Don Russell

As you contemplate amendments to Chapter 173-201A WAC bear in mind that Ecology's current water quality standards for the protection of aquatic life are woefully inadequate to protect (and restore) the beneficial use by salmon of the sediment and nutrient polluted streams flowing to Puget Sound.

That such is the case is apply demonstrated by the failure of the Clarks Creek Dissolved Oxygen and Sediment Total Maximum Daily Load Water Quality Improvement Report and Implementation Plan to properly identify and address the sediment and nutrient pollution of Clarks Creek. I have attached two papers that specifically identify why this is so.

It is unfortunate that you have narrowly focused your efforts on the protection of contact recreational use of surface waters and neglected the necessary water quality standards that will assure the safe beneficial use of State owned surface water (and discharging groundwater as base flow) by endangered and threated salmon species.

FALLACY OF THE CLARKS CREEK TMDL'S STORMWATER THESIS

Preface

During the public review period for the draft Clarks Creek Dissolved Oxygen and Sediment Total Maximum Daily Load Water Quality Improvement Report and Implementation Plan Pierce County Surface Water Management's Dan Wrye and I (and WSDOT belatedly and subsequently disallowed) delivered the same message to Ecology and US EPA. That message was that the Plan is based upon insufficient and inadequate water quality monitoring data, faulty interpretation of the data contained in the TMDL study, inappropriate models and arbitrary wasteload and load allocations assigned to the several agencies Ecology claimed were responsible for Clarks Creek' impaired condition.

I have subsequently asserted that the impaired condition of Clarks Creek is due to nutrient (nitrate, phosphate) and iron pollution and that the correct model for assessing such a condition can be found in US EPA's document EPA-820-S-10-001 titled User Stressor-response Relationships to Derive Numeric Nutrient Criteria.

This paper lends credence to my claim that it is nutrient pollution of groundwater discharging as base flow into the upper reach of Clark Creek and iron polluted groundwater from the City of Puyallup's stormwater drainage system (which includes Meeker Ditch) discharging into the alluvial plain reach of Clarks Creek that is the proximate cause of Clarks Creek's water quality impairment, degraded salmon habitat and pre-spawn mortality of salmon entering Meeker Ditch.

Clarks Creek TMDL models

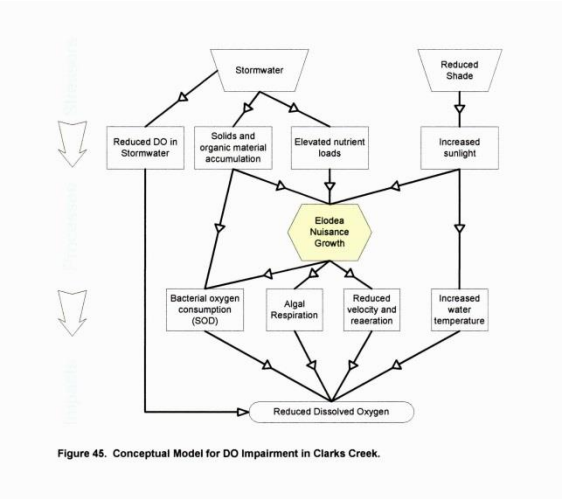


Figure 45. Conceptual Model for DO Impairment in Clarks Creek.

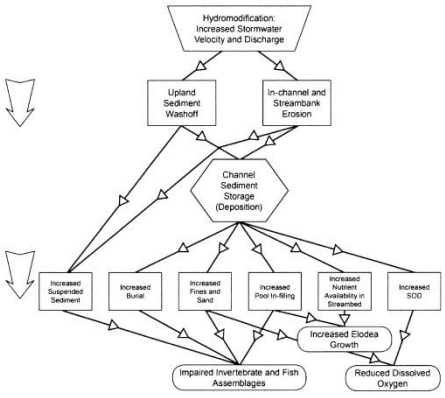


Figure 46. Conceptual Model for Sediment Impairment in Clarks Creek.

The first model (Figure 45) indicates that reduced dissolved oxygen in Clarks Creek is a direct result of stormwater runoff and reduced shade. The second model (Figure 46) indicates that sediment impairment is a direct result of stormwater runoff induced upland sediment washoff and in-channel and stream bank erosion. Water quality monitoring data does not support these assertions.

The purpose of a TMDL study/cleanup plan is to restore the beneficial use of an impaired water body. Neither model stipulates the intended beneficial use that the Plan is intended to restore.

Purpose of the Clarks Creek TMDL

The purpose of the Clarks Creek TMDL should have been to restore impaired Clarks Creek for beneficial use (i.e., migration, spawning and rearing) by ESA listed as endangered Chinook and threatened Puget Sound Steelhead, as well as for other salmon species.

An appropriate model

Such a model would identify the physical, chemical and biological factors that are necessary to provide suitable migration, spawning and rearing habitat for these ESA listed fish species.

An appropriate TMDL study

The TMDL study would require monitored of these identified physical, chemical and biological attributes to determine their adequacy to provide suitable habitat conditions for these ESA listed fish species. The study would identify deficiencies in Clarks Creek's providing all the critical need attributes that deny or impair these ESA listed fish species beneficial use of Clarks Creek and prescribe the appropriate remedial actions needed to assure their beneficial use.

An appropriate TMDL Cleanup Implementation Plan

The TMDL Cleanup Implementation Plan would identify the parties responsible for the identified impaired physical, chemical and biological conditions and mandate the actions necessary to restore Clarks Creek for beneficial use by these ESA listed fish species.

Clarks Creek TMDL

The Clarks Creek TMDL does not have restoration of Clarks Creek for beneficial use by ESA listed as impaired Chinook salmon and Puget Sound Steelhead as its focus. Rather the Plan's very narrow focus is on stormwater runoff induced sedimentation, low dissolved oxygen and excessive elodea growth.

Models used

The models used were to predict and quantify sediment loading and offer an (erroneous) explanation as to why low dissolved oxygen and excessive elodea growth occurs in Clarks Creek. There is no mention of restoring Clarks Creek for beneficial use by salmon.

The TMDL Study

The Clarks Creek TMDL study involved monitored only those attributes identified in Washington's Surface Water Quality Standards. These Standards do not contain parameters for iron, nitrate-nitrogen, and phosphate-phosphorus concentration and alkalinity, all important water quality attributes in determining whether or not a stream's water quality provides suitable habitat for salmon. Furthermore these Standards to not include limits on dissolved hydrogen sulfide and methane concentrations. Both these substances, evident in Meeker Ditch's and Clarks Creek's water, are toxic to fish.

There was very little monitoring of the physical and chemical attributes of the groundwater that discharges into the steep gradient upper reach and low gradient alluvial plain reach of Clarks

Creek. This discharge provides Clarks Creek's base flow. Had this been done it would have disclosed that Clarks Creek's groundwater provided base flow is polluted by high concentrations of nitrate-nitrogen, phosphate-phosphorus, and in the alluvial plain reach, ammonia-nitrogen and iron as well.

There was very little monitoring of the physical and chemical attribute of the stormwater runoff that discharge into Meeker Ditch and Clarks Creek via the City of Puyallup's stormwater drainage system. Had this been done it would have disclosed that this occasional and flashy discharge of stormwater runoff is low in pH and very low in alkalinity. The discharge of stormwater runoff into Meeker Ditch and Clarks Creek has a sudden and adverse impact on the physical and chemical properties of Clarks Creek groundwater base flow and the salmon present therein.

Clarks Creek TMDL Assigned Wasteload and Load Allocations

Clarks Creek TMDL assigned wasteload and load allocations are based upon a proportional distribution of the amount of stormwater runoff discharged into Clarks Creek and its tributaries by each jurisdiction with the objective of reducing or treating stormwater runoff by 50% over the next twenty years. Stormwater runoff is an occasional event and relatively minor source of water quality problems in Clarks Creek and its tributaries.

Clarks Creek's impairment as salmon habitat (beneficial use) has more to do with its current physical, chemical and biological impairment under groundwater discharge base flow conditions than it does with the impact of occasional stormwater runoff events.

Current Conditions

The proximate cause of Clarks Creek's impaired ability to provide suitable habitat for salmon is nitrate nitrogen and phosphate-phosphorus polluted groundwater discharging as base flow into the upper steep gradient reach of Clarks Creek and iron, ammonia-nitrogen and phosphate-phosphorus polluted groundwater being discharged into the alluvial plain reach of Clarks Creek by the City of Puyallup's groundwater inundated stormwater drainage system, which includes Meeker Ditch.

The high iron concentration groundwater being discharged 24/7/365 into Meeker Ditch and Clarks Creek has resulted in a buildup of a thick bed of iron oxyhydroxide and phosphate laden silt in the alluvial plain reach of Clarks Creek. It is the existence of this nutrient rich bed that has both degraded salmon habitat and fosters prolific growth of starwort, curly leaf pondweed and elodea. Hydraulic suction dredge removal of this accumulated nutrient rich silt bed would not only enhance salmon habitat it would address the prolific aquatic plant growth problem and eliminate the need for annual diver assisted suction harvesting (DASH) of each year's standing elodea crop.

Hydraulic suction dredging of the alluvial plain reach of Clarks Creek would also result in the lowering of adjacent groundwater levels to the extent that the City of Puyallup's stormwater drainage system and bed of Meeker Ditch would once again be located above groundwater level. This action would eliminate the primary source of particulate iron oxyhydroxide and colloidal iron hydroxide loading that has so adversely impacted the beneficial use of Clarks Creek by salmon.

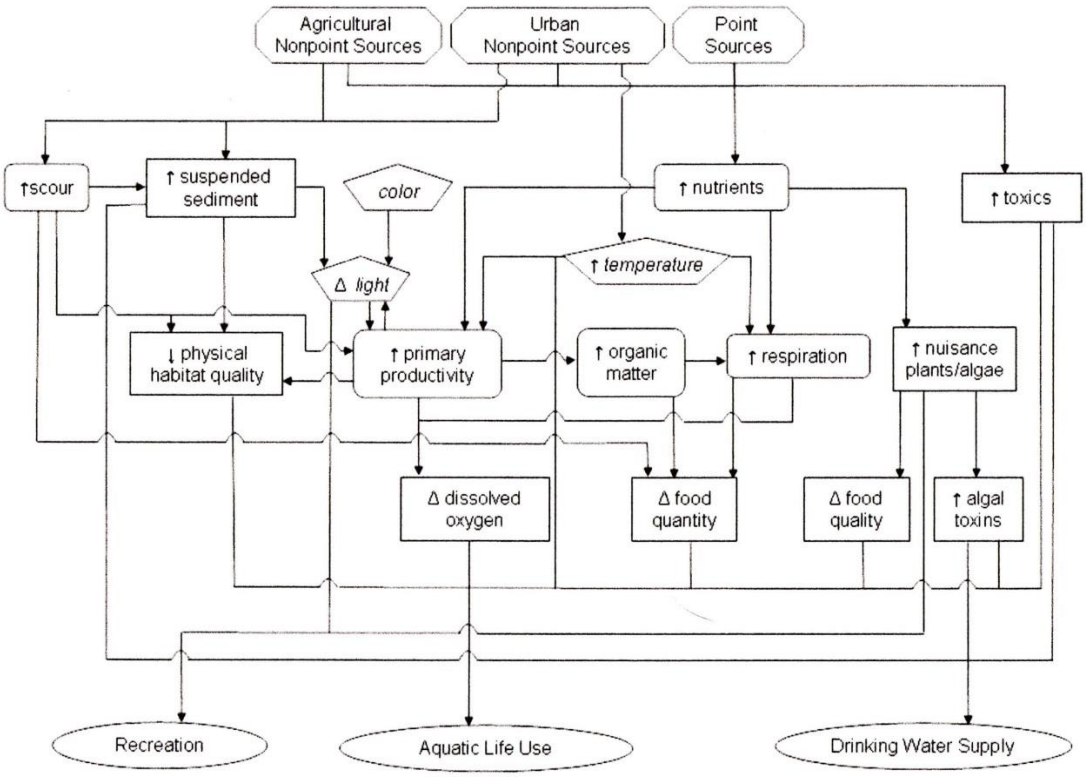
In Conclusion

The Clarks Creek Dissolved Oxygen and Sediment Total Maximum Daily Load Water Quality Improvement Report and Implementation Plan is based upon insufficient and inadequate water quality monitoring data, faulty interpretation of the data contained in the TMDL study, inappropriate models and arbitrary wasteload and load allocations assigned to the several agencies Ecology claimed were responsible for Clarks Creek's impaired condition.

By requiring agencies to perform the wasteload and load allocation actions specified by the Clarks Creek Dissolved Oxygen and Sediment Total Maximum Daily Load Water Quality Improvement Report and Implementation Plan available funds that should be spent on actions to restore salmon habitat in Clarks Creek will be misallocated and misspent on activities that do not achieve restoration of salmon populations in Clarks Creek.

The appropriate action that now needs to be taken

A task force comprised of representatives from Pierce County Surface Water Management, Ecology, the Puyallup Tribe of Indians, Washington Department of Fish and Wildlife, and US EPA should be convened to develop a modified version of US EPA's below model as being appropriate to restore Puget Sound Basin impaired (once productive) coho and steelhead streams.



A conceptual model diagram is a visual representation of relationships among human activities, stressors such as nitrogen/phosphorus pollution, biotic responses, and designated uses in aquatic systems.

EPA-820-10-001 Using Stressor-response Relationships to Derive Numeric Nutrient Criteria

A COSTLY AND FAILED ATTEMPT TO RESTORE SALMON HABITAT IN NUTRIENT AND IRON POLLUTED AND SEDIMENT IMPAIRED CLARKS CREEK

Preface

This paper identifies the factors that make Ecology's Total Maximum Daily Load (TMDL) study and water quality improvement program an ineffective model for restoring salmon habitat in nutrient (and iron) polluted and sediment impaired urban streams.

TMDL's focus on the adverse impact of stormwater runoff

The Clarks Creek TMDL study and water quality improvement Plan focused on the adverse impact that stormwater runoff was having on Clarks Creek's water quality. It ascribed this impact as primarily due to stream bank and bed erosion caused by the discharge of polluted stormwater runoff into the steep gradient upper reaches of Clarks Creek and its tributaries. The prescribed water quality improvement plan was to reduce or treat stormwater runoff discharge by fifty percent over the next twenty years.

Whereas stormwater runoff does cause the problem cited in the TMDL it is not the primary cause of Clarks Creek's impaired condition. The primary cause of Clarks Creek's impaired condition is nutrient (nitrate, phosphate) and iron polluted groundwater being discharged into Clarks Creek 24/7/365 and the resultant accumulation of iron compound laden silt on Clarks Creek's alluvial plain reach bed.

Reliance on Ecology's surface water quality standards as the basis for TMDL studies

Ecology's surface water quality standards do not include a number of factors that contribute to water quality and salmon habitat impairment. These include:

- Stream bed sediment physical and chemical properties
- Nitrate concentration
- Phosphorus concentration
- Iron concentration
- Alkalinity

Stream bed sediment physical and chemical properties

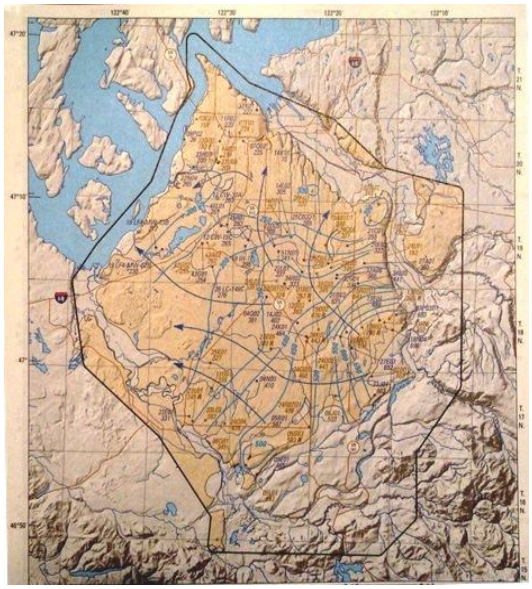
The Clarks Creek TMDL study and water quality improvement plan, in spite of no DOE freshwater quality standard for sediment, did describe the physical properties of the sediment in Clarks Creek as being characteristic of gravel, sand, silt and clay. However it did not identify the physical and, importantly, the chemical composition of silt. Had it done so it would have found that the silt that has accumulated on Clarks Creek's alluvial plain bed is comprised primarily of carbonaceous organic material and iron compounds.

There is little iron in either the water or sediment above 12 Ave SW. However there is plenty of soluble and insoluble iron emanating 24/7/365 from Meeker Ditch and from all of the City of Puyallup's groundwater inundated stormwater drainage system's outfalls.

Clarks Creek TMDL study and water quality improvement plan did not identify iron as a pollutant or Meeker Ditch and City of Puyallup stormwater drainage system as its source.

Nitrate-nitrogen concentration

The nitrate-nitrogen concentration in the groundwater discharging into the upper reach (above the WDFW hatchery settling pond) of Clarks Creek is approximately 5.0 ppm which is twenty times the nitrate-nitrogen concentration of groundwater found in undeveloped areas of Pierce County. The primary source of this nitrate is likely septic system effluent from systems located up gradient in the Chambers Clover Creek watershed that is being conveyed by groundwater flow to the point of its discharge into the upper reach of Clarks Creek.



Nitrate-nitrogen contained in water is both a nutrient that stimulates aquatic plant growth and, in concentration in excess of 2.0 ppm, harmful to salmon gill tissue, the oxygen carrying capacity of blood and in egg developing salmon embryos.

Phosphate-Phosphorus concentration

The Clarks Creek TMDL study and water quality improvement plan did not recognize phosphate-phosphorus as a groundwater supplied nutrient pollutant. Soluble reactive phosphorus (orthophosphate) is a nutrient that stimulates aquatic plant and toxic blue-green algae (cyanobacteria) growth when in excess of 20 ppb as phosphorus.

The phosphorus concentration in the upper reach waters of Clarks Creek is approximately 85 ppb. Its source is likely the same as that described for nitrate-nitrogen above.

Groundwater being discharging by the City of Puyallup's stormwater drainage system into the alluvial plain reach of Clarks Creek contains phosphorus concentrations in excess of hundreds of parts per billion. One of the consequences of this high phosphorus concentration is recurring toxic cyanobacteria blooms in DeCoursey pond and in the 20th St Place SW groundwater flooded detention/infiltration pond.

Iron concentration

The Clarks Creek TMDL study and water quality improvement plan did not recognize soluble (ferrous) iron as a both a groundwater and sediment supplied nutrient pollutant and toxic substance. Nor did the TMDL study recognize particulate (ferric) iron as a pollutant that causes salmon and macroinvertebrate asphyxiation and a major component of the silt that has accumulated on the historic bed of the alluvial plain reach of Clarks Creek. Failure to recognize the adverse impact of iron on aquatic life in Clarks Creek was likely due to Ecology having no surface water quality standard for either soluble (ferrous) or total (ferrous plus particulate ferric) iron.

Soluble (ferrous) iron is both an elodea growth stimulant and causes damage to salmon gill tissue leading to asphyxiation when in excess of 0.35 mg/L. Groundwater being discharged into Meeker Ditch contains soluble iron in excess of 5.0 mg/L!

Particulate iron as flocculent iron oxyhydroxide clogs salmon and macroinvertebrate gill tissue leading to their death and blankets spawning gravel resulting in suffocation of in egg salmon embryos. The below photos show the discharge of particulate iron into Meeker Ditch and the resulting effect of iron oxyhydroxide settling on salmon spawning gravel beds.

Alkalinity

The Clarks Creek TMDL study and water quality improvement plan did not recognize that discharging low alkalinity stormwater runoff into high alkalinity groundwater fed Clarks Creek causes sudden and extreme fluctuations in the alkalinity that is harmful to aquatic life in Clarks Creek. The failure of the TMDL study to recognize this fact is likely due to Ecology having no surface water quality standard for alkalinity. The US EPA guideline standard for alkalinity is that water to be protective of aquatic life has to contain more than 20 ppm of calcium carbonate (CaCO3) concentration.

Alkalinity is a measure of surface water's ability to maintain pH levels that are protective of aquatic life. Stormwater runoff is very low in calcium ion and bicarbonate ion concentration and is high in hydrogen ion concentration, thus it has a low pH (is acidic). By contrast Clarks Creek's base flow is provided by groundwater that is high in calcium ion and bicarbonate ion concentration and low in hydrogen ion concentration, thus has a slightly alkaline pH.

Proper salmon gill functioning is very dependent upon continuous exposure to water containing alkalinity that is typical of that found in discharging groundwater. Exposure to low alkalinity stormwater runoff causes a major malfunctioning of gill tissue and can lead to pre-spawn mortality in salmon so exposed. The effect of stormwater runoff on alkalinity in Meeker Ditch and subsequently Clarks Creek is illustrated in the below photos.

Groundwater base flow alkalinity 100 ppm

Surface water runoff effect; alkalinity 3 ppm

The result of this sudden change in alkalinity coupled with the effect of iron pollution on gill tissue function and nitrate-nitrogen's adverse impact on the oxygen carrying capacity of the hemoglobin in the blood of salmon causes sudden (within a few hours) pre-spawn mortality of salmon in streams so affected by these three conditions as noted in the below photos of Duri Creek chum salmon and a Meeker Ditch Chinook salmon.

Conclusion

The fact that there are no Ecology surface water quality standards for the five salmon stress factors identified above render Ecology's Total Maximum Daily Load (TMDL) study and water quality improvement program an ineffective model for restoring salmon habitat in nutrient (and iron) polluted and sediment impaired urban streams.

Ecology's Clarks Creek TMDL study and water quality improvement plan has wasted five years of effort and five million dollars to achieve little to no net gain in the salmon population or salmon habitat of this nutrient and iron polluted and sediment impaired urban stream. Hardly a model to be emulated elsewhere.