Total Maximum Daily Loads for the Middle Columbia-Hood (Miles Creeks) Subbasin

Temperature

Draft

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State of Oregon
DEQ Department of Environmental Quality

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Name	Association
Name	Association
Name	Association
Name	Association
Name	Association

In addition, we would like to thank the TMDL Rule Advisory Committee Members, Tribal Nations, and all the individuals or organizations who provided data or took time to review and provide comments to DEQ.

Executive summary

[add details]

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Acronyms

7DADM	7-Day Average Daily Maximum
7Q10	7-Day, 10-Year Low Flow
ADWDF	Average Dry Weather Design Flow
AU	Assessment Unit
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
DEQ	Oregon Department of Environmental Quality
DMA	Designated Management Agency
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency
EQC	Oregon Environmental Quality Commission
EWEB	Eugene Water and Electric Board
GNIS	USGS Geographic Names Information System
HUA	Human Use Allowance
HUC	Hydrologic Unit Code
IMD	Internal Management Directive
LA	Load Allocation
LC	Loading Capacity
MGD	Millions of Gallons per Day
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
OAR	Oregon Administrative Rules
ODC	Oregon Department of Corrections
ODFW	Oregon Department of Fish & Wildlife
ORS	Oregon Revised Statutes
POMI	Point of Maximum Impact
SIC	Standard Industrial Classification
STP	Sewage Treatment Plant
TMDL	Total Maximum Daily Load
TSD	Technical Support Document
USGS	United States Geological Survey
WLA	Wasteload Allocation
WQMP	Water Quality Management Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

1 Introduction

This Total Maximum Daily Load (TMDL) project addresses temperature impairments in the Middle Columbia-Hood (Miles Creeks) Subbasin, which includes the following watersheds and subwatersheds: Eightmile Creek Watershed, Fifteenmile Creek Watershed, Mill Creek-Columbia River Watershed, Upper Mosier Creek Subwatershed, Lower Mosier Creek Subwatershed, Rock Creek Subwatershed, and Rowena Creek-Columbia River Subwatershed. This TMDL will be adopted by reference in Oregon Administrative Rules OAR 340-42-0090.

OAR 340-42-0040(3) requires the Oregon Department of Environmental Quality (DEQ) or the Oregon Environmental Quality Commission (EQC) to prioritize and schedule TMDLs for completion considering various factors outlined in the rule. The temperature TMDL for the Middle Columbia-Hood (Miles Creeks) Subbasin was identified as a medium priority on Oregon's TMDL priority ranking submitted with Oregon's 2022 Integrated Report. This priority ranking is primarily due to a court order requiring Oregon and the U.S. Environmental Protection Agency (EPA) to establish TMDLs to replace previous temperature TMDLs developed as part of the 2008 Middle Columbia-Hood (Miles Creeks) Subbasin TMDL (Table 1-1).

1.1 Previous TMDLs

DEQ issued one previous TMDL action in 2008 that addressed listings for temperature in the Middle Columbia-Hood (Miles Creeks) Subbasin (DEQ, 2008a). Once approved by EPA, the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL for temperature will replace the temperature TMDL approved by EPA in 2009 and listed in Table 1-1.

Table 1-1: Summary of previous temperature TMDLs developed for the Middle Columbia-Hood (Miles Creeks) Subbasin.

TMDL Action ID	TMDL Name	EPA Approval Date	Water Quality Impairments Addressed
35890	Middle Columbia-Hood (Miles Creeks) Subbasin TMDL and WQMP	2/5/2009	Temperature

2 TMDL name and location

Per OAR 340-042-0040(4)(a), this element describes the geographic area for which the TMDL was developed.

This TMDL replacement project is applicable within the central portion of the Middle Columbia-Hood (Miles Creeks) Subbasin (17070105), also sometimes known as the Miles Creeks area. The specific watersheds in the TMDL project area include Eightmile Creek Watershed (1707010502), Fifteenmile Creek Watershed (1707010503), and Mill Creek-Columbia River Watershed (1707010504) (Table 2-1). The project area also includes four subwatersheds within the Mosier Creek-Columbia River Watershed (1707010511), including Upper Mosier Creek Subwatershed (170701051102), Lower Mosier Creek Subwatershed (170701051103), Rock Creek Subwatershed (170701051104), and Rowena Creek-Columbia River Subwatershed (170701051105) (Table 2-2).

The Columbia River and waters in the State of Washington are not included in the project area.

The temperature TMDL for the Middle Columbia-Hood (Miles Creeks) Subbasin addresses all Category 5 listed assessment units (AUs) impaired for temperature on Oregon's 2022 Section 303(d) list (Table 2-3) and, as applicable, any AUs identified as temperature-impaired in the future. In total, the TMDL applies to 29 unique AUs, of which 17 are impaired for temperature. Some of these assessment units are impaired for both year-round and spawning use designations. If both use designations are impaired, it is counted as two Category 5 303(d) listings. Therefore, the TMDL addresses a total of 25 Category 5 temperature listings identified on the 2022 Integrated Report.

The loading capacity, allocations, surrogate measures, and implementation framework apply to all waters in the Middle Columbia-Hood (Miles Creeks) Subbasin determined to be waters of the state as defined under Oregon Revised Statutes ORS 468B.005(10), including all perennial and intermittent streams that have surface flow or residual pools during the TMDL allocation period.

The TMDL implementation framework is presented in the Middle Columbia-Hood (Miles Creeks) Subbasin WQMP and includes implementation activities and timeframes to improve water quality, as well as measures of success. These and other protection plan elements are further explained in Section 10.

The map in Figure 2-1 provides an overview of where the temperature TMDLs are applicable. Appendix D of the Middle Columbia-Hood (Miles Creeks) Subbasin TSD provides a list of all AUs addressed by the TMDL.

Table 2-1: HUC10 codes and names in the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL project area.

HUC10	Watershed Name
1707010503	Fifteenmile Creek Watershed
1707010502	Eightmile Creek Watershed
1707010504	Mill Creek-Columbia River Watershed

Table 2-2: HUC12 codes and names (within the Mosier Creek-Columbia River Watershed) in the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL project area.

HUC12	Subwatershed Name
170701051102	Upper Mosier Creek Subwatershed
170701051103	Lower Mosier Creek Subwatershed
170701051104	Rock Creek Subwatershed
170701051105	Rowena Creek-Columbia River Subwatershed

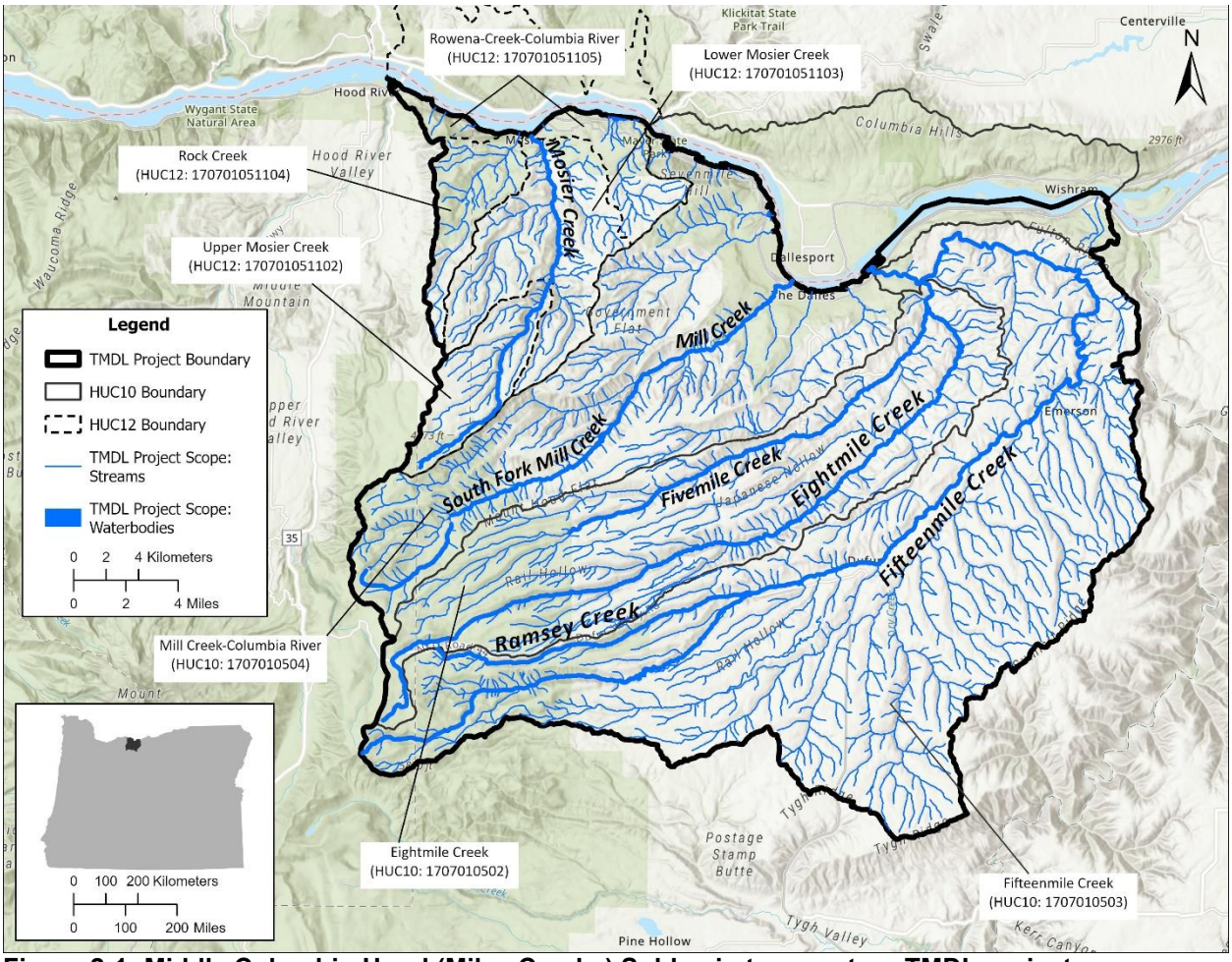

Figure 2-1: Middle Columbia-Hood (Miles Creeks) Subbasin temperature TMDL project area overview.

2.1 Impaired waters on 303(d) list

Table 2-3 presents stream AUs within the Middle Columbia-Hood (Miles Creeks) Subbasin that were listed as impaired for temperature on DEQ's 2022 Clean Water Act Section 303(d) List (as part of Oregon's Integrated Report), which was approved by the EPA on September 1, 2022. Status category designations are prescribed by Sections 305(b) and 303(d) of the Clean Water Act. AUs listed in Category 5 (i.e., designated use is not supported, or a water quality standard is not attained) require development of a TMDL. Locations of these listed segments are shown in Figure 2-2.

Table 2-3: Middle Columbia-Hood (Miles Creeks) Subbasin Category 5 temperature impairments on the 2022 Integrated Report.

AU ID	AU Name	Use Period
OR_SR_1707010502_02_101504	Eightmile Creek	Year Round
OR_SR_1707010503_02_101505	Dry Creek	Year Round
OR_SR_1707010503_02_101506	Fifteenmile Creek	Spawning
OR_SR_1707010503_02_101506	Fifteenmile Creek	Year Round
OR_SR_1707010503_02_101507	Fifteenmile Creek	Spawning
OR_SR_1707010503_02_101507	Fifteenmile Creek	Year Round
OR_SR_1707010511_02_101513	Mosier Creek	Year Round

AU ID	AU Name	Use Period
OR_WS_170701050201_02_101980	HUC12 Name: Upper Eightmile Creek	Spawning
OR_WS_170701050202_02_101981	HUC12 Name: Middle Eightmile Creek	Year Round
OR_WS_170701050202_02_101981	HUC12 Name: Middle Eightmile Creek	Spawning
OR_WS_170701050204_02_101983	HUC12 Name: Lower Eightmile Creek	Spawning
OR_WS_170701050204_02_101983	HUC12 Name: Lower Eightmile Creek	Year Round
OR_WS_170701050301_02_101984	HUC12 Name: Headwaters Fifteenmile Creek	Spawning
OR_WS_170701050301_02_101984	HUC12 Name: Headwaters Fifteenmile Creek	Year Round
OR_WS_170701050302_02_101985	HUC12 Name: Upper Fifteenmile Creek	Spawning
OR_WS_170701050302_02_101985	HUC12 Name: Upper Fifteenmile Creek	Year Round
OR_WS_170701050303_02_101986	HUC12 Name: Upper Dry Creek	Year Round
OR_WS_170701050402_02_101991	HUC12 Name: Threemile Creek	Year Round
OR_WS_170701050403_02_101992	HUC12 Name: North Fork Mill Creek-South Fork Mill	Spawning
OR_WS_170701050404_02_101993	HUC12 Name: Mill Creek	Spawning
OR_WS_170701050404_02_101993	HUC12 Name: Mill Creek	Year Round
OR_WS_170701050405_02_101994	HUC12 Name: Chenoweth Creek	Year Round
OR_WS_170701050405_02_101994	HUC12 Name: Chenoweth Creek	Spawning
OR_WS_170701051103_02_102009	HUC12 Name: Lower Mosier Creek	Year Round
OR_WS_170701051104_02_102010	HUC12 Name: Rock Creek	Year Round

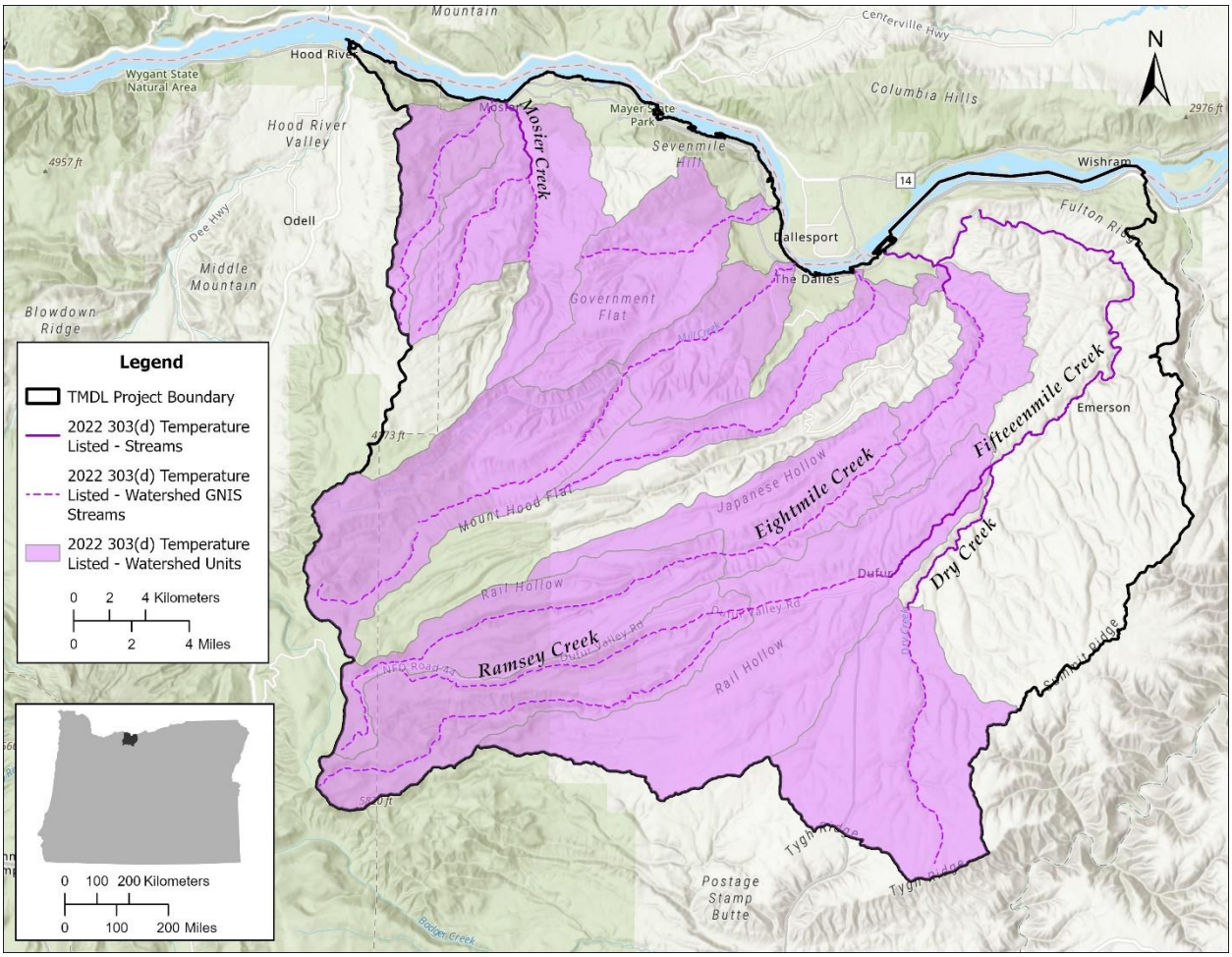

Figure 2-2: Middle Columbia-Hood (Miles Creeks) Category 5 temperature impairments on the 2022 Integrated Report.

3 Pollutant identification

As required by OAR 340-042-0040(4)(b), this element identifies the pollutants causing impairment of water quality that are addressed by this TMDL. The associated water quality standards and beneficial uses are identified in Section 4.

Temperature is the water quality parameter of concern, but heat or thermal loading is the pollutant of concern causing impairment. Heat caused by human activities is of particular concern. Water temperature change (ΔTw) is a function of the heat transfer in a discrete volume and may be described in terms of changes in heat per unit volume. Conversely, a change in volume can also result in water temperature change for a defined amount of heat exchange.

$$\Delta T_w = \frac{\Delta Heat}{Density \times Specific\ Heat \times \Delta Volume}$$

EPA regulations (40 CFR 130.2(i)) and OAR 340-042-0040(O)(5)(b) allow for TMDLs to utilize other appropriate measures (or surrogate measures). Surrogate measures are defined in OAR 340-042-0030(14) as "substitute methods or parameters used in a TMDL to represent pollutants." In accordance with OAR 340-042-0040(5)(b), DEQ used effective shade as a surrogate measure for thermal loading caused by excessive solar radiation. Effective shade is the percent of the daily solar radiation flux blocked by vegetation and topography. Implementation of the surrogate measures ensures achievement of necessary pollutant reductions and the nonpoint load allocations (LAs) for this temperature TMDL.

4 Temperature water quality standards and beneficial uses

As required by OAR 340-042-0040(4)(c), this section identifies the applicable water quality standards and beneficial uses in the Middle Columbia-Hood (Miles Creeks) Subbasin. This section also specifies the most sensitive beneficial use, and the relevant water quality standards established in OAR 340-041-0160 through 340-041-0165.

Table 4-1 specifies the designated beneficial uses in the Middle Columbia-Hood (Miles Creeks) Subbasin, and also indicates the most sensitive beneficial uses related to each standard.

Water quality criteria have been set at a level to protect the most sensitive beneficial uses. This TMDL is designed such that meeting water quality standards for the most sensitive beneficial uses will be protective of all other uses for that parameter. Fish and aquatic life use is the most sensitive beneficial use for temperature. Oregon's water temperature criteria use salmonids' life cycles as indicators. If temperatures are protective of these indicator species, other species will share in this protection. The locations and periods of criteria applicability are determined from designated fish use maps in rule at OAR 340-041-0160 Figure 160A and Figure 160B. The maps from the rule have been reproduced and shown in Figure 4-1 and Figure 4-2. Figure 4-1 shows various designated fish uses and applicable criteria, while Figure 4-2 shows salmon and steelhead spawning use designation, based on the USGS National Hydrography Dataset (NHD).

The temperature water quality standards for the Middle Columbia-Hood (Miles Creeks) Subbasin are based on the rolling seven-day average daily maximum (7DADM)[1] temperatures and include the following numeric criteria:

- Salmon and steelhead spawning: 13.0°C (55.4°F) (OAR 340-041-0028(4)(a))
- Core cold water habitat: 16.0°C (60.8°F) (OAR 340-041-0028(4)(b))
- Salmon and trout rearing and migration: 18.0°C (64.4°F) (OAR 340-041-0028(4)(c))

The following narrative temperature water quality standards and other rule provisions also apply in the Middle Columbia-Hood (Miles Creeks) Subbasin:

- Human use allowance (OAR 340-041-0028(12)(b))
- Minimum duties (OAR 340-041-0028(12)(a))
- Natural lakes (OAR 340-041-0028(6))
- Protecting cold water (OAR 340-041-0028(11))
- Antidegradation (OAR 340-041-0004)

Table 4-1: Designated beneficial uses for the Middle Columbia-Hood (Miles Creeks) Subbasin as identified in OAR 340-041-0160 Table 160A. An "X" indicates the use is applicable.

Beneficial Uses	All waterbodies	Most Sensitive to Temperature
Public Domestic Water Supply	X	
Private Domestic Water Supply	X	
Industrial Water Supply	X	
Irrigation	X	
Livestock Watering	X	
Fish & Aquatic Life	X	X
Wildlife & Hunting	X	
Fishing	X	
Boating	X	
Water Contact Recreation	X	
Aesthetic Quality	X	
Hydro Power	X	
Commercial Navigation & Transportation		

[1] Referred to as the "Seven-Day Average Maximum Temperature" in OAR 340-041 and defined as the average of the daily maximum temperatures from seven consecutive days made on a rolling basis.

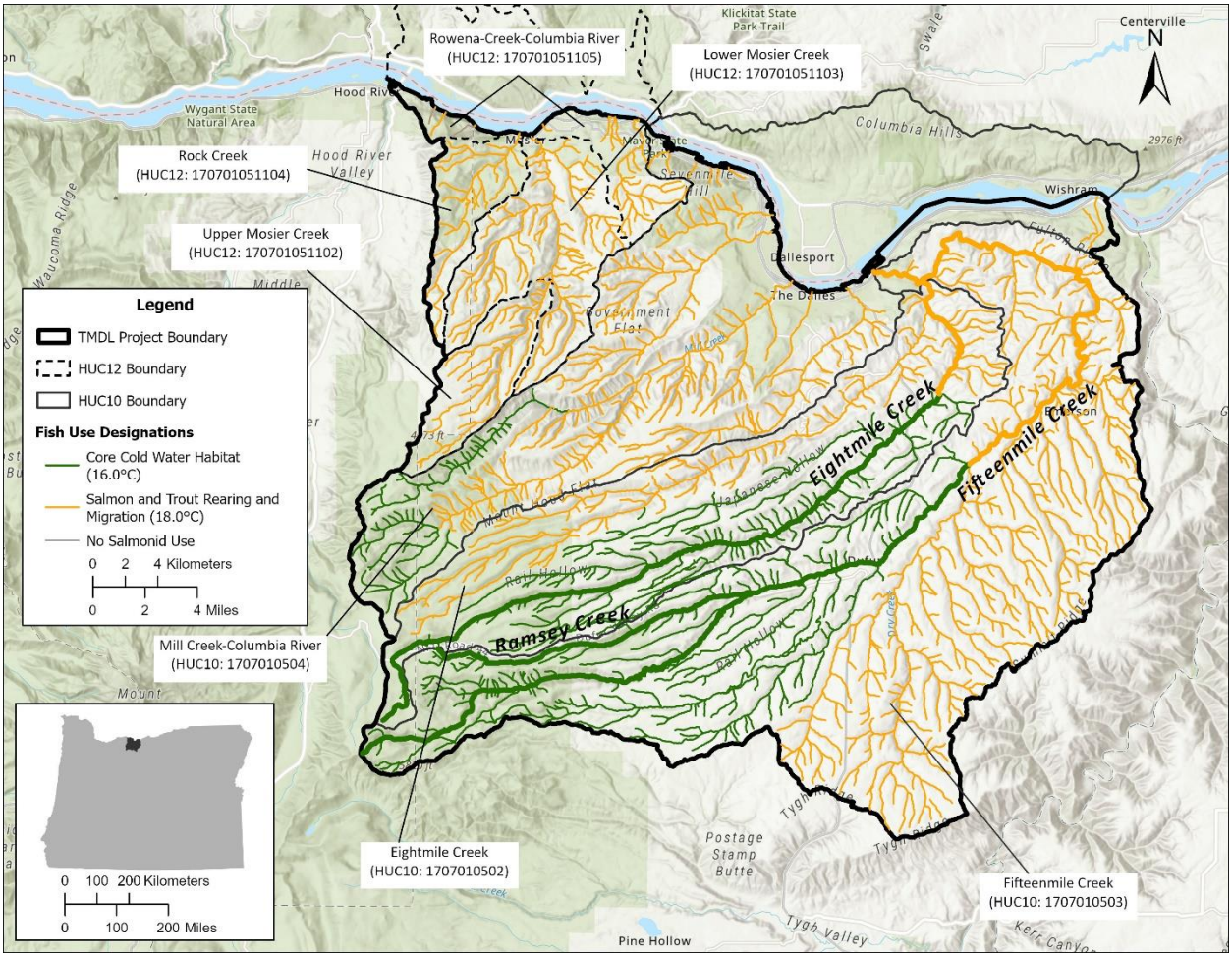

Figure 4-1: Fish use designations in the Middle-Columbia Hood (Miles Creeks) Subbasin TMDL project area.

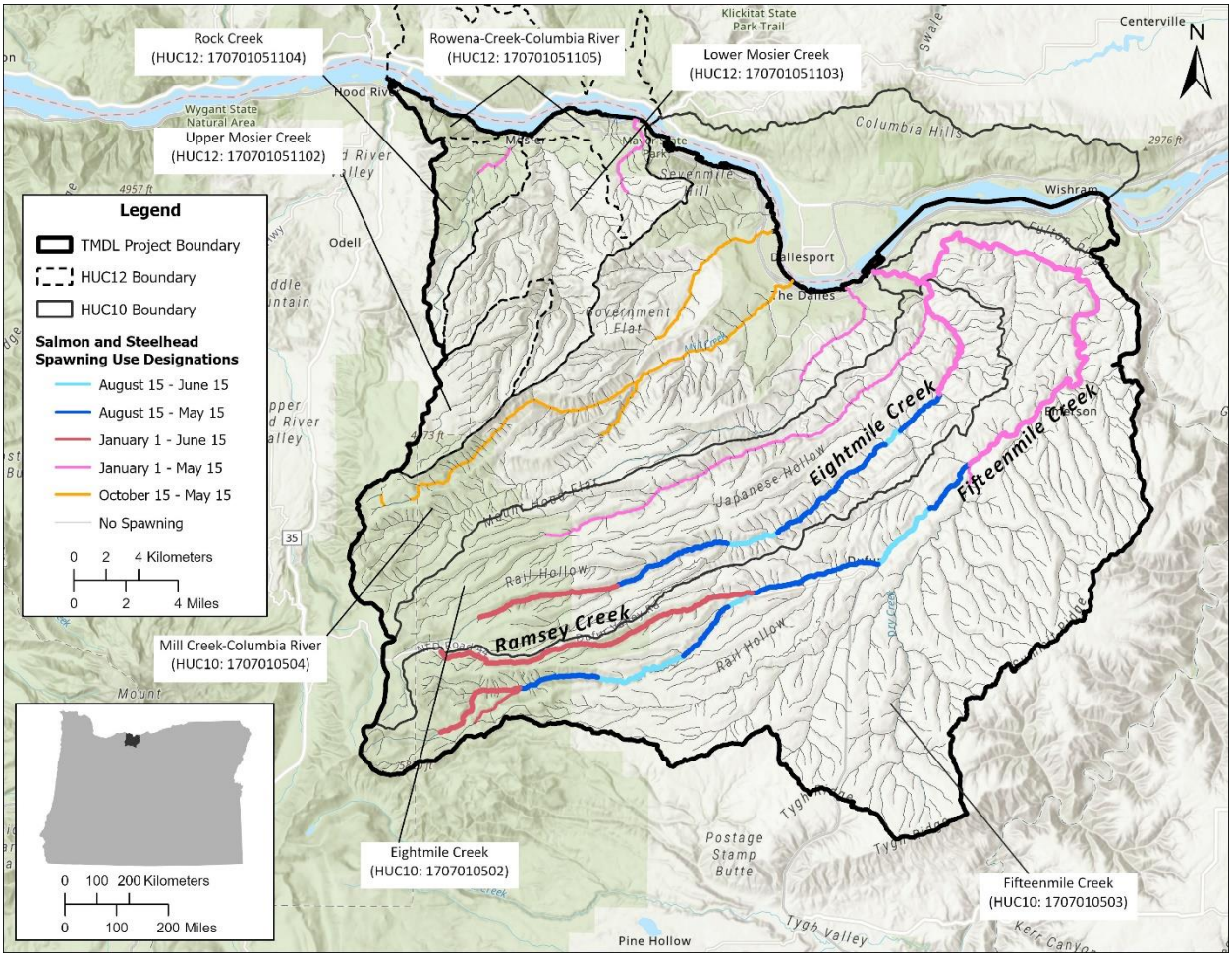

Figure 4-2: Salmon and steelhead spawning use designations in the Middle-Columbia Hood (Miles Creeks) Subbasin TMDL project area.

4.1 Salmon and steelhead spawning use

OAR 340-041-0028(4)(a) specifies that waters designated as having salmon and steelhead spawning use are identified in rule at OAR 340-041-0160 Figure 160B and are shown in Figure 4-2. During the spawning period, these waters may not exceed 13.0°C (55.4°F) expressed as a 7DADM.

4.2 Core cold water habitat use

OAR 340-041-0028(4)(b) specifies that waters designated as having core cold water habitat use are identified in OAR 340-041-0160 Figure 160A and are shown in Figure 4-1. These waters may not exceed 16.0°C (60.8°F) expressed as a 7DADM.

4.3 Salmon and trout rearing and migration

OAR 340-041-0028(4)(c) specifies that waters designated as having salmon and trout rearing and migration use are identified in OAR 340-041-0160 Figure 160A and shown in Figure 4-1. These waters may not exceed 18.0°C (64.4°F) expressed as a 7DADM.

4.4 Human use allowance

Oregon water quality standards also have provisions for human use (OAR 340-041-0028(12)(b)). The human use allowance (HUA) is an insignificant addition of heat (0.3°C) authorized in waters that exceed the applicable temperature criteria. The applicable temperature criteria are defined in OAR 340-041-0002(4) to mean "the biologically based temperature criteria in OAR 340-041-0028(4), or the superseding cold water protection criteria in 340-041-0028(11)". Following a temperature TMDL or other cumulative effects analysis, wasteload and load allocations will restrict all National Pollutant Discharge Elimination System (NPDES) point sources and nonpoint sources to a cumulative increase of no greater than 0.3°C (0.5°F) above the applicable biological criterion after complete mixing in the waterbody, and at the point of maximum impact (POMI). The rationale behind selection of 0.3°C for the HUA and how DEQ implements this portion of the standard can be found in the Staff Report to the EQC (DEQ, 2003) and DEQ's Internal Management Directive (IMD) for temperature water quality standard implementation (DEQ, 2008b).

4.5 Antidegradation

Under federal rule (40 CFR 131.12(a)), the EPA directs states and tribes to implement antidegradation policies. Oregon has antidegradation policy to guide decisions that affect water quality to prevent unnecessary further degradation from new or increased point and nonpoint sources of pollution, and to protect, maintain, and enhance existing surface water quality to ensure the full protection of all existing beneficial uses.

OAR 340-041-0004 (3)(c) specifies that insignificant temperature increases authorized under OAR 340-041-0028(11) and (12) are not considered a reduction in water quality. Furthermore, OAR 340-041-0004 (5)(a) specifies that DEQ-determined activities to restore geomorphology or riparian vegetation that have a net ecological benefit do not need antidegradation review; this is known as the Riparian Restoration Activities Exemption.

4.6 Protecting cold water

The "protecting cold water" (PCW) criterion in OAR 340-041-0028(11) applies to waters of the state that have summer ambient 7DADM temperatures that are colder than the biologically based criteria. With some exceptions (Figure 4-3), these waters may not be warmed cumulatively by anthropogenic point and nonpoint sources by more than 0.3°C (0.5°F) above the colder ambient water temperature. This criterion applies to all anthropogenic sources taken together (i.e., "cumulatively") at the POMI where salmon, steelhead or bull trout are present. A summary of how DEQ implements this portion of the standard can be found in the PCW IMD (DEQ, 2011) and the Temperature IMD (DEQ, 2008a).

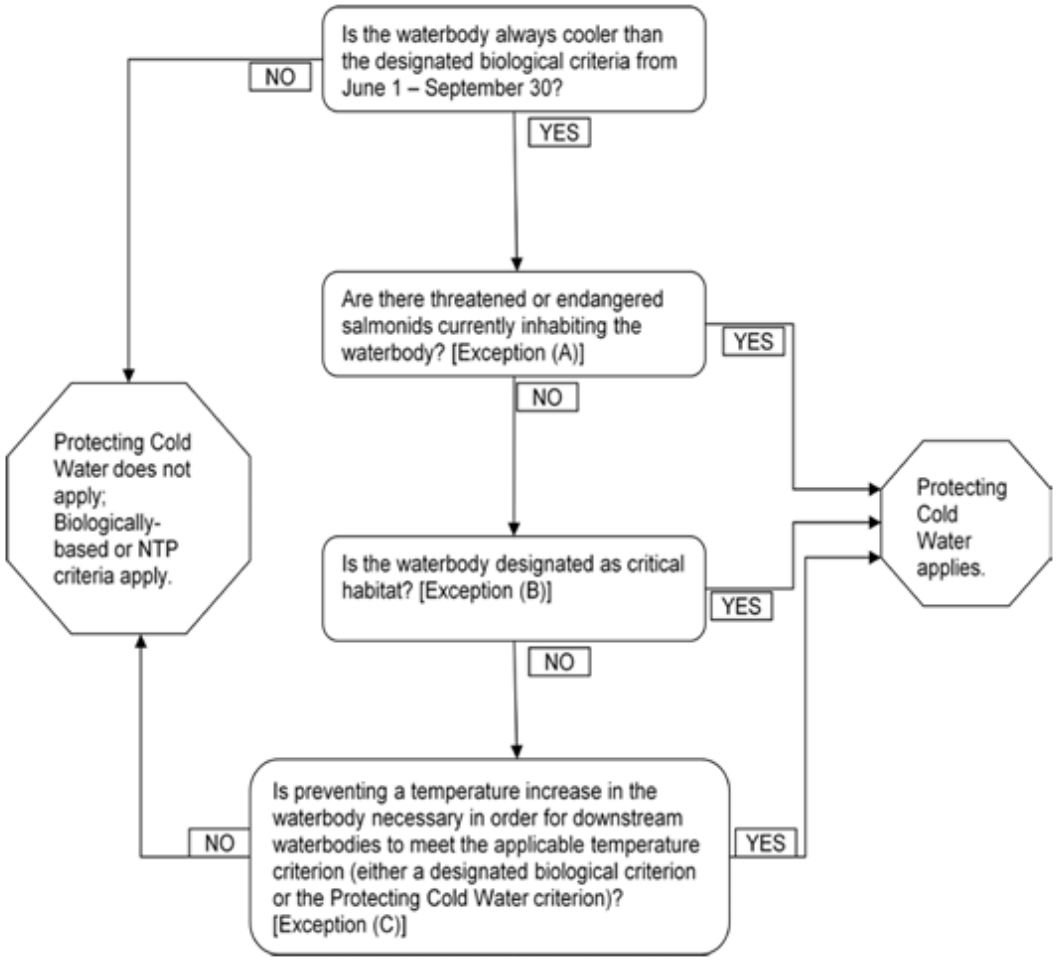

Figure 4-3: Flowchart to determine applicability of the PCW criterion. Extracted from DEQ, 2011.

4.7 Minimum duties

The minimum duties provision at OAR 340-041-0028(12)(a) states that there is no duty for anthropogenic sources to reduce heating of waters of the State below their natural condition. Similarly, each anthropogenic point and nonpoint source is responsible only for controlling the thermal effects of its own discharge or activity in accordance with its overall heat contribution. In no case may a source cause more warming than that allowed by the HUA.

For point sources, DEQ implements the minimum duties provision if a facility operation meets acceptable operation and design requirements. The facility must be operated as a “flow through” facility where intake water moves through the facility but is not processed as part of an industrial or wastewater treatment operation. If a facility mixes intake water with other wastewater or as a method to cool equipment, then DEQ considers the operation’s thermal effects to be part of the facility’s activity and thus the minimum duties provision does not apply. The intake water must also be returned to the same stream where the intake is located. If the water is not returned to the same stream, then any thermal effects are not due to the receiving stream and are therefore attributed to the facility’s own discharge such that the facility is not considered “flow-through”.

For facilities that operate as a flow through facility, the minimum duties provision applies when the intake temperatures are warmer than the maximum effluent discharge temperatures allowed by the assigned wasteload allocation. On days when this occurs, the facility cannot add any additional thermal loading above what is contributed by the intake temperatures (i.e. no increase in temperature, HUA = 0.0°C above the intake temperature) The purpose is to ensure the facility controls for thermal effects resulting from passing the water through and not from upstream sources. DEQ found this provision does not apply to any of the NPDES permitted facilities discharging to surface waters in the Middle Columbia-Hood (Miles Creeks) Subbasin.

The minimum duties provision is also applicable to dam and reservoir operations. On days when incoming temperatures upstream of the reservoir cause exceedances to applicable criteria plus assigned HUA in the reservoirs or downstream, the dam and reservoir operations must not contribute any additional heat to the waterbody above those incoming temperatures. This ensures dam operators are only responsible for temperature increases caused by the dam and reservoir operations. DEQ developed a surrogate measure temperature target for dam and reservoir operations to be consistent with the minimum duties provision (Section 9.1.4.1).

4.8 Statewide narrative criteria

Statewide narrative criteria at OAR 340-041-0007(1) apply to all waters of the state. The highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious factors at the lowest possible levels.

4.9 Numeric water quality targets

TMDLs must contain numeric water quality targets. The targets represent the instream endpoint that ensures all applicable temperature water quality standards are attained and beneficial uses are protected. These temperature targets are summarized in Table 4-2.

Table 4-2: Summary of applicable numeric temperature targets in the Middle Columbia-Hood (Miles Creeks) Subbasin. [make table accessible]

Applicable Criteria	Fish and Aquatic Life Use Protected	7DADM Temperature Target (°C)	Notes
Biologically based numeric criteria apply OAR 340-041-0028(4) or Protecting cold water criterion OAR 340-041-0028(11)	**Waters that exceed the biologically based numeric criteria**		
	Salmon and steelhead spawning	13.0 + 0.3 HUA	Seasonally applies
	Core cold water habitat	16.0 + 0.3 HUA	
	Salmon and trout rearing and migration	18.0 + 0.3 HUA	
	Waters that are always colder than the applicable biologically based numeric criteria and the protecting colder water criterion does not apply		
	Salmon and steelhead spawning	13.0	Seasonally applies
	Core cold water habitat	16.0	
	Salmon and trout rearing and migration	18.0	

Applicable Criteria	Fish and Aquatic Life Use Protected	7DADM Temperature Target (°C)	Notes
	Waters that are always colder than the applicable biologically based numeric criteria and the protecting colder water criterion applies		
	Fish and aquatic life	Ambient temperature + 0.3 HUA	
Natural lakes narrative OAR 340-041-0028(6)	Fish and aquatic life Natural Lakes	Natural thermal condition + 0.3 HUA as a 7DADM	Absent a discharge or human modification that would reasonably be expected to increase temperature, DEQ will presume that the ambient temperature of a natural lake is the same as its natural thermal condition

5 Seasonal variation and critical period for temperature

Per OAR 340-042-0040(4)(j) and 40 Code of Federal Regulation 130.7(c)(1),TMDLs must also identify any seasonal variation and the critical condition or period of each pollutant, if applicable.

The critical periods for waterbodies in the Middle Columbia-Hood (Miles Creeks) Subbasin are presented in Table 5-1. Allocations presented in the TMDL apply during these periods. Section 5 of the TSD summarizes the critical period approach and presents plots of 7DADM temperature data used to determine seasonal variation and the critical periods.

Table 5-1: Designated critical periods for waterbodies in the Middle Columbia-Hood (Miles Creeks) Subbasin.

Watershed/Subwatershed	Waterbody Name	Critical Period
Fifteenmile Creek Watershed 1707010503	All waters	March 15 – October 31
Eightmile Creek Watershed 1707010502	All waters	March 15 – October 31
Mill Creek-Columbia River Watershed 1707010504	All waters	May 1 – October 31
Upper Mosier Creek Subwatershed 170701051102	All waters	May 1 – October 31
Lower Mosier Creek Subwatershed 170701051103	All waters	May 1 – October 31
Rock Creek Subwatershed 170701051104	All waters	May 1 – October 31
Rowena Creek-Columbia River Subwatershed 170701051105	All waters	May 1 – October 31

6 Temperature water quality data evaluation overview

The TMDL development process requires use of numerous temperature, hydrologic, meteorologic, and landscape data sets to characterize temperature conditions and complete a thermal pollutant source assessment. The purpose of the source assessment is to identify the sources of stream temperature warming and quantify the impact and contributions each source contributes to the temperature criteria exceedances. Data analysis and models provide the means to evaluate potential sources of stream warming and, to the extent existing data allow, the amount of pollutant loading from these sources. The results from this analysis are then used to evaluate the maximum amount of thermal load the waterbody can receive from each source category and still meet temperature criteria. This latter step informs the assignment of allocations to each pollutant source category.

Figure 6-1 provides an overview of the analyses completed for this TMDL.

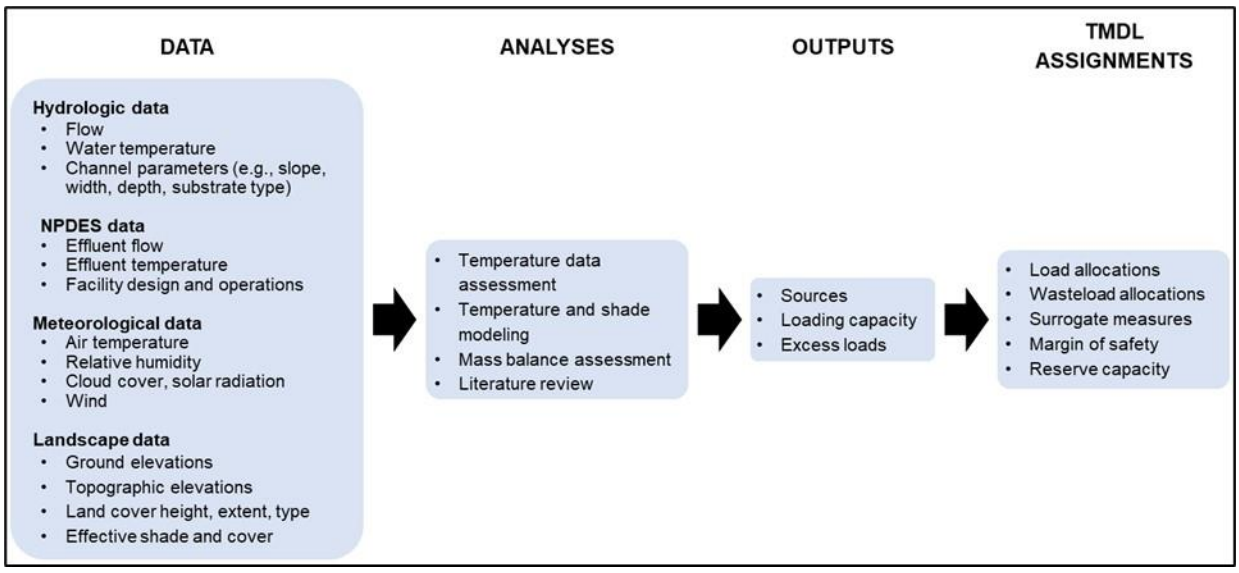

Figure 6-1: Middle Columbia-Hood (Miles Creeks) Subbasin temperature analysis overview.

6.1 Model overview

An important step in the TMDL process is to perform a source assessment which quantifies the background and anthropogenic contributions to stream heating. Models provide a way to evaluate potential sources of stream warming and complete a cumulative effects analysis to ensure the TMDL pollutant allocations assigned to each source will result in attainment of the applicable temperature criteria.

As described in the TSD model report appendices, DEQ set up and calibrated temperature and shade models for streams in the Middle Columbia-Hood (Miles Creeks) Subbasin (Figure 6-2) as part of previous TMDL efforts. Several model scenarios were developed to evaluate different management options and assess TMDL allocations (TSD Appendix C).

Heat Source temperature and shade models were developed for:

- Fifteenmile Creek

Heat Source shade model only models were developed for:

- Eightmile Creek
- Ramsey Creek

During development of the 2008 TMDL, the models were adjusted iteratively until acceptable goodness-of-fit was achieved relative to the observed current conditions. For this TMDL effort, DEQ did not adjust the original calibrated temperature models.

DEQ did adjust various model scenarios that were developed for the 2008 TMDL; new scenarios were also developed. These adjustments were primarily focused on updating vegetation data to reflect more current conditions, accounting for the influences of tributaries on downstream temperatures, and assessing the impacts of consumptive water withdrawals.

The results of these models were used in tandem with applicable temperature criteria to complete source assessment and cumulative effects analyses, determine TMDL allocations and surrogate measures that attain applicable temperature criteria, and develop information to support TMDL implementation and the TMDL WQMP development. Due to time and resource limitations, it was not possible to model all waters with a temperature listing, so the determination of sources and source categories is principally based on the findings from the streams that were modeled or assessed using available data. Results from the modeled reaches and reaches with available data are relevant in the larger watershed context.

A summary of the source assessment findings is provided in Section 7. Detailed model calibration and scenario results are provided in TSD Appendix A.

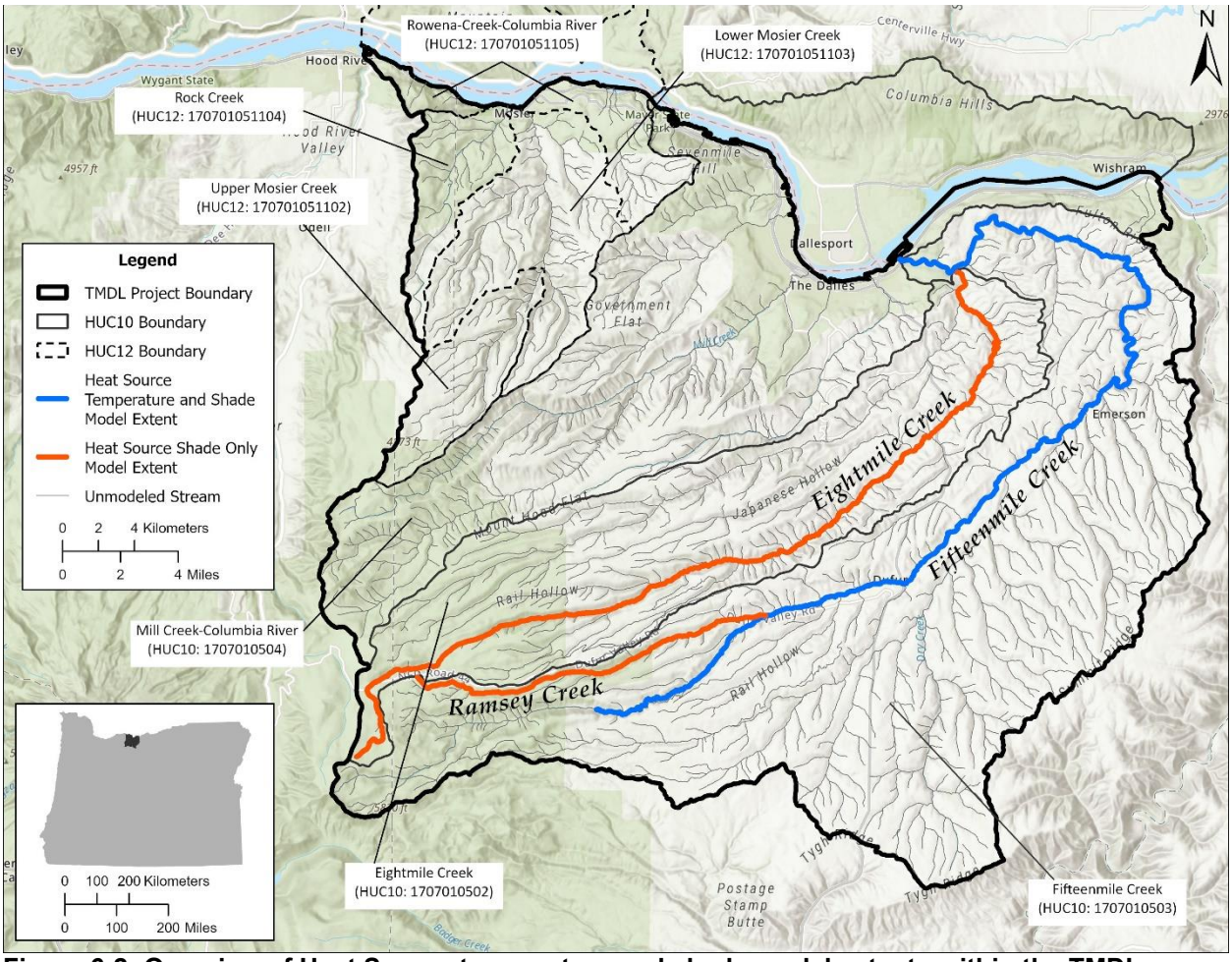

Figure 6-2: Overview of Heat Source temperature and shade model extents within the TMDL project area.

7 Pollutant sources or source categories

As noted in OAR 340-042-0040(4)(f) and OAR 340-042-0030(12), a source is any process, practice, activity or resulting condition that causes or may cause pollution or the introduction of pollutants to a waterbody. This section identifies the various pollutant sources and estimates, to the extent existing data allow, the significance of pollutant loading from existing sources.

Both point and nonpoint sources are sources of thermal pollution to surface waters in the Middle Columbia-Hood (Miles Creeks) Subbasin. Within the nonpoint source category, both background and anthropogenic nonpoint sources contribute thermal pollution. Each source's thermal loading varies in frequency and magnitude based on discharge rate and temperature, the prevalence of associated activities, the land area extent on which activities occur, the proximity of activities to surface water, and thermal transport mechanisms.

7.1 Point sources

OAR 340-045-0010(17) defines a point source as “any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.”

Dufur STP is the only industrial individual NPDES permitted point source located within the Middle Columbia-Hood (Miles Creeks) Subbasin. However, the facility is currently in the process of terminating their permit and has decommissioned the piping to the Fifteenmile Creek outfall. As a result, the facility will no longer be discharging effluent to the creek (Table 7-1).

Table 7-1: Individual NPDES permit holder Dufur STP (permit termination in progress).

Permittee	Permit type	DEQ WQ File Number	EPA Number	Receiving water name (AU ID)	River mile
Dufur STP	NPDES-DOM-Db	25491	OR0029050	Fifteenmile Creek (OR_WS_170701050302_02_101985)	30.3

There are several categories of general NPDES permits with registrants in the Middle Columbia-Hood (Miles Creeks) Subbasin, including:

- 200-J Industrial Wastewater; NPDES filter backwash
- 1200-C Stormwater: NPDES construction
- 1200-Z Stormwater: NPDES specific Standard Industrial Classification codes

DEQ determined the following general permit categories have potential to discharge thermal loads that contribute to exceedances of the applicable temperature criteria:

- 200-J Industrial Wastewater: NPDES filter backwash

One 200-J permit registrant (Table 7-2) is located within the TMDL project area and was identified as a potential source of thermal load with a temperature impact. Wasteload allocations for this registrant are provided in Section 9.1.

Table 7-2: General NPDES permit registrants that contribute thermal loads to Middle Columbia-Hood (Miles Creeks) Subbasin streams at a frequency and magnitude to cause temperature standard exceedances.

Registrant	General Permit	DEQ WQ File Number	EPA Number	Receiving water name (AU ID)	River mile
City of The Dalles WTP	200-J	87831	ORG387001	South Fork Mill Creek (OR_WS_170701050403_02_101992)	0.87

Additionally, there are 10 total registrants of the 1200-C and 1200-Z permits. DEQ completed a review of published literature and other studies related to stormwater runoff and stream temperature in Oregon (see TSD Section 7.1) and concluded that stormwater discharges authorized under current municipal (MS4), construction (1200-C) and industrial (1200-A and 1200-Z) general stormwater permits are unlikely to contribute to exceedances of the

temperature standard. Therefore, no additional TMDL requirements are needed for stormwater sources to control temperature, other than those included in the current permits. More specific thermal wasteload allocations can be considered if subsequent data and evaluation demonstrate a need and if reserve capacity is available.

7.2 Nonpoint sources

OAR 340-041-0002(42) defines nonpoint sources as “diffuse or unconfined sources of pollution where wastes can either enter, or be conveyed by the movement of water, into waters of the state.” ORS 468B.005(3) defines a nonpoint source as any source of pollution other than a point source.

Nonpoint source categories or activities identified as sources of thermal loading and increase 7DADM stream temperatures above the applicable criteria include:

- Increases in solar radiation loading from the disturbance or removal of near stream vegetation;
- Elevated temperatures from inflowing tributaries;
- Dam and reservoir operation;
- Activities that modify flow rate or volume; and
- Background sources, including natural sources and anthropogenic sources defined as background sources (see Section 7.3).

In Fifteenmile Creek, thermal loading from nonpoint sources contributed to exceedances of the applicable temperature criteria and therefore these sources were identified as significant sources of thermal loading. The maximum 7DADM water temperature increase from nonpoint source categories is shown in Table 7-3. Reductions from nonpoint sources will be required to attain the applicable temperature criteria.

Table 7-3: Summary of nonpoint source maximum 7DADM temperature increases above the applicable criteria on Fifteenmile Creek at the POMI (point of maximum impact).

Nonpoint Source Category	Maximum 7DADM warming (°C)	POMI (Model km)
Tributaries	1.79	3.8
Disturbance or removal of near-stream vegetation	11.93	27.8
Consumptive use water withdrawals	4.67	30.8

7.3 Background sources

By definition, OAR 340-042-0030(1) states that background sources include all sources of pollution or pollutants not originating from human activities. Background sources may also include anthropogenic sources of a pollutant that DEQ or another Oregon state agency does not have the authority to regulate, such as pollutants emanating from another state, tribal lands, or sources otherwise beyond the jurisdiction of the state.

The amount of background thermal loading a stream receives is influenced by multiple landscape and meteorological characteristics, such as substrate and channel morphology conditions, streambank and channel elevations, near-stream vegetation, groundwater, hyporheic flow, tributary inflows, precipitation, cloudiness, air temperature, relative humidity, and others. Many of these factors, however, are influenced by anthropogenic impacts related to the

surrogate measures. As such, it was not possible to develop a model in which all human influences were controlled or accounted for. As a best estimate, background thermal sources were quantified for the modeled rivers with delineable anthropogenic influences (i.e., vegetation alterations, point source discharges, water withdrawals) accounted for, thus isolating the remaining background sources.

In the Fifteenmile Creek temperature model, thermal loading from background sources contributed to exceedances of the applicable temperature criteria and therefore was identified as a significant source of thermal loading. Reductions from background sources will be required to attain the applicable temperature criteria. The maximum 7DADM temperature standard exceedance of background sources was 4.03°C in Fifteenmile Creek.

8 Loading capacity and excess loads

Summarizing OAR 340-042-0040(4)(d) and 40 CFR 130.2(f), loading capacity is the amount of a pollutant or pollutants that a waterbody can receive and still meet water quality standards.

For temperature, thermal loading capacity is calculated on AUs using Equation 8-1.

$$LC = (T_C + \mathrm{HUA}) \cdot Q_R \cdot C_F$$ **Equation 8-1**

where,

$LC =$ Loading Capacity (kilocalories/day).

$T_C =$ The applicable river temperature criterion (ºC).

$\mathrm{HUA} =$ The 0.3°C human use allowance allocated to point sources, nonpoint sources, margin of safety, or reserve capacity.

$Q_R =$ The daily mean river flow rate in cubic feet per second (cfs).

$C_F =$ Conversion factor using flow in cfs: 2,446,665

$$\left(\frac{1\ \mathrm{m}}{3.2808\ \mathrm{ft}}\right)^3 \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

Equation 8-1 will be used to calculate the thermal loading capacity for any surface water location in the Middle Columbia-Hood (Miles Creeks) Subbasin. Table 8-1 presents the loading capacities for temperature impaired Category 5 AUs modeled for the TMDL analysis at the critical 7Q10 low flow. Equation 8-1 may be used to calculate the loading capacity when river flows are greater than 7Q10. Equation 8-1 may also be used to calculate the loading capacity if in the future the applicable temperature criteria are updated and approved by EPA.

Table 8-1: Thermal loading capacity (LC) for select assessment units by applicable fish use period at 7Q10 flow.

AU Name and AU ID	Annual 7Q10 (cfs)	Year Round Criterion + HUA (°C)	Spawning Criterion + HUA (°C)	7Q10 LC Year Round (kcal/day)	7Q10 LC Spawning (kcal/day)
Eightmile Creek OR_SR_1707010502_02_101504	0.1	18.3	13.3	4.96E+06	3.61E+06
Dry Creek OR_SR_1707010503_02_101505	0	18.3	13.3	0.00E+00	0.00E+00
Fifteenmile Creek OR_SR_1707010503_02_101506	2.0	18.3	13.3	8.87E+07	6.44E+07
Fifteenmile Creek OR_SR_1707010503_02_101507	1.2	16.3	NA	4.78E+07	NA
Mosier Creek OR_SR_1707010511_02_101513	0.5	18.3	NA	2.23E+07	NA
HUC12 Name: Upper Eightmile Creek OR_WS_170701050201_02_101980	8.1	16.3	NA	3.23E+08	NA
HUC12 Name: Middle Eightmile Creek OR_WS_170701050202_02_101981	2.9	16.3	NA	1.17E+08	NA
HUC12 Name: Lower Eightmile Creek OR_WS_170701050204_02_101983	1.7	18.3	NA	7.61E+07	NA
HUC12 Name: Headwaters Fifteenmile Creek OR_WS_170701050301_02_101984	1.2	16.3	NA	4.78E+07	NA
HUC12 Name: Upper Fifteenmile Creek OR_WS_170701050302_02_101985	1.2	16.3	NA	4.78E+07	NA
HUC12 Name: Upper Dry Creek OR_WS_170701050303_02_101986	0	18.3	NA	0.00E+00	NA
HUC12 Name: Threemile Creek OR_WS_170701050402_02_101991	0	18.3	NA	0.00E+00	NA
HUC12 Name: North Fork Mill Creek-South Fork Mill Creek OR_WS_170701050403_02_101992	0.3	16.3	NA	1.36E+07	NA
HUC12 Name: Mill Creek OR_WS_170701050404_02_101993	12.5	18.3	NA	5.60E+08	NA
HUC12 Name: Chenoweth Creek OR_WS_170701050405_02_101994	0.7	18.3	NA	3.33E+07	NA
HUC12 Name: Lower Mosier Creek OR_WS_170701051103_02_102009	0.5	18.3	NA	2.23E+07	NA
HUC12 Name: Rock Creek OR_WS_170701051104_02_102010	2.4	18.3	NA	1.09E+08	NA

In accordance with OAR 340-042-0040(4)(e), the excess load calculation evaluates, to the extent existing data allow, the difference between the actual pollutant load in a waterbody and the loading capacity of that waterbody.

Because flow monitoring data were not available at most temperature monitoring locations, it was not possible to calculate the excess load. Instead, the excess temperature and percent load reduction were calculated for each AU where temperature data were available (Table 8-2). Not all streams within the Middle Columbia-Hood (Miles Creeks) project area have monitoring data. Equation 8-2 from the TSD can be used to determine excess temperature and percent reduction for additional streams if data becomes available in the future.

$$\mathrm{PR} = \frac{(T_R - T_C - \mathrm{HUA})}{T_R} \cdot 100$$ **Equation 8-2**

where,

$\mathrm{PR} =$ Percent load reduction (%). If PR < 0, PR = 0

$T_R =$ The maximum 7DADM ambient river temperature (°C).

$T_C =$ The applicable river temperature criterion (°C).

$\mathrm{HUA} =$ The 0.3°C human use allowance assigned to point sources, nonpoint sources, margin of safety, or reserve capacity.

The excess temperatures are the maximum difference between the monitored 7DADM river temperatures and sum of the applicable numeric criteria plus the HUA. The percent load reduction represents the portion of the actual thermal loading that must be reduced to attain the TMDL loading capacity. The percent load reduction can be calculated from the excess temperature. If the maximum calculated observed excess temperature is negative, the excess temperature and required percent load reduction are zero.

Table 8-2: Excess temperature and percent load reduction for AUs with available temperature data in the Middle Columbia-Hood (Miles Creeks) Subbasin.

AU Name	AU ID	Maximum 7DADM River Temperature (°C)	Applicable Criterion + HUA (°C)	Excess Temperature (°C)	Percent Load Reduction
Crow Creek Reservoir	OR_LK_1707010504_02_100015	15.3	18.3	0	0.0
Eightmile Creek	OR_SR_1707010502_02_101504	19.5	13.3	6.21	31.8
Eightmile Creek	OR_SR_1707010502_02_101504	25.5	18.3	7.23	28.3
Fifteenmile Creek	OR_SR_1707010503_02_101506	21.2	13.3	7.86	37.1
Fifteenmile Creek	OR_SR_1707010503_02_101506	30.6	18.3	12.34	40.3
Fifteenmile Creek	OR_SR_1707010503_02_101507	26.6	13.3	13.27	49.9
Fifteenmile Creek	OR_SR_1707010503_02_101507	27.1	16.3	10.8	39.9

AU Name	AU ID	Maximum 7DADM River Temperature (°C)	Applicable Criterion + HUA (°C)	Excess Temperature (°C)	Percent Load Reduction
HUC12 Name: Upper Eightmile Creek	OR_WS_1707010 50201_02_101980	11.5	13.3	0	0.0
HUC12 Name: Upper Eightmile Creek	OR_WS_1707010 50201_02_101980	16.6	16.3	0.25	1.5
HUC12 Name: Fivemile Creek	OR_WS_1707010 50203_02_101982	7.2	13.3	0	0.0
HUC12 Name: Fivemile Creek	OR_WS_1707010 50203_02_101982	18.3	18.3	0	0.0
HUC12 Name: Lower Eightmile Creek	OR_WS_1707010 50204_02_101983	28.7	13.3	15.41	53.7
HUC12 Name: Lower Eightmile Creek	OR_WS_1707010 50204_02_101983	29.9	16.3	13.64	45.6
HUC12 Name: Lower Eightmile Creek	OR_WS_1707010 50204_02_101983	25.1	18.3	6.76	27.0
HUC12 Name: Headwaters Fifteenmile Creek	OR_WS_1707010 50301_02_101984	22.3	13.3	9.03	40.4
HUC12 Name: Headwaters Fifteenmile Creek	OR_WS_1707010 50301_02_101984	22.9	16.3	6.57	28.7
HUC12 Name: Upper Fifteenmile Creek	OR_WS_1707010 50302_02_101985	25.7	13.3	12.37	48.2
HUC12 Name: Upper Fifteenmile Creek	OR_WS_1707010 50302_02_101985	26.3	16.3	10.01	38.0
HUC12 Name: Upper Dry Creek	OR_WS_1707010 50303_02_101986	22.4	18.3	4.1	18.3
HUC12 Name: North Fork Mill Creek-South Fork Mill*	OR_WS_1707010 50403_02_101992	15.1	13.3	1.82	12.0
HUC12 Name: North Fork Mill Creek-South Fork Mill*	OR_WS_1707010 50403_02_101992	22.0	16.3	5.71	25.9
HUC12 Name: North Fork Mill Creek-South Fork Mill*	OR_WS_1707010 50403_02_101992	21.7	18.3	3.44	15.8
HUC12 Name: Mill Creek	OR_WS_1707010 50404_02_101993	13.0	13.3	0	0.0
HUC12 Name: Mill Creek	OR_WS_1707010 50404_02_101993	26.6	18.3	8.29	31.2

AU Name	AU ID	Maximum 7DADM River Temperature (°C)	Applicable Criterion + HUA (°C)	Excess Temperature (°C)	Percent Load Reduction
HUC12 Name: Mill Creek	OR_WS_1707010 50404_02_101993	21.1	18.3	2.81	13.3
HUC12 Name: Upper Mosier Creek	OR_WS_1707010 51102_02_102008	15.9	18.3	0	0.0
HUC12 Name: Rock Creek	OR_WS_1707010 51104_02_102010	13.6	18.3	0	0.0

9 Allocations, reserve capacity, and margin of safety

OAR 340-042-0040(4)(g),(h),(i) and (k) [and 40 CFR 130.2(h) and (g) and 130.7(c)(2)] respectively define the required TMDL elements of apportionment of the allowable pollutant load: point source wasteload allocations; nonpoint source load allocations (including background); margin of safety; and reserve capacity. Collectively, these elements add up to the maximum pollutant load that still allows a waterbody to meet water quality standards. OAR 304-042-0040(5) and (6) describe potential factors to consider when determining and distributing these allocations of the allowable pollutant loading capacities. Water quality data analysis must be conducted to determine allocations, potentially including statistical analysis and mathematical modeling. Factors to consider in allocation distribution may include source contributions, costs of implementing management measures, ease of implementation, timelines to attain water quality standards, environmental impacts of allocations, unintended consequences, reasonable assurance of implementation, and any other relevant factor.

9.1 Thermal allocations

9.1.1 Human use allowance assignments

The HUA rule in OAR 340-041-0028(12)(b)(B) identifies the allowed temperature increase reserved for human uses. The rule requires that wasteload and load allocations restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.3°C (0.5°F) above the applicable criteria after complete mixing in the waterbody, and at the POMI.

Table 9-1 through **Error! Reference source not found.** present the portions of the HUA assigned to each relevant anthropogenic source category in each AU in the TMDL project area. Temperature impacts associated with climate change sources are assigned a zero HUA. See TSD Section 9 for the HUA assignment methodology and additional details. DEQ typically rounds final results to hundredths (°C) for the purposes of this TMDL. It is important to note that an HUA assignment of 0.00 does not mean that absolutely no warming may occur; instead, a 0.00°C HUA means that the quantity of any relevant warming must be no greater than 0.00 when rounded to the hundredths (°C). So, a temperature effect of 0.004°C rounds to 0.00°C and

is not considered an exceedance. In contrast, 0.006°C rounds to 0.01°C and thus would violate a 0.00°C HUA.

The HUA assigned to NPDES point sources in each AU represents the maximum cumulative warming allowed anywhere in that AU from all NPDES permittees taken together. Similarly, the HUA portions assigned to various nonpoint source categories represent the maximum cumulative warming allowed anywhere in the AU and at the POMI from all nonpoint source activities in that source category. The HUA assignments in Table 9-1 for nonpoint source categories are achieved through the implementation of the load allocations described in Section 9.1.3 and the surrogate measures described in Section 9.1.4. Designated Management Agencies (DMAs) are responsible for implementing management activities that achieve the surrogate measure targets appropriate to their source category and location. A DMA has achieved their load allocation when surrogate measure targets are met. When all DMAs within a nonpoint source category have met their surrogate measure targets and achieved their load allocations, the HUA assigned to that nonpoint source category is achieved.

It is unlikely that the maximum HUA for each point and nonpoint source category will be consumed simultaneously in an AU; instead, various sources will typically use their entire HUA at different times; thus, DEQ expects the total warming for each unique point or nonpoint source activity to add up to less than the sum of each row's values in Table 9-1. DEQ will implement the TMDL in a manner consistent with the HUA rule by requiring all nonpoint sources to implement management strategies to reduce their warming impact such that the assigned HUA is attained. Point sources will be required to implement their wasteload allocations through their NPDES permits such that the assigned HUA is attained. Note that HUA assignments to specific NPDES point sources are presented in Section 9.1.2, and assignments to specific non-point sources in Section 9.1.3.

The "Dam and reservoir operations" source category accounts for nonpoint source temperature impacts associated with the dam impoundment and release of the impounded water back into the natural channel. Dam and reservoir operations not associated with an NPDES permit are assigned HUAs of 0.00°C. These are achieved through implementation of the load allocations described in Section 9.1.3 and the temperature target surrogate measure described in Section 9.1.4.1.

The HUA category "Anthropogenic warming from tributaries" accounts for temperature increases in a stream that are caused by point or nonpoint source anthropogenic warming in tributaries to that stream. This category also includes inflow from canals and drains. In Table 9-1, HUA assignments for this category were made for all but one AU within the project area. For these AUs, their categorical HUA assignments are based on results of a "Tributary Temperatures" model scenario for Fifteenmile Creek, in which tributary temperature inputs were set to reflect warming from anthropogenic sources on those tributaries attaining their assigned HUA portions. In Table 9-1, South Fork Mill Creek received a 0.00°C HUA assignment for this thermal source category, and warming is assumed accounted for by the remaining categorical allocations. Details of the tributary temperature assessments are presented in TSD Appendix A [sections] (see the "Tributary temperatures" subsections).

The "background" load allocation accounts for warming from background sources (Section 9.3). Other nonpoint source categories include warming associated with climate change; solar loading from streamside vegetation disturbance; and water withdrawals for consumptive uses.

Table 9-1: HUA assignments (°C) for source or source categories on assessment units in the Middle Columbia-Hood (Miles Creeks) TMDL project area.

Assessment Unit	Assessment Unit ID	NPDES point sources	Dam and reservoir operations	Water management activities and water withdrawals	Solar loading from existing transportation, buildings, and utility easements and infrastructure	Anthropogenic warming from tributaries	Other nonpoint sectors	Reserve capacity	Total HUA
South Fork Mill Creek	OR_WS_170701050403_02_101992	0.20	0.00	0.00	0.05	0.00	0.00	0.05	0.30
All other AUs	Applicable AUs are listed in TSD Appendix D	0.00	0.00	0.10	0.05	0.10	0.00	0.05	0.30

9.1.2 Wasteload allocations for point sources

Wasteload allocations are assigned to NPDES permitted point sources listed in Table 9-2. Discharges covered by a number of NPDES permits have been determined to be unlikely to contribute to exceedances of temperature criteria. The wasteload allocations for registrants under the general stormwater permits (1200-C and 1200-Z) are set equal to loads permitted by the applicable NPDES permit. This means that registrants must follow their permit conditions to meet the wasteload allocation. Beyond NPDES permit limits, no additional TMDL requirements are needed for these sources to control temperature. For all general wastewater and stormwater NPDES permits, more precise wasteload allocations may be considered if subsequent data analysis indicates a need and loading capacity is available.

Wasteload allocations were calculated using Equation 9-1.

$$WLA = (\Delta T) \cdot (Q_E + Q_R) \cdot C_F \qquad \textbf{Equation 9-1}$$

where,

$WLA =$ Wasteload allocation (kilocalories/day), expressed as a rolling seven-day average.

$\Delta T =$ The assigned portion of the HUA from Table 9-2. It is the maximum temperature increase (°C) above the applicable river temperature criterion using 100% of river flow not to be exceeded by each individual source from all outfalls combined.

$Q_E =$ The daily mean effluent flow (cfs).
When effluent flow is in million gallons per day (MGD) convert to cfs:
$$\frac{1{,}000{,}000\ gallons}{1\ day} \cdot \frac{0.13368 ft^3}{1\ gallon} \cdot \frac{1\ day}{86{,}400\ sec} = 1.5472\ ft^3/sec$$

$Q_R =$ The daily mean river flow rate, upstream (cfs).
When river flow is <= 7Q10, Q_R = 7Q10. When river flow > 7Q10, Q_R is equal to the daily mean river flow, upstream.

$C_F =$ Conversion factor using flow in cfs: 2,446,665
$$\left(\frac{1\ \text{m}}{3.2808\ \text{ft}}\right)^3 \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

The effluent discharge used to calculate the wasteload allocations presented in Table 9-2 is based on maximum effluent discharge reported from discharge data. More information on the specific source of the effluent discharge flow, effluent temperature, and the rationale behind the assigned HUA is described in the TSD Section 9.1.

Wasteload allocations may be implemented in NPDES permits in any of the following ways:

(1) Incorporate the 7Q10 wasteload allocation in Table 9-2 as a static numeric limit. Permit writers may recalculate the static limit using different values for 7Q10 (Q_R) and effluent discharge (Q_E) using seasonal values or annual values, as appropriate, if more recent data or better estimates are available. The assigned portion of the HUA (ΔT) is static and based on the value in Table 9-2.

(2) Incorporate Equation 9-1 directly into the permit with effluent flow (Q_E), river flow (Q_R), and the wasteload allocation (WLA) being dynamic and calculated on a daily basis. The assigned portion of the HUA (ΔT) is static and based on the value in Table 9-2. Permit writers may recalculate the 7Q10 using seasonal or annual values, as appropriate, if more recent data or better estimates are available.

The wasteload allocation period for each facility is consistent with the critical period of the receiving waterbody, which is presented in Section 5. Wasteload allocations in Table 9-2 for facilities currently enrolled as a registrant under a general permit may be incorporated into an individual permit, if the facility obtains an individual permit for the same discharge in the future.

Table 9-2: Thermal wasteload allocations (WLA) for point sources. Listed WLAs were calculated based on the 7Q10 flow. Note: WLA = wasteload allocation; kcals/day = kilocalories/day.

NPDES Permittee WQ File Number: EPA Number	Assigned HUA ΔT (°C)	WLA period start	WLA period end	7Q10 River flow (cfs)	Effluent discharge (cfs)	7Q10 WLA (kcals/day)
Dufur STP 25491 : OR0029050	0.00	N/A	N/A	1.2	0.00	0.00
City of The Dalles WTP 87831 : ORG387001	0.20	3/15	10/31	0.3	1.380	8.43E+05

9.1.3 Load allocations for nonpoint sources

OAR 340-042-0040(4)(h) defines load allocations as the portions of the receiving water's loading capacity that are allocated to existing nonpoint sources, including runoff, deposition, soil contamination and groundwater discharges, or to background sources. Load allocations are best estimates of loading and may range from reasonably accurate estimates to gross allotments depending on the availability of data and appropriate techniques for predicting loading. Whenever reasonably feasible, natural background, long-range transport and anthropogenic nonpoint source loads will be distinguished from each other.

Load allocations assigned to background sources on each AU are calculated using Equation 9-2.

$$LA_{BG} = (T_C) \cdot (Q_R) \cdot C_F$$ **Equation 9-2**

where,

$LA_{BG} =$ Load allocation to background sources (kilocalories/day), expressed as a rolling seven-day average.

$T_C =$ The applicable temperature criteria, not including the HUA. When there are two year-round applicable temperature criteria that apply to the same AU, the more stringent criteria will be used.

$Q_R =$ The daily average river flow rate (cfs). For a lake, a dilution factor of 1 may be used for Q_R unless determined using another method.

$C_F =$ Conversion factor using flow in cfs: 2,446,665

$$\left(\frac{1\text{ m}}{3.2808\text{ ft}}\right)^3 \cdot \frac{1\ m^3}{35.31\ ft^3} \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

Table 9-3 presents the load allocations assigned to background sources on temperature impaired Category 5 AUs. The load allocations are based on the 7Q10 low river flows and the minimum applicable criterion in the respective AUs. Equation 9-2 will be used to calculate the load allocations assigned to background sources on all other AUs or stream locations in the Middle Columbia-Hood (Miles Creeks) project area not identified in Table 9-3 or for any AUs identified in Table 9-3 when river flows are greater than 7Q10.

If the applicable temperature criteria are updated and approved by EPA, the background load allocations assigned to any AU or stream location where the temperature criterion changed will be recalculated using the updated criterion and Equation 9-2.

Load allocations assigned to anthropogenic nonpoint sources on each AU are calculated using Equation 9-3. The portions of the HUA (ΔT) assigned to nonpoint sources or source categories are presented in Section 9.1.1. When all load allocations assigned to a nonpoint source or source category have been achieved, the HUA allocation to that nonpoint source or source category is achieved.

$$LA_{NPS} = (\Delta T) \cdot (Q_R) \cdot C_F$$ **Equation 9-3**

where,

$LA_{NPS} =$ Load allocation to anthropogenic nonpoint sources (kilocalories/day), expressed as a rolling seven-day average.

$\Delta T =$ The portion of the HUA assigned to each nonpoint source category representing the maximum cumulative temperature increase (°C) from all source activity in the nonpoint source category. When the minimum duties provision at OAR 340-041-0028(12)(a) applies, ΔT = 0.0.

$Q_R =$ The daily average river flow rate (cfs). For a lake, a dilution factor of 1 may be used for Q_R unless determined using another method.

$C_F =$ Conversion factor using flow in cfs: 2,446,665

$$\left(\frac{1\text{ m}}{3.2808\text{ ft}}\right)^3 \cdot \frac{1\ m^3}{35.31\ ft^3} \cdot \frac{1000\ kg}{1\ m^3} \cdot \frac{86400\ sec}{1\ day} \cdot \frac{1\ kcal}{1\ kg\ \cdot 1℃} = 2{,}446{,}665$$

Table 9-4 presents the load allocations assigned to anthropogenic nonpoint sources on temperature impaired Category 5 AUs. The load allocations are based on the 7Q10 low river flows and the minimum applicable criterion in the respective AUs. Equation 9-3 will be used to calculate the load allocations assigned to anthropogenic sources on all other AUs or stream location in the Middle Columbia-Hood (Miles Creeks) project area not identified in Table 9-4 or for any AUs identified in Table 9-4 when river flows are greater than 7Q10.

Table 9-3: Thermal load allocations (LA) for background sources in the Middle Columbia-Hood (Miles Creeks) TMDL project area.

AU Name and AU ID	Annual 7Q10 (cfs)	Year Round Criterion (°C)	Spawning Criterion (°C)	LA period start	LA period end	7Q10 LA Year Round (kcal/day)	7Q10 LA Spawning (kcal/day)
Eightmile Creek OR_SR_1707010502_02_101504	0.1	18	13	3/15	10/31	4.88E+6	3.52E+6
Dry Creek OR_SR_1707010503_02_101505	0	18	13	3/15	10/31	0	0
Fifteenmile Creek OR_SR_1707010503_02_101506	2.0	18	13	3/15	10/31	87.2E+6	62.98E+6
Fifteenmile Creek OR_SR_1707010503_02_101507	1.2	16	NA	3/15	10/31	46.89E+6	NA
Mosier Creek OR_SR_1707010511_02_101513	0.5	18	NA	5/1	10/31	21.95E+6	NA
HUC12 Name: Upper Eightmile Creek OR_WS_170701050201_02_101980	8.1	16	NA	3/15	10/31	316.7E+6	NA
HUC12 Name: Middle Eightmile Creek OR_WS_170701050202_02_101981	2.9	16	NA	3/15	10/31	115.09E+6	NA
HUC12 Name: Lower Eightmile Creek OR_WS_170701050204_02_101983	1.7	18	NA	3/15	10/31	74.87E+6	NA
HUC12 Name: Headwaters Fifteenmile Creek OR_WS_170701050301_02_101984	1.2	16	NA	3/15	10/31	46.89E+6	NA
HUC12 Name: Upper Fifteenmile Creek OR_WS_170701050302_02_101985	5.8	16	NA	3/15	10/31	227.05E+6	NA
HUC12 Name: Upper Dry Creek OR_WS_170701050303_02_101986	0	18	NA	3/15	10/31	0	NA
HUC12 Name: Threemile Creek OR_WS_170701050402_02_101991	0	18	NA	5/1	10/31	0	NA
HUC12 Name: North Fork Mill Creek-South Fork Mill Creek OR_WS_170701050403_02_101992	0.3	16	NA	5/1	10/31	13.39E+6	NA
HUC12 Name: Mill Creek OR_WS_170701050404_02_101993	12.5	18	NA	5/1	10/31	550.5E+6	NA

AU Name and AU ID	Annual 7Q10 (cfs)	Year Round Criterion (°C)	Spawning Criterion (°C)	LA period start	LA period end	7Q10 LA Year Round (kcal/day)	7Q10 LA Spawning (kcal/day)
HUC12 Name: Chenoweth Creek OR_WS_170701050405_02_101994	0.7	18	NA	5/1	10/31	32.72E+6	NA
HUC12 Name: Lower Mosier Creek OR_WS_170701051103_02_102009	0.5	18	NA	5/1	10/31	21.95E+6	NA
HUC12 Name: Rock Creek OR_WS_170701051104_02_102010	2.4	18	NA	5/1	10/31	107.46E+6	NA

Table 9-4: Thermal load allocations (LA) for nonpoint sources in the Middle Columbia-Hood (Miles Creeks) TMDL project area.

AU Name and AU ID	Annual 7Q10 (cfs)	NPDES point sources	Dam and reservoir operations	Consumptive use water management and water withdrawals	Solar loading from existing transportation corridors, existing utility infrastructure	Solar loading from other nonpoint sectors	Anthropogenic warming from tributaries
Eightmile Creek OR_SR_1707010502_02_101504	0.1	0.00	0.00	2.71E+04	1.36E+04	0.00E+00	2.71E+04
Dry Creek OR_SR_1707010503_02_101505	0	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Fifteenmile Creek OR_SR_1707010503_02_101506	2.0	0.00	0.00	4.84E+05	2.42E+05	0.00E+00	4.84E+05
Fifteenmile Creek OR_SR_1707010503_02_101507	1.2	0.00	0.00	2.93E+05	1.47E+05	0.00E+00	2.93E+05
Mosier Creek OR_SR_1707010511_02_101513	0.5	0.00	0.00	1.22E+05	6.10E+04	0.00E+00	1.22E+05
HUC12 Name: Upper Eightmile Creek	8.1	0.00	0.00	1.98E+06	9.90E+05	0.00E+00	1.98E+06

AU Name and AU ID	Annual 7Q10 (cfs)	NPDES point sources	Dam and reservoir operations	Consumptive use water management and water withdrawals	Solar loading from existing transportation corridors, existing utility infrastructure	Solar loading from other nonpoint sectors	Anthropogenic warming from tributaries
OR_WS_170701050201_02_101980							
HUC12 Name: Middle Eightmile Creek OR_WS_170701050202_02_101981	2.9	0.00	0.00	7.19E+05	3.60E+05	0.00E+00	7.19E+05
HUC12 Name: Lower Eightmile Creek OR_WS_170701050204_02_101983	1.7	0.00	0.00	4.16E+05	2.08E+05	0.00E+00	4.16E+05
HUC12 Name: Headwaters Fifteenmile Creek OR_WS_170701050301_02_101984	1.2	0.00	0.00	2.93E+05	1.47E+05	0.00E+00	2.93E+05
HUC12 Name: Upper Fifteenmile Creek OR_WS_170701050302_02_101985	5.8	0.00	0.00	1.42E+06	7.10E+05	0.00E+00	1.42E+06
HUC12 Name: Upper Dry Creek OR_WS_170701050303_02_101986	0	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HUC12 Name: Threemile Creek OR_WS_170701050402_02_101991	0	0.00	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
HUC12 Name: North Fork Mill Creek-South Fork Mill Creek OR_WS_170701050403_02_101992	0.3	1.67E+05	0.00	0.00E+00	4.18E+04	0.00E+00	0.00E+00
HUC12 Name: Mill Creek OR_WS_170701050404_02_101993	12.5	0.00	0.00	3.06E+06	1.53E+06	0.00E+00	3.06E+06
HUC12 Name: Chenoweth Creek OR_WS_170701050405_02_101994	0.7	0.00	0.00	1.82E+05	9.09E+04	0.00E+00	1.82E+05
HUC12 Name: Lower Mosier Creek OR_WS_170701051103_02_102009	0.5	0.00	0.00	1.22E+05	6.10E+04	0.00E+00	1.22E+05
HUC12 Name: Rock Creek OR_WS_170701051104_02_102010	2.4	0.00	0.00	5.97E+05	2.98E+05	0.00E+00	5.97E+05

9.1.4 Surrogate measures

EPA regulations (40 CFR 130.2(i)) and OAR 340-042-0040(O)(5)(b) allow for TMDLs to utilize other appropriate measures (or surrogate measures). This section presents surrogate measures that implement the load allocations.

9.1.4.1 Dam and reservoir operations

Dam and reservoir operations have been assigned a 0.00°C of the HUA (Section 9.1) and the equivalent load allocation as calculated using Equation 9-3. Monitoring stream temperature, rather than a thermal load, is easier and a more meaningful approach for reservoir management. Temperature is mathematically related to excess thermal loading and directly linked to the temperature water quality standard. For these reasons, DEQ is using a surrogate measure to implement the load allocation for dam and reservoir operations.

DEQ has developed the following surrogate measure temperature approach to implement the load allocation. The surrogate measure compliance point is located just downstream of the dam or just downstream of where impounded water is returned to the free-flowing stream. The surrogate measure is:

a) Release temperatures less than or equal to the 7DADM temperatures immediately upstream of the reservoirs. If multiple streams flow into the reservoir, 7DADM temperatures upstream of the reservoirs may be calculated as a flow weighted mean of temperatures from each inflowing tributary. The estimated free flowing (no dam) temperatures may be calculated using a mechanistic or empirical model to account for any warming or cooling that would occur through the reservoir reaches absent the dam and reservoir operations. The results may be applied as the temperature surrogate measure or to adjust the 7DADM temperatures monitored immediately upstream of the reservoirs. Use of the model approach for the surrogate measure must be approved by DEQ.

b) Additional adjustments to the surrogate temperature target calculated or measured under item a) may be allowed when all the following are true:

    i. Monitoring data shows 7DADM temperatures do not exceed the applicable temperature criteria plus assigned HUA in the AU downstream of the dam;
    ii. The protecting cold water criterion at OAR 340-041-0028(11) does not apply. DEQ has evaluated which dams the protecting cold water criterion likely apply in the TSD Section 7.2.1;
    iii. A cumulative effects analysis, approved by DEQ, demonstrates that dam release water temperatures warmer than the surrogate measure calculated or measured under item a) will result in attainment of the dam and reservoir assigned HUA above the applicable criteria in downstream waters.

For implementation of the low flow conditions provision at OAR 340-041-0028(12)(d), the 7Q10 will be calculated at a monitoring gage upstream of the reservoir or at nearby gage that isn't influenced by the dam's operations.

9.1.4.2 Site specific effective shade surrogate measure

Effective shade surrogate measure targets shown in Table 9-5 through Table 9-8 represent a surrogate for the amount of solar loading that will attain the HUA and load allocations for nonpoint sources managing streamside vegetation. The surrogate measure is the arithmetic mean of the effective shade values at all model nodes assigned to each DMA (Equation 9-4). Equation 9-4 may be used to recalculate the mean effective shade targets if DMA boundaries change or the DMA boundary needs to be corrected. Equation 9-4 may also be used to recalculate the mean effective shade targets based on an updated shade gap assessment following the process and methods outlined in the WQMP.

Changes in the target effective shade from the values presented in Table 9-5 through Table 9-8 may result in redistribution of the sector or source responsible for excess load reduction. If the shade target increases, the equivalent portion of the excess load is reassigned from background sources to nonpoint sources. If the shade target decreases, the portion of the excess load is reassigned from nonpoint sources to background sources. The exact portion reassigned can only be determined in locations where temperature models have been developed. In locations without temperature models, the reassignment remains unquantified. Changes to the target effective shade do not impact the loading capacity, HUA, or the load allocations. They remain the same as presented in this TMDL.

$$\overline{ES} = \frac{\sum ES_{n_i}}{n_i}$$ **Equation 9-4**

Where,

$\overline{ES} =$ The mean effective shade for DMA *i.*

$\sum ES_{n_i} =$ The sum of effective shade from all model nodes or measurement points assigned to DMA *i.*

$n_i =$ Total number of model nodes or measurement points assigned to DMA *i.*

Table 9-5: Site specific effective shade surrogate measure targets to meet nonpoint source load allocations for specific model extents.

Model stream	Total kilometers assessed	Assessed effective shade (%)	TMDL target effective shade (%)	Shade gap
Fifteenmile Creek	70.5	27	77	50
Eightmile Creek	58.6	68	83	15
Ramsey Creek	22.5	78	93	15

Table 9-6: Site specific effective shade surrogate measure targets to meet nonpoint source load allocations for DMAs in the Fifteenmile Creek.

DMA	Total kilometers assessed	Assessed effective shade (%)	TMDL target effective shade (%)	Shade gap
City of Dufur	1.1	33	72	39
Oregon Department of Agriculture	61	25	77	52
Oregon Department of Forestry - Private	2.4	72	92	20
U.S. Forest Service	0.3	31	96	65
U.S. Government	0.2	11	49	38
Union Pacific Railroad	0.2	66	58	-8

DMA	Total kilometers assessed	Assessed effective shade (%)	TMDL target effective shade (%)	Shade gap
Wasco County	4.4	33	80	47
City of Dufur	1.1	33	72	39

Table 9-7: Site specific effective shade surrogate measure targets to meet nonpoint source load allocations for DMAs in the Eightmile Creek model area.

DMA	Total kilometers assessed	Assessed effective shade (%)	TMDL target effective shade (%)	Shade gap
Oregon Department of Agriculture	38	59	79	20
Oregon Department of Forestry - Private	2	67	91	24
Oregon Department of Transportation	0.1	46	79	33
U.S. Forest Service	18.2	87	93	6
Wasco County	0.1	32	82	50

Table 9-8: Site specific effective shade surrogate measure targets to meet nonpoint source load allocations for DMAs in the Ramsey Creek model area.

DMA	Total kilometers assessed	Assessed effective shade (%)	TMDL target effective shade (%)	Shade gap
Oregon Department of Agriculture	6.6	57	87	30
Oregon Department of Forestry - Private	0.8	95	98	3
U.S. Forest Service	15.1	86	95	9

9.1.4.3 Effective shade curve surrogate measure

Effective shade targets serve as a surrogate measure for the solar loading that will attain the HUA and load allocations for nonpoint sources that manage or are otherwise responsible for streamside vegetation. Effective shade curves apply to streams without defined site-specific shade targets (Section 9.1.4.2). Effective shade curves represent the maximum possible effective shade range for a given vegetation type over certain geographic conditions.

The values presented within the effective shade curves (Figure 9-1 through Figure 9-5) represent the mean effective shade target for different mapping units, stream aspects, and active channel widths. See TSD Appendix A and Appendix C for additional details on the model approach for shade curves and the methodologies used to determine the mapping units and vegetation characteristics. Section 13 of this TMDL document provides tables of the plotted shade curve values. A map of all mapping units in the Middle Columbia-Hood (Miles Creeks) Subbasin can be found in TSD Appendix H. This is an interactive map that can be opened in an internet browser.

Local geology, geography, soils, climate, legacy impacts, natural disturbance rates, and other factors may prevent effective shade from reaching the target effective shade. No enforcement action will be taken by DEQ for reductions in effective shade caused by natural disturbances. Where natural disturbances prevent achievement of the target effective shade, DEQ will work with the DMAs to develop plans to restore riparian vegetation.

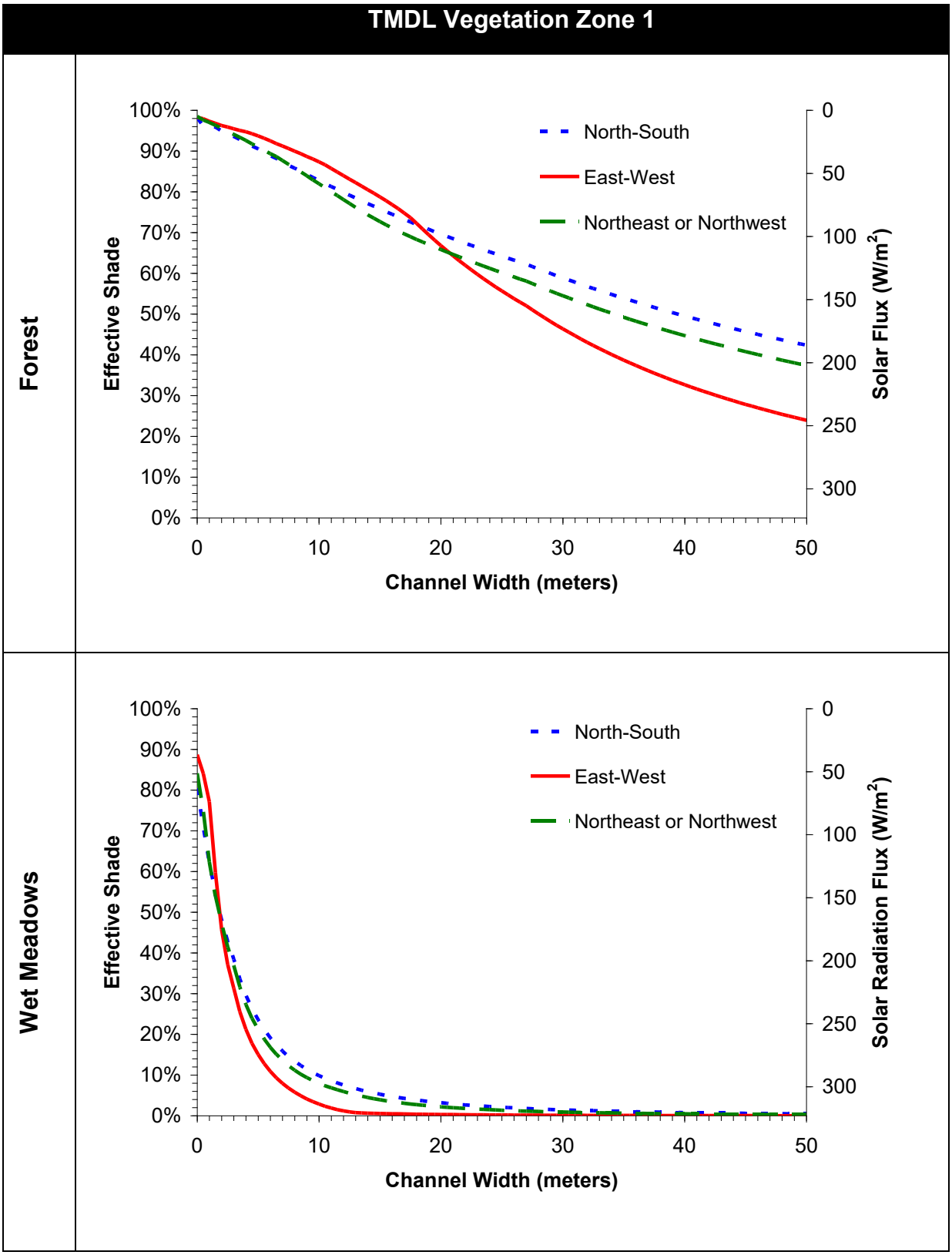

Figure 9-1: Effective shade curves for Vegetation Zone 1 in the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL project area (North-South, East-West, and Northeast-Northwest refer to stream aspect).

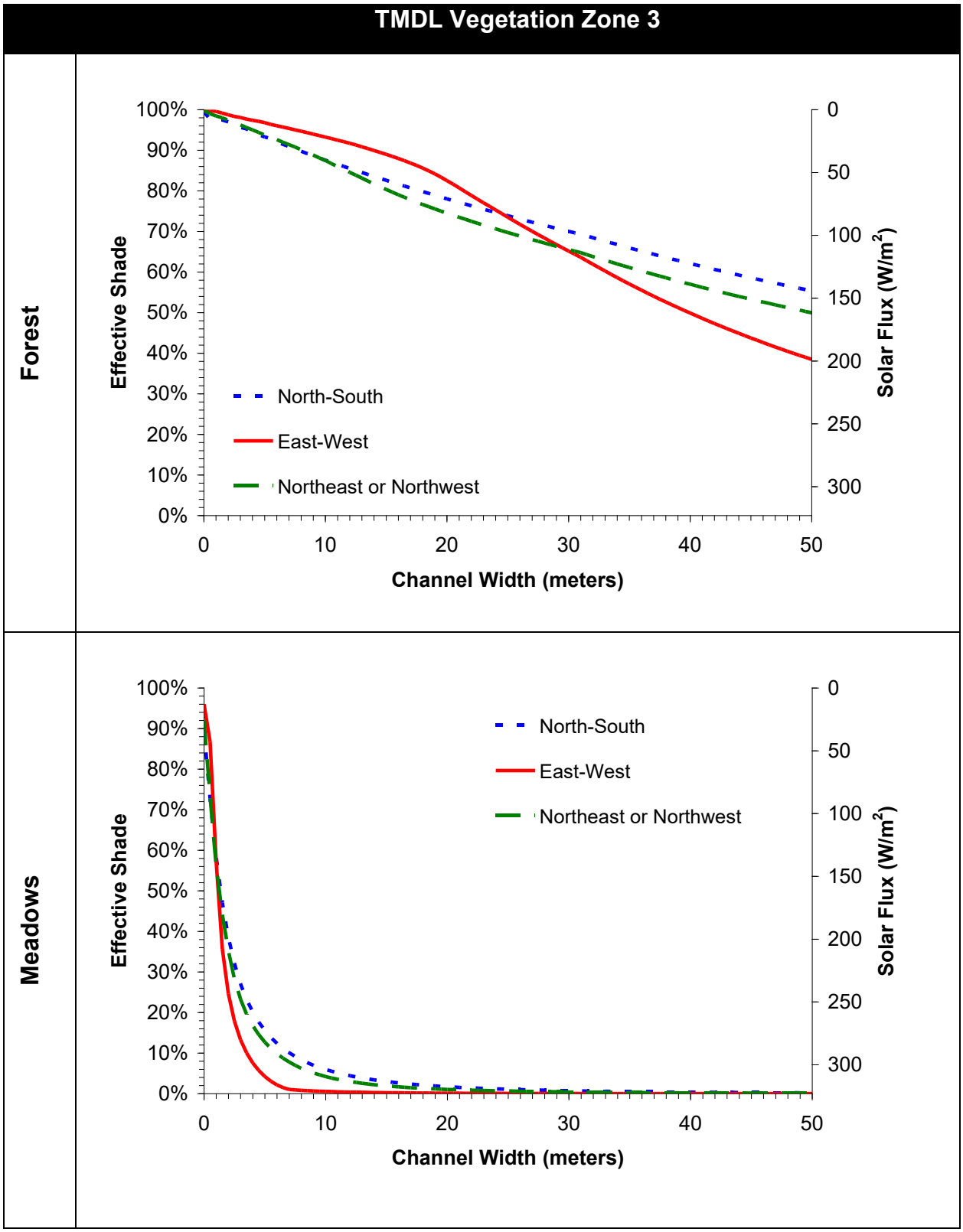

Figure 9-2: Effective shade curves for Vegetation Zone 3 in the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL project area (North-South, East-West, and Northeast-Northwest refer to stream aspect).

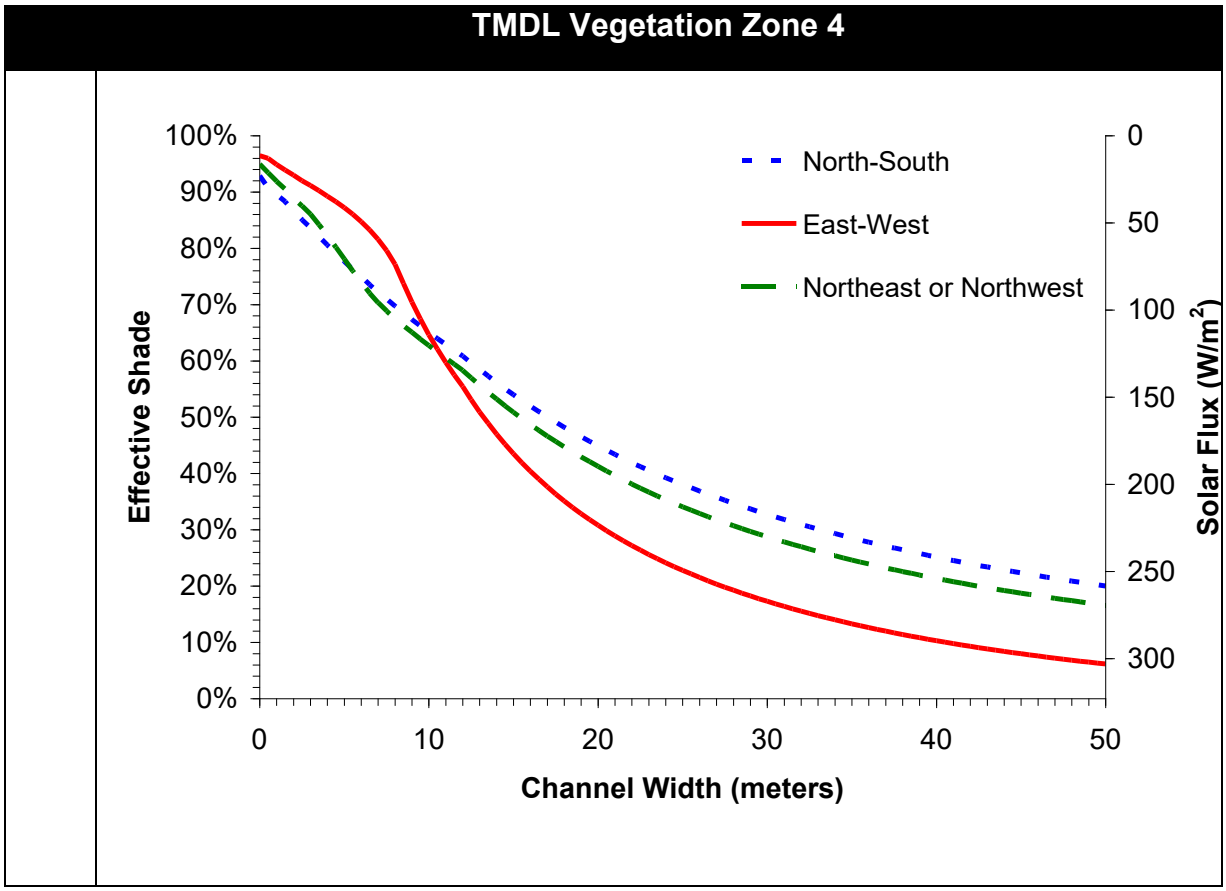

Figure 9-3: Effective shade curves for Vegetation Zone 4 in the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL project area (North-South, East-West, and Northeast-Northwest refer to stream aspect).

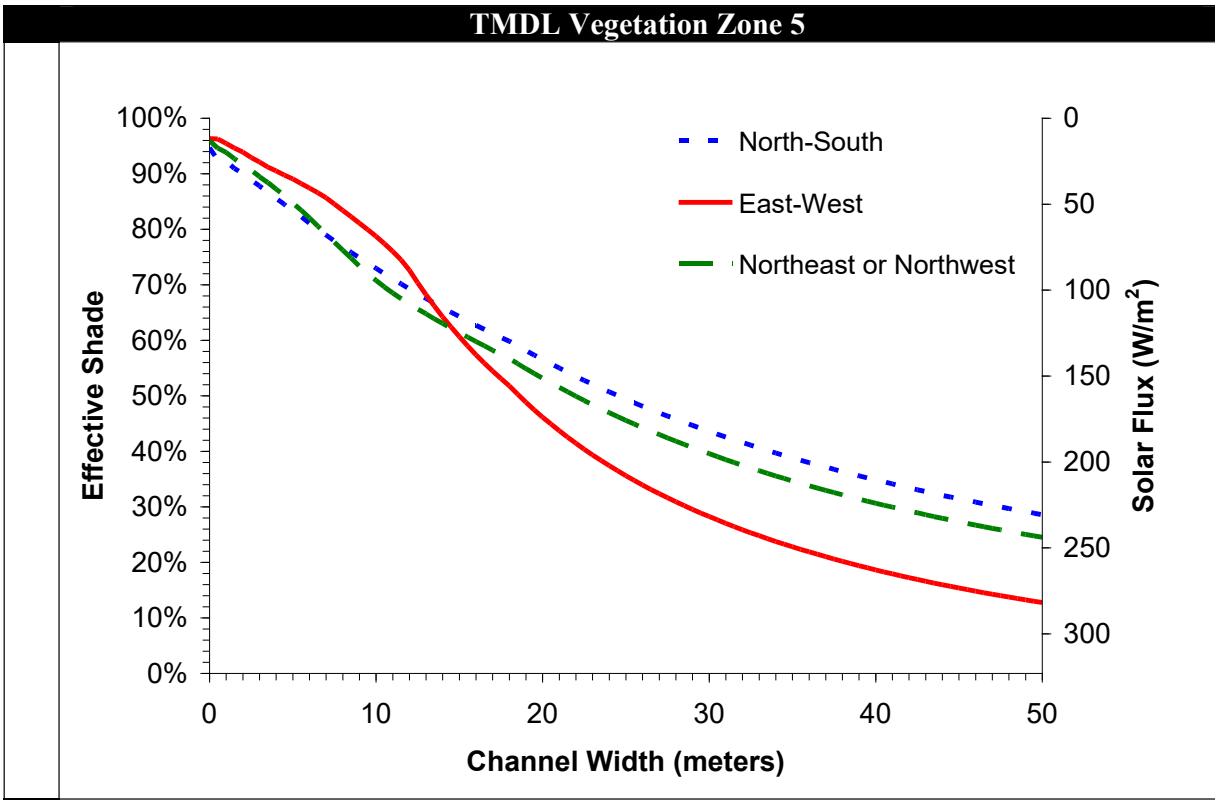

Figure 9-4: Effective shade curves for Vegetation Zone 5 in the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL project area (North-South, East-West, and Northeast-Northwest refer to stream aspect).

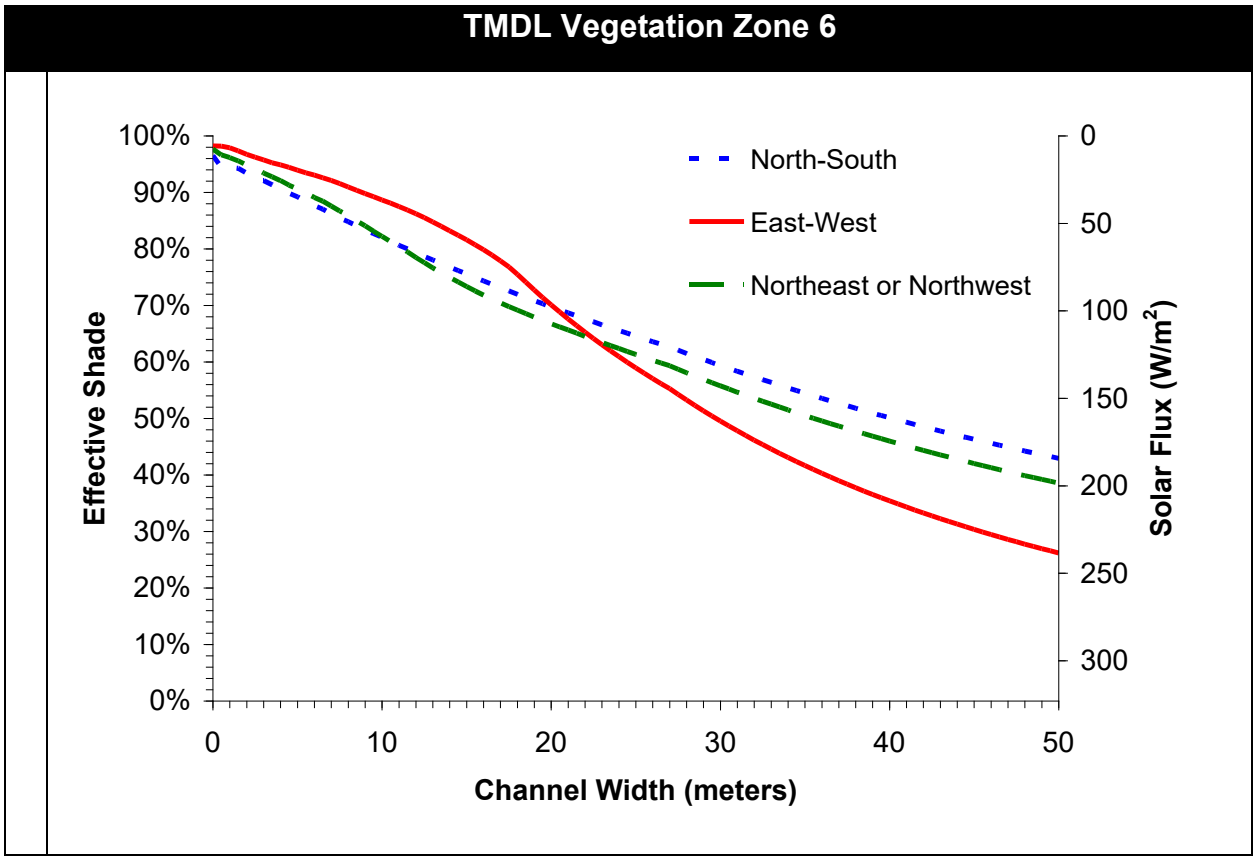

Figure 9-5: Effective shade curves for Vegetation Zone 6 in the Middle Columbia-Hood (Miles Creeks) Subbasin TMDL project area (North-South, East-West, and Northeast-Northwest refer to stream aspect).

9.1.5 Reserve capacity

DEQ set aside explicit portions of the HUA as reserve capacity that may be available to provide either point or nonpoint source allocation(s) to new or increased thermal loads, or to assign corrected allocations to any existing source(s) that were assigned an erroneous allocation or may not have been identified during the development of this TMDL. The portion of the HUA associated with the reserve capacity is described in Section 9.1.1.

DEQ will consider requests for allocation of reserve capacity submitted in writing on a case-by-case basis. Except when DEQ is correcting an error or omission, DEQ may require requesters to demonstrate that there are no reasonable alternatives to an increased load and to prepare modeling or similar analysis to ensure that loading capacity is available at the discharge location(s) or in downstream waters. The HUA assigned to reserve capacity may not be available for allocation due to cumulative warming and points of maximum impact downstream. DEQ will use its discretion in making determinations on requests, based on the information available and priorities appropriate at the time of the request. DEQ will track allocation of reserve capacity over time and will not approve requests once reserve capacity is depleted. Allocations of reserve capacity must be approved by DEQ's Director or designee.

[insert RC table]

9.2 Margin of safety

CFR 130.7(c)(1) and OAR 340-042-0040(4)(i) require a TMDL to include a margin of safety. The margin of safety accounts for lack of knowledge or uncertainty. This may result from limited data; an incomplete understanding of the exact magnitude or quantity of thermal loading from various sources; or the actual effect controls will have on loading reductions and receiving water. The margin of safety is intended to account for such uncertainties in a manner that is conservative and will result in environmental protection. A margin of safety can be achieved through two approaches: (1) implicitly using conservative analytical assumptions to develop allocations, or (2) explicitly specifying a portion of the TMDL loading capacity as a margin of safety.

In the Middle Columbia-Hood (Miles Creeks) project area, an implicit margin of safety was used in derivation of the allocations. The primary conservative assumptions include:

- Setting effluent flow rates at a maximum flow obtained from discharge monitoring reports (DMRs) for assessments of current thermal loading. It is rare that actual discharges from point sources will reach maximum flows and sustain that discharge for long periods of time.
- The cumulative effects analysis on Fifteenmile Creek applied the maximum assigned HUA to each source category to assess cumulative allocation attainment. The modeling shows the maximum allowed temperature increase is limited to one day.
- The maximum temperature increase from each source category is unlikely to occur at the same time and is geographically limited to distinct locations. This means that a portion of the loading capacity reserved for human use will go unutilized most of the time. The cumulative effects analysis was performed for modeled reaches and is described in the TSD and modeling reports.
- On unmodeled streams, the sum of individual human use allocations (HUAs) was used to assess cumulative attainment across the entirety of a given AU. This method does not account for longitudinal instream heat dissipation downstream from each thermal source. Thus, the total thermal load and corresponding temperature increase is likely to result in a maximum temperature increase of less than 0.3°C.

9.3 Allocation summary

Allocations for source or source categories may be calculated on each AU in the project area. As an example, Table 9-9 presents TMDL allocations for source or source categories on the segment of Fifteenmile Creek from Dry Creek to the confluence with the Columbia River. The allocations to background sources were calculated using Equation 9-2 and were based on the applicable year-round use criterion and the spawning use criterion in the AU. The allocations to NPDES point sources were calculated using **Error! Reference source not found.**. The allocations to nonpoint sources were calculated using Equation 9-3. All allocations presented in Table 9-10 were calculated using the annual 7Q10 river flow rate (Table 9-9). These calculations assume the 7Q10 flows at these gages include effluent flow from all upstream point sources, plus inflows from upstream tributaries, groundwater, or nonpoint sources, and any outflows. As summarized in the TMDL, allocations may be dynamic and calculated using the relevant equations when river flow rates are greater than 7Q10.

The HUA assignments to all anthropogenic sources or source categories are equal to 0.30°C. Wasteload allocations to point sources and load allocations to nonpoint sources are based on loads equivalent to the allowed 0.30°C increase. For some sources, the maximum cumulative impact at the POMI in the AU is less than the sum of the individual HUA assignments at their respective points of discharge or activity due to heat dissipation within the AU.

Table 9-9: Example of 7Q10 flow and temperature targets used to calculate allocations for AUs that are 303(d) listed and modeled in this TMDL: Fifteenmile Creek from Dry Creek to confluence with Columbia River.

AU description	AU ID	Annual 7Q10 (cfs)	Year-round use period temperature target (°C)	Spawning use period temperature target (°C)
Fifteenmile Creek from Dry Creek to confluence with Columbia River	OR_SR_1707010503_02_101506	1.98	18 + 0.3 HUA (7DADM)	13 + 0.3 HUA (7DADM)

Table 9-10: Example allocation summary: Fifteenmile Creek from Dry Creek to confluence with Columbia River.

Source or Source Category	Assigned HUA (°C)	7Q10 Allocation Year Round (kilocalories/day)
Background	0.00	87.2E+06
NPDES point sources	0.00	0.00
Nonpoint source dam and reservoir operations	0.00	0.00
Anthropogenic warming from tributaries	0.10	4.84E+05
Solar loading from nonpoint sectors	0.00	0.00
Solar loading from existing transportation corridors, existing utility infrastructure	0.05	2.42E+05
Consumptive use water management and water withdrawals	0.10	4.84E+05
Reserve capacity	0.05	2.42E+05
-	Total Allocated Load:	8.87E+07
-	Loading Capacity:	8.87E+07

10 Water quality management plan

As described in OAR 340-042-0040(4)(I)(A)-(O), an associated WQMP is a required element of a TMDL and must include the following components: (A) Condition assessment and problem description; (B) Goals and objectives; (C) Proposed management strategies design to meet the TMDL allocations; (D) Timeline for implementing management strategies; (E) Explanation of how TMDL implementation will attain water quality standards; (F) Timeline for attaining water quality standards; (G) Identification of persons, including DMAs, responsible for TMDL implementation; (H) Identification of existing implementation plans; (I) Schedule for submittal of implementation plans and revision triggers; (J) Description of reasonable assurance of TMDL implementation; (K) Plan to monitor and evaluate progress toward achieving TMDL allocations and water quality standards; (L) Plan for public involvement in TMDL implementation; (M) Description of planned efforts to maintain management strategies over time; (N) General discussion of costs and funding for TMDL implementation; and (O) citation of legal authorities relating to TMDL implementation.

DEQ sought and considered input from various persons, including DMAs, responsible for TMDL implementation and other interested public and prepared the Middle Columbia-Hood (Miles Creek) Subbasin WQMP as a stand-alone rule document.

11 Reasonable assurance

OAR 340-042-0030(9) defines Reasonable Assurance as “a demonstration that a TMDL will be implemented by federal, state or local governments or individuals through regulatory or voluntary actions including management strategies or other controls.” OAR 340-042-0040(6)(g) states that “to establish reasonable assurance that the TMDL’s load allocations will be achieved requires determination that practices capable of reducing the specified pollutant load: (1) exist; (2) are technically feasible at a level required to meet allocations; and (3) have a high likelihood of implementation.” Likewise federal regulations (40 CFR § 130.2(i)) and EPA’s TMDL guidance describes that when a TMDL is developed for waters impaired by both point and nonpoint sources and WLAs are based on an assumption that NPS load reductions will occur, the TMDL must provide “reasonable assurances” that NPS control measures will achieve expected load reductions (EPA, 1991).

The Middle Columbia-Hood (Miles Creek) Subbasin TMDLs were developed to address both point and nonpoint sources with TMDL load reductions set at a level estimated to attain the applicable temperature criteria with consideration of opportunities for effective measures to reduce those contributions. Reasonable assurance that Oregon’s three-point test is met, needed load reductions will be achieved for nonpoint sources, and that antidegradation requirements and narrative water quality criteria will be attained is based primarily on an accountability framework incorporated into the WQMP. The accountability framework includes identification of pollutant reduction strategies by source and activity, identification of persons and agencies responsible to implement the strategies, timelines and measurable objectives, tracking implementation progress and water quality conditions, and DEQ action when responsible persons or agencies fail to implement. Section 7 of the WQMP (Reasonable Assurance of Implementation) discusses this framework directly.

The WQMP also includes a general discussion of implementation costs and available funding programs, identification of state legal authorities that aid in implementation of management strategies, and DEQ’s adaptive management approach DMA implementation if sufficient progress towards TMDL attainment is not being made. The entirety of the WQMP and its execution along with the implementation plans of persons and agencies responsible for TMDL implementation represents reasonable assurance that nonpoint source load reductions will be achieved.

12 References

[populate]

DEQ (Oregon Department of Environmental Quality). 2003. Staff report to the Environmental Quality Commission from Stephanie Hallock, Director. "Agenda Item D, Rule Adoption: Water Quality Standards, Including Temperature Criteria, OAR Chapter 340, Division 41, December 4, 2003, EQC Meeting."

DEQ (Oregon Department of Environmental Quality). 2008a. "Middle Columbia-Hood (Miles Creeks) Subbasin TMDL."

DEQ (Oregon Department of Environmental Quality). 2008b. Temperature Water Quality Standard Implementation – A DEQ Internal Management Directive. https://www.oregon.gov/deq/Filtered%20Library/IMDTemperature.pdf

13 Appendix of effective shade curve tables