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NSY PORTSMOUTH
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LETTER REPORT REGARDING LOW FLOW PILOT STUDY NSY PORTSMOUTH ME
11/13/1996
NAVFAC NORTHERN

DEPARTMENT OF THE NAVY
NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
10 INDUSTRIAL HIGHWAY
MAIL STOP, #82
LESTER, PA 19113-2090

IN REPLY REFER TO

5090
Code 1823/FE

NOV 13 1996

Ms. Meghan Cassidy
U.S. Environmental Protection Agency Region 1
JFK Federal Building, Mailcode HBT
Boston, MA 02203-2211

Mr. Iver McLeod
Maine Department of Environmental Protection
State House Station 17
Augusta, ME 04333-0017

Subj: LOW FLOW PILOT STUDY LETTER REPORT FOR PORTSMOUTH NAVAL SHIPYARD, KITTERY, ME

Dear Ms. Cassidy/Mr. McLeod:

Enclosed are copies of the low flow pilot study letter report which provides the results of our study conducted at Portsmouth Naval Shipyard between September 16 and September 20, 1996. If you have any questions on this matter please call me at (610) 595-0567 extension 159.

For the Community Restoration Advisory Board (RAB) members; if you have any comments or questions on these issues, they can be provided to the Navy at a RAB meeting, by calling the Public Affairs Office at (207) 438-1140 or by writing to:

Portsmouth Naval Shipyard
Code 106.3R, Bldg 44
Attn Marty Raymond
Portsmouth, NH 03804-5000

Sincerely,

Frederick J. Evans

FREDERICK J. EVANS, P.E.
Remedial Project Manager
By direction of the
Commanding Officer

Encl: Low Flow Pilot Study Letter Report

Distribution:
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C-49-11-6-28

November 13, 1996

Project Number 6515

Mr. Fred Evans
Remedial Project Manager
Northern Division
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, Pennsylvania 19113

Reference: CLEAN Contract No. N62472-90-D-1298
Contract Task Order No. 232

Subject: Portsmouth Naval Shipyard, Kittery, Maine
Final Low Flow Pilot Study Letter Report

Dear Mr. Evans:

As part of the Draft Groundwater Investigation and Monitoring Plan (Brown & Root Environmental, April 1996) Brown & Root Environmental (B&R Environmental) conducted a pilot study to evaluate low-flow purging and its effects on stabilization of the groundwater quality parameters (pH, specific conductance, temperature, dissolved oxygen, turbidity, salinity, and eH) that will be field monitored during the Groundwater Investigation at Portsmouth Naval Shipyard (PNS) in Kittery, Maine. The pilot study was conducted from September 16 through September 20, 1996 for the U.S. Department of the Navy (Navy) under the Comprehensive Long-Term Environmental Action Navy (CLEAN), Contract Number N62472-90-D-1298, Contract Task Order (CTO) 232. The purpose of this brief letter report is to discuss the findings of the pilot study including recommendations for the upcoming sampling.

The pilot study was conducted in accordance with the Draft Groundwater Investigation and Monitoring Plan (the Plan). Low-flow purging was conducted during both low and high tidal cycles to determine if there are any significant differences in stabilization between low and high tide. Sampling, however, will be conducted at low tide only (for tidally influenced wells). At low tide, contaminant concentrations are expected to be at a maximum concentration, therefore, providing conservative data (at high tide, inflow of "clean" water would potentially dilute the contaminants in tidally influenced wells). Details of the pilot study are provided in the Plan and included in this letter report as Attachment A. One exception was taken to the Plan. Monitoring well HW-2 was purged independent of tide conditions, rather than at low and high tide because the well is located inland where groundwater is known to be fresh and not impacted by tidal changes. Monitoring well HW-2 was tested twice since it was purged dry during the first test. Monitoring well JW-12B was retested at low tide because purging was not initiated approximately three hours prior to low tide the first time and the well did not stabilize within three hours. Therefore, 11 tests were conducted but nine tests (excludes the initial HW-2 and JW-12B test) are evaluated herein. Representatives from EPA Region I and the State of Maine Department of Environmental Protection (MEDEP) were present for portions of the pilot study.

The location of the five monitoring wells (DW-3, DW-7B, JW-13D, JW-12B, and HW-2) included in the pilot study are shown on Map A which is included as Attachment B. The Pump Tracking Sheet which presents a tabulation of the pump installation information is included as Attachment C. The Low Flow Purge Data Sheets which present a tabulation of the data collected during purging are included as Attachment D. The pilot study results are summarized in Tables 1 and 2. Table 1 presents a summary of results in terms of the time taken to reach stabilization. Table 2 presents a summary of results in terms of the purge volume removed to reach stabilization. The results are discussed below in terms of each criterion used to determine when a sample can be collected (e.g., after stabilization is reached). Stabilization is discussed in reference to EPA guidance (±0.2 for pH and ±10 % for all other parameters for 3 consecutive readings taken 5 minutes apart). The results are discussed in the following order: pH, specific conductivity, temperature, salinity, turbidity, eh, dissolved oxygen, pumping rate, water level drawdown and purge volume. Stabilization is discussed first in terms of time and then in terms of purge volume.

pH, Specific Conductivity, Salinity

The pH readings stabilized within 30 minutes during seven of the nine tests. The readings stabilized within one hour for the remaining two tests (DW-7B at low tide and HW-2). Once pH stabilized it remained stabile for the remainder of the test. The stabilization of specific conductivity and temperature readings was identical to pH. The stabilization of salinity readings was identical to pH and specific conductivity except for at the fresh water well (HW-2) where salinity readings took twice as long (approximately one hour rather than one-half hour) to stabilize and continued to decrease after three readings within ten percent were recorded. The pH, specific conductivity and salinity readings were never the controlling parameter for sampling (e.g., other parameters took longer to stabilize).

The pH readings stabilized within one saturated screen length volume being removed at all but one of the tests (JW-13D high tide did not stabilize until 1.3 saturated screen length volumes were removed). Specific conductivity and salinity also stabilized within one saturated screen length volume being removed during all tests except JW-13D high tide where it took 1.1 volumes.

Turbidity

The turbidity readings stabilized at less than 5 NTU during six tests (JW-13D low and high tide, DW-3 low and high tide, DW-7B low tide, and HW-2). Two tests stabilized above 5 NTU (DW-7B stabilized at 14.2 NTU and JW-12B high tide stabilized at 248.1 NTU). One test did not stabilize (JW-12B low tide). In two tests (DW-7B low tide and JW-12B high tide) the stabilized reading was not the lowest reading achieved. During four of the nine tests turbidity stabilized within approximately 30 minutes. During the other five tests turbidity either did not stabilize at all or did not stabilize for at least an hour. Although turbidity at HW-2 did not stabilize for almost two hours, turbidity readings were less than 5 NTU after 39 minutes. At six of the nine tests turbidity was the controlling parameter for sampling.

The turbidity readings stabilized within two saturated screen length volumes during five of the nine tests. Two tests (JW-13D low tide and DW-3 low tide) stabilized after slightly more than two volumes were removed. HW-2 did not stabilized until 4.2 volumes were removed and JW-12B low tide never stabilize even after 7.3 volumes had been removed.

eH

The eH readings stabilized within the three hour test period for all of the tests. The eH readings during several of the tests moved outside the stabilized range after stabilization occurred. At JW-13D high tide, eH was the last parameter to stabilize after approximately one hour and therefore was the controlling parameter for sampling.

The eH readings stabilized within one saturated screen length volume being removed at six of the nine tests; within two volumes at two tests (JW-12B low tide and HW-2); and not until 3.8 volumes at JW-13D high tide.

Dissolved Oxygen

The dissolved oxygen readings stabilized within the three hour test period for all of the tests. The dissolved oxygen moved outside the stabilized range after stabilization occurred. At DW-3 low tide and JW-12B high tide, dissolved oxygen was the last parameter to stabilize after approximately one and one-half to two hours.

The dissolved oxygen readings stabilized within one saturated screen length volume being removed at four of the nine tests; within two volumes at two tests (JW-13D high tide and HW-2); and greater than two volumes at three tests (DW-3 low tide at 2.4 volumes, JW-12B low tide at 7.3 and JW-12B high tide at 2.9).

Pumping Rate

The initial pumping rate of 300 ml/min had to be decreased in all tests to achieve lower turbidity. The pumping rate when stabilization occurred ranged from 35 to 166 ml/min.

Water Level Drawdown

With the exception of HW-2, drawdown as a result of pumping could not be determined because changes in the water level were also impacted by the rising or falling tide. The drawdown at HW-2, which is not impacted by the tide, was approximately zero feet which meets the requirement of less than 0.3 feet.

Purge Volume

The purge volume at stabilization was less than the required two saturated screen length volumes for four of the nine tests. Purging was, however, continued during these four tests until at least two saturated screen length volumes were removed.

In all but one of the tests the turbidity readings were lower after purging (at DW-7B low tide the turbidity reading started at 8.9 and stabilized at 14.2 even though a reading of 6 was achieved during the test). At six of the nine tests low flow purging resulted in turbidity readings below the goal of five NTU. This is a significant improvement over previous sampling using conventional techniques when turbidity ranged from 6 to greater than 200 NTU. The largest improvement was at DW-7B where turbidity was greater than 200 previously and was 14.2 using low flow purging.

Revised EPA Region I Low Flow Standard Operating Procedure

The EPA low-flow purging and sampling procedure included in the Draft Groundwater Investigation Plan and therefore, followed during the pilot study has been revised by the EPA. The revised version is included as Attachment E. The differences between the old and new standard operating procedure (SOP) are summarized below:

- Collection of turbid free water samples may be especially difficult if there is 2 feet or less of standing water in the well. (The previous SOP stated 3 feet of standing water).

- Stabilization is considered achieved when parameters have stabilized and the final purge volume is greater than the stabilized drawdown volume plus the extraction tubing volume. (The previous SOP stated 2 saturated screen intervals.)

- If the recharge rate of the well is lower than the extraction well capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized. (The previous SOP stated that the minimum purge volume of 2 saturated screen lengths had to be removed first.)

- Stabilization requirements have changed as follows:

Parameter	New Limit	Previous Limit
Turbidity	+/- 10% for values > than 1 NTU	+/- 10%
Dissolved Oxygen	+/- 10%	+/- 10%
Conductivity	+/- 3%	+/- 10%
pH	+/- 0.1 unit	+/- 0.2 unit
Temperature	+/- 3%	+/- 10%
Eh	+/- 10 millivolts	+/- 10%

Recommendations

Based on the previous presentation and discussion of results, the following recommendations are made for future low flow purging:

- The pumps/flow-through cells worked well and should be used for groundwater sampling. The procurement of pumps, compressors, etc. should be initiated.

- The revised EPA guidance on low-flow purging, dated July 30, 1996, should be followed except as noted below.

- The drawdown criterion of 0.3 feet or less should not be applied at tidally influenced wells because drawdown cannot be determined during purging in tidally affected wells.

- The initial pumping rate of 300 ml/min should be reduced to 100 ml/min to 200 ml/min or lower, if possible, because all of the pilot study tests demonstrated that a pumping rate of less than 200 ml/min is required to obtain turbidity readings of less than 5 NTU. In addition the pumping rate of 300 ml/min caused rapid drawdown in well HW-2 and the well was purged dry. Later in the week the well was purged again at a much lower rate (100 ml/min) and there was no drawdown. This agrees with EPA guidance (Attachment E) that states that the pumping rate should be started at as low a rate as possible.

- During purging of some wells (JW-12B and DW-7B), the turbidity readings would increase, indicating a problem with the turbidity cell. The field crew found that sediment would build up in the flow through cell and that after cleaning the cell the readings would decrease. The cell should be cleaned at each well prior to purging and during purging, as needed (e.g., when fluctuating turbidity readings are observed and confirmed by collection of a turbidity sample before the cell for comparison). A tee connector with a valve should be inserted into the pump's tubing prior to the cell for collection of the turbidity sample. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities. The cell should be cleaned by rinsing with deionized water.

- With the exception of JW-12B low tide, which had a previous turbidity during sampling of greater than 200 NTU, the field monitored parameters stabilized within one and one-half hours. The lowest turbidity reading at JW-12B low tide occurred within 30 minutes (e.g., extending the test to the three hours referenced in the EPA guidance did not provide improved results). If the parameters have not stabilized after one and one-half hours, then sampling should be initiated. It is estimated that sample collection may generally take up to one hour. Therefore, for tidally influenced wells purging should commence approximately two and one-half hours prior to low tide so that the sample is taken between one hour before low tide of the well and before the end of the slack tide for the well.

- In some cases (e.g., JW-12B) low-flow purging does not result in the collection of low turbidity samples. This may be a result of well construction or well development problems. Those wells which have excessive turbidity even after low-flow purging for one and one-half hours (e.g., lowest turbidity after purging is greater than 50 NTUs) should be sampled and then scheduled for redevelopment following completion of the first round of sampling. After redevelopment, the well should be resampled. If the sample collected following redevelopment has a lower turbidity than the sample collected prior to redevelopment, then the sample will be sent for laboratory analysis.

- The EPA has stated that the turbidity probe contained in the flow through cell uses an infrared light source and this source does not meet the requirements of EPA Method

180.1. EPA Method 180.1 requires a visible light source. Therefore, the turbidity probe in the flow through cell should be used up to the time the turbidity stabilizes and then turbidity stabilization should be confirmed with a HORIBA water quality meter or other visible light source turbidity probe.

- Although eH and dissolved oxygen stabilized for the pilot test wells, it is recognized that eH and dissolved oxygen are sensitive parameters (e.g., in three cases eH or dissolved oxygen was the last parameter to stabilize, and after stabilizing readings for these parameters during several tests moved outside the stabilized range) and may not stabilize for all remaining wells even though low turbidity readings are reached. If stabilization of eH and dissolved oxygen do not occur, the maximum purge time should remain one and one-half hours.

Precautions will be taken to prevent air entrapment and/or air leaks in the purging system so that potential problems with stabilizing dissolved oxygen are minimized. Precautions will include: 1) taking care to fill the cell with water, while minimizing air entrapment, prior to initiating purging and 2) maintaining a full cell of water by pinching the discharge line shut or keeping the tubing from the pump to the cell elevated above the cell.

- Wells that are not significantly tidally influenced will be sampled independent of the tide. A list of wells that will be sampled independent of the tide and the justification is presented in Table 3. Resolution of this item is required to develop a detailed field planning effort. A detailed field planning effort for all 70 wells will be developed to coordinate field work efforts based on monitoring well characteristics (e.g., tidally influenced), tide tables, number of sampling crews, available sampling equipment and working hours.

- Placement of the cap which holds the pump and tubing in place at each well results in water level measurements being taken from a new elevation. In addition several wells are being converted to flush mounts and others are being repaired. Therefore the elevations of all monitoring wells should be resurveyed.

- The controllers cannot operate efficiently using bottle gas and therefore compressors should be used throughout.

- The flow through cells and tubing are susceptible to freezing, so cold weather conditions (below 32 degrees) will be a factor. The cell will be heated, if needed, by placing it in a container of warm water.

- Pertinent stabilization data should be recorded in the upcoming field log book to aid future sampling efforts, particularly in refining required time frames.

Please contact me at 412-921-7217 if you have any questions or comments.

Sincerely,

Mark T. Perry

Mark T. Perry
Project Manager

MTP/dt

Enclosures

c: Mr. Roger Boucher - NAVFAC NORTHDIV (w/o enclosures)
Mr. John Trepanowski, P.E. - B&RE Wayne
Mr. Daryl Hutson - B&RE Pittsburgh (w/o enclosures)
Mr. Mark Mengel - B&RE Pittsburgh
Project File 6515, CTO 232

TABLE 1
SUMMARY OF RESULTS (IN TERMS OF TIME)
LOW FLOW PILOT STUDY
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

Well No.	Tide	TIME TO REACH STABILIZATION (minutes)[1]							Initial Turbidity Reading (NTU)	Stabilized Turbidity Reading[2] (NTU)	Stabilized Pumping Rate (ml/min)	Stabilized Drawdown (ft)	Stabilized Purge Volume (No. of saturated screen length volumes)	Comments	Reference Turbidity from Previous Sampling (NTU)
		pH	Specific Conductivity	Temperature	Turbidity	eH	Dissolved Oxygen	Salinity							
JW-13D	Low	12	12	12	37	12	12	12	0.0	0.0	140	[3]	2.1		15-147
JW-13D	High	22	17	17	32	67	27	17	55.7	0.0	166	[3]	3.8		
DW-3	Low	21	21	21	75	21	80	21	6.6	0.7	155	[3]	2.4		6-116
DW-3	High	21	21	21	72	26	31	21	57.5	0.0	90	[3]	1.3		
DW-7B	Low	42	42	42	82	47	52	42	8.9	14.2	[4]	[3]	>1.7	The lowest turbidity recorded during the test was 6.0 NTU after 27 minutes.	>200
DW-7B	High	20	20	20	25	25	25	20	7.4	0.0	166	[3]	0.7		
JW-12B	Low[5]	25	25	35	DNS	65	200	25	171.1	DNS	DNS	[3]	DNS	Turbidity reading after 3 hours and 28 minutes was 146 NTU. Flow rate at that time was approximately 100 ml/min. 7.3 saturated screen length volumes were purged.	>200
JW-12B	High	20	20	20	30	20	70	20	175.3	248.1	100	[3]	2.9	The lowest turbidity recorded during the test was 145.3 NTU after 125 minutes.	
HW-2	NA	29	34	39	114	49	59	39	40.2	0.0	124	[3]	4.2		Not Sampled

[1]Stabilization - ±0.2 for pH and ±10% for all other parameters for 3 consecutive readings taken 5 minutes apart.
[2]Negative turbidity readings were interpreted as zero per discussions with manufacturer.
[3]Drawdown as a result of pumping cannot be determined because changes in water level are also impacted by the tide rising or falling.
[4]No reading taken. Pump was being adjusted.
[5]Results presented are associated with the re-test.

DNS - Did Not Stabilize.
NA - Not Applicable. Pilot test was run independent of the tidal cycle since the well is not affected by the tide.

TABLE 2
SUMMARY OF RESULTS (IN TERMS OF PURGE VOLUME)
LOW FLOW PILOT STUDY
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

Well No.	Tide	PURGE VOLUME REMOVED TO REACH STABILIZATION[1] (No. of saturated screen lengths)							Initial Turbidity Reading (NTU)	Stabilized Turbidity Reading[2] (NTU)	Stabilized Pumping Rate (ml/min)	Stabilized Drawdown (ft)	Stabilized Purge Volume (No. of saturated screen length volumes)	Comments	Reference Turbidity from Previous Sampling (NTU)
		pH	Specific Conductivity	Temperature	Turbidity	eH	Dissolved Oxygen	Salinity							
JW-13D	Low	0.7	0.7	0.7	2.1	0.7	0.7	0.7	0.0	0.0	140	[3]	2.1		15-147
JW-13D	High	1.3	1.1	1.1	1.9	3.8	1.6	1.1	55.7	0.0	166	[3]	3.8		
DW-3	Low	0.5	0.5	0.5	2.3	0.5	2.4	0.5	6.6	0.7	155	[3]	2.4		6-116
DW-3	High	0.4	0.4	0.4	1.3	0.6	0.7	0.4	57.5	0.0	90	[3]	1.3		
DW-7B	Low	0.6	0.6	0.6	>1.7	0.8	0.9	0.6	8.9	14.2	[4]	[3]	>1.7	The lowest turbidity recorded during the test was 6.0 NTU after 27 minutes.	>200
DW-7B	High	0.5	0.5	0.5	0.7	0.7	0.7	0.5	7.4	0.0	166	[3]	0.7		
JW-12B	Low[5]	0.5	0.5	0.7	DNS	1.7	7.3	0.5	171.1	DNS	DNS	[3]	DNS	Turbidity reading after 3 hours and 28 minutes was 146 NTU. Flow rate at that time was approximately 100 ml/min. 7.3 saturated screen length volumes were purged.	>200
JW-12B	High	1.0	1.0	1.0	1.7	1.0	2.9	1.0	175.3	248.1	100	[3]	2.9	The lowest turbidity recorded during the test was 145.3 NTU after 125 minutes.	
HW-2	NA	0.4	0.6	0.8	4.2	1.3	1.8	0.8	40.2	0.0	124	[3]	4.2		Not Sampled

[1]Stabilization - ±0.2 for pH and ±10% for all other parameters for 3 consecutive readings taken 5 minutes apart.
[2]Negative turbidity readings were interpreted as zero per discussions with manufacturer.
[3]Drawdown as a result of pumping cannot be determined because changes in water level are also impacted by the tide rising or falling.
[4]No reading taken. Pump was being adjusted.
[5]Results presented are associated with the re-test.
DNS - Did Not Stabilize.
NA - Not Applicable. Pilot test was run independent of the tidal cycle since the well is not affected by the tide.

TABLE 3
TIDALLY AFFECTED WELLS [1]
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

WELL NO.	TIDALLY AFFECTED	WATER LEVEL LOW TIDE [2] (feet)	WATER LEVEL HIGH TIDE [2] (feet)	DIFFERENCE (feet)
DI-O1B	NO	12.22	12.25	-0.03
DI-01DB [3]	NO	13.18	13.18	0.0
FA-01	NO	8.38	8.40	-0.02
FA-O1B	YES	9.48	8.05	1.43
FA-O1DB	YES	9.97	8.42	1.55
SI-O1B	NO	1.82	1.85	-0.03
SI-01DB	NO	5.92	5.85	0.07
DW-O7DB	YES	15.46	10.69	4.77
JW-13DB [4]	YES	11.57	11.36	0.21
HW-3 [5] [6]	NO	---	---	---
WOT-2	NO	4.20	4.19	0.01
WOT-3	NO	5.02	5.02	0.0
WOT-4	NO	3.66	3.74	-0.08
WOT-5	NO	6.21	6.22	-0.01
JW-3	NO	6.31	6.36	-0.05
JW-4	NO	7.57	7.67	-0.1
JW-5	YES	7.18	5.60	1.58
JW-6	NO	6.71	6.74	-0.03
JW-7	NO	5.30	5.28	0.02
JW-7B	NO	5.48	5.48	0.0
JW-8	NO	7.93	7.98	-0.05
JW-8B	NO	8.32	8.37	-0.05
JW-9	NO	5.62	5.73	-0.11
JW-9B	NO	5.52	5.61	-0.09
JW-10	YES	9.91	5.72	4.19
JW-12S [6]	YES	11.67	5.44	6.23
JW-12D	YES	14.99	5.34	9.65
JW-13S [6]	YES	11.85	7.35	4.5
JW-13B	YES	14.74	7.68	7.06
JW-14 [4]	YES	8.37	8.30	0.07
JW-14B [4]	YES	9.56	9.22	0.34
JW-15	YES	10.17	6.46	3.71
JW-15B	YES	11.04	6.85	4.19
JW-16	NO	5.11	5.08	0.03
JW-16B	NO	5.04	5.03	0.01
JW-17B	NO	6.78	6.70	0.08
JW-18 [7]	NO	8.44	8.41	0.03
JW-18B [5] [7]	NO	---	---	---
JW-19	NO	11.22	11.21	0.01
JW-19B [3]	NO	11.84	12.22	-0.38
MW-2	NO	12.75	12.54	0.21
MW-3	NO	13.51	13.45	0.06
MW-4	NO	12.81	12.97	-0.16
MW-5	NO	13.14	13.17	-0.03

WELL NO.	TIDALLY AFFECTED	WATER LEVEL LOW TIDE [2] (feet)	WATER LEVEL HIGH TIDE [2] (feet)	DIFFERENCE (feet)
MW-6	NO	13.27	13.23	0.04
MW-7	NO	13.51	13.70	-0.19
DW-1 [6]	YES	11.77	8.23	3.54
DW-1B	YES	13.40	8.50	4.9
DW-2 [5] [7]	YES	---	---	---
DW-2B	YES	17.48	8.78	8.7
DW-4	YES	12.19	8.68	3.51
DW-5	YES	9.28	8.11	1.17
DW-6 [4]	YES	8.47	8.21	0.26
DW-7	YES	17.35	8.37	8.98
DW-8	YES	13.51	6.44	7.07
DW-8B	YES	14.16	6.10	8.06
DW-9	YES	14.23	7.65	6.58
DW-10B [3]	YES	14.16	10.65	3.51
FW-1	YES	8.33	5.32	3.01
FW-2	YES	10.32	3.73	6.59
FW-3	YES	10.51	3.43	7.08
FW-4	YES	11.84	4.66	7.18
FW-5	YES	10.80	4.21	6.59
FW-6 [3]	YES	12.21	3.67	8.54
GW-1	NO	10.18	10.16	0.02
DW-3	YES	14.92	6.47	8.45
DW-7B	YES	17.00	9.53	7.47
JW-12B	YES	14.91	4.90	10.01
JW13D	YES	15.99	7.72	8.27
MW-10-BW [5]	YES	---	---	---
HW-2 [5]	NO	---	---	---

NOTES:

1. The monitoring wells shown in **BOLD** are considered to be tidally influenced (e.g., difference between low and high tide greater than 1 foot) and therefore should be sampled at low tide.

2. Low tide/high tide water level data were obtained on July 26, 1994. The low tide was -0.4 feet.

3. Four wells (DI-01DB, DW-10B, JW-19B, and FW-6) are damaged and cannot be sampled until they are replaced.

4. Although the difference between low and high tide is less than one foot, the location indicates that the well may be tidally affected and therefore the well will be sampled at low tide.

5. Water level data was not available. The tidally influenced determination was made based on the well location and the tidal impact on nearby wells.

6. Peristaltic pumps will be used in four wells (HW-3, DW-1, JW-12S, and JW-13S) where water depth is not sufficient for pump installation.

7. Three wells (JW-18, JW-18B, and DW-2) have not been located.

ATTACHMENT A

PILOT STUDY PLAN
(Taken from the Draft Groundwater Investigation and Monitoring Plan, Brown & Root Environmental, April 1996)

4.0 SAMPLING AND ANALYSIS

4.1 PILOT STUDY

As part of the Groundwater Investigation and Monitoring Plan, a pilot study will first be performed to evaluate low-flow purging and its effects on the groundwater quality parameters that will be field monitored during this investigation (pH, specific conductance, temperature, dissolved oxygen, turbidity, salinity, and eH) at selected monitoring wells. At the completion of the pilot study, the data will be evaluated for trends and for stabilization of groundwater quality parameters. A brief letter report will be generated discussing the findings, including recommendations for the subsequent baseline conditions sampling. A detailed discussion of the pilot study and rationale is described below.

4.1.1 Sampling Rationale

The primary objective of the pilot study will be to determine whether or not field measurements collected during low-flow purging of the monitoring wells will stabilize within the guidelines established for each of the individual groundwater quality parameters, as follows, in accordance with EPA guidance provided in Appendix B: pH, $\pm$ 0.2 standard units; specific conductivity, +/- 10 %; temperature, +/- 10 %; turbidity, +/- 10 %; eH, +/- 10 %; dissolved oxygen (DO), +/- 10 % and salinity. Through previous investigations conducted at the PNS it has been determined that the exchange of tidal water in some of the monitoring wells may effect the stabilization of water quality parameters. To date, monitoring wells at the NSY Portsmouth have been purged and sampled using conventional style pumping and/or bailing methods. The pilot study will consist of low-flow purging using stainless steel, bladder-style submersible pumps on five monitoring wells selected based on several criteria, as described below.

Two monitoring wells each have been selected from the primary sites of concern; the JILF Landfill Area and the DRMO Salvage Yard Area. An attempt has been made to select wells which have historically been known to have high turbidity readings and high total metal results. Other criteria includes the selection of one well from each area where the groundwater quality is brackish and one from each area where the groundwater quality is saline (seawater). During the RFI Data Gap Investigation (Halliburton NUS, 1995a) several of the monitoring wells along the shoreline recovered so quickly during slug tests that the hydraulic conductivity could not be determined. It is possible that water quality parameters may not easily stabilize where the permeability of the porous media is so high. Therefore, one well from each area has been selected that exhibits quick recovery and one well will be monitored that demonstrates slower recovery

characteristics. The fifth monitoring well to be selected, will be located further inland where groundwater is known to be fresh with high turbidity. The following table shows the monitoring wells that were selected based upon the above criteria.

WELL NO.	TIDALLY INFLUENCED	TURBIDITY (DURING DEVELOPMENT)	TURBIDITY (DURING SAMPLING)	METALS DATA	WATER QUALITY	HYDRAULIC CONDUCTIVITY (FT/DAY)
DW-3	YES	< 5	6 - 116	(b)	SEAWATER	TOO FAST TO MEASURE
DW-7B	YES	> 5	> 200	(b)	BRACKISH	8.39
JW-13D	YES	< 5	15 - 147	(b)	SEAWATER	TOO FAST TO MEASURE
JW-12B	YES	> 5	> 200	(b)	BRACKISH	60.69
WOT-06(a)	NO	> 5	74	(b)	FRESH	0.27

NOTES: (a) WOT-06 has been damaged and has been replaced with HW-2.

(b) Numerous total metals, including lead, exceed On-Shore Media Protection Standards (MPS), while only a few filtered metals are present at much lower concentrations.

Turbidity units expressed in NTUs.

4.1.2 Technical Approach

The purging procedures to be used during the pilot study will follow Section 4.3 of this Plan. The equipment to be used during the pilot study will consist of stainless steel, bladder-type pumps to be permanently installed in the wells. To measure water quality parameters during the purging, a flow-through cell will be used that is capable of measuring all of the required parameters. Each of the monitoring wells identified above will be purged during both low and high tidal cycles. High and low tides will be determined by the tide tables. Purging will begin approximately 3 hours before the peak of each cycle. It is proposed that 2 monitoring wells will be purged simultaneously during each cycle (DW-3 and DW-7B) and (JW-13D and JW-12B) to obtain same point in time comparisons. The pumps will remain in place until both low and high tide cycles are completed. The remaining well will be purged independently.

When purging the wells, the pumping rate will be adjusted based on the drawdown of the well being pumped. Drawdown will not be greater than 0.3 feet during the purging. Monitoring wells will be pumped initially at 300 ml per minute and adjusted to a slower rate as needed. Water quality parameters will be

monitored and recorded approximately every 5 minutes throughout the purging cycle until all of the parameters have stabilized and a minimum purge volume of two saturated screen lengths is removed. If water quality parameters do not stabilize within 3 hours, samples will be collected anyway (unless some other "trigger" is determined appropriate during the pilot study).

All purge water will be containerized in 55-gallon drums provided by PNS. It is expected that approximately three 55-gallon drums of purge water will be generated during the pilot study. All containerized water will be turned over to PNS for disposal at the completion of the pilot study. Purge water should be staged until results of the sampling have been identified.

4.1.3 Reporting

At the completion of the pilot study, all of the data will be tabulated and evaluated for trends as to whether water quality parameters stabilized during purging. Recommendations for the subsequent first event sampling program will be made in the form of a brief letter report.

~~4.2 SELECTION OF MONITORING WELLS FOR SAMPLING AND ANALYSIS~~

~~4.2.1 Groundwater Monitoring - First Two Events Re-Sampling~~

~~Re-sampling will be conducted at all 55 existing monitoring wells installed as part of the RFI and 15 monitoring wells installed during the RFI Data Gap investigation. Additionally, monitoring is included for MW-10-BW from the Stearns & Wheler investigation of the tank farm; this well is upgradient of the DRMO Salvage Yard. Two rounds of sampling are initially planned. Future sampling events, as required, will build on the existing database and be used in migration modeling efforts. Analysis primarily consists of TCL organics/TAL inorganics which is consistent with the analytical methods used for the RFI and RFI Data Gap investigations. Freon will be quantitated by the laboratory, and included with the TCL volatiles analysis. Qualitative information on TICs will be provided with the TCL analytical package in accordance with EPA Region I guidance. Also indicator parameters will be analyzed; however replicate sampling will not be conducted, since sampling/analysis includes TCL organics/TAL inorganics, resulting in less reliance on indicator parameters. Gasoline range and diesel range petroleum hydrocarbons will also be analyzed, where appropriate.~~

~~Analytes for the first two events of groundwater monitoring were established based on an evaluation of the complete database for the PNS facility (Halliburton NUS, 1995b). Rationale for inclusion/ omission of~~

~~M-scopes will be calibrated prior to each sampling event by comparison of M-scope markings with a steel~~ tape measure.

4.3.3 Measurement of Immiscible Layers

During installation of the low-flow pumps, floating free product may be encountered at a few wells, particularly the FW wells at the Fuel Oil Spillage Area at Berth 6. To address this problem wells containing LNAPL will be purged using a peristaltic pump before the submersible pump is installed. The peristaltic pump will be lowered to the top of the LNAPL, and purged moving the tube increasingly downward until the pump begins to extract water. At that point the tubing will be removed and the pump lowered into well and installed. Since pump installation will be permanent, this procedure only applies to the initial installation.

Measurement of light phase floating product, which is less dense than water, will take place before purging of a given monitoring well for sampling purposes. Free product measurement will be accomplished with an interface probe. Thickness of the free product layer, detected at the potentiometric surface, will be recorded in the field logbook. All monitoring wells at the Former Waste Oil Tanks including JW-16 and JW-16B and the Fuel Oil Spillage Area will be checked for floating product using the interface probe.

Measurement of dense non-aqueous phase layer (DNAPL) will also occur before purging of a given monitoring well for sampling purposes and will be accomplished with an interface probe. Thickness of the free product layer, detected by lowering the instrument to the bottom of the monitoring well will be recorded in the field logbook. All monitoring wells at the Former Waste Oil Tanks including JILF monitoring wells ~~JW-16 and JW-16B will be checked for DNAPL using the interface probe.~~

4.3.4 Well Purging

It is anticipated that dedicated 1.66 inch diameter low-flow bladder type pumps will be installed in all of the monitoring wells prior to the baseline sampling. The pumps will be certified contaminant free; this certification as well as lot numbers will be provided in an appendix of the initial groundwater monitoring report. Purging and sampling will be accomplished by using low-flow purging techniques in accordance with SOP-SA-1.1 (Groundwater Sample Acquisition) and US EPA Region I Low-Flow Purging and Sampling Procedure found in Appendix B. Low-flow purging and sampling is being implemented because this method will provide the least disturbance to the surrounding formation (i.e., less turbulence in sampling and hence less turbidity) allowing for a more representative sample to be collected. Specific purging requirements will be determined during the pilot-scale study (Refer to Section 4.2).

Prior to obtaining groundwater samples, water levels will be measured using an electric water-level indicator (M-Scope) capable of 0.01-foot accuracy. Water levels will be monitored every 3 to 5 minutes as purging occurs. Each monitoring well will be purged and sampled using a dedicated, low-flow 1.66-inch diameter bladder pump and dedicated teflon or teflon-lined polyethylene tubing. The pump will be placed at the midpoint of the well screen and if possible no less than 2 feet above the bottom of the well so as to not disturb any sediment which may be located near the bottom of the well. Initially, the pumping rate will be set at approximately 0.3 liters per minute, not to exceed 0.5 liters per minute. The pumping rate will be reduced to 0.1 to 0.2 liters per minute if turbidity is greater than 5 NTUs after all other field parameters have stabilized. The pumping rates will be adjusted so as to not allow drawdown to exceed 0.3 feet during the purging. If groundwater is drawn down below the top of the well screen purging will cease and the well will be allowed to recover before purging continues. Slow recovering wells will be identified and purged at the beginning of the work day. If possible samples will be collected from these wells within the same 8-hour work day.

During purging, water quality parameters (pH, turbidity, specific conductance, temperature, eH, salinity, and dissolved oxygen) will be measured and recorded every 5-minutes using a flow-through cell until all of the parameters have stabilized and the minimum purge volume has been removed (2-saturated well screen volumes). Stabilization of the above parameters is defined as follows:

- pH $\pm$ 0.2 standard units
- turbidity $\pm$ 10 %
- specific conductance $\pm$ 10 %
- temperature $\pm$ 10 %
- eH $\pm$ 10 %
- dissolved oxygen $\pm$ 10 %

Calibration and standards checks will be conducted on the flow-through cell in accordance with the manufacturer.

Purge water will be containerized and labeled by B&R Environmental. The empty containers will be provided by PNS. The containerized water will be turned over to PNS for disposal. Refer to Section 4.3.7 concerning residue management.

Section 5.0 of SOP-SF-1.1, attached in Appendix B, provides additional requirements for groundwater sample acquisition.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW FLOW (minimum stress) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

I. SCOPE & APPLICATION

The purpose of this standard operating procedure (SOP) is to provide information on the collection of ground water samples that are "representative" of mobil organic and inorganic loads in the vicinity of the selected open well interval, at near natural flow conditions. The minimum stress procedure emphasizes negligible water level drawdown and low pumping rates in order to collect samples with minimal alterations in water chemistry. This procedure is designed primarily to be used in wells with a casing diameter of 2 inches or more and a saturated screen, or open interval, length of ten feet or less. Samples obtained are suitable for analyses of common types of ground water contaminants (volatile and semi-volatile organic compounds, pesticides, PCBs, metals and other inorganic ions [cyanide, chloride, sulfate, etc.]). This procedure is not designed to collect samples from wells containing light or dense non-aqueous phase liquids (LNAPLs or DNAPLs) using pumps.

The procedure is flexible for various well construction and ground water yields. The goal of the procedure is to obtain a turbidity level of less than 5 NTU and to achieve a water level drawdown of less than 0.3 feet during purging and sampling. If these goals cannot be achieved, sample collection can take place provided the remaining criteria in this procedure are met.

II. EQUIPMENT

Adjustable rate, submersible pump (e.g., centrifugal or bladder pump constructed of stainless steel or Teflon). Peristaltic pumps may be used only for inorganic sample collection.

Disposable clear plastic bottom filling bailers may be used to check for and obtain samples of LNAPLs or DNAPLs.

Tubing - Teflon, Teflon lined polyethylene or stainless steel tubing must be used to collect samples for organic analysis. For samples collected for inorganic

analysis, Teflon or Teflon lined polyethylene, PVC, Tygon, polyethylene or stainless steel tubing may be used.

Water level measuring device, 0.01 foot accuracy, (electronic devices are preferred for tracking water level drawdown during all pumping operations).

Flow measurement supplies (e.g., graduated cylinder and stop watch).

Interface probe, if needed.

Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at a safe distance from the well so that the exhaust fumes do not contaminate the samples.

Indicator parameter monitoring instruments - pH (EPA Methods 150.1 or 9040), turbidity (EPA Method 180.1), specific conductance (EPA Methods 120.1 or 9050) , and temperature (EPA Method 170.1). Use of a flow-through cell is recommended. Optional Indicators - eH and dissolved oxygen (EPA Method 360.1), flow-through cell is required. Standards to perform field calibration of instruments.

Decontamination supplies.

Logbook(s), and other forms (e.g. well purging forms).

Sample Bottles.

Sample preservation supplies (as required by the analytical methods).

Sample tags or labels.

Well construction data, location map, field data from last sampling event.

Field Sampling Plan.

PID or FID instrument for measuring VOCs (volatile organic compounds).

III. PRELIMINARY SITE ACTIVITIES

Check well for damage or evidence of tampering, record pertinent observations.

Lay out sheet of polyethylene for monitoring and sampling equipment.

Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one.

Note that if water level data will be used to construct potentiometric surface map(s) then a synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin.

Measure and record the depth to water (to 0.01 ft) in the well to be sampled before any purging begins. Care should be taken to minimize disturbance of any particulate attached to the sides or at the bottom of the well.

Measure and record (as appropriate) the depth of any DNAPLs or LNAPLs with an interface probe. Care should be given to minimize disturbance of any sediment which has accumulated at the bottom of the well. If LNAPLs or DNAPLs are present, a decision needs to be made as to whether to collect samples of the free phase liquid(s) and/or the dissolved phase.

IV. PURGING AND SAMPLING PROCEDURE

Use a submersible pump to purge and sample monitoring wells which have a 2.0 inch or greater well casing diameter.

Measure and record the water level again just prior to placing the pump in the well.

Lower pump, safety cable, tubing and electrical lines slowly into the well so that the pump intake is located at the center of the saturated screen length of the well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of sediment that may be present in the bottom of the well. Collection of turbid free water samples my be difficult if there is three feet or less of standing water in the well.

When starting the pump, slowly increase the pump speed until a discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown. The target drawdown should be less than 0.3 feet and it should stabilize. If the target of less than 0.3 feet cannot be achieved or maintained, the sampling is acceptable if remaining criteria in the procedure are met. Subsequent

sampling rounds will probably have intake settings and extraction rates that are comparable to those used in the initial sampling rounds.

Monitor water level and pumping rate every three to five minutes (or as appropriate) during purging. Record pumping rate adjustments and depths to water. Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (e.g., 0.1 - 0.2 l/min) to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During initial pump start-up, drawdown may exceed the 0.3 feet target and then recover as pump flow adjustments are made (minimum purge volume calculations should utilize stabilized drawdown values, not the initial drawdown). If the recharge rate of the well is less than minimum capability of the pump do not allow the water level to fall to the intake level (if the static water level is above the screen, avoid lowering the water level into the screen). Shut off the pump if either of the above is about to occur and allow the water level to recover. Repeat the process until field indicator parameters stabilize and the minimum purge volume is removed. The minimum purge volume with negligible drawdown (0.3 feet or less) is two saturated screen length volumes. In situations where the drawdown is greater than 0.3 feet and has stabilized, the minimum purge volume is two times the saturated screen volume plus the stabilized drawdown volume. After the minimum purge volume is attained (and field parameters have stabilized) begin sampling. For low yield wells, commence sampling as soon as the well has recovered sufficiently to collect the appropriate volume for all anticipated samples.

During well purging, monitor field indicator parameters (turbidity, temperature, specific conductance, pH, etc.) every three to five minutes (or as appropriate). Purging is complete and sampling may begin when all field indicator parameters have stabilized (variations in values are within ten percent of each other, pH +/- 0.2 units, for three consecutive readings taken at three to five minute intervals). If the parameters have stabilized, but turbidity remains above 5 NTU goal, decrease pump flow rate, and continue measurement of parameters every three to five minutes. If pumping rate cannot be decreased any further and stabilized turbidity values remain above 5 NTU goal record this information. Measurements of field parameters should be obtained using a flow-through cell (preferred method) or taken in a clean container (a glass beaker is suitable). However, if measurements for dissolved oxygen and eH are to be obtained, they must be obtained using a flow-through cell in a manner in which the sample is not exposed to air prior to the measurement. Prior to collecting the samples for laboratory analyses, the flow-through cell must be disconnected. Note, turbidity,

temperature, specific conductance and pH measurements must be recorded. If these measurements are missing, the resulting sampling data may not be acceptable. If the optional indicator parameters, dissolved oxygen and eH, are measured, they must be recorded.

VOCs samples are preferably collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the water column in the pump tubing collapses (water does not completely fill the tubing) before exiting the tubing, use one of the following procedures to collect VOC samples: (1) Collect the non-VOCs samples first, then increase the flow rate incrementally until the water column completely fills the tubing, collect the sample and record the new flow rate; (2) reduce the diameter of the existing tubing until the water column fills the tubing either by adding a connector (Teflon or stainless steel), or clamp which should reduce the flow rate by constricting the end of the tubing; (3) insert a narrow diameter Teflon tube into the pump's tubing so that the end of the tubing is in the water column and the other end of the tubing protrudes beyond the pump's tubing, collect sample from the narrow diameter tubing.

Preserve all samples immediately after they are collected.

Check the pH for all samples requiring pH adjustment to assure that the proper pH has been obtained. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If dissolved metal concentrations are desired, collect filtered water samples. The use of an in-line filter is preferred. An in-line 0.45 um particulate filter should be pre-rinsed with approximately 25 - 50 ml of groundwater prior to sample collection. After filtering the sample, preserve the water sample immediately. Note that filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations representative of total mobile loads.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into an ice cooler for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

After collection of the samples, the pump tubing may either

be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth.

Secure the well.

V. DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

Procedure 1

Steam clean the outside of the submersible pump.

Pump hot water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump tap water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

Procedure 2

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that

detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is flushed out. The outside of the pump and the electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with tap or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Flush with isopropyl alcohol. If equipment blank data shows that the level of contaminants is insignificant, then this step may be skipped.

Flush with distilled/deionized water. The final water rinse must not be recycled.

VI. FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one per sample cooler.

Field duplicate.

Matrix spike.

Matrix spike duplicate.

Equipment blank.

Trip blank (VOCs).

Sampling should proceed from wells with the lowest contaminant concentration to the highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

When field duplicates or split samples are to be collected,

they will be collected consecutively for the same parameters.

All monitoring instrumentation must be operated in accordance with EPA analytical methods and the operating instructions as supplied by the manufacturer. The instruments must be calibrated at the beginning of each day and the calibration checked at least once throughout the day (i.e. at the end of the day) to verify that the instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, should be checked for accuracy prior to field use according to the EPA Method 170.1 and the manufacturer's instructions.

VII. FIELD LOGBOOK

A field log must be kept each time ground water monitoring activities are conducted in the field. The field logbook should document the following:

Well identification.

Well depth, and measurement technique.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid layers and detection method.

Collection method for immiscible liquid layers.

Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.

Well sampling sequence and time of sample collection.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analysis.

Field observations of sampling event.

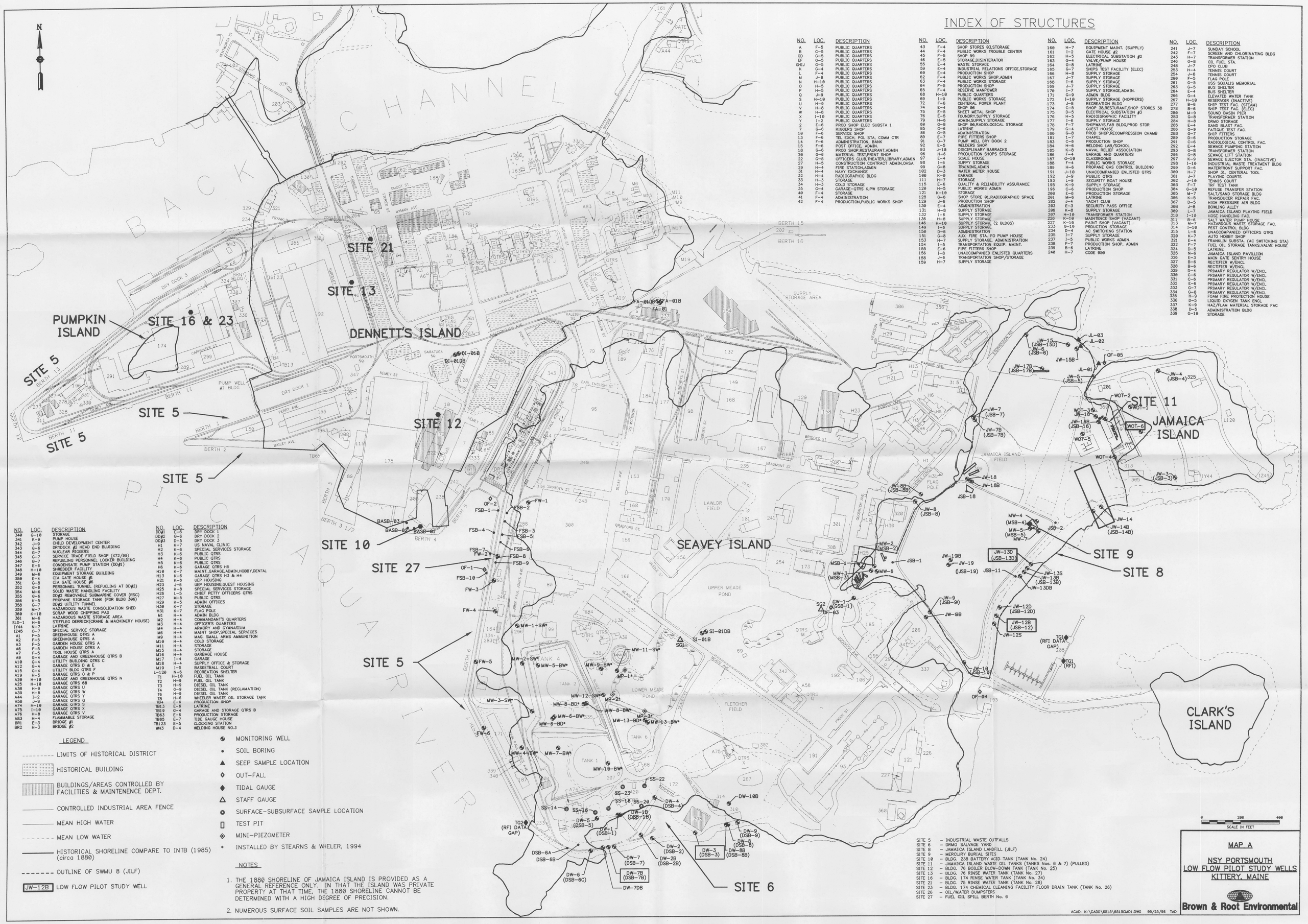
Name of sample collector(s).

Weather conditions.

QA/QC data for field instruments.

ATTACHMENT B

PILOT STUDY WELL LOCATION MAP



INDEX OF STRUCTURES

NO.	LOC.	DESCRIPTION
A	F-5	PUBLIC QUARTERS
B	G-5	PUBLIC QUARTERS
CD	G-5	PUBLIC QUARTERS
EF	G-5	PUBLIC QUARTERS
GHIJ	G-5	PUBLIC QUARTERS
K	G-4	PUBLIC QUARTERS
L	F-4	PUBLIC QUARTERS
M	J-8	PUBLIC QUARTERS
N	H-10	PUBLIC QUARTERS
O	H-5	PUBLIC QUARTERS
P	H-5	PUBLIC QUARTERS
Q	J-9	PUBLIC QUARTERS
S	H-10	PUBLIC QUARTERS
U	H-9	PUBLIC QUARTERS
V	H-8	PUBLIC QUARTERS
W	H-8	PUBLIC QUARTERS
X	I-10	PUBLIC QUARTERS
Y	I-2	PUBLIC QUARTERS
2	E-6	PROD SHOP ELEC SUBSTA 1
7	G-6	RIGGERS SHOP
10	F-6	SERVICE SHOP
13	F-6	TEL EXCH, POL STA, COMM CTR
14	F-6	ADMINISTRATION, BANK
15	F-6	POST OFFICE, ADMIN.
18	G-6	PROD SHOP,RESTAURANT,ADMIN
20	G-6	MATERIAL TEST,PRINT SHOP
22	G-5	OFFICERS CLUB,THEATER,LIBRARY,ADMIN
27	H-5	CONSTRUCTION CONTRACT ADMIN,OHSA
29	H-4	FIRE STATION,ADMIN
31	H-4	NAVY EXCHANGE
32	H-4	RADIOGRAPHIC BLDG
33	H-3	STORAGE
34	H-3	COLD STORAGE
35	G-4	GARAGE-QTRS C,LPW STORAGE
40	F-4	STORAGE
41	F-4	ADMINISTRATION
42	F-4	PRODUCTION,PUBLIC WORKS SHOP
43	F-4	SHOP STORES 03,STORAGE
44	F-4	PUBLIC WORKS TROUBLE CENTER
45	F-5	SHOP 99
46	E-5	STORAGE,DISINTERATOR
55	E-4	WASTE STORAGE
59	E-4	INDUSTRIAL RELATIONS OFFICE,STORAGE
60	E-4	PRODUCTION SHOP
62	F-4	PUBLIC WORKS SHOP,ADMIN
63	F-4	PUBLIC WORKS STORAGE
64	F-5	PRODUCTION SHOP
65	F-4	RESERVE MANPOWER
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69	I-9	PUBLIC WORKS STORAGE
72	F-6	CENTERAL POWER PLANT
74	E-4	SHOP 06
75	E-5	SHEET METAL SHOP
76	E-5	FOUNDRY,SUPPLY STORAGE
79	H-6	ADMIN,SUPPLY STORAGE
80	G-8	SHOP 06,RADIOLOGICAL STORAGE
85	G-6	LATRINE
86	G-5	ADMINISTRATION
89	E-7	PIPE FITTERS SHOP
91	G-7	PUMP WELL DRY DOCK 2
92	E-5	WELDERS SHOP
93	J-10	DISCIPLINARY BARRACKS
96	H-6	PRODUCTION SHOPS STORAGE
97	E-4	SCALE HOUSE
98	I-6	SUPPY STORAGE
99	H-8	TRAINING,ADMIN
102	D-3	WATER METER HOUSE
106	K-9	GARAGE
111	H-7	STORAGE
115	E-6	QUALITY & RELIABILITY ASSURANCE
120	H-5	PUBLIC WORKS ADMIN
121	K-10	STORAGE
128	G-6	SHOP STORE 01,RADIOGRAPHIC SPACE
129	J-6	PRODUCTION SHOP
130	E-4	ADMINISTRATION
131	H-8	SUPPLY STORAGE
132	I-6	SUPPLY STORAGE
136	H-8	SUPPLY STORAGE
146	H-10	SUPPLY STORAGE (2 BLDGS)
149	I-6	SUPPLY STORAGE
150	D-8	ADMINISTRATION
151	G-8	AUX. FIRE STA. FO PUMP HOUSE
153	H-7	SUPPLY STORAGE, ADMINISTRATION
154	I-5	TRANSPORTATION EQUIP. MAINT.
155	E-6	PIPE FITTERS SHOP
156	I-8	UNACCOMPANIED ENLISTED QUARTERS
158	J-6	TRANSPORTATION SHOP/STORAGE
159	H-7	SUPPLY STORAGE
160	H-7	EQUIPMENT MAINT. (SUPPLY)
161	I-2	GATE HOUSE #2
162	H-5	ELECTRICAL SUBSTATION #2
163	G-4	VALVE/PUMP HOUSE
164	G-8	LATRINE
165	G-7	SHIPS TEST FACILITY (ELEC)
166	H-8	SUPPLY STORAGE
167	J-7	SUPPLY STORAGE
168	I-6	SUPPLY STORAGE
169	J-7	SUPPLY STORAGE
170	I-7	SUPPLY STORAGE,ADMIN.
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173	J-8	RECREATION BLDG
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175	D-5	ELECTRICAL SUBSTATION #3
176	H-5	RADIOIGRAPHIC FACILITY
177	I-6	SUPPLY STORAGE
178	F-7	SHIPWAYS,FAB BLDG,PROD STOR
179	G-4	GUEST HOUSE
180	G-8	PROD SHOP,RECOMPRESSION CHAMB
181	I-7	CHAPEL
183	C-6	PRODUCTION SHOP
184	H-6	WELDING LAB/SCHOOL
185	K-8	NAVAL RELIEF ASSOCIATION
186	F-4	GARAGE AND QUARTERS
187	G-10	CLASSROOMS
188	F-4	PUBLIC WORKS STORAGE
189	H-6	PROPANE GAS CONTROL BUILDING
191	J-10	UNACCOMPANIED ENLISTED QTRS
192	J-9	PUBLIC QTRS
193	L-9	SECURITY BOAT HOUSE
195	K-9	SUPPLY STORAGE
196	K-6	PRODUCTION SHOP
200	E-6	PRODUCTION STORAGE
201	M-6	LATRINE
202	J-4	YACHT CLUB
203	E-3	SECURITY PASS OFFICE
206	J-6	SUPPLY STORAGE
207	H-10	TRANSFORMER STATION
226	K-10	MAINTENCE SHOP (VACANT)
227	K-10	PAINT SHOP (VACANT)
233	G-10	PRODUCTION STORAGE
234	D-4	AC SWITCHING STATION
235	I-7	SUPPLY STORAGE
237	I-5	PUBLIC WORKS ADMIN.
238	F-7	PRODUCTION SHOP, ADMIN
239	B-6	LATRINE
240	H-7	CODE 950
241	J-7	SUNDAY SCHOOL
242	F-7	SCREEN AND CHLORINATING BLDG
243	H-7	TRANSFORMER STATION
246	G-8	OIL FUEL STA.
248	J-7	CPO CLUB
253	H-4	TENNIS COURT
254	J-8	TENNIS COURT
260	F-5	FLAG POLE
261	G-5	USS SQUALIS MEMORIAL
263	G-5	BUS SHELTER
264	E-4	BUS SHELTER
266	G-4	ELEVATED WATER TANK
267	H-10	RESERVOIR (INACTIVE)
277	B-6	SHIP TEST FAC. (STEAM)
278	B-6	SHIP TEST FAC. (ELEC)
288	M-9	SOUND BASIN PIER
283	G-8	TRANSFORMER STATION
284	H-8	DRMO STORAGE
285	E-4	SAND BLAST FAC.
286	G-9	FATIGUE TEST FAC.
288	G-7	SHIP FITTERS
289	D-6	PRODUCTION STORAGE
291	C-6	RADIOLOGICAL CONTROL FAC.
292	E-4	SEWAGE PUMPING STATION
293	G-8	TRANSFORMER STATION
296	G-8	SEWAGE LIFT STATION
297	K-9	SEWAGE EJECTOR STA. (INACTIVE)
298	I-10	INDUSTRIAL WASTE TREATMENT BLDG
299	D-6	WATERFRONT SUPPORT FAC.
300	H-7	SHOP 31, CENTERAL TOOL
301	J-7	PLAYING COURTS
302	J-10	TENNIS COURT
303	F-7	TRF TEST TANK
304	G-10	REFUSE TRANSFER STATION
305	M-7	SALT/SAND STORAGE BLDG
306	K-5	TRANSDUCER REPAIR FAC.
307	D-5	HIGH PRESSURE AIR BLDG
308	J-8	BOWLING ALLEY
309	L-7	JAMAICA ISLAND PLAYING FIELD
310	I-10	HOSE HANDLING FAC.
311	B-6	SALT WATER PUMP HOUSE
313	M-7	HAZARDOUS WASTE STORAGE FAC.
314	I-10	PEST CONTROL BLDG
315	L-6	UNACCOMPANIED OFFICERS QTRS
320	K-7	AUTO HOBBY SHOP
321	E-4	FRANKLIN SUBSTA. (AC SWITCHING STA)
322	F-7	FUEL OIL STORAGE TANKS,VALVE HOUSE
324	D-5	LATRINE
325	N-6	JAMAICA ISLAND PAVILLION
326	E-3	MAIN GATE SENTRY HOUSE
327	B-6	RECTIFIER W/ENCL
328	B-6	RECTIFIER W/ENCL
329	D-4	PRIMARY REGULATOR W/ENCL
330	C-6	PRIMARY REGULATOR W/ENCL
331	C-6	PRIMARY REGULATOR W/ENCL
332	E-6	PRIMARY REGULATOR W/ENCL
333	G-7	PRIMARY REGULATOR W/ENCL
334	G-8	PRIMARY REGULATOR W/ENCL
335	H-9	FOAM FIRE PROTECTION HOUSE
336	D-5	LIQUID OXYGEN TANK ENCL
337	K-9	HAZ/FLAM MATERIAL STORAGE FAC
338	D-5	ADMINISTRATION BLDG
339	G-10	STORAGE
340	G-10	STORAGE
341	K-9	PUMP HOUSE
342	J-9	CHILD DEVELOPMENT CENTER
343	G-6	DRYDOCK #2 HEAD END BLUIDING
344	G-7	NUCLEAR RIGGERS
345	G-7	SERVICE TRADE FIELD SHOP (X72/99)
346	G-7	REFUELING PERSONNEL LOCKER BUILDING
347	E-6	CONDENSATE PUMP STATION (DD#1)
348	H-10	SHREDDER FACILITY
349	M-6	EQUIPMENT STORAGE BUILDING
350	E-4	CIA GATE HOUSE #1
351	G-8	CIA GATE HOUSE #6
352	G-8	PERSONNEL TUNNEL (REFUELING AT DD#2)
354	M-6	SOLID WASTE HANDLING FACILITY
355	G-6	DD#2 REMOVABLE SUBMARINE COVER (RSC)
356	K-5	PROPANE STORAGE TANK (FOR BLDG 306)
358	G-7	DD#2 UITLITY TUNNEL
359	M-7	HAZARDOUS WASTE CONSOLIDATION SHED
360	K-10	SCRAP WOOD CHIPPING PAD
361	M-6	HAZARDOUS WASTE STORAGE AREA
SLD-1	H-6	STIFFLEG DERRICK(CRANE & MACHINERY HOUSE)
IY44	N-7	LATRINE
IZ45	O-7	SPECIAL SERVICE STORAGE
A1	F-5	GREENHOUSE QTRS A
A2	F-5	GREENHOUSE QTRS A
A3	F-5	GARDEN HOUSE QTRS A
A6	F-5	GARDEN HOUSE QTRS A
A7	F-5	TOOL HOUSE QTRS A
A9	G-4	GARAGE AND GREENHOUSE QTRS B
A10	G-4	UTILITY BUILDING QTRS C
A12	G-4	GARAGE QTRS D & E
A15	G-4	UTILITY BLDG QTRS F
A19	H-5	GARAGE QTRS O & P
A20	H-10	GARAGE AND GREENHOUSE QTRS N
A25	H-10	GARAGE QTRS 6B
A38	H-9	GARAGE QTRS U
A39	H-8	GARAGE QTRS W
A44	I-2	GARAGE QTRS Y
A58	J-9	GARAGE QTRS Q
A74	H-10	GARAGE QTRS S
A75	I-10	GARAGE QTRS X
A76	H-8	GARAGE QTRS V
A83	H-4	FLAMMABLE STORAGE
BR1	E-3	BRIDGE #1
BR2	H-3	BRIDGE #2
DD#1	E-6	DRY DOCK 1
DD#2	G-6	DRY DOCK 2
DD#3	E-5	DRY DOCK 3
H1	K-7	US NAVAL CLINIC
H2	K-6	SPECIAL SERVICES STORAGE
H3	K-6	PUBLIC QTRS
H4	K-6	PUBLIC QTRS
H5	K-6	PUBLIC QTRS
H6	K-6	GARAGE QTRS H5
H10	K-7	MAINT.,GARAGE,ADMIN,HOBBY,DENTAL
H13	K-6	GARAGE QTRS H3 & H4
H21	K-6	UEP HOUSING
H23	J-6	UEP HOUSING,GUEST HOUSING
H25	K-8	SPECIAL SERVICES STORAGE
H26	L-5	CHIEF PETTY OFFICERS QTRS
H27	M-5	PUBLIC QTRS
H29	K-5	ADMIN OFFICES
H30	K-7	STORAGE
H31	K-7	FLAG POLE
M1	H-4	ADMIN BLDG
M2	H-4	COMMANDANT'S QUARTERS
M3	H-4	OFFICER'S QUARTERS
M4	H-4	ARMORY AND GYMNASIUM
M6	H-4	MAINT SHOP,SPECIAL SERVICES
M9	H-4	MAG. SMALL ARMS AMMUNITION
M10	H-4	COLD STORAGE
M11	H-4	STORAGE
M15	H-4	STORAGE
M16	H-4	GARBAGE HOUSE
M17	I-4	GARAGE
M18	H-4	SUPPLY OFFICE & STORAGE
M19	I-5	BASKETBALL COURT
L-120	N-6	RECREATION SHELTER
T1	H-10	FUEL OIL TANK
T2	H-9	FUEL OIL TANK
T3	H-9	DIESEL OIL TANK
T4	G-9	DIESEL OIL TANK (RECLAMATION)
T6	H-9	DIESEL OIL TANK
T8	H-6	WHEELER WASTE OIL STORAGE TANK
TB4	E-6	PRODUCTION SHOP
TB13	E-6	LATRINE
TB19	G-4	GARAGE AND STORAGE QTRS B
TB63	E-6	PRODUCTION STORAGE
TB65	E-7	TIDE GAUGE HOUSE
TB123	E-5	CLOCKING STATION
WH3	D-4	WELDING HOUSE NO.3

LEGEND

- LIMITS OF HISTORICAL DISTRICT
- HISTORICAL BUILDING
- BUILDINGS/AREAS CONTROLLED BY FACILITIES & MAINTENENCE DEPT.
- CONTROLLED INDUSTRIAL AREA FENCE
- MEAN HIGH WATER
- MEAN LOW WATER
- HISTORICAL SHORELINE COMPARE TO INTB (1985) (circa 1880)
- OUTLINE OF SWMU 8 (JILF)
- JW-12B LOW FLOW PILOT STUDY WELL
- MONITORING WELL
- SOIL BORING
- SEEP SAMPLE LOCATION
- OUT-FALL
- TIDAL GAUGE
- STAFF GAUGE
- SURFACE-SUBSURFACE SAMPLE LOCATION
- TEST PIT
- MINI-PIEZOMETER
- * INSTALLED BY STEARNS & WHELER, 1994

NOTES

1. THE 1880 SHORELINE OF JAMAICA ISLAND IS PROVIDED AS A GENERAL REFERENCE ONLY. IN THAT THE ISLAND WAS PRIVATE PROPERTY AT THAT TIME, THE 1880 SHORELINE CANNOT BE DETERMINED WITH A HIGH DEGREE OF PRECISION.
2. NUMEROUS SURFACE SOIL SAMPLES ARE NOT SHOWN.

SITE 5 – INDUSTRIAL WASTE OUTFALLS
SITE 6 – DRMO SALVAGE YARD
SITE 8 – JAMAICA ISLAND LANDFILL (JILF)
SITE 9 – MERCURY BURIAL SITES
SITE 10 – BLDG. 238 BATTERY ACID TANK (TANK No. 24)
SITE 11 – JAMAICA ISLAND WASTE OIL TANKS (TANKS Nos. 6 & 7) (PULLED)
SITE 12 – BLDG. 76 BOILER BLOW-DOWN TANK (TANK No. 25)
SITE 13 – BLDG. 76 RINSE WATER TANK (TANK No. 27)
SITE 16 – BLDG. 174 RINSE WATER TANK (TANK No. 34)
SITE 21 – BLDG. 75 RINSE WATER TANK (TANK No. 28)
SITE 23 – BLDG. 174 CHEMICAL CLEANING FACILITY FLOOR DRAIN TANK (TANK No. 26)
SITE 26 – OIL/WATER DUMPSTERS
SITE 27 – FUEL OIL SPILL BERTH No. 6

ACAD: K:\CADD\6515\6515CM01.DWG 09/25/96 TAD

MAP A

NSY PORTSMOUTH
LOW FLOW PILOT STUDY WELLS
KITTERY, MAINE

Brown & Root Environmental

ATTACHMENT C

PILOT STUDY PUMP TRACKING SHEET

Pump Tracking Sheet

SITE NAME: PNS Kittery ME JOB NUMBER: 6515

Pump ID Number	Pump Manufacturer/ Model Number	Well Number	Pump Material	Date Installed	Depth Installed (feet TOC)	Total Well Depth (feet TOC)	Installed By:	Remarks
1082-15601	Timco / 1.66"Ø x 20"	HW-2	PVC	9-16-96	12.5	14.90	SJC / RR	5' screen
1079-15601	"	JW-13D	PVC	9-16-96	18.5	22.09	RR / TE	5' screen
TE 1078-15601 ~~1078-15601~~	"	JW-12B	PVC	9-16-96	40.5' ~~38.5~~ TE	42.65	RR / TE	5' screen
1081-15601	"	DW-3	PVC	9-17-96	19.25 SJC	22.25	SJC/RR	10' screen
1080-15601	"	DW-7B	PVC	9-17-96	32.25 SJC	34.75	SJC/RR	5' screen

ATTACHMENT D

PILOT STUDY LOW FLOW PURGE DATA SHEETS

Monitoring Well	Tide	Pages
JW-13D	low	2
JW-13D	high	3
JW-12B	low and high	5
DW-3	low	2
DW-3	high	2
DW-7B	low	5
JW-12B	low[1]	3
HW-2	Not Applicable[2]	3
HW-2	Not Applicable[3]	1

[1]Pilot test was re-run because initial test did not start three hours prior to low tide.
[2]Not impacted by tidal cycle.
[3]Not impacted by tidal cycle. Pilot test was re-run because well was pumped dry during initial test.

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW-13D
Date: 9-17-96

Start Time: 0811 hours
End Time: 1041 hours

Total Depth:
Total Volume Purged: 20 (gal. (L))

Tide Cycle: [ ] High [X] Low @ 0836 [ ] N/A
Weather: overcast +

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO* mg/L	Turb. NTU	Sal. %	Eh mV	Comments
0811	WL below top of pump (16.27')										Static Water Level
0817		230	85								clear
0830											Problem w/meter
0843											Continue
0847		490	-123	15.53	7.56	42.02	6.95	0.0	26.96	126.5	clear
0850		510	170	15.75	7.55	41.90	6.76	-0.0	26.92	125.6	clear
0855		680	136	15.87	7.53	41.82	6.30	-0.0	26.86	122.7	clear
0900		320 + 350	134	15.91	7.53	41.85	7.76	-0.2	26.91	117.6	clear
0905		510 + 200	142	15.96	7.54	41.85	7.31	-0.2	26.91	111.6	clear LaMotte 2008 0.5 NTU
0910		770	154	15.96	7.53	41.88	7.68	-0.3	26.92	103.9	clear
0915		700	140	15.90	7.54	41.87	8.40	-0.3	26.91	99.0	clear
0920		700	140	15.84	7.54	41.82	7.52	-0.3	26.86	91.4	clear
0925		690	138	15.84	7.54	41.82	8.00	-0.3	26.86	85.0	clear
0930		850	170	15.82	7.52	41.82	7.42	-0.2	26.84	74.8	clear
0935		690	138	15.85	7.53	41.78	8.63	-0.3	26.83	68.5	clear
0940		690	138	15.85	7.53	41.78	7.28	-0.2	26.84	63.5	clear

* DO correction = $\frac{X}{1.039}$

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Well #: JW-13D
Date: 9-17-96

Start Time: _____ hours
End Time: _____ hours
Total Depth: _____
Total Volume Purged: _____ (gal. / L)

Tide Cycle: [ ] High [X] Low [ ] N/A
Weather: _____

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
0945		660	132	15.85	7.56	41.74	6.79	-0.3	26.81	54.5	Clear
0950		700	140	15.87	7.54	41.73	7.08	-0.3	26.79	51.7	Clear
0955		150+510	132	15.85	7.56	41.70	6.70	-0.3	26.79	48.7	Clear
1000		650	130	15.85	7.54	41.72	6.96	-0.3	26.78	45.2	Clear
1005		840	168	15.83	7.53	41.70	7.41	-0.3	26.79	44.8	Clear
1010		680	136	15.77	7.53	41.67	6.87	-0.3	26.79	41.2	
1015		680	136	15.74	7.53	41.67	6.82	-0.3	26.77	40.5	
1040	16.22	640	128	15.58	7.51	41.67	5.50	-0.3	26.77	32.7	Clear
1042											End

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Start Time: 1228 hours
End Time: 1536 hours
Total Depth:
Total Volume Purged: (gal. / L)

Well #: JW-13D
Date: 9-17-96 @1450
Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: rain, 56°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
1223	13.56'										Static Water Level
1232	13.20'	—	200	15.78	7.51	41.41	5.84	55.7	26.61	104.5	Initial clear
1240	12.88	1310	165	15.79	7.53	42.05	4.85	-0.3	27.01	86.2	clear 950
1245	12.77	1000	200	15.84	7.55	42.15	6.16	-0.2	27.11	74.5	
1250	12.52	850	170	15.79	7.54	42.21	6.16	-0.3	27.14	67.1	
1255	12.36	850	170	15.77	7.55	42.28	6.32	-0.3	27.21	61.1	clear
1300	12.10	860	172	15.82	7.55	42.32	6.58	-0.3	27.22	59.2	clear
1307	11.70	1190	170	15.82	7.54	42.36	6.41	-0.3	27.25	54.5	
1310	11.47	500	167	15.83	7.55	42.38	6.77	-0.3	27.26	52.0	clear
1315	11.02	870	174	15.84	7.54	42.39	6.54	0.0	27.27	48.9	
1321	NM	1030	172	15.87	7.56	42.41	6.73	-0.3	27.27	43.7	clear
1325	NM	680	170	15.85	7.55	42.38	6.84	-0.3	27.27	44.8	
1330	10.08	850	170	15.89	7.55	42.40	6.83	-0.3	27.28	45.1	clear
1335	9.80	830	166	15.91	7.54	42.37	6.91	-0.3	27.27	45.3	clear
1340		850	170	15.93	7.55	42.37	6.72	-0.3	27.26	41.5	
1344											Re-zero turb sensor

NM = Not measured

Turb = negative value may be due to sensitivity of sensor (i.e. approx 0.0)

Correct DO reading by 1/103.9 %

36 650

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW-13D
Date: 9-17-96

Start Time: _____ hours Total Depth: _____
End Time: _____ hours Total Volume Purged: _____ (gal. / L)

Tide Cycle: [✓] High @ 1450 [ ] Low [ ] N/A
Weather: rain 58°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
1350	9.52	520	173	15.77	7.54	42.48	5.63	-0.3	27.35	42.6	clear
1355	9.46	870	174	15.85	7.53	42.51	7.36	-0.4	27.38	36.0	clear
1400	9.49	870	174	15.91	7.54	42.56	6.93	-0.4	27.40	32.9	clear 4 gal
1406	9.20	1050	175	15.92	7.53	42.55	7.59	-0.4	27.40	31.9	clear
1416	9.02	1740	174	15.85	7.56	42.55	5.94	-0.4	27.40	25.7	clear
1420	9.04	680	170	15.84	7.54	42.56	6.62	-0.4	27.39	26.0	clear
1426	9.04	1050	175	15.84	7.56	42.58	5.91	-0.4	27.41	23.8	clear
1430	NM	700	175	15.85	7.57	42.56	5.75	-0.4	27.41	22.1	clear
1435	8.96	870	174	15.84	7.55	42.59	5.86	-0.4	27.41	22.3	clear
1440	9.00	870	174	15.85	7.55	42.61	6.46	-0.4	27.43	21.9	clear
1444	8.88	870	174	15.84	7.57	42.60	6.12	-0.4	27.40	21.3	clear
1449	8.85	870	174	15.85	7.55	42.60	6.34	-0.4	27.42	21.0	clear
1454	8.95	870	174	15.87	7.55	42.59	6.65	-0.4	27.42	20.6	Highest tide @ 1450
1459	8.86	880	176	15.85	7.56	42.62	6.63	-0.4	27.43	19.6	clear
1506	8.91	1050	175	15.87	7.55	42.61	6.61	-0.4	27.43	19.5	

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW-13D
Date: 9-17-96

Start Time: _____ hours
End Time: _____ hours

Total Depth: _____
Total Volume Purged: _____ (gal. / L)

Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: _____

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm.	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
1510	8.93	870	174	15.85	7.54	42.62	6.49	-0.4	27.43	20.5	Clear
1515	9.03	880	176	15.89	7.57	42.61	6.48	-0.4	27.42	18.8	
1520	9.12	870	174	15.88	7.57	42.59	6.29	-0.4	27.43	18.1	Clear
1525	9.19	870	174	15.88	7.53	42.60	6.07	-0.4	27.42	19.2	
1530	9.18	870	174	15.85	7.55	42.60	6.51	-0.4	27.42	18.3	clear
1535	9.25	870	174	15.84	7.55	42.60	5.90	-0.4	27.42	18.9	Clear
1536											End
											Total Vol =

pH +/-.2 std units
cond, temp, turb, eh, do +/-10%

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW 12B
Date: 9-17-96

Start Time: ~~0855~~ 0800 hours
End Time: 1530 hours

Total Depth: 42.65'
Total Volume Purged: ~33.65L or ~8.5gal (min/min) (gal. / L)

Tide Cycle: [ ] High [X] Low [ ] N/A
Weather: Overcast, Windy, 55°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
0800	14.74'										Static Water Level
0805	14.85'	500	166	15.37	7.32	21.42	7.61	458.9	12.89	67.6	
0810	14.85'	550	200	13.68	7.26	21.44	5.50	136.6	12.93	26.0	
0815	14.95'	475	206	13.05	7.27	21.45	4.81	276.8	12.90	-13.8	
0820	15.15'	600	200	12.77	7.29	21.45	3.43	391.6	12.90	-40.3	
0825	15.15'	450	163	12.57	7.31	21.45	2.66	388.5	12.91	-65.4	
0830	15.21'	475	203	12.41	7.32	21.45	2.04	345.4	12.91	-94.8	LOW TIDE TIME
0835	15.00'	—	—	12.31	7.32	21.46	1.55	445.9	12.90	-115.2	
0840	15.10'	450	190	12.27	7.32	21.45	1.18	467.3	12.90	-127.9	Increased cycle time slowing flowrate -
0845	15.06'	~600	171	12.32	7.32	21.44	1.06	412.3	12.89	-133.6	at "D" setting
0850	15.10'	600	171	12.37	7.33	21.45	0.86	349.1	12.90	-142.2	
0855	15.04'	475	158	12.37	7.33	21.44	0.78	312.0	12.89	-148.0	Increased cycle time slowing flow rate
0900	15.06'	600	171	12.52	7.33	21.43	0.69	361.4	12.89	-152.8	at E setting
0905	14.95'	600	150	12.66	7.33	21.43	0.02	359.9	12.89	-158.1	Increased cycle time slowing flow rate
0910	14.92'	600	120	12.71	7.33	21.42	0.55	243.1	12.89	-161.8	at E setting
0915	14.81'	600	120	12.93	7.33	21.42	0.52	235.7	12.90	-165.7	

(7875)

Note: DATA RECORDED BY K. JALKUT B&RE Wilmington MA

Approx. 8-10 gals in drum

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW 12B
Date: 9/27/96

Start Time: 0800 hours
End Time: 1530 hours

Total Depth: 42.65'
Total Volume Purged: ~33.65 L or ~8.5 gal (gal. / L)
(minimum)

Tide Cycle: [ ] High [x] Low [ ] N/A
Weather: H. RAIN 50°F WINDY (NorEASTER)

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
~~0940~~											Static Water Level
0920	14.76	600	150	13.02	7.33	21.42	0.42	229.8	12.89	-169.0	
0925	14.41	–	–	13.07	7.33	21.42	0.42	185.1	12.89	-172.4	Increased cycle time slowing flow rate
0930	14.38	–	–	13.17	7.33	21.41	0.33	170.8	12.88	-173.5	
0940	14.56	600	80	13.45	7.33	21.39	0.42	174.2	12.87	-174.6	Readings every 10 min. ACK until notice
0950	14.28	600	~~88~~ 7 (E) 9-27-96	13.79	7.33	21.39	0.38	160.3	12.88	-177.3	Increased cycle time slowing flow rate –
1000	14.00	–	–	13.77	7.34	21.41	0.40	119.4	12.87	-174.5	At or near F setting
1010	13.90	600	104	14.27	7.33	21.37	0.37	108.7	12.87	-170.6	Changing Nitrogen Tank #1
1020	13.41	600	89	14.09	7.33	21.39	0.34	95.1	12.87	-173.8	
1030	13.25	–	–	13.95	7.31	21.00	0.82	845.2?	12.63	-146.8	Cleaned out ~~sonde~~ cell now reading 1.3 NTU *
1040	13.00	600	90	13.85	7.34	21.43	0.24	175.4	12.90	-172.6	
1050	12.75	–	–	13.83	7.34	21.44	-0.89	162.2	12.90	-177.1	Turned off sonde – instrument was shutting down every 10's
1100	12.21	600	90	13.81	7.34	21.41	0.17	155.4	12.89	-185.7	
1110	12.00	–	– (E) 9-27-96	13.83	7.35	21.40	0.21	156.0	12.88	-189.2	
1120	11.46	600	~~90~~ 104	13.83	7.34	21.41	0.56	167.2	12.88	-193.0	
1130	11.32	~~600~~ 570	110	13.88	7.35	21.39	-0.02	199.6	12.88	-195.4	

NOTE: EPA rep suggested cleaning of sonde to rid water / ~~sonde~~ cell of any fines collecting in it during measurements.
1 well vol = ~4.5 gals at wl = 14.76' and bottom @ 42.65'
using 1 well vol = 0.163 Tr^2
(5350)

Approx. 8-10 gals in drum!

NOTE: DATA RECORDED BY K. JALKUT WILMINGTON, MA
BERE →

OVER →

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW12B
Date: 9/17/96

Start Time: 0800 hours
End Time: 1530 hours

Total Depth: 42.65'
Total Volume Purged: ~33.65L or ~8.5gal (Minimum) (gal. / L)

Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: H Rain, Strong winds (NorEASTER)

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
		@ 9/17/96 1040									Static Water Level
1140	11.07'	~~600~~ 20	104	13.85	7.34	21.38	0.15	175.3	12.87	-197.4	
1150	10.71'	1100 ~~550~~	110	13.88	7.34	21.37	0.16	195.7	12.87	-199.3	
1200	10.39'	1100	110	13.90	7.35	21.38	0.33	245.8	12.87	-200.6	Back to readings every 5 minutes
1205	10.20'	—	—	13.93	7.34	21.37	0.34	245.4	12.86	-201.6	
1210	9.96'	1000	100	13.95	7.34	21.36	0.18	248.1	12.86	-202.4	
1215	9.75'	860	108	13.97	7.33	21.35	0.15	251.4	12.85	-203.3	
1220	9.52'	500	100	14.03	7.35	21.35	0.20	297.4	12.85	-203.0	
1225	9.39'	350	70	14.03	7.34	21.35	0.13	252.5	12.85	-203.8	Increased cycle time. Slow flow rate to F
1230	9.28'	—	—	14.03	7.34	21.34	0.26	221.4	12.84	-204.3	setting
1235	8.96'	—	—	14.13	7.34	21.32	0.18	196.2	12.83	-203.6	
1240	8.80'	500	50	14.33	7.34	21.31	0.15	197.1	12.82	-201.0	
1245	8.68'	—	—	14.34	7.34	21.33	0.15	193.4	12.84	-200.2	
1250	8.51'	175	17.5	14.55	7.33	21.30	0.16	187.5	12.82	-197.8	Decreased cycle time increased flow rate up to E
1255	8.39'	—	—	14.76	7.33	21.32	0.17	220.0	12.83	-197.6	setting
1300	8.13'	500	50	14.92	7.34	21.32	0.11	208.6	12.83	197.7	

(7125)

Approximately 8-10 gals in drum!

Note: DATA RECORDED BY K. JALKOT BERE WILMINGTON, MA

~ Low Tide Time 0836 hrs
~ High Tide Time 1450 hrs

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW12B
Date: 9/17/96

Start Time: 0800 hours
End Time: 1530 hours

Total Depth: 42.65'
Total Volume Purged: 33.65 L or ~8.5 gal (minimum) (gal. / L)

Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: Heavy Rain, Strong Wind 45-55°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
1305											Changing Nitrogen tank #2
1310	7.92	—	—	14.85	7.35	~~0.26~~ 21.34	0.26	184.1	12.84	-194.8	Tightening all connections - possible leak @ connector
1315	7.70	8800	880	14.84	7.34	21.32	0.21	183.4	12.83	-194.7	
1320	NR	—	—	15.09	7.33	21.29	1.48	254.7	12.81	-175.8	Borrowed M-scope for DRMO location - no reading (WR) for now - set up
1325	NR	8500	850	15.21	7.33	21.29	0.56	225.2	12.81	-173.4	took a fall - righted instrumentation - now
1330	NR	—	—	15.27	7.32	21.27	0.48	201.3	12.80	-174.2	secure. *
1335	NR	7500	750	15.25	7.32	21.30	0.35	180.8	12.82	-176.1	
1340	NR	—	—	15.22	7.32	21.29	0.22	161.0	12.82	-183.3	
1345	NR	8500	850	15.15	7.32	21.31	0.17	145.3	12.82	-186.0	
1350	NR	—	—	14.93	7.33	21.32	0.13	150.7	12.85	-192.4	CLEANED OUT CELL AGAIN W/ DI H2O *
1355	NR	7500	750	14.15	7.33	20.87	4.64	260.8	12.53	-151.9	HIGHER READINGS DUE TO REMOVAL OF WATER IN CELL AND
1400	NR	—	—	14.18	7.33	21.13	2.54	197.3	12.73	-160.0	CLEANING - WATER STILL BEING ADDED TO CELL VIA PUMP.
1405	NR	8650	865	14.16	7.33	21.27	1.18	244.6	12.80	-170.9	
1410	NR	—	—	14.07	7.33	21.31	0.49	319.5	12.82	-180.4	
1415	NR	1000 (5650)	100	14.05	7.33	21.31	0.41	316.2	12.82	-181.6	

M-scope being used at next location @ DRMO

NR = NO READING

* Instrument cell fell over likely re-suspending any sediment in cell or in water resulting in a turbidity increase, as well as an increase in DO

Approximately 8-10 gals in drum!

DATA RECORDED BY: K. JALKUT WILMINGTON, MA (B&RE)

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW 12 B
Date: 9/17/96

Start Time: 0800 hours
End Time: 1530 hours

Total Depth: 42.65
Total Volume Purged: 33.65 L oz ~8.5 gal (gal. / L) (minimum)

Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: Rain, Wind, 45-55°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
1420	NR	–	–	13.92	7.33	21.29	0.18	313.0	12.81	-200.3	
1425	NR	1000	100	13.91	7.33	21.29	0.17	314.5	12.81	-201.5	
1430	NR	–	–	13.90	7.33	21.28	0.15	314.0	12.80	-202.4	
1435	NR	1000	100	13.88	7.33	21.26	0.13	314.9	12.79	-205.3	
1440	NR	–	–	13.82	7.33	21.24	0.12	287.6	12.77	-210.1	
1445	NR	950	95	13.82	7.33	21.24	0.12	289.1	12.77	-210.4	
1450	NR	–	–	13.80	7.32	21.23	0.12	276.8	12.77	-211.3	HIGH TIDE!
1455	NR	1000	100	13.77	7.33	21.22	0.11	303.6	12.76	-212.7	
1500	NR	–	–	13.72	7.33	21.21	0.11	328.4	12.76	-213.4	
1505	NR	1000	100	13.71	7.33	21.21	0.18	340.7	12.76	-201.4	
1510	NR	–	–	13.70	7.33	21.21	0.18	319.0	12.75	-207.3	
1515	NR	1000	100	13.68	7.33	21.20	0.15	283.6	12.76	-212.7	
1520	NR	–	–	13.68	7.33	21.21	0.13	316.4	12.75	-217.7	
1525	NR	1000	100	13.71	7.33	21.20	0.10	~~24~~ 185.4	12.75	-219.6	
1530	NR	–	–	13.72	7.34	21.20	0.12	177.7	12.75	-221.4	
1535	NR	1000	100	13.72	7.33	21.20	0.11	186.6	12.75	-221.5	CEASE PUMPING PER T. BOBER (NORTHAN)

ALL DATA RECORDED BY: K. JALKUT, WILMINGTON, MA (BERE)

NR = NO READING SEE pp. 4

(7950)

Approximately 8-10 gals in drum!

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Well #: DW3
Date: 9-18-96
Start Time: 0645 hours
Total Depth: 22.35' TOC
Tide Cycle: [ ] High [X] Low @0920 [ ] N/A
End Time: 1032 hours
Total Volume Purged: 5 (gal.) L)
Weather: rain 56°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
0642	13.81										Static Water Level
0652				15.49	7.82	42.16	1.39	6.6	27.12	90.1	Initial Clear 550
0658	14.41	840	210	15.62	7.79	42.55	2.66	3.9	27.39	90.5	
0706	@top of pump 14.67	850	155	15.57	7.79	42.58	3.37	5.2	27.41	89.0	clear dry to top of pump
0711		850	155	15.59	7.79	42.52	3.95	3.5	27.37	85.5	clear
0716		850	155	15.59	7.79	42.51	4.42	1.7	27.37	81.9	clear
0721		850	155	15.63	7.79	42.50	4.58	4.8	27.36	80.5	clear
0726		850	155	15.63	7.78	42.48	4.95	3.4	27.37	82.4	clear
0732		850	155	15.62	7.78	42.47	4.12	1.4	27.35	86.7	clear
0738		850	155	15.63	7.78	42.46	4.80	0.3	27.34	91.4	
0743		850	155	15.58	7.81	42.47	5.46	0.5	27.34	90.7	clear
0749		850	155	15.62	7.82	42.44	4.18	0.7	27.29	91.2	
0754		850	155	15.59	7.79	42.44	5.44	0.7	27.29	94.1	
0800		850	155	15.58	7.78	42.39	5.51	0.7	27.27	94.5	clear
0805		850	155	15.54	7.78	42.41	5.49	0.2	27.26	94.8	
0810		850	155	15.55	7.77	42.33	5.17	0.4	27.22	96.1	

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: DW3
Date: 9-18-96

Start Time: _____ hours
End Time: _____ hours

Total Depth: _____
Total Volume Purged: _____ (gal. / L)

Tide Cycle: [ ] High [X] Low [ ] N/A
Weather: _____

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
0816		850	155	15.55	7.78	42.21	5.68	0.0	27.14	96.1	
0821		850	170	15.53	7.79	42.16	5.37	0.0	27.10	94.3	Clear ~4gal
0826		850	170	15.53	7.81	42.05	4.68	0.0	27.04	93.9	
0832		850	158	15.53	7.80	42.02	5.10	0.4	27.00	94.9	clear
0837		850	158	15.38	7.79	42.05	5.95	1.5	27.04	98.3	Air in line ∴ WL near pump inlet
0842		500	100	15.07	7.76	42.03	6.49	15.2	27.00	101.8	Slow pump rate
0850											No H_2O in line!
0910											Still NO H_2O Stop purging.
1012	16.67										Continue after adding 2' tubing
1017		450	90	14.97	7.76	41.34	0.08	39.9	26.57	129.4	
1022		860	172	15.59	7.77	42.01	3.36	13.5	26.99	121.1	
1027		860	172	15.68	7.77	42.16	4.04	9.0	27.11	117.1	
1031	16.2	860	-	15.74	7.77	42.16	4.82	5.0	27.11	112.3	
1032											Stop
											Total

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Start Time: 1305 hours
End Time: 1552 hours
Total Depth:
Total Volume Purged: (gal. / L)

Well #: DW-3
Date: 9-18-96
Tide Cycle: [X] High @ 1536 [ ] Low [ ] N/A
Weather: rain 58-61°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
1239	12.42'										Static Water Level
1240											compressor won't start
1305											Start purging
1312	11.26'	850	170	15.47	7.85	41.60	3.81	57.5	26.70	129.2	clear
1321	10.93	870	170	15.45	7.86	41.73	4.19	2.4	26.80	118.5	
1326	10.72	870	170	15.43	7.87	41.78	4.65	1.4	26.83	114.1	
1331	10.58	870	170	15.37	7.88	41.82	4.94	1.1	26.84	110.5	
1336	10.42	700	140	15.22	7.87	41.85	4.98	0.5	26.90	110.1	clear
1342	10.24	720	127	15.12	7.91	41.90	5.23	0.3	26.92	107.9	
1349.5	10.18	710	130	15.10	7.91	41.91	5.57	0.0	26.94	109.1	
1356	9.96	720	110	15.06	7.91	41.97	5.42	0.5	26.95	107.7	clear
1405	9.70	700	78	15.06	7.91	41.97	5.54	0.0	26.96	109.6	
1412	9.52	310+310	70	14.94	7.91	42.01	5.86	0.0	26.99	109.7	clear
1417	9.41	510	90	15.10	7.90	42.00	5.92	-0.1	26.98	109.2	
1430	9.19	540	2	15.22	7.92	42.03	4.98	0.3	27.01	114.4	pump reset
1433	NM	900	300	15.30	7.92	42.02	4.95	0.2	26.99	111.7	

NM = Not measured

Correct DO to X/1.03 (compensate for barometric pressure to 760 mm Hg)

YSI 6080 S/N 95032839

YSI 610-D S/N 133875R

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: DW-3
Date: 9-18-93

Start Time: _____ hours Total Depth: _____
End Time: _____ hours Total Volume Purged: _____ (gal. / L)

Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: _____

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
1437.5	9.04	900	225	15.27	7.92	41.96	4.67	0.4	26.96	106.4	clear
1442	8.92	900	200	15.25	7.94	41.99	4.65	0.0	26.97	103.9	Clear
1447.5	8.80	890	162	15.25	7.94	42.01	4.58	0.1	26.99	102.7	
1453	8.75	890	162	15.24	7.92	42.03	4.59	0.10	27.00	102.8	4gal
1458.5	8.70	890	162	15.22	7.92	42.07	4.38	0.6	27.05	103.6	
1504	8.67	890	162	15.20	7.92	42.09	4.82	0.1	27.06	103.4	clear
1510	8.67	890	162	15.14	7.92	42.08	4.62	0.5	27.06	103.9	
1515.75	8.57	890	155	15.14	7.92	42.09	5.11	0.4	27.06	102.8	
1521.50	8.52	890	155	15.10	7.92	42.09	5.15	0.6	27.06	102.6	
1527.	8.49	890	155	15.12	7.92	42.07	4.90	0.4	27.05	103.4	
1533.25	8.48	890	155	15.10	7.91	42.09	4.93	0.0	27.06	103.6	
1536	8.47										High Tide
1539	8.50	890	155	15.17	7.92	42.08	5.35	0.3	27.06	102.4	clear
1545	8.51	890	148	15.18	7.92	42.07	5.45	0.5	27.05	102.2	
1550.75	8.65	890	155	15.19	7.92	42.08	5.11	0.4	27.05	102.0	

1552
1602

Stop purge
LV site

1well vol = ~2.8 gals using V = 0.163 Tr²

Low Flow Purge Data Sheet

Low Tide - 9:20 AM
High Tide - 3:36 PM

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Start Time: ~~0725~~ 0708 @ 9-18-96 hours
End Time: ~~1540~~ 1000 @ 9-18-96 hours
Total Depth: 32.??
Total Volume Purged: 12.7 L or ~3.2 gal (gal. / L)

Well #: DW 7B
Date: 9/18/96
Tide Cycle: [ ] High [X] Low [ ] N/A
Weather: V. Heavy rain Strong Wind 45-50°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments New Nitrogen Tank
0708	15.00'		300	NOTICED DRAWDOWN. REDUCED FLOW RATE IMMEDIATELY							Static Water Level
0725	16.80'	600	160	13.87	6.89	29.29	7.24	8.9	18.17	73.2	Settings at D pressure D-vent
0735	17.00	600	150	13.37	6.81	31.31	6.14	6.0	19.50	79.4	
0750	18.00'	600	200	13.21	6.82	31.43	5.31	7.5	19.59	82.1	
0755	18.35'	600	150	13.16	6.83	31.41	5.20	7.9	19.57	82.6	
0800	19.00'	500	250	13.06	6.84	31.29	5.08	9.6	19.47	83.6	Appears that turbidity increasing, flowrate increasing, tide in a low cycle - less water with higher rate equals to kid H2O. Increasing cycle time to slow flow rate now - setting at "C"
0805	NR*	600	200	13.03	6.84	31.27	5.03	10.3	19.47	83.8	
0810	NR*	600	200	12.97	6.85	31.35	4.97	11.4	19.54	84.5	
0815	NR*	600	141	12.95	6.85	31.42	4.98	13.4	19.57	84.6	
0820	NR*	500	125	12.90	6.84	31.59	4.99	14.7	19.70	86.8	
0825	NR*	175	35	12.88	6.84	31.63	5.11	16.1	19.72	87.4	
0830	NR*			12.89	6.85	31.69	5.55	14.2	19.75	87.4	ALL READINGS FROM WATER IN CELL - NO NEW WATER COMING INTO CELL - PUMP NEEDS ADJUSTMENT
0835	NR*	PUMP NEEDS ADJUSTMENT + NO VOLUME + FLOWRATE CALCULATIONS		12.88	6.85	31.71	5.72	14.4	19.76	87.9	
0840	NR*			12.88	6.85	31.71	5.22	14.3	19.76	88.7	
0845	NR*			12.85	6.85	31.72	5.12	16.2	19.76	88.6	
0850	NR*			12.85	6.86	31.73	5.10	17.5	19.77	88.6	

Note: Per background (5975) - DW 7B is tidally influenced.

* Water Level Indicator is too wet - attempting to dry off instrument

TIMCO REP SUGGESTED THAT PUMP WILL NOT FUNCTION IF WATER LEVEL BELOW SCREEN. CHECKED WATER LEVEL W/ DRY INSTRUMENT @ 0855 hrs - indicated water at 17.20' from top PVC. Pump adjustments being made.

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Well #: DW 7B
Date: 9-18-96

Start Time: 0708 hours
End Time: 1000 hours
Total Depth: 32.??
Total Volume Purged: 12.72 oz 3.2 gal (gal. / L)
Tide Cycle: [ ] High [X] Low [ ] N/A
Weather: V Heavy Rain, Strong wind

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
0855	17.20'	Readjusting		13.65	6.85	31.94	5.69	21.0	19.92	88.0	Adjusting setting
0900	— NR*	pressure + vent setting		13.08	6.84	31.92	5.40	21.7	19.84	87.6	on controller
0905	17.50'	At C setting now	—	12.32	6.92	30.71	5.29	37.7	18.92	84.3	
0910	NR*	600	218	12.32	6.92	30.37	4.59	38.7	18.90	84.0	Adjusting flow
0915	~~NR~~ 18.00'	—	—	12.68	6.88	31.32	5.00	52.7	19.56	87.8	rate
0920	NR*	—	—	12.82	6.85	31.77	4.96	41.9	19.82	90.0	LOW TIDE
0925	NR*	600	150	12.82	6.85	31.78	4.89	41.9	19.82	89.7	
0930	17.60'	500	166	13.25	6.83	32.28	5.12	53.9	20.18	90.4	WATER STARTING TO COME UP
0935	NR*	500	105	12.97	6.83	32.29	5.89	72.8	20.17	91.0	
0940	NR*	—	—	12.72	6.87	— READINGS SKEWED				→	CLEANING CELL
0945	NR*	—	—	12.65	6.83	32.68	6.57	11.8	20.44	90.3	
0950	NR*	500	100	12.51	6.83	32.81	6.21	13.1	20.50	92.0	
0955	NR*	500	150	12.41	6.82	32.90	6.39	14.8	20.57	92.7	
1000	NR*			12.32	6.81	32.99	6.45	21.5	20.62	95.5	END PUMPING

* NR - Conditions too wet for accurate readings on the water level indicator. Heavy rain precludes reading instrument constantly needs to be dried off.

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Well #: DW 7B
Date: 9/18/96

Start Time: 1235 hours
End Time: 1540 hours
Total Depth: 32.??
Total Volume Purged: 12.7 L @ 3.2 gal (gal. / L)
Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: H. Rain Strong wind 55°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
1235	14.30'										Static Water Level
1245	NR*	600	218	13.79	6.83	31.45	7.82	7.4	19.64	106.7	Settling @
1250	NR*	—	—	13.41	6.80	31.73	6.30	-1.3	19.81	97.7	@ pressure
1255	14.14'	500	166	13.28	6.80	31.75	6.22	-1.2	19.82	95.1	@ vent
1300	NR*	—	—	13.19	6.81	31.76	6.23	-1.3	19.81	92.7	
1305	14.65'	500	166	13.19	6.80	31.78	5.83	-1.2	19.82	92.5	
1310	NR*	—	—	13.18	6.80	31.78	4.08	-1.3	19.84	91.6	
1315	14.15'	500	166	13.18	6.80	31.79	5.50	-1.3	19.85	91.5	
1320	14.03'	500	182	13.14	6.81	31.95	5.88	-1.31	19.92	90.3	@ 9-18-96
1325	13.93'	500	166	13.15	6.80	31.97	5.61	-1.3	19.96	91.0	
1330	13.51'	500	181	13.14	6.80	32.12	6.65	-1.3	20.05	91.5	
1335	13.50'	500	181	13.10	6.81	32.28	6.35	-1.3	20.16	92.4	
1340	13.52'	500	181	13.07	6.81	32.39	6.02	-1.3	20.25	93.4	
1345	13.05'	500	181	13.09	6.82	32.44	~~6.43~~	-1.3	20.29	94.1	@ 9-18-96
1350	NR	500	166	13.10	6.80	32.54	5.73	-1.3	20.34	96.1	
1355					Change Nitrogen Tank						Recalibrated Turbidity

(5600)

NR* Instrument not dry enough for proper use or accurate readings

Using nitrogen gas cylinder vs. compressor

↳ @ 0 NTU = -0.3 NTU
@ 100 NTU = 99.8 NTU

1-800-363-3269

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Well #: DW 76
Date: 9/18/96

Start Time: 1235 hours
End Time: 1540 hours
Total Depth: 32.??
Total Volume Purged: 12.7L or 3.2gal (gal. / L)
Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: Heavy rain Strong Wind 55°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
1410											Water Filling up Well
1415											Letting Instrument Dry out - hand unit
1420	NR*	500	166	13.52	6.77	32.54	5.92	-0.7	20.35	98.2	
1425	NR*	500	166	13.34	6.78	32.75	6.32	-0.8	20.48	98.4	
1430	NR*	500	166	13.33	6.77	32.93	5.96	-0.7	20.61	98.7	
1435	NR*	500	166	13.37	6.78	33.00	5.97	-0.8	20.67	98.9	
1440	NR*	500	166	13.38	6.78	33.06	5.98	-0.7	20.71	99.4	
1445	NR*	500	166	13.43	6.73	33.08	6.01	-0.7	20.72	99.2	
1450	NR*	500	166	13.45	6.78	33.13	~~6.49~~ 5.99	-0.7	20.75	99.3	
1455	NR*	500	166	13.46	6.78	33.12	5.99	-0.8	20.76	99.6	
1500	NR*	600	~~181~~ 150								No readings! call in to tech rep for assistance
1505	↓										
1510											
1515											
1520	NR*	500 (5100)	160	13.46	6.80	33.24	~~6.~~ 6.11	-0.7	20.85	100.5	

Note: Wiper device on turbidity meter appears to significantly decrease readings when used

NR*- wet weather precludes proper function of water level indicator, unless instrument dry enough during use

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Well #: DW 7B
Date: 9/18/96

Start Time: 1235 hours
End Time: 1540 hours
Total Depth: 32.??
Total Volume Purged: 12.7L ≈ 3.2gal (gal. / L)
Tide Cycle: [X] High [ ] Low [ ] N/A
Weather: Rain, Windy

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
											Static Water Level
1525	NR*	500	160	13.47	6.79	33.23	6.09	-0.7	20.83	100.9	
1530	NR*	500	160	13.51	6.79	33.24	6.15	-0.7	20.84	101.0	
1535	NR*	500	160	13.54	6.79	33.24	6.13	-0.7	20.84	100.6	HIGH TIDE
1540	NR*	500	160	13.54	6.79	33.24	6.17	-0.7	20.83	100.5	
1545											stop purging per PNS rep + North Div rep
1550											
1555											
1600											

(2000)

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW-12B
Date: 9-19-96

Start Time: 0710 hours
End Time: 1030 hours

Total Depth:
Total Volume Purged: ~ 7 (gal / L)

Tide Cycle: [ ] High [X] Low @ 1010 [ ] N/A
Weather: clear, 62°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
0710	10.49'										Static Water Level
0724				16.11	7.34	25.78	2.77	171.1	15.78	22.2	
0727	11.80'	650	130	15.22	7.31	25.75	1.89	140.2	15.73	0.8	
0735	11.55'	880	176	14.34	7.31	25.71	0.65	242.2	15.74	-31.4	vent c pressure c
0745	12.00'	680	62	15.35	7.29	25.68	0.68	301.2	15.73	-39.6	
			<	15.50	7.36	20.10	1.57	576	12.0	–	HORIBA >
0755	12.51'	1040	104	15.54	7.29	25.72	0.69	281.4	15.74	-49.9	
0800	12.73'	500	100	15.40	7.28	25.70	2.29	251.8	15.74	-52.1	tan/cloudy
0805	12.96'	550	110	15.47	7.27	25.68	0.73	209.4	15.71	-64.1	
0810	13.10'	500	100	15.59	7.26	25.71	0.65	208.4	15.73	-62.9	
			<	16.4	7.37	19.8	1.88	402	11.8	–	HORIBA >
0815	13.02'	500	100	15.51	7.25	25.68	1.60	248.3	15.75	-67.5	cloudy
0820	13.10'	550	110	15.60	7.25	25.68	0.81	213.3	15.70	-83.6	
0825	13.17'	510	102	15.37	7.25	25.78	0.52	218.0	15.77	-88.7	
0830	13.40'	700	140	15.47	7.23	25.70	0.77	259.2	15.73	-93.9	•Change N_2 Tank •clean flow-thru @0832
			<	16.70	7.35	20.0	1.46	448	11.9	–	HORIBA >

YSI S/N 95D32351 Sonde
YSI 610-D S/N _____

HORIBA -> No

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: JW-12B
Date: 9-19-96

Start Time: _____ hours Total Depth: _____
End Time: _____ hours Total Volume Purged: _____ (gal. / L)

Tide Cycle: [ ] High [X] Low [ ] N/A
Weather: _____

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
0835	-										~~Static Water Level~~ antic
0845	13.89'	400	80	16.41	7.19	25.74	1.96	1.4	15.77	-78.1	
0850	14.00'	530	106	15.41	7.17	25.81	0.69	221.6	15.83	-86.4	
0855	NM	870	174	14.68	7.16	25.74	0.80	254.5	15.75	-96.7	
0900	14.10'	1150	230	13.92	7.17	25.80	0.54	390.8	15.80	-109.8	
0905	14.10'	1050	210	13.90	7.17	25.73	0.49	264.4	15.76	-120.8	INC CYCLE TIME 1050/5MIN D/D
0910	14.27'	1000	200	13.95	7.16	25.76	0.15	270.8	15.75	-122.2	
			HORIBA >	15.60	7.36	20.10	1.91 ↓	501	1.19%	—	< HORIBA
0915	14.36	820	164	14.19	7.17	25.85	0.49	293.0	15.78	-126.8	022481R 820/5min
0920	14.55	840	168	14.17	7.16	25.80	0.46	214.0	15.83	-130.9	133875R - TRIED OTHER 610D 840/5MIN
0925	14.59	1400	280	13.27	7.17	25.76	0.30	208.7	15.82	-134.8	Sonde 95D32839
0930	14.63	1050	210	13.62	7.17	25.79	0.22	154	15.81	-137.4	Vent E Pressure E
0935	14.58	650	130	14.46	7.17	25.73	0.41	135.1	15.74	-139.0	
0940	14.82	500	100	15.38	7.19	25.76	0.43	105.0	15.78	-141.4	Cloudy
	<			16.3	7.39	19.9	2.75	321	11.8	—	HORIBA >
0945	13.80	500	100	15.60	7.19	25.82	0.75	93.4	15.85	-141.0	

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Well #: JW - 12B
Date: 9-19-96

Start Time: _____ hours Total Depth: _____
End Time: _____ hours Total Volume Purged: _____ (gal. / L)
Tide Cycle: [ ] High [X] Low [ ] N/A
Weather: _____

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %	Eh	Comments
—	—										Static Water Level
0950	14.66	500	100	16.05	7.17	25.75	0.52	81.1	15.76	-140.1	
0955	14.64	500	100	15.78	7.19	25.90	0.63	111.2	15.83	-139.6	
1000	14.52	690	138	16.07	7.17	25.75	0.62	83.3	15.79	-138.7	
1005	14.88'	500	100	16.07	7.17	25.76	0.45	88.4	15.77	-137.7	
1010	14.76	500	100	16.29	7.19	25.91	1.21	357.5	15.88	-124.4	Low Tide@1010
	<			17.4	7.37	19.8	2.33	263	11.7	—	HORIBA >
1015	14.73'	490	98	16.12	7.21	25.80	0.52	174.4	15.81	-124.3	
1020	14.67	460	92	15.84	7.21	25.88	0.41	94.2	15.82	-129.0	
1026	14.75	600	100	15.75	7.22	25.94	0.39	91.4	15.85	-132.6	clear
1030	14.88	460		16.01	7.22	25.77	0.43	61.7	15.80	-135.6	
	<			17.8	7.36	19.7	2.08	146	11.7	—	HORIBA >
											Stop @ 1030

Note: Horiba temp. may be high because instrument, H_2O, & beaker in sun between readings

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: HW-2
Date: 9-19-96

Start Time: 1211 hours
End Time: 1518 hours

Total Depth:
Total Volume Purged: (gal. / L)

Tide Cycle: [ ] High @1626 [ ] Low [X] N/A
Weather: sunny 84°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. ‰	Eh	Comments
1210	7.43										Static Water Level
1230	7.51			20.60	6.01	13.73	7.05	40.2	7.96	126.7	Initial
1235	7.62	550	110	18.37	5.88	15.74	3.03	11.3	9.21	129.1	
			<	22.0	6.35	10.90	3.90	40	6.10	—	HORIBA >
1240	7.75	630	126	17.49	5.91	15.37	2.52	9.0	8.99	118.1	
1245	7.64	720	144	17.14	5.94	15.29	2.24	5.8	8.95	108.4	Clear v c p b 16 psi
1250	7.55	650	130	17.20	5.93	15.28	1.93	3.9	8.94	101.7	
1255	7.57	800	140	17.32	5.94	13.22	1.89	1.0	7.66	97.0	
1300	7.56	610	122	17.42	5.95	10.72	1.45	0.8	6.11	95.0	clear
1305	7.57	900		17.30	5.99	9.08	1.66	5.5	5.10	89.0	clear
			<	18.9	6.21	8.54	1.74	3	4.60	—	Horiba>
1310	7.70	790	158	17.47	6.00	8.20	1.74	5.9	4.60	86.9	clear
1315	7.63	790	158	17.36	6.00	7.83	2.04	5.5	4.36	86.1	clear
1320	7.68	630	126	17.45	5.99	7.41	1.79	7.1	4.14	86.6	clear
1325	7.65	780	156	17.41	5.99	6.88	1.61	7.0	3.79	86.1	clear
1330	7.57	630	126	17.44	6.00	6.43	1.48	9.5	3.52	83.3	

YSI S/N 95032839 sonde
YSI 610-D 133875R

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Start Time: 1211 hours
End Time: 1518 hours
Total Depth:
Total Volume Purged: (gal. / L)

Well #: HW-2
Date: 9-19-26
Tide Cycle: [ ] High @1626 [ ] Low [X] N/A
Weather: Sunny 84°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. %0	Eh	Comments
											Static Water Level
1335			<	18.9	6.24	5.42	1.34	2.0	2.80	—	HORIBA >
1335	7.65	800	160	17.54	5.99	5.92	0.82	10.5	3.19	81.2	clear
1340	7.62	750	150	17.52	6.02	5.39	0.79	10.9	2.91	78.2	clear
1345	7.56	600	120	17.55	6.03	5.02	0.87	13.7	2.71	75.3	clear
1350	7.55	600	120	17.64	6.03	4.78	0.80	13.2	2.57	73.8	clear
1355	7.64	630	126	17.76	6.04	4.57	0.73	-0.1	2.46	72.2	cleaned turb. sensor
1400	7.62	630	126	17.70	6.04	4.36	0.95	-0.9	2.33	71.3	
1400	—		<	19.2	6.26	3.98	1.15	2.0	2.00	—	HORIBA >
1405	7.58	620	124	17.69	6.05	4.10	0.75	-0.9	2.19	70.0	
1410	—									→	CLEANED + CHECKED FOR TURBIDITY - EMPTY CELL
1417	—									→	COMPLETED REFILL OF CELL 470 u
1420	7.61	400	133	17.90	6.08	3.70	1.25	0.2	1.95	62.9	clear
1425	7.50	480	96	17.85	6.08	3.62	0.99	0.1	1.91	62.0	clear
1430	7.57	500	100	17.80	6.08	3.57	0.88	0.1	1.88	61.9	clear - PSI@8 V=D P=D
1435	7.58	620	206	17.87	6.07	3.51	0.76	0.0	1.85	61.9	Adding Gasoline to compressor @ 1431 Restart 1432 hrs

V= VENT SETTING
P= PRESSURE SETTING

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515
Start Time: 1211 hours
End Time: hours
Total Depth:
Total Volume Purged: (gal. / L)

Well #: HW-2
Date: 9-19-96
Tide Cycle: [✓] High @ 1626 [ ] Low [x] N/A
Weather: Sunny 84°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO mg/L	Turb. NTU	Sal. ‰	Eh	Comments
											Static Water Level
1440	—	—	— <	20.0	6.33	3.21	2.08	5	1.6	—	HORIBA >
1440	7.68	630	126	17.77	6.08	3.47	0.75	0.0	1.83	61.3	clear
1445	7.57	630	126	17.36	6.09	3.40	0.77	0.0	1.79	60.7	clear
1450	7.59	650	130	17.07	6.11	3.33	0.69	12.7*	1.75	58.8	knocked sonde accidentally *
1455	7.66	150 + 470	124	16.87	6.11	3.25	0.70	-0.1	1.71	57.3	
1500	7.55	620	124	16.95	6.11	3.20	0.83	-0.1	1.68	57.3	clear
1505	7.66	640	128	17.00	6.12	3.16	1.24	-0.1	1.66	57.0	
			<	17.60	6.26	2.73	2.12	2	1.3	—	HORIBA >
1510	7.57	640	128	16.95	6.11	3.13	0.66	-0.1	1.64	56.2	clear
1515	7.64	600	120	16.95	6.12	3.09	0.76	-0.1	1.62	56.1	clear
	<			17.3	6.23	2.70	1.01	3	1.30	—	Horiba >
1518											stop

Preliminary Test

Low Flow Purge Data Sheet

Project Site Name: PNS, Kittery, ME
Project Number: 6515

Well #: HW-2
Date: 9-16-96

Start Time: 1307 hours
Total Depth: 14.90'
End Time: hours
Total Volume Purged: (gal. / L)

Tide Cycle: [X] High @ 1410 [ ] Low [ ] N/A
Weather: overcast 66°F

Time minutes	Water Level feet below TOC	Volume mL	Flow Rate mL/min	Temp °C	pH	Cond. mS/cm	DO ~~mg/L~~	Turb. NTU	Sal. ‰	Eh	Comments
1300	TE ~~7.75~~ 7.82										Static Water Level
1310				17.85	6.10	15.96	72.0%	11.7	10.05	74.5	Initial
1330	9.58			14.33	6.21	8.05	13.2	1.8	4.49	21.8	
1345	@ top of pump		450	15.46	6.17	11.94	34.5	-657	6.61	53.3	

ATTACHMENT E

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION I

Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells

Revision Number 2
July 30, 1996

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

I. SCOPE & APPLICATION

This standard operating procedure (SOP) provides a general framework for collecting ground water samples that are indicative of mobile organic and inorganic loads at ambient flow conditions (both the dissolved fraction and the fraction associated with mobile particulates). The SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. This SOP is aimed primarily at sampling monitoring wells that can accept a submersible pump and have a screen, or open interval length of 10 feet or less (this is the most common situation). However, this procedure is flexible and can be used in a variety of well construction and ground-water yield situations. Samples thus obtained are suitable for analyses of ground water contaminants (volatile and semi-volatile organic analytes, pesticides, PCBs, metals and other inorganics), or other naturally occurring analytes.

This procedure does not address the collection of samples from wells containing light or dense non-aqueous phase liquids (LNAPLs and DNAPLs). For this the reader may wish to check: Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation; C.K. Smoley (CRC Press), Boca Raton, Florida and U.S. Environmental Protection Agency, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance; Washington, DC (EPA/530-R-93-001).

The screen, or open interval of the monitoring well should be optimally located (both laterally and vertically) to intercept existing contaminant plume(s) or along flowpaths of potential contaminant releases. It is presumed that the analytes of interest move (or potentially move) primarily through the more permeable zones within the screen, or open interval.

Use of trademark names does not imply endorsement by U.S.EPA but is intended only to assist in identification of a specific type of device.

Proper well construction and development cannot be overemphasized, since the use of installation techniques that are appropriate to the hydrogeologic setting often prevents "problem well" situations from occurring. It is also recommended that as part of development or redevelopment the well should be tested to determine the appropriate pumping rate to obtain stabilization of field indicator parameters with minimal drawdown in shortest amount of time. With this information field crews can then conduct purging and sampling in a more expeditious manner.

The mid-point of the saturated screen length (which should not exceed 10 feet) is used by convention as the location of the pump intake. However, significant chemical or permeability contrast(s) within the screen may require additional field work to determine the optimum vertical location(s) for the intake, and appropriate pumping rate(s) for purging and sampling more localized target zone(s). Primary flow zones (high(er) permealability and/or high(er) chemical concentrations) should be identified in wells with screen lengths longer than 10 feet, or in wells with open boreholes in bedrock. Targeting these zones for water sampling will help insure that the low stress procedure will not underestimate contaminant concentrations. The Sampling and Analysis Plan must provide clear instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. If after 4 hours of purging indicator field parameters have not stabilized, one of 3 optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization) c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may not meet the sampling objectives).

Changes to this SOP should be proposed and discussed when the site Sampling and Analysis Plan is submitted for approval. Subsequent requests for modifications of an approved plan must include adequate technical justification for proposed changes. All changes and modifications must be approved before implementation in field.

II. EQUIPMENT

A. Extraction device

Adjustable rate, submersible pumps are preferred (for example, centrifugal or bladder pump constructed of stainless steel or Teflon).

Adjustable rate, peristaltic pumps (suction) may be used with caution. Note that EPA guidance states: "Suction pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" (EPA/540/P-87/001, 1987, page 8.5-11).

The use of inertial pumps is discouraged. These devices frequently cause greater disturbance during purging and sampling and are less easily controlled than the pumps listed above. This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

B. Tubing

Teflon or Teflon lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for inorganics analyses. However, these materials should be used with caution when sampling for organics. If these materials are used, the equipment blank (which includes the tubing) data must show that these materials do not add contaminants to the sample.

Stainless steel tubing may be used when sampling for VOCs, SVOCs, pesticides, and PCBs. However, it should be used with caution when sampling for metals.

The use of 1/4 inch or 3/8 inch (inner diameter) tubing is preferred. This will help ensure the tubing remains liquid filled when operating at very low pumping rates.

Pharmaceutical grade (Pharmed) tubing should be used for the section around the rotor head of a peristaltic pump, to minimize gaseous diffusion.

C. Water level measuring device(s), capable of measuring to 0.01 foot accuracy (electronic "tape", pressure transducer). Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use

must include check measurements with a water level "tape" at the start and end of each record.

D. Flow measurement supplies (e.g., graduated cylinder and stop watch).

E. Interface probe, if needed.

F. Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate the samples.

G. Indicator field parameter monitoring instruments - pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Use of a flow-through-cell is required when measuring all listed parameters, except turbidity. Standards to perform field calibration of instruments. Analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846. For Eh measurements, follow manufacturer's instructions.

H. Decontamination supplies (for example, non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.).

I. Logbook(s), and other forms (for example, well purging forms).

J. Sample Bottles.

K. Sample preservation supplies (as required by the analytical methods).

L. Sample tags or labels.

M. Well construction data, location map, field data from last sampling event.

N. Well keys.

O. Site specific Sample and Analysis Plan/Quality Assurance Project Plan.

P. PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

III. PRELIMINARY SITE ACTIVITIES

Check well for security damage or evidence of tampering, record pertinent observations.

Lay out sheet of clean polyethylene for monitoring and sampling equipment.

Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook.

A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. It is recommended that water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) be measured the day before, in order to allow for re-settlement of any particulates in the water column. If measurement of total well depth is not made the day before, it should not be measured until after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe are usually not needed unless analytical data or field head space information signal a worsening situation. Note: procedures for collection of LNAPL and DNAPL samples are not addressed in this SOP.

IV. PURGING AND SAMPLING PROCEDURE

Sampling wells in order of increasing chemical concentrations (known or anticipated) is preferred.

1. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the midpoint of the zone to be sampled. The Sampling and Analysis Plan should specify the sampling depth, or provide criteria for selection of intake depth for each well (see Section I). If possible keep the pump intake at least two

feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well. Collection of turbid free water samples may be especially difficult if there is two feet or less of standing water in the well.

2. Measure Water Level

Before starting pump, measure water level. If recording pressure transducer is used-initialize starting condition.

3. Purge Well

3a. Initial Low Stress Sampling Event

Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.

Monitor and record water level and pumping rate every three to five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (for example, 0.1 - 0.4 l/min) to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

3b. Subsequent Low Stress Sampling Events

After synoptic water level measurement round, check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). Perform purging operations as above.

4. Monitor Indicator Field Parameters

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, Eh, DO) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at three (3) to five (5) minute intervals, are within the following limits:

turbidity (10% for values greater than 1 NTU),
DO (10%),
specific conductance (3%),
temperature (3%),
pH (± 0.1 unit),
ORP/Eh (± 10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell and may also cause an underestimation of turbidity values measured after the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities.

The flow-through-cell must be designed in a way that prevents air bubble entrapment in the cell. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must be submerged in water at all times. If two flow-through-cells are used in series, the one containing the dissolved oxygen probe should come first (this parameter is most susceptible to error if air leaks into the system).

5. Collect Water Samples

Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect cell to obtain sample).

VOC samples should be collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use one of the following procedures to collect samples: (1) add clamp, connector (Teflon or stainless steel) or valve to constrict sampling end of tubing; (2) insert small diameter Teflon tubing into water filled portion of pump tubing allowing the end to protrude beyond the end of the pump tubing, collect sample from small diameter tubing; (3) collect non-VOC samples first, then increase flow rate slightly until the water completely fills the tubing, collect sample and record new drawdown, flow rate and new indicator field parameter values.

Add preservative, as required by analytical methods, to samples immediately after they are collected if the sample containers are not pre-preserved. Check analytical methods (e.g. EPA SW-846, water supply, etc.) for additional information on preservation. Check pH for all samples requiring pH adjustment to assure proper pH value. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter is required, and the filter size (0.45 um is commonly used) should be based on the sampling objective. Pre-rinse the filter with approximately 25 - 50 ml of ground water prior to sample collection. Preserve filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in ground water for human health risk calculations.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

6. Post Sampling Activities

If recording pressure transducer is used, remeasure water level with tape.

After collection of the samples, the pump tubing may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth is optional after the initial low stress sampling event. However, it is recommended if the well has a "silting" problem or if confirmation of well identity is needed.

Secure the well.

V. DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

<u>Procedure 1</u>

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is

recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.

Flush with distilled/deionized water. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

VI. FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch

may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one set per VOC sample cooler.

Field duplicate.

Matrix spike.

Matrix spike duplicate.

Equipment blank.

Trip blank (VOCs).

Temperature blank (one per sample cooler).

Equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank will only include the pump in subsequent sampling rounds.

Collect samples in order from wells with lowest contaminant concentration to highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

Field duplicates are collected to determine precision of sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

If split samples are to be collected, collect split for each analyte group in consecutive order (VOC original, VOC split, etc.). Split sample should be as identical as possible to original sample.

All monitoring instrumentation shall be operated in accordance with EPA analytical methods and manufacturer's operating instructions. EPA analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846 with exception of Eh, for which the manufacturer's instructions are to be followed. Instruments shall be calibrated at the beginning of each day. If a measurement falls outside the calibration range, the instrument should be re-calibrated so that all measurements fall within the calibration range. At the end of each day, check calibration to verify that instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, need not be calibrated to the above frequency. They should be checked for accuracy prior to field use according to EPA Methods and the manufacturer's instructions.

VII. FIELD LOGBOOK

A field log shall be kept to document all ground water field monitoring activities (see attached example matrix), and record all of the following:

- Well identification.
- Well depth, and measurement technique.
- Static water level depth, date, time and measurement technique.
- Presence and thickness of immiscible liquid (NAPL) layers and detection method.
- Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.
- Well sampling sequence and time of each sample collection.
- Types of sample bottles used and sample identification numbers.
- Preservatives used.
- Parameters requested for analysis.
- Field observations during sampling event.
- Name of sample collector(s).
- Weather conditions.
- QA/QC data for field instruments.
- Any problems encountered should be highlighted.
- Description of all sampling equipment used, including trade names, model number, diameters, material composition, etc.

VIII. DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, and whatever field logbook information is needed to allow for a full evaluation of data useability.

EXAMPLE (Minimum Requirements) Page____of____

Well PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)_____
Well Number_____ Date_____
Field Personnel_____
Sampling Organization_____
Identify MP_____

Depth to _____/_____ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)_____
Purging Device; (pump type)_____

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP/ Eh[3] mv	DO mg/L	Turb-idity NTU	Comments

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm (same as µmhos/cm) at 25°C.
3. Oxidation reduction potential (stand in for Eh).