LBR TP TMDL Modeling Decision Log

(**Note – this document strives to address the major decision points and rationales made during the Model Workgroup and Work Sessions. Tere are many more discussion points and documents that are available as part of the post meeting summaries, etc. available on the DEQ LBR webpage at: http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx)

November 28, 2012 thru March 21, 2013 – Monthly Model Workgroup Meetings
- Discussing mass balance and mechanistic modeling approaches (e.g. Qual2k and AQUATOX)

March 21, 2013 – Monthly Model Workgroup Meeting
- AQUATOX is selected to help model TP and periphyton relationships on the LBR
- Weekly Model Work Sessions established to determine and implement model set-up, calibration, and execution
- Modeling participants will work cooperatively to "build up" the model by reviewing previously-used model components, including coefficients, parameters, segmentation, time, etc...and determine how to maintain and/or modify the existing model to best meet the needs of the TMDL
- Although modeling will be a group venture and transparent, DEQ will house and run any model scenarios used in the TMDL due to the regulatory implications

April 2, 2013 Weekly Model Work Session
- A 4-segment unlinked model of the LBR, recently updated by Dr. Richard Park was initially reviewed as a starting point, and to be refined, as appropriate, based on group input, review of current data, appropriateness of segments, and needs of the TMDL, etc.

April 9, 2013 – 2nd Weekly Model Work Session
- January 1, 2012 through April 30, 2013 selected as time period for initial model set-up and calibration. These dates were chosen in part to: 1) help capture at least a full year, 2) maximize use of USGS synoptic data (August & October 2012, and March 2013), and 3) allow/verify scour during early in the model simulation (e.g. spring 2012).
- More discussion centered on the pros/cons of linked vs. unlinked model, and identification of what logical segments for either method should be, appropriate initial conditions, simplifying the model by removing/lumping animals, periphyton, and/or other parameters, etc. – follow-up discussions and decisions to take place at April 16 meeting.
  - Initial modeling timeline discussed and established.

April 16, 2013 Weekly Model Work Session
- A 9-segment linked model of the LBR will be implemented as the starting point for model set-up and calibration. This was based on input from the group and toward meeting the needs of the TMDL (ability to understand the system as a whole, more easily/functionally run scenarios, etc.)

- However, it was discussed and noted that other potential approaches, including a single-segment approach and sensitivity analyses, may need to be implemented if the 9-segment linked model is not performing well and/or meeting the needs of the TMDL.
- For model simplicity and defensibility, animals will not be included in the initial model set-up and calibration.
- Currently, no changes will be made to the existing periphyton categories; however, the group is taking a closer look to determine if changes should be made.
- Initial conditions selected will represent existing conditions to the extent possible/practicable.
  - It was also discussed that because the model run includes more than a year, the first few months of 2012 (e.g. Jan – April), which will be subsequently modeled again for 2013, may need to be evaluated as an "initial spin-up period," depending on the model performance.

April 23, 2013 Weekly Model Work Session

- Based on Dick Park's advice and preliminary "test case" presented during the meeting, the periphytic growth parameters modeled will include:
  - Periphytic High and Low Nutrient Diatoms
  - Periphytic greens
  - Potentially include Cladophora and Periphytic Cyanobacteria depending on model performance and goodness-of-fit
- The previous 13-segment model set-up will be used as the basis to most efficiently maintain, aggregate, and split segments to develop the appropriate 9-segment version.
- At this time, the tributaries will be treated as inputs to each segment, and not individual segments. However, questions about how to address potential phytoplankton inputs from these sources will need to be further addressed.
- Based on 1997 vs. 2011 pebble count data and Dorene MacCoy's opinion about the river conditions, the previously-used pebble count/physical properties for Eckert and Glenwood will be used to represent current conditions. However, Middleton, Caldwell, and Parma reaches have likely changed, probably necessitating a revised assessment.
- WWTF (and other point source data) will be incorporated into the model even if discharging to LBR tributaries. This will help us to evaluate scenarios with differing point source input levels into the future, regardless of direct discharge location.

April 30, 2013 Weekly Model Work Session

- ***A 13-segment linked model will be used for initial set-up and calibration, changing from the previous plan to run a 9-segment version*** (this was suggested by Jack, and supported by most others in the group). Rationale for the change include:
  - We may not be gaining much in terms of simplifying the model between 9 vs. 13 segments; Alex's USGS data can still be fully utilized; the model has already been set-up for the 13 segments and may require considerable work to make the change to 9 segments; the appropriateness of the segment breaks is more important than the number of segments.

- For initial model set-up and calibration, the original 1997/98 USGS pebble count data and previously-implemented normalization will be used.
    - This was based in part on Dick Park's recommendation that the data should still be valid based on long-term river conditions remaining mostly similar.

June 25, 2013 Weekly Model Work Session

- For initial model set-up and calibration, utilize the empirical USGS 2012 and 2013 synoptic data rather than Schmidt estimates, as was used in the previous model run, to account for inputs from all unaccounted flows.

July 23, 2013 Weekly Model Work Session

- The AQUATOX segments breaks, lengths, and coordinates have been revised (the excel and kml files are identified with the date label, "…2013_0723").
    - 13 segments remain
    - The revised segments should more appropriately locate the split/confluence of segments 5-8 around Eagle Island, as well as major tributary inputs
- Per Michael's Fifteenmile Creek flow memo from July 16, 2013, we will, "Use the Estimated monthly flows for Fifteenmile Creek flows in the AQUATOX model," given the paucity of flow data for this tributary.
- The run/riffle/pool data collected on June 20-21st from the Star Bridge to Hwy 95 will be utilized in the mode as the most recent and comprehensive data for those habitat parameters.

August 13, 2013 Weekly Model Work Session

- Freshwater Trust provided their shade data that was analyzed for the City of Boise. Additionally, Mark Shumar provided his professional opinion for interpretation of the data and his own experience on the LBR. Troy Smith created a hybrid of the two, which resulted in the following shading (when leaves are present). This is currently in the AQUATOX model unless new information becomes available:
    - Segment 1 = 5 percent
    - Segment 2 = 10 percent
    - Segment 3, 4, 5, 6, 7 = 15 percent
    - Segment 8 = 10 percent
    - Segment 9, 10, 11, 12, 13 = 5 percent

August 27, 2013 Weekly Model Work Session

- Based on discussions and input with Dick Park during the meeting, the following decisions were confirmed and agreed to for calibrating the model:
    - Can ignore animals in simulation.
    - Macrophytes can be ignored, although they do occur in the Lower Boise River (LBR).
    - Algal Groups – the current assemblage of algal groups in model consists of *Peri Low-Nut Diatoms*, *Peri High-Nut Diatoms*, *Phyt High-Nut Diatoms*, *Phyt Low-Nut Diatoms*, *Cladophora*, *Peri-Green*, *Phyto-Green*, and *Cyanobacteria (blue-greens)*:
        - *Cladophora*, a nuisance filamentous macroalga, does occur and should be modeled.

- ▪ *Cyanobacteria* (blue-greens) should also be modeled and may help with calibration issues (e.g. Glenwood and other March 2013 periphyton observed data).
- ▪ Include paired periphyton and phytoplankton model—the latter are mostly sloughed and scoured periphyton, so-called "sestonic" algae.
- ▪ Periphyton mats have been observed on sand substrates, but they do not appear to be important and can be ignored.
- o Pools account for a very small percentage of the LBR habitat and can be ignored.
- o The newly-collected data by DEQ in June and August 2013 identify the available substrate and periphyton abundance throughout the river. Also, periphyton appear to inhabit riffles and runs and are probably more influenced by other environmental factors including water depth, velocity, turbidity, temperature, etc. As such, data transformation/normalization is not needed to interpret AQUATOX output, which provides average values (e.g. peri biomass, etc.) on a per-segment basis. It is not possible to narrow the scope of output to specific locations within each segment.