Spokane DO TMDL
Monitoring Workgroup Meeting Notes
November 3, 2015
10:00 am - 12:00 pm
Ecology's Eastern Regional Office 2nd Floor Large Conference Room

Participants

BiJay Adams, Liberty Lake Sewer & Water District
John Beacham, City of Post Falls
Ben Brattebo, Spokane County
Mike Coster, City of Spokane
Bob Cusimano, Ecology
Lisa Dally-Wilson, SRSP
Jeff Donovan, City of Spokane
Speed Fitzhugh, Avista
Kris Holm
Dave Knight, Ecology
Meghan Lunney, Avista
Wes McCart, Stevens County
Jim Ross, Ecology
Ken Windram, Hayden Area Regional Sewer Board
Karin Baldwin, Ecology

Workgroup Focus

Members of the advisory group have requested meetings to discuss monitoring and what the 10-year assessment will look like. Since these topics are related, Ecology has combined them for this workgroup to discuss. Future Monitoring Workgroup meetings will address both the 10 Year Assessment and monitoring data that may be required to perform a 10 Year Assessment. Monitoring Workgroup meetings will likely occur quarterly, or as needed.

Ecology envisions that the workgroup's decisions, recommendations, and commitments will be recorded in the next biennial report. One of the products the workgroup could create is a list of subjects to evaluate - much like the subjects in a report card. We would collect and compile data for the various subjects and include summaries of the data collected and progress reports in the biennial reports. The subject 'grades' would be determined by the results of the 10-year assessment.

Some examples of topics the workgroup could address are:

- Maintain a good understanding of what monitoring data is being collected by whom and how often.
- Address data quality concerns.
- Identify projects and data needs that individual groups could collect or apply for funding to collect.
- Identify and address issues ahead of the 10-year assessment.
- The literature search EAP is conducting.
    - This group could review and discuss the literature search that Ecology's Environmental Assessment is working on. Anyone who has peer reviewed literature sources that should be included in the review should send them to Karin by the end of December. The literature search subjects are broad, and will likely include evaluation of how other entities have evaluated compliance or improvements in water quality or fish habitat.

Policy related questions posed during workgroup meetings will be recorded and discussed at future advisory group meetings.

There was agreement that the model should not become the sole focus of the workgroup when other factors may be important, such as things that support the designated use. Another example may be phytoplankton assemblage changes.

Purpose of Today's Discussion

Ecology does not intend to give the impression we are working on or preparing to run the model, or that we know what the 10-year assessment looks like. However, the CE-QUAL-W2 model is likely to play some role in the assessment. The exact role is a discussion the monitoring workgroup will have later. Ecology's intent is to understand

the model inputs so we can discuss what data exists, the data to collect now, and the data to collect in the future for a possible model run. Some workgroup members weren't around when the model was developed, so this meeting is an opportunity to learn how the model works and what data will likely be needed.

To take advantage of Bob Cusimano attending the meeting in person, Ecology postponed the development of the workgroup's mission statement, scope, vision, etc. for the next meeting.

CE-QUAL-W2 Model Input Requirements

See Bob Cusimano's presentation attached at the end of the notes.

Ecology (Bob Cusimano) started developing the model for the Spokane DO TMDL in 1999 and his involvement with the CE-QUAL-W2 Model continued until 2004. The CE-QUAL-W2 model was selected for the following reasons:

- It was designed by the US Army Corps of Engineers to model reservoirs.
- It takes into account physical features (i.e. hydrodynamics) and water quality impacts.
- It was specifically designed to connect river and dam segments together.
- The model is 2D [the river is broken into segments along the length (e.g., Lake Spokane segments are about ¾ mile long), and then each segment is divided into vertical layers (e.g., Lake Spokane layers are 1 meter deep). The 2D segments are laterally averaged across the channel, which fits the Spokane River and Lake Spokane well since they are mostly linear features.
- The model allows you to track the age of the water (a part of the hydrodynamic capability), which is a good way to simulate the interflow zone of the reservoir.

Boundary conditions are important. Boundary conditions come from Lake Coeur d'Alene, the point source dischargers, tributaries, groundwater, and dams.

The data requirements or inputs include:

- meteorological data
- inflow water quality
- inflow temperature
- bathymetry
- inflows

For dynamic models like CE-QUAL-W2, good continuous data from a few locations is more important than many locations with less data. Or said another way, the more data you have from fewer locations, the better to calibrate the model.

The model has different modules which function together to simulate water quality impacts. For example, the model simulates dissolved oxygen including all of the variables that affect it including algae growth and decay, CBOD decay, and sediment oxygen demand (SOD). Phytoplankton data are included as a separate module within the algal group module. The model also could be used to account for fish biomass in Lake Spokane (i.e., fish uptake of nutrients). A goal for a future version of the model is to have a sediment diagenesis module to account for SOD and nutrient fluxes.

For now, the model uses initial conditions, SOD, and first order sediment decay and accumulation factors. A more complex version of this is being developed. The Spokane DO TMDL model was effectively driven by the organic matter and CBOD decay rates (kinetic coefficients) in the model.

The model allows the creation of individual effluent characteristics for each point source discharger to account for the varying decay rates and stoichiometry of the organic material discharged.

The model simulates actual years, so you can't roll years together. However, you can put in new information into the model, such as updated physical information, and run the critical conditions represented by the 2001 year. We would

likely want to start a model run in February since the age of the water in the hypolimnion can be as long as 180 days old.

Data needs can be broken out into two categories: Needs for evaluation and needs for improving the model performance/prediction.

Data Needed to Improve Model Predictions

Portland State University provided the below list of data needs that will help improve the model in the future:

- Sediment oxygen demand (SOD) in Lake Spokane, particularly near the dam
- Sediment nutrient fluxes
- Meteorological data measured at Long Lake Dam
- Occasional wind direction and speed measurements at different locations in the reservoir
- Macrophyte distribution in Long Lake
- Phytoplankton species and concentrations
- Characterization of organic matter and nutrient loading to Lake Spokane

SOD is complex to model. SOD and sediment nutrient flux data may be better to collect a year or two before the ten-year assessment in order to set initial conditions for modeling the year we collect the comprehensive assessment year data. Since Lake Coeur d'Alene is an oligotrophic lake, the SOD levels in the northern part of the lake may give us an idea of the best SOD levels we can expect in Lake Spokane. The assumption for the current TMDL is that if we meet the standard in the water column on an annual basis where the water quality decay impacts are more evident, the SOD will improve over time because it will take longer for SOD to adjust to the reduced organic loading to the sediments as a result of reduced nutrient concentrations. After tertiary treatment occurs and non-point sources are reduced, internal nutrient cycling will continue in the lake, but the model does not evaluate how this cycling changes over time. Meeting water quality standards in the water column is a better indicator because SOD will take more time to assimulate. At the time the Spokane DO TMDL model was developed, SOD was not modeled at a level able to predict this; SOD modeling at higher complexity was not recommended at the time of TMDL model development.

Groundwater information was based on documented information as well as the residual from the water balance calculation (documented information plus water level and river flow data).

Of the list of data needs provided by PSU, the information that we have recently collected, or are collecting includes:

- updated bathymetry from Avista as of 2009
- macrophyte and phytoplankton data from the lake collected by Avista
- Characterization of loading:
    - New river flow data
    - Groundwater nutrient concentrations at Suncrest
    - Coulee & Deep Creek nutrient contributions

The information that PSU recommended that we still need to collect is:

- SOD and nutrient flux data
- Meteorological data (it would be good to have 2 stations: one close to the dam and one around the bend)
- Perhaps more information about the blue-green algae bloom areas

The model uses phytoplankton data as input to the algal group module which is useful for a better prediction of outcomes. Bob said that periphyton sloughing is important and understanding blue-green blooms would greatly benefit the entire process. For specific periphyton and blue-green algae related data collection recommendations, the group should consult with PSU.

A future model run would really just be another, better model run because it has more information. The additional data will make the model a better tool for simulating water quality after a significant level of management actions have been completed to reduce nutrient loading to the river. Figuring out if we need to collect an entire model input

data set (i.e., simulate another year) or just focus on specific data that could improve the current 2001 critical condition TMDL model run is an example of a discussion this group will likely have in the future.

The CE-QUAL-W2 model is a tool used to set and measure loads. Ecology has not used the model for determining compliance with TMDL allocations.

Deciding on the timing of the data collection (such as weather and SOD), who is going to collect the data, and who pays for the work are questions that the workgroup will need to discuss. By working to identify what data collection is needed now, the workgroup has time to plan and apply for funding to complete the work. For example, weather and SOD data would be better collected closer to the 10-year assessment. EAP has the option to measure water quality continually and nutrients every two weeks where the boundary conditions are set, which would be a good idea for the assessment.

Next Steps

- Keep the monitoring and data ideas coming! You can send thoughts to Karin anytime.
- Send in literature sources for EAP to consider for the literature review. Ecology would like you literature suggestions by the end of December.
- Karin will schedule the next meeting in early 2016.

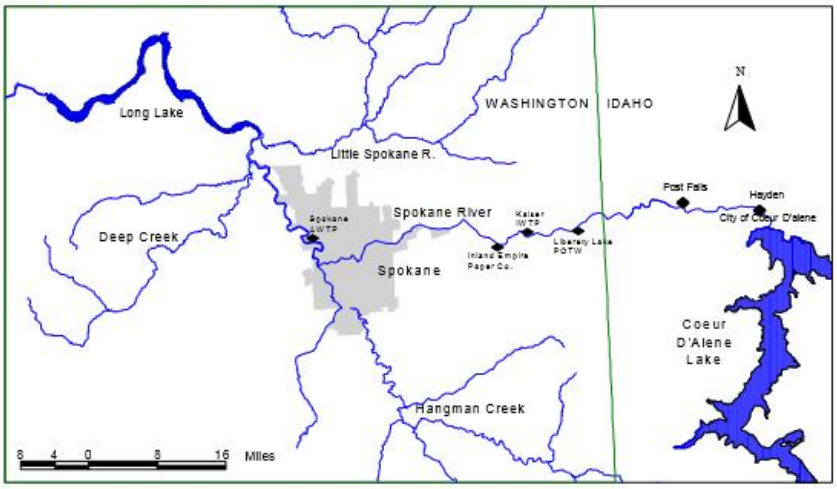
10:30 CEQUALW2 model input requirements
Bob Cusimano

- Geometric data
- Initial conditions
- Boundary conditions
- Kinetic parameters
- Future "implementation verification" data

Water Quality Model for the Spokane River – Long Lake System Using CE-QUAL-W2

Chris Berger, Scott Wells & Rob Annear
Department of Civil and Environmental Engineering
Portland State University

Spokane River

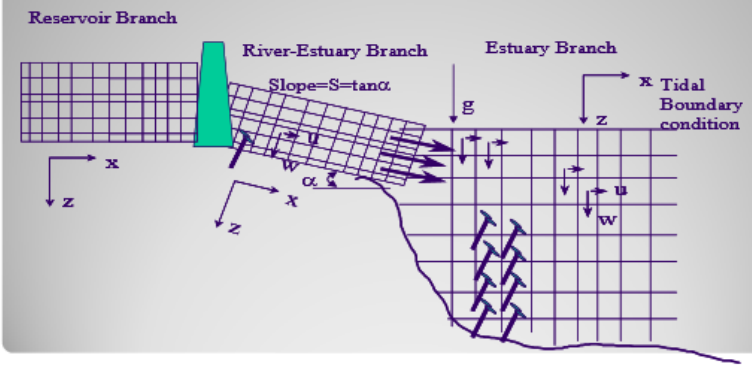


Spokane River

Long Lake Dam

Model Choice: CE-QUAL-W2 River Basin Model Version 3

2-D (vertical-longitudinal), unsteady finite difference model for hydrodynamics and water quality for rivers, reservoirs, lakes, estuaries supported by the Waterways Experiment Station, Vicksburg, MS, USA



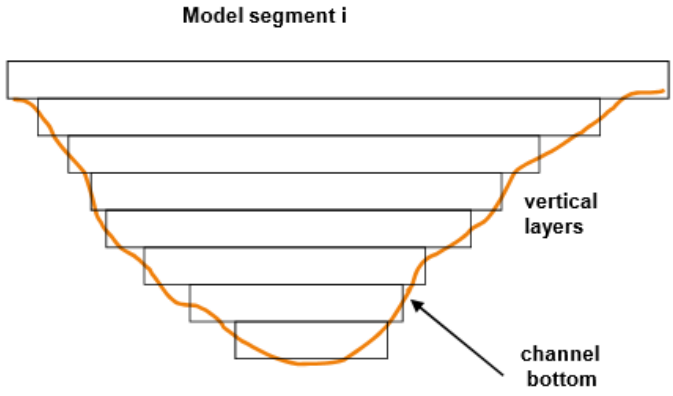
CE-QUAL-W2 Version 3

Data Requirements

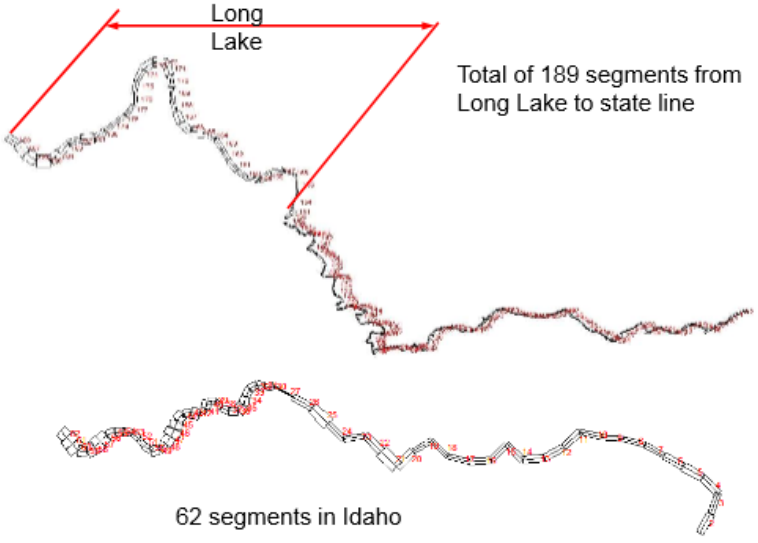
Meteorological Conditions	• One meteorological file for each waterbody
Inflows	• Needed for boundary conditions, tributaries and point sources
Inflow temperature	
Inflow water quality	• The frequency of the data needed depends on the questions the model is being used to answer.
Bathymetry of the system	•The more refined the data the more accurate the grid

CE-QUAL-W2 Version 3

River Basin Reservoir Model 2-D longitudinal-vertical

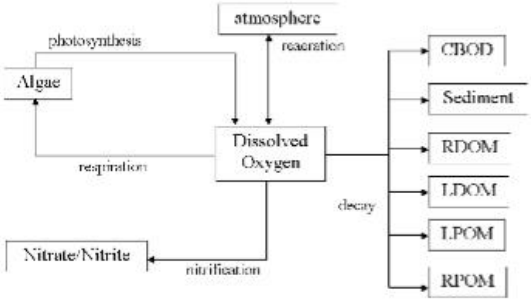


Model Development – Grid Layout



Modeling Capabilities

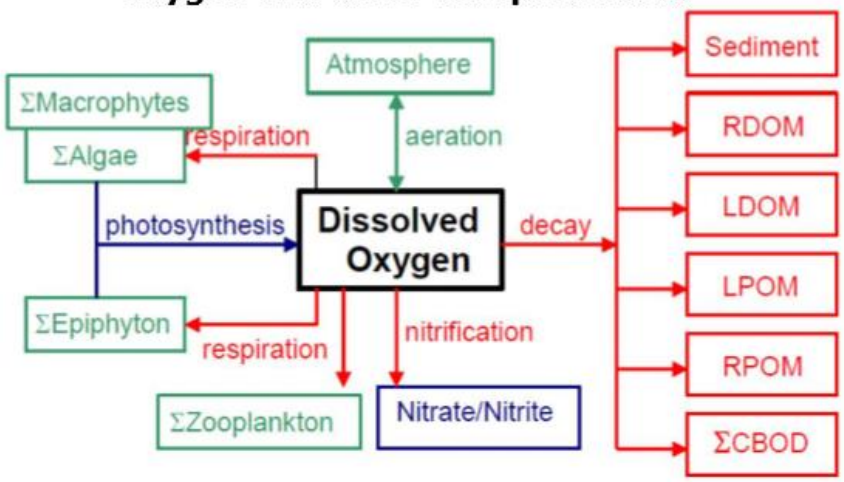
Non-Point Sources
Tributaries/Point Sources
Weirs/Spillways/Gates



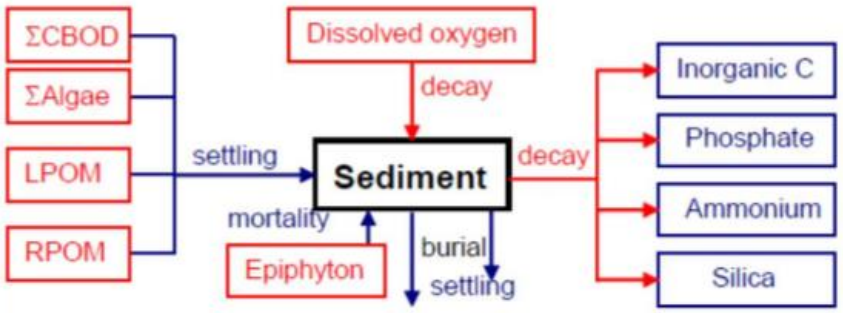
Constituents

Temperature
Tracer
Residence Time
Dissolved Solids/Salinity
Coliform
Arbitrary Constant
Suspended Solids (9 groups)
Nutrients(P and N)
Organic Matter (4 groups)
CBOD (30 groups)
Algae (3 groups)
Dissolved Oxygen
Inorganic Carbon
Alkalinity
Periphyton

Internal flux between dissolved oxygen and other compartments

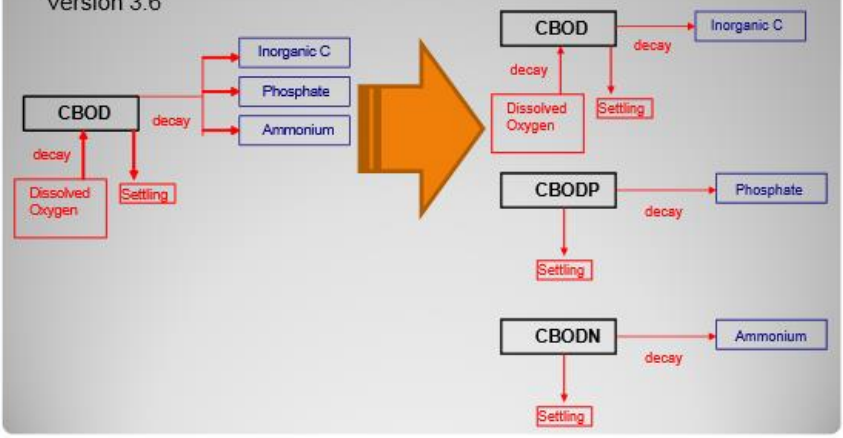


Internal flux between 1st-order sediment compartment and other compartments



Modeling CBOD of dischargers

Version 3.6



Point Dischargers

- Each Discharger has separate CBOD decay rate

CBOD compartment # in Spokane model	Corresponding Source
1	Liberty Lake WWTP
2	Kaiser Aluminum
3	Inland Empire Paper
4	Spokane WWTP
5	Organic matter from Washington Tributaries
6	Coeur D'Alene WWTP
7	Hayden POTW
8	Post Falls STP
9	Lake Coeur D'Alene CBOD
10	Proposed Spokane County WWTP (for scenarios)

Long Lake Water Age