Western Hood Subbasin Temperature Total Maximum Daily Load

Revision to the 2001 Western Hood Subbasin TMDL

February 2018

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Executive Summary

In 2001, the Department of Environmental Quality adopted a plan to improve stream temperatures in the western half of the Middle Columbia–Hood Subbasin. This plan was called the “Western Hood Subbasin Total Maximum Daily Load (TMDL)” and it described the amount of heat (thermal load) that streams could receive and still meet the state’s water quality standard for temperature. The 2001 Western Hood Subbasin (WHS) TMDL incorporated a temperature standard that had been adopted by the Environmental Quality Commission in 1996.

As part of the TMDL evaluation, the allowable heat load was divided (allocated) between different sources. Wasteload allocations were developed for point source discharges and were expressed as heat load limits assigned to individual point sources of treated industrial and domestic waste. In the 2001 TMDL, wasteload allocations were developed for 13 point sources, including three sewage treatment plants and nine fruit packing facilities.

Load allocations were developed for nonpoint sources of heat, such as dams and degraded streamside vegetation. In the 2001 TMDL, specific load allocations were developed for two dams: Powerdale Hydroelectric Project and Laurance Lake Reservoir. Streamside shade targets were established as surrogate load allocations to address the need to improve shade from streamside vegetation in much of the subbasin.

In December 2003, the Environmental Quality Commission adopted a new temperature standard for the state of Oregon, which was approved by the U.S. Environmental Protection Agency in March 2004. The standard revision included a number of significant changes from the earlier standard approved in 1996. The allocations developed in the 2001 TMDL were based on the numeric criteria, spawning seasons, and an “unmeasureable” temperature increase included in the 1996 standard. Most of these criteria changed with the adoption of the new standard in 2003. This TMDL revision updates the loading capacity and allocations so they are based on the current temperature standard.

Most of the water quality permits for the point sources in the Western Hood Subbasin are expired and need to be renewed. In order for the 2003 standard to be used in drafting new permits, the wasteload allocations need to be recalculated and the TMDLs revised to incorporate the more recent standard. Revised wasteload allocations were developed using a similar approach to that in the 2001 TMDL. Wasteload allocations were developed for nine facilities with water quality permits. The following key changes were incorporated into the new allocations:

- New biologically based numeric criteria and spawning seasons
- Human use allowance (HUA) of 0.18˚C (rather than 0.25°F [0.14°C] in the 2001 TMDL)
- Cumulative effects analyses, which enabled use of 100 percent of the stream flow for mixing, rather than 25 percent
- More recent data on the temperature and flow of receiving waters and effluent
- Definition of new critical periods when the numeric criteria are exceeded

A new load allocation was also developed for Laurance Lake Reservoir. The 2003 standard includes a specific temperature criterion for temperature below Laurance Lake, which will serve as the implementing mechanism for the Middle Fork Irrigation District.

In this TMDL revision, the human use allowance is split between sources, with 15 percent of the HUA (0.045°C) assigned to nonpoint sources. In the 2001 WHS TMDL, 100% of the nonpoint source load was

assigned to natural sources, with zero percent assigned to anthropogenic sources. While this revision modestly increases the allowable nonpoint source load allocation, it does not modify the effective shade surrogate measures established in the 2001 WHS TMDL. The effective shade surrogate measure implements the nonpoint source load allocation

The 2001 WHS TMDL did not identify a reserve capacity. This TMDL revision includes a specific allocation for reserve capacity set aside that can be used for unidentified sources, future growth and new or expanded sources. The general framework of this revision allocates 0.045°C or 15 percent of the HUA to reserve capacity.

The Water Quality Management Plan included in the 2001 TMDL continues to serve as the implementing mechanism for the Western Hood Subbasin TMDL. The Designated Management Agencies named in this Plan and other local partners continue to be active in TMDL implementation.

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1. Introduction

1.1 Background

The US Environmental Protection Agency approved the current Western Hood Subbasin Total Maximum Daily Load in January, 2002 (ODEQ, 2001, http://www.oregon.gov/deq/wq/tmdls/Pages/TMDLS-Basin-List.aspx). The 2001 TMDL referenced the Oregon standard for temperature (OAR 340-041-0565(2)(b)) which was adopted in 1996. In December 2003, the Environmental Quality Commission adopted a new temperature standard for the state of Oregon (OAR 340-041-0028, hereafter referred to as the 2003 standard), which was approved by the USEPA in March 2004. This standard modification, along with the pending reissuance of National Pollutant Discharge Elimination System permits for facilities in this subbasin, necessitated a recalculation of the wasteload allocations. In addition, ODEQ took this opportunity to update other aspects of the 2001 Western Hood Subbasin TMDL in order to provide clarification and information relevant to the 2003 applicable temperature standard. This revision is to be attached to the 2001 WHS TMDL and the allocations presented in this revision supersede the allocations in the 2001 WHS TMDL.

Several of the pertinent changes in the temperature standard which are specifically addressed in this revision, include:

1. A change in the applicable biologically based numeric criteria;
2. Adjustments to spawning time periods and locations; and
3. A change in the definition of “no measureable” or “insignificant” additions of authorized heat from human sources.

In this revision, the Oregon Department of Environmental Quality is modifying the wasteload allocations for the following facilities with individual NPDES permits and the load allocation for Laurance Lake Reservoir:

- Diamond Fruit Growers Central facility
- Diamond Fruit Growers Odell facility
- Diamond Fruit Growers Parkdale facility
- Duckwall Pooley Fruit Company Odell facility
- Duckwall Pooley Fruit Company Van Horn facility
- Terminal Ice and Cold Storage facility (formerly Diamond Fruit – Van Horn)
- Mt. Hood Meadows Wastewater Treatment Plant
- Odell Wastewater Treatment Plant
- Parkdale Wastewater Treatment Plant
- Laurance Lake Reservoir

New wasteload allocations or load allocations were not calculated for the following facilities that were included in the 2001 WHS TMDL because they no longer have an NPDES permit and/or or no longer exist:

- Lage Orchards
- Pacificorp - Cooling Water
- Powerdale Hydroelectric Project
- Stadelman Fruit Lenz facility
- Stadelman Fruit Whitney facility

WLAs for facilities with general permits were not calculated in the 2001 WHS TMDL. WLAs are calculated in this revision for the following facilities with permits for industrial stormwater:

- Mount Hood Forest Products
- Hood River Recycling and Transfer Station

A WLA for the log pond/log deck facility associated with Mount Hood Forest Products was not calculated in this revision or in the 2001 WHS TMDL because there is no discharge allowed during the critical period.

This revised TMDL does not identify new nonpoint sources of heat other than those described in the 2001 WHS TMDL. As was true in the 2001 WHS TMDL, this temperature TMDL targets system potential effective shade as the surrogate measure to meet the TMDL load allocation for nonpoint sources.

1.2 Geographic Area and Subbasin Characteristics

The geographic scope of this TMDL revision is the same scope as in the 2001 WHS TMDL and includes portions of five watersheds (ten digit Hydrologic Unit Codes) which fall in the western half of the Middle Columbia-Hood Subbasin within Oregon **(Figure 1** and **Figure 2**). It should be noted that, although the geographic scope of the TMDL is the same, the naming and designation of the HUCs in this area has changed since 2001 as a result of the adoption of the national Watershed Boundary Dataset (https://nhd.usgs.gov/wbd.html). The five watersheds covered by this TMDL revision include East Fork Hood River wastershed (1707010505), West Fork Hood River watershed (1707010506), Hood River watershed (1707010507), Eagle Creek-Columbia River watershed (1707010512), and the western portion of Mosier Creek-Columbia River watershed (1707010511). These watershed areas are collectively referred to as the Western Hood Subbasin in this document. The major tributaries to the Columbia River in the Western Hood Subbasin include Eagle Creek, Herman Creek, Phelps Creek, and Hood River. This TMDL applies to all perennial and intermittent streams within the Subbasin.

A further description of the characteristics of the Western Hood Subbasin is provided in Chapter 3 of the 2001 WHS TMDL. The reader is referred to that section of the 2001 document for further discussion of geology, climate, land use and ownership, and stream flow characteristics. Because of the importance of stream flow in determining loads, the description of the 7Q10[1] low flows from the three gaging stations in the Subbasin is updated in this revision and included in Section 1.2.1.

[1] The 7Q10 flow is the 7-day average low flow with a 10-year return interval.

Figure 1. Location of the Western Hood Subbasin in Oregon

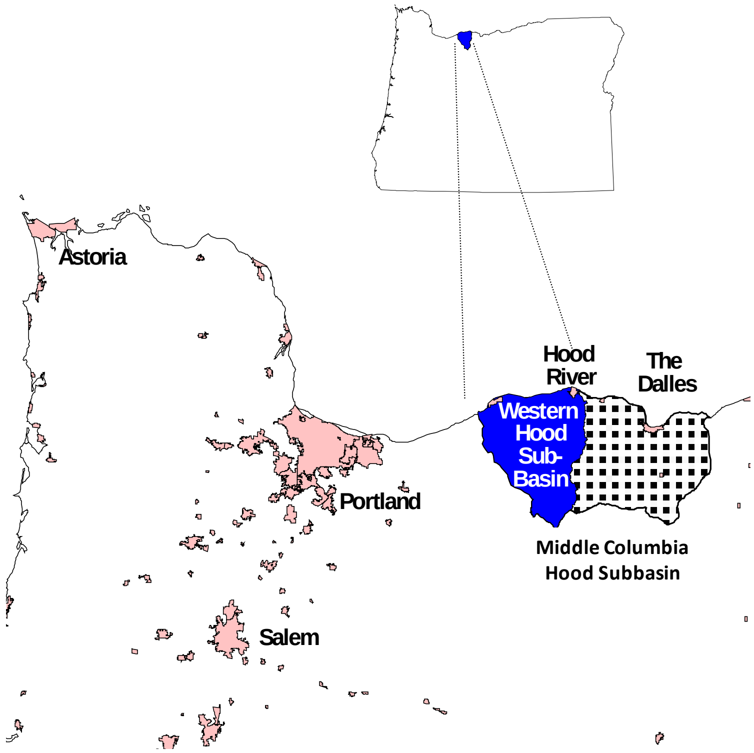


Figure 2. Geographic Area of the Western Hood Subbasin, including Category 4A listed stream segments

(replaces Figure 10 from 2001 WHS TMDL)

1.2.1 Stream Flow Characteristics

As was true in 2001, the natural flow of water in the Western Hood Subbasin is interrupted by withdrawals and diversions for irrigation, domestic, industrial, municipal, and hydropower uses. When the 2001 WHS TMDL was completed, the single largest diversion and the single largest water right in the Subbasin was for the Powerdale Hydroelectric Project diversion at Powerdale Dam. Up to 500 cfs was diverted from the Hood River at rivemile 4.5, and returned three miles downstream. In 2010, Powerdale Dam was removed and water is no longer diverted from the Hood River for this use. Although there are no permanent flow or temperature monitoring stations in Hood River below the Powerdale Dam site, it is anticipated that removal of the dam has resulted in more natural flows and temperatures in the lower 4.5 miles of the Hood River.

Three permanent flow gaging stations continue to operate in the Western Hood Subbasin: Hood River at Tucker Bridge (USGS #14120000, https://waterdata.usgs.gov/or/nwis/rt), West Fork Hood River near Dee (USGS #14118500, http://apps.wrd.state.or.us/apps/sw/hydro_near_real_time/display_hydro_graph.aspx?station_nbr=14118500) and Clear Branch below Laurance Lake (USGS #14115815; Ed Salminen, Watershed Professionals Network, personal communication)). The Tucker Bridge site is operated by the U.S. Geological Survey, the West Fork Hood River site is operated by the Oregon Water Resources Department, and the Clear Branch site is now operated by the Middle Fork Irrigation District.

Updated 7Q10 low flow statistics were calculated for these three gaging stations using recent data and are provided in **Table 1**. This replaces Table 1 in the 2001 WHS TMDL. These flows were used in calculations of loading capacity by watershed, as is described in **Section 5**.

Low stream flow estimates were also needed in order to calculate wasteload allocations; however none of the point sources discharge into a stream with 7Q10 low flow data. Because of this, the best available data by source was used to estimate the upstream low flow statistic used in calculating wasteload allocations, as is described further in **Section 4**.

Table 1. Log Pearson Type III 7Q10 Low Flows

(replaces Table 1 from 2001 WHS TMDL)

Location	Gage Period	Season	7Q10 Low Flow (cfs)
Hood River at Tucker Bridge (Gage 14120000)	1983-2012	Year-round	185
		Spawning (October 1-June 15)	235
		Non-spawning (June 16-September 30)	185
West Fork Hood River near Dee (Gage 14118500)	1983-2012	Year-round	90
		Spawning (August 15-June 15)	92
		Non-spawning (June 16-August 14)	113
Clear Branch below Laurance Lake (Gage 14115815)	1994-2009	Year-round	4.0
		August 15-May 15	4.3
		May 16-August 14	3.9

1.3 Water Quality Impairments and 303(d) Listings

This revision contains TMDLs that address temperature impairments in the Western Hood Subbasin **(Figure 2**, **Table 2**). These impairments are identified as Category 4A in Oregon's 2012 Integrated Report Database, and include listings from Integrated Report Assessments in 1998 and 2002. Further details are available in ODEQ's database: http://www.deq.state.or.us/wq/assessment/rpt2012/search.asp.

Table 2 lists all of the impaired streams included in the 2012 Integrated Report. With the change in Oregon's temperature standard in 2003, the applicable listing criteria changed. **Table 2** includes both sets of criteria – those that were in effect at the time of the 1998 and 2002 assessments (indicated as the 1996 standard) and those that are currently in effect and covered in this TMDL revision (indicated as the 2003 standard). The beneficial use designation included in **Table 2** also reflects the 2003 standard. **Table 2** and **Figure 2** replace Table 5 and Figure 10, respectively, in the 2001 WHS TMDL.

The 2001 WHS TMDL addressed temperature impairments in the Western Hood Subbasin that were identified in Oregon's 1998 303(d) List of Water Quality Limited Waterbodies. These impaired waterbodies were listed in Table 5 in the 2001 WHS TMDL, and are identified with an Assessment Year of 1998 in **Table 2**. Oregon's next water quality assessment was the 2002 Integrated Report and 303(d) List. In this assessment, seven more water bodies were identified as impaired in the Western Hood Subbasin, and minor modifications in rivermiles were made. These listings are identified in **Table 2** with an Assessment Year of 2002, and include listings on East Fork Hood River, Hood River, Lake Branch, West Fork Hood River, and an un-named tributary. Based on the LLID for the un-named tributary, it appears to be Robinhood Creek.

There have been no additional temperature listings in the Western Hood Subbasin since the 2002 Integrated Report. However, in an evaluation of more recent data for this TMDL revision, a number of additional impairments were identified (**Table 3)**. Because these impairments were not identified as part of an Integrated Report assessment, the record ID and river miles are not included in this table.

The number of listed segments and TMDLs addressed in this 2018 revision and in the 2001 WHS TMDL document are summarized in **Table 4** and **Table 5**. In addition, this TMDL covers the impaired streams and beneficial use seasons as described above and included in **Table 3**.

Table 2. Waterbodies in the Western Hood Subbasin listed as "Category 4A: Water Quality Limited" for temperature (Oregon's 2012 Integrated Report)

http://www.deq.state.or.us/wq/assessment/rpt2012/search.asp
(replaces Table 5 from 2001 WHS TMDL)

Water Body	Latitude Longitude Identification Number (LLID)	River Miles	Integrated Report Assessment Year	Applicable Numeric Criterion		Beneficial Use (2003 Standard)	Record ID
				1996 Standard	2003 Standard		
Clear Branch	1216613454604	0 to 3.8	1998	10.0°C	12.0°C	Bull trout spawning and juvenile rearing	1201
East Fork Hood River	1216272455754	0 to 9.8	2002	17.8°C	18.0°C	Salmon and trout rearing and migration	1202
East Fork Hood River	1216272455754	9.8 to 27.4	2002	17.8°C	18.0°C	Salmon and trout rearing and migration	1203
Hood River	1215067457204	1.5 to 4.6	1998	17.8°C	16.0°C	Core cold water habitat	1316
Hood River	1215067457204	4.6 to 14.6	2002	17.8°C	16.0°C	Core cold water habitat	1317
Indian Creek	1215104457009	0 to 7.8	1998	17.8°C	18.0°C	Salmon and trout rearing and migration	1324
Lake Branch	1217031455483	0 to 10	2002	17.8°C	16.0°C	Core cold water habitat	1204
Lake Branch	1217031455483	10 to 11.1	1998	17.8°C	16.0°C	Core cold water habitat	1210
Middle Fork Hood River	1216272455753	0 to 9.5	1998	10.0°C	12.0°C	Bull trout spawning and juvenile rearing	1205
Neal Creek	1215257456640	0 to 5.6	1998	17.8°C	18.0°C	Salmon and trout rearing and migration	1318
Un-named creek (Robinhood Cr)	1215723453666	0 to 1.7	2002	17.8°C	18.0°C	Salmon and trout rearing and migration	1218
West Fork Hood River	1216335456049	0 to 14.4	2002	17.8°C	16.0°C	Core cold water habitat	1206
Whiskey Creek	1215108456840	0 to 2.5	1998	17.8°C	18.0°C	Salmon and trout rearing and migration	1319

Table 3. Additional waterbodies identified as impaired in this TMDL assessment

Water Body	LLID	Applicable Numeric Criterion	Beneficial Use (2003 Standard)
East Fork Hood River	1216272455754	13.0°C	Salmon and steelhead spawning
Hood River	1215067457204	13.0°C	Salmon and steelhead spawning
Lenz Creek	1215146456436	18.0°C	Salmon and trout rearing and migration
Neal Creek	1215257456640	13.0°C	Salmon and steelhead spawning
Odell Creek	1215398456564	16.0°C	Core cold water habitat
Odell Creek	1215398456564	13.0°C	Salmon and steelhead spawning
Un-named Pine Grove creek	1215278455850	18.0°C	Salmon and trout rearing and migration
Un-named creek, tributary to West Fork Neal Creek	1215137456488	18.0°C	Salmon and trout rearing and migration
West Fork Neal Creek	1214995455943	18.0°C	Salmon and trout rearing and migration

Table 4. Summary of TMDLs addressed in the 2001 WHS TMDL and this 2018 TMDL Revision

Parameter	Criterion	2001 WHS TMDL	2018 WHS TMDL Revision
		Listed Miles (# Listed Segments)	Listed Miles (# Listed Segments)
Temperature	Salmonid fish rearing	20.9 (5)	
	Bull trout	10.4 (2)	
	Salmon and trout rearing and migration		45.0 (6)
	Core cold water habitat		38.6 (5)
	Bull trout spawning and juvenile rearing		13.3 (2)
	Mileage Total	31.3	96.9
	TMDL Total	7	13

Table 5. Western Hood Subbasin 303(d) Listings addressed in the 2001 WHS TMDL and this 2018 TMDL Revision

Water Body	River Miles	TMDL document	Applicable Numeric Criterion	Beneficial Use	TMDL Count 2001	TMDL Count 2018
2001 WHS TMDL						
Clear Branch, mouth to Laurance Lake	1.4	2001	10.0°C	Oregon bull trout	1	
Indian Creek, mouth to headwaters	7.5	2001	17.8°C	Salmonid fish rearing	1	
Hood River, Powerdale powerhouse to diversion dam	3.9	2001	17.8°C	Salmonid fish rearing	1	
Lake Branch, rivermile 10 to Lost Lake	1.0	2001	17.8°C	Salmonid fish rearing	1	
Middle Fork Hood River, mouth to Clear Branch	9.0	2001	10.0°C	Oregon bull trout	1	
Neal Creek, mouth to East/West Fork confluence	6.0	2001	17.8°C	Salmonid fish rearing	1	
Whiskey Creek, mouth to headwaters	2.5	2001	17.8°C	Salmonid fish rearing	1	
2018 WHS TMDL Revision						
Clear Branch	3.8	2018	12.0°C	Bull trout spawning and juvenile rearing		1
East Fork Hood River	9.8	2018	18.0°C	Salmon and trout rearing and migration		1
East Fork Hood River	17.6	2018	18.0°C	Salmon and trout rearing and migration		1
Hood River	3.1	2018	16.0°C	Core cold water habitat		1
Hood River	10.0	2018	16.0°C	Core cold water habitat		1
Indian Creek	7.8	2018	18.0°C	Salmon and trout rearing and migration		1
Lake Branch	10.0	2018	16.0°C	Core cold water habitat		1
Lake Branch	1.1	2018	16.0°C	Core cold water habitat		1
Middle Fork Hood River	9.5	2018	12.0°C	Bull trout spawning and juvenile rearing		1
Neal Creek	5.6	2018	18.0°C	Salmon and trout rearing and migration		1
Unnamed (Robinhood Cr.)	1.7	2018	18.0°C	Salmon and trout rearing and migration		1
West Fork Hood River	14.4	2018	16.0°C	Core cold water habitat		1
Whiskey Creek	2.5	2018	18.0°C	Salmon and trout rearing and migration		1

2. Water Quality Standard and Beneficial Uses

The applicable temperature water quality standard for this revised TMDL is included in OAR 340-041-0028 (**Appendix A**). This replaces the 1996 standard referred to in the 2001 WHS TMDL in Section 4.3.

Subsections (1), (2) and (3) of the current standard give the background, policy and purpose of the rule. Subsection (4) lists the biologically based numeric criteria determined as necessary for supporting salmonid fishes in the state. For the Western Hood Subbasin, the beneficial uses related to temperature are delineated in Figures 160A and 160B of the rule (**Appendix A**). These figures show waterbodies supporting salmon and trout rearing and migration habitat (Figure 160A) and salmon and steelhead spawning use (Figure 160B). It should be noted that, although the 1996 temperature standard did not define spawning seasons, spawning seasons were identified in the 2001 WHS TMDL with input from local stakeholders (Figure 9 and Table 12). The information in Figures 160A and 160B replaces Figure 9 and Table 12 in the 2001 WHS TMDL.

Oregon Department of Fish and Wildlife staff have identified new steelhead spawning use (January 1-May 15) in Odell Creek after the removal of a small hydroelectric dam in 2016 at approximately river mile 0.5 (Rod French, personal communication). Steelhead spawning use was not identified for McGuire Creek, tributary to Odell Creek. To be consistent with Oregon's antidegradation policy and federal requirements to protect existing uses (Wigal, 2014), the TMDL and any permits to Odell Creek will apply temperature and dissolved oxygen spawning criteria to protect the new steelhead spawning use in Odell Creek. When ODEQ next updates the fish use maps in OAR 340-041-0028-0160, we will rely on ODFW's fish distribution database and will add steelhead spawning as a designated use for Odell Creek.

Table 6 summarizes the changes in numeric criteria between the 2001 WHS TMDL and the standards currently in effect. In both standards, the numeric criteria are based on the seven-day moving average of daily maximum temperatures (7DADM). As with the 2001 WHS TMDL, this TMDL revision is being written to protect the most temperature-sensitive beneficial uses.

Table 6. Biologicially based numeric temperature criteria and human use allowance referenced in the 2018 TMDL revision and the 2001 WHS TMDL

Applicable Standard	Beneficial Use/Human Use Allowance	Numeric Criteria
2003	salmon and trout rearing and migration	18.0°C (64.4°F)
1996	salmonid fish rearing	17.8°C (64°F)
2003	salmon and steelhead spawning	13.0°C (55.4°F)
1996	salmonid spawning, egg incubation, fry emergence	12.8°C (55°F)
2003	bull trout spawning and juvenile rearing	12.0°C (53.6°F)
1996	native Oregon bull trout	10.0°C (50°F)
2003	core cold water habitat	16.0°C (60.8°F)
1996	N/A	N/A
2003	allowable human caused temperature increase	0.3°C (0.5°F)
1996		0.14°C (0.25°F)

In addition to needing to meet the 7DADM criterion of 12°C to protect bull trout spawning and juvenile rearing, there is now a specific temperature criterion for Laurance Lake (bolding added for emphasis) which applies from August 15 through May 15:

OAR 340-041-0028(4)(f)

*(f) The seven-day-average maximum temperature of a stream identified as having bull trout spawning and juvenile rearing use on subbasin maps set out at OAR 340-041-0101 to 340-041-0340: Figures 130B, 151B, 160B, 170B, 180A, 201A, 260A, 310B, and 340B, may not exceed 12.0 degrees Celsius (53.6 degrees Fahrenheit). From August 15 through May 15, in bull trout spawning waters below Clear Creek and Mehlhorn reservoirs on Upper Clear Creek (Pine Subbasin), **below Laurance Lake on the Middle Fork Hood River**, and below Carmen reservoir on the Upper McKenzie River, there may be no more than a 0.3 degrees Celsius (0.5 Fahrenheit) increase between the water temperature immediately upstream of the reservoir and the water temperature immediately downstream of the spillway when the ambient seven-day-average maximum stream temperature is 9.0 degrees Celsius (48 degrees Fahrenheit) or greater, and no more than a 1.0 degree Celsius (1.8 degrees Fahrenheit) increase when the seven-day-average stream temperature is less than 9 degrees Celsius.*

Table 6 also summarizes the changes made to the definition of the amount of heat allowed from human activities. The 1996 standard stated that: “no measureable surface water temperature increase resulting from anthropogenic activities is allowed”. A “measureable temperature increase” was defined as an increase in stream temperature of more than 0.25°F. Subsection (12)(b)(B) of the 2003 standard explains how the temperature criteria are to be implemented and specifically defines a “human use allowance”:

OAR 340-041-0028 (12) Implementation of Temperature Criteria

(b) Human Use Allowance. Insignificant additions of heat are authorized in waters that exceed the applicable temperature criteria as follows:

(A) Prior to the completion of a temperature TMDL or other cumulative effects analysis, no single NPDES point source that discharges into a temperature water quality limited water may cause the temperature of the water body to increase more than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after mixing with either twenty five (25) percent of the stream flow, or the temperature mixing zone, whichever is more restrictive; or

(B) Following a temperature TMDL or other cumulative effects analysis, waste load and load allocations will restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after complete mixing in the water body, and at the point of maximum impact.

(C) Point sources must be in compliance with the additional mixing zone requirements set out in OAR 340-041-0053(2)(d).

(D) A point source in compliance with the temperature conditions of its NPDES permit is deemed in compliance with the applicable criteria.

Subsection (11) of the 2003 standard pertains to the protection of waters that are colder than the biologically based numeric criteria identified in subsection (4). It is expected that TMDL allocations in this revision will be protective of cold water.

OAR 340-041-0028(11) Protecting Cold Water.

(a) Except as described in subsection (c) of this rule, waters of the State that have summer seven-day-average maximum ambient temperatures that are colder than the biologically based criteria in section (4) of this rule, may not be warmed by more than 0.3 degrees Celsius (0.5 degrees Fahrenheit) above the colder water ambient temperature. This provision applies to all sources taken together at the point of maximum impact where salmon, steelhead or bull trout are present.

(b) A point source that discharges into or above salmon & steelhead spawning waters that are colder than the spawning criterion, may not cause the water temperature in the spawning reach where the physical habitat for spawning exists during the time spawning through emergence use

occurs, to increase more than the following amounts after complete mixing of the effluent with the river:
(A) If the rolling 60 day average maximum ambient water temperature, between the dates of spawning use as designated under subsection (4)(a) of this rule, is 10 to 12.8 degrees Celsius, the allowable increase is 0.5 Celsius above the 60 day average; or
(B) If the rolling 60 day average maximum ambient water temperature, between the dates of spawning use as designated under subsection (4)(a) of this rule, is less than 10 degrees Celsius, the allowable increase is 1.0 Celsius above the 60 day average, unless the source provides analysis showing that a greater increase will not significantly impact the survival of salmon or steelhead eggs or the timing of salmon or steelhead fry emergence from the gravels in downstream spawning reach.
(c) The cold water protection narrative criteria in subsection (a) do not apply if:
(A) There are no threatened or endangered salmonids currently inhabiting the water body;
(B) The water body has not been designated as critical habitat; and
(C) The colder water is not necessary to ensure that downstream temperatures achieve and maintain compliance with the applicable temperature criteria.

Subsection (4) of OAR 340-041-0028 states that the biologically based numeric criteria apply unless superseded by natural conditions criteria described in Section (8) of the rule. On August 8, 2013, USEPA disapproved this natural conditions criterion. In its action letter, USEPA identified several options ODEQ could consider to remedy the disapproval. In the meantime, it is USEPA's position that the remaining components of Oregon's temperature standard remain effective for federal Clean Water Act purposes, including the biologically-based numeric criteria, and the human use allowance provisions. The changes proposed in this revision to the Western Hood Subbasin TMDL rely on these portions of the temperature standard which still remain in effect.

3. Seasonal Variation and Critical Period

In the 2001 WHS TMDL, seasonal variation in stream temperatures was described for the Hood River and tributaries in Section 4.4 based on data collected in 1998. After evaluating this data, a critical period (Section 4.5.4.4) was determined for each stream segment with a point source discharge or dam (Table 12 in the 2001 WHS TMDL). The critical period is the period when available data show the 7DADM temperatures exceed the applicable temperature criteria. The critical period also defines the time period when the TMDL allocations, reserve capacity, and margin of safety apply.

More recent in-stream temperature data (2007-2014) was evaluated for this TMDL revision to determine if the critical periods in the 2001 WHS TMDL are reflective of more recent conditions. The revised critical periods are summarized in **Table 7**, and plotted with the available temperature data in **Figures 3-7**. **Table 7** also outlines the differences in critical period between the 2001 WHS TMDL and this revision. This new information replaces Section 4.4 and Section 4.5.4.4 and Table 12 from the 2001 WHS TMDL. The spawning season information in Table 12 is replaced by Figure 160B in OAR 340-041-0028 (**Appendix A**).

Table 7. Critical periods referenced in the 2018 TMDL revision and the 2001 WHS TMDL

(replaces Table 12 from 2001 WHS TMDL)

Stream	TMDL	Critical Period	Criterion
Hood River	2018 revision	May 1-Sept 30	16.0°C
	2001	May 1-Aug 15, Sept 1-30	17.8°C
East Fork Hood River*	2018 revision	May 1-Sept 30	18.0°C
	2001	June 1-Sept 30	17.8°C
Trout Creek**	2018 revision	May 1-Sept 30	18.0°C
	2001	June 15-July 15	17.8°C
Wishart Creek** (called Emil Creek in Table 12)	2018 revision	May 1-Sept 30	18.0°C
	2001	June 15-July 15	17.8°C
Odell Creek	2018 revision	April 15-Sept 30	16.0°C
	2001	May 1-Sept 14	17.8°C
McGuire Creek***	2018 revision	May 1-Sept 30	16.0°C
	2001	May 1-Sept 14	17.8°C
Neal Creek	2018 revision	May 1-Oct 31	18.0°C
	2001	May 1-Sept 30	17.8°C
Lenz Creek****	2018 revision	May 1-Oct 31	18.0°C
	2001	May 1-Sept 30	17.8°C
Ditch in Van Horn area	2018 revision	March 1-Oct 31	18.0°C
	2001	N/A	
Clear Branch	2018 revision	Year-round	12.0°C
	2001	Year-round	10.0°C

* Critical period for this stream falls within the critical period for the Hood River watershed in the 2018 revision.

** Based on available data, the numeric criteria in this creek are not exceeded therefore the critical period is the period for the Hood River watershed.

*** Based on available data, the numeric criteria in this creek are not exceeded therefore the critical period is the period for the Odell River watershed.

**** Critical period for this stream falls within the critical period for the Neal Creek watershed.

Based on available data for the Hood River (**Figure 3**), the critical period for the Hood River watershed is May 1-September 30. Exceedance of the salmon and steelhead spawning criterion was observed from May 10-June 15 at the former Powerdale Dam site; exceedance of the core cold water habitat criterion was observed from June 18-September 14 at either the Powerdale Dam site or at the mouth of the Hood River. Because all tributaries contribute heat to the Hood River, this critical period applies throughout the Hood River watershed, unless a longer critical period is needed for a specific tributary.

Data from 2007-2014 were evaluated for major tributaries (East Fork Hood River (**Figure 4**), Odell Creek (**Figure 5**), Neal Creek (**Figure 6**), and Clear Branch (**Figure 7**)) to determine if a longer critical period was needed for any of these tributaries. A longer critical period of April 15-September 30 was applied to the Odell Creek watershed to be protective of newly established salmon and steelhead spawning in the spring. Based on available data, the spawning criterion was exceeded in at least one year after April 24th.

A longer critical period of May 1-October 31 was applied for Neal Creek to be protective of salmon and steelhead spawning in mid-October. While the spawning criterion was not exceeded after October 15th based on available data, it came very close to being exceeded in 2014.
A longer critical period was applied for the effluent-dominated ditch in the Van Horn area, into which the Terminal Ice and Duckwall-Pooley Fruit Company Van Horn facilities discharge. Based on the limited

effluent and climate data available, it appears likely that temperatures in the ditch could exceed 18°C from March 1-October 31. Effluent temperatures can exceed 18°C anytime during the year, but when air temperatures are much colder than 18°C, ditch temperatures would cool off quickly. The critical period was established for the time of year when air temperatures were generally greater than 13°C (Western Regional Climate Center, http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or4003).

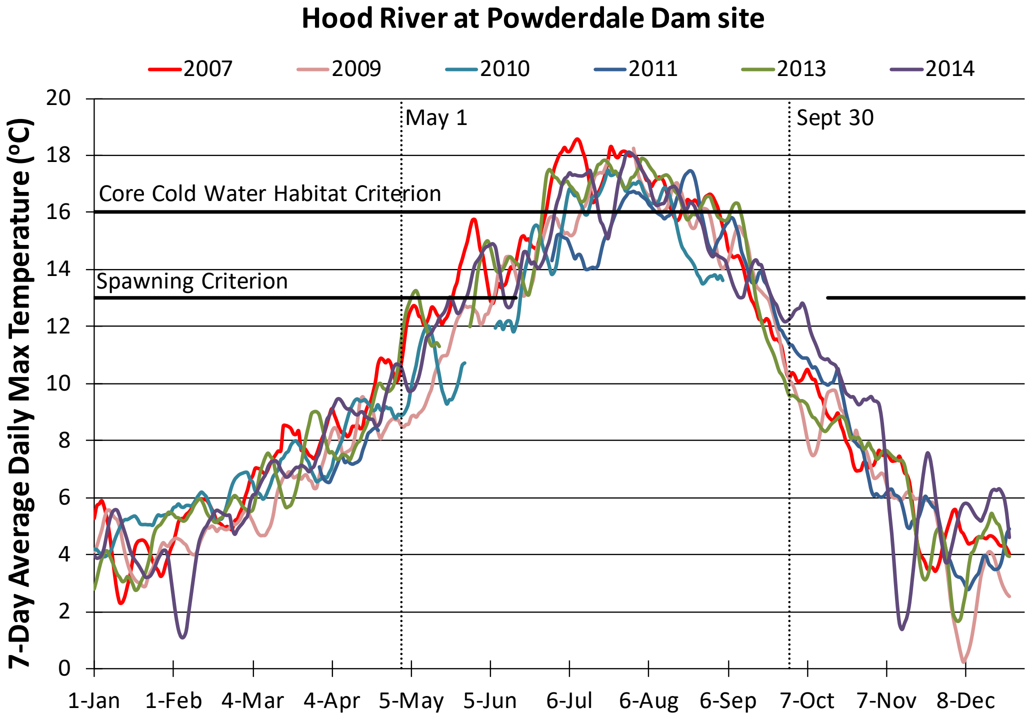
A longer critical period was applied for Clear Branch to be protective of bull trout spawning and juvenile rearing. Temperature data from Clear Branch above and below Laurance Lake was evaluated for the period 2007-2014. Thermistors were typically deployed in mid-late May and retrieved in early November, although thermistors were left out until the end of the year in 2014. Below the reservoir, the 12.0°C bull trout criterion could be exceeded from early May through early August. Exceedances typically occurred during times when the reservoir was spilling.

To evaluate the specific criterion which applies below Laurance Lake from August 15-May 15, temperatures in Clear Branch above and below the reservoir were compared. Very little, if any, data were available for January-May 15th. In most years, there were several days in mid-August to early September where the 7DADM temperature criterion for Laurance Lake was met when comparing Clear Branch temperatures above and below the reservoir. However, during the rest of the time, the difference between upstream and downstream temperatures exceeded the applicable HUA (0.3°C or 1.0°C depending on ambient temperatures). In 2014, the Laurance Lake criterion was largely met from late November through the end of December, although there were a number of days in December where the HUA of 1.0°C was exceeded.

Because it appears that the bull trout criterion could be exceeded at any time between May and December, the critical period for Laurance Lake is defined as year-round. This is the same critical period that was defined in the 2001 WHS TMDL.

Figure 3. Observed Seasonal Variation in Stream Temperature and Critical Period: Hood River

(data from Powerdale Dam site was collected by the Confederated Tribes of Warm Springs [Eineichner, personal communication], data from the mouth was collected by the Columbia River Keepers [Hanson, personal communication]; vertical dashed lines in the figures represent the critical period)



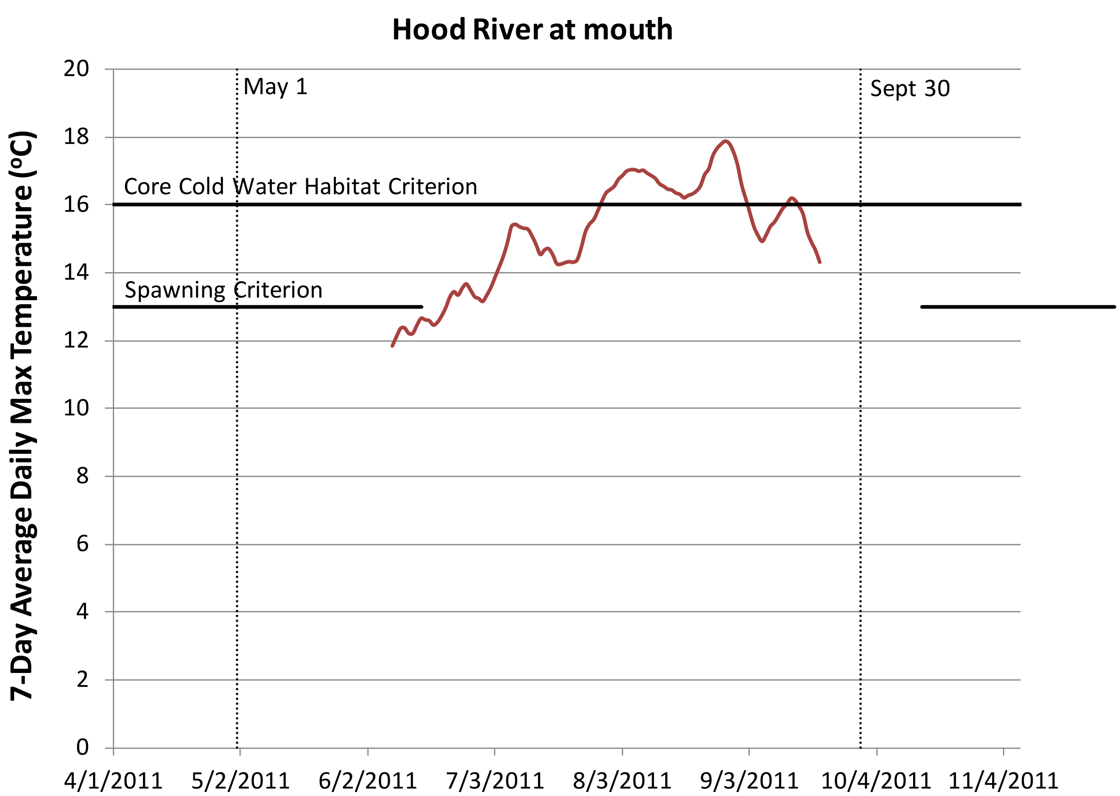


Figure 4. Observed Seasonal Variation in Stream Temperature and Critical Period: East Fork Hood River

(data collected by the Confederated Tribes of Warm Springs [Eineichner, personal communication] and Oregon Department of Fish and Wildlife [Simpson, personal communication]; vertical dashed lines in the figures represent the critical period)

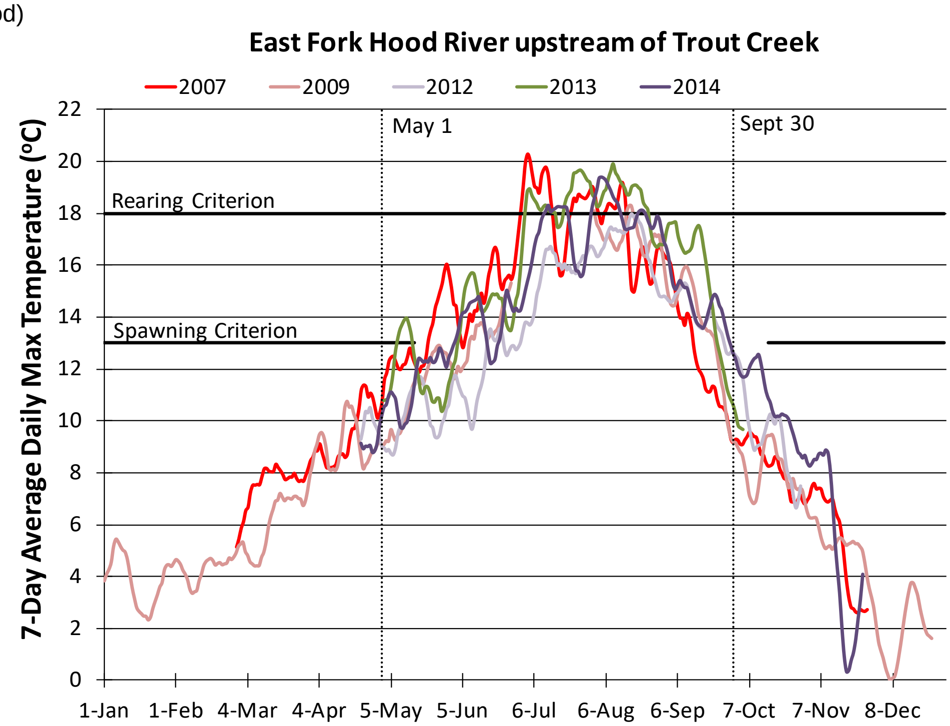


Figure 5. Observed Seasonal Variation in Stream Temperature and Critical Period: Odell Creek

(data collected by Confederated Tribes of Warm Springs [Brewer, personal communication] and Hood River Watershed Group [Saunders, personal communication]; vertical dashed lines in the figures represent the critical period)

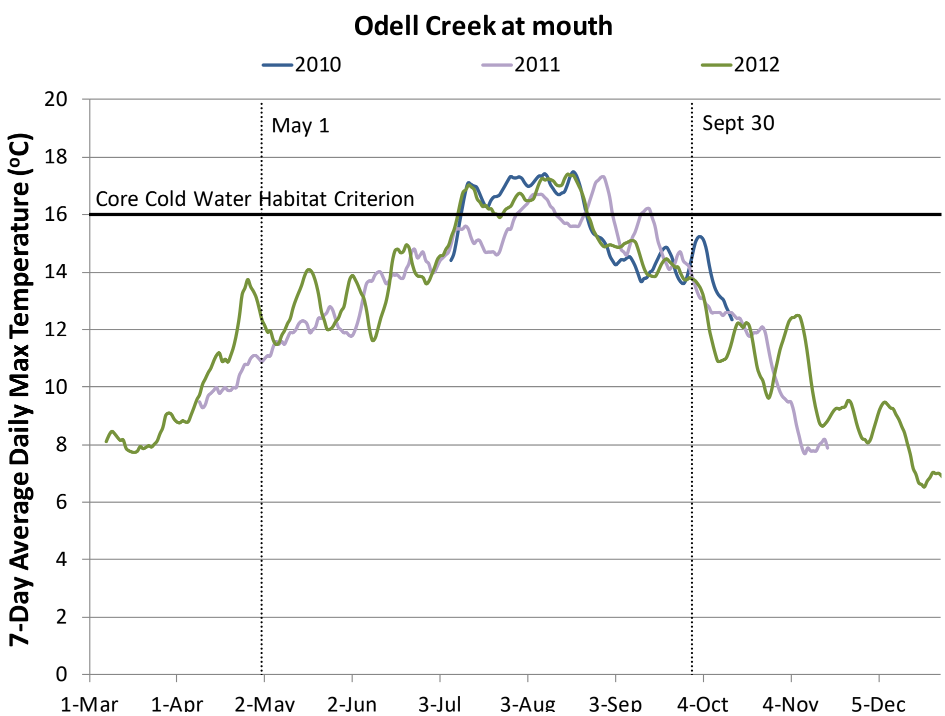
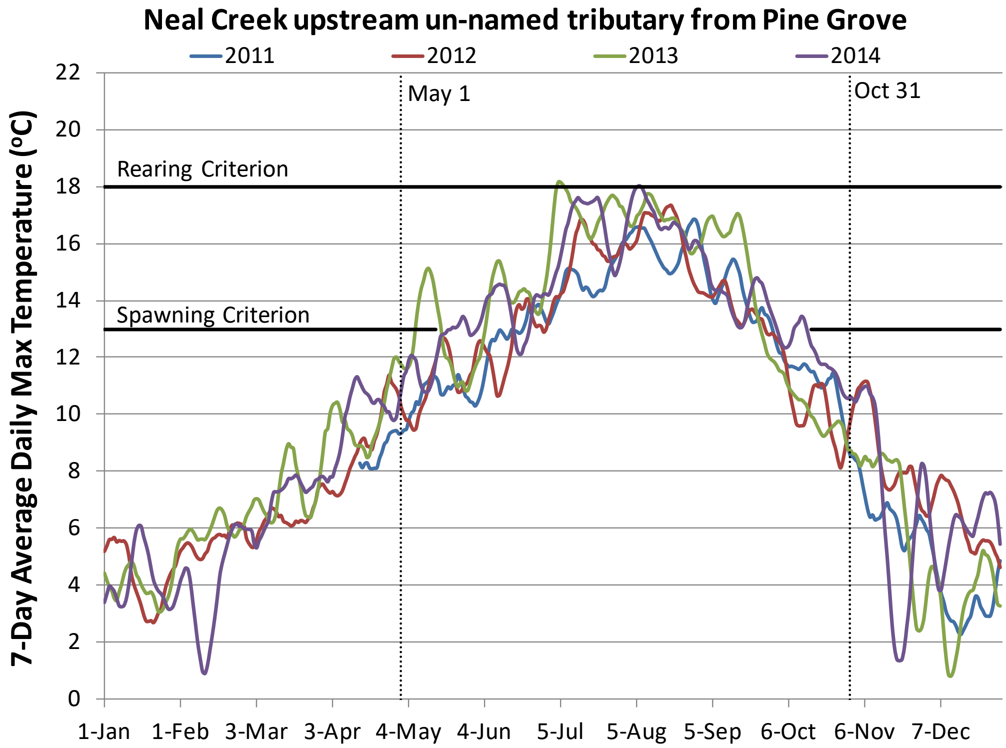


Figure 6. Observed Seasonal Variation in Stream Temperature and Critical Period: Neal Creek

(data at mouth collected by the Confederated Tribes of Warm Springs [Eineichner, personal communication], Hood River Watershed Group [Saunders, personal communication], data upstream un-named tributary collected by Duckwall-Pooley Fruit Company [Mallon, personal communication]; vertical dashed lines in the figures represent the critical period)



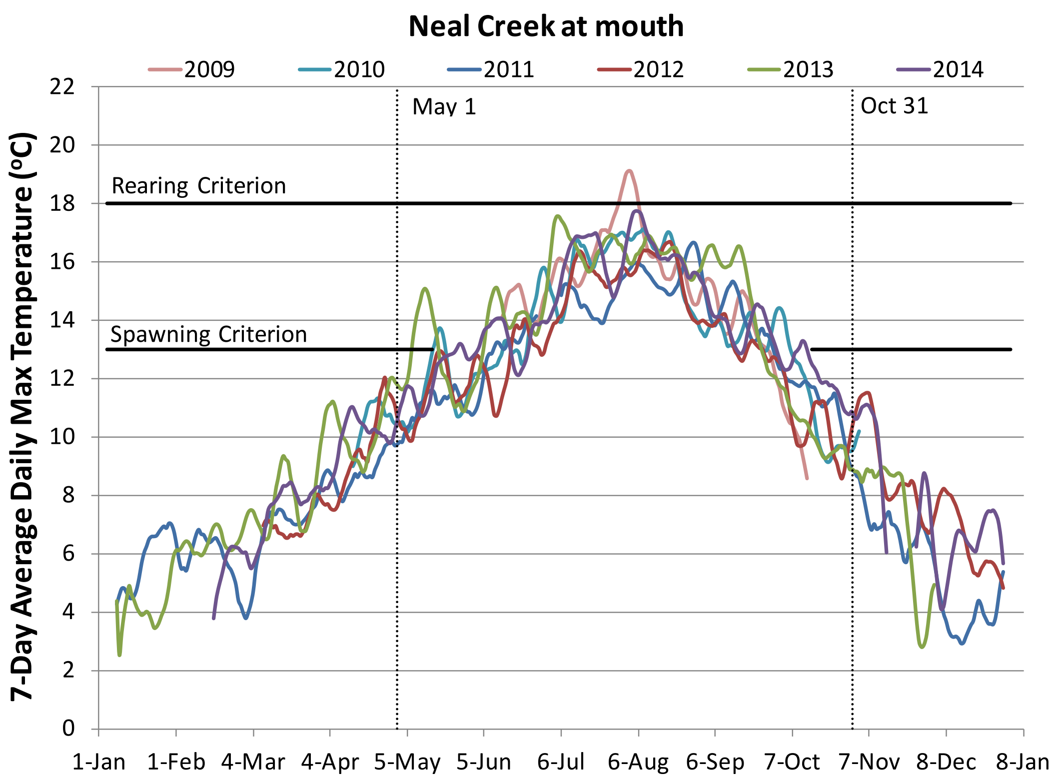
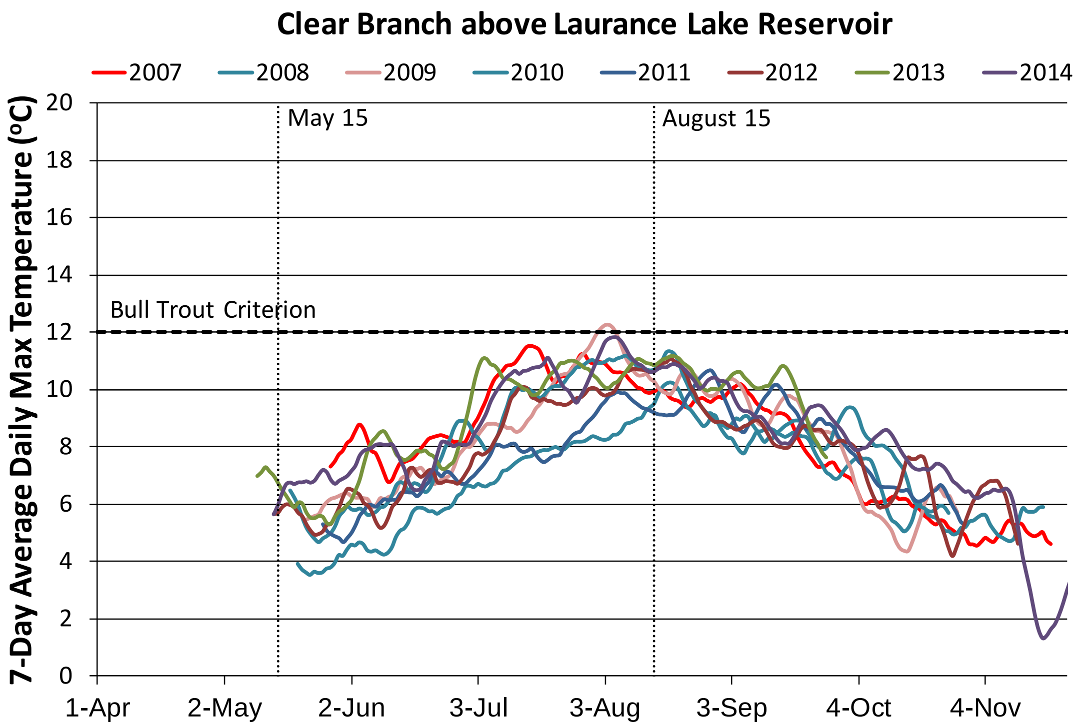
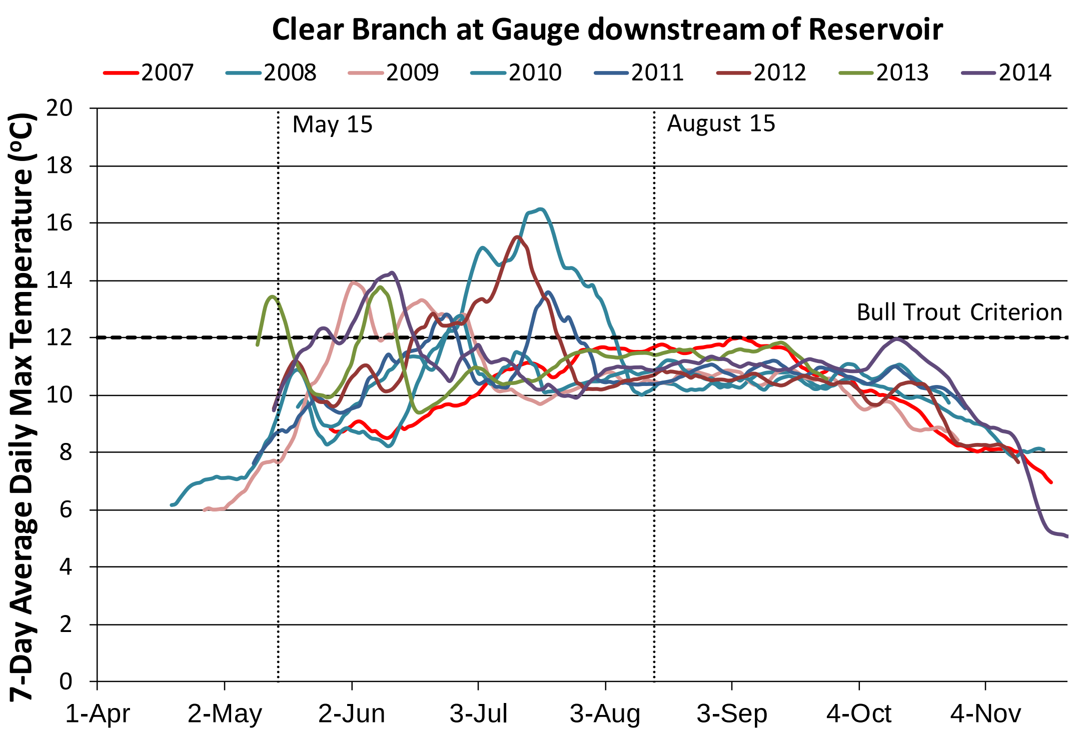


Figure 7. Observed Seasonal Variation in Stream Temperature: Clear Branch above and below Laurance Lake Reservoir

(data collected by Hood River Watershed Group and Middle Fork Irrigation District [Saunders, personal communication]; August 15 and May 15 are shown in the charts in this figure to indicate the period when a site-specific criterion applies to Laurance Lake)





4. Existing Heat Sources

4.1 Point Sources

Figure 8 and **Table 8** show the location of NPDES permitted facilities located in the Western Hood Subbasin for which wasteload allocations are developed in this revision. These replace Figure 34 and Table 10 in the 2001 WHS TMDL. **Table 8** includes recent permit information, including the receiving water identified in the permit. In some instances, the facility actually discharges into a ditch or unnamed tributary prior to entering a waterbody named in the current permit. In this TMDL revision, WLAs were developed at the point of discharge, even if that is in a ditch, since ditches are considered waters of the state. More detailed maps of the location of each facility within the Subbasin are provided in **Appendix B**. Facilities with stormwater construction permits are not shown on either **Figure 8** or **Table 8**, because of their ephemeral nature. The number and location of these permitted sources will change over the life of the TMDL. Information on the number and location of permitted sources can be found in ODEQ's permits database: http://www.deq.state.or.us/wq/sisdata/sisdata.asp. As of January 2017, there were nine active stormwater construction permits in the Western Hood Subbasin.

The facilities for which new wasteload allocations are developed in this revision are described in further detail in **Sections 4.1.1-4.1.4.** The facilities were not described in any detail in the 2001 WHS TMDL, so information is provided about each facility in this revision. A summary of temperature and flow data used in determining WLAs is also described. The best available data was evaluated from 1998 to 2014. For most of the facilities, there was more data available than was available in the 2001 WHS TMDL. The variables T_E and Q_R mentioned in this section are further described in Equations 3-7 in **Section 7.1** and in **Appendix F**.

One of the statistics that is used in WLA determinations is the 7Q10 low flow of the receiving stream (Q_R). Because 7Q10 low flow data was not available for any of the receiving streams, an alternative approach was used for estimating upstream low flows, as is described further for each facility in **Sections 4.1.1-4.1.4**. To ensure that the years of data used were representative of normal weather years and watershed flow conditions, several different data sources were evaluated over the 30-year period of 1985-2014, including:

- Mean annual Hood River flows at the USGS Gage at Tucker bridge (#14120000) (https://waterdata.usgs.gov/or/nwis/rt)
- Mean annual precipitation and air temperature data from COOP (Cooperative Observer Network) climate stations at the Hood River Experiment Station (#USC00354003) and Greenpoint (#USS0021D01S) (https://www.ncdc.noaa.gov/cdo-web/datatools/findstation)

Based on an evaluation of this data, the years with data used for low flow estimates appear to fall within the range of normal variability and were not representative of unusually dry, wet or warm years.

The 2001 WHS TMDL (Section 4.6.2.1) did not develop TMDLs and wasteload allocations for construction or industrial stormwater permitted facilities because they were not considered to have a thermal discharge. ODEQ continues to believe that these facilities do not contribute to exceedances of the 7DADM numeric criteria in the temperature standard. However, because these facilities can discharge into waterbodies identified as Category 5 (water quality impaired for temperature and needing a TMDL), wasteload allocations are developed in this revision.

As in the 2001 WHS TMDL analysis, this revision does not develop TMDLs and wasteload allocations for facilities with NPDES permits which discharge directly to the Columbia River or for the fish hatcheries (covered under 300-J general NPDES permits) which discharge to Eagle Creek and Herman Creek (direct tributaries to the Columbia River). Facilities which discharge directly to the Columbia River will be assessed during development of TMDLs for the Columbia River. Eagle Creek and Herman Creek are not identified as Category 5 (water quality impaired and needing a TMDL). Limited temperature data collected by ODEQ and ODFW in 2002-2005 did not indicate exceedance of the biologically based numeric criteria on these creeks outside of the influence of the Bonneville Pool of the Columbia River. If future monitoring indicates that these creeks should be listed as Category 5 impaired, wasteload allocations for these facilities will be developed as part of a future TMDL.

Figure 8. Location of Point Sources and Dam with Wasteload Allocations and Load Allocation in the 2018 WHS TMDL Revision

(replaces Figure 34 from 2001 WHS TMDL)

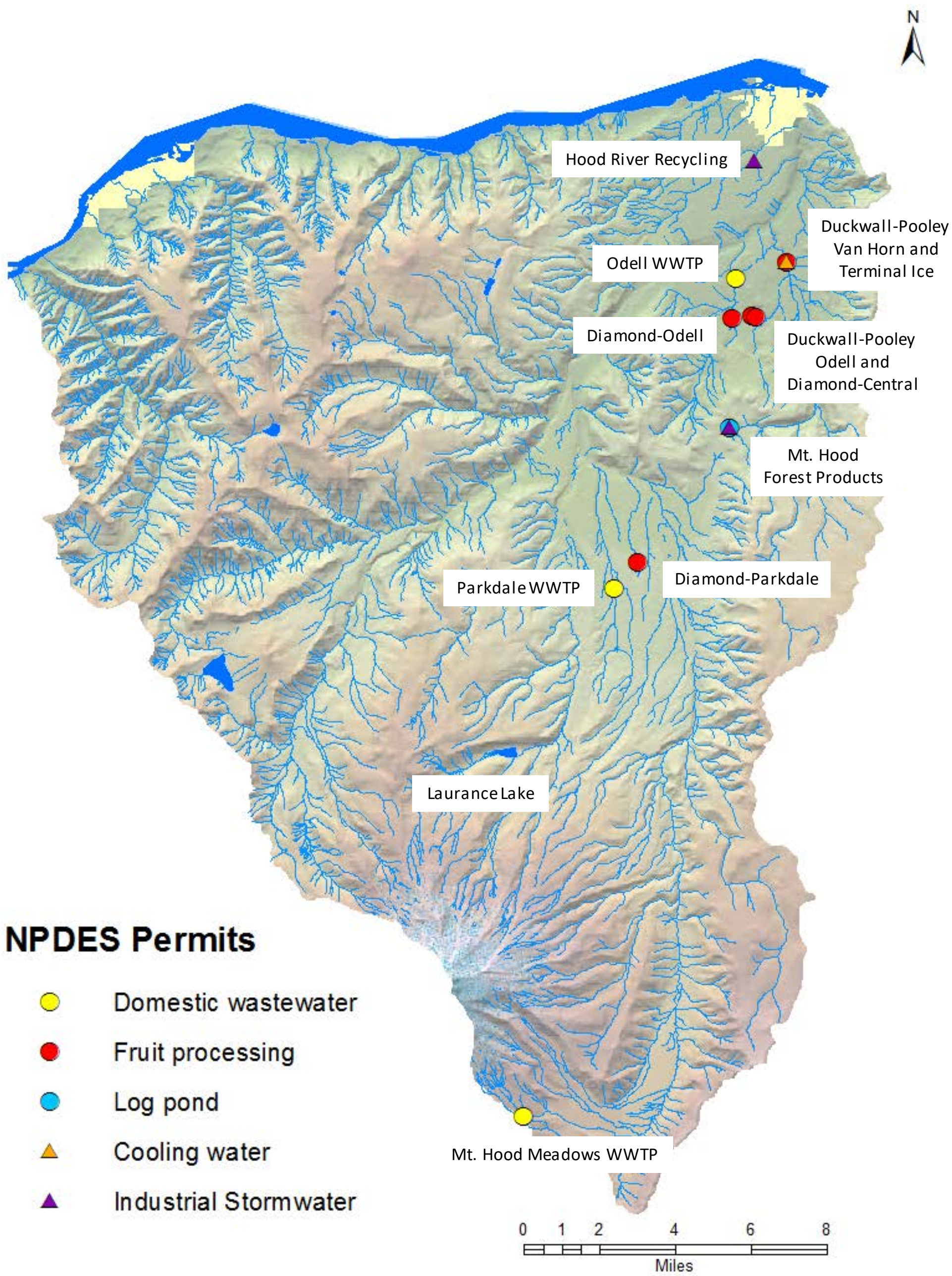


Table 8. NPDES Permitted Facilities with Wasteload Allocations in the 2018 WHS TMDL Revision

(replaces Table 10 from 2001 WHS TMDL)

Permit Number	Facility Name	Description	Permit Type	Receiving Water	River Mile
East Fork Hood River Watershed					
67545	Parkdale Sanitary District	Sewage - less than 1 MGD	NPDES-DOM-Da	Trout Creek	3.5
24351	Diamond Fruit Growers Parkdale Facility	Food/beverage processing - washing/packing	NPDES-IW-B02	Wishart Creek*	2.5
58827	Mt. Hood Meadows Ski Resort	Sewage - less than 1 MGD	NPDES-DOM-Da	East Fork Hood River	25.8
Odell Creek Watershed					
63062	Odell Sanitary District	Sewage - less than 1 MGD	NPDES-DOM-Da	Odell Creek	1.1
24344	Diamond Fruit Growers Odell Facility	Food/beverage processing - Washing/packing	NPDES-IW-B02	McGuire Creek	0.4
Neal Creek Watershed					
24356	Terminal Ice and Cold Storage (formerly Diamond Fruit Growers Van Horn facility)	Food/beverage processing - washing/packing	NPDES-IW-B02	Neal Creek*	1.5
100115	Duckwall-Pooley Fruit Company Van Horn Cold Storage facility	Small cooling water discharges	NPDES-IW-B16	Neal Creek*	0.1
107229	Quality Veneer and Lumber – Booth Hill Wood Waste Landfill	Industrial stormwater	Facility Closed (NPDES permit terminated 6/30/07)		
48290	Lage Orchards	WPCF seasonal wine and fresh food packing	GEN14A	WPCF, no longer a surface water discharge (NPDES permit terminated 7/31/11)	
24337	Diamond Fruit Growers Central facility	Food/beverage processing - washing/packing	NPDES-IW-B02	Lenz Creek	1.8
24337	Diamond Fruit Growers	Industrial stormwater	NPDES permit terminated 6/30/02		
25434	Duckwall-Pooley Fruit Company Odell facility	Food/beverage processing - washing/packing	NPDES-IW-B02	Lenz Creek	1.7
84088	Stadelman Fruit Company Whitney facility	Food/beverage processing - washing/packing	NPDES permit terminated 7/31/11, now discharges directly to Odell WWTP		
84086	Stadelman Fruit Company Lenz facility	Non-contact cooling water	NPDES permit terminated 7/31/01		
107226	Quality Veneer and Lumber – Planer Mill	Industrial stormwater	Facility Closed (NPDES permit terminated 6/30/02)		
36515	Mt. Hood Forest Products (formerly Quality Veneer and Lumber)	Log ponds	GEN04	Unnamed creek	1.0
36515	Mt. Hood Forest Products (formerly Quality Veneer and Lumber)	Industrial stormwater	GEN12Z	Neal Creek*	1.0

* Receiving water as identified in NPDES permit, although discharge is actually into a ditch or un-named creek upstream of this receiving water. WLAs have been developed for the ditch or un-named creek because they are considered waters of the state.

Table 8 (continued). NPDES Permitted Facilities with Wasteload Allocations in the 2018 WHS TMDL Revision

<table>
<tr><th>File Number</th><th>Facility Name</th><th>Description</th><th>Permit Type</th><th>Receiving Water</th><th>River Mile</th></tr>
<tr><td colspan="6">Mainstem Hood River Watershed</td></tr>
<tr><td>108947</td><td>Mt. Hood Railroad</td><td>Industrial stormwater</td><td colspan="3">NPDES permit terminated 10/24/17 (Approved No Exposure Certification)</td></tr>
<tr><td>113105</td><td>Hood River Recycling and Transfer Station</td><td>Industrial stormwater</td><td>GEN12Z</td><td>Unnamed tributary to Indian Creek</td><td>0.3</td></tr>
<tr><td>66602</td><td>PacifiCorp –
Powerdale Powerhouse</td><td>Non-contact cooling water</td><td colspan="3">Facility Closed
(NPDES permit terminated 7/31/01)</td></tr>
<tr><td>51810</td><td>Oak Grove Smoker Plant (formerly Luhr Jensen –
Oakgrove Plant)</td><td>Industrial wastewater – Tier 2 sources</td><td>WPCF-IW-B15</td><td colspan="2">WPCF, no longer a surface water discharge (NPDES permit terminated 12/10/13)</td></tr>
</table>

4.1.1 East Fork Hood River Watershed

Flow and temperature data were compiled for East Fork Hood River near the mouth in order to evaluate the cumulative effect of facilities which discharge in the watershed during the critical period.

Temperature Data. Under the 2003 temperature standard, the applicable temperature criteria for East Fork Hood River are 18.0°C for salmon and trout rearing and migration and 13.0°C for salmon and steelhead spawning use (October 15-May 15). Hourly temperature data has been collected in East Fork Hood River upstream of Trout Creek by ODFW (Simpson, personal communication) and the Confederated Tribes of Warm Springs (Eineichner, personal communication). 7DADM data from 2007-2014 was evaluated for this analysis (**Figure 4**). Depending on the year, the rearing criterion was exceeded from late June or early July through mid-late August, although it was not exceeded at all in 2012. The spawning criterion was exceeded in one year (2013) in early-mid May. There are Category 4A 303(d) listings for salmonid fish rearing in the East Fork Hood River from the mouth to river mile 27.4 (**Table 2**).

Flow Data. There is not a long-term gauge on the East Fork Hood River to calculate 7Q10 low flows. However, hourly flow data was collected by ODFW (Reagan, personal communication) at rivermile 1.0, just above where Trout Creek enters the East Fork Hood River, from 2009-2014. Using this six years of data, an alternative approach was used for calculating upstream low flows to represent Q_R in Equations 3-7:

- The minimum flow was determined for the spawning and rearing seasons for each year (2009-2014).
- These minimum flows were then averaged by season, resulting in average low flows of 42 cfs during the rearing season and 112 cfs during the spawning season.

4.1.1.1 Mount Hood Meadows Wastewater Treatment Plant

Meadows Utilities Company, LLC owns and operates a wastewater collection system and activated sludge sewage treatment facility located at the Mt. Hood Meadows Ski Resort. Wastewater is treated and discharged to East Fork Hood River under an NPDES permit. The ski resort includes two day lodges that contain six food service establishments, laundry, a day care center, three main restroom areas, offices and rental, sales and maintenance shops. No overnight facilities are currently included at the ski resort. The current NPDES Permit expires in February 2019.

Wastewater from the ski resort is processed through a sewage grinder and flows into two of three 65,000 gallon Activated Sludge - Sequencing Batch Reactors. The third SBR has not been needed and is currently used to store and aerate excess solids. The wastewater is then pumped to a 25,000-gallon holding chamber, filtered, disinfected with ultra-violet light, and discharged to East Fork Hood River at approximately river mile 26.5. Wastewater is discharged on a year-around basis, although summertime discharge flows are quite low. Under the current permit, the permittee must stop their discharge when temperature criteria in the river are exceeded. If this were to occur, it would occur during the summer months when discharge flows are quite low and could be held in the 25,000-gallon holding chamber.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-1**.

Temperature Data. Continuous hourly effluent and river temperature data are collected by staff at the WWTP. This data is provided to ODEQ as daily maximum and minimum values on their Discharge Monitoring Reports. The 7DADM statistic was not readily available for this TMDL analysis. Instead, the monthly maximum effluent temperatures were calculated for the period 2009 to 2014. The maximum value by month for this six-year period was used to represent T_E in Equations 3-7 and ranged from 13.9°C to 20.1°C. Given that the 7DADM statistic would be lower than the maximum of daily maximum values, this is a conservative approach.

Under the 2003 temperature standard, the applicable temperature criterion for East Fork Hood River at the point of the WWTP discharge is 18.0°C for salmon and trout rearing and migration; there is no salmon and steelhead spawning use identified. Salmon and steelhead spawning use (October 15-May 15) is identified approximately 0.7 miles below the point of discharge. River temperature data is collected by staff at the WWTP at their point of discharge. Data evaluated from 2009-2014 indicates that the river is below the biologically-based numeric criteria for both salmon/trout rearing and salmon/steelhead spawning. The maximum river temperature observed during this time period was 13.9°C in the summer and 10.6°C during the spawning season. There are Category 4A 303(d) listings for salmonid fish rearing in the East Fork Hood River at the point of discharge, even though the data suggests that this criterion is met. There are no impairment listings for spawning.

Flow Data. The WWTP has two different daily flow limits in their permit. For the period May 1-October 31 (summer season), they are allowed to discharge 0.0187 MGD (0.03 cfs). From November 1-April 30 (winter season) they are allowed to discharge 0.0375 MGD (0.06 cfs).

There is not a long-term gauge on the East Fork Hood River to calculate 7Q10 low flows. However, daily flow data are collected by the staff at the WWTP in the East Fork Hood River above their point of discharge and reported to ODEQ on their DMRs. Data from 2009-2014 were used in an alternative approach for calculating upstream low flow values to represent Q_R in Equations 3-7:

- The minimum flow was determined for each month from 2009-2014.
- These minimum flows were then averaged by month for this six year period to represent Q_R. The low flow ranged from 5.6 cfs in January and March to 19.4 cfs in June. The average low flow during the critical period was 6.7 cfs in August.

4.1.1.2 Diamond Fruit Growers – Parkdale Facility

The Diamond Fruit Growers Parkdale facility (Diamond-Parkdale) is a small "seasonal house" fruit packing facility located in the community of Parkdale. Their NPDES permit allows discharge of fruit processing wastewater to Wishart Creek. The facility discharges to a ditch which runs along a railroad track before entering a underground pipe which then discharges into Wishart Creek just below its headwaters (**Figure B-1**). Wishart Creek, in turn, joins the East Fork Hood River at approximately rivermile 1.7. In the 2001 WHS TMDL, the receiving stream for this discharge is incorrectly identified as Emil Creek in Table 12, although it is correctly identified as Wishart Creek elsewhere in the document.

At the Diamond-Parkdale facility, pears are pre-sized and stored prior to being packaged at the Diamond-Central facility. No packing actually occurs at Diamond-Parkdale. The Parkdale facility operates from about the last week of August to approximately November 15th, although storage occurs through April. As of October 2013, the facility began sending their rinse water directly to the Parkdale WWTP. They now only discharge their condenser cooling water to the ditch and Wishart Creek, although they still operate under the original permit. Cooling water is discharged at full capacity from mid-August through December. From January to April, they operate with reduced storage.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-2** and **Table D-1**.

Temperature Data. Effluent temperature data is very limited. Sporadic weekly grab sample measurements of effluent temperatures from 2009-2012 were reported on DMRs submitted to ODEQ (12.2°C -15.0°C). ODEQ also deployed a thermistor in the effluent discharge in mid-August to October in 2002-2003. The 7DADM statistic was calculated from this data, with the maximum 7DADM value of 20.1°C in 2003. In 2014, Diamond staff (Nick Erickson, personal communication) indicated that effluent temperatures were generally around 21.0°C (70°F). To be conservative, this warmest (and most recent) estimate of effluent temperatures (21.0°C) was used to represent T_E in Equations 3-7.

Under the 2003 temperature standard, the applicable temperature criterion for the ditch and Wishart Creek is 18.0°C for salmon and trout rearing and migration. There is no salmon and steelhead spawning use identified for either water body. Limited temperature data was collected by ODEQ in 2002 (August 15-October 2) and 2003 (September 3-October 27). This data indicates exceedance of the rearing criterion in the ditch during late August and early September and no exceedances in Wishart Creek. Neither the ditch or Wishart Creek are listed as impaired on the 303(d) list.

Flow Data. The average dry-weather design flow for the facility is 0.22 MGD (0.34 cfs). Discharge from this facility has decreased significantly since they are now only discharging condenser cooling water. Effluent flow rates (2013-2014) ranged between 0.004 MGD with all storage running and 0.0005 MGD during the winter months (January-April) with one storage unit running. However, since they are still operating under their old permit, the WLA in this TMDL analysis was developed using the permitted design flow of 0.22 MGD. Two alternative WLAs were developed assuming the discharge of cooling water alone, using design flows of 0.003 MGD and 0.004 MGD.

Limited flow data has been collected in the ditch and Wishart Creek, in part because flows are too low to accurately measure. One flow measurement in the ditch (0.1 cfs) was collected by ODEQ in October 2005. Measurements collected by ODEQ in Wishart Creek in October 2004, 2005 and 2013 indicated flows between 0.2 and 0.45 cfs. There was not enough data available to calculate the 7Q10 low flow or an alternative upstream low flow estimate. To be conservative, the lowest measured flows were used to represent upstream low flows (Q_R in Equations 3-7) in this analysis: 0.1 cfs in the ditch and 0.2 cfs in Wishart Creek.

4.1.1.3 Parkdale Wastewater Treatment Plant

Parkdale Sanitary District owns and operates a secondary wastewater treatment facility that serves the community of Parkdale. The Parkdale wastewater treatment facility utilizes an activated sludge process to treat domestic wastewater. When it was built, the facility's approved average dry weather design flow was 0.10 MGD. The treatment facility discharges treated effluent to Trout Creek at approximately river mile 3.5 via a buried pipeline (**Figure B-1**). Trout Creek is tributary to the East Fork Hood River, entering the East Fork at approximately river mile 0.5. Biosolids generated by the facility are taken to the Hood River sewage facility for treatment and land application with the biosolids generated at the Hood River facility.

On July 15, 2013, the District and the ODEQ entered into Mutual Agreement and Order No. WQ/M-ER-13-060, which includes a schedule for the District to update the current facilities plan, submit final plans and specifications, and construct the upgrade to the facility. The upgrade will include a continuous discharge system, reconfigured outfall, new influent pumps, new secondary clarifiers, an effluent filtration system, a dechlorination system, and the addition of aeration prior to discharging.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-3**.

Temperature Data. Limited temperature data has been collected for the Parkdale WWTP effluent. In 2002, ODEQ deployed continuous thermistors in plant effluent from May through September. The 7DADM statistic was calculated for this period and the highest 7DADM was 19.0°C. Since 2009, WWTP staff has collected daily grab measurements of effluent data, which is reported to ODEQ on their DMRs. For the period 2009-2014, the maximum effluent temperature was 20.8°C observed during September. To be conservative, this maximum effluent temperature of 20.8°C was used to represent T_E in Equations 3-7.

Under the 2003 temperature standard, the applicable temperature criterion for Trout Creek is 18.0°C for salmon and trout rearing and migration. There is no salmon and steelhead spawning use identified for Trout Creek. Data collected by ODEQ and the Hood River Watershed Group in 2000-2002 indicates that the creek was below the rearing criterion at all times of year. Trout Creek is not listed as impaired on the 303(d) list.

Flow Data. Under the current permit, the average dry-weather design flow for the facility is 0.10 MGD (0.15 cfs). This is the same effluent flow used in the 2001 WHS TMDL. Under the planned upgrade for this facility, the average dry-weather design flow will be reduced to 0.08 MGD (0.12 cfs). Both design flows were evaluated in this TMDL analysis.

Limited flow data has been collected in Trout Creek. In 2002, ODEQ installed a staff gauge immediately upstream from the point of discharge and collected as series of four flow measurements from June through September, 2002. WWTP staff took additional staff gauge readings during this time. Flows ranged from 2.5 to 3.0 cfs. There was not enough data available to calculate the 7Q10 low flow or an alternative upstream low flow estimate. To be conservative, the lowest flow of 2.5 cfs was used in this analysis to represent Q_R in Equations 3-7.

4.1.2 Odell Creek Watershed

Temperature and flow data were compiled for Odell Creek near the mouth in order to evaluate creek temperature impairments and to develop watershed loading capacity. The Odell WWTP discharges into Odell Creek at river mile 1.1, and flow and temperature data used in development of wasteload allocations for that facility are described in **Section 4.1.2.2**.

Temperature Data. Under the 2003 temperature standard, the applicable temperature criterion for Odell Creek is 16.0°C for core cold water. There was no salmon and steelhead spawning use identified for Odell Creek in the standard. However, with the removal of a small hydroelectric dam near the mouth in

2016, ODFW now designates Odell Creek as steelhead habitat with a spawning season of January 1-May 15 (Rod French, personal communication). The Confederated Tribes of Warm Springs (Brewer, personal communication) and the Hood River Watershed Group (Saunders, personal communication) collected data at the mouth of Odell Creek from 2010-2012. These data indicate exceedance of the rearing criterion from early July until the middle of September and exceedance of the spawning criterion from mid/late April through May15 (**Figure 5**). Odell Creek is not listed as impaired on the 303(d) list.

Flow Data. There is not a long-term gauge on Odell Creek to calculate 7Q10 low flows. However, flow data has been collected at the mouth of Odell Creek by the Confederated Tribes of Warm Springs (McKim, personal communication). Data from 2010-2014 was evaluated and included: weekly flow data in July and August, 2010; daily flow data in 2011; and hourly flow data in 2012-2014. This data was used to to develop an alternative approach for calculating upstream low flow values to represent Q_R in Equation 2:

- The minimum flow was determined for each month.
- These minimum flows were then averaged by month to represent Q_R. During the critical period, the low flow in the spawning season was 8.3 cfs in May and the low flow during the non-spawning season was 8.4 cfs in September.

4.1.2.1 Diamond Fruit Growers – Odell Facility

The Diamond Fruit Growers Odell facility (Diamond-Odell) is a fruit packing facility located in the community of Odell. The facility discharges treated effluent to McGuire Creek, tributary to Odell Creek, at approximately river mile 0.4 (**Figure B-2**).

The facility primarily processes pears, with about 500,000 boxes packed annually. Lady apples, a small decorative apple, are also packed and make up about one percent of the fruit processed. The facility operates full time from about mid-August until late November. After November the facility is operated intermittently until mid to late May as fruit is needed from the controlled atmosphere rooms. The design flow for the facility is 0.03 MGD (0.05 cfs).

As of April 2013, Diamond-Odell began discharging their rinse water directly to the Odell WWTP. They now only discharge their condenser cooling water to McGuire Creek, although they are still permitted to discharge all of their wastewater to McGuire Creek. Since October 2013, the facility has been measuring flow and temperature of the cooling water discharge.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-5** and **Table D-2**.

Temperature Data. Effluent temperature data is limited. Weekly grab sample measurements of effluent temperatures have been reported on DMRs submitted to ODEQ. To be conservative, the maximum grab sample temperature by month was calculated for the period 2008-2012 and was used to represent T_E in Equations 3-7. This ranged from 16.7°C in April to 22.2°C in October. This data was used in the analysis of all of the discharges covered under their current individual NPDES permit (**Table C-5**).

Temperature of the cooling water discharge has been collected since October 2013. To be conservative, the maximum reported temperature by month was used to represent T_E in the cooling water analysis. This ranged from 16.1°C in November to 20.2°C in August for the period of October 2013 to December 2014. This data was used in the cooling water analysis (**Table D-2**).

Under the 2003 temperature standard, the applicable temperature criterion for McGuire Creek is 16.0°C for core cold water habitat. There is no salmon and steelhead spawning use identified for McGuire Creek, even after the removal of a small hydroelectric dam on Odell Creek (Rod French, personal communication). Data collected by ODEQ in 2002 at five locations on McGuire Creek indicates that the creek was well below the core cold water habitat criterion. McGuire Creek is not listed as impaired on the 303(d) list.

Flow Data. The average dry-weather design flow for the facility is 0.03 MGD (0.05 cfs). Measured flows of the current cooling water discharge ranged from 0.001 MGD (February and March, 2014) to 0.004 MGD (August and September, 2014) for the period October 2013-November 2014. However, since the facility is still operating under their existing permit, this TMDL analysis uses the permitted design flow of 0.03 MGD. An alternative WLA was developed assuming the discharge of cooling water alone, using a design flow of 0.004 MGD.

Little data exists on flows in McGuire Creek. ODEQ took field measurements in 1998, 2002 and 2005, for a total of 5 measurements. The flows ranged from 1.6 cfs to 3.9 cfs. There was not enough data available to calculate the 7Q10 low flow or an alternative upstream low flow estimate. To be conservative, the lowest flow of 1.6 cfs (10/19/05) was used for this analysis to represent Q_R in Equations 2-7.

4.1.2.2 Odell Wastewater Treatment Plant

Odell Sanitary District owns and operates a secondary wastewater treatment facility that serves the community of Odell. The sanitary district upgraded their wastewater treatment facility to a membrane bioreactor system in 2008. Odell's new sewage treatment facility utilizes an advance activated sludge membrane filtration system to treat domestic wastewater. The treatment facility discharges treated effluent to Odell Creek at river mile 1.1 on a year-round basis (**Figure B-2**). Biosolids generated by the facility are land applied on approved sites.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-6** and **Table D-4**.

Temperature Data. Continuous hourly effluent temperature data have been collected by staff at the Odell WWTP since late 2009, and daily maximum values are reported on DMRs. For this TMDL analysis, the 7DADM statistic was calculated for effluent data collected in 2010-2014. The maximum 7DADM for each month was used to represent T_E in Equations 3-7. This ranged from 14.6°C in February to 22.5°C in August.

Refer to the temperature data section above under the Odell Creek watershed for a discussion of temperature criteria and conditions in Odell Creek.

Flow Data. The average dry-weather design flow for the facility is 0.42 MGD (0.65 cfs). This represents a change from the 2001 WHS TMDL, where the permitted flow was 0.50 MGD (0.77 cfs).

There was not enough data available to calculate the 7Q10 low flow. However, since 2010, flow data has been recorded for Odell Creek by staff at the Odell WWTP using a staff gauge located just above the discharge point. A rating curve was developed for this gauge and daily flows are estimated based on one daily reading of the gauge. This data is provided to ODEQ on DMRs. Data from 2010-2014 were used in an alternative approach for calculating upstream low flow values to represent Q_R in Equations 3-7:

- The minimum flow was determined for each month from 2010-2014.
- These minimum flows were then averaged by month for this five year period to represent Q_R. The low flow ranged from 3.2 cfs in November to 14.1 cfs in April. The average low flow during the critical period was 8.5 cfs in September (core cold water habitat season) and 11.6 cfs in May (spawning season).

4.1.3 Neal Creek Watershed

Although none of the facilities currently discharge into Neal Creek, flow and temperature data were compiled for Neal Creek in order to evaluate the cumulative effect of the five facilities which discharge in the watershed (**Figure B-3**). This data was also used to develop alternative WLAs for the Terminal Ice and Duckwall-Pooley facilities in the event that either facility decides to pipe their discharge directly to Neal Creek.

Temperature Data. Under the 2003 temperature standard, the applicable temperature criteria for Neal Creek are 18.0°C for salmon and trout rearing and migration and 13.0°C for salmon and steelhead spawning use (October 15-May 15). In recent years, temperature data has been collected at the mouth of Neal Creek (Eineichner and Saunders, personal communication) and upstream of the un-named Pine Grove tributary (Mallon, personal communication). Data from 2009-2014 was evaluated for this analysis. The rearing criterion was exceeded in some years in July and early August; the spawning criterion was exceeded in early May (**Figure 6**). While the spawning criterion was not exceeded after October 15th based on available data, it came very close to being exceeded in 2014. There are Category 4A 303(d) listings for salmonid fish rearing in Neal Creek from the mouth to river mile 5.6 (the confluence of the West and East Forks) (**Table 2**).

Flow Data. There is not a long-term gauge on Neal Creek to calculate 7Q10 low flows. However, flow data has been collected at the mouth of Neal Creek by a consortium of stakeholders and compiled by the Confederated Tribes of Warm Springs (McKim, personal communication). Data from 2007-2014 was evaluated to develop an alternative approach for calculating upstream low flow values to represent Q_R in Equations 2-7:

- The frequency of data collection was evaluated. Data was only used in this TMDL analysis for months where data was collected at least once per week. Beginning in 2012, data has been collected hourly.
- The minimum flow was determined for each month or two-week period (two-week period in May and October because of the mid-month break in spawning season).
- These minimum flows were then averaged by month or two-week period to represent Q_R. The low flows ranged from 7.6 cfs in November to 38.6 cfs in April. Low flow during the critical period was 10.3 cfs in the last two weeks of October (spawning season) and 14.2 cfs in the first two weeks of Ocrtober (rearing season.
- Because this measurement point is downstream of all of the discharges, the permitted flows from the applicable facilities was subtracted from the Neal Creek flows to determine Q_R to be used in the different WLA analyses. This resulted in slightly different flows represented in the WLA tables in **Appendices C** and **D**.

4.1.3.1 Mt. Hood Forest Products (formerly Quality Veneer and Lumber, Inc.)

This facility was owned and operated by Quality Veneer and Lumber, Inc. until the plant was sold to Mt. Hood Forest Products in 2001. The facility holds two general NPDES permits: a 400J permit for log ponds/log decks and a 1200Z permit for industrial stormwater. Under the 400J permit, discharge is only allowed from November 1 through April 30 with a minimum of 50:1 dilution required at all times of discharge.

Both discharges for this facility pass through vegetated bioswales designed to facilitate water retention before entering a ditch which runs through and alongside the log yard. During the irrigation season, the ditch carries flow which is diverted from the East Fork Hood River by the East Fork Irrigation District. During the non-irrigation season, flow in the ditch is comprised primarily of runoff and water from springs which enter the ditch just downstream of the log yard. Downstream of the log yard, the ditch is called an unnamed creek which joins West Fork Neal Creek approximately one mile below the facility

(**Figure B-3**). West Fork Neal Creek joins East Fork Neal Creek approximately 1.7 miles further downstream to form Neal Creek.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-8**.

Temperature Data. Maximum weekly log pond effluent temperatures (based on grab samples) are reported on the DMRs for 2013-2014. To be conservative, the maximum values for each month were used to represent T_E in Equations 3-7. Maximum monthly effluent temperatures ranged from 7.8°C in January to 14.4°C in February. The facility is not required to monitor temperature of their industrial stormwater discharge.

Under the 2003 temperature standard, the applicable temperature criterion for the ditch and the un-named creek is 18.0°C for salmon and trout rearing and migration. There is no salmon and steelhead spawning use identified for either waterbody, although salmon and steelhead spawning use (13.0°C) is identified for West Fork Neal Creek from October 15-May 15. Temperature data collected by the Hood River Watershed Group (Saunders, personal communication) was evaluated for this analysis at the mouth of the un-named creek (2009-2011),West Fork Neal Creek downstream of the un-named creek (2007, 2009, 2010-2011), and mouth of West Fork Neal Creek (2007, 2009, 2010-2011). Temperatures at the mouth of West Fork Neal Creek and the mouth of the un-named creek slightly exceeded the 18.0°C criterion in late July and early August in 2009; otherwise temperatures were below the applicable criteria at all three sites. Neither the West Fork Neal Creek or the un-named creek are listed as impaired on the 303(d) list.

Flow Data. There was not enough data available to calculate the 7Q10 low flow or an alternative upstream low flow estimate for the ditch. The facility is required to measure or estimate ditch and log pond discharge flows on the DMRs they submit to ODEQ from November-April. Data from 2013-2014 was used in this analysis. To be conservative, for each month, flow data from the day with the lowest dilution ratio was used to represent Q_R in Equations 3-7. The lowest dilution reported for this two year period was 70:1. No flow rates were reported for this facility in the 2001 WHS TMDL. The facility is not required to monitor flow of their industrial stormwater discharge.

4.1.3.2 Terminal Ice and Cold Storage (formerly Diamond Fruit Growers Van Horn)

The Terminal Ice and Cold Storage Company (Terminal Ice) and the Duckwall-Pooley Fruit Company Van Horn facilities both discharge in to a ditch which runs along the railroad tracks through the Van Horn community (**Figure B-4**). The two facilities discharge within a couple hundred feet of each other and appear to form the “headwaters” of the ditch, making it an effluent dominated ditch until it is joined by other surface waters, including water from adjacent orchards. The ditch runs along the west side of the railroad tracks for approximately 600 yards before going underneath Highway 35. Underneath the highway, the ditch combines with flows from an un-named creek coming out of the Pine Grove area and another ditch which runs along the east side of the railroad tracks. The un-named creek then flows several hundred yards before its confluence with Neal Creek. The point where the un-named creek enters Neal Creek is several hundred yards upstream of the Dethman Ridge Dr. crossing (river mile 1.5). In the event that either facility might decide to discharge directly to the un-named creek rather than the ditch, temperature and flow information is provided for both possible receiving waters.

The Terminal Ice facility was owned and operated under a permit held by Diamond Fruit Company until the facility’s permit was transferred to Terminal Ice and Cold Storage in 2005. Although the permit authorizes the discharge of fruit processing wastewater to waters of the state, Terminal Ice does not discharge at this time. Even though Terminal Ice is not currently discharging to waters of the state, wasteload allocations were developed for the facility because they have expressed a desire to maintain their current permit (Jon Morrill, personal communication to Jayne West) so they could begin discharging at any time.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-9,** and **Table D-6** through **Table D-10**.

Temperature Data. Maximum weekly effluent temperatures (based on grab samples) were reported on DMRs from 2006-2008. The maximum values for each month were used to represent T_E in Equations 3-7. Temperatures ranged from 19.4°C to 21.1°C.

Under the 2003 temperature standard, the applicable temperature criterion for the ditch and the un-named creek is 18.0°C for salmon and trout rearing and migration. There is no salmon and steelhead spawning use identified for either waterbody. Data was collected by ODEQ in 2002 and 2003. Temperatures for the two possible receiving waters are described below. Neither the ditch or the un-named creek is listed as impaired on the 303(d) list.

- *Ditch*. Data at the mouth of the ditch was collected by ODEQ from 8/28/02-10/07/02. During this time, the rearing criterion was exceeded through the end of September.
- *Un-named creek*. Data at the mouth of the creek was collected by ODEQ in 2002 and 2003. During these two years the rearing criterion was exceeded from the middle of July through early August.

Flow Data. The permitted flow for the facility is 0.12 MGD (0.19 cfs).

Flow data for the two different possible receiving waters is described below. There was not enough data available to calculate the 7Q10 low flow or an alternative upstream low flow estimate for either of them.

- *Ditch*. Terminal Ice and Duckwall-Pooley discharge into a ditch which does not appear to have any other regular flow. Therefore the receiving stream low flow used in this analysis to represent Q_R in Equations 3-7 was 0 cfs.
- *Un-named creek*. ODEQ collected two flow measurements in the un-named creek in October 2005 (1.0 cfs) and September 2005 (1.5 cfs). To be conservative, the lowest flow of 1.0 cfs was used to represent Q_R in Equations 2-7.

4.1.3.3 Duckwall-Pooley Fruit Company – Van Horn Cold Storage

Duckwall-Pooley Fruit Company operates a cold storage facility (Duckwall-Pooley Van Horn) in the community of Van Horn under an individual NPDES permit for non-contact cooling water. The facility's operational season is typically from late August until the end of December, although some discharge can occur during other times of the year. The facility’s NPDES permit allows them to discharge year-round. This facility presently discharges non-contact cooling water to the ditch along the railroad tracks (**Figure B-4**), as described for the Terminal Ice facility.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-10**, and **Table D-11** through **Table D-15**.

Temperature Data. Continuous hourly effluent temperature data have been collected by staff at the Duckwall-Pooley Van Horn facility since 2011 and reported to ODEQ. For this TMDL analysis, the 7DADM statistic was calculated for effluent data collected in 2011-2014. The maximum 7DADM for each month was used to represent T_E in Equations 3-7. Temperatures ranged from 19.7°C in March to 26.6°C in August.

The applicable temperature criterion and available data are as described above in **Section 4.1.3.2** for the Terminal Ice facility.

Flow Data. The permitted flow for the facility is 0.04 MGD (0.06 cfs).

Flow data for the two different possible receiving waters is described above in **Section 4.1.3.2** for the Terminal Ice facility.

4.1.3.4 Diamond Fruit Growers – Central Facility

The Diamond Fruit Growers Central facility (Diamond-Central) is located in the community of Odell. The facility operates year round and processes both pears and cherries for packing. Their NPDES permit allows discharge of fruit processing wastewater to Lenz Creek at approximately river mile 1.8 (**Figure B-5**). Diamond-Central essentially discharges into the headwaters of Lenz Creek. In addition to the Diamond-Central discharge, there are several other sources of water that all come together at Lingren Rd. From this point downstream, the combined waters are identified as Lenz Creek. Duckwall-Pooley Fruit Company discharges into Lenz Creek about one-tenth of a mile below Lingren Rd.

Cherry processing occurs between June and August and consists mainly of a rinse with domestic water and cold storage. Diamond Central produces 175,000 boxes of cherries during the packing season. Pears are processed mostly in late August and September.

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-11**.

Temperature Data. Diamond-Central reported maximum monthly effluent temperatures on their DMRs from 2007-2011. Beginning in October 2012, they began collecting continuous temperature data and reporting the week-day daily maximum temperatures on their DMRs. Daily maximum data for every day of the week was provided beginning in May 2014. To represent T_E in Equations 3-7, monthly maximum data was used for January-April based on data from 2007-2014. The 7DADM statistic was used for May-December based on data provided in 2014. Temperatures ranged from 11.4°C in February to 21.0°C in August.

Under the 2003 temperature standard, the applicable temperature criterion for Lenz Creek at the point of discharge is 18.0°C for salmon and trout rearing and migration. A spawning season (October 15-May 15) is identified for Lenz Creek from the mouth up to approximately rivermile 1.4. A number of springs enter Lenz Creek at this point, resulting in spawning habitat from this point downstream. ODEQ collected temperature data at a number of locations along Lenz Creek in 2002 (May 1-Oct 15). This data indicated that the temperature in Lenz Creek downstream of the springs was well below both the spawning and rearing criteria during the appropriate seasons of use. Data collected by ODEQ (2002) and Duckwall-Pooley Fruit Company (2011-2014) in Lenz Creek at several locations between the springs and the headwaters indicate that, depending on the year, the rearing criterion has been exceeded from early July through the middle of August. Lenz Creek is not listed as impaired on the 303(d) list during either the spawning or rearing seasons.

Flow Data. The average dry-weather design flow for the facility is 0.09 MGD (0.14 cfs).

There is not a long-term gauge on Lenz Creek to calculate 7Q10 low flows. However, daily flow data has been collected by Duckwall-Pooley Fruit Company in Lenz Creek directly above their point of discharge (see **Section 4.1.3.5** for more information). Data from 2013-2014 were used in an alternative approach for calculating upstream low flow values to represent Q_R in Equations 3-7:

- The minimum flow was determined for each month for 2013-2014.

- Because this measurement point is downstream of the Diamond-Central discharge, the permitted flows from the facility was subtracted from the measured Lenz Creek flows to determine Lenz Creek flows above the Diamond-Central discharge.
- These minimum flows were then averaged by month for this two year period to represent Q_R. Using this approach, receiving stream low flows ranged from 0 cfs (July, September to December) to 0.7 cfs in January. Low flow during the critical period was 0 cfs in July, September and October.

4.1.3.5 Duckwall-Pooley Fruit Company – Odell Facility

Duckwall-Pooley Fruit Company operates a fresh fruit packing plant and storage facility (Duckwall-Pooley Odell) in the community of Odell. The facility typically operates from mid-August through early June, packing pears for wholesale. The company packs approximately one and a half million boxes of pears in a given year. Their NPDES permit allows discharge of fruit processing wastewater to Lenz Creek at approximately rivermile 1.7 (**Figure B-5**).

A summary of the temperature and flow data described below and used in this TMDL analysis is included in **Table C-12**.

Temperature Data. The Duckwall-Pooley Fruit Company has collected continuous temperature data of their effluent discharge into Lenz Creek since 2011 and reported it to ODEQ.. For this TMDL analysis, the 7DADM statistic was calculated for effluent data collected from 2011-2014. The maximum 7DADM for each month was used to represent T_E in Equations 3-7. Temperatures ranged from 10.0°C in January to 17.0°C in June.

The applicable temperature criterion and available data for Lenz Creek is as described above in **Section 4.1.3.4** for Diamond-Central.

Flow Data. The average dry-weather design flow for the facility is 0.25 MGD (0.39 cfs).

There is not a long-term gauge on Lenz Creek to calculate 7Q10 low flows. However, the Duckwall-Pooley Fruit Company has been collecting continuous flow data in Lenz Creek directly above their point of discharge since 2011. Because stream flows in the creek can be quite low during summer months, the creek can get choked with vegetation, which has interfered with the data recorder, often resulting in negative flows in the creek. Data from 2013-2014 were used in an alternative approach for calculating upstream low flow values to represent Q_R in Equations 3-7:

- The minimum flow was determined for each month for 2013-2014.
- These minimum flows were then averaged by month for this two year period to represent Q_R. Using this approach, Lenz Creek low flows ranged from 0.1 cfs in July and October-December to 0.9 cfs in January. Low flow during the critical period was 0.1 cfs in July and October.

4.1.4 Mainstem Hood River Watershed

Flow and temperature data were compiled for Hood River in order to evaluate the critical period for the TMDL revision **(Figure 3**) as well as to evaluate a possible alternative discharge scenario for the facilities located in the community of Odell, if they were to switch their points of discharge to Hood River.

Temperature Data. Under the 2003 temperature standard, the applicable temperature criteria for Hood River are 16.0°C for core cold water and 13.0°C for salmon and steelhead spawning use (October 1-June 15). As described in **Section 3**, exceedance of the salmon and steelhead spawning criterion was observed from May 10-June 15 at the former Powerdale Dam site; exceedance of the core cold water habitat criterion was observed from June 18-September 14 at either the Powerdale Dam site or at the mouth of the Hood River. There are Category 4A 303(d) listings for salmonid fish rearing in the Hood River from the river mile 1.5 to river mile 14.6 (**Table 2**).

Flow Data. The 7Q10 low flow could be calculated for Hood River based on data collected at the USGS Gage Station at Tucker Bridge (USGS Gage #14120000, approximately river mile 6). The 7Q10 low flow was calculated by season (1983-2012) and used to represent Q_R: 185 cfs during the core cold water season and 235 cfs during the spawning season.

4.1.4.1 Hood River Recycling and Transfer Station

The Hood River Recycling and Transfer Station is located on Guignard Drive in Hood River. The facility has an industrial stormwater (1200-Z) permit for discharge to an unnamed tributary to Indian Creek. The transfer station site consists of a four building complex that includes an office and maintenance shop, a solid waste transfer building, a recycling depot and a prefabricated, household hazardous waste storage unit. Site stormwater is collected in catch basins and travels underground to eventually discharge through an outfall to a heavily vegetated, unnamed, intermittent creek at the southeast corner of the site. This unnamed creek meanders to the north where it combines with another drainage way from a nearby golf course. The unnamed creeks are not listed as impaired (**Table 2**). These combined drainages eventually discharge into Indian Creek at approximately river mile 1.4. This reach of Indian Creek is listed as impaired (**Table 2**). The Hood River Recycling and Transfer Station is not required to collect flow or temperature data.

4.2 Nonpoint Sources of Heat

This revised TMDL does not identify new nonpoint sources of heat other than those described in the 2001 WHS TMDL. Removal or disturbance of riparian vegetation, reduced summertime base flow, and channel modifications and widening continue to be potentially significant nonpoint sources of thermal warming. Section 4.5.3 in the 2001 WHS TMDL provides an extensive discussion of nonpoint sources of pollution, including information about current and potential vegetation conditions. For easier reference, this section of the 2001 document is included in this revision as **Appendix G**.

The 2001 WHS TMDL evaluated the thermal discharges associated with two dams – the Powerdale Hydroelectric Project located on the Hood River and the dam at Laurance Lake Reservoir on Clear Branch. The Powerdale Hydroelectric Project no longer exists, with Powerdale Dam removed in 2010. This dam is therefore not included in this revision. Laurance Lake Reservoir still exists and is included in this revision.

4.2.1 Laurance Lake Reservoir

As described in the 2001 WHS TMDL (Section 4.5.4.3), Middle Fork Irrigation District operates the dam at Laurance Lake Reservoir (**Figure 8**) for irrigation and hydropower purposes. The dam creates an impoundment of Clear Branch. Within a mile below the dam, Clear Branch combines with Coe Branch and Eliot Branch to form the Middle Fork Hood River. Bull trout are found in Clear Branch, Coe Branch, and Middle Fork Hood River. Recent data for Clear Branch and Laurance Lake was evaluated for this TMDL revision. This information is presented here and in **Section 3** and replaces Section 4.5.4.3 in the 2001 WHS TMDL.

Temperature Data. MFID and the Hood River Watershed Group have collected continuous temperature data on Clear Branch (above and below the reservoir) since 2007 (Saunders, personal communication). Thermistors are typically deployed in mid-late May and retrieved in early November, although thermistors were left out until the end of the year in 2014. For this TMDL analysis, temperature data were evaluated for the period 2007-2014 (**Figure 7**). During this time, the bull trout spawning and juvenile rearing criterion of 12°C was exceeded in Clear Branch below the dam most years at some point between early May and early August. Exceedances typically occurred during times when the reservoir was spilling surface water.

Flow Data. MFID collects continuous flow data at an old USGS gage site on Clear Branch dam below Laurance Lake. The 7Q10 low flow was calculated (Ed Salminen, Watershed Professionals Network, personal communication), by season, for Clear Branch below the dam using data for the period 1993-2009. The 7Q10 statistic during this period was 4.3 cfs for August 15-May 15 and 3.9 cfs for May 16-August 14 (**Table 1**).

Inflow to the lake is not currently measured, although inflows can be calculated from flow at the gage below the dam, the amount of water diverted by MFID, and the change in lake storage (Ed Salminen, Watershed Professionals Network, personal communication). Based on this calculation, the 7Q10 statistic for water flowing into the lake for the period 1993-2009 was 11.8 cfs for August 15-May 15 and 15.4 cfs for May 16-August 14. These calculations include inflow from both Clear Branch and Pinnacle Creek. The Laurance Lake Temperature Model report (Berger, et.al., 2005) indicates that Clear Branch represents 70%-80% of the inflow to Laurance Lake.

5. Loading Capacity

Loading capacity specifies the amount of pollutant a waterbody can receive and still meet water quality standards. For temperature TMDLs, the loading capacity is the sum of background sources of thermal load, allowable nonpoint source thermal load (Load Allocations), allowable point source thermal load (Wasteload Allocations), and thermal load included in a margin of safety and held as a reserve capacity for future sources. The generalized loading capacity equation is shown in Equation 1:

EQ 1. $Loading\ Capacity = LA_B + LA_{NPS} + WLA + MOS + RC$

Where:

LA_B = Background load allocations
LA_{NPS} = Nonpoint source load allocations
WLA = Wasteload allocations
MOS = Margin of safety
RC = Reserve capacity

This is the same general definition of loading capacity that was included in the 2001 WHS TMDL; however, loading capacity was not explicitly calculated in the earlier TMDL. In this revision, a method for calculating loading capacity is presented and the loading capacity is calculated for watersheds with impaired streams or streams with point source discharges.

Loading capacity in this TMDL is expressed as a thermal load in gigacalories[2] (gcal) per day and is calculated as the product of a conversion factor, the river flow, and the applicable temperature criteria plus the small increase in temperature provided with the human use allowance (Equation 2). Refer to **Section 7** for further discussion of the human allowance.

EQ 2. $LC = (T_C + HUA) \cdot Q_R \cdot C_F$

[2] 1 gigacalorie = 1,000,000 kilocalories

Where:

- LC = Loading capacity (gcals/day)
- T_C = The applicable temperature criterion (ºC)
- HUA = The 0.3ºC human use allowance allocated to point sources, nonpoint sources, margin of safety, and reserve capacity (ºC)
- Q_R = The daily average river flow rate (cfs)
- C_F = Conversion factor for calculating gcals/day from ºC-ft^3: (2.446665 gcal-s / ºC-ft^3-day)

The loading capacity at low stream flow was calculated for impaired streams or streams with point sources discharges using Equation 2 (**Table 9**). The stream flows (Q_R) presented in **Table 9** represent estimated low flows by season at the mouth of each stream. Because most of these streams do not have flow gage stations, low flows were estimated from either 7Q10 data for the Hood River or West Fork Hood River USGS gage stations (**Table 1**) or from stream specific data (**Section 4)**. If a gage stations was used as the data source, the low flow estimates were computed using the drainage area ratio method (Ries 2007, Risley 2009, and Gianfagna 2015). Draingage area estimates were made using the USGS StreamStats tool (https://streamstats.usgs.gov/ss/). The drainage area ratio method is based on the assumption that the streamflow for any given location can be estimated by the product of the stream flow at a reference gauging station and the ratio between the drainage areas for the site of interest and the gage. Sometimes a weighting factor is used when the drainage area ratio of the two sites is not between 0.5 and 1.5. For these estimates, no weighting factors were used. The selection of the gaging station to use for a given stream was determined based on geographic location and glacial (or non-glacial) nature of the stream.

The loading capacity presented in **Table 9** reflects the loading capacity at low flows. Because loading capacity at any given time will vary based on stream flow, Equation 2 should be used to calculate the loading capacity at other stream flows. **Figure 9** shows the loading capacity at different stream flows for each applicable criteria.

Table 9. Loading capacity for impaired streams or streams with point source discharges at estimated low stream flows

(Loading capacity calculated at the mouth of each stream)

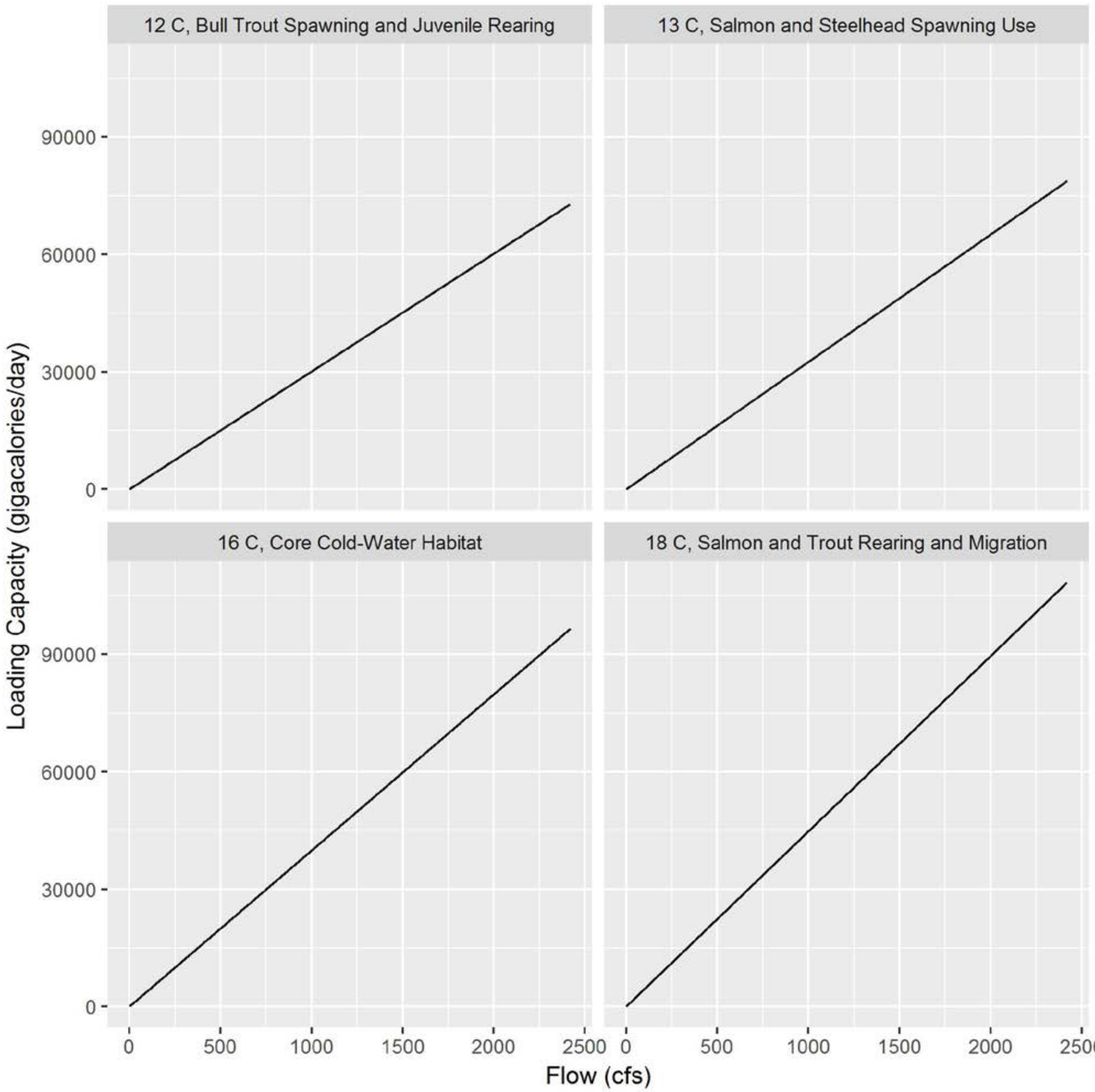
Stream	Source of Flow Data*	T_C[1] (ºC)	HUA[2] (ºC)	Q_R[3] (cfs)	LC[4] (gcal/day)
Clear Branch	Tucker Bridge Gage	12.0	0.3	10.6	319
East Fork Hood River	Tucker Bridge Gage	18.0	0.3	50	2239
East Fork Hood River	Tucker Bridge Gage	13.0	0.3	125	4068
Hood River	Tucker Bridge Gage	16.0	0.3	225	8973
Hood River	Tucker Bridge Gage	13.0	0.3	286	9307
Indian Creek	West Fork Hood River Gage	18.0	0.3	6.1	273
Lake Branch	West Fork Hood River Gage	16.0	0.3	34.4	1372
Lake Branch	West Fork Hood River Gage	13.0	0.3	28.0	911
Lenz Creek	Tucker Bridge Gage	18.0	0.3	2.2	99
Lenz Creek	Tucker Bridge Gage	13.0	0.3	2.9	94
McGuire Creek	Stream-specific data	16.0	0.3	1.6	64
Middle Fork Hood River	Tucker Bridge Gage	12.0	0.3	27.5	828
Neal Creek	Stream-specific data	18.0	0.3	14.2	636
Neal Creek	Stream-specific data	13.0	0.3	10.3	335
Odell Creek	Stream-specific data	16.0	0.3	8.4	335
Odell Creek	Stream-specific data	13.0	0.3	8.3	270
Trout Creek	West Fork Hood River Gage	18.0	0.3	5.8	260
Un-named Pine Grove creek	Stream-specific data	18.0	0.3	1.0	45
Un-named creek (Robinhood Cr.)	West Fork Hood River Gage	18.0	0.3	7.3	327
Un-named creek (Robinhood Cr.)	West Fork Hood River Gage	13.0	0.3	3.3	107
Un-named creek (tributary to West Fork Neal Creek)	Neal Creek (stream-specific data)	18.0	0.3	1.0	45
West Fork Hood River	West Fork Hood River Gage	16.0	0.3	113	4507
West Fork Hood River	West Fork Hood River Gage	13.0	0.3	92	2994
West Fork Neal Creek	Neal Creek (stream-specific data)	18.0	0.3	4.8	215
West Fork Neal Creek	Neal Creek (stream-specific data)	13.0	0.3	3.5	114
Whiskey Creek	West Fork Hood River Gage	18.0	0.3	4.3	193
Wishart Creek	West Fork Hood River Gage	18.0	0.3	1.4	63

* Flow estimates were based on the best available information for flows at the mouth of each stream. In most cases, 7Q10 flow information from the flow gages at Hood River at Tucker Bridge (USGS #14120000) or West Fork Hood River near Dee (USGS #14118500) were used to estimate low flows based on watershed area comparisons. Where stream-specific data was available at the mouth of the stream, flow estimates were based on this data, as described in **Section 4**.

Table Notes:

1. T_C = Applicable temperature criterion (ºC)
2. HUA = Human use allowance (ºC)
3. Q_R = Low stream flow estimate (cfs)
4. LC = Loading capacity (gcal/day)

Figure 9. Loading capacity as a function of flow



6. Excess Load

This section evaluates, to the extent existing data allow, the difference between the actual pollutant load in a waterbody and the loading capacity of that waterbody. The 2001 WHS TMDL did not include a section on Excess Load. Because of the limited flow data available in the Western Hood Subbasin, excess load is presented here **(Table 10**) as the difference between the applicable numeric criteria plus the human use allowance and the measured instream temperature, rather than as a difference in actual load. Excess load information is presented for the impaired streams listed in **Table 2** and **Table 3**, where recent temperature data was available.

Table 10. Excess load for streams identified as impaired (Table 2 and Table 3)

Stream	Location (years of available data)	T_C plus HUA[1] (ºC)	Exceedance Period	Excess Load[2] Maximum (ºC)	Excess Load[2] Mean (ºC)
Clear Branch	Upstream of Coe Branch (2007-2014)	12.3	May 11 – Aug 4	4.2	1.3
Clear Branch	Upstream of Laurance Lake (2007-2014)	12.3	No exceedances	--	--
East Fork Hood River	Upstream of Trout Creek (2007, 2009, 2012-2014)	18.3	July 1 – Aug 22	2.0	0.8
		13.3	May 9 – May 13	0.7	0.4
Hood River	Powerdale Dam site (2007-2014)	16.3	June 27 – Sept 1	0.8	2.3
		13.3	May 28 – June 15	0.9	1.7
Indian Creek	No available data				
Lake Branch	No available data				
Lenz Creek	Upstream of Duckwall-Pooley discharge (2011-2014)	18.3	July 8 – Aug 16	3.4	1.7
Middle Fork Hood River*	Red Hill Rd (2009-2014)	12.3	May 1 – Sept 30	4.8	2.3
Neal Creek	Mouth (2009-2015)	18.3	Jul 30 – Aug 5	0.8	0.5
		13.3	May 7 – May 15	1.8	1.3
Odell Creek	Mouth (2010-2012)	16.3	July 10 – Aug 31	1.2	0.6
		13.3	April 24 – May 15	0.4	0.3
Un-named Pine Grove tributary	Mouth (2002, 2003)	18.3	July 13 – Aug 3	0.5	0.3
Un-named creek (Robinhood Cr)	No available data				
Un-named creek, tributary to West Fork Neal Creek	Mouth (2009-2011)	18.3	No exceedances	--	--
West Fork Hood River*	Lost Lake Rd (~RM 4.5) (2006-2014)	16.3	No exceedances	--	--
		13.3	No exceedances	--	--
West Fork Neal Creek	Mouth (2007, 2009, 2010-2011)	18.3	July 31 – Aug 4	0.5	0.4
		13.3	No exceedances	--	--
Whiskey Creek	No available data				

* Data from long-term monitoring sites maintained by the Confederated Tribes of Warm Springs, not described elsewhere in this report.

Table Notes:

1. T_C = Applicable temperature criterion (ºC); HUA = Human use allowance
2. Excess load is presented here as the difference between the applicable numeric criteria plus the human use allowance and the measured instream temperature

7. Allocations

This section provides a discussion of the allocations of the loading capacity, by sector. **Section 7.1** and **Section 7.2** provide information on the methods and equations used to develop wasteload allocations and load allocations, respectively. The margin of safety and reserve capacity are discussed further in **Section 8** and **Section 9**, respectively.

In the 2003 temperature standard, heat available for human use is based on an allowable 0.3°C temperature increase after complete mixing with the waterbody, and at the point of maximum impact, relative to the applicable biologically based numeric temperature criterion. In this TMDL revision, the human use allowance is split between sources, including 10% as a margin of safety, as shown in **Table 11**. The nonpoint source HUA apportionment may be used by any of the nonpoint source sectors, including agriculture, forestry, urban development, irrigation, or as part of a thermal load trading program. If no point sources discharge into a waterbody, this additional portion of the HUA will revert to Reserve Capacity.

Table 11. Allocation of the Human Use Allowance (0.3°C or 0.54°F)

Source	Portion of the Human Use Allowance	Allowed Temperature Increase
Nonpoint Sources	15%	0.045°C (0.081ºF)
NPDES Point Sources and Laurance Lake	60%	0.180°C (0.324ºF)
Reserve Capacity*	15%	0.045°C (0.081ºF)
Margin of Safety	10%	0.030°C (0.054ºF)

*The amount available for reserve capacity could vary by waterbody and depend on whether or not there are already point source discharges.

Based on the distribution of the human use allowance presented in **Table 11**, the thermal load allocation for each sector was calculated for the watersheds included in **Table 9**. The results are shown in **Table 12**. **Table 12** includes the background load and loading capacity to show that the various components of the TMDL meet the loading capacity. Because the loading capacity was calculated at the mouth of each stream, the WLA presented in **Table 12** may not always align with the WLA presented in **Section 7.**1. As is explained in **Section 7.1**, the WLA for each facility was based on the point of discharge or the appropriate cumulative effects analysis, which was not always at the mouth of the stream. The load allocation for Laurance Lake Reservoir is not included in **Table 12**, but is rather treated separately in **Section 7.2.3**.

Table 12. Allocations for impaired streams and streams with point source discharges at estimated low stream flows

Stream	T_C[1] (ºC)	Q_R[2] (cfs)	LC[3] (gcal/day)	WLA[4] (gcal/day)	LA_B[5] (gcal/day)	LA_{NPS}[6] (gcal/day)	MOS[7] (gcal/day)	RC[8] (gcal/day)
Clear Branch	12.0	10.6	319	0.0*	311	1.2	0.8	5.8
East Fork Hood River	18.0	50	2239	22**	2202	5.5	3.7	5.5
East Fork Hood River	13.0	125	4068	55**	3976	14	9.2	14
Hood River	16.0	225	8973	99**	8808	25	17	25
Hood River	13.0	286	9307	126**	9097	31	21	31
Indian Creek	18.0	6.1	273	2.7**	269	0.7	0.4	0.7
Lake Branch	16.0	34.4	1372	0.0*	1347	3.8	2.5	19
Lake Branch	13.0	28.0	911	0.0*	891	3.1	2.1	15
Lenz Creek	18.0	2.2	99	1.0**	97	0.2	0.2	0.2
Lenz Creek	13.0	2.9	94	1.3**	92	0.3	0.2	0.3
McGuire Creek	16.0	1.6	64	0.7	63	0.2	0.1	0.2
Middle Fork Hood River	12.0	27.5	828	0.0*	807	3.0	2.0	15
Neal Creek	18.0	14.2	636	6.3	625	1.6	1.0	1.6
Neal Creek	13.0	10.3	335	4.5	328	1.1	0.8	1.1
Odell Creek	16.0	8.4	335	3.7**	329	0.9	0.6	0.9
Odell Creek	13.0	8.3	270	3.7**	264	0.9	0.6	0.9
Trout Creek	18.0	5.8	260	2.6**	255	0.6	0.4	0.6
Un-named Pine Grove creek	18.0	1.0	45	0.4	44	0.1	0.1	0.1
Un-named (Robinhood Cr.)	18.0	7.3	327	0.0*	321	0.8	0.5	4.0
Un-named (Robinhood Cr.)	13.0	3.3	107	0.0*	105	0.4	0.2	1.8
Un-named creek (tributary to W. Fork Neal Ck)	18.0	1.0	45	0.4**	44	0.1	0.1	0.1
West Fork Hood River	16.0	113	4507	0.0*	4424	12	8.3	62
West Fork Hood River	13.0	92	2994	0.0*	2926	10	6.8	51
West Fork Neal Creek	18.0	4.8	215	2.1**	211	0.5	0.4	0.5
West Fork Neal Creek	13.0	3.5	114	1.5**	111	0.4	0.3	0.4
Whiskey Creek	18.0	4.3	193	0.0*	189	0.5	0.3	2.4
Wishart Creek	18.0	1.4	63	0.6	62	0.2	0.1	0.2

* Because there are no point source discharges in this watershed, all of this WLA reverts to the reserve capacity.

** Because existing point source discharges in this watershed do not use all of this WLA, a portion of this allocation reverts to the reserve capacity.

Table Notes:

1. T_C = Applicable temperature criteria (ºC)
2. Q_R = Low stream flow estimate (cfs)
3. LC = Loading capacity (gcal/day)
4. WLA = Wasteload allocation (gcal/day)
5. LA_B = Background load allocation (gcal/day)
6. LA_{NPS} = Nonpoint source load allocation (gcal/day)
7. MOS = Margin of safety (gcal/day)
8. RC = Reserve capacity (gcal/day)

7.1 Wasteload Allocations

The methodology used to develop wasteload allocations for facilities with individual NPDES permits and the general 400J NPDES permit for log ponds/log decks is similar to that used in the 2001 WHS TMDL. The following summarizes the changes made in the WLA approach:

1. The biologically-based numeric criteria and spawning seasons identified in the 2003 temperature standard (**Table 6**) replace the criteria and spawning seasons used in the 2001 WHS TMDL. The applicable criteria that apply for each discharge are included in the Reasonable Potential Analysis tables included in **Appendix C** and **Appendix D**.
2. In the 2001 WHS TMDL, the "no measureable" increase in stream temperature allowed for point sources was 0.25°F (0.14°C) at the edge of a facility's mixing zone. This has been replaced by 0.18°C (0.324°F), a portion of the human use allowance of 0.30°C (0.54°F). The specifics of the portion of the HUA used for each facility and in cumulative effects analyses are described in **Sections 7.1.1-7.1.3**.
3. The 2001 WHS TMDL used 25% of the stream flow for calculations. The current analysis includes cumulative effects analyses, so WLAs were based on 100% of the stream flow (OAR 340-041-0028 (12)(b)(B). The 2001 WHS TMDL did not include CEAs.
4. In the 2001 WHS TMDL (Table 12), critical periods when numeric criteria were exceeded were defined for each stream and each facility based on data collected in 1998. The critical periods spanned May through September for most streams and was year-round for Clear Branch below Laurance Lake. In this revision, the critical period is defined broadly for the Hood River Subbasin based on the evaluation of data for the Hood River. This critical period is May 1-September 31. Where data was available for tributaries, this data was evaluated to define more restrictive critical periods if needed. A more restrictive critical period is defined for the Odell Creek watershed (April 15-September 30), the Neal Creek watershed (May 1-October 31) and the ditch in the Van Horn area (March 1-October 31). The critical period for Clear Branch below Laurance Lake remains year-round. The critical periods for both TMDLs are summarized in **Table 7**.
5. The 2001 WHS TMDL applied a 10% margin of safety in the equations used to calculate the WLAs. In this revision, we have applied a 10% margin of safety by allocating 10% of the HUA (0.03°C) as the margin of safety.
6. The units for wasteload allocations have been converted from "kilocalories/day" to "gigacalories/day" for ease of reporting. "Gigacalories/day" is the same as "million kilocalories/day".

Equations. The following equations, variables, and assumptions were used to calculate the thermal wasteload allocations and to evaluate the thermal impact of the discharges. Equation 3 describes how to calculate a WLA. Equations 4 and 5 describe how to calculate the current load of the facility and the change in stream temperature at the edge of the mixing zone under current operations. These can be used to determine compliance with the WLA in Equation 3. Equations 6 and 7 describe how to calculate maximum effluent temperature or flow to maintain compliance with the WLA.

EQ 3. $$WLA = (HUA_{PS})(Q_E + Q_R)(C_F)$$

EQ 4. $$CL = (Q_E)(T_E - T_C)(C_F)$$

EQ 5. $$\Delta T_R = \frac{T_E + (S-1)T_C}{S} - T_C = \left(\frac{Q_E}{Q_E + Q_R}\right)(T_E - T_C)$$

EQ 6. $T_{WLA} = \left(\frac{WLA}{Q_E \cdot C_F}\right) + T_C$

and,

EQ 7. $Q_{WLA} = \frac{WLA}{(T_E - T_C) \cdot C_F} = \frac{(HUA_{PS})(Q_R)}{(T_E - T_R) - HUA_{PS}}$

Where,

WLA = Wasteload allocation thermal load (gcals/day)
CL = Current thermal load (gcals/day)
HUA_{PS} = Portion of human use allowance allocated to point sources (°C)
Q_E = Point source effluent flow (dry weather design flow) (cfs)
Q_R = Upstream river low flow (estimated or measured low flow) (cfs)
T_C = Applicable temperature criterion (°C)
T_E = Maximum point source effluent temperature (7DADM or maximum temperature if 7DADM not available) (°C)
ΔT_R = Calculated change in river temperature at the edge of the mixing zone (°C)
T_{WLA} = Maximum allowable effluent 7DADM temperature that will not exceed the WLA (°C)
Q_{WLA}= Maximum allowable effluent flow rate that will not exceed the WLA (cfs)
S = Dilution ratio (river flow:effluent flow in percent)
C_F = Conversion factor for calculating gcals/day from °C-ft^3: (2.446665 gcal-s / °C-ft^3-day)

The best available data for river low flows (Q_R) and maximum effluent temperatures (T_E) was described in more detail in **Sections 4.1.1-4.1.4** for each of the individual facilities. The dry weather design flow of the facility was used to represent Q_E. WLAs were calculated to ensure that each individual discharge would not cause an increase in stream temperature greater than the allowable portion of the HUA_{PS} above the applicable instream criterion at the facility's point of discharge during the critical period. Outside of the critical period, temperature data collected from 2000-2014 (depending on location) indicate no reasonable potential for temperature criteria to be exceeded. During this time, point sources are assigned their current load. If future data indicate that temperature criteria are exceeded outside of the designated critical periods, WLAs to existing point sources would be extended through the end or beginning of the month with the temperature criteria exceedance.

Cumulative Effects Analyses. CEAs were used to evaluate the cumulative effects of multiple facilities discharging in the same watershed. CEAs were done for East Fork Hood River, Odell Creek, Lenz Creek, and Neal Creek. In each CEA, it was assumed that all dischargers in the watershed were discharging at the most downstream point in the watershed. This is equivalent to the point of maximum impact, as referenced in OAR340-041-0028(12)(b)(B). Because thermal modeling was not done to demonstrate the degree of thermal load dissipation between sources, this is a conservative approach which assumes no excess thermal load dissipation. In the CEA analyses, WLAs were calculated with the following modifications to the methodology: (1) the point source portion of the HUA of 0.18°C was split between the different sources; (2) Q_E = the combined point source effluent design flows at the assumed most downstream point of discharge; and (3) T_E = flow-weighted maximum effluent temperature of the combined discharges. If the CEA analysis indicated exceedance of HUA_{PS}, then a subsequent analysis was done by splitting HUA_{PS} between the facilities to evaluate the contribution of each facility.

WLA Approach Summary. The WLAs calculated in this TMDL reflect the low flow conditions during the critical period and assume an effluent flow rate equal to the facility's permitted design flow. The most stringent WLA (direct point of discharge or CEA) determined for each facility during the critical period is the one allocated in this TMDL. The wasteload allocations are summarized in **Table 13**, included at the end of Section 7.1. This replaces the TMDL wasteload allocation tables (Table 13 and

Table 17) from the 2001 WHS TMDL (Table 17 is included in this Revision in **Appendix E**). A discussion of the WLAs for each facility is provided in **Sections 7.1.1-7.1.3**, summarized by watershed.

For several facilities, alternative WLAs were also calculated assuming different design flows or points of discharge than is in their current permits. This was done in the event the facility decides to change the configuration of their discharge in order to meet WLAs or other permit requirements. If the facility decides to make this change, then the alternative WLAs will apply, as appropriate. These scenarios are numbered sequentially as they are described in **Sections 7.1.1-7.1.3**, and are presented in **Appendix D** and summarized in **Table 14**.

Reasonable Potential Analyses. The thermal effects of the discharges were determined using the Reasonable Potential Analysis tool. The RPA tool is used by ODEQ permit writers. The details of the RPA analyses are summarized as tables which are included in **Appendix C** and **Appendix D**. The variables outlined in the tables refer to the variables presented in Equations 3-7. Where applicable, information from the 2001 WHS TMDL is provided in these tables for ease of comparison. For most facilities, the RPA tool was used to evaluate thermal loading for each month of the year. This was done to better evaluate the range of flow and loading conditions and to provide additional information which can be utilized by the permit writer during permit renewal after the re-issuance of this TMDL.

In this TMDL analysis, T_{WLA} (Equation 6) represents the maximum effluent temperature that could be discharged and still meet the WLA, assuming effluent discharge at design flows and low creek flows as described for each facility. In some situations, calculation of T_{WLA} returned a temperature that was higher than would be allowed under OAR 340-041-0053(2)(d), which specifies thermal plume limitations, and higher than would be physically possible to generate at the facility. The calculated value of T_{WLA} does not allow a facility to discharge effluent at these high temperatures. A thermal plume analysis must be conducted for all facilities during permit renewal to ensure compliance with OAR 340-041-0053(2)(d) and prevent or minimize adverse effects to salmonids within the mixing zone. In this TMDL analysis, Q_{WLA} (Equation 7) represents the maximum effluent flow that could be discharged and still meet the WLA, assuming the maximum effluent temperature and low creek flow as described for each facility. Q_{WLA} was only calculated for those facilities that did not meet their WLA under current operations and permitted flows. Facilities that discharge into effluent dominated ditches must not exceed T_C regardless of effluent flow.

During permit implementation, Equations 4-7 can be used to determine compliance with the WLA as effluent temperature and flow vary from the values assumed in this TMDL analysis. Tiered flow-based allocations could also be considered during permit renewal, which would allow the NPDES permitted sources the potential to utilize the greater loading capacity that is available during periods of higher flow. However, this approach would require that additional ambient river flow and effluent temperature data be collected and the waste load allocation be calculated using Equations 3-7. The 2001 WHS TMDL allowed for the calculation of flow-based temperature limitations.

Industrial and Construction Stormwater permits. Based on a review of current published literature and other studies related to stormwater runoff and stream temperature in Oregon, ODEQ does not believe there is sufficient evidence to demonstrate that stormwater discharges authorized under the current industrial and construction stormwater permits contribute to exceedances of the 7DADM numeric criteria in the temperature standard.

A review of literature from studies in the mid-west and east coast of the United States provides evidence that, under certain conditions, runoff from impervious pavement or runoff that is retained in uncovered open ponds can produce short duration warm discharges (Herb et. al. 2008, Jones and Hunt 2009, UNH Stormwater Center 2011, Winston et. al. 2011, Hester and Bauman 2013). Increases in runoff temperature are highly dependent on many factors including air temperature, dewpoint, pavement type, percent impervious, and the amount of impervious surface blocked from solar radiation (Nelson and Palmer 2007, Herb et. al. 2008, Thompson et. al. 2008, Winston et. al. 2011, Jones et. al. 2012, Sabouri et. al. 2013, and Zeiger and Hubbert 2015). These warm runoff discharges can create "surges" that produce increases in stream temperature typically for short durations (Hester and Bauman 2013, Wardynski et. al. 2014, Zeiger and Hubbert 2015). However, studies that evaluated stormwater discharges over weekly averaging periods did not indicate exceedences above biologically based critical thresholds (Wardynski et. al. 2014, Washington Department of Ecology 2011a and 2011b).

ODEQ evaluated temperature, rainfall, cloud cover and stream temperature data for warm seasons in three years in the adjacent Miles Creeks area of the Middle Columbia-Hood Subbasin (ODEQ 2008). In this evaluation, there was no consistent patterns between runoff events in urban areas and stream temperature. In Oregon, we commonly see cooling trends during warm season rain events that are much more clearly related to stream temperature than is precipitation. The limited analysis of local stream temperature in response to precipitation suggests no consistent thermal effects, and any increase in temperature would be small and short term relative to our 7-day average criteria or acute effects.
Because we have determined that facilities with stormwater permits do not have a reasonable potential to impact stream temperature relative to our 7DADM criteria, all permitted stormwater facilities are assigned a WLA equal to their existing thermal load. For construction stormwater operations, the allocation is to the GEN12C permit since construction stormwater permits are ephemeral in nature and the number and location will vary year-to-year and over the life of the TMDL (refer to ODEQ's permits database for current permit information: http://www.deq.state.or.us/wq/sisdata/sisdata.asp.

If data collected at a later date indicates that stormwater in the Western Hood Subbasin is a source of thermal loading that is causing an increase in stream temperature in relation to the 7DADM criteria, then stormwater facilities may access a portion of the reserve capacity. At that time, the use of additional BMPs to reduce thermal loading should also be evaluated. Effective BMPs include: reducing the amount of solar exposure on the runoff by directing it through covered or underground storage detention facilities; reducing the volume of runoff using bioretention or other filtration methods; and providing thermal protection through the use of vegetated buffers (Jones and Hunt 2009; Natarajan and Davis 2010; UNH Stormwater Center 2011; Winston et. al. 2011, Wardynski et. al. 2013, Long and Dymond 2014). A number of these BMPs are already being utilized by permitted stormwater sources in the Western Hood Subbasin, as is described in Section 4.1

7.1.1 East Fork Hood River Watershed

Reasonable potential analyses and waste load allocations were developed for each of the facilities located within the East Fork Hood River watershed (**Figure 8**, **Figure B-1**). The critical period which applies in this watershed is the Hood River watershed critical period of May 1-September 30 (**Table 7**). WLAs were developed for each facility at their point of discharge under currently permitted conditions. Four alternative WLAs were also developed for the Diamond Fruit Growers Parkdale facility.

A cumulative effects analysis assessed the combined effects of Diamond Fruit Growers Parkdale facility and the Parkdale WWTP on the East Fork Hood River. Because it is located approximately 25 miles away from the other two facilities, the Mount Hood Meadows WWTP discharge was not included in the cumulative effects analysis. Wishart Creek (Diamond-Parkdale) and Trout Creek (Parkdale WWTP) discharge into the East Fork Hood River at approximately river miles 1.7 and 0.5, respectively. In this analysis, it was assumed that both facilities discharged into the East Fork Hood River at the mouth of Trout Creek (rivermile 0.5), which would be the point farthest downstream in the watershed and the point of maximum impact (**Figure B-1**).

7.1.1.1 Mount Hood Meadows Wastewater Treatment Plant

The parameters used in the reasonable potential analysis for the Mount Hood Meadows WWTP are shown in **Table C-1**. In this analysis, there was enough data to assess the thermal impacts of the discharge for each month of the year. The WLA of 3.0 gcals/day was based on the month with the lowest flow (6.7 cfs) in the East Fork Hood River (August) during the critical period of May 1-September 30. The effluent design flow used in this analysis was 0.0187 MGD.

The calculations indicate that the WWTP discharge does not increase river temperatures beyond the human use allowance (HUA_{PS} =0.18°C) during any months of the critical period under current permitted conditions. The calculated change in river temperature at the edge of the mixing zone during the critical period was -0.01°C to 0.01°C. The calculated maximum allowable effluent temperatures under allocated conditions are much higher than would be physically possible to generate at the facility (greater than 59.8°C). OAR 340-041-0053(2)(d) specifies thermal plume limitations which must be followed to prevent and minimize adverse effects to salmonids inside the mixing zone.

The Mount Hood Meadows WWTP discharges into a waterbody that has summer 7DADM ambient temperatures that are colder than the salmon and trout rearing and migration criterion. The WWTP also discharges above salmon and steelhead spawning water that are colder than the spawning criterion during some, if not all, months of the spawning season of October 15-May 15. Demonstration of compliance with both subsections (a) and (b) of the Protecting Cold Water criterion (OAR 340-041-0028(11) will be required during the next permit renewal.

7.1.1.2 Diamond Fruit Growers – Parkdale Facility

The parameters used in the reasonable potential analyses for the Diamond-Parkdale facility are shown in **Table C-2** and **Table D-1**. In this analysis, there was not enough data to assess the thermal impacts of the discharge for each month of the year. The RPAs and WLAs were simplified by looking at the conservative low ditch/creek flow (0.1 cfs and 0.2 cfs, respectively) and high effluent temperatures (21.0°C) as described in **Section 4.1.1.2**. The WLAs apply during the critical period of May 1-September 30.

WLAs were developed for five scenarios for this facility: (1) discharge to the ditch under their currently permitted flows; (2) discharge to Wishart Creek under their currently permitted flows; (3) discharge to Wishart Creek with reduced cooling water effluent flows of 0.004 MGD; (4) discharge to the ditch with reduced cooling water effluent flows of 0.004 MGD; and (5) discharge to the ditch with reduced cooling water flows of 0.003 MGD. ***The first scenario (Scenario 1) describes the currently permitted operations and the WLA which applies during the critical period.*** Alternative WLAs were developed for the other four scenarios in the event the facility decides to pipe their effluent to Wishart Creek and/or apply for a new permit with reduced design flows reflecting cooling water flows alone. The alternative WLAs would apply if Diamond Fruit Growers decides to make one of these changes. The facility did not contribute to exceedances of HUA_{PS} in the East Fork Hood River cumulative effects analysis under any of these scenarios.

This evaluation determined that the Protecting Cold Water criterion (OAR 340-041-0028(11) does not apply to the Diamond-Parkdale discharge. Although there is little data to determine if the summer 7DADM in either the ditch or Wishart Creek are colder than 18.0°C (the applicable biologically based criterion), the exceptions in subsection (c) would apply for this discharge. The Diamond-Parkdale facility does not discharge into or above salmon and steelhead spawning waters, so subsection (b) of this criterion does not apply.

Scenario 1: Discharge to the ditch with permitted flows (current permitted operations) (**Table C-2**).
The WLA calculations indicate that the Diamond-Parkdale discharge has the potential to increase ditch temperatures beyond the human use allowance (HUA_{PS}=0.18°C), assuming the permitted effluent flow of 0.22 MGD, ditch flow of 0.1 cfs, and maximum effluent temperature of 21.0°C. Under these conditions, the calculated change in ditch temperature at the edge of the mixing zone during the critical period was 2.3°C. In order to meet the WLA of 0.2 gcals/day, either effluent temperature or flow needs to be reduced. Because flows in the ditch are so low relative to permitted effluent flows (0.22 MGD), effluent temperatures essentially need to stay below the criterion of 18.0°C in order to meet the WLA. Alternatively, the WLA would be met if effluent flows are reduced to 0.004 MGD and the maximum effluent temperature remains at 21.0°C.

Scenario 2: Discharge to Wishart Creek with permitted flows (**Table D-1**).
The WLA calculations indicate that the Diamond-Parkdale discharge also has the potential to increase Wishart Creek temperatures beyond the human use allowance (HUA_{PS}=0.18°C). The calculated change in creek temperature at the edge of the mixing zone during the critical period was 1.9°C. In order to meet the WLA of 0.2 gcals/day, either effluent temperature or flow needs to be reduced. Because flows in the creek are so low relative to permitted effluent flows, effluent temperatures essentially need to stay below the criterion of 18.0°C in order to meet the WLA. Alternatively, the WLA would be met if effluent flows are reduced to 0.008 MGD and the maximum effluent temperature remains at 21.0°C.

Scenario 3: Discharge to Wishart Creek with only cooling water flows (**Table D-1**).
With the anticipated reduced flows of only condenser cooling water, calculations indicate that the Diamond-Parkdale discharge does not have the potential to increase Wishart Creek temperatures beyond the human use allowance (HUA_{PS}=0.18°C). With condenser cooling water flows of 0.004 MGD discharged into Wishart Creek, the calculated change in creek temperature at the edge of the mixing zone during the critical period was 0.09°C. The WLA during the critical period in this scenario would be 0.1 gcals/day, if implemented.

Scenarios 4 and 5: Discharge to the ditch with cooling water flows (**Table D-1**).
With condenser cooling water flows of 0.004 MGD or 0.003 MGD discharged into the ditch, calculations indicate that the Diamond-Parkdale discharge does not have the potential to increase ditch temperatures beyond the human use allowance (HUA_{PS}=0.18°C). The calculated change in ditch temperature at the edge of the mixing zone during the critical period was 0.17°C and 0.13°C, respectively. The WLA during the critical period in both of these scenarios would be 0.05 gcals/day, if implemented.

7.1.1.3 Parkdale Wastewater Treatment Plant

The parameters used in the reasonable potential analysis for the Parkdale WWTP are shown in **Table C-3**. In this analysis, there was not enough data to assess the thermal impacts of the discharge for each month of the year. The RPA and WLA for the Trout Creek discharge were simplified by looking at the conservative low creek flow (2.5 cfs) and high effluent temperature (20.8°C) as described in **Section 4.1.1.3**. The WLA of 1.2 gcals/day (both before and after the upgrade) applies during the critical period of May 1-September 30.

The calculations indicate that the WWTP discharge does not increase Trout Creek temperatures beyond the human use allowance (HUA_{PS}=0.18°C) under current permitted flows (0.10 MGD) or after the planned upgrade (0.08 MGD). The calculated change in creek temperature at the edge of the mixing zone was 0.16°C before the upgrade and 0.13°C after the upgrade. The facility did not contribute to exceedances of HUA_{PS} in the East Fork Hood River cumulative effects analysis.

This evaluation determined that the Protecting Cold Water criterion (OAR 340-041-0028(11) does not apply to the Parkdale WWTP discharge. Although the WWTP discharges into a waterbody that has summer 7DADM ambient temperatures that are colder than the biologically based rearing criterion, the Protecting Cold Water summer criterion (OAR 340-041-0028(11)(a)) does not apply because the conditions of subsection (c) are met. The Parkdale WWTP does not discharge into or above salmon and steelhead spawning waters, so subsection (b) of this criterion does not apply.

7.1.1.4 East Fork Hood River Cumulative Effects Analysis

A cumulative effects analysis (**Table C-4**) assessed the combined effects of Diamond-Parkdale and the Parkdale WWTP on the East Fork Hood River. In this analysis, it was assumed that both facilities discharged into the East Fork Hood River at the mouth of Trout Creek (rivermile 0.5), which would be the point farthest downstream in the watershed and the point of maximum impact (**Figure B-1**). The applicable numeric criteria for the East Fork Hood River are 18.0°C for salmon and trout rearing and migration habitat and 13.0°C for salmon and steelhead spawning (October 15-May 15).

The cumulative effects analysis used two different effluent flow scenarios for the Parkdale WWTP – before (0.10 MGD) and after (0.08 MGD) their upgrade. Design flows (0.22 MGD) were used for the Diamond-Parkdale facility, with the assumption that if their permitted discharge changed to cooling water flows only, the thermal impacts would be even less. Flow-weighted average effluent temperatures were calculated. Flows for the East Fork Hood River were based on flow data (2009-2014) provided by Oregon Department of Fish and Wildlife at river mile 1.0 as described in **Section 4.1.1**.

Given the high flows in the East Fork Hood River relative to the combined discharge of the two facilities, there is no potential for the discharges to affect East Fork Hood River temperatures. The calculations indicate that the combined discharges will not increase river temperatures beyond the human use allowance (HUA_{PS}=0.18°C) during the critical period. The maximum calculated river temperature increase at the edge of the mixing zone was 0.03°C.

7.1.2 Odell Creek Watershed

Reasonable potential analyses and wasteload allocations were developed for the two facilities located within the Odell Creek watershed (**Figure B-2**). Although not listed as impaired on the 303(d) list, temperature data collected near the mouth of Odell Creek indicates that the core cold water habitat criterion can be exceeded from early-July until mid-September and that the spawning criterion can be exceeded from mid/late-April through May 15th, depending on the year. To be protective of the spring spawning season, the critical period which applies in the Odell Creek watershed is April 15-September 30 (**Table 7**). WLAs were developed for each facility at their point of discharge under currently permitted conditions, assuming a low creek flow of 1.6 cfs for McGuire Creek and 8.5 cfs for Odell Creek. In addition, one alternative WLA was developed for the Diamond Fruit – Odell facility, and four alternative WLAs were developed for the Odell WWTP.

The combined thermal effect of the facilities on Odell Creek was evaluated in two different cumulative effects analyses (**Section 7.1.3.3**) - one using the permitted flows for the Diamond-Odell facility and one using only their cooling water flows. In both these analyses, it was assumed that the Odell WWTP and the Diamond Fruit-Odell facility discharged into Odell Creek at the location of the WWTP (river mile 1.1), which would be the point farthest downstream in the watershed and the point of maximum impact. The thermal effect of the combined discharges was greater than the human use allowance in both analyses, therefore subsequent analyses were done to evaluate the contribution of each facility.

7.1.2.1 Diamond Fruit Growers – Odell Facility

The parameters used in the reasonable potential analyses for the Diamond-Odell facility are shown in **Table C-5** and **Table D-2**. In these analyses, the thermal impacts of the discharge were evaluated for each month of the year using data as described in **Section 4.1.2.1**. Because their permit allows them to discharge during all months of the year, wasteload allocations were developed for the summer months even though they do not currently discharge during all months. Effluent temperatures for non-discharging months were estimated by averaging temperatures from the months on either side of the non-discharge season. The critical period which applies for this facility is the Odell Creek watershed critical period of April 15-September 30.

To evaluate the thermal impacts on McGuire Creek, wasteload allocations were developed for two different scenarios as described below. ***Scenario 6 describes the currently permitted operations and the WLA which applies during the critical period***. The alternative cooling water scenario was evaluated in the event that the facility decides to modify their permit with reduced design flows reflecting only cooling water. The alternative WLA would apply if Diamond Fruit Growers decides to make this change in their permit. Each discharge was also incorporated into an Odell Creek cumulative effects analysis (**Section 7.1.2.3**). The results of Scenario 6 are included in the WLA summary table (**Table 13**), while the results of Scenario 7 are included in the alternative WLA summary table (**Table 14**).

The Diamond-Odell facility discharges into a waterbody that has summer 7DADM ambient temperatures that are colder than the salmon and trout rearing and migration criterion. The facility also discharges above salmon and steelhead spawning water in Odell Creek that are colder than the spawning criterion during some months of the spawning season of January 1- May 15. Demonstration of compliance with both subsections (a) and (b) of the Protecting Cold Water criterion (OAR 340-041-0028(11) will be required during the next permit renewal.

Scenario 6: Discharge to McGuire Creek with permitted flows (currently permitted operations) (**Table C-5**).

The WLA calculations indicate that the Diamond-Odell discharge will not increase creek temperatures in McGuire Creek beyond the human use allowance (HUA_{PS}=0.18°C) and the WLA of 0.7 gcals/day will be met assuming the permitted effluent flow of 0.03 MGD and low creek flow of 1.6 cfs. The maximum calculated change in creek temperature at the edge of the mixing zone during the critical period was 0.14°C in September, assuming maximum effluent temperature of 21.1°C. This scenario represents the most restrictive WLA under current operating conditions and is the one that applies in this TMDL during the critical period (**Table 13**).

Scenario 7: Only cooling water discharged to McGuire Creek (**Table D-2**).

With the anticipated reduced flows of only non-contact cooling water (0.004 MGD), the maximum change in creek temperatures is well below the human use allowance of 0.18°C, with a maximum increase in creek temperature at the edge of the mixing zone of 0.02°C. The WLA during the critical period in this scenario would be 0.7 gcals/day, if implemented.

Cumulative effects analyses (**Table C-7** and **Table D-5**). In the Odell Creek cumulative effects analyses, neither Diamond-Odell discharge increased Odell Creek temperatures beyond the human use allowance (HUA_{PS}=0.09°C, with the HUA_{PS} split between the two facilities). The maximum calculated change in creek temperature at the edge of the mixing zone during the critical period attributed to the Diamond-Odell facility was 0.03°C. For both discharge scenarios, the most stringent WLA is the one developed for direct discharge into McGuire Creek, rather than as part of the cumulative effects analysis in Odell Creek. The most stringent WLA is allocated in this TMDL.

7.1.2.2 Odell Wastewater Treatment Plant

The parameters used in the reasonable potential analyses for the Odell WWTP are shown in **Table C-6**, **Table D-3**, and **Table D-4**. In these analyses, there was enough data to assess the thermal impacts of the discharge for each month of the year using data described in **Section 4.1.2.2**. The facility's design flow of 0.42 MGD was used in all of the WLA analyses. The critical period which applies for this facility is April 15-September 30.

WLAs were developed for five different scenarios, as described below. ***The first scenario (Scenario 8) describes the cumulative effects analysis under currently permitted operations and has the most restrictive WLA for the WWTP which applies during the critical period***. The other four alternative scenarios were developed in the event the facility decides to pipe their effluent to Hood River and/or the other facilities in the Odell community decide to change their point of discharge or permitted discharge flows. The alternative WLAs would apply if the Odell Sanitary District decides to make one of these changes. The results of Scenario 8 are included in the WLA summary table (**Table 13**), while the results of the other alternative scenarios are included in **Table 14**.

Based on the temperature data collected in Odell Creek, the Odell WWTP does not discharge into a waterbody that has summer 7DADM ambient temperatures that are colder than the biologically based rearing criterion. However, it does discharge into salmon and steelhead spawning waters. Demonstration of compliance with subsection (b) of the Protecting Cold Water criterion (OAR 340-041-0028(11) will be required during the next permit renewal. If the WWTP were to pipe their discharge directly to Hood River, subsection (b) of this criterion would still need to be evaluated to ensure compliance during the spawning season, since the Hood River is designated for salmon and steelhead spawning use. Summer 7DADM ambient temperatures in Hood River are not colder than the biologically based core cold water criterion, so subsection (a) does not need to be evaluated.

Scenario 8: Odell Creek cumulative effects analysis with the currently permitted Diamond-Odell flows (0.03 MGD) (**Table C-6**).
This scenario represents the most restrictive WLA for the Odell WWTP under current operating conditions and is the one that applies in this TMDL (**Table 13**). In the cumulative effects analysis, HUA_{PS} is split between the two facilities, with each allowed 0.09°C of the HUA_{PS}. The calculations indicate that the WWTP discharge has a reasonable potential to increase creek temperature above their portion of the HUA_{PS} at the edge of the mixing zone throughout the entire critical period. The WLA during the spawning season (April 15-May 15) and core cold water habitat season is 2.7 gcals/day and 2.0 gcals/day, respectively. In order to meet the WLAs, either effluent temperature or flow need to be reduced. Assuming the facility design flow and low creek flows presented in **Table C-6**, effluent temperatures would need to stay below 14.7°C and 17.3°C in the spawning and core cold water seasons, respectively, in order to meet the WLAs. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table C-6,** the WLAs would be met if discharge flows are kept below 0.16 MGD and 0.08 MGD during the spawning and core cold water seasons, respectively.

Scenario 9: Odell WWTP discharge alone into Odell Creek (**Table D-3**).
This scenario is presented as an alternative WLA that would apply if the Diamond Fruit-Odell facility ceases its discharge into McGuire Creek. This scenario is also shown in **Table C-6** as a comparison to the WLA from the Odell Creek cumulative effects analysis. The WLA calculations indicate that the WWTP discharge, by itself, has the potential to increase Odell Creek temperatures beyond the human use allowance (HUA_{PS}=0.18°C) during most of the critical period (May 1-15 and June through September). The calculated change in creek temperature at the edge of the mixing zone during these months was 0.23°C to 0.44°C. The WLAs during the spawning season (April 15-May 15) and core cold water habitat season are 5.4 gcals/day and 4.0 gcals/day, respectively. In order to meet the WLAs, either effluent

temperature or flow needs to be reduced. Assuming the facility design flow and low creek flows presented in **Table D-3**, effluent temperatures would need to stay below 16.4°C and 18.5°C in the spawning and core cold water seasons, respectively, in order to meet the WLAs. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-3,** the WLAs would be met if discharge flows are kept below 0.32 MGD and 0.16 MGD during the spawning and core cold water seasons, respectively.

Scenario 10: Odell Creek cumulative effects analysis with only cooling water flows for Diamond-Odell facility (0.004 MGD) (**Table C-6**).
Because of the relatively insignificant amount of flow from either of the Diamond-Odell discharges (permitted or cooling water) relative to the WWTP flow, the WLAs for the Odell WWTP are the same under both Odell Creek cumulative effects analyses (Scenario 8 and Scenario 10).

Scenario 11: Odell WWTP discharge directly into Hood River (**Table D-4**).
Alternative WLAs were developed to evaluate the thermal impacts of the Odell WWTP discharge if it were to be piped directly to the Hood River. Because of the considerably higher flows in Hood River, the calculations indicate that the Odell WWTP discharge would not increase river temperatures beyond the human use allowance (HUA_{PS}=0.18°C) at the edge of the mixing zone during any months of the critical period. The calculated maximum allowable effluent temperatures under allocated conditions are much higher than would be physically possible to generate at the facility (greater than 68.0°C). OAR 340-041-0053(2)(d) specifies thermal plume limitations which must be followed to prevent and minimize adverse effects to salmonids inside the mixing zone. The WLAs for the Odell WWTP under this scenario (104 gcals/day during the spawning season and 82 gcals/day during the core cold water habitat season) would apply if the Sanitary District decides to pipe their discharge to Hood River rather than to Odell Creek.

Scenario 12: All permitted facilities in Odell community discharge to Odell WWTP and then the Hood River (**Table D-4**).
This scenario assumes that all of the permitted facilities in the Odell community (Diamond-Central, Diamond-Odell, and Duck-Pooley Odell facilities) would send their effluent directly to the Odell WWTP and that the combined effluent would be piped to the Hood River. This scenario assumes a revised design flow for the Odell WWTP that is equal to the combined design flows from all of the facilities (0.79 MGD), as well as flow-weighted effluent temperatures. Even with the combined effluent flows, flows in Hood River are still so much higher than effluent flows that the increase in river temperature is still well below the human use allowance (HUA_{PS}=0.18°C) at the edge of the mixing zone during all months of the critical period. The calculated maximum allowable effluent temperatures under allocated conditions are much higher than would be physically possible to generate at the facility (greater than 43.7°C). OAR 340-041-0053(2)(d) specifies thermal plume limitations which must be followed to prevent and minimize adverse effects to salmonids inside the mixing zone. The WLAs for the Odell WWTP under this scenario (104 gcals/day during the spawning season and 82 gcals/day during the core cold water habitat season) would apply if the facilities in the community of Odell decide to pipe their discharge to the Odell WWTP, which in turn pipes the combined effluent directly to the Hood River rather than to Odell Creek.

7.1.2.3 Odell Creek Cumulative Effects Analyses

Two different cumulative effects analyses were done to analyze the thermal impacts of the combined discharges from the two facilities. In both analyses, it was assumed that both facilities discharged into Odell Creek at the location of the WWTP (river mile 1.1), which would be the point farthest downstream in the watershed and the point of maximum impact. In the first analysis (**Table C-7**), the Diamond-Odell facility was discharging at the permitted design flow. A combined effluent flow of 0.45 MGD was used, as well as flow-weighted effluent temperatures. In the second analysis (**Table D-5**), it was assumed that

Diamond-Odell was only discharging cooling water, with a combined discharge flow of 0.424 MGD. Flow and temperature data used are as described above for the Odell WWTP analysis.

The calculations indicate that the combined discharges have the potential to increase creek temperatures beyond the human use allowance (HUA_{PS}=0.18°C) during the critical period from May 1-15 and June through September in both analyses. During these months, the calculated stream temperature increase at the edge of the mixing zone was 0.25°C to 0.46°C when using the permitted Diamond-Odell flows, and 0.24°C to 0.44°C when using their cooling water flows. Because the HUA_{PS} was exceeded, the thermal contribution of each of the two facilities was evaluated by splitting the HUA_{PS} between the facilities, giving each facility 0.09°C of the human usse allowance and using their design flows and effluent temperatures, as was described above. In both cumulative effects analyses, the Diamond-Odell facility did not contribute to exceedances of the criteria, whereas the Odell WWTP did.

7.1.3 Neal Creek Watershed

Reasonable potential analyses and wasteload allocations were developed for each of the facilities located within the Neal Creek watershed (**Figure B-3** to **Figure B-5**). Temperature data collected in Neal Creek indicates that either the spawning or rearing criteria can be exceeded during the period of early May-early August. In addition, the spawning criterion came very close to being exceeded after October 15th. To be protective of the fall spawning season, the critical period which applies in the Neal Creek watershed is May 1-October 31 (**Table 7**). WLAs were developed for each facility at their point of discharge under currently permitted conditions. In addition, six alternative WLAs were developed for both the Terminal Ice and Duckwall-Pooley Van Horn facilities.

The combined thermal effect of the facilities was evaluated in the following cumulative effects analyses:

- Van Horn ditch: Terminal Ice and Cold Storage facility and Duckwall-Pooley Fruit Company Van Horn facility (**Sections 7.1.3.2** and **7.1.3.3**)
- Un-named Pine Grove creek: Terminal Ice and Cold Storage facility and Duckwall-Pooley Fruit Company Van Horn facility (**Sections 7.1.3.2** and **7.1.3.3**)
- Lenz Creek (river mile 1.7): Diamond Fruit Growers Central facility and Duckwall-Pooley Fruit Company Odell facility (**Section 7.1.3.6**)
- Neal Creek (river mile 1.5): Mt. Hood Forest Products, Duckwall-Pooley Fruit Company Van Horn facility, Terminal Ice and Cold Storage facility, Diamond Fruit Growers Central facility and Duckwall-Pooley Fruit Growers Odell facility (**Section 7.1.3.7**)

Each analysis was done at the most downstream point in the watershed, which is the point of maximum impact. Where the thermal effect of the combined discharges was greater than the human use allowance, subsequent analyses were done to evaluate the contribution of each facility, splitting the HUA_{PS} between the facilities.

7.1.3.1 Mt. Hood Forest Products (formerly Quality Veneer and Lumber, Inc.) Log Pond

Mt. Hood Forest Products is only allowed to discharge outside of the Neal Creek critical period. In this TMDL, facilities which discharge outside of the critical period are assigned their existing load. Although the data were limited, the thermal impacts of the facility were evaluated using a reasonable potential analysis (**Table C-8**) for possible use in future permitting.

7.1.3.2 Terminal Ice and Cold Storage (formerly Diamond Fruit Growers Van Horn Facility)

The parameters used in the reasonable potential analyses for the Terminal Ice and Cold Storage facility are shown in **Table C-9**, and **Table D-6** through **Table D-10**. Although the data for the facility is limited, the thermal impacts of the discharge were evaluated for each month of the year. The monthly evaluation was done in order to incorporate this facility into the Neal Creek cumulative effects analysis.

The ditch is considered the receiving water for this discharge under current conditions. The critical period for the ditch was established to be March 1-October 31 (**Section 3**). The critical period for the un-named creek and Neal Creek is the Neal Creek watershed critical period of May 1-October 31.

Wasteload allocations were developed for seven different discharge scenarios, as described below. ***The first scenario (Scenario 13) describes the currently permitted operations and the WLA which applies during the critical period***. The other six alternative scenarios were evaluated in the event that some or all of the permitted facilities in the Neal Creek watershed decide to change their discharge location. The alternative WLAs would apply if any of these changes are made. The results of Scenario 13 are included in the WLA summary table (**Table 13**), while the results of the other alternative scenarios are included in **Table 14**.

Because there is limited data on temperatures in the ditch and the un-named creek, additional temperature data should be collected in order to evaluate whether or not 7DADM ambient temperatures are colder than the biologically based rearing criterion. This information should be used to determine whether compliance with subsection (a) of the Protecting Cold Water criterion (OAR 340-041-0028(11) will be required during the next permit renewal. The facility does not discharge into or above salmon and steelhead spawning waters, so subsection (b) of this criterion does not apply. If Terminal Ice decides to pipe their discharge to Neal Creek, compliance with both subsections of this criterion will likely be required.

Scenario 13: Terminal Ice and Duckwall-Pooley Van Horn both discharging into the ditch (currently permitted operations, **Table C-9**).

Because the Terminal Ice and Duckwall-Pooley Van Horn facilities are permitted to discharge so close to each other in the ditch, wasteload allocations under currently permitted conditions were developed assuming that they discharged at the same point. The HUA_{PS} of 0.18°C was split between the two facilities (0.09°C each). Under these conditions, the analysis demonstrates that the Terminal Ice discharge will increase ditch temperatures beyond the human use allowance during all months of the critical period. The calculated temperature increase ranged from 2.0°C to 3.1°C during this time. Because there is no flow in the ditch above the point of discharge, effluent temperatures need to be less than the 18°C criterion for discharge into the ditch in order to meet the WLA of 0.04 gcals/day. A decrease in the volume of effluent discharge is not an available option. This scenario represents the most stringent WLA under current operating conditions during the critical period (**Table 13**).

Scenario 14: Terminal Ice discharging alone into the ditch (**Table D-6**).
Scenario 15: Terminal Ice discharging alone into the un-named Pine Grove creek (**Table D-7**).
Scenario 16: Terminal Ice and Duckwall-Pooley Van Horn both discharging into the un-named Pine Grove creek (**Table D-8**).

These scenarios were developed in the event that Duckwall-Pooley Fruit Company decides to stop discharging into the ditch (Scenario 14) or un-named creek (Scenario 15) or that Terminal Ice and Duckwall-Pooley decide to move their combined discharge to the un-named Pine Grove creek (Scenario 16). In Scenarios 14 and 15, Terminal Ice is the only discharger into these receiving waters and is able to utilize the entire portion of HUA_{PS} (0.18°C). In scenario 16, the HUA_{PS} of 0.18°C was split between the two facilities (0.09°C each).

Under these alternative scenarios, the Terminal Ice discharge would increase temperatures above the human use allowance during the critical period. In Scenario 14, effluent temperatures need to be less than the 18°C criterion and a decrease in the volume of effluent discharged is not an option. In Scenario 15, assuming the facility design flow and low creek flows presented in **Table D-7**, effluent temperatures would need to be less than 19.1°C in order to meet the WLA. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-7,** the WLAs would be met if discharge flows are kept below 0.04 MGD. In Scenario 16, assuming the facility design flow and low creek flows presented in **Table D-8**, effluent temperatures would need to be less than 18.6°C in order to meet the WLA. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-7,** the WLAs would be met if discharge flows are kept below 0.02 MGD. The results of these alternative scenarios are summarized in **Table 14**.

Scenario 17: Terminal Ice discharging directly into Neal Creek with all of the other permitted facilities in the watershed (**Table D-9**).
This scenario was developed in the event that Terminal Ice decides to pipe their discharge directly to Neal Creek and assumes that all of the other permitted facilities in the Neal Creek watershed are continuing to discharge. The results of this scenario come from the Neal Creek cumulative effects analysis, where the HUA_{PS} is split between the four facilities (HUA_{PS}=0.045°C each) discharging during the critical period (**Section 7.1.3.7**). Under this alternative scenario, the Terminal Ice discharge would increase creek temperatures above their human use allowance from May 1-May 15 and October 15-October 31 during the critical period in the spawning season. Assuming the facility design flow and low creek flows presented for this scenario in **Table D-9**, effluent temperatures would need to be less than 15.3°C in the spawning season in order to meet the WLA of 1.1 gcals/day during this time of year. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-9,** the WLA would be met in the spawning season if discharge flows are kept below 0.04 MGD. During the rearing season, the calculations indicate that discharge would not increase creek temperatures beyond the human use allowance at the edge of the mixing zone and the WLA of 1.5 gcals/day will be met. The results of this alternative scenario are summarized in **Table 14**.

Scenario 18: Terminal Ice and Duckwall-Pooley Van Horn discharging directly into Neal Creek without Lenz Creek facilities (**Table D-10**).
This scenario was evaluated in the event that Terminal Ice and Duckwall-Pooley Van Horn decide to pipe their discharges directly to Neal Creek and Diamond-Central and Duckwall-Pooley Odell decide to pipe their effluent to the Odell WWTP rather than continuing to discharge into Lenz Creek. If this were to occur, there would only be two facilities discharging in the Neal Creek watershed in the critical period, so the HUA_{PS} would be split between the two (0.09°C each). Under this alternative scenario, the Terminal Ice discharge would increase creek temperatures above their human use allowance from October 15-October 31 during the critical period in the spawning season. Assuming the facility design flow and low creek flows presented for this scenario in **Table D-10**, effluent temperatures would need to be less than 17.9°C in the spawning season in order to meet the WLA of 2.2 gcals/day during this time of year. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-10,** the WLA would be met in the spawning season if discharge flows are kept below 0.08 MGD. During the rearing season, the calculations indicate that discharge would not increase creek temperatures beyond the human use allowance at the edge of the mixing zone and the WLA of 3.1 gcals/day will be met. For much of the year, the calculated maximum allowable effluent temperatures under allocated conditions are higher than would be allowed under OAR 340-041-0053(2)(d). The calculated value of T_{WLA} does not allow a facility to discharge effluent at these high temperatures. A thermal plume analysis must be conducted for all facilities during permit renewal to ensure compliance with OAR 340-041-0053(2)(d) and prevent or minimize adverse effects to salmonids within the mixing zone. The results of this alternative scenario are summarized in **Table 14**.

Scenario 19: Terminal Ice discharging alone directly into Neal Creek with no other facilities discharging (**Table D-10**) during the critical period.
This scenario was evaluated in the event that all of the other permitted facilities in the Neal Creek watershed decide to stop discharging to surface waters in the watershed during the critical period. Under

this alternative scenario, the Terminal Ice discharge would not increase river temperatures beyond the human use allowance (HUA_{PS}=0.18°C) during any months of the critical period and the WLAs of 4.5 gcals/day during the spawning season and 6.2 gcals/day during the rearing season would be met. For much of the year, the calculated maximum allowable effluent temperatures under allocated conditions are higher than would be allowed under OAR 340-041-0053(2)(d). The calculated value of T_{WLA} does not allow a facility to discharge effluent at these high temperatures. A thermal plume analysis must be conducted for all facilities during permit renewal to ensure compliance with OAR 340-041-0053(2)(d) and prevent or minimize adverse effects to salmonids within the mixing zone. The results of this alternative scenario are summarized in **Table 14**.

7.1.3.3 Duckwall-Pooley Fruit Company – Van Horn Cold Storage

The parameters used in the reasonable potential analyses for the Duckwall-Pooley Van Horn facility are shown in **Table C-10**, and **Table D-11** through **Table D-15**. Although the data for the facility is limited, the thermal impacts of the discharge were evaluated for each month of the year. The monthly evaluation was done in order to incorporate this facility into the Neal Creek cumulative effects analysis. The ditch is considered the receiving water for this discharge under current conditions. The critical period for the ditch was established to be March 1-October 31 (**Section 3**). The critical period for the un-named creek and Neal Creek is the Neal Creek watershed critical period of May 1-October 31.

Wasteload allocations were developed for seven different discharge scenarios, as described below. ***The first scenario (Scenario 20), describes the currently permitted operations and the WLA which applies during the critical period***. The other six alternative scenarios were evaluated in the event that some or all of the permitted facilities in the Neal Creek watershed decide to change their discharge location. The alternative WLAs would apply if any of these changes are made. The results of Scenario 20 are included in the WLA summary table (**Table 13**), while the results of the other alternative scenarios are included in **Table 14**.

Because there is limited data on temperatures in the ditch and the un-named tributary, additional temperature data should be collected in order to evaluate whether or not 7DADM ambient temperatures are colder than the biologically based rearing criterion. This information should be used to determine whether compliance with subsection (a) of the Protecting Cold Water criterion (OAR 340-041-0028(11) will be required during the next permit renewal. The facility does not discharge into or above salmon and steelhead spawning waters, so subsection (b) of this criterion does not apply. If Duckwall-Pooley decides to pipe their discharge to Neal Creek, compliance with both subsections of this criterion will likely be required.

Scenario 20: Duckwall-Pooley Van Horn and Terminal Ice both discharging into the ditch (currently permitted operations, **Table C-10**).
Because the Terminal Ice and Duckwall-Pooley Van Horn facilities are permitted to discharge so close to each other in the ditch, wasteload allocations under currently permitted conditions were developed assuming that they discharged at the same point. The point source HUA_{PS} of 0.18°C was split between the two facilities (0.09°C each). Under these conditions, the analysis demonstrates that the Duckwall-Pooley Van Horn discharge will increase ditch temperatures beyond the human use allowance during all months of the critical period. The calculated temperature increase ranged from 1.7°C to 8.6°C during this time. Because there is no flow in the ditch above the point of discharge, effluent temperatures need to be less than the 18°C criterion for discharge into the ditch. A decrease in the volume of effluent discharge is not an available option. This scenario represents the most stringent WLA under current operating conditions during the critical period (**Table 13**).

Scenario 21: Duckwall-Pooley Van Horn discharging alone into the ditch (**Table D-11**).
Scenario 22: Duckwall-Pooley Van Horn discharging alone into the un-named Pine Grove creek (**Table D-12**).
Scenario 23: Duckwall-Pooley Van Horn and Terminal Ice both discharging into the un-named Pine Grove creek (**Table D-13**).
These scenarios were developed in the event that Terminal Ice and Cold Storage decides to stop discharging into the ditch (Scenario 21) or un-named creek (Scenario 22) or that Terminal Ice and Duckwall-Pooley decide to move their combined discharge to the un-named Pine Grove creek (Scenario 23). In Scenarios 21 and 22, Duckwall-Pooley is the only discharger into these receiving waters and is able to utilize the entire portion of HUA_{PS} (0.18°C). In scenario 23 the HUA_{PS} of 0.18°C was split between the two facilities (0.09°C each).

Under these alternative discharge scenarios evaluated in the ditch or the un-named creek, the Duckwall-Pooley Van Horn discharge would increase temperatures above the human use allowance during most months of the critical period. The one exception was during the month of May for Scenario 22. In Scenario 21, effluent temperatures need to be less than the 18°C criterion and a decrease in the volume of effluent discharged is not an option. In Scenario 22, assuming the facility design flow and low creek flows presented in **Table D-12**, effluent temperatures would need to be less than 21.1°C in order to meet the WLA. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-12,** the WLAs would be met if discharge flows are kept below 0.01 MGD. In Scenario 23, assuming the facility design flow and low creek flows presented in **Table D-13** effluent temperatures would need to be less than 19.5°C in order to meet the WLA. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-13,** the WLAs would be met if discharge flows are kept below 0.01 MGD. The results of these scenarios are summarized in **Table 14**.

Scenario 24: Duckwall-Pooley Van Horn discharging directly into Neal Creek with all of the other permitted facilities in the watershed (**Table D-14**).
This scenario was developed in the event that Duckwall-Pooley Van Horn decides to pipe their discharge directly to Neal Creek and assumes that all of the other permitted facilities in the Neal Creek watershed are continuing to discharge. The results of this scenario come from the Neal Creek cumulative effects analysis, where the HUA_{PS} is split between the four facilities (HUA_{PS} =0.045°C each) discharging during the critical period (**Section 7.2.3.7**). Under this alternative scenario, the Duckwall-Pooley Van Horn discharge would increase creek temperatures above their human use allowance from October 15-October 31 during the critical period in the spawning season. Assuming the facility design flow and low creek flows presented for this scenario in **Table D-14**, effluent temperatures would need to be less than 19.9°C in the spawning season in order to meet the WLA of 1.1gcals/day during this time of year. Alternatively, assuming the maximum effluent temperature and low creek flows presented in **Table D-14,** the WLA would be met in the spawning season if discharge flows are kept below 0.03 MGD. During the rearing season, the calculations indicate that discharge would not increase creek temperatures beyond the human use allowance at the edge of the mixing zone and the WLA of 1.5 gcals/day will be met. For much of the year, the calculated maximum allowable effluent temperatures under allocated conditions are higher than would be allowed under OAR 340-041-0053(2)(d). The calculated value of T_{WLA} does not allow a facility to discharge effluent at these high temperatures. A thermal plume analysis must be conducted for all facilities during permit renewal to ensure compliance with OAR 340-041-0053(2)(d) and prevent or minimize adverse effects to salmonids within the mixing zone. The results of this alternative scenario are summarized in **Table 14**.

Scenario 25: Duckwall-Pooley Van Horn and Terminal Ice discharging directly into Neal Creek without Lenz Creek facilities (**Table D-15**).
This scenario was evaluated in the event that Duckwall-Pooley Van Horn and Terminal Ice decide to pipe their discharge directly to Neal Creek and Diamond-Central and Duckwall-Pooley Odell decide to pipe their effluent to the Odell WWTP and Hood River rather than continuing to discharge into Lenz Creek. If this were to occur, there would only be two facilities discharging in the Neal Creek watershed in the critical period, so the HUA_{PS} would be split between the two (0.09°C each). Under this alternative scenario, the Duckwall-Pooley Van Horn discharge would not increase creek temperatures above their human use allowance during any months of the critical period and the WLAs of 2.2 gcals/day during the spawning season and 3.1 gcals/day during the rearing season would be met. The calculated maximum allowable effluent temperatures under allocated conditions are higher than would be allowed under OAR 340-041-0053(2)(d). The calculated value of T_{WLA} does not allow a facility to discharge effluent at these high temperatures. A thermal plume analysis must be conducted for all facilities during permit renewal to ensure compliance with OAR 340-041-0053(2)(d) and prevent or minimize adverse effects to salmonids within the mixing zone. The results of this scenario are summarized in **Table 14**.

Scenario 26: Duckwall-Pooley Van Horn discharging alone directly into Neal Creek with no other facilities discharging (**Table D-15**) during the critical period.
This scenario was evaluated in the event that all of the other permitted facilities in the Neal Creek watershed decide to stop discharging to surface waters in the watershed during the critical period. Under this alternative scenario, the Duckwall-Pooley Van Horn discharge would not increase river temperatures beyond the human use allowance (HUA_{PS} = 0.18°C) during any months of the critical period and the WLA of 4.5 gcals/day during the spawning season and 6.2 gcals/day during the rearing season would be met. The calculated maximum allowable effluent temperatures under allocated conditions are higher than would be allowed under OAR 340-041-0053(2)(d). The calculated value of T_{WLA} does not allow a facility to discharge effluent at these high temperatures. A thermal plume analysis must be conducted for all facilities during permit renewal to ensure compliance with OAR 340-041-0053(2)(d) and prevent or minimize adverse effects to salmonids within the mixing zone. The results of this alternative scenario are summarized in **Table 14**.

7.1.3.4 Diamond Fruit Growers – Central Facility

The parameters used in the reasonable potential analysis for the Diamond-Central facility are shown in **Table C-11**. As described in **Section 4.1.3.4**, there was enough data to assess the thermal impacts of the discharge for each month of the year. The data indicates that the rearing criterion in Lenz Creek can be exceeded from the end of June through the end of August; the spawning criterion is not exceeded in the portion of the creek designated as spawning habitat. Since this critical period falls within the Neal Creek watershed critical period (May 1-October 31), this is the critical period which applies for facilities located on Lenz Creek. The WLA of 0.1 gcals/day applies during this period and was based on the months with no flow in Lenz Creek above the Diamond-Central discharge. The effluent design flow of 0.09 MGD was used in this analysis.

The calculations indicate that the Diamond-Central discharge, by itself, will increase temperatures in Lenz Creek beyond the human use allowance (HUA_{PS} =0.18°C) during the critical period in the months of August through October. During these months, the calculated temperature increase at the edge of the mixing zone ranged from 1.3°C to 2.1°C. Because of the limited flow in Lenz Creek, effluent temperatures generally need to be less than 18°C during the critical period in order to meet the WLA. This analysis represents the most restrictive WLA under current operating conditions and is the one that applies in this TMDL during the critical period (**Table 13**). The results from the Neal Creek cumulative effects analysis are included in **Table C-11** to show the less stringent WLAs for the facility associated with that analysis.

Based on the data collected in Lenz Creek by Duckwall-Pooley, Diamond-Central does not discharge into a waterbody that has summer 7DADM ambient temperatures that are colder than the biologically based rearing criterion. However, it does discharge above salmon and steelhead spawning waters, which are approximately 0.4 miles below their point of discharge. Demonstration of compliance with subsection (b) of the Protecting Cold Water criterion (OAR 340-041-0028(11) will be required during the next permit renewal.

7.1.3.5 Duckwall-Pooley Fruit Company – Odell Facility

The parameters used in the reasonable potential analysis for the Duckwall-Pooley Odell facility are shown in **Table C-12**. In this analyses, there was enough data to assess the thermal impacts of the discharge for each month of the year. Even though the facility does not discharge in July, a wasteload allocation was calculated for this month since they are allowed to discharge all months in their permit. Effluent temperatures for July were estimated by averaging temperatures from June and August. Since this critical period falls within the Neal Creek watershed critical period (May 1-October 31), this is the critical period which applies for facilities located on Lenz Creek. The WLA of 0.2 gcals/day applies during this period and was based on the months with the lowest flow in Lenz Creek at the Duckwall-Pooley point of discharge (July, October). The effluent design flow of 0.25 MGD was used in this analysis.

The calculations indicate that the Duckwall-Pooley Odell discharge, by itself, will not increase temperatures in Lenz Creek beyond the human use allowance (HUA_{PS} =0.18°C) during the critical period. Based on the available data, the effluent was cooler than the criterion of 18.0°C every month and the calculated change in creek temperature ranged from -0.5°C to -2.7°C during the critical period. This analysis represents the most restrictive WLA under current operating conditions and is the one that applies in this TMDL during the critical period (**Table 13**). The results from the Neal Creek cumulative effects analysis are included in **Table C-12** to show the less stringent WLAs for the facility associated with that analysis.

Based on the data collected in Lenz Creek by Duckwall-Pooley Fruit Company, the Duckwall-Pooley Odell facility does not discharge into a waterbody that has summer 7DADM ambient temperatures that are colder than the biologically based rearing criterion. However, it does discharge above salmon and steelhead spawning waters, which are approximately 0.3 miles below their point of discharge. Demonstration of compliance with subsection (b) of the Protecting Cold Water criterion (OAR 340-041-0028(11) will be required during the next permit renewal.

7.1.3.6 Lenz Creek Cumulative Effects Analysis

A cumulative effects analysis (**Table C-13**) assessed the combined effects of the Diamond-Central and Duckwall-Pooley facility discharges on Lenz Creek. In this analysis, it was assumed that both facilities discharged into Lenz Creek at the Duckwall-Pooley point of discharge into Lenz Creek (approximately river mile 1.7), which would be the point farthest downstream in the watershed and the point of maximum impact.

A combined effluent flow of 0.34 MGD was used to represent Q_E, and flow-weighted effluent temperatures were calculated to represent T_E. Flow data for the creek came from data collected by Duckwall-Pooley Fruit Company above their point of discharge, as described in **Section 4.1.3.5**. Because the flow measured at this point includes effluent flow from the Diamond-Central facility, the design flow for Diamond-Central was subtracted from the measured flow in Lenz Creek to estimate Q_R for the cumulative effects analysis. The applicable temperature criterion that applies to Lenz Creek at the point of discharge is 18.0°C for salmon and trout rearing and migration. There is no spawning criterion in Lenz Creek in the point of discharge.

The calculations indicate that the combined discharges do not have the potential to increase creek temperatures beyond the human use allowance (HUA_{PS} =0.18°C) during the critical period. Based on the flow-weighted effluent temperature and flow data, the combined effluent temperature was cooler than the criterion of 18.0°C every month and the calculated change in creek temperature ranged from -0.36°C to -2.2°C during the critical period.

7.1.3.7 Neal Creek Cumulative Effects Analysis

West Fork Neal Creek, Lenz Creek, and the un-named Pine Grove creek discharge into Neal Creek at river miles 5.6, 1.8 and 1.5, respectively. A cumulative effects analysis evaluated the combined thermal impact of the five discharges located in the Neal Creek watershed on Neal Creek (**Table C-14**). In this analysis it was assumed that all of the facilities discharged at the un-named tributary, the most downstream location in the watershed, which would be the point farthest downstream in the watershed and the point of maximum impact.

A combined effluent flow of 0.654 MGD was used to represent Q_E from November-April when Mt. Hood Forest Products is allowed to discharge. During the rest of the year, a combined effluent flow of 0.5 MGD was used to represent Q_E. Flow-weighted effluent temperatures were calculated for each month to represent T_E based on the available data as described in **Section 4**. Data collected by the Confederated Tribes of Warm Springs and other local partners was used to estimate Neal Creek flows. The applicable numeric criteria for Neal Creek are 18.0°C for salmon and trout rearing and migration and 13.0°C for spawning (October 15-May 15).

The calculations indicate that the combined discharges have the potential to increase creek temperatures beyond the human use allowance (HUA_{PS} =0.18°C) during the critical period from October 15 to October 31. During this period, the calculated stream temperature increase was 0.30°C. Because the HUA was exceeded during the critical period in the cumulative effects analysis, the thermal contribution of each of the facilities was evaluated by splitting the HUA between the facilities, using their design flows and effluent temperatures. In this analysis, the Terminal Ice, Duckwall-Pooley Van Horn and Diamond-Central facilities contributed to exceedances of the 13°C criterion from October 15 – October 31. The calculated temperature increases were 0.13°C from the Terminal Ice facility, 0.06°C from the Duckwall-Pooley Van Horn facility, and 0.08°C from the Diamond-Central facility.

Table 13. Waste Load Allocations in the Western Hood Subbasin

(Replaces Tables 13 and Table 17 in the 2001 WHS TMDL)
Variables indicated in the first row of this table refer to variables used in Equations 3-5 presented in Section 7.1 and as defined below the table.

Facility	Receiving Stream	RPA Table	T_C[1] (°C)	Q_R[2] (cfs)	Q_E[3] (MGD)	HUA_{PS}[4] (°C)	WLA[5] (gcal/day)	Critical period
East Fork Hood River Watershed								
Mount Hood Meadows WWTP	East Fork Hood River	C-1	18.0	6.7	0.0187	0.18	3.0	May 1 - Sept 30
Diamond Fruit - Parkdale	Ditch	C-2	18.0	0.1	0.22	0.18	0.2	May 1 - Sept 30
Parkdale WWTP (before upgrade)	Trout Creek	C-3	18.0	2.5	0.10	0.18	1.2	May 1 - Sept 30
Parkdale WWTP (after upgrade)					0.08		1.2	
Odell Creek Watershed								
Diamond Fruit - Odell	McGuire Creek	C-5	16.0	1.6	0.03	0.18	0.7	April 15 - Sept 30
Odell WWTP	Odell Creek (WLA from Odell Creek Cumulative Effects Analysis)	C-6	13.0	11.6	0.42	0.09	2.7	April 15 – May 15
			16.0	8.5	0.42	0.09	2.0	May 16 – Sept 30
Neal Creek Watershed								
Mt. Hood Forest Products	Ditch	C-8	18.0	--	--	--	Existing load	May 1 – Oct 31
Terminal Ice and Cold Storage	Ditch	C-9	18.0	0.0	0.12	0.09	0.04	March 1 – Oct 31
Duckwall-Pooley - Van Horn	Ditch	C-10	18.0	0.0	0.04	0.09	0.01	March 1 – Oct 31
Diamond Fruit - Central	Lenz Creek	C-11	18.0	0.0	0.09	0.18	0.1	May 1 – Oct 31
Duckwall-Pooley - Odell	Lenz Creek	C-12	18.0	0.1	0.25	0.18	0.2	May 1 – Oct 31
Mainstem Hood River Watershed								
Hood River Recycling and Transfer Station	Unnamed tributary to Indian Creek	--	18.0	--	--	--	Existing load	May 1 - Sept 30

Table Notes:
1. T_C = Applicable temperature criterion (°C)
2. Q_R = Upstream river low flow (cfs)
3. Q_E = Point source effluent flow (MGD)
4. HUA_{PS} = Portion of human use allowance allocated to point source (°C)
5. WLA = Wasteload allocation thermal load (gcals/day)

Table 14. Alternative Waste Load Allocations in the Western Hood Subbasin

Variables indicated in the first row of this table refer to variables used in Equations 3-5 presented in Section 7.1 and as defined below the table on the last page.

Facility	Scenario*	RPA Table	Receiving Stream	T_C[1] (°C)	Q_R[2] (cfs)	Q_E[3] (MGD)	HUA_{PS}[4] (°C)	WLA[5] (gcal/day)	Critical period
Diamond Fruit – Parkdale	Scenario 1*: Current permitted flows	C-2	Ditch	18.0	0.1	0.22	0.18	0.2	May 1 – Sept 30
	Scenario 2: Current permitted flows	D-1	Wishart Creek	18.0	0.2	0.22	0.18	0.2	May 1 – Sept 30
	Scenario 3: Cooling water flows	D-1	Wishart Creek	18.0	0.2	0.004	0.18	0.1	May 1 – Sept 30
	Scenario 4: Cooling water flows	D-1	Ditch	18.0	0.1	0.004	0.18	0.05	May 1 – Sept 30
	Scenario 5: Cooling water flows	D-1	Ditch	18.0	0.1	0.003	0.18	0.05	May 1 – Sept 30
Diamond Fruit – Odell	Scenario 6*: Current permitted flows	C-5	McGuire Creek	16.0	1.6	0.03	0.18	0.7	April 15 -Sept 30
	Scenario 7: Cooling water flows	D-2	McGuire Creek	16.0	1.6	0.004	0.18	0.7	April 15 -Sept 30
Odell WWTP	Scenario 8*: Odell Creek CEA with Diamond-Odell permitted discharge	C-6	Odell Creek	13.0	11.6	0.42	0.09	2.7	April 15 – May 15
				16.0	8.5	0.42	0.09	2.0	May 16 – Sept 30
	Scenario 9: WWTP alone, no Diamond-Odell discharge, no CEA needed	D-3	Odell Creek	13.0	11.6	0.42	0.18	5.4	April 15 – May 15
				16.0	8.5	0.42	0.18	4.0	May 16 – Sept 30
	Scenario 10: Odell Creek CEA with Diamond-Odell cooling water	C-6	Odell Creek	13.0	11.6	0.424	0.09	2.7	April 15 – May 15
				16.0	8.5	0.424	0.09	2.0	May 16 – Sept 30
	Scenario 11: WWTP discharge directly to Hood River	D-4	Hood River	13.0	235	0.42	0.18	104	May 1 – June 15
				16.0	185	0.42	0.18	82	June 16 – Sept 30
	Scenario 12: all dischargers in Odell discharge directly to Hood River via Odell WWTP	D-4	Hood River	13.0	235	0.79	0.18	104	May 1 – June 15
				16.0	185	0.79	0.18	82	June 16 – Sept 30

Table 14 (continued). Alternative Waste Load Allocations in the Western Hood Subbasin

Facility	Scenario*	RPA Table	Receiving Stream	T_C[1] (°C)	Q_R[2] (cfs)	Q_E[3] (MGD)	HUA_{PS}[4] (°C)	WLA[5] (gcal/day)	Critical period
Terminal Ice and Cold Storage	Scenario 13*: Terminal Ice and Duckwall-Pooley Van Horn combined discharge	C-9	Ditch	18.0	0.0	0.12	0.09	0.04	March 1 – Oct 31
	Scenario 14: Terminal Ice discharge alone	D-6	Ditch	18.0	0.0	0.12	0.18	0.1	March 1 – Oct 31
	Scenario 15: Terminal Ice discharge alone	D-7	Un-named Pine Grove creek	18.0	1.0	0.12	0.18	0.5	May 1 – Oct 31
	Scenario 16: Terminal Ice and Duckwall-Pooley Van Horn combined discharge	D-8	Un-named Pine Grove creek	18.0	1.0	0.12	0.09	0.3	May 1 – Oct 31
	Scenario 17: Terminal Ice discharge with all of the other permitted facilities in the watershed continuing to discharge	D-9	Neal Creek	13.0	9.5	0.12	0.045	1.1	May 1-15, Oct 15-31
				18.0	13.4	0.12	0.045	1.5	May 16 – Oct 14
	Scenario 18: Terminal Ice and Duckwall-Pooley Van Horn discharge without discharge from Lenz Creek facilities	D-10	Neal Creek	13.0	10.0	0.12	0.09	2.2	May 1-15, Oct 15-31
				18.0	13.9	0.12	0.09	3.1	May 16 – Oct 14
	Scenario 19: Terminal Ice the only discharger in the watershed	D-10	Neal Creek	13.0	10.1	0.12	0.18	4.5	May 1-15, Oct 15-31
				18.0	14.0	0.12	0.18	6.2	May 16 – Oct 14

Table 14 (continued). Alternative Waste Load Allocations in the Western Hood Subbasin

Facility	Scenario*	RPA Table	Receiving Stream	T_C[1] (°C)	Q_R[2] (cfs)	Q_E[3] (MGD)	HUA_{PS}[4] (°C)	WLA[5] (gcal/day)	Critical period
Duckwall-Pooley - Van Horn	Scenario 20*: Ditch CEA, with Terminal Ice discharge	C-10	Ditch	18.0	0.0	0.04	0.09	0.01	March 1 – Oct 31
	Scenario 21: Duckwall-Pooley Van Horn discharge alone	D-11	Ditch	18.0	0.0	0.04	0.18	0.03	March 1 – Oct 31
	Scenario 22: Duckwall-Pooley Van Horn discharge alone	D-12	Un-named Pine Grove creek	18.0	1.0	0.04	0.18	0.5	May 1 – Oct 31
	Scenario 23: Terminal Ice and Duckwall-Pooley Van Horn combined discharge	D-13	Un-named Pine Grove creek	18.0	1.0	0.04	0.09	0.2	May 1 – Oct 31
	Scenario 24: Duckwall-Pooley Van Horn discharge with all of the other permitted facilities in the watershed continuing to discharge	D-14	Neal Creek	13.0	9.5	0.04	0.045	1.1	May 1-15, Oct 15-31
				18.0	13.4	0.04	0.045	1.5	May 16 – Oct 14
	Scenario 25: Duckwall-Pooley Van Horn and Terminal Ice discharge without discharge from Lenz Creek facilities	D-15	Neal Creek	13.0	10.0	0.04	0.09	2.2	May 1-15, Oct 15-31
				18.0	13.9	0.04	0.09	3.1	May 16 – Oct 14
	Scenario 26: Duckwall-Pooley Van Horn the only discharger in the watershed	D-15	Neal Creek	13.0	10.2	0.04	0.18	4.5	May 1-15, Oct 15-31
				18.0	14.1	0.04	0.18	6.2	May 16 – Oct 14

* This scenario indicated with this symbol and highlighted in grey is the scenario that represents the current operating conditions and represents the WLA in effect at the time of TMDL approval. This is the scenario included in Table 13 for each of the facilities.

Table Notes:

1. T_C = Applicable temperature criterion (°C)
2. Q_R = Upstream river low flow (cfs) Note: the minimum Neal Creek flow varies between scenarios because the flow measurement point was downstream of all of the dischargers so discharge flows were subtracted from the measured Neal Creek flow.
3. Q_E = Point source effluent flow (MGD)
4. HUA_{PS} = Portion of human use allowance allocated to point sources (°C)
5. WLA = Wasteload allocation thermal load (gcals/day)

7.2 Load Allocations

This section describes the portions of the receiving water's loading capacity that are allocated to existing nonpoint sources of pollution and background sources. In the 2001 WHS TMDL, 100% of the nonpoint source load was assigned to natural sources, with 0% assigned to anthropogenic sources. Because of the human use allowance included in the 2003 temperature standard, 15% of the HUA (0.045°C) is assigned to nonpoint sources in this revision. Because load allocations were not explicated calculated in the 2001 WHS TMDL, this section replaces the load allocation section (Section 4.7) in the earlier TMDL.

The following equation is used to calculate the thermal load allocations:

EQ 8. $LA = \Delta T \cdot Q_R \cdot C_F$

Where:

- LA = Load allocation (gcals/day)
- ΔT = The maximum temperature increase (ºC) not to be exceeded by the identified source (T_C for background allocations and HUA_{NPS} for nonpoint source allocations)
- T_C = Applicable temperature criterion (°C)
- HUA_{NPS} = Portion of human use allowance allocated to nonpoint sources (°C)
- Q_R = The daily average river flow rate (cfs)
- C_F = Conversion factor for calculating gcals/day from ºC-ft^3: (2.446665 gcal-s / ºC-ft^3-day)

Table 12 (refer back to Section 7.1) presents the calculated background and nonpoint source load allocations using Equation 8 on impaired streams. The background load allocations were calculated based on the applicable criteria (T_C) and the estimated low stream flow; the load allocations for nonpoint sources were calculated based on the portion of the human use allowance assigned to nonpoint sources (HUA_{NPS}) and the estimated low stream flow. The stream flows represented in **Table 12** are the estimated low flows as described in **Section 5**, however the actual load allocations will vary based on stream flow. Equation 8 should be used to calculate the load allocations at other stream flows.

7.2.1 Background

Non-anthropogenic sources are assigned the amount of thermal loading associated with the applicable criteria. Examples of background thermal loading from natural, or non-anthropogenic sources, are: short and longwave radiation under natural riparian vegetation; advective inflows from natural tributaries, springs, and groundwater; hyporheic flow and other heat distribution effects of natural channel morphology; and any other features that comprise background thermal loads.

7.2.2 Nonpoint Sources: Surrogate Measures

This temperature TMDL targets system potential effective shade as the surrogate measure to meet the TMDL load allocation for nonpoint sources. As allowed under USEPA regulations (40 CFR 130.2(i)), the 2001 WHS TMDL allocated "other appropriate measures" (or surrogate measures) in addition to thermal loads. Effective shade is inversely proportional to direct solar flux, which is a measure of the daily longitudinal heating rate per stream surface area. The units of flux presented in this TMDL are Langleys[3]/day (ly/day). Although daily solar load allocations were derived, they are of limited value in guiding management activities needed to solve water quality problems. In order for the TMDL to be more meaningful to the public and guide implementation efforts, load allocations for nonpoint source

[3] Langley = calorie/cm^2

loads were expressed in terms of percent effective shade. While this revision modestly increases the allowable nonpoint source load, it does not modify the effective shade surrogate measures established in the 2001 WHS TMDL (Section 4.8).

System potential vegetation corresponds to no anthropogenic increase above natural background temperatures. Section 4.5 and Section 4.8 of the 2001 WHS TMDL provide background information on the dynamics of shade, the methodology used to develop and model system potential vegetation, and the use of surrogate measures for TMDL development. Section 4.5.2 and Section 4.5.3 of the 2001 WHS TMD describe the data and analytical methodology used in the effective shade and temperature simulations. For easier reference, this information is repeated in this 2018 TMDL revision in **Appendix G**. Because the effective shade surrogate measures from the 2001 WHS TMDL implement the nonpoint source load allocation, the figures from Section 4.8 in the earlier TMDL are repeated below in **Section 7.2.2.1** and **7.2.2.2**.

This TMDL document contains two types of load allocations and surrogate measures from the 2001 WHS TMDL:

1. *Site-specific* solar loading and effective shade allocations apply to six streams where longitudinal shade sampling was completed;
2. *Generalized (non site-specific)* solar loading and effective shade curves apply to all other streams in the WHS where heating and shade were not simulated.

7.2.2.1 Site Specific Effective Shade Surrogate Measures

Current condition and system potential solar flux and effective shade were assessed at 100-meter intervals along six streams in the Western Hood Subbasin: East Fork Hood River/Hood River, Middle Fork Hood River, Neal Creek, Odell Creek, Trout Creek, and Indian Creek. While a new assessment of "current" vegetation conditions was not done for this TMDL revision, it is anticipated that the 2018 effective shade conditions will have improved, moving closer to system potential vegetation, given the local investments in restoration that have occurred since 2001. **Figure 10** through **Figure 15** (Figures 42 through 47 from the WHS TMDL) display the system potential percent effective shade values that correspond to the loading capacities for these six specific streams.

7.2.2.2 Effective Shade Curve - Surrogate Measures

Generalized (non site-specific) solar flux and effective shade curves were developed as load allocations and surrogate measures for streams where effective shade and temperature were not simulated. In the 2001 WHS TMDL, curves were developed for six different system potential vegetation communities where the effective shade surrogate was expressed as the solar flux versus channel width relationship for specified stream aspects (Figures 48 through 53). These figures are repeated in this TMDL revision as **Figure 16** through **Figure 21**.

Figure 10. East Fork Hood River/Hood River Effective Shade Surrogate Measure for Nonpoint Sources

(Figure 42 in the 2001 WHS TMDL)

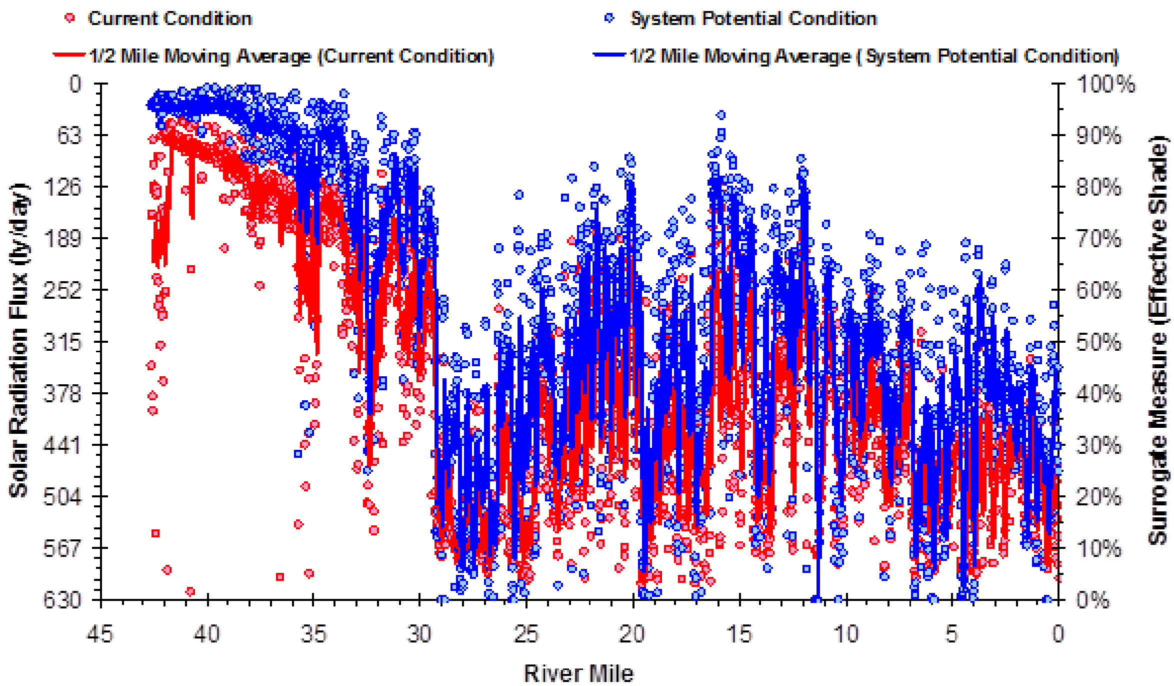


Figure 11. Middle Fork Hood River Effective Shade Surrogate Measure for Nonpoint Sources

(Figure 43 in the 2001 WHS TMDL)

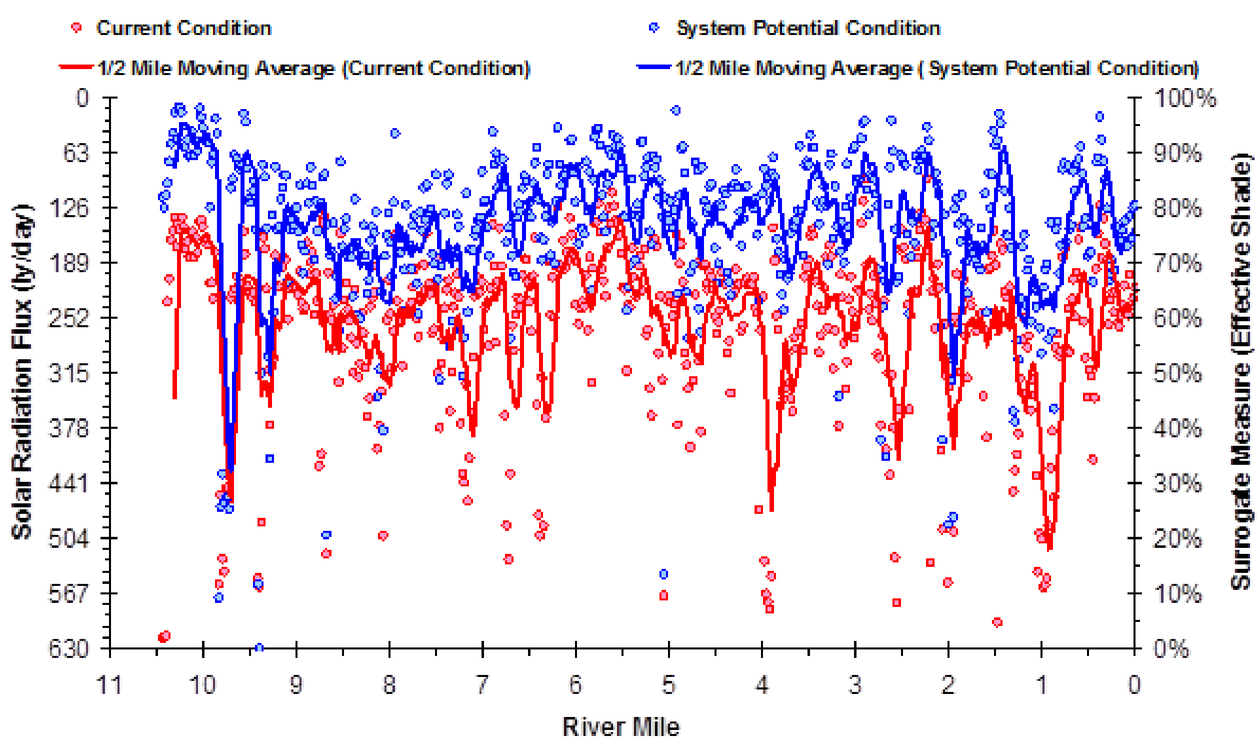


Figure 12. Neal Creek Effective Shade Surrogate Measure for Nonpoint Sources

(Figure 44 in the 2001 WHS TMDL)

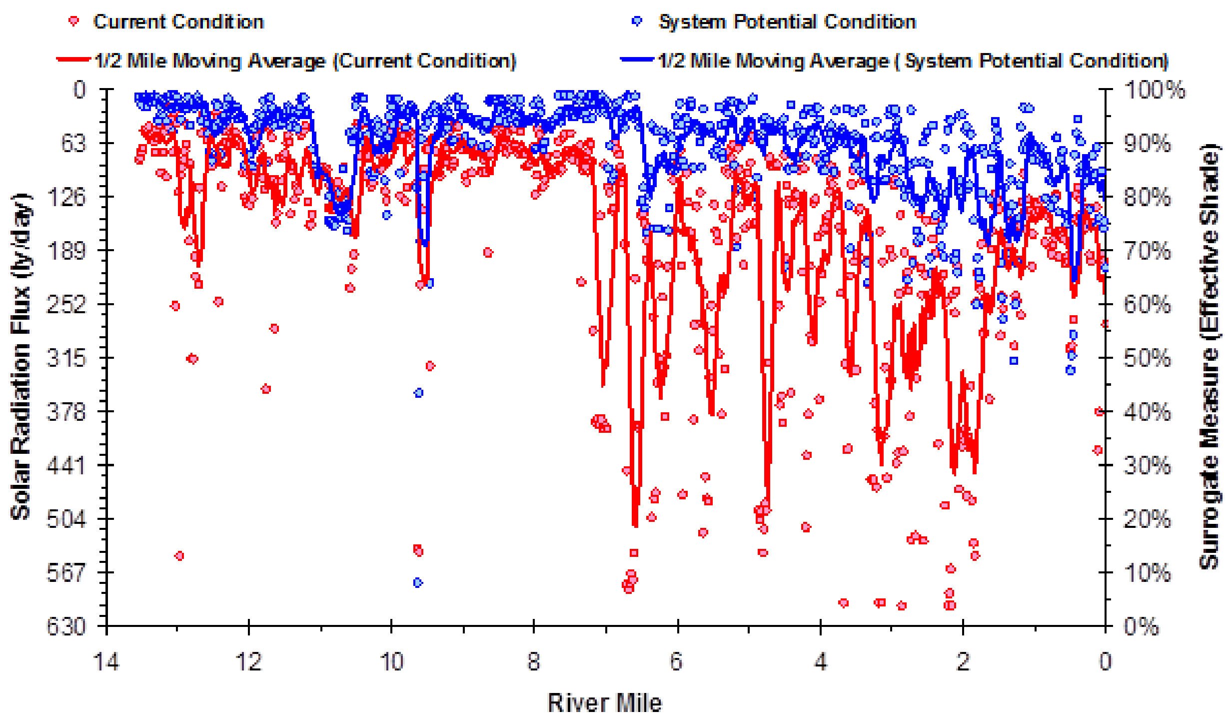


Figure 13. Odell Creek Effective Shade Surrogate Measure for Nonpoint Sources

(Figure 45 in the 2001 WHS TMDL)

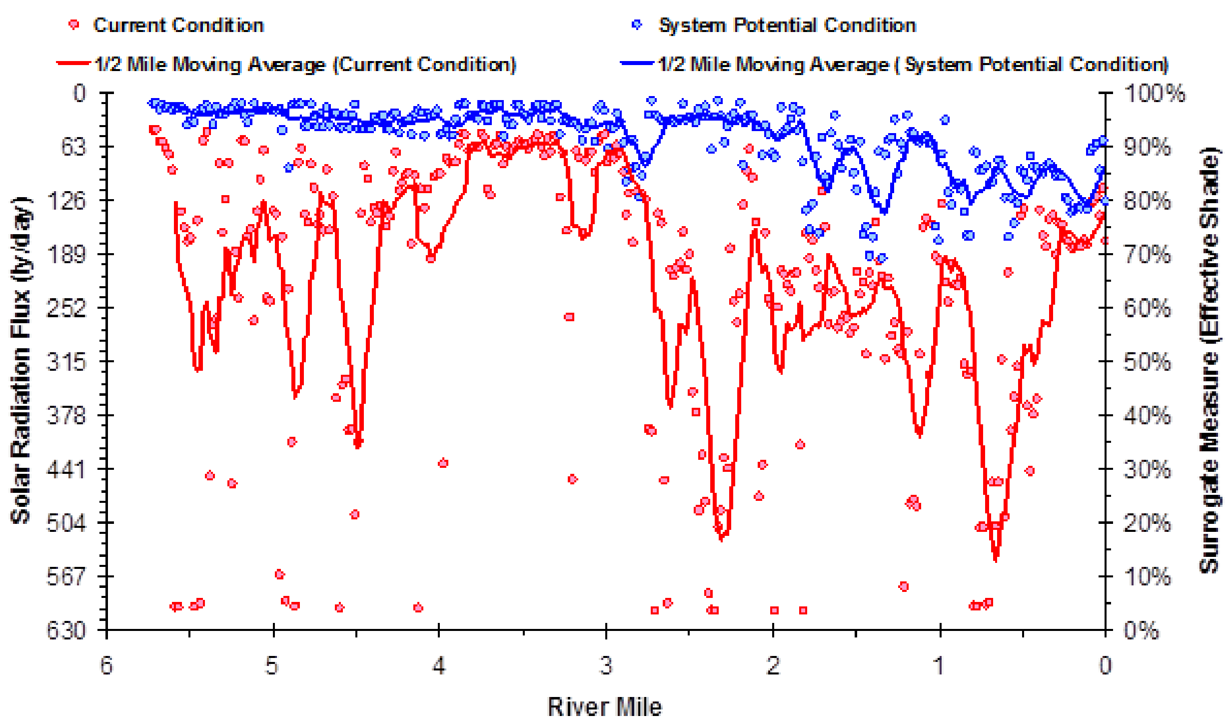


Figure 14. Trout Creek Effective Shade Surrogate Measure for Nonpoint Sources

(Figure 46 in the 2001 WHS TMDL)

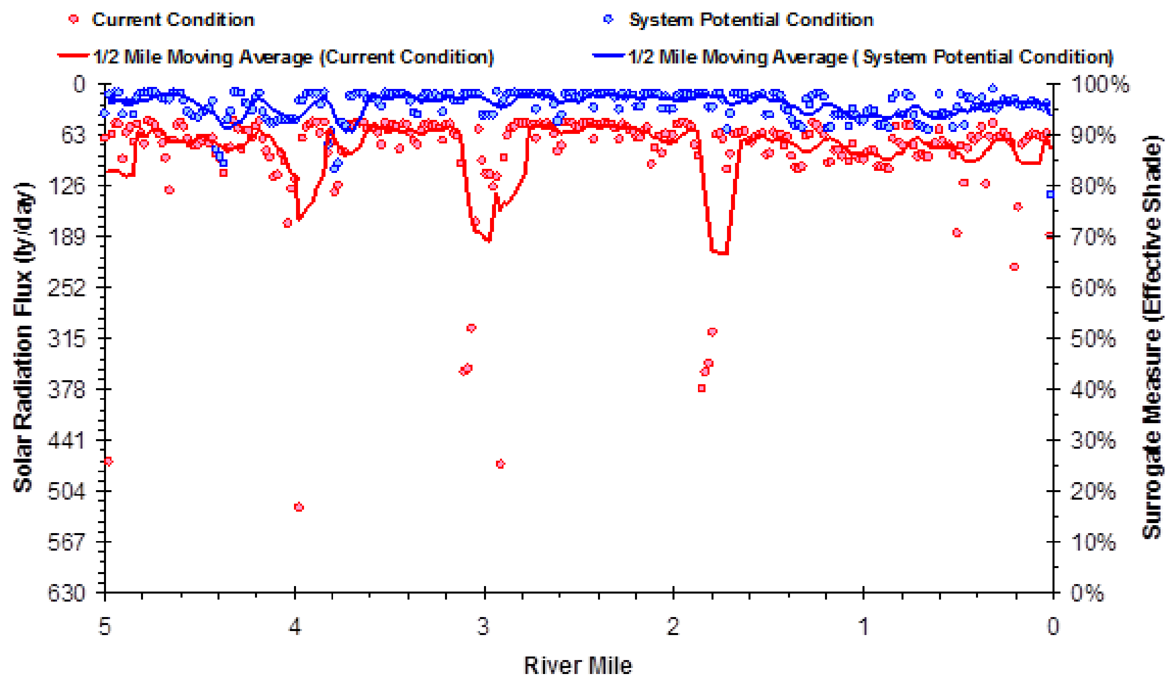


Figure 15. Indian Creek Effective Shade Surrogate Measure for Nonpoint Sources

(Figure 47 in the 2001 WHS TMDL)

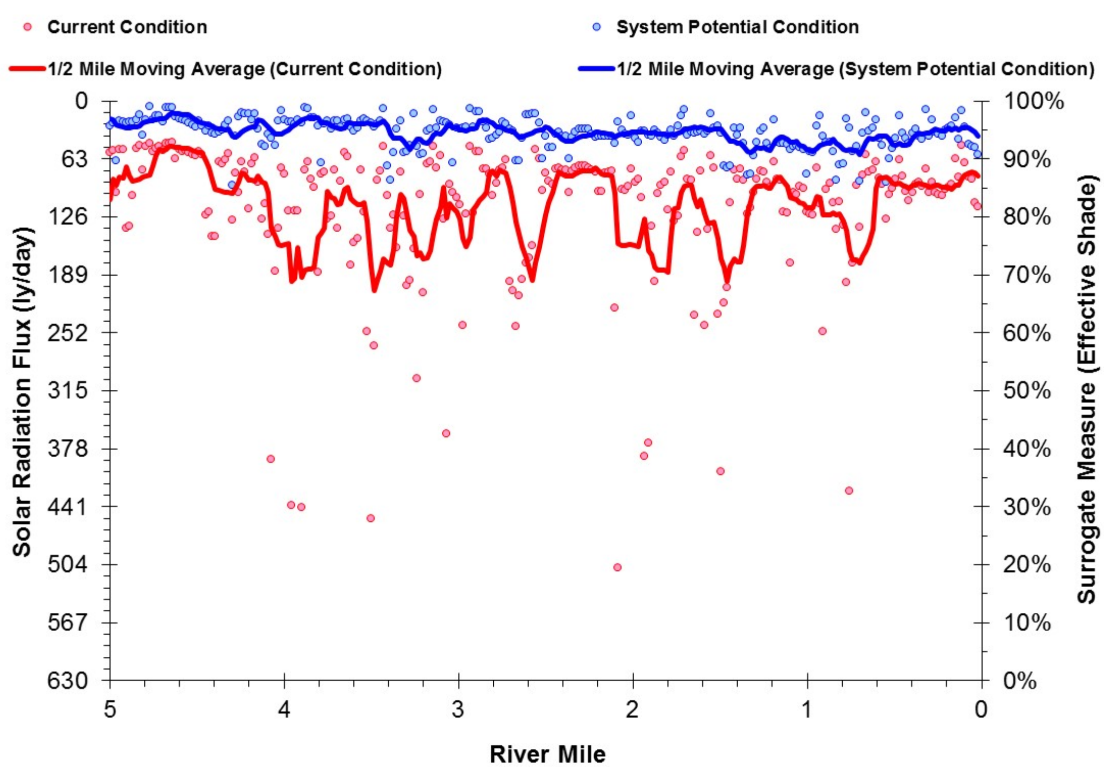


Figure 16. Effective Shade Curve – Ponderosa Pine Potential Vegetation Zone

(Figure 48 in the 2001 WHS TMDL)

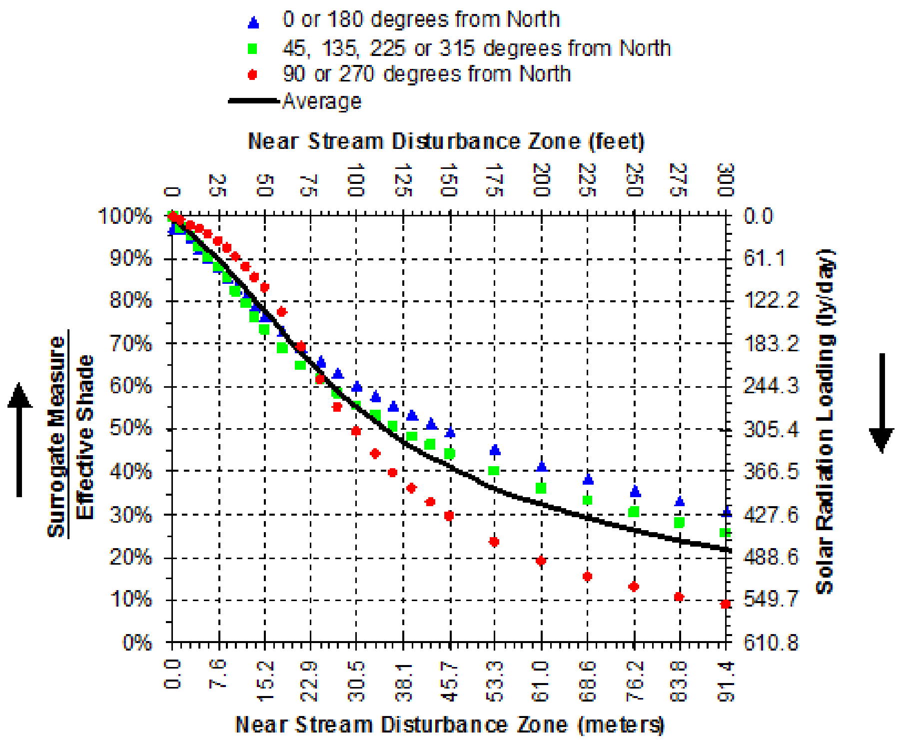


Figure 17. Effective Shade Curve – Eastside Douglas Fir Potential Vegetation Zone

(Figure 49 in the 2001 WHS TMDL)

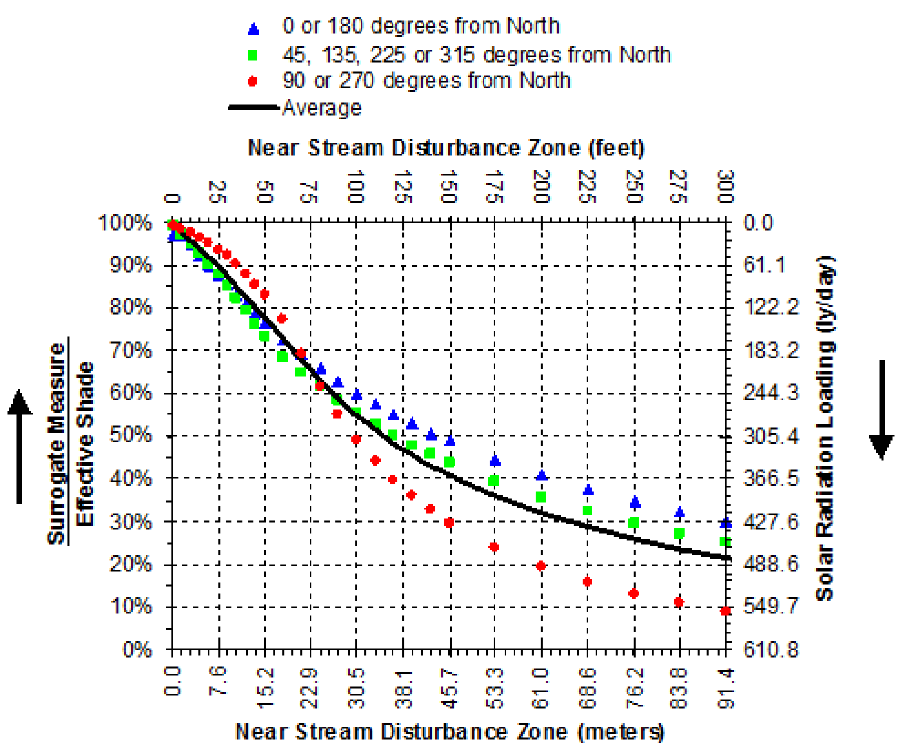


Figure 18. Effective Shade Curve – Western Hemlock Potential Vegetation Zone

(Figure 50 in the 2001 WHS TMDL)

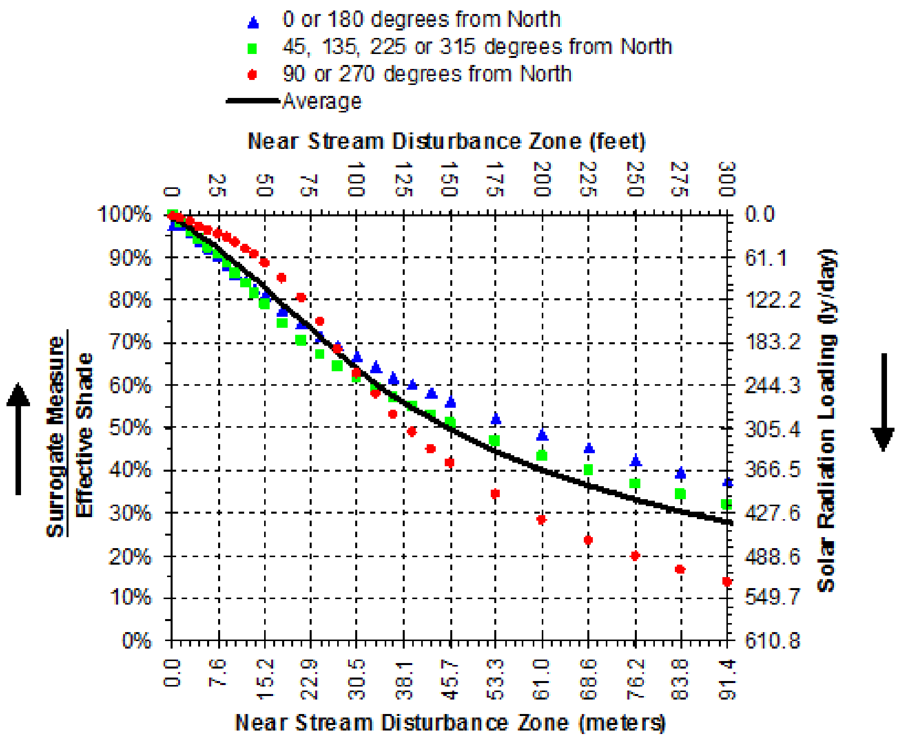


Figure 19. Effective Shade Curve – Grand Fir Potential Vegetation Zone

(Figure 51 in the 2001 WHS TMDL)

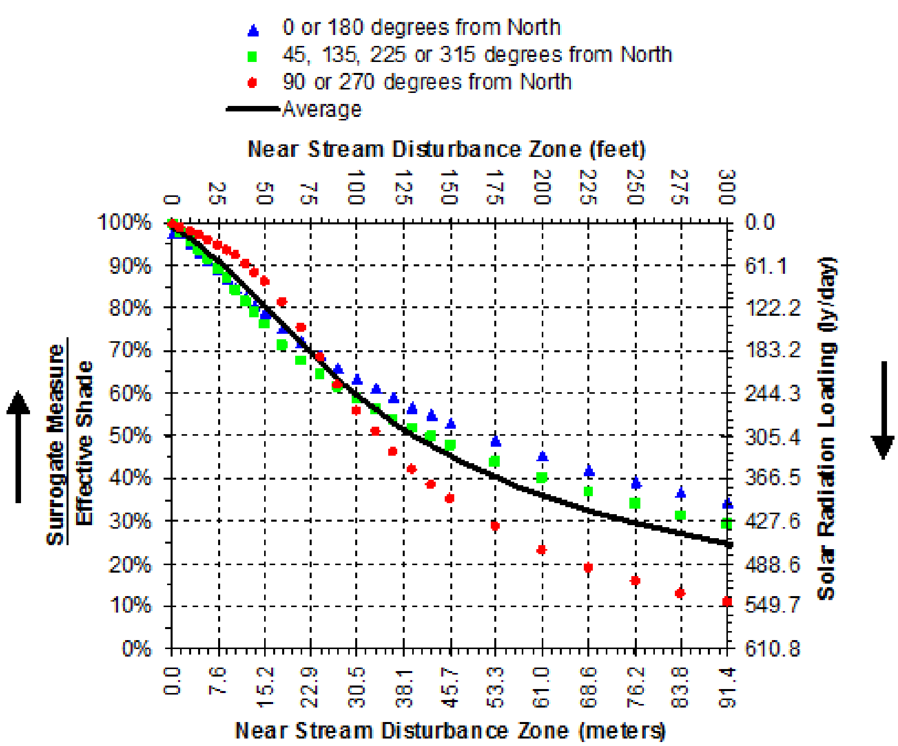


Figure 20. Effective Shade Curve – Pacific Silver Fir Potential Vegetation Zone

(Figure 52 in the 2001 WHS TMDL)

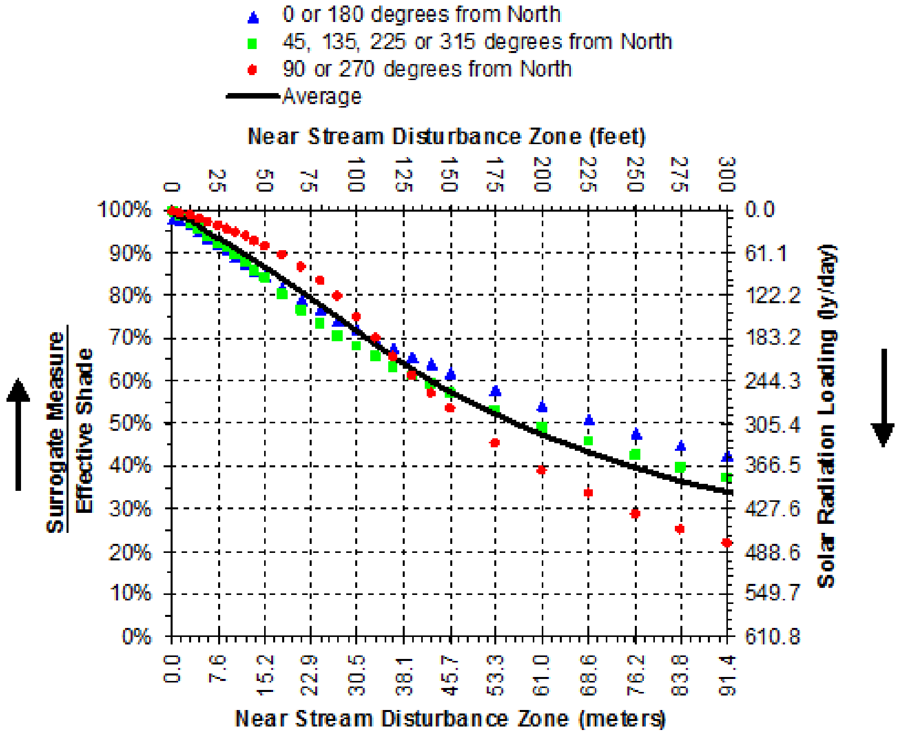
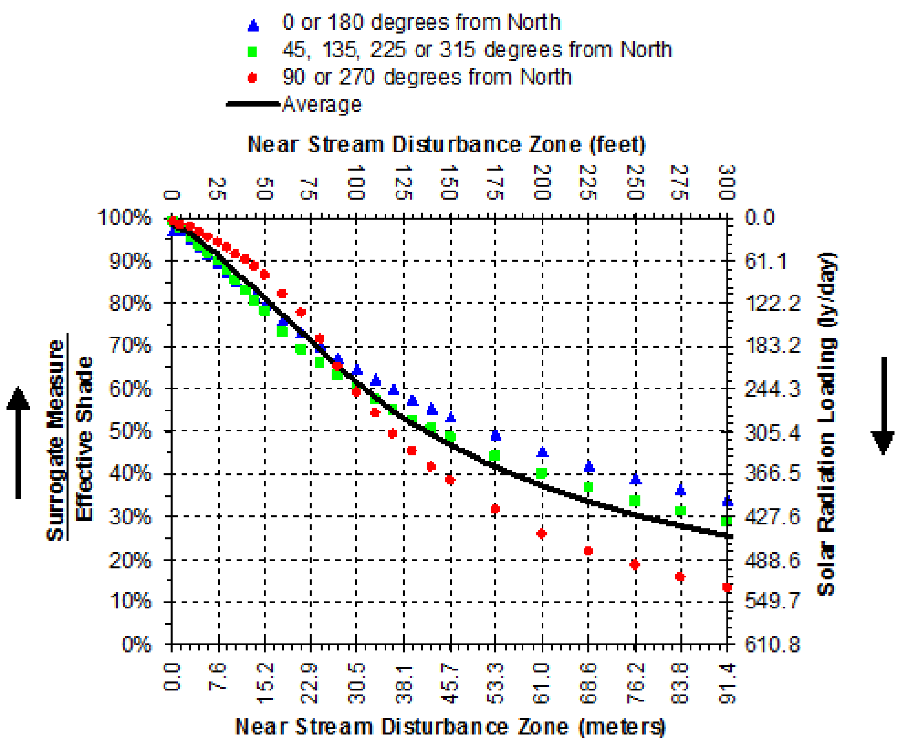


Figure 21. Effective Shade Curve – Mountain Hemlock Potential Vegetation Zone

(Figure 53 in the 2001 WHS TMDL)



7.2.3 Laurance Lake

The load allocation for Laurance Lake Reservoir was calculated using a flow-based methodology similar to that used in the 2001 WHS TMDL (Section 4.6.2.3). The 2001 WHS TMDL noted that, although the allocation was flow-based, ODEQ did not believe that increasing flow through the reservoir would achieve the allocation.
However, since development of a daily load is required, the load allocations for the reservoir can be calculated using Equation 8, where ΔT is the change in Clear Branch temperatures allowed in OAR 340-041-0028(4)(f).

Table 15 summarizes the load allocations calculated for the reservoir using Equation 8, by season and criterion as referenced in OAR 340-041-0028(4)(f) and described in **Section 2**. Q_R represents the estimated low flows by season from USGS gage #14115815 (**Table 1**). ODEQ believes evaluating compliance using the change in temperature, rather than a thermal load expressed as units of energy such as gigacalories, is more useful approach for reservoir management. OAR 340-041-0028(4)(f) implements the Laurence Lake thermal load allocations. From August 15 – May 15, the allowed change in temperature (ΔT) shown in **Table 15** is calculated as the difference between7DADM stream temperatures in Clear Branch immediately above and below the reservoir. From May 16 - August 14, the state-wide criterion of 12.0 ºC applies to temperatures in Clear Branch below the reservoir, and the portion of the human use allowance allocated to Laurance Lake (**Table 11**) is 0.18ºC.

Table 15. Load allocations for Laurance Lake

Waterbody	Season	Temperature Criterion (ºC)	ΔT (ºC)	Q_R (cfs)	LA (gcal/day)
Laurance Lake	August 15 – May 15	ambient 7DADM stream temperature above reservoir >= 9.0ºC	0.3	4.3	3.2
		ambient 7DADM stream temperature above reservoir < 9.0ºC	1.0	4.3	10.5
	May 16 – August 14	12.0	0.18	3.9	1.7

Equation 8 and **Table 15** replace Table 15 in the 2001 WHS TMDL. This **Section 7.2.3** replaces Section 4.6.2.3 in the 2001 WHS TMDL.

Section 401 Hydropower Certification. Section 401 of the Federal Water Pollution and Control Act (Clean Water Act) requires any applicant for a federal license or permit that may result in a discharge into navigable waters to provide the federal licensing or permitting agency with a 401 Certificate from the State in which the discharge originates. While the MFID hydroelectric project has a small hydro (under 5 MW) conduit exemption from Federal Energy Regulatory Commission licensing, it has been determined that 401 certification will be required for the project in conjunction with renewal of the MFID's Special Use Permit with the Mt. Hood National Forest, as the SUP is a federal permit. The current SUP will expire on December 31, 2021. The MFID has not yet requested 401certification from ODEQ. Once this request is made, ODEQ will have one year from receipt of that request in which to approve or deny certification. ODEQ's evaluation and required findings for 401 certification will consider additional water quality data beyond that considered in this TMDL revision, as will be necessary to determine consistency with water quality rules adopted by the Environmental Quality Commission and provisions of sections 301, 302, 303, 306 and 307 of the Federal Water Pollution Control Act, P.L. 92-500, as amended. It is possible that 401 certification could require a broader set of management practices than the TMDL since certification will be based on the review of a broader set of water quality issues.

7.3 Water Quality Trading

Water quality trading is an innovative program that allows facilities that discharge wastewater to a stream or river to meet regulatory obligations by: (1) purchasing equivalent or larger pollution reductions from another source; or (2) taking action to protect or restore riparian areas, wetlands, floodplains, and aquatic habitat to reduce the impact of pollutants.
Trading is based on the fact that dischargers in a watershed can face very different costs to control the same pollutant. Trading programs allow facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or superior) pollution reductions from another source at lower cost, thus achieving the same water quality improvement at lower overall cost. The successful trading process allows a source with high TMDL implementation costs to exchange the same or greater level of load reduction from other sources with lower costs. Trading may also allow Oregon to achieve water quality improvements more quickly than would otherwise be possible.

The Oregon Environmental Quality Commission unanimously approved rules establishing a voluntary water quality trading program to facilitate pollution reduction and protect the quality of Oregon's waterways in December 2015. The new rules, at OAR 340 Division 039, establish a trading program that is transparent and enforceable and will provide clarity for regulated entities, the public and ODEQ staff.

ODEQ encourages the use of water quality trading as one possible management strategy to be used in implementation of the Western Hood Subbasin temperature TMDL. ODEQ can authorize trading in NPDES permitting and/or 401 water quality certifications. Authorization can occur either through development of a trading framework for all or a portion of the Western Hood Subbasin, or through approval of a facility's water quality trading plan. For more information refer to ODEQ's web page on water quality trading: http://www.deq.state.or.us/wq/trading/faqs.htm. Sources wishing to pursue trading should contact their regional ODEQ office and permit writer.

8. Margin of Safety

In the 2001 WHS TMDL, ODEQ applied an explicit margin of safety of 10% in the equations used to calculate the WLAs because there was very little measured data available to use in developing the WLAs. Although we now have more measured data, data was still limited for most of the facilities. Because of this, we have retained an explicit 10% margin of safety. This margin of safety was incorporated into the allocations by assigning 10% of the human use allowance (0.03°C) to the margin of safety.

In addition to this explicit margin of safety, we have also incorporated a number of conservative assumptions as an implicit margin of safety. These include:

- Using the lowest measured steam flow and highest measured effluent temperature in the RPA analyses for facilities with limited data.
- Where maximum daily effluent temperature data was available instead of 7DADM data, this daily maximum data was used. Given that the 7DADM statistic would be lower than the maximum of daily maximum values, this is a conservative assumption.
- RPA analyses assumed that facilities were discharging at their design flows. In most situations, this was higher than the actual discharge flows.
- In each CEA, it was assumed that all dischargers in the watershed were discharging at the most downstream point of discharge in the watershed. Because thermal modeling was not done to demonstrate the degree of thermal load dissipation between sources, this is a conservative approach which assumes no excess thermal load dissipation.

- ODEQ allocated 15 percent of the human use allowance to nonpoint sources but is basing the load allocation on system potential conditions. ODEQ considers this conservative methodology to be part of the implicit margin of safety.

9. Reserve Capacity

The 2001 WHS TMDL did not identify a reserve capacity. This TMDL revision includes a specific allocation for reserve capacity set aside that can be used for unidentified sources, future growth and new or expanded sources. The general framework of this revision allocates 0.045°C or 15 percent of the HUA to reserve capacity. On streams without any point sources, an additional 0.18°C will be available for reserve capacity. Reserve capacity is available for use by either nonpoint or point sources to accommodate future growth as well as to provide an allocation to any existing source that may not have been identified during the development of this TMDL.

10. Reasonable Assurances and Attainment of Water Quality Standards

In Oregon, Water Quality Management Plans provide the framework of management strategies needed to attain and maintain water quality standards and provides reasonable assurance that the TMDL and associated allocations will be implemented. WQMPs are designed to work in conjunction with detailed plans and analyses provided in sector-specific or source-specific implementation plans. The 2001 WHS TMDL included a WQMP in Chapter 5, which named nine Designated Management Agencies: ODEQ, Oregon Department of Agriculture, Oregon Department of Forestry, Oregon Department of Transportation, U.S. Forest Service, City of Hood River, Hood River County, Bonneville Power Administration, and Middle Fork Irrigation District. These DMAs and other local partners continue to be active in TMDL implementation, therefore the WQMP continues to serve as the implementing mechanism for the Western Hood Subbasin TMDL.

ODEQ is not planning to revise the WQMP at this time. However, we have provided information in this section of the TMDL revision to discuss reasonable assurances that the TMDL and associated allocations will be met. This section includes information about the implementation progress that has been made in the Western Hood Subbasin since 2001.

10.1 TMDL Implementation Progress

This section describes the Implementation Plans and progress made by each DMA since adoption of the 2001 WHS TMDL, as well as expectations for future implementation activities.

In addition to the specific DMAs listed below, the Hood River Watershed Group plays an important role in TMDL implementation in the Western Subbasin. One of 90 watershed councils in Oregon, the Hood River Watershed Group is a forum of landowners, citizens, growers, irrigation and water districts, environmental organizations, businesses, recreationists, governments and tribal representatives working together to benefit Hood River Valley’s natural resources. ODEQ is an active partner in the Watershed

Group. Through a collaborative, consensus-based process, the Watershed Group developed a comprehensive Watershed Assessment (Coccoli 1999) and Action Plan (Coccoli 2002). The Action Plan is updated periodically, with the last update in 2014 (Thieman 2014). The 2014 Action Plan identifies and prioritizes projects and strategies to improve watershed health, water quality, and fish populations in the Hood River watershed. Since the development of the original Action Plan in 2002, Hood River Watershed Group partners have completed over 100 significant watershed restoration projects, in addition to numerous watershed education, planning, monitoring, and assessment activities. More information about the Hood River Watershed Group is available from their website: http://hoodriverswcd.org/hrwg/.

10.1.1 ODEQ: Permitted sources

NPDES Permits. Section 7.1 of this document provides detailed information about the WLAs and elements that should be considered by permit writers upon permit renewal. During permit implementation, Equations 4-7 can be used to determine compliance with the WLA as effluent temperature and flow vary from the values assumed in this TMDL analysis. Tiered flow-based allocations could also be considered during permit renewal, which would allow the NPDES permitted sources the potential to utilize the greater loading capacity that is available during periods of higher flow. However, this approach would require that additional ambient river flow and effluent temperature data be collected and the waste load allocation be calculated using Equations 3-7.

Section 401 Certification. The 2001 WHS WQMP referenced the Section 401 Certification and Implementation Agreement as the mechanism for the Powerdale Hydroelectric Project to comply with TMDL load allocations. When the 2001 WHS TMDL was completed, the Powerdale Hydroelectric Project diversion at Powerdale Dam was the single largest diversion and the single largest water right in the Subbasin. Up to 500 cfs was diverted from the Hood River at rivemile 4.5, and returned three miles downstream. In 2010, Powerdale Dam was removed and water is no longer diverted from the Hood River for this use. Although there are no permanent flow or temperature monitoring stations in Hood River below the Powerdale Dam site, it is anticipated that removal of the dam has resulted in more natural flows and temperatures in the lower 4.5 miles of the Hood River. Temperature modeling done for the 2001 WHS TMDL indicated there should be a significant improvement in stream temperatures below the dam site with the removal of the diversion.

Section 401 certification will be required for the Middle Fork Irrigation District hydroelectric project in conjunction with renewal of the MFID's Special Use Permit with the Mt. Hood National Forest. The current SUP will expire on December 31, 2021. The MFID has not yet requested 401certification from ODEQ. Once this request is made, ODEQ will have one year from receipt of that request in which to approve or deny certification. MFID's 401 Certification will incorporate load allocations from this TMDL and will be another mechanism for ensuring implementation.

10.1.2 Oregon Department of Forestry: Non-federal forest lands

The Oregon Forest Practices Act provides for ODF's water quality authority on non-federal forestlands; therefore ODF is the DMA responsible for water quality protection from nonpoint source discharges of pollutants from forest operations on non-federal forest lands. As has been the case since 2001, TMDL implementation for no-federal forestry continues to carried out through existing regulatory and non-regulatory programs.

10.1.3 Oregon Department of Agriculture: Agricultural activities

The Oregon Department of Agriculture is the DMA, by statute, responsible for regulating agricultural activities that affect water quality through the Agricultural Water Quality Management Act (SB 1010) and Senate Bill 502. As was referenced in the 2001 WQMP, the first Hood River Agricultural Water Quality Management Area Plan and Rules were adopted by ODA on March 2, 2001. Since that time, the Area

Plan has been reviewed and updated by ODA and the local advisory committee every two years, with the last Plan adopted by ODA in December 2016. Information about the Hood River Area Plan and Rules is available from ODA's website: http://www.oregon.gov/ODA/programs/NaturalResources/AgWQ/Pages/AgWQPlans.aspx. The Area Plan guides local landowners and local partners on how to prevent pollution. Relative to temperature and implementation of the WHS TMDL, the Area Plan requires all agricultural landowners to allow vegetation growth along streams to provide shade and stabilize banks. The Hood River Soil and Water Conservation District is the primary source of local assistance to assist landowners in addressing water quality concerns. As is discussed further in **Section 10.2**, the Neal Creek watershed was one watershed prioritized for work by the local advisory committee, ODA, the SWCD and other local partners. The next watershed that has been prioritized for focused work by the SWCD and ODA is the Odell Creek watershed.

10.1.4 Oregon Department of Transportation

The Oregon Department of Transportation is the DMA for the regulation of water quality related to roads, highways and bridges under their jurisdiction. Since completion of the 2001 WHS TMDL, ODOT has continued to work with ODEQ to develop a statewide TMDL management program, which is implemented statewide.

10.1.5 U.S. Forest Service: Federal lands

Land management activities in the Mt. Hood National Forest are guided by the Northwest Forest Plan and the Mt. Hood Forest Plan. ODEQ continues to believe these plans meet the requirements of a TMDL implementation plan and are protective of restoring and enhancing riparian conditions. The Mt. Hood National Forest is an active partner in the Hood River Watershed Group, providing funding and support for a number of restoration projects in the watershed, both on and off national forest lands. In conjunction with many of the Watershed Group members, the Mt. Hood National Forest developed the Hood River Basin Aquatic Habitat Restoration Strategy in November 2006 (Shively 2006). The basin-wide strategy provides a geographic focus and framework for directing resources (staff and funding) towards fulfilling high priority restoration needs for fish habitat and water quality improvements. More information about land management projects and activities is available from the Forest Service website: https://www.fs.usda.gov/land/mthood/landmanagement

10.1.6 City of Hood River

In December, 2002, ODEQ and the City of Hood River entered into a Memorandum of Agreement outlining the steps the City would take to develop a TMDL Implementation Plan. The Plan was submitted to ODEQ in January, 2005. ODEQ approved the Plan in June 2005 and it has been in effect since that time. One of the most significant aspects of the City's Plan was the adoption of a Natural Resource Overlay Zone (Chapter 17.22 of the City Municipal Code). The ordinance limits new development and removal of existing native vegetation in setback areas along fish-bearing streams. More information about the overlay zone is available from the City's website: http://ci.hood-river.or.us/pageview.aspx?id=18355#1722. The City's Implementation Plan also recognizes the need for outreach to educate the public about the functions and values of riparian areas. The City implements the outreach program of their Plan in cooperation with the Hood River Watershed Group and other local agencies and partners.

10.1.7 Hood River County

In December, 2002, ODEQ and Hood River County entered into a Memorandum of Agreement outlining the steps the County would take to develop a TMDL Implementation Plan. The Plan was submitted to ODEQ in June, 2004. ODEQ approved the Plan in December 2004 and it has been in effect since that time. One of the most significant aspects of the County's Plan was the adoption of a Stream Protection

Overlay Zone (Article 42 of the County Zoning Ordinance). The ordinance limits new development and removal of existing native vegetation in setback areas along fish-bearing streams. More information about the overlay zone is available from the County's website: http://hrccd.co.hood-river.or.us/images/uploads/documents/%2B%2BZONING_ARTICLES_-_JANUARY_2017.pdf. The County's Implementation Plan also recognizes the need for outreach to educate the public about the functions and values of riparian areas. The County implements the outreach program of their Plan in cooperation with the Hood River Watershed Group and other local agencies and partners.

10.1.8 Bonneville Power Administration

As acknowledged in the 2001 WQMP, ODEQ understands that strict adherence to the Load Allocations of system potential shade is subservient to the needs of public safety. Recognizing the safety restraints that limit BPA's ability to allow system potential vegetation to mature, ODEQ still encourages BPA to comply with the practices to protect riparian vegetation and promote the growth of healthy riparian communities as much as is possible.

10.1.9 Middle Fork Irrigation District

The 2001 WHS TMDL required the MFID to develop an operational plan to control stream temperature impacts to Laurance Lake (Section 4.6.2.3.1). MFID has worked closely with ODEQ since completion of the TMDL to collect additional data and develop models for evaluating temperature management strategies.

In 2005, MFID and the Mt. Hood National Forest convened an interagency stakeholder group to discuss compliance of MFID operations with the Endangered Species Act and the Clean Water Act. The stakeholder group consisted of representatives from MHNF, U.S. Fish and Wildlife Service, National Marine Fisheries Service, ODFW, ODEQ, and the Confederated Tribes of the Warm Springs Reservation. Various meetings were held to synthesize all pertinent fisheries, water quality, and habitat issues being affected by MFID operations and to venture approaches to resolving the issues. After five years, a Fisheries Management Plan was finalized (May 2010) and accepted by the MHNF as the Operational Plan for the Special Use Permit issued to MFID by the MHNF. The FMP serves as the basis for the water quality management plan required by the 2001 WHS TMDL.

A number of needed studies (fish passage, flows, and water quality) were outlined in the FMP and the stakeholder group has continued to meet to guide these studies. The last of these studies was development of temperature models for Clear Branch, Coe Branch and Eliot Branch, which will likely be completed in 2018. Once all of the studies are complete, the stakeholder group will meet and prioritize implementation of a suite of projects. ODEQ anticipates that a selective withdrawal system will ultimately be constructed to manage temperatures in Clear Branch below the dam.

10.2 Attainment of Water Quality Standards

The 2001 WHS TMDL included a section on attainment of water quality standards (Section 4.10). Computer simulations were performed using the Heat Source model to estimate instream temperatures that would result from restoration of riparian conditions on Neal Creek and East Fork Hood River/Hood River (Figure 55 and Figure 56). In the reaches that were modeled, there were no direct point source discharges. The simulations showed that the numeric criterion in effect at that time (17.8°C) was met under allocated conditions. It should be noted that the simulations were only run for one day (August 6, 1998) so the 7DADM could not be calculated. Maximum stream temperatures typically occur in late July or early August, so this one day of simulation is still considered representative of worse-case conditions. The data and analytical methodology used in these simulations is included as part of this TMDL revision in **Appendix G**.

To demonstrate compliance with the biologically based numeric criteria in the 2003 standard, the earlier Heat Source simulations were re-evaluated for this revision. The current protocol used by ODEQ to assess system potential conditions typically includes incorporating estimates of system potential vegetation and natural flows. Because we did not have the necessary flow information to include natural flows as part of the Neal Creek analysis, the Neal Creek simulation remains essentially the same as in the 2001 WHS TMDL except that the applicable criterion changed from 17.8°C to 18.0°C. Because we did have estimates of natural flows for East Fork Hood River/Hood River (Figure 33 in the 2001 WHS TMDL), we were able to evaluate system potential conditions which included both system potential vegetation and natural flows. As shown in **Figure 22** and **Figure 23**, the daily maximum temperatures in both Neal Creek and East Fork Hood River/Hood River were well below the biologically based numeric criterion for the one day simulated. **Figure 22**, **Figure 23**, and **Figure 24** replace Figure 56, Figure 55, and Figure 54, respectively, in the 2001 WHS TMDL.

As another way to evaluate progress made towards attaining water quality standards, ODEQ evaluated temperature data collected by local partners in the Neal Creek watershed between 1998 and 2016. This watershed has been a priority watershed for restoration and implementation efforts since completion of the 2001 WHS TMDL. Using a Seasonal Kendall test (Hirsch et al 1982, Hirsch and Slack 1984, and Helsel and Hirsch 2002), ODEQ evaluated the trend in seven-day average daily maximum temperatures at a number of sites on Neal Creek and West Fork Neal Creek. A seasonal Kendall test removes the influence of season-to-season fluctuations by calculating the Mann Kendall test (Mann 1945) on each season separately and then comparing the slopes. A significant positive or negative trend was determined across all seasons and years when the significance of the seasonal slopes had a two-tailed $p < 0.10$. Prior to applying the seasonal Kendall test, data was grouped into monthly "seasons" (July-September). Observations within each month were collapsed into a single value using the median.

Figure 25 shows the results for the mouth of Neal Creek in the month of July. This figure shows that there has been a significant ($p<0.05$) improvement in stream temperature at this site since 1998. While there are still occasional exceedances of the biologically based numeric criterion during the summer months, the magnitude and frequency of the exceedances has been significantly reduced. This same pattern is seen at this site in August and September, as well as at the monitoring site on Fir Mt. Road (approximately river mile 2.3). Both of these sites on Neal Creek are downstream of areas where restoration and implementation activities have occurred. In contrast, no significant trends in stream temperature have been seen at the site on West Fork Neal Creek near the USFS boundary (**Figure 26**). Stream temperatures were well below the numeric criterion back in 1998 and have continued to be below the criterion.

Figure 22. Neal Creek Diurnal Temperatures – Current Condition and Allocated Condition (August 6, 1998)

(replaces Figure 56 from 2001 WHS TMDL)

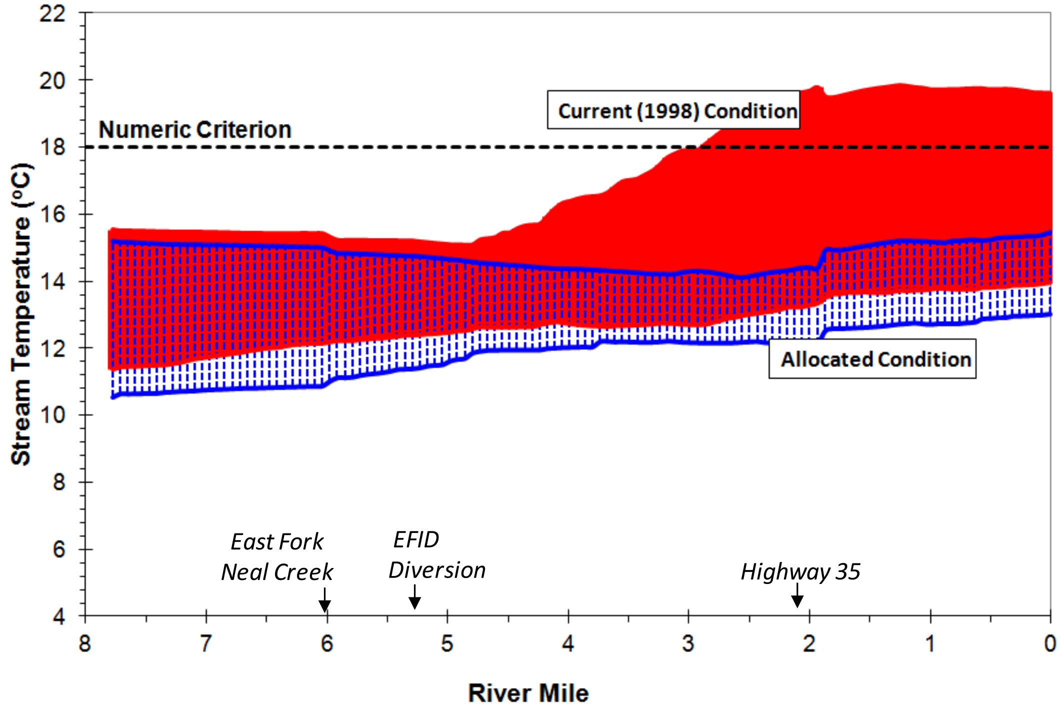


Figure 23. Hood River/ East Fork Hood River Diurnal Temperatures – Current Condition and Allocated Condition (August 6, 1998)

(replaces Figure 55 from 2001 WHS TMDL)

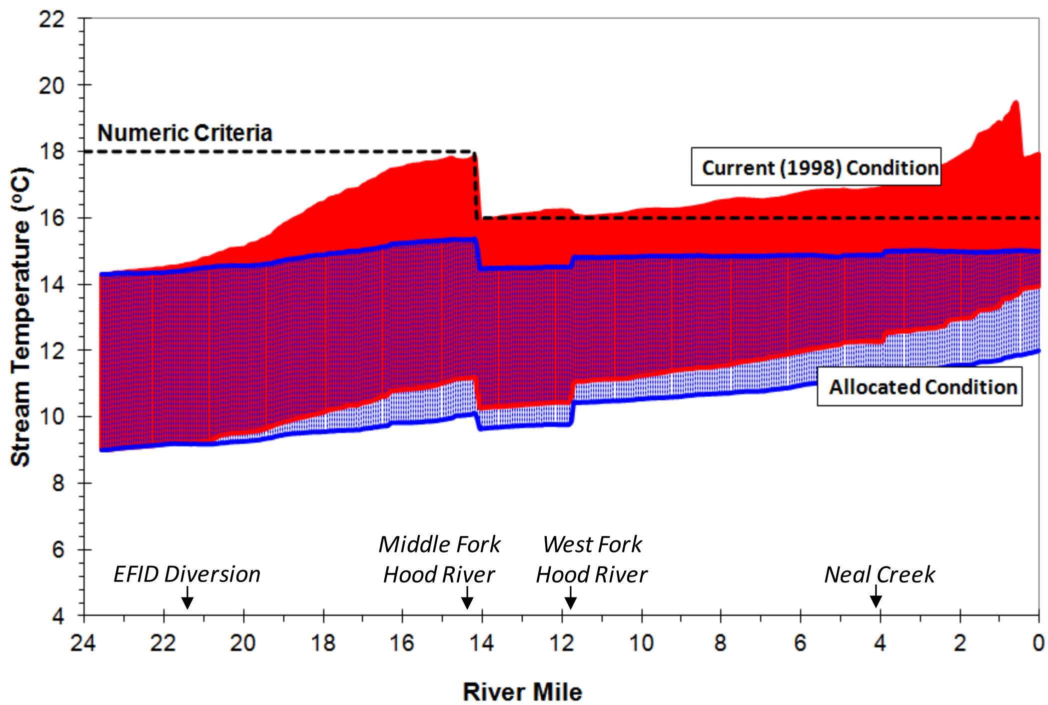


Figure 24. Distributions of Daily Maximum Temperatures for Current Conditions and the Allocated Condition (August 6, 1998)

(replaces Figure 54 from 2001 WHS TMDL)

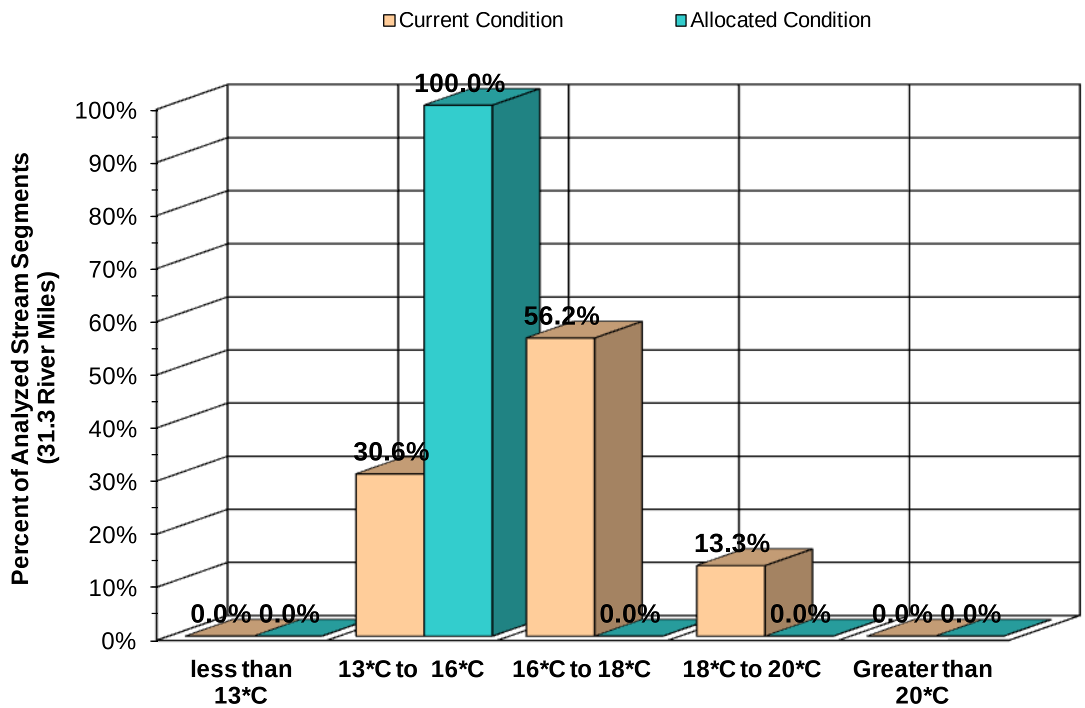


Figure 25. Trends in Stream Temperature: Neal Creek at the mouth in July

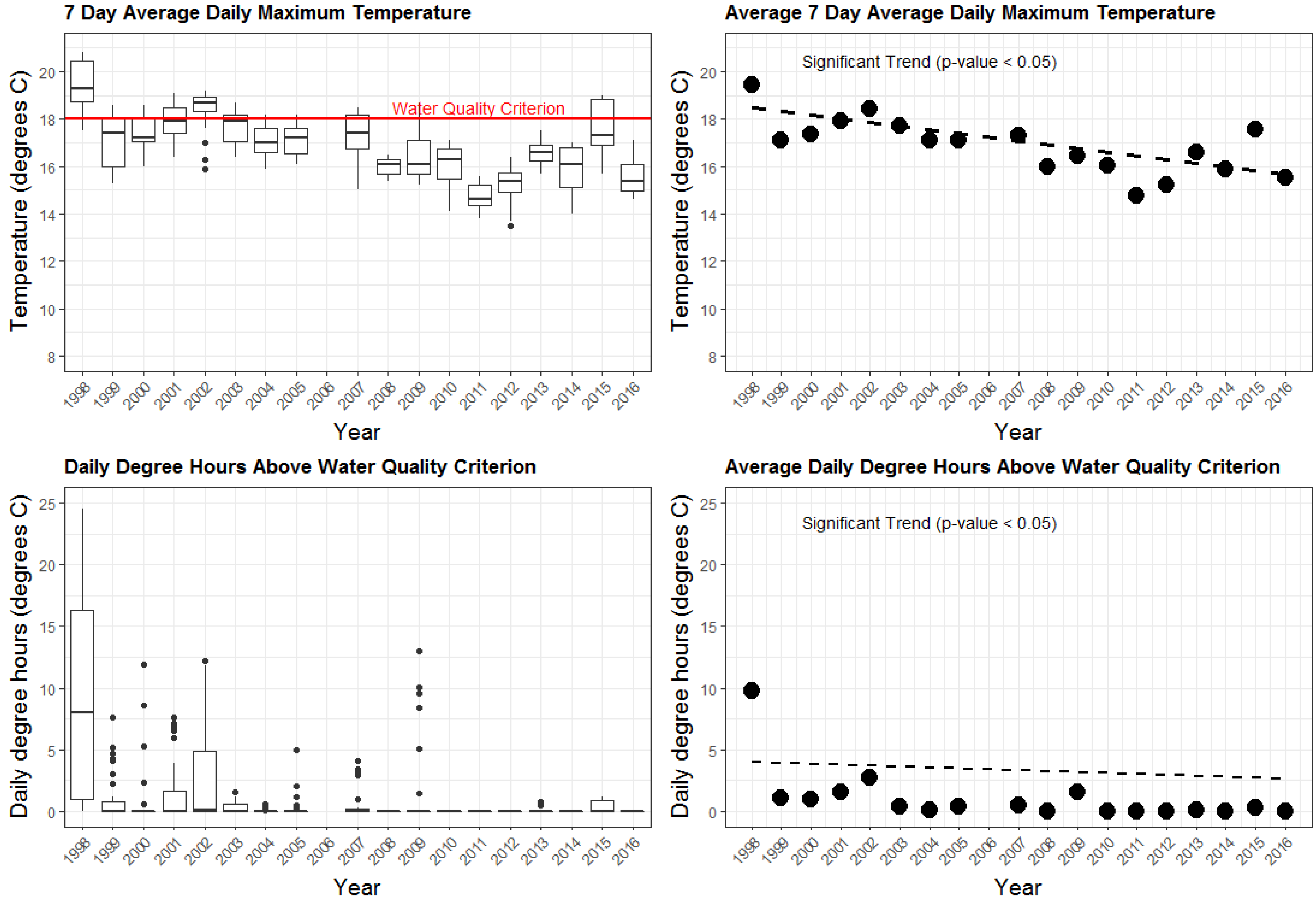
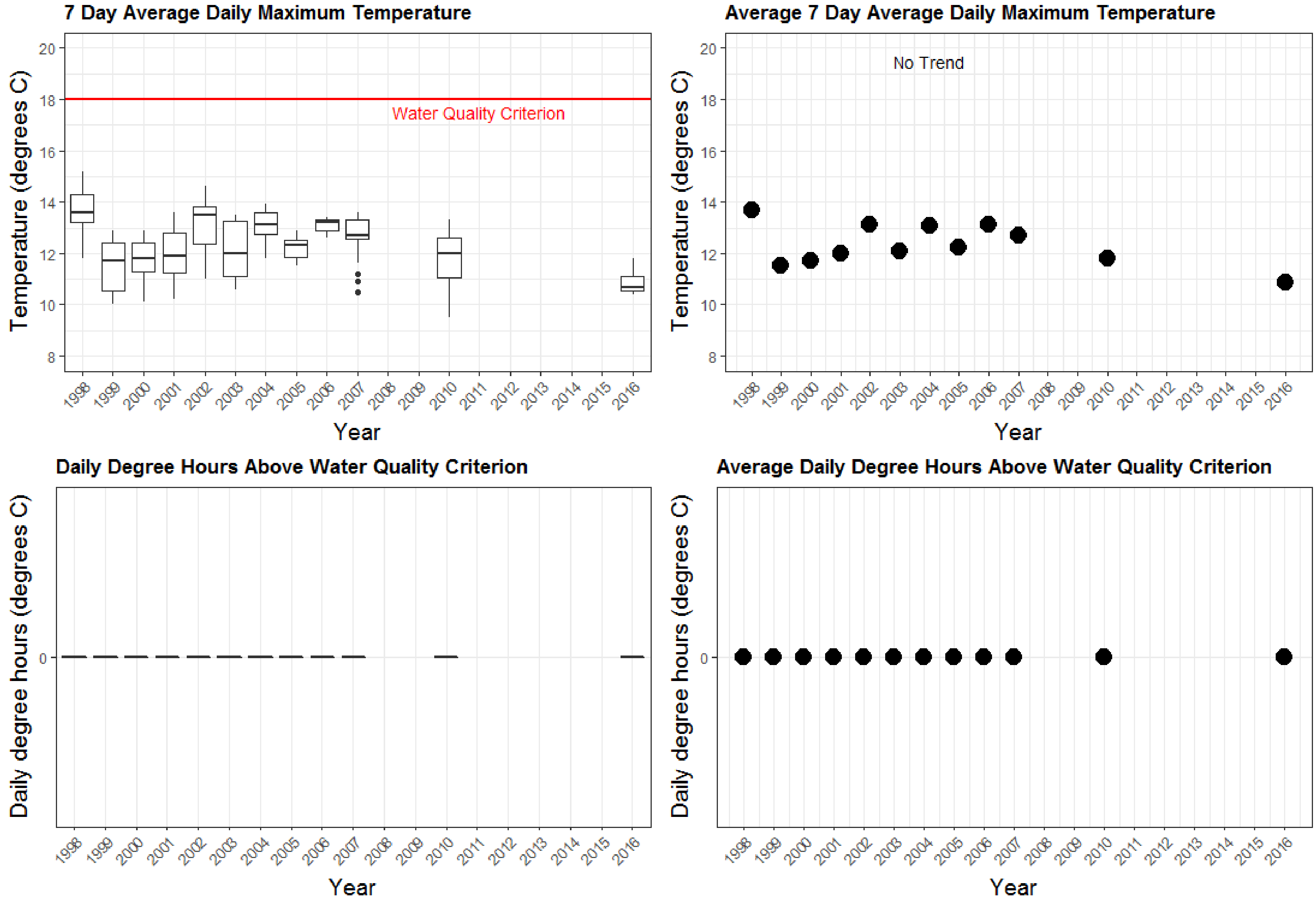


Figure 26. Trends in Stream Temperature: West Fork Neal Creek at USFS boundary in July



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