

Hells Canyon MIKE 11 Temperature and Total Dissolved Gas (E.1-4, Chapter 6)

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Contracted by the
Oregon and Idaho Bureau of Land Management
November 4, 2002

I. Introduction

This chapter includes the result of model calibration and verification in relation to modeling of simulations of water temperature and total dissolved gas (TDG) in the Snake River between Hells Canyon Dam, at river mile (RM) 247.6, and just upstream of the confluence with the Clearwater River, at RM 145.

II. Conclusions

With respect to modeling of water temperature, IPC concluded the following:

1. *“Using a more physically correct description of the heating/cooling processes provides good agreement between simulated and measured temperatures in the Snake River (between Hells Canyon Dam and RM 191) when we used meteorological data at Lewiston. For verification of the model further downstream, additional data are required. Thus, when using the model to forecast the impact of different management scenarios, the heating/cooling processes should be described properly.” (Page 17, Paragraph 3)*

Response: The BLM agrees with this finding.

2. *“Error analysis shows a good correlation between measurements and model predictions during the calibration periods. Comparisons with literature suggest that the accuracy of the model predictions is as good as, or better than, similar modeling exercises.” (Page 17, Paragraph 4)*

Response: The BLM agrees with this finding.

3. *“Sensitivity analysis shows that model predictions are sensitive to wind strength and vaporization (variations of up to $\pm 0.5^{\circ}\text{C}$, corresponding to approximately 2%). However, diurnal variations in temperature are not sensitive to wind or vaporization.” (Page 17, Paragraph 5)*

Response: The BLM agrees with this finding.

With respect to modeling of TDG, we concluded the following:

1. *“The model is capable of describing the variation in TDG along the Snake River. It has been demonstrated how the model can be used to forecast the downstream impact of supersaturation at the toe of the spillway during spills. We recommend that, as more data become available, the model be fine-tuned with respect to re-aeration.” (Page 17, Paragraph 6)*

Response: The BLM agrees that more data is needed to verify the model. The oxygen recorders did not function properly and therefore did not provide the needed data. The study states: “The TDG measurements were not considered to be sufficiently reliable for calibration and so were also excluded from the analysis.”... “Although the error analysis suggests that the model predictions are quite accurate, it is difficult to quantify this conclusion.” (Page 12, Paragraph 3)

It appears that until additional oxygen data collection and TDG measurements are obtained, the model will not provide accurate results.

2. *“Apparently, a problem exists with the recorders of dissolved oxygen (abrupt changes in monitored values occur). This implies that the calibration of the TDG model with respect to re-aeration is based on two stations only. Therefore, as soon as more data become available, verifying the model is recommended.” (Page 17, Paragraph 7)*

Response: The applicant will need to obtain additional dissolved oxygen data before it can be certain that the calibration of the TDG model is correct.

3. *“Including biological respiration and production terms in the TDG model is required to capture the measured day to night variation in dissolved oxygen.” (Page 17, Paragraph 8)*

Response: The BLM agrees with this statement.

4. *“Error analysis shows a good correlation between measurements and model predictions during the calibration periods. Comparisons with literature suggest that the accuracy of the model predictions is as good as or better than similar modeling exercises. The model predictions are similar to an updated model that included water surface slope. This suggests that the model is not significantly sensitive to changes in water surface slope that occur in the Snake River.” (Page 18, Paragraph 1)*

Response: The study indicates that the RMS errors and absolute errors presented are very low. However, the study states there is some level of difficulty in quantifying the conclusion that the model predictions are quite accurate. (Page 12, Paragraph 7) There appears to be a conflict in the findings that needs to be resolved by collecting additional data for further analysis.

5. *“Sensitivity analysis shows that model predictions are not sensitive to shading, but respiration reduces peak dissolved oxygen by up to 0.3 mg/l (approximately 3%). Diurnal variations are not sensitive to shading or respiration.” (Page 18, Paragraph 2)*

Response: The BLM agrees with this statement.

6. *“Using the re-aeration equations recommended in literature did not give accurate model predictions. These formulae are based on analyses of a range of stream measurements and do not appear to represent re-aeration in the Snake River.” (Page 18, Paragraph 2)*

Response: The BLM agrees with this statement.

III. Study Adequacy

The study is not complete and therefore not adequate. There is a need for additional oxygen data and TDG measurements to calibrate the TDG model. Until this data is gathered the study should not be considered complete, and the model should not be used.

IV. BLM Conclusions and Recommendations

Conclusions

1. The study results provide good temperature modeling results.
2. The oxygen and TDG modeling needs additional data to verify the calibration. The oxygen recording equipment only functioned at two stations. The TDG measurements were not considered to be sufficiently reliable for calibration.

Recommendations

1. Until high quality oxygen data and TDG measurements are collected and the calibration completed, the TDG model should not be accepted as adequate.