RESPONSE TO COMMENTS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY NEW ENGLAD REGION 1 DRAFT GROUNDWATER MODELING SUMMARY REPORT SITES 1 AND 3 AND THE EASTERN PLUME NAVAL AIR STATION BRUNSWICK, BRUNSWICK, MAINE

Commentor: Michael J. Daly, EPA - Remedial Project Manager Federal Facilities Superfund Section	
Comment Issue Date: 22 Jan 2009	**Navy Response Date: 17 Mar 2009**

General Comments:

1. The groundwater model should provide an adequate basis for evaluation of the Eastern Plume extraction system and the Sites 1 and 3 slurry wall. Vertical discretization (8 layers) is ample. Horizontal discretization is adequate for the regional scale of the model, but may prove to be somewhat coarse for more local characterization (e.g., the Sites 1 and 3 slurry wall is approximately 12 grid cells across). A smaller scale model in the vicinity of the Eastern Plume and Sites 1 and 3 should be considered for detailed site-specific evaluations.

Response: We agree the horizontal discretization is adequate for the regional scale of the model, but may prove to be somewhat coarse for more local characterization. However we believe the model grid size is adequate for the goals and objectives of this modeling effort. The objective for the groundwater model as planned and as detailed in the Final Groundwater Model Work Plan (EA 2006) was to produce a plume scale approximation of the groundwater flow pattern in the areas of Sites 1 and 3 Landfill and the Eastern Plume.. Localized, site-specific, finer scale simulations may follow and can be built over this base groundwater model.

2. There are many potential uses for this ground water model beyond the report's stated objectives. EPA strongly recommends that the Navy receive all model data deliverables from their consultant. The Navy or other Brunswick cleanup team stakeholders can further refine and utilize the model for other site-specific remedial evaluations that may be necessary and/or to evaluate whether future land alterations associated with the redevelopment of Brunswick have the potential to impact any of the Navy's on-going ground water restoration efforts.

Response: The Navy will have the model input files for the final calibrated model to distribute to the project stakeholder, as needed.

Specific Comments:

3. **Page 4, Section 2.1, first bullet**: The text cites the total contaminant mass removed by the extraction system by the end of 2003. A more current figure should be supplied. How much mass was removed in the period 2004 – 2008?

Response: The total mass removed through 2008 is 453 Kg (approximately 1,000 lbs) and this amount will be cited in the text.

4. **Page 6, Section 3, ¶1**: The text states that the entire perimeter of the basin was modeled as a no-flow boundary, including that along the ocean. Is it correct to conclude that the entire discharge of groundwater from the basin must go to Mere Brook/Merriconeag Stream in the model?

Response: The entire discharge of groundwater from the basin was assumed to go to Mere Brook/Merriconeag Stream in the model. The model was constructed to incorporate the stakeholder-agreed-to Conceptual Site Model approximation. This Conceptual Site Model assumed that the majority of flow within the drainage basin discharges to surface water. Therefore, the model was built using no-flow boundary conditions and presumption that groundwater discharges to the Mere Brook/Merriconeag surface drainage system.

5. **Page 6, Section 3, ¶2**: The text states that the Topsham Water District supply wells are believed to have only a minor effect on the location of the groundwater divide, and that, "Therefore these water production wells were accounted for in the groundwater flow model." Since it appears that the supply wells were *ignored* based on judgment, rather than "accounted for" by some explicit inclusion in the model, it would be more transparent to state that the supply wells were "considered, but ultimately neglected based on the argument given. Please revise the text for clarity.

Response: The referenced sentence was intended as, "Therefore these water production wells were *not* accounted for in the groundwater model." The text has been revised.

6. **Page 12, Section 3.4.4**: The text defines the "hydraulic characteristic" for the slurry wall as, "… the barrier hydraulic conductivity divided by the width of the barrier." This implies that the hydraulic characteristic carries dimensions of [time^{-1}]. However, the text indicates that the hydraulic characteristic is unitless. Please check for internal consistency.

Response: The correct unit for the hydraulic characteristic is [time^{-1}]. The text and tables have been checked for unit consistency and revised.

7. **Page 13, Section 4.1, ¶3**: *typo:* Please change, "… screened partly or entirely with the lower sand unit" to, "… screened … with*in* the lower sand … ."

Response: The text has been revised to correct this typo.

8. **<u>Page 15, Section 4.1 and Figure E-1</u>**: For control points at higher elevations (shown on the figure with a filled circle surrounded by an open square, labeled "wells outside focus area"), the error shown appears to be systematic. At the highest elevations, the model under-predicts the observed water levels; at lower elevations, the model over-predicts the observed values. That is, the predicted hydraulic gradient in this portion of the domain is significantly smaller than observed. Assuming that the recharge is reasonably well constrained, this would suggest that the modeled hydraulic conductivity in the upland portion of the domain is too large. According to the description given on page 8, Section 3.4.1, this area appears to have been assigned the K given to the upper sand unit in the Eastern Plume area (calibrated value: 25 ft/d; *cf.* Figs. B-1 and B-2). While allowance for a lower K value over the northwestern portion of the domain may not have a large influence on the model results in the in the Eastern Plume area, it may allow for a better overall calibration.

Response: It is believed this comment refers to the comparison of observed groundwater elevations at the NEX and Site 9. We agree the modeled hydraulic gradient in this area is significantly smaller than observed, but the actual hydraulic gradient between the two sites is very large, 0.129 ft/ft (12.8 ft of head change over 994 ft between MW-NASB-23 and MW-NASB-80 for the October 2001 gauging) which seems suspect. To assess whether the actual hydraulic gradient could be simulated by decreasing the Upper Sand hydraulic conductivity, a cursory sensitivity analysis was completed where the Upper Sand model layer hydraulic conductivity was changed to roughly an order of magnitude less that 25 ft/day. This change did not significantly steepen the modeled hydraulic gradient in this area. The sensitivity testing allowed for the conclusion that the measured data maybe non-representative of actual conditions or that some hydraulic controlling factor is unaccounted for. Attempting to calibrate the model to potentially suspect data was deemed beyond the requirements of the model, and since it was outside the focus area, calibration to this data set (NEX and Site 9 wells) was not pursued beyond a general fit to observed water levels.

9. **<u>Page 18, Section 4.2.1</u>**: The verification step comparing modeled, and observed, water levels under steady pumping conditions is well conceived, and the results (e.g., Fig. F-1) is quite satisfying. However, past well gauging results have indicated that measurable draw-downs are fairly local to the extraction wells. If this is the case, then one might expect that the agreement between calculated and observed water levels will be similar for the un-stressed and the steady-state pumping models, because few of the available monitoring points register significant changes due to the pumping. This limitation of the verification exercise should be acknowledged, if applicable.

Response: The purpose of first calibrating the model to non-pumping conditions was so that the effects from pumping could be subsequently isolated during model verification and therefore more accurately simulated. The purpose of model verification was to build confidence in the ability of the model to accurately simulate conditions under a different set of stresses which not only included stresses from pumping but also included stresses related to different rates of recharge. In this respect, the purpose of model verification was achieved.

The implication of the comment seems to be that since drawdown from pumping is minor, the effect of pumping on groundwater flow patterns is minor. However, keep in mind that the aquifer is under confined conditions and that even though measurable drawdown is small, the radius of influence in a confined aquifer can be relatively large.