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PITT-06-2-030

June 13, 2002

Project Number 2863

Ms. Kymberlee Keckler
Remedial Project Manager
U.S. Environmental Protection Agency – Region 1
1 Congress St.
Suite 1100 (HBT)
Boston, Massachusetts 02114-2023

Subject: Responses to EPA's May 29, 2002 Comments and Page Updates
Draft Round 1 Quarterly Groundwater Monitoring Report
For Goss Cove Landfill, Naval Submarine Base-New London, Groton, Connecticut

Reference: CLEAN Contract Number N62467-94-D-0888
Contract Task Order Number 0816

Dear Ms. Keckler:

On behalf of the U.S. Navy, Tetra Tech NUS, Inc. (TtNUS) is pleased to submit to the U.S. Environmental Protection Agency, Region 1 (EPA), 2 copies of the subject responses and the applicable updated report pages. Please insert the updated pages as appropriate.

If you have any questions regarding the responses or updated pages, please contact Mr. Mark Evans of Engineering Field Activity Northeast at (610) 595-0567 (ext. 162) or me at (412) 921-8984.

Sincerely,

Corey A. Rich, P.E.
Project Manager

Enclosure(s)

c: Mr. Mark Lewis, CTDEP (1 copy)
Mr. Mark Evans, EFANE (2 copies)
Mr. Richard Conant, NSB-NLON (3 copies)
Mr. Roger Boucher, EFANE (w/o enclosure)
Ms. Jennifer Hayes Stump, Gannett Fleming (1 copy)
Mr. John Trepanowski, TtNUS-KOP (1 copy)
CTO 816 – File Copy

RESPONSES TO USEPA's MAY 29, 2002 COMMENTS
DRAFT ROUND 1 QUARTERLY GROUNDWATER MONITORING REPORT
FOR GOSS COVE LANDFILL, NSB-NLON, GROTON, CONNECTICUT
JUNE 13, 2002

Comment 1: p. 2-2, §2.3

typo: Please change "... inefficient amount of water ..." to "... insufficient amount of water ...."

Response:

Agree. "inefficient" was changed to "insufficient" as requested.

Comment 2: p. 2-5, §2.5

The text notes that the water level in well 8MW5S dropped below the well screen at low tide. This would suggest that low tide is not the optimal time to sample this well, as it will not be possible to purge it properly. What procedure is proposed for the sampling of this well?

Response:

Agree. The following changes were made to the text of Section 2.5 and the calculations provided in Appendix J.

The words "low tide" were deleted from the last sentence of Section 2.5 on p. 2-5. The modified sentence was changed as follows:

"...not tidally influenced. The results of this tidal study will be used to determine proper sampling times during subsequent sampling events at Goss Cove Landfill."

The last paragraph of the Conclusions section on p. 5 of 8 of Appendix J was changed as follows:

"...staff gauge. When sampling events are performed at Goss Cove, the average low tide lag times between the monitoring wells that are tidally influenced (8MW1, 8MW2D, 8MW2S, 8MW3, 8MW6D, and 8MW8D) and the staff gauge should be used to estimate the proper time for sampling at low tide. Monitoring well 8MW5S is also tidally influenced; however, in most cases the groundwater elevation at low tide is below the bottom of the screen interval of the monitoring well and sampling is not able to be completed at low tide. Therefore, purging and sampling at this well should begin shortly after high tide so that the sampling effort can be completed prior to the well going dry. Sampling between high-tide and low-tide should provide a reasonable estimate of contaminant levels in the groundwater."

Comment 3: Appendix E

I note that the redevelopment of HNUS-23 and 8MW3 was completed with high turbidity still in evidence (off-scale and 414 NTU, respectively). However, turbidity in these wells appears to have

been down to acceptable levels (9 and 16 NTU, respectively) by the time the purging and sampling were performed a few days later.

Response:

Comment noted. Redevelopment of the monitoring wells included in the Goss Cove Landfill groundwater monitoring program was completed since many of the wells were installed approximately 8 years ago and many had not been sampled for years. Redevelopment was completed to promote proper flow through each well by removing buildup on the well screen and sediments that may have settled in the bottom of the well. Redevelopment activities involved surging the well with a submersible pump at high flow rates. Approximately 10 and 20 well volumes were pumped from monitoring wells 8MW3 and HNUS-23, respectively. Ideally, redevelopment would have continued until turbidity levels were lower than those recorded for HNUS-23 and 8MW3. However, the other water quality parameters that were recorded during redevelopment (i.e., temperature, pH, and specific conductance) were generally stable at the end of redevelopment. In addition, as the commentor noted, turbidity levels were down to acceptable levels at the time of well purging and sampling. Therefore, the Navy believes that the redevelopment activities that were completed were sufficient. No changes will be made to the report in response to this comment.

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Response:

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2.0 FIELD INVESTIGATION ACTIVITIES

Field investigation activities performed as part of the first round of the groundwater monitoring at Goss Cove Landfill included the following:

- Inspection and development of 11 monitoring wells.
- Collection of two rounds of water level measurements (high and low tide) at 11 monitoring wells and one staff gauge in the vicinity of Goss Cove.
- Collection of groundwater samples from 11 monitoring wells.
- Measurement of field parameters and redox-sensitive parameters.
- A tidal study to determine tidal responses and proper sampling times for the tidally-influenced monitoring wells.

Round 1 field activities occurred in December 2001 and January 2002. Figure 2-1 illustrates the sampling locations. Copies of the field activities logbook; monitoring well inspection sheets; water level measurement sheets and survey results; monitoring instrument calibration logs; monitoring well development logs; groundwater sample logsheets and low-flow purge data sheets; chain-of-custody records; data validation letters and laboratory data sheets; waste characterization and waste manifest; and tidal study results for Round 1 are provided in Appendices A through J.

Monitoring well 8MW8S was to be included in the monitoring program per the GMP. During monitoring well inspection and development activities, it was determined that this well did not produce sufficient water volume for sampling. Historical information for the well was reviewed and it showed that this well had similar problems since it was installed. The Navy and USEPA discussed the issue and decided to replace 8MW8S with 8MW10S for the monitoring program. Monitoring well 8MW8S was eliminated from the program after well inspection, development activities, and the tidal study were completed.

2.1 MONITORING WELL INSPECTION

Prior to water level measurements, 11 monitoring wells were inspected. The monitoring wells were generally in good condition (refer to Appendix B). Issues noted during the inspection included several wells were unlabeled and did not have locks. Two wells (HNUS-23 and 8MW8S) had water in the vaults indicating a problem with the seals on the vaults.

2.2 WATER LEVEL MEASUREMENT

Water levels were measured at 11 monitoring wells and one staff gauge prior to the tidal study, at the start of the tidal study, and at two time periods during the tidal study. The tidal study was performed from December 17 to 19, 2001. The results of the tidal study are discussed in Section 2.5.

Water level measurements were also collected during low tide and high tide on January 9, 2002. Table 2-1 summarizes the January round of water level measurements. Figures 2-2 and 2-3 illustrate the potentiometric surface maps for the shallow groundwater at Goss Cove Landfill for Round 1. Reference elevations for all monitoring wells were re-surveyed after the remedial action and prior to this field sampling event. Groundwater level measurement sheets and survey results are provided in Appendix C.

2.3 MONITORING WELL DEVELOPMENT AND GROUNDWATER PURGING AND SAMPLING

Prior to purging activities, each well was re-developed. Well re-development served a dual purpose, testing well integrity and functionality, and reconditioning the well by removing any excess sediment that has settled over time. All wells were developed using a 12-volt submersible whale pump with the exception of wells 8MW2D and 8MW5. These wells were developed using a peristaltic pump due to space restriction (8MW2D) preventing the placement of the pump down the well casing, or due to an insufficient amount of water (8MW5). Prior to removing any water, each well was surged for approximately 5 minutes to loosen and agitate sediment from the well bottom and any potential scaling or fouling of the well screen for more efficient recovery. Following surging activities, groundwater was removed at a continuous rate while collecting the following parameters for each well volume:

- Temperature in Degrees Celsius (°C)
- pH
- Specific Conductance in microseimens per centimeter (mS/cm)
- Turbidity in nepholometric turbidity units (NTU)

The evacuation of water continued until the above parameters stabilized, and the water was observed as "clear" and free of visible sediment.

Once the wells were re-developed and allowed sufficient time to recharge, the wells were then prepared for sampling. Prior to sampling activities, each well was purged using a low flow method utilizing a dedicated bladder pump. Prior to purging, the initial static water level was measured in the well using a water-level indicator. During purging, the water level was measured every 5 to 10 minutes. The pumping rate was initially set at 300 milliliter per minute and adjusted as necessary such that drawdown within the well did not exceed 0.3 feet. Copies of the low-flow purge data sheets are provided in Appendix F.

During purging, water quality parameters of pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh, and salinity were measured and recorded every 5 to 10 minutes using a water quality meter and flow through cell until all of the parameters stabilized, and the minimum purge volume (equal to the stabilized drawdown volume plus the tubing volume) was removed. Stabilization of the above parameters is defined as follows:

- pH ± 0.2 standard units
- turbidity ± 10 % for values greater than 1 NTU
- specific conductance ± 10 %
- temperature ± 10 %
- Eh ± 10 mV
- dissolved oxygen ± 10 %.

When these parameters had stabilized, iron (Fe+2) was measured in the field and recorded on the sample log sheets. Following purging, samples were collected directly from the discharge end of the tubing. All sample containers were filled by allowing the discharge to flow gently down the inside of the container with minimal turbulence. Samples analyzed for volatile organic compounds (VOCs) were collected by drawing a column of water into the tubing with the pump; crimping the discharge end of the tubing; disconnecting the tubing from the well; releasing the tubing; and decanting the sample into the sample vials from an intake end of the tubing via gravity flow. Due to conditions mentioned previously, 8MW2D and 8MW5 samples were collected using a peristaltic pump. For filtered inorganic samples, an in-line 0.45-micron filter was used, pre-rinsed with approximately 400 ml of deionized water and attached to the discharge end of the pump tubing. Copies of the groundwater sample logsheets and Chain-of-Custody-Records are provided in Appendix F and G, respectively.

Groundwater samples were sent to the project laboratory (Katahdin) for analysis for select TCL VOCs, semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), pesticides and polychlorinated biphenyls (PCBs); TAL metals (total and dissolved); and water chemistry parameters (nitrate, sulfate, and hardness). Data validation letters and laboratory data sheets are provided in Appendix H. Analytical results for groundwater samples are discussed in Section 3.0.

2.4 DECONTAMINATION AND INVESTIGATION-DERIVED WASTE

All water quality and water level meters were decontaminated by rinsing with deionized water prior to and after use.

Liquid IDW derived from the monitoring of groundwater at the Goss Cove Landfill was tested for COCs during the first round of monitoring. Waste was sampled, analyzed, and disposed offsite as non-hazardous waste. Waste profile and waste manifest documentation are provided in Appendix I.

2.5 TIDAL STUDY

A tidal study was conducted at the Goss Cove Landfill monitoring wells and a staff gauge in the Thames River from December 17 through 19, 2001. One objective was to determine the proper low-tide sampling times for the tidally-influenced monitoring wells. Previously, monitoring wells have been sampled during low tide based on tidal predictions that are readily available for Smith Cove, and it was necessary to validate whether low tide at Goss Cove occurs at a comparable time as Smith Cove. A second objective was to determine the magnitude and lag times of tidal influences on the monitoring wells across the site.

Pressure transducers and data loggers were placed in 10 monitoring wells and in the Thames River at the staff gauge. The pressure transducers/data loggers were set to measure and record water levels at 6-minute intervals. This interval corresponds to the frequency used by the National Oceanic and Atmospheric Administration/National Oceanic Service (NOAA/NOS).

Data collected during the study was verified against actual tidal data recorded by NOAA/NOS at the New London station (#8461490). Prior to the comparison, the tidal data from the New London station was corrected with the appropriate factors, as specified by NOAA/NOS, to estimate tidal data at the entrance to Smith Cove. This cove is located directly across the Thames River from NSB-NLON.

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A second set of lag times was calculated as the time difference between the occurrence of low tide at the staff gauge and the low groundwater level at each monitoring well. This approach was taken because the monitoring wells are to be sampled at a time when the low tide effects on groundwater levels are greatest. Estimated low tide lag times for the monitoring wells ranged from 0 minutes at 8MW2D to 64 minutes at 8MW3.

Appendix J contains a summary of the tidal study results, supporting data, and calculations. Hydrographs at each monitoring well are provided with the Smith Cove and staff gauge elevations included as references. Tidal influences of measurable magnitude were observed at 8MW1, 8MW2D 8MW2S,

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Data collected during the study was verified against actual tidal data recorded by NOAA/NOS at the New London station (#8461490). Prior to the comparison, the tidal data from the New London station was corrected with the appropriate factors, as specified by NOAA/NOS, to estimate tidal data at the entrance to Smith Cove. This cove is located directly across the Thames River from NSB-NLON.

After the data was verified, it was used to determine the minimum and maximum tidal influence and the lag (response) time for each monitoring well. One lag time was calculated by taking the difference between the predicted time of low tide at Smith Cove and the actual time of low tide measured at the staff gauge. The Smith Cove to Goss Cove lag time for low tide was estimated as approximately 0.5 minutes; therefore, low tide predictions for Smith Cove are applicable to the Goss Cove area of the Thames River.

A second set of lag times was calculated as the time difference between the occurrence of low tide at the staff gauge and the low groundwater level at each monitoring well. This approach was taken because the monitoring wells are to be sampled at a time when the low tide effects on groundwater levels are greatest. Estimated low tide lag times for the monitoring wells ranged from 0 minutes at 8MW2D to 64 minutes at 8MW3.

Appendix J contains a summary of the tidal study results, supporting data, and calculations. Hydrographs at each monitoring well are provided with the Smith Cove and staff gauge elevations included as references. Tidal influences of measurable magnitude were observed at 8MW1, 8MW2D 8MW2S,

8MW3, 8MW5S (water drops below well screen at low tide), 8MW6D, and 8MW8D. Monitoring wells 8MW6S, 8MW7S, and 8MW8S were not tidally influenced. The results of this tidal study will be used to determine proper sampling times during subsequent sampling events at Goss Cove Landfill.

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CLIENT: Naval Submarine Base - New London		JOB NUMBER: 2863-3520	
SUBJECT: GOSS COVE LANDFILL MONITORING WELL LAG TIMES			
BASED ON: RESULTS OF TIDAL STUDY		DRAWING NUMBER: 1 AND 2	
BY: CAR Date: 6-13-02	CHECKED BY: JAW Date: 6-13-02	APPROVED BY: CAR	DATE: 6/13/02

CONCLUSIONS:

Based on the information included in this calculation, the following conclusions are made:

1) There is no significant difference between the times of Smith Cove and the Goss Cove staff gauge high and low tides. The high and low tide average lag times between the two stations are 4 minutes and 0.5 minutes, respectively.

2) The high and low tide lag times between the Goss Cove staff gauge and monitoring wells varied between wells, ranging from 3 to 111 minutes. The variations are likely due to the geologic material in the vicinity of each well.

3) From the graphs in Appendix E, monitoring wells 8MW1, 8MW2D, 8MW2S, 8MW3, 8MW5S, 8MW6D, and 8MW8D appear to all be tidally influenced wells. The transducer data obtained mirrors the data obtained for the Goss Cove staff gauge as well as the State Pier (Station 8461490). It should be noted that monitoring well 8MW5S is dry during low tide due to the depth of the well screen. Monitoring wells 8MW6S, 8MW7S, and 8MW8S do not appear to be tidally influenced wells. Since all of these wells are shallow wells, it is uncertain why they are not tidally influenced. An increase in the water elevation of monitoring well 8MW8S around 9:00 on 12-18-2002 is seen on the graph. This increase is likely due to the infiltration of precipitation into the well, and not an indication of tidal influence. Rainfall occurred during the tidal study and a copy of the rainfall data collected by Groton Utilities is provided in Appendix D. This rainfall gauge is the closest known gauge to Goss Cove Landfill.

The State Pier (Station 8461490) is a good starting point in determining when the monitoring wells of the Goss Cove Landfill should be sampled. An adjustment factor should be applied to the State Pier data to obtain the Smith Cove data. The Smith Cove data relates closely to the Goss Cove staff gauge. When sampling events are performed at Goss Cove, the average low tide lag times between the monitoring wells that are tidally influenced (8MW1, 8MW2D, 8MW2S, 8MW3, 8MW6D, and 8MW8D) and the staff gauge should be used to estimate the proper time for sampling at low tide. Monitoring well 8MW5S is also tidally influenced; however, in most cases the groundwater elevation at low tide is below the bottom of the screen interval of the monitoring well and sampling is not able to be completed at low tide. Therefore, purging and sampling at this well should begin shortly after high tide so that the sampling effort can be completed prior to the well going dry. Sampling between high and low tide should provide a reasonable estimate of contaminant levels in the groundwater.

ADDITIONAL INFORMATION:

A subsequent field investigation was conducted on January 9, 2002 during which hand measurements were taken of the water levels at monitoring wells 8MW6S, 8MW7S, and 8MW10S. The measurements were taken at 8MW6S and 8MW7S to verify the results of the initial investigation. The measurements were taken at 8MW10S to determine if it was tidally influenced. This well was not part of the initial investigation, but was selected to replace 8MW8S in the monitoring program. Monitoring well 8MW8S was not a reliable monitoring location. The following data was collected:

CLIENT: Naval Submarine Base - New London		JOB NUMBER: 2863-3520	
SUBJECT: GOSS COVE LANDFILL MONITORING WELL LAG TIMES			
BASED ON: RESULTS OF TIDAL STUDY		DRAWING NUMBER: 1 AND 2	
BY: CAR Date: 6-13-02	CHECKED BY: [illegible] Date: 6-13-02	APPROVED BY:	DATE:

Time (min)	Water Level (ft from Top of Riser)		
	8MW6S	8MW7S	8MW10S
8:00	8.43	9.16	16.55
10:35	8.43	9.13	16.55
12:50	8.49	9.14	16.59
16:30	8.54	9.14	16.59
17:55	8.54	9.20	16.58

This additional data correlates with the initial investigation and is further proof that monitoring wells 8MW6S and 8MW7S are not tidally influenced. The data for 8MW10S also indicates that this well is not tidally influenced.

CLIENT: Naval Submarine Base - New London		JOB NUMBER: 2863-3520	
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BASED ON: RESULTS OF TIDAL STUDY		DRAWING NUMBER: 1 AND 2	
BY: CAR Date: 6-13-02	CHECKED BY: JRW Date: 6-13-02	APPROVED BY: CAR	DATE: 6/13/02

CONCLUSIONS:

Based on the information included in this calculation, the following conclusions are made:

1) There is no significant difference between the times of Smith Cove and the Goss Cove staff gauge high and low tides. The high and low tide average lag times between the two stations are 4 minutes and 0.5 minutes, respectively.

2) The high and low tide lag times between the Goss Cove staff gauge and monitoring wells varied between wells, ranging from 3 to 111 minutes. The variations are likely due to the geologic material in the vicinity of each well.

3) From the graphs in Appendix E, monitoring wells 8MW1, 8MW2D, 8MW2S, 8MW3, 8MW5S, 8MW6D, and 8MW8D appear to all be tidally influenced wells. The transducer data obtained mirrors the data obtained for the Goss Cove staff gauge as well as the State Pier (Station 8461490). It should be noted that monitoring well 8MW5S is dry during low tide due to the depth of the well screen. Monitoring wells 8MW6S, 8MW7S, and 8MW8S do not appear to be tidally influenced wells. Since all of these wells are shallow wells, it is uncertain why they are not tidally influenced. An increase in the water elevation of monitoring well 8MW8S around 9:00 on 12-18-2002 is seen on the graph. This increase is likely due to the infiltration of precipitation into the well, and not an indication of tidal influence. Rainfall occurred during the tidal study and a copy of the rainfall data collected by Groton Utilities is provided in Appendix D. This rainfall gauge is the closest known gauge to Goss Cove Landfill.

The State Pier (Station 8461490) is a good starting point in determining when the monitoring wells of the Goss Cove Landfill should be sampled. An adjustment factor should be applied to the State Pier data to obtain the Smith Cove data. The Smith Cove data relates closely to the Goss Cove staff gauge. When sampling events are performed at Goss Cove, the average low tide lag times between the monitoring wells that are tidally influenced (8MW1, 8MW2D, 8MW2S, 8MW3, 8MW6D, and 8MW8D) and the staff gauge should be used to estimate the proper time for sampling at low tide. Monitoring well 8MW5S is also tidally influenced; however, in most cases the groundwater elevation at low tide is below the bottom of the screen interval of the monitoring well and sampling is not able to be completed at low tide. Therefore, purging and sampling at this well should begin shortly after high tide so that the sampling effort can be completed prior to the well going dry. Sampling between high and low tide should provide a reasonable estimate of contaminant levels in the groundwater.

ADDITIONAL INFORMATION:

A subsequent field investigation was conducted on January 9, 2002 during which hand measurements were taken of the water levels at monitoring wells 8MW6S, 8MW7S, and 8MW10S. The measurements were taken at 8MW6S and 8MW7S to verify the results of the initial investigation. The measurements were taken at 8MW10S to determine if it was tidally influenced. This well was not part of the initial investigation, but was selected to replace 8MW8S in the monitoring program. Monitoring well 8MW8S was not a reliable monitoring location. The following data was collected:

CLIENT: Naval Submarine Base - New London		JOB NUMBER: 2863-3520	
SUBJECT: GOSS COVE LANDFILL MONITORING WELL LAG TIMES			
BASED ON: RESULTS OF TIDAL STUDY		DRAWING NUMBER: 1 AND 2	
BY: CAR Date: 6-13-02	CHECKED BY: JRW Date: 6-13-02	APPROVED BY:	DATE:

Time (min)	Water Level (ft from Top of Riser)		
	8MW6S	8MW7S	8MW10S
8:00	8.43	9.16	16.55
10:35	8.43	9.13	16.55
12:50	8.49	9.14	16.59
16:30	8.54	9.14	16.59
17:55	8.54	9.20	16.58

This additional data correlates with the initial investigation and is further proof that monitoring wells 8MW6S and 8MW7S are not tidally influenced. The data for 8MW10S also indicates that this well is not tidally influenced.