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To:	PDS_Planning_Commission
Cc:	Council
Subject:	Whatcom County Comprehensive Plan Update Public Comment: Chapter 11 -- Environment, Lake Whatcom Watershed Management
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Whatcom County Comprehensive Plan Update Public Comment
Chapter 11 -- Environment, Lake Whatcom Watershed Management

As one of the Initiating Governments in the Water Resource Inventory Area 1 (WRIA 1) Watershed Management Project, Whatcom County is in a position to provide policy direction to WRIA 1 programs. Policy direction might include investigating the most cost-effective methods and using best available science to evaluate, improve and ultimately remove Lake Whatcom from the Department of Ecology (DOE) impaired waterbody list.

In 1998 DOE designated Lake Whatcom an impaired waterbody because dissolved oxygen was found to be depleted in the deepest part of the small, shallow and urbanized northernmost end of the lake, called Basin 1 (Pelletier,1998). During the same time period, dissolved oxygen was also measured in Basin 3 of Lake Whatcom. Basin 3 is the immense, deep and much less developed southernmost basin. Those measurements found Basin 3 not impaired and it's water well oxygenated. However, because Basin 1 had become impaired, all of Lake Whatcom was designated an impaired waterbody. At present, Basin 3, containing about 96% of Lake Whatcom water, has continued to be well oxygenated. Meanwhile Basin 1, with about 2% of the lake water, remains impaired due to oxygen depletion.

Because Lake Whatcom is on the DOE impaired list, phosphorus in the Lake Whatcom watershed is restricted. Although Basin 3 is not impaired, it has the same phosphorus restrictions imposed on it as the impaired Basin 1 has. Is it reasonable to assume it is necessary to impose the same phosphorus restrictions on Basin 3 as are imposed on Basin 1 ? Might allowing a somewhat greater phosphorus load in Basin 3 than in Basin 1 lead to a less expensive, more cost-effective way to restore Basin 1 water quality ?

Fortunately, an existing report prepared for DOE has already looked at this very question. The "Preliminary Management Scenarios" chapter of the "Lake Whatcom Water Quality Model" (Berger & Wells 2005) describes their approach. The investigators analyzed individual basin response to various Lake Whatcom phosphorus loads using the Corps of Engineers CE_QUAL-W2/3 hydrodynamic and water quality modeling software. That model was chosen because, among other reasons, it could be adapted to the site-specific physical characteristics of Lake Whatcom.

Under DOE direction and supervision, the investigators used the CE_QUAL-W2/3 water quality model to determine the phosphorus loading needed to impact dissolved oxygen by -0.20 mg/l relative to natural conditions in each basin. The -0.20 mg/l value at a critical time and point is a threshold value chosen by DOE to represent impaired conditions (Pickett & Hood 2008).

As part of the modeling process, the investigators divided Lake Whatcom into two distinct and separate water bodies. Basin 3, modeled as Waterbody 1, is separated from the second water body by Strawberry Sill, which acts as a submerged dam. Waterbody 2 contains two small basins: Basin 1 and the similar-sized Basin 2. Each Waterbody is further divided into branches, segments and cells. The CE_QUAL-W2 model layout is pictured in Figure 21 of "Water Quality Study Findings" (Pickett & Hood 2008).

The investigators identified the most oxygen depleted segments during the most oxygen depleted days for each basin. These three "critical segments" are located in the deepest area in each respective basin.

The DOE provided Lake Whatcom total phosphorus loading level inputs and the model calculated the dissolved oxygen response to phosphorus in each basin's critical segment. Analysis shows great differences in the resulting dissolved oxygen among the basins critical segments (Berger & Wells, 2005 Table 21). The differences suggest each basin can be loaded with different amounts of phosphorus and still remain unimpaired, so a uniform lake-wide phosphorus reduction target is not necessary.

The modelers investigated several phosphorus loading scenarios, ranging from a base case representing natural conditions to a fully developed case. In the Full Rollback to Base Case (FR-BC) scenario, the modeled dissolved oxygen difference in Basin 1 was -1.66 mg/l. In Basin 3 the FR-BC modeled dissolved oxygen difference was -0.06 mg/l. Using the DOE -0.20 mg/l threshold value, Basin 1 became impaired but Basin 3 did not.

The FR-BC scenario modeling result is not surprising. Shallow sills between basins impede lake-wide circulation so the basins behave somewhat independently. Basin 3 is much larger and deeper than Basin 1. Because the Basin 3 water column remained fully oxygenated, sediments in Basin 3 released much less phosphorus than sediments in oxygen depleted Basin 1. The average total phosphorus concentration in samples collected from Basin 3 is less than one third that of the average concentration in samples collected from Basin 1 (2014_wq.csv). Basin 3 waters eventually travel northward over Strawberry Sill and into Basin 1, thereby improving Basin 1 water quality by diluting the Basin 1 phosphorus concentration.

Unfortunately, inquiry into the individual basin response to various phosphorus loading scenarios was dropped following the 2005 preliminary results. Further investigation could have determined if Basin 1 water quality can be improved by restrictions on Basin 3 or if only additional Basin 1 restrictions will improve Basin 1 water quality. Current investigators model Lake Whatcom as a continuous, unimpeded single body of water, eliminating the ability to evaluate basin response.

Rather than imposing a single phosphorus target on the entire lake, preliminary hydrodynamic and water quality modeling results suggest imposing phosphorus loading targets by basin as a valid approach to managing Lake Whatcom water quality. Phosphorus reduction is expensive for county taxpayers and watershed homeowners. Phosphorus load targets defined by basin could be a more cost-effective way to restore Lake Whatcom water quality and an approach that deserves investigation.

References:

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http://www.wwu.edu/iws/

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