Technical Memorandum

Review of "Study of Alternatives of Management of Impacted Groundwater at Bethpage" Report

To: Karla Harre, P.E. (NAVFAC ESC)
From: Heather Rectanus, PhD (Battelle)
Date: April 6, 2012
Re: Technical review of Bethpage Alternatives Report

Objective:

This technical memorandum summarizes Battelle's technical assessment of the "Study of Alternatives of Management of Impacted Groundwater at Bethpage" as it pertains to the technical and economic feasibility of plume containment at the leading edge and other plume management alternatives at Operable Unit 2 (OU-2) of the former Northrop Grumman and Navy property in Bethpage, New York. Specifically, Battelle was tasked with the following:

1. Review the report "Study of Alternatives for Management of Impacted Groundwater at Bethpage" (hereafter referred to as the Bethpage Alternatives Report), which was prepared to fulfill one of the recommendations identified in the "Remedy Optimization Team Report for the Bethpage Groundwater Plume Remedy."
2. Provide comments on the technical logic and conclusions presented.

Comments and Recommendations:

Battelle has completed an evaluation of the Bethpage Alternatives Report that fulfills one the recommendations requested by the Remedy Optimization Team. Overall, Battelle agrees with the technical basis of the report and supports the conclusions reached within the report.

Battelle's specific comments on the technical logic and conclusions presented in the report are provided for each section below:

Introduction

- Clarify whether the locations of the planned wells in the outpost monitoring well program are the same locations for the pending vertical profile borings (noted in the continuing plume delineation bullet). Additionally, clarify whether all the installed borings noted in the second bullet on page 1-4 will become permanent monitoring wells.
- Additional sources contributing to the Bethpage Plume are identified in the last paragraph of Section 1.2 Background. Since more than two additional sources may exist, perhaps the sentence should be worded "Additional sources contributing to the Bethpage Plume include, but are not limited to, the Hooker/Ruco Superfund Site and the American Drive-In Cleaners Site."
- Introduction paragraph to Section 1.3 notes that the effect of extraction wells, recharge basins, and water supply wells on regional groundwater flow in the description of current site conditions is important. This point cannot be emphasized enough at this site.
- At the bottom of page 1-3, the bullet states that the deep plumes appear "relatively continuous." However, the second and third bullets on page 1-4 state the deep plumes (western and eastern) are "not uniform." Clarify this dichotomy in plume description.

- Figure 1-5 does not have well names and appears to have a lower resolution. Coupled with the small font on Figure 1-7, it is difficult to compare the plan view (Figure 1-5) with the cross section (Figure 1-7).
- For future reference, include method used for detecting volatile organic compounds (VOCs) when discussed at the bottom of page 1-4.

Evaluation of Alternatives

Alternative 1

- For all alternative descriptions, discuss components in the order provided on page 1-2 followed by any new components as applicable. Consistency across all the alternatives will improve the reader's understanding of the proposed alternatives. For example, outpost monitoring and plume delineation are combined in Alternative 1A although they are listed as separate components on page 1-2.
- Please provide context to the basis of the conservative assumption "that three well fields would be impacted in 10 years, two well fields would be impacted in 15 years, and three well fields would be impacted in 25 years." What is the scientific basis for these impact time frames?
- On page 2-3, hot spot treatment for OU-2 and OU-3 are mentioned under expected outcomes for Alternative 1. Please remind the reader that OU-3 hot spot treatment is not considered part of the OU-2 remedy.
- When describing the attenuation mechanisms weakening the strength of the off-site plume in the fourth bullet of Section 2.1.2 Technical Feasibility (on page 2-3), elucidate the type(s) of expected degradation mechanisms (e.g., abiotic or biotic) as discussions on contaminant degradation have been limited.
- For bullet five on page 2-3, was the "probability" of impact to the downgradient wells calculated? If not, recommend removing "probability" from the bullet as "strength of impacts" relates the same sentiment without implying statistics. The same comment applies for all other alternatives where this phrase is used.
- Clarify why the OU-3 hot spot treatment discussed as part of the Technical Feasibility for this remedy?
- In the third bullet of the advantages of Alternative 1(on page 2-4), what does the statement "all this capture substantially reduces the risk of downgradient migration" imply? Subsequent alternatives discuss a "reduced impact" due to the various remedy components.
- In the following bullet, consider specifying that the "response appears commensurate with the *current* spatial distribution of risk."
- On page 2-5, the first potential disadvantage of Alternative 1describes the possibility that the plume could migrate downgradient in a weakened state. Please provide context to the phrase "*much* weakened state."
- In the costs of the off-site hot spot treatment, please clarify the need for additional vertical profile borings and plume delineation?

Alternative 2A

- On page 2-6, please specify to what extent Alternative 2A is similar to Alternative 1 as the Bethpage Water District (BWD) hot spot treatment noted in Alternative 1 is not included in Alternative 2A. Please consider the first comment under Alternative 1 that requests presenting the components to the alternatives in the same manner as on page 1-2. As a reader, it was difficult to ascertain the exact components of Alternative 2A solely on the basis of Section 2.2.1.

- On page 2-7, in the third full sentence, excess water would be discharged to local recharge basins located within the BWD distribution network. Please give context regarding the hydraulic impacts of this action.
- Please explain how additional characterization and flow modeling (noted at the end of the second bullet) are incorporated into the cost estimate for Alternative 2A.
- The paragraph at the end of page 2-7 might be better started with "In essence, Alternative 2A would opportunistically increase plume capture during the winter months, which is the time of year when plume capture by strategic supply wells is otherwise low. Treatment of the captured VOCs would occur through investments in wellhead treatment that have already been made under the current ROD" followed by "Figure 2-4 shows the BWD and ANY water supply wells…the potential for recharge to affect plume capture and migration" and ending with "Additionally, it is possible that the ANY-SNR facility…"
- The second paragraph of page 2-8 assumes the plume migration timeframe will be different in comparison to Alternative 1. Please provide the basis for the impact time frame assumptions to strengthen the discussion.
- Should "fortuitous" be used in reference to capture of VOC mass in the second bullet of Section 2.2.2 Technical Feasibility given the intentional nature of the increased capture for Alternative 2A?
- As noted for Alterative 1, the last bullet in Section 2.2.2 Technical Feasibility uses "probability" to discuss impacts to downgradient wells. If no statistics were calculated, then consider removing "probability" from the sentence.
- Please expand the discussion in how the assumptions for impact times to downgradient wells were selected. For example, why do both remedies assume that the first set of downgradient wells will be impacted in 10 years while the second set of downgradient wells will be impacted after 15 years for Alternative 1 and 20 years for Alternative 2A?
- On page 2-9, please revise the sentence beginning with "This part of the Alternative 2A remedy is the quickest action possible among all the enhanced containment options…" for conciseness. Also, please elaborate on why this option potentially provides the greatest incremental benefit for the incremental costs incurred.
- Consider updating the first and third bullets on page 2-10 to reflect Alternative 2A specific information and not repeat Alternative 1 advantages.
- In reference to the last sentence of page 2-11, might mounding be used also to contain the plume through creation of groundwater divides in strategic locations?

Alternative 2B

- As with Alternatives 1 and 2A, consider revising the description section to present the components to the alternatives in the same manner as on page 1-2.
- The end of the first paragraph on page 2-13 suggests more modeling. How will the costs associated with this modeling impact the potential implementation of this alternative as modeling was not a line item in the costing for Alternative 2B?
- How does the volumetric flow rate of the extracted water in Alternative 2B compare to excess water generated as part of Alternative 2A?
- If the capture zone of BWD 6-2 pumping at 1,200 gpm is estimated at 5000 feet wide (page 2-7), please provide the basis for the need of pumping 9,000 gpm in the shallow extraction wells in Alternative 2B given the plume's width is 9,700 feet (page 1-3).
- Please provide the basis for the assumption that Alternative 2B would have the same impact time frames to downgradient wells as Alternative 2A.

- In the last paragraph of the description section, the difference in plume migration times was stated to "reflect the reduced probability of impacts to downgradient supply wells." Was the change in assumed plume migration time based on a calculated probability? Or, does this assumed time change reflect the increased attenuation of the plume via additional removal mechanisms as noted in the first full bullet on page 2-14?
- Please describe the mechanisms for developing new plume fingers to strengthen the discussion point.
- Consider revising the sentence "At the Bethpage site, much of the plume containment effort in Alternative 2B…" The length and complexity of the sentence distracts from the importance of its point.
- Provide context to the assertion that past experience at Bethpage indicates that implementing a plume containment system would take at least 5 years. An example would strengthen this important discussion point.

Alternative 2C

- As with the previous description of alternatives, consider revising the description section to present the components to the alternatives in the same manner as on page 1-2.
- "All the elements of Alternative 1" are stated to be part of Alternative 2C, however hot spot treatment in OU-2 was removed from the alternative in the last paragraph of the description section.
- As in the previous alternatives, both phrases "would further reduce migration of the off-site plume" and "reduce the probability of VOC impacts to downgradient water supply wells" were used to describe the outcome of Alternative 2C. Was the change in assumed plume migration times based on a calculated probability?
- Under the advantages of Alternative 2C, the second bullet states Alternative 2B "has the potential to capture more of the plume" instead of stating that Alternative 2C has this potential.
- As with Alternative 2B, providing an example to explain why it would take at least 5 years from decision to system operation would strengthen the discussion.
- Please describe the nature of the "significant local impacts to supply wells" given the additional groundwater to be extracted from and returned to the aquifer with this alternative.

Alternative 3

- As with the previous description of alternatives, consider revising the description section to present the components to the alternatives in the same manner as on page 1-2.
- Provide the basis for quarterly monitoring of the downgradient water supply wells.

Analysis of Alternatives

- Note the differences in the alternatives within the bulleted list of alternative. For example, hot spot treatment at BWD 6-2 is not included in all alternatives and Alternative 3 does not include all the vertical profile borings and plume delineation costs. These items should be noted.
- With each alternative, the hydraulic impact at the site becomes more profound in terms of extraction and potential re-injection. An expanded discussion on this impact would help the reader put the alternatives into perspective.
- On page 3-3, consider revising the sentence "Therefore, it is unclear whether or not much added risk reduction" to improve the reader's understanding of the discussion point.
- In Table 3-1, review the components of each alternative for consistency. As noted in the bullet above, the subtle differences between the alternatives were not included.