Seven HD Models
On the
Snake River
(E.1-4, Chapter 7)

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I. Introduction

The study describes the construction and calibration of seven depth-averaged 2D (two dimensional) HD (hydraulic) models on the Hells Canyon Reach of the Snake River. The models are to be used for analyses that require high accuracy in the description of the complex flow fields often found on the Snake River. This model will be used to calculate the instream flow impacts on fish and aquatic species. The applications include habitat analysis and bank stability evaluations. The modeled sites are Pine Bar, Tin Shed, Hastings Bar, Steep Creek, Fish Trap, Robison Gulch, and Camp Creek on the Hells Canyon Reach of the Snake River. For each site, DHI used the curvilinear grid, bathymetry data, resistance calibration, and comparison with Acoustic Doppler Current Profiler (ADCP) data sets to build hydrodynamic models that accurately reproduced site conditions.

II. Conclusions

1. "Five of the models give a satisfactory agreement with the standard choice of eddy viscosity, and no further adjustment is needed for these sites." (Page 5-84, Paragraph 6)

Response: BLM agrees with this statement. These sites did not have flow separation that caused the model to fail initially at the other two sites.

2. "Two models, Robinson Gulch and Steep Creek, have been found to yield poor agreement between observation and simulation for the standard choice of eddy viscosity. By trial and error it was found that agreement could be markedly improved by modifying the viscosity. For these two sites we found an alternative eddy viscosity model that is the same for both. The eddy viscosity varies linearly with the discharge for these two sites. The alternative eddy viscosity model gives these two sites a fully satisfactory performance." (Page 5-84, Paragraph 6)

Response: The BLM does not agree with this finding. These two sites had a complexity about them that was caused by flow separation that the simpler approach did not take into account. The manipulation of the eddy viscosity by trial and error (data manipulation) found an agreement. However, if this model is to be trusted, it would have to be more consistent than to have a success rate of 3.5:1. Without ADCP data collected on each

site, the modelers could not have fitted their model to the actual flow situation. Therefore, when future modeling is attempted without ADCP data, it would seem that there would be a probability of a 28% error rate.

3. "It has been shown that the alternative eddy viscosity model gives directly wrong results at Pine Bar. This occurs because a high eddy viscosity in the areas with flow separation must originate for secondary flow, which can vary substantially in a river like the Snake." (Page 6-86, Paragraph 2)

Response: The study states that "There is thus an inconsistency in the way the model should be calibrated for the individual reaches." They further state, "One thing that can vary significantly in a river like the Snake is the secondary flow. It must be expected that the big variation in the cross section causes a lot of secondary flow in some reaches." (Page 4-8, Paragraph 8) This would indicate that the model can be correlated to collected data, but it may not provide correct analysis of reaches of interest that have no ADCP data available.

4. "All models have been shown to yield extremely good performance for the flow fields. The agreement between ADCP data and the simulated velocity fields is extremely good for all the sites and ADCP data sets. With respect to data, there is a general lack of measurements at high discharges, especially ADCP data. It would have been opportune to have such data, but there is none available for the simple reason that the Snake has not had a discharge much higher than 1000m^{3}/s. The model calibration at the high discharges is hence uncertain. There are good reasons to believe that the behavior is correctly captured, i.e. the behavior is basically the same character, but the exact details of what goes on are unknown. The MIKE 21C model with its curvilinear grid is highly suited for the present application. There are large variations in the bank lines and the flow along these is often of critical importance, which is captured accurately by the curvilinear approach. The approach that we [HDI Water & Environment] have followed is to try for the simplest description, i.e. constant resistance and eddy viscosity, and then to observe whether it can be calibrated into representing the data correctly. This has been the case in five of the sites while a slightly more refined eddy viscosity approach turned out to be necessary for two sites." (Page 6-86, Paragraph 3)

Response: BLM finds that it is difficult to understand how the models have an extremely good performance for the flow fields when it only scored 5 out of 7 right answers. If reaches are to be modeled without field data, there would appear to be only a 72% chance of being correct. Without field data there can be no adjustments for viscosity. Unless this model is only going to be used when ADCP data is available, it would appear to give inaccurate results.

III. Study Adequacy

The BLM does not find the study to be adequate, even though the study provides an adequate analysis of the methods and approach. The findings do not indicate that the model can be used without gathering ADCP field information at each site. If this is the case, the model is not valid.

IV. BLM Conclusions and Recommendations

Conclusions

1. The conclusion that the model provides good performance is a matter of interpretation. The model was able to predict correctly 5 out of 7 sites initially. The other two sites were brought into alignment with the model through trial and error adjustment of viscosity factors. In a real modeling effort, when no field data is available to make adjustments, there would be only a 72% chance of being correct. The BLM interprets this to be less than good performance that could provide erroneous modeling results.

Recommendations

1. IPC needs to specifically explain how they intend to use this model. A better explanation of why they feel the model can be used when it has a 28% margin for error is needed.