESA-listed as threatened. Work in Box Canyon Creek was funded by the U.S. Bureau of Reclamation through a contract with WDFW.
- Precedent-setting fisheries and hydraulic project closures and restrictions were implemented statewide in 2015 in response to high water temperatures. Actions included outright closures at some locations, and “hoot owl” (afternoon closures) in other streams. The attached map shows areas having restrictions during the summer of 2015.
- Occurrence of fish-passage-blocking rock dams (in-water rock structures made by recreationists) far exceeded normal levels, and were seen earlier in the year than normal because of the warm dry weather in late spring. Rock dams were notched or removed in at least eighteen Washington counties, and involved partners like tribes, local fish recovery and enhancement groups, and conservation districts.
- WDFW passed through drought funds to Mid-Columbia Regional Fisheries Enhancement Group, Cascade-Columbia Fisheries Enhancement Group, Hood Canal Salmon Enhancement Group, and Lower Columbia Fish Enhancement Group to locate and breach recreational rock dams, salvage stranded fish, and provide outreach on drought impacts on fish and wildlife. Hundreds of rock structures were breached by these groups in the summer of 2015.

- Ecology's Washington Conservation Corps assisted WDFW, tribes, and regional fishery enhancement groups (RFEG) in removing rock dams, removing water weeds in the lower Yakima River, and implementing low flow remediation projects.
- Benton Conservation District was a key player along with the Mid-Columbia RFEG in removing weeds in the Yakima, which had become thick enough to slow fish migrations through lower river reaches.
- Several reports of (native) freshwater mussel die-offs have been received from around the state at locations experiencing loss of continuous surface flow during the summer months.

### **Columbia Basin Impacts**

- Fall Chinook appear to be a bright spot in an otherwise dismal return year for salmon in the Columbia Basin. Hanford Reach fall chinook returned in record numbers, with approximately 200,000 spawners. About 8,500 fall Chinook were counted at Prosser Dam on the Yakima River this fall, which is about 30 percent above the most recent 10-year average returns.
- Hundreds of thousands of Columbia/Snake basin sockeye disappeared between Bonneville Dam and natal streams. Early counts at Bonneville signaled potentially record runs for Snake, Wenatchee, Yakima, and Okanogan bound sockeye, but fish expected to be counted upstream never materialized after the first week in July. By mid-July, there were many sockeye carcasses in cold-water Columbia River gorge tributaries (e.g., Wind and White Salmon rivers), streams not usually visited by sockeye. Preliminary numbers show 320 sockeye counted migrating up the Yakima River, most of which entered the river beginning the end of August through the first week of September, when mainstem river temperatures began to decrease. In 2014, just over 2,500 sockeye were counted in the Yakima. Similarly, sockeye escaping to the Canadian Okanagan spawning grounds numbered approximately 11,000, contrasting with a 2015 expected escapement of 285,500.
- Sturgeon die-offs started in late June/early July in several locations within the Columbia Basin, most noticeably between John Day and Priest Rapids dams on the Columbia River and in the lower Willamette River in Oregon. As of October 20, WDFW and Oregon Department of Fish and Wildlife staff and local law enforcement had confirmed 182 sturgeon carcasses in these primary die-off areas (160 upstream from Bonneville Dam to Lake Roosevelt; 22 below Bonneville Dam). The majority (88 percent) of these were breeders over 55 inches in length.
- Bull trout and other fish were stranded in isolated pools in Upper Yakima/Naches tributaries because many small streams were impacted by hot weather and low flows. A temporary fish flume was constructed at Box Canyon Creek (tributary to Lake Kachess at Snoqualmie Pass) in order to allow bull trout to swim out of Lake Kachess and up Box Canyon Creek to spawn.

## **Puget Sound Impacts**

- Low numbers of South Fork Nooksack Spring Chinook were reported in 2015, potentially representing a brood year spawning failure. The south fork was inaccessible in July and August, with high water temperatures.
- In general, pink returns were lower in number and arrived later than expected. Both pink and Chinook salmon took advantage of the intermittent rain showers in August and September to seek their spawning grounds. Both pink and Coho exhibited smaller than normal body sizes.
- Dungeness River received low numbers of both pink and Chinook salmon, but these fish were able to reach upstream spawning areas because lower river shallow riffles had been deepened using channel shaping projects. This was another project involving WCC crews.

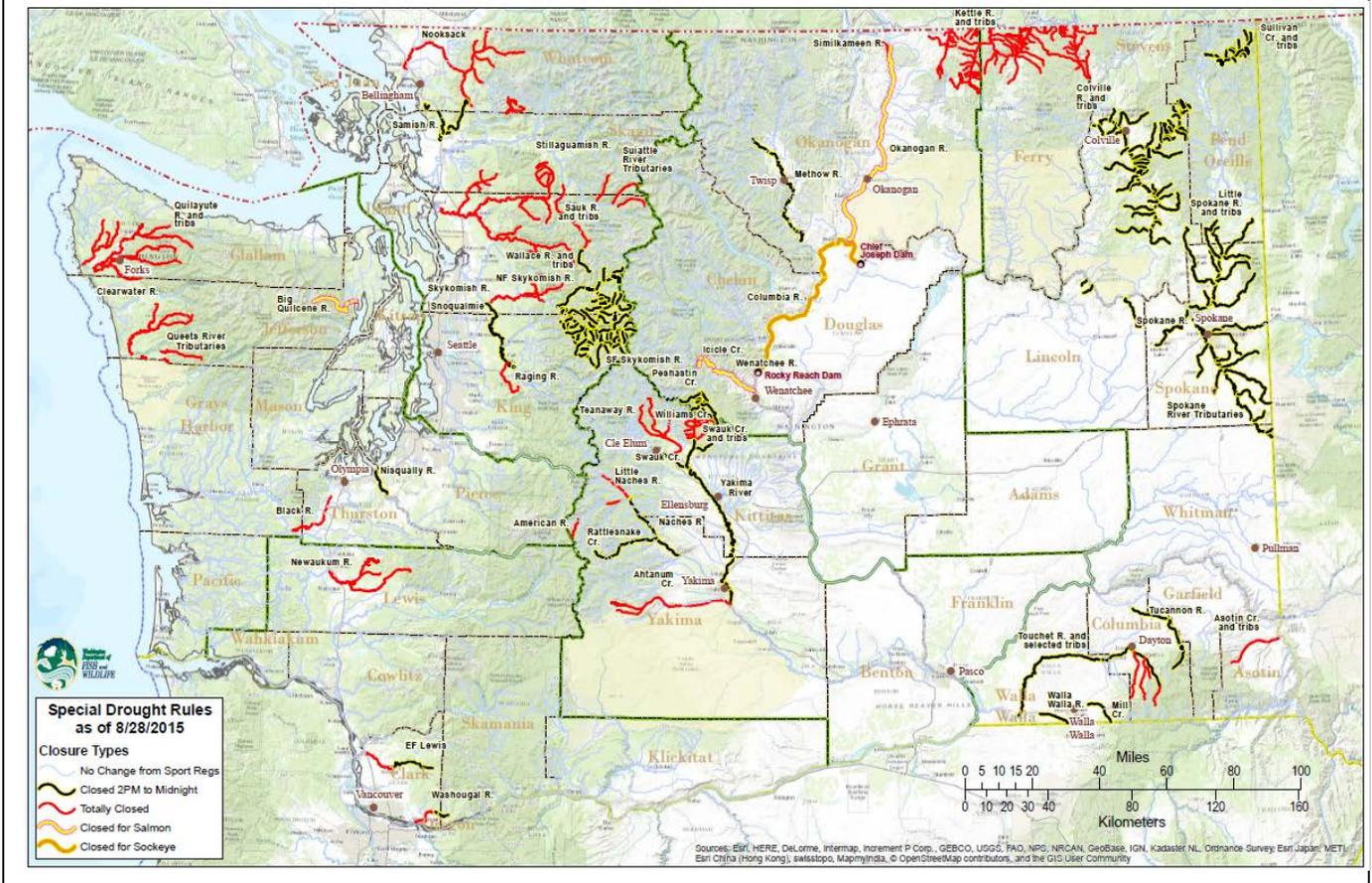
## **Hatcheries**

- Around 1,647,000 juvenile salmon, steelhead, and rainbow trout perished at 11 Washington hatcheries due to drought conditions during the summer of 2015.
- Measures implemented this year included:
  - Fish transfers
  - Early releases
  - Shade cloth installed over ponds and raceways
  - Temperature or dissolved oxygen meters purchased
  - Aerators or recirculation pumps installed
  - Accelerated water supply intake maintenance
  - New backup water supply wells (Naches, Elwha)
  - Extra disease medications
- WDFW is working to estimate what additional projects are needed to drought-proof all facilities in anticipation of future drought conditions.

## **Wildlife and Lands**

- Four water access sites were improved/extended using drought funds in 2015:
  - Silver Lake (Skagit County)
  - Fuller Bridge (Chehalis River)
  - Phillips Lake (Mason County)
  - Offut Lake (Thurston County)
- Improvements were completed for the irrigation water supply at the Wooten Wildlife Area (Tucannon River), which had been interrupted due to low flows.
- Low wetland water levels, starting in the spring, have impacted reproduction for wetland dependent species including wading birds, waterfowl, and amphibians.

## WDFW drought stream closures and restrictions as of August 28, 2015



### Expenditures

- As of October 31, 2015, WDFW had spent (or committed to spending) approximately \$1.3 million of the \$1.8 million designated for WDFW 2015 drought preparedness and response.
- Approximately \$150,000 of the savings can be attributed to expenditures made in the previous fiscal year (through June 30, 2015).
- The remainder of the savings is related to receiving funds late in the progress of the drought and the inability to respond (and spend) in time to make a difference for 2015.

## Department of Health

This year, many public water systems were required to more actively manage their supplies and customer demand to ensure that supplies lasted until the fall months. Large municipalities such as Seattle, Tacoma, and Everett rely on large storage water reservoirs that were full or near full by late spring, as water managers took action to more aggressively capture rain in lieu of snowmelt, but reservoir levels quickly dropped due to high demand and low inflows. Seattle, Tacoma, and Everett jointly issued a water conservation advisory (Stage 1) on July 27 followed by a request for voluntary conservation (Stage 2) on August 11. Seattle and Tacoma supplemented their supplies with backup groundwater wells. The cities maintained Stage 2 conservation status until mid-November, when fall rains returned reservoir levels to normal.

In preparation for drought conditions, the Department of Health identified small water systems that were at greatest risk of water supply shortages. These were systems that depended on sole-source, shallow wells. The concern was that diminished snowmelt would reduce recharge to shallow aquifers.

As the year progressed, there were only a few reports of water systems facing serious challenges of dropping water levels or failing wells. Water supply problems were reported by the City of Forks on the Olympic Peninsula, the City of Moxee in the Yakima Valley, the town of Startup in the Skykomish watershed in Snohomish County, and the Riverside well operated by Stevens County Public Utility District, north of Spokane. Several of these entities requested and received drought relief funding (See Table 1).

On the Olympic Peninsula, the City of Port Townsend and Clallam Public Utility District (Clallam PUD) both depend on surface water supplies, which are subject to instream flow conditions. Port Townsend's condition is based upon an agreement with the Forest Service. When flows drop below the specified level on the Big Quilcene River, Port Townsend draws upon two reservoirs, one of them being Lords Lake. In anticipation of reduced river levels, the City took action in the spring to obtain approval from Ecology to raise the pool level in Lords Lake to increase the volume of stored water.

Clallam PUD, which diverts water from Morse Creek east of Port Angeles, received an emergency drought relief grant from Ecology to pump water uphill from an existing groundwater well to service areas that otherwise would have been unserved when flows on the creek dropped below the specified flow threshold.

## Department of Natural Resources

### Wildfires

2015 was by far the worst wildfire season in state history. More than 1 million acres and 300 homes were destroyed, at a cost of nearly \$178 million. The Department of Natural Resources has reported its activities separately in a report:

[http://file.dnr.wa.gov/publications/em\\_wildfire\\_summary\\_2015.pdf](http://file.dnr.wa.gov/publications/em_wildfire_summary_2015.pdf)

### Drought Impact on Groundwater Levels

The severity of this this year's drought raised important questions about the impact on groundwater resources. Ecology monitored groundwater levels extensively in 2015 to help provide data to answer those questions. Based on a preliminary analysis of the data collected, it does not appear that there was a clear impact on groundwater levels that can be attributed exclusively to drought. However, water level data collected after the summer irrigation season are not yet available where increased groundwater use offset a portion of the reductions in surface water supplies. Additional data will be collected spring of 2016 to more completely understand these impacts.

Importantly however, Ecology measured groundwater levels in many areas of the state where a strong declining trend already existed, primarily in the Columbia River Basin in eastern and central Washington. These groundwater level declines are statistically significant, and represent a larger and longer-term concern that Ecology will be investigating further.

For more information on the groundwater level monitoring and initial findings, please visit our web page at:

<http://waecy.maps.arcgis.com/apps/MapSeries/index.html?appid=b64d6f24e4894b878e47a209020b73a9>

### State Agency Coordination

As described above the Water Supply Availability Committee (WSAC) consists primarily of representatives from federal agencies involved in monitoring, forecasting, or managing state water supplies. They assess watersheds likely to be have water supply conditions below 75 percent of normal. The Executive Water Emergency Committee (EWEC) assesses the information provided by the WSAC and determines whether water users within the water-short areas will likely incur undue hardships.

State agency representatives communicated regularly regarding impacts, drought relief grant requests, data needs, funding and the need for special action.

Ecology scheduled media events with representatives from WDFW, Health, DNR, the State Climatologist, and also USGS at the federal level. At each event, reporters from the print and other media were able to ask questions which, in turn, could be addressed by the agency responsible.

State agencies received invitations from several local governments and other organizations to participate in community drought forums held across the state to communicate information regarding drought impacts, state response and opportunities for assistance. Public meetings were held in Yakima, Sequim, Chimacum, and south of Forks.

## **Potential for Continued Drought Conditions**

Concern for ongoing water supply hardship remained at the beginning of the new water year on October 1, 2015. Drought conditions continued in Washington through October, despite record August rainfall in parts of the state. Reservoirs throughout the state were well below normal storage levels. The climate outlook for the winter predicted warmer than normal temperatures, combined with lower than normal precipitation because of very strong El Niño conditions in the Pacific Ocean.

Instead, however, Washington faced a relatively normal November followed by a very wet, record-setting December. Drought conditions were all but eliminated by mid-December. By the end of December, many areas in the state had received more snow than fell during the entire 2014-2015 snow season.

When the Water Supply Availability and Emergency Water Executive committees met in December, conditions had improved dramatically. There were no apparent immediate or forecast hardships because of water supply conditions, so the drought declaration was allowed to expire on December 31, 2015.

Ongoing El Niño conditions continue to warrant close monitoring of snowpack conditions because of a higher than normal likelihood that late winter and spring snowfall will be less than normal, and temperatures could remain above normal. The Water Supply Availability Committee and Emergency Water Executive Committee will continue to meet periodically and be prepared to take action if warranted.

# Looking Ahead

## Challenges and Considerations

### **It has been a decade since the last drought**

This was Washington State’s first statewide drought declaration since 2005. As drought conditions may be experienced infrequently, Ecology had lost a substantial portion of “institutional memory” due to employee turnover.

Despite this challenge, Ecology shifted staff resources to address the important work that was at hand—responding to water shortages, resolving water conflicts, assisting with projects to boost stream flow, and review and process funding applications.

Ecology determined an updated drought contingency plan was needed to ensure more effective preparation and response in future droughts. In September, Ecology was awarded a federal grant to update the state’s drought contingency plan and Ecology is moving forward to update the plan, working collaboratively with other agencies and key stakeholders. Our current work plan projects completing the drought contingency plan update in 2017. For more information, see the more detailed discussion, below.

### **Funding uncertainty meant delays in response**

At the time of the last drought in 2005, the state funded a State Drought Preparedness Account, which allowed agency’s to begin drought response activities immediately when a drought was declared. This reserve was not included in the FY 2013-2015 biennial budget.

Specifically appropriated drought funds were not available until July 1, 2015, when the Legislature adopted its FY 2015-2017 biennial budget. Until July, Ecology reprogrammed some existing funding that could be used for drought response to support initial actions that could not wait until July. Actions taken using these funds included primarily entering into leases with irrigators to fallow fields and stop use, which boosted stream flows and assisted irrigators with junior water rights.

However, Ecology did not have sufficient funding to provide drought relief grants before the budget was approved. Once the budget was approved, Ecology quickly adopted an emergency rule defining funding criteria and processed applications immediately. The first funding decisions were made less than 30 days after funding was available.

By that time, it was difficult for many entities to design and construct projects that provided timely drought relief. This delay also hampered drought response by partner agencies such as Washington Department of Fish and Wildlife and the State Conservation Commission.

### **Focus on the Yakima Basin**

Much of Ecology’s drought response effort focuses on providing drought relief to water users and uses in the Yakima Basin, where major water users may receive less than their full allocation

in water short years. The scope and scale of Ecology's response is largely driven by the degree to which the Bureau of Reclamation pro-rates allocations to major junior water users in the basin (e.g., the Roza and Kittitas Reclamation District). When water allocations are cut back substantially, many users within the Districts desire to make use of emergency drought wells to compensate for a reduced surface water supply.

This past year, the Bureau's forecasts were initially less severe than a level that would trigger the need for the types of responses that were eventually required. In subsequent forecasts, the Bureau revised its allocation downward to a point where irrigators viewed emergency drought wells as a priority. The uncertainty associated with the Bureau's forecast created uncertainty for Ecology as to whether an emergency well program would be necessary and created some delay in making funding for emergency wells available to users.

### **What is hardship?**

Drought is defined in state law when less than 75 percent of normal water supply is projected to be available and the reduced water supply will cause undue hardships. Hardship determinations are required at both the drought declaration decision-making phase and as part of review of applications for financial assistance. The law does not define "hardship." Finding the appropriate definition of hardship remains a challenge.

Although clear in some cases – for instance when a city's well runs dry – most cases are not so clear. A significant portion of our staff time was spent trying to determine if specific situations and requests met the definition of hardship. These discussions continue today as one applicant that was denied funding has appealed Ecology's decision.

Drought response would benefit by the Legislature clarifying its intent for use of drought funds, and how Ecology should approach the hardship questions it faces as it reviews funding proposals.

### **Climate change and drought**

Climatologists have stated that the conditions that Washington experienced during 2015 may be similar to conditions predicted by climate change models. We may not experience reduced overall precipitation, but warmer weather in the winter could result in reduced snowpack, earlier runoff, and less water supply available in the summer.

In planning for climate change, we should use the lessons learned from this year's drought to identify potential impacts, needs, and uncertainties. Successfully adapting to these changes will be required to protect our state's farms, communities, and natural environment.

### **Groundwater levels**

Although we did not measure a specific impact from the drought to groundwater levels, more extensive monitoring has identified significant groundwater level declines in several areas of the state, primarily in the Columbia River basin. These declines indicate that in some areas in our state, water users are withdrawing groundwater faster than it is being replenished. We should use data gathered to understand the 2015 drought impacts to plan and prepare for water supply needs before water shortages result from groundwater level declines.

For more information about groundwater level declines, see “Drought Impact on Groundwater Levels” on page 23.

### **The impact of drought is local**

The early onset and sustained nature of the drought highlighted a number of challenges for public access to safe drinking water that fell outside of the existing emergency tools. Washington has nearly 14,000 public water systems that range in size from large municipalities, with significant resources and skills, to very small systems run by volunteers. As a result a system’s capacity to react and respond to drought is variable.

Water systems adjacent to each other may experience the drought differently. Existing drought response tools have focused on emergency intervention for municipal and other publicly owned utilities such as PUDs and Water Districts. There are few governmental tools designed to address the drought risk challenges for private water systems serving rural Washington and small communities. These systems include a host of non-profit public systems and homeowner associations. There also are no tools specifically targeted to the more than one million residents that rely on private wells. When these systems fail or are at risk of failure – the first responders are at the local county programs (public health or emergency services).

During the summer of 2015, some counties were contacted by residents with water system failures (e.g., dry wells), but few had resources to address them. The opportunity exists to work with local health and emergency response partners to build a more comprehensive set of mitigation, education, and prevention options that can be used in the “next” drought.

### **Update to Drought Contingency Plan**

Ecology has applied for, and received a grant from the Bureau of Reclamation to update Washington’s Comprehensive Drought Contingency Plan. The updated plan will be a multi-agency effort, and include participation from the following agencies and organizations:

- Department of Ecology
- Department of Agriculture
- Department of Commerce
- Washington Emergency Management Division
- Department of Fish and Wildlife
- Department of Health
- Office of Washington State Climatologist
- Washington State Conservation Commission

For additional information on the plan and process, contact Jeff Marti at [Jeff.Marti@ecy.wa.gov](mailto:Jeff.Marti@ecy.wa.gov).