Snake River - Hells Canyon
Total Maximum Daily Load (TMDL)

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moderately simple scheme of classification developed by Horne and Goldman (1994) includes four basic characteristics: concentration and supply rates of nutrients, substantial variation in oxygen saturation (supersaturation in the epilimnion and depression of dissolved oxygen concentrations in the hypolimnion), high primary productivity, and cloudy water with relatively low light penetration (Secchi depths 0.1 to 2 m).

Low dissolved oxygen concentrations in the water column have not been documented in the Upstream Snake River segment (RM 409 to 335). During the summer months when low dissolved oxygen concentrations are most likely to occur in areas of slow flow, high algal productivity results in supersaturation of the water column. While low dissolved oxygen is not expected to occur in the river to the degree that it does in the reservoir, due to mixing and shallow water aeration, it is expected that low dissolved oxygen concentrations would occur in areas of slow flow or in places where eddies and backwaters result in sluggish waters, and as a result of diurnal variations in the immediate vicinity of large algal blooms during periods when photosynthesis is not occurring.

As discussed in Section 3.2.2.3, violations of the dissolved oxygen criteria have been documented in data from artificial redd studies conducted upstream of RM 409 by IPCo in 1999 to 2000 and 2000 to 2001 (IPCo, 2001c). These data show dissolved oxygen concentrations of less than 2.0 mg/L during the late spring and summer months at the sediment/water interface between Swan Falls and the upstream portion of the SR-HC TMDL reach. Due to the fact conditions similar to those that occur in the region between Swan Falls and RM 409, also occur in the Upstream Snake River segment (RM 409 to 335), low dissolved oxygen concentrations are likely to occur in areas of the Upstream Snake River segment. Data available on white sturgeon in the Upstream Snake River segment (RM 409 to 335) show that this population is not being supported. Water quality degradation, including low dissolved oxygen at the sediment/water interface is most likely contributing to this lack of support.

3.2.6 Determination of Nutrient Loading

The method used for determination of nutrient loading for the SR-HC TMDL reach is discussed in the general hydrology and loading analysis, and in the sections above.

The available data show that total phosphorus loading into the SR-HC reach originates almost exclusively from the Upstream Snake River segment (RM 409 to 335).

No point source discharge permits in the SR-HC TMDL reach contain phosphorus limitations. One treated wastewater discharger currently monitors for total phosphorus concentrations on a quarterly basis (City of Fruitland). One industrial point source discharger currently monitors for total phosphorus concentrations (Heinz Frozen Foods). The reported concentrations from these monitoring efforts, and estimates available for average discharge concentrations are above the 0.070 mg/L instream target for the SR-HC TMDL. Using available data and estimated discharge concentrations for wastewater treatment plants of 3.5 mg/L, the total phosphorus loading from point source discharges was calculated at 516 kg/year. For facilities discharging part time, only that time when discharge occurred was assessed. Therefore, the calculated point source load for the summer growing season does not include loading from the City of Ontario as this facility

utilizes land application in the summer and there is no discharge during the critical period. Point source loading represents approximately 8 percent of the total calculated load to the SR-HC reach. As all point sources discharging directly to the SR-HC TMDL reach do not monitor total phosphorus discharge concentrations, additional data would be necessary to determine actual total phosphorus loading from each permitted point source discharge and the concentration observed at the edge of the mixing zone.

Measured tributary total phosphorus loading to this segment accounts for the majority of the phosphorus load to the SR-HC TMDL reach (76%), with ungaged (estimated) drain flows accounting for 10 percent of the total system load and unmeasured sources accounting for approximately 6 percent of the total. Measured tributary dissolved ortho-phosphate loading to this segment also accounts for the majority of the dissolved ortho-phosphate load to the SR-HC reach (approximately 80%), with ungaged (estimated) drain flows accounting for approximately 7 percent of the total system load and unmeasured sources accounting for approximately 4 percent of the total. Care should be taken in the interpretation of dissolved ortho-phosphate values however, as ortho-phosphate is not a conservative parameter throughout the system.

Sources of unmeasured load may include nonpoint source runoff from anthropogenic sources, precipitation events, unidentified small tributaries and drains, ground-water sources and ground-water sources. As ungaged flows were calculated by subtraction, this may also include error in gaged flow measurements.

Nutrient loads from agricultural drains discharging to the SR-HC reach were determined using concentration and flow data where available. Flow data was not plentiful however, and most flows were estimated using general descriptions and the calculated return flow information by area supplied by the USBR (USBR, 2001). Calculated averages were used in place of concentration values where data were not available. These values therefore should be viewed as best estimates. If additional, drain-specific data become available during the implementation of this TMDL, it will be used in place of these estimates. Land area associated with the drains was calculated at 249,100 acres total (USBR, 2001). A listing of drain names and locations is included in Appendix J.

The relative nutrient loads shown in Table 3.2.3 a and b are calculated for the SR-HC reach using average summer flows (Table 2.1.1).

3.2.7 TMDL Determination

Nutrient standards for both the State of Idaho and the State of Oregon are narrative in nature, identifying that nutrient concentrations that result in the impairment of designated beneficial uses or the production of visible slime growths or other nuisance aquatic growths that impair designated beneficial uses are in violation of the standard.

Given the water quality concerns that can result from excessive nutrient concentrations and the range of concentrations and related system characteristics such as flow, temperature, water column mixing, light penetration and water depth under which these conditions can occur throughout the Pacific Northwest, a narrative nutrient standard is appropriate. Interpretation of

will be identified on a tributary by tributary basis using tributary TMDL processes with the goal of establishing accurate site-specific targets for each anthropogenic source.

4.0.2.3 Margin of Safety

A 13 percent margin of safety has been applied to total phosphorus load allocations and capacity for this TMDL as determined by the accuracy and representativeness of sampling techniques and analytical methods. This margin of safety has been incorporated into the identification of the 0.07 mg/L total phosphorus target for the SR-HC TMDL. Other areas of uncertainty such as system uptake, assimilative capacity, and relative impairment to different use categories were addressed to the extent possible through the use of conservative assumptions in the identification of the nutrient target, sensitive designated uses and critical period.

4.0.2.4 Background/Natural Loading

For the mainstem Snake River portion of the SR-HC TMDL reach, the natural total phosphorus loading was calculated using the natural background concentration of 0.02 mg/L total phosphorus identified within the SR-HC TMDL, along with average flow values for the Snake River (Table 2.1.1). A necessary set of data for the tributary streams is not currently available. Therefore, natural background concentrations for all tributaries will be determined as part of upcoming TMDL development on the Weiser, Owyhee, and Malheur Rivers, and tributary implementation plans for the Payette and Boise Rivers.

4.0.2.5 Reserve

Waste load allocations to point sources were determined based on design capacity. The reserve capacity allocation is therefore the difference between the current discharge and design flow discharge. This allows for expansion of existing sources or addition of new point source discharges through trading or demonstration of an offset within the SR-HC system.

4.0.2.6 Total Phosphorus Load Allocations

Total Phosphorus load and waste load allocations have been identified for point and nonpoint sources in the SR-HC TMDL reach based on the less than 0.07 mg/L total phosphorus target and the seasonal application period (May through September).

Point Sources.

Biological nutrient removal (BNR) was identified as an appropriate mechanism for phosphorus removal for point sources currently employing activated sludge as a treatment process and discharging directly to the Snake River within the SR-HC TMDL reach. Application of this treatment reduction mechanism commonly results in an 80 percent reduction of total phosphorus concentration in the discharged effluent. As BNR represents a reasonable mechanism for the reduction of total phosphorus concentrations in point source discharges, and as the reductions commonly realized from BNR approximate the average reductions required from nonpoint sources (direct and tributary discharges to the Snake River) within the SR-HC TMDL reach, this mechanism was used as an initial basis for assigning total phosphorus waste load allocations for point sources discharging directly to the Snake River within the SR-HC TMDL reach (as outlined in Appendix I).

Table 4.0.8 contains waste load allocations for those permitted point sources that discharge directly to the Snake River within the SR-HC TMDL reach. Waste load allocations have been

assigned to permitted point source discharges based on an evaluation of phosphorus reduction mechanisms available, the relative loading from each point source and type of treatment currently in place.

Waste load allocations to point sources discharging directly to the Snake River within the SR-HC TMDL reach have been assigned as follows:

- The critical time period over which total phosphorus reductions apply is from May through September.
- Point sources currently employing facultative lagoons (Table 4.0.8) represent a miniscule proportion of the total point source phosphorus loading (1.2%) within the SR-HC TMDL reach and will therefore not receive specific total phosphorus reduction requirements at this time. These facilities will prepare facilities plans to determine the costs and time frames associated with upgrading treatment mechanisms which will be used as the basis for future evaluation of potential phosphorus reductions.
- Point sources (activated sludge or other treatment method) (Table 4.0.8) represent a greater proportion of the total point source phosphorus loading (98.8%) within the SR-HC TMDL reach. These facilities will reduce total phosphorus loading by 80 percent (applied daily on a monthly average basis and based on design flows). While BNR was utilized as a basis for assigning appropriate point source load reductions, it is not required as a method of reduction under this TMDL. Any approved mechanism or treatment alternative (or combination of such) that results in the required daily 80 percent reduction (calculated on a monthly average basis) required will be acceptable under this TMDL (for example, land application during the target season would potentially be an acceptable method of achieving the total phosphorus reduction required if it were implemented in an approved and responsible fashion).
- The waste load allocations identified here for permitted point sources apply ONLY to those point sources discharging directly to the Snake River within the SR-HC TMDL reach. Waste load allocations to point sources discharging to tributaries that flow into the SR-HC TMDL reach will be the result of tributary TMDLs crafted through the state-specific tributary TMDL processes and will be completed on a state-specific basis and schedule.
- The current level of effort for total phosphorus reduction on the part of Amalgamated Sugar Company, and the identified goal of load minimization through stockpile removal are recognized in the waste load allocation identified in Table 4.0.8. Progress toward the identified goal will be documented through the iterative TMDL process and appropriate adjustments to the waste load allocation will be made if necessary.
- The current loading and thus the waste load allocations are based on limited effluent data. Waste load allocations for permitted point sources may be modified through the facility planning process if new information indicates that actual design loads were higher than originally determined.

Table 4.0.8. Total phosphorus waste load allocations (WLAs) for permitted point sources in the Snake River - Hells Canyon TMDL reach. (Waste load allocations are based on design flows and discharge concentrations from Table 2.5.0 for the critical period: May through September).

Point Source	NPDES Permit Number	River Mile	Treatment Type	Total phosphorus Concentration (mg/L)	Current Design-Flow Load (kg/day)	Waste Load Allocation (kg/day)	% Reduction
City of Nyssa	101943 OR0022411	385	Activated sludge	3.5 mg/L[1]	11 kg/day	2.2 kg/day	80%
Amalgamated Sugar	101174 OR2002526	385	Seepage ponds	50 kg/day[2] (estimated)	50 kg/day	50 kg/day (initial) and continue with current reduction measures	
City of Fruitland	ID0020907	373	Facultative lagoon	2.9 mg/L	5.5 kg/day[3]	5.5 kg/day	0%
Heinz Frozen Foods	63810 OR0002402	370	Activated sludge	32 mg/L	412 kg/day	83 kg/day	80%
City of Ontario	63631 OR0020621	369	Facultative lagoon	3.5 mg/L[1]	0 kg/day [4]	0 kg/day	0%
City of Weiser (WWTP)	ID0020290	352	Activated sludge	3.5 mg/L[1]	32 kg/day	6.4 kg/day	80%
City of Weiser (WTP)	ID0001155	352	Settling pond	3.5 mg/L[1]	5.5 kg/day[3] (max)	5.5 kg/day	0%
Brownlee Dam (IPCo)	ID0020907	285		Assumed Negligible[5]	Unmeasured assumed minimal	Appropriate BMPs and source control	
Oxbow Dam (IPCo)	101275 OR0027286	272.5		Assumed Negligible[5]	Unmeasured assumed minimal	Appropriate BMPs and source control	
Hells Canyon Dam (IPCo)	101287 OR0027278	247		Assumed Negligible[5]	Unmeasured assumed minimal	Appropriate BMPs and source control	

1. Estimated value provided by Boise City Public Works for use in absence of monitored data.
2. Estimated value provided by Amalgamated Sugar for use in absence of monitored data.
3. Wastewater treatment systems utilizing lagoons will be required to prepare facilities plans showing potential treatment mechanisms to reduce phosphorus loading as part of any proposed upgrade or expansion of the facility.
4. City of Ontario uses land application in the summer months and does not currently contribute a phosphorus load to the SR-HC TMDL reach during the critical season.
5. Facilities sump discharge and turbine cooling water, not a phosphorus or waste treatment source.

Nonpoint Sources.

Table 4.0.9 lists the total phosphorus load allocations to nonpoint sources in the SR-HC TMDL reach.

Tributary inflows to the SR-HC TMDL reach have been treated as discrete, nonpoint sources for the purposes of loading analysis and allocation within this TMDL. Gross allocations have been

Table 4.0.9. Calculated total phosphorus load allocations for tributary, point and nonpoint sources to the Snake River - Hells Canyon TMDL reach based on calculated average flows (May through September).

Segment	Load Allocation[a,b] (kg/day)	Percent Reduction
Snake River Inflow	1,379	28
Owyhee River	71	73
Boise River	242	78
Malheur River	58	88
Payette River	469	34
Weiser River	136	65
Drains	91	86
Ungaged flows	137	64
Total Upstream Snake River Load Allocations	2582	54
Total Upstream Snake River Waste Load Allocations	153	
Total Upstream Snake River Segment Load and Waste Load Allocations	2,735[c]	
Burnt River	21	60
Powder River	33	74
Unmeasured Tributaries to Brownlee	40	50
Total Brownlee Reservoir Segment	2,829[d]	
Unmeasured Tributaries to Oxbow	10	50
Total Oxbow Reservoir Segment	2,839	

[a] The SR-HC TMDL target for total phosphorus for each tributary is a concentration of less than or equal to 0.07 mg/L total phosphorus as measured at the mouth of the tributary and applies from May through September. Because the total phosphorus target is concentration-based, actual allowable tributary load allocations under the TMDL are dependant on actual tributary flow and will fluctuate year to year. The total phosphorus load allocations listed in this table are based on averaged tributary flows measured in 1979, 1995 and 2000, which were average Snake River flow years, not necessarily average tributary flow years. Therefore they do not necessarily represent the calculated load allocations for any specific year or different series of years.

[b] Future data collection and analyses may determine that, due to natural conditions or other factors, the target concentrations for the mouths of the tributaries cannot be practicably achieved. This, in most cases, will occur when TMDLs are conducted on the tributaries. If subsequent tributary TMDLs indicate that the target concentration is not achievable, the Snake River/Hells Canyon TMDLs for total phosphorus will be reopened and appropriately revised.

[c] Total allocable load for this segment is 2,735 kg/day (2,582 kg/day from nonpoint sources and 153 kg/day from point sources)

[d] Total allocable load includes point source wasteload allocation from upstream sources. A dissolved oxygen load allocation has also been established for this segment.

assigned to each inflowing tributary equal to the load capacities listed in Table 4.0.7. Existing or future tributary TMDL processes will distribute load allocations in the form of load allocations and/or waste load allocations within their respective watersheds. Tributary loads are allocated to the mouth of the tributary and do not attempt to identify point and nonpoint source contributions within the tributary watersheds. Load allocations for tributaries are based on the less than or equal to 0.07 mg/L total phosphorus target and average flows (Table 2.1.1), and applies at the

mouth of the tributary system. It is anticipated that tributary-specific data will be collected and will allow for accurate estimates of the naturally occurring total phosphorus loading so that anthropogenic loads can be identified and distributed to point and nonpoint sources within each tributary.

4.0.2.7 IMPLEMENTATION

The geographic scope of the SR-HC TMDL is extensive. The SR-HC watershed encompasses a 221 mile stretch of the Snake River with a 73,000 square mile drainage area. It is expected that attaining the SR-HC TMDL targets will require implementation of control strategies throughout this massive watershed, from facilities and return flows that discharge directly to the Snake River, to more remote activities affecting tributaries many miles upstream of their confluences with the Snake River.

Water users, administrative agencies, and research organizations in Idaho and Oregon have many years of experience developing and implementing strategies to improve water quality. Efforts in several tributary (e.g. Rock Creek) and upstream Snake River (e.g. the Middle Snake River) watersheds have become more focused during recent years as instream water quality objectives have been defined through TMDLs and other programs. These ongoing efforts provide incremental improvements to water quality as new treatments are applied to additional agricultural lands, storm drains, and point source discharges.

SR-HC PAT members and other PAT participants and consultants representing water users, administrative and research groups, together with the DEQs, utilized their collective experience to determine the time frame required to implement necessary control strategies throughout the SR-HC watershed to attain SR-HC TMDL targets. Due to the extraordinary size and complexity of the SR-HC watershed, its hydrology, and the various factors that affect the implementation of control strategies (discussed in Appendix I), it was determined that a time frame of approximately 50 to 70 years will be required to implement all necessary control strategies and fully attain SR-HC TMDL targets. This does not mean, however, that Snake River water quality will not improve until the TMDL targets are fully attained. For example, the DEQs have determined that there is a direct relationship between instream phosphorus concentrations and algal growth so that algal biomass will decrease incrementally as the instream concentration of phosphorus decreases. Water quality will consistently improve as treatments are applied to point and nonpoint discharges. To ensure measurable, consistent progress, interim, 10-year objectives (corresponding to 0.01 mg/l reductions in instream phosphorus concentrations) will be established. Progress in implementing control strategies will be reviewed periodically, and the time frame for full implementation can be evaluated in light of data and experience.

In identifying an appropriate time frame for implementation, the schedules of the tributary TMDLs and their Implementation Plans have to be considered. While there are some tributary TMDLs currently in place, others will not all be completed until the end of 2006. The tributary TMDLs must then be approved by EPA. The approval process can take several months. Implementation plans are completed approximately 18 months following EPA approval of TMDLs. For tributary TMDLs already in place this 18-month time frame starts with the approval of the SR-HC TMDL. For tributary TMDL processes that are not yet complete, the implementation plan will be prepared within 18 months of the approval of the tributary TMDL.