99
8-15-2009

Easterly, Jennifer S - DNR

From: Easterly, Jennifer S - DNR
Sent: Thursday, October 15, 2009 10:41 AM
To: Evanson, Theresa A - DNR
Subject: FW: Ripon FF/NN Landfill Proposed MNA Monitoring Plan
Attachments: 081209 MNA Monitoirng.pdf

Terry,
Can you take a peak at the parameters that they are suggesting. Considering that this is a superfund site and that they are trying to prove that MNA is the answer here....I would think that they would want to pick a few more parameters. Your thoughts?

From: Noel, Mike [mailto:Mike.Noel@geotransinc.com]
Sent: Wednesday, August 12, 2009 3:53 PM
To: Easterly, Jennifer S - DNR
Cc: Olavarria, Nelson; Steve Barg; Schorle, Bernard
Subject: Ripon FF/NN Landfill Proposed MNA Monitoring Plan

Jennie,
As a follow up to our meeting June 24, attached for your review and approval is the proposed MNA monitoring plan for the site. Let me know if you have any questions or need additional information.
Mike

Michael R. Noel | Vice President, Principal Hydrogeologist
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August 12, 2009

Ms. Jennifer Easterly, RPM
Wisconsin Department of Natural Resources
625 E. County Road Y, Suite 700
Oshkosh, WI 54901-9731

Re: Ripon FF/NN Landfill
Proposed MNA Monitoring Plan

Dear Jennie:

At our meeting on June 24, 2009 you indicated that you were looking to put off the ROD amendment for the Ripon FF/NN Landfill (Site) until additional groundwater monitoring data was collected to support a recommendation that monitored natural attenuation (MNA) was an appropriate alternative for groundwater contaminants at the Site. This document presents a proposed groundwater monitoring plan to provide you with the information you need.

Current Analysis

Multiple lines of evidence are typically required to demonstrate the effectiveness of chlorinated solvent remediation. The goal of an MNA evaluation is to confirm that the plume is stable or receding, and that there are no unacceptable risks posed to human health or the environment.

The primary line of evidence that natural attenuation of an organic contaminant is occurring is indicated by a significant decrease in contaminant concentrations over time, or by a significant decrease in chemical concentrations along a groundwater flow path down-gradient from a source area when the plume is known to be relatively stable. As demonstrated in our April 2009 Progress Report for the Site, there has been a significant decrease in contaminant concentrations in groundwater over time.

The current condition at the Site is that the parent product TCE has totally degraded to non-detectable levels in 6 of 7 wells and in the 1 well where it is still present (MW-103) it is at a concentration below the ES. The TCE daughter product DCE has totally degraded to non-detectable levels in 7 of 11 wells and in the 4 wells where it is still present it is at a concentration below the ES and only exceeds the PAL at 1 well (MW-103). The remaining daughter product VC has totally degraded to non-detectable levels in 9 of 13 wells and in the 4 wells that it is still present (3 wells in Layer 3 and 1well in Layer 4) the highest concentration is 6.5 ug/L.

Indirect (i.e., secondary) lines of evidence that support MNA typically include trends in geochemical or redox indicators which demonstrate biodegradation is occurring down-gradient from a source area, or an increase in daughter product concentrations down-gradient from a source area. Under anaerobic conditions, chlorinated VOC's can be biodegraded by reductive dechlorination which entails the sequential replacement of chlorine atoms by hydrogen to produce more reduced, less-chlorinated products. Rates of reduction are highest for the more chlorinated compounds like TCE and decrease with the degree of chlorination to a point when oxidation rates become faster. While the reductive dechlorination of TCE and DCE are dominated by anaerobic processes, the reduction of VC is typically an aerobic process, although anaerobic microbial VC oxidation can occur under iron-reducing conditions.

At the Site the parent and first-order daughter product, TCE and DCE, respectively, have been nearly totally degraded and the only daughter product remaining above the ES is VC. The VC is only present in the deepest (Layers 3 and 4) and furthest wells from the Site. Sequential anaerobic/aerobic biodegradation of TCE can take place as reductive dechlorination proceeds under anaerobic conditions and then the dechlorination by-product (VC) flows out of the anaerobic zone into an aerobic environment. In the Layer 3 and 4 groundwater units the dissolved oxygen has historically been >0.5 mg/L but <2.0 mg/L. DO greater than 0.5 mg/L is considered an aerobic state (EPA, 1998), which would not promote reductive dechlorination but could oxidize VC aerobically.

Proposed MNA Monitoring Plan
The proposed MNA monitoring plan for the Site is summarized on Table 1. The plan includes semiannual water level measurements for all wells, semiannual groundwater MNA parameter monitoring for all Layer 2, 3 and 4 wells with dedicated QED sampling equipment, and semiannual or annual groundwater VOC sampling of all wells. Other elements of the monitoring plan include semiannual groundwater VOC sampling of 3 residential wells (Baneck, Gaastra and Rohde), semiannual gas VOC sampling of 4 gas extraction wells/vents and 1 gas probe, and annual leachate VOC sampling (if leachate is present).

MNA Parameters
Because VC is the sole remaining contaminant of concern and because VC reduction is most commonly an aerobic process via direct oxidation, MNA parameters that can demonstrate oxidative conditions will be monitored. MNA parameter monitoring will be conducted on wells vertically and horizontally up-gradient, within and down-gradient of the VC plume. Based on EPA (1998) guidance the following parameters will be monitored:

Analysis	Concentrations for VC Oxidation
Dissolved Oxygen	> 0.5 mg/L
Oxidation Reduction Potential	> 50 mV
Iron II Ferrous	ND (< 0.2 mg/L)
Nitrite	ND (< 0.08 mg/L)
Sulfide	ND (< 0.2 mg/L)
Methane	< 0.5 mg/L

↑ Iron II, Sulfide, methane = reductive dechlorination

DO, nitrate, ~~Manganese~~, iron, sulfate, ~~methane~~

ferric +3

The DO and ORP along with temperature, pH and conductivity will be measured using a QED MP20 MicroPurge Flow Cell Meter. Because of problems in the past with ORP calibration, a second standard will be used to confirm operation and a second meter will be used for back up confirmation that the meter is accurate.

The iron II, nitrite and sulfide will be measured in the field using CHEMetrics analyte-specific Vacu-vials® for photometric analysis using a CHEMetrics Model V-2000 LED photometer.

For dissolved methane, groundwater samples will be collected and submitted to Pace Analytical Laboratories for analysis using Method 8000.

VOC Sampling

Groundwater sampling for VOCs will follow the current frequency of semiannual and annual sampling of wells as shown on Table 1. Groundwater samples will be collected using low-flow sampling techniques for Layer 2, 3 and 4 wells which have been outfitted with dedicated QED equipment. The remaining wells (all Layer 1 and 3 Layer 2 wells) will be sampled by purging 3 casing volumes and collecting a sample with a bailer.

Reporting

Semiannual progress reports will be prepared and submitted to the WDNR within 30 days of receipt of analytical results.

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If you have any questions please feel free to contact me.

Sincerely,

GeoTrans, Inc.

Michael R. Noel, P.G.
Vice President, Principal Hydrogeologist

Enclosures

cc: Bernard Schorle, USEPA w/ Both Enclosures
Nelson Olavarria, Cooper Industries, w/o Enclosures
Steve Barg, City of Ripon, w/o Enclosures

All 1/4ly   Both should be 1/4ly to prove MNA is working

Groundwater Monitoring Schedule
FF/NN Landfill, Ripon, WI

Stratigraphic Layer	Sampling Point:	Location Relative to Landfill	Water Level	MNA Parameters	VOCs	Vinyl Chloride Concentration Apr 09	Equipment Type
Layer 1 Wells (25-65 ft bgs)	MW-101	Up-gradient	SA	SA	A	ND	Bailer
	MW-102	Side-gradient	SA		A	ND	Bailer
	MW-103	Down-gradient	SA	SA	SA	ND	Bailer
	MW-104	Within Landfill	SA		SA	ND	Bailer
	MW-106	Side-gradient	SA		A	ND	Bailer
	MW-107	Down-gradient	SA	SA	SA	ND	Bailer
	MW-108	Side-gradient	SA		SA	ND	Bailer
	MW-111	Down-gradient	SA	SA	A	ND	Bailer
	MW-112	Down-gradient	SA		SA	ND	Bailer
Layer 2 Wells (62-95 ft bgs)	P-101	Up-gradient	SA	SA	A	ND	Bailer
	P-102	Side-gradient	SA		SA	ND	Bailer
	P-103	Down-gradient	SA	SA	SA	ND	QED
	P-104	Beneath Landfill	SA		A	ND	QED
	P-106	Side-gradient	SA		SA	ND	QED
	P-107	Down-gradient	SA	SA	SA	ND	QED
	P-108	Side-gradient	SA		A	ND	Bailer
	P-111	Down-gradient	SA	SA	A	ND	QED
Layer 3 Wells (152-199 ft bgs)	MW-3B	Down-gradient	~~SA~~ Q	SA	SA	ND	QED
	P-103D	Down-gradient	SA	SA	SA	ND	QED
	P-111D	Down-gradient	SA	SA	SA	5.5 ug/L	QED
	P-113B	Down-gradient	SA	SA	SA	ND	QED
	P-114	Down-gradient	SA	SA	SA	6.5 ug/L	QED
	P-115	Down-gradient	SA	SA	SA	1.3 ug/L	QED
	P-116	Down-gradient	SA	SA	SA	ND	QED
Layer 4 Wells (281-328 ft bgs)	MW-3A	Down-gradient	~~SA~~ Q	SA	SA	ND	QED
	P-107D	Down-gradient	SA	SA	SA	2.5 ug/L	QED
	P-113A	Down-gradient	SA	SA	A	ND	QED
Private Wells	Baneck	Down-gradient			~~SA~~ Q	ND	Spigot
	Gaastra	Down-gradient			~~SA~~ Q	ND	Spigot
	Rohde	Down-gradient			~~SA~~ Q	ND	Spigot
Landfill	Leachate LH-1	Within Landfill	A		A	ND	Disposable bailers
	Leachate LH-2	Within Landfill	A		A	ND	Disposable bailers
	Leachate LH-3	Within Landfill	A		A	ND	Disposable bailers
	Gas VOCs LH-1	Within Landfill			SA	ND	Summa Canister
	Gas VOCs LH-2	Within Landfill			SA	ND	Summa Canister
	Gas VOCs LH-3	Within Landfill			SA	ND	Summa Canister
	Gas VOCs GV-6	Within Landfill			SA	ND	Summa Canister
	Gas VOCs GP-3	Down-gradient			SA	ND	Summa Canister
	Cap Inspection	On Landfill			SA		

OK (Leachate LH-1 to LH-3)
OK (Gas VOCs)
OK (Cap Inspection)

MNA = Monitored Natural Attenuation field parameters (Ph, Cond, Temp, DO, ORP, Fe(II), Nitrite and Sulfide)

SA = Semianual (Apr and Oct); A = Annual (Apr)

From Jan 27, 2003 Report on Dec 02' Sampling event.

Table 4 - Natural Attenuation Sampling Results - Field Measurements
FF/NN Landfill, Ripon, WI

Sampling Point	Collection Date	Temp	Conductivity	DO		pH	ORP	Iron II
		C	uS/cm	%	ug/L		mV	mg/L
MW-3A	12/05/2002	9.79	589	0.30	0.03	7.30	-312	0.6
MW-3B	12/05/2002	9.84	1248	-0.90	-0.11	6.57	-87	1.3
P-101	12/04/2002	9.26	843	0.70	0.08	7.12	-53.5	1.5
P-102	12/04/2002	9.33	1127	0.10	0.01	6.82	-47.80	4.4
P-103	12/04/2002	9.49	956	10.40	1.17	7.00	-60.50	3.0
P-104	12/04/2002	9.64	1247	4.50	0.51	6.82	-11.70	0
P-106	12/04/2002	9.38	1125	12.90	1.48	6.92	-21.60	0.9
P-107	12/04/2002	9.40	791	7.60	0.86	7.22	-28.00	0.6
P-107D	12/04/2002	7.90	594	NT	NT	7.64	NT	0
P-108	12/05/2002	10.01	807	0.90	0.10	7.31	10.90	0
MW-111	12/05/2002	7.84	866	1.20	0.15	7.15	27.20	0
P-111	12/05/2002	9.76	639	-0.20	-0.03	7.43	-88.30	1.1
P-111D	12/05/2002	9.75	910	-0.20	-0.02	7.32	-75.60	1.0
P-113A	12/03/2002	10.39	579	179.50	20.00	7.26	111.80	0
P-113B	12/03/2002	10.18	960	3.40	0.39	6.80	27.20	1.2
Ehster	12/03/2002	11.10	695	NT	NT	7.71	NT	3.2
Hadel	12/03/2002	6.60	539	NT	NT	7.72	NT	2.3
Weiss	12/03/2002	7.90	525	NT	NT	7.20	NT	2.4

NT: Not taken as probe could not be sent downhole at this well

FF/NN Landfill, Ripon, WI

Sampling Point:	Collection Date:	Manganese	Sulfate	Sulfide	Methane	Ethane	Ethene	Total Organic Carbon
	units	ug/L	mg/L	ug/L	ug/L	ug/L	ug/L	mg/L
MW-3A	12/05/2002	**430**	20					NA
MW-3B	12/05/2002	**93**	36					NA
MW-111	12/05/2002	**460**	44					NA
P-101	12/04/2002	**97**	50					2.0
P-102	12/04/2002	**130**	53		59			NA
P-103	12/04/2002	**88**	54		37			2.9
P-104	12/04/2002	**64**	52					NA
P-106	12/04/2002	**110**	<u>210</u>					NA
P-107	12/04/2002	**200**	66		110			3.4
P-107D	12/04/2002	**190**	19					NA
P-108	12/05/2002	4.1	55					NA
P-111	12/05/2002	**93**	44					[1.6]
	12/05/2002 Dup	**90**	43					1.9
P-111D	12/05/2002	2.1	62		130			2.5
P-113A	12/03/2002	**68**	12					NA
P-113B	12/03/2002	**79**	47					[1.7]
Ehster	12/03/2002	**66**	44		84			2.0
Hadel	12/03/2002	**100**	17					NA
	12/03/2002 Dup	**110**	16					NA
Weiss	12/03/2002	**130**	17					NA
WDNR	PAL	25	125	NE	NE	NE	NE	NE
NR140	ES	50	250	NE	NE	NE	NE	NE

Blank = not detected
NA = not analyzed
NE = Standard not established
PAL = NR 140 Preventive Action Limit
ES = NR 140 Enforcement Standard
Underline values indicate PAL exceedance
Bold values indicate ES exceedance
[ ] = detected at less than quantitation limit

from 1-7-04 Report Oct 03 Status Rpt

Table 4 - Natural Attenuation Sampling Results
FF/NN Landfill, Ripon, WI

Sampling Point	Collection Date	Nitrate	Sulfate	Total Organic Carbon	Temp	Conductivity	pH	DO	DO	ORP	Iron II	Sulfide #
		Lab Measurements			*Field Measurements*							
			mg/L	mg/L	C	uS/cm		%	mg/L	mV	mg/L	mg/L
MW-3A	12/5/2002	NA	20	NA	9.79	589	7.30	0.30	0.03	-312	0.6	0.0
	4/22/2003	NA	26	0.64	10.22	464	7.52	5.90	0.66	3	0.4	0.0
	10/22/2003	<0.058	14	<1.0	10.06	552	7.29	7.70	0.87	-98	1.9	0.1
MW-3B	12/5/2002	NA	36	NA	9.84	1248	6.57	-0.90	-0.11	-87	1.3	0.0
	4/22/2003	NA	46	0.73	9.86	815	7.18	3.30	0.37	-92	1.5	0.0
	10/22/2003	<0.058	43	<1.0	9.79	662	7.45	4.90	0.55	-161	0.1	0.0
MW-104	4/22/2003	NA	26	5.10	11.61	1200	6.83	16.60	1.81	-23	3.9	0.0
	10/23/2003	<0.058	4	14	11.40	891	7.69	NT	NT	NT	3.5	0.1
MW-107	4/21/2003	NA	NA	NA	9.84	1021	7.00	180.20	21.27	185.70	0.1	0.0
	4/22/2003	NA	30	2.20	10.32	1024	7.06	51.20	5.70	74.10	NT	NT
	10/21/2003	3.3	32	4.80	9.64	1211	6.92	51.10	5.80	79.30	0.0	0.0
MW-111	12/5/2002	NA	44	NA	7.84	866	7.15	1.20	0.15	27.20	0.0	0.0
P-101	12/4/2002	NA	50	2.00	9.26	843	7.12	0.70	0.08	-53.5	1.5	0.0
	4/22/2003	NA	51	1.30	10.12	646	7.46	7.40	0.81	-36.9	1.2	0.0
	10/23/2003	<0.058	49	<1.0	10.20	754	7.04	5.90	0.66	-65.5	1.1	0.0
P-102	12/4/2002	NA	53	NA	9.33	1127	6.82	0.01	0.001	-47.8	4.4	0.0
P-103	12/4/2002	NA	54	2.90	9.49	956	7.00	10.40	1.17	-60.50	3.0	0.0
	4/21/2003	NA	58	1.30	10.50	388	7.28	6.30	0.71	-29.90	3.2	0.0
	10/22/2003	0.41	54	<1.0	10.06	874	7.17	7.30	0.82	-147.10	3.0	0.0
P-107	12/4/2002	NA	66	3.40	9.40	791	7.22	7.60	0.86	-28.00	0.6	0.0
	4/21/2003	NA	74	1.70	9.62	646	7.43	6.70	0.76	37.30	1.2	0.0
	10/21/2003	<0.058	74	4.30	9.73	716	7.18	8.20	0.92	-70.40	1.3	0.0
P-107D*	12/4/2002	NA	19	NA	7.90	594	7.64	NT	NT	NT	0	0.0
	4/21/2003	NA	27	0.55	10.50	388	7.28	NT	NT	NT	NT	NT
	10/21/2003	<0.058	19	1.10	10.05	528	7.34	11.20	1.25	51.40	0.00	0.0
P-111	12/5/2002	NA	44	[1.6]	9.76	639	7.43	-0.20	-0.03	-88.30	1.1	0.0
	4/22/2003	NA	39	1.80	12.06	486	7.71	6.50	0.67	-74.20	1.0	0.0
	10/22/2003	<0.058	31	<1.0	9.87	566	7.53	6.60	0.75	-94.00	1.0	0.0
P-111D	12/5/2002	NA	62	2.50	9.75	910	7.32	-0.20	-0.02	-75.60	1.0	0.0
	4/23/2003	NA	64	1.40	9.98	706	7.63	8.10	0.94	-20.50	0.7	0.0
	10/23/2003	<0.058	65	2	9.78	838	7.17	9.20	0.70	-68.30	0.4	0.0
P-113A	12/3/2002	NA	12	NA	10.39	579	7.26	179.50	20.00	111.80	0	0.0
	4/23/2003	NA	15	0.87	10.37	465	7.50	27.00	2.98	42.00	1	0.0
	10/22/2003	0.3	10	<1.0	10.17	576	7.30	19.90	2.23	-62.60	0	0.1
P-113B	12/3/2002	NA	47	[1.7]	10.18	960	6.80	3.40	0.39	27.20	1.2	0.0
	4/23/2003	NA	56	0.58	10.13	715	7.22	9.20	1.05	-54.30	1.1	0.0
	10/22/2003	<0.058	49	4.10	10.13	616	7.42	4.10	0.46	-125.40	0.2	1.5
P-114 (Ehster)	12/3/2002	NA	44	2.00	11.10	695	7.71	NT	NT	NT	3.2	0.0
	4/23/2003	NA	63	1.20	10.00	669	7.71	7.50	0.85	-117.00	0.4	0.0
	10/23/2003	<0.058	49	<1.0	9.87	1379	7.31	4.80	0.54	-125.10	0.9	0.0

NT: Measurement not taken

NA: Parameter not analyzed

* Probe cannot be sent downhole at this well due to dedicated pump

\# December 2002 sulfide test was done using laboratory analysis Subsequent analyses were conducted using a Hach field kit

7-10-03 April 2003 Status Report

Table 4 - Natural Attenuation Sampling Results
FF/NN Landfill, Ripon, WI

		Lab Measurements		*Field Measurements*							
Sampling Point	Collection Date	Sulfate	Total Organic Carbon	Temp	Conductivity	pH	DO		ORP	Iron II	Sulfide [#]
		mg/L	mg/L	C	uS/cm		%	mg/L	mV	mg/	mg/
MW-3A	12/05/2002	20	NA	9.79	589	7.30	0.30	0.03	-312	0.6	0.0
	04/22/2003	26	0.64	10.22	464	7.52	5.90	0.66	3	0.4	0.0
MW-3B	12/05/2002	36	NA	9.84	1248	6.57	-0.90	-0.11	-87	1.3	0.0
	04/22/2003	46	0.73	9.86	815	7.18	3.30	0.37	-92	1.5	0.0
MW-104	04/22/2003	26	5.10	11.61	1200	6.83	16.60	1.81	-23	3.9	0.0
MW-107	04/21/2003	NA	NA	9.84	1021	7.00	180.20	21.27	185.70	0.1	0.0
	04/22/2003	30	2.20	10.32	1024	7.06	51.20	5.70	74.10	NT	NT
MW-111	12/05/2002	44	NA	7.84	866	7.15	1.20	0.15	27.20	0.0	0.0
P-101	12/04/2002	50	2.00	9.26	843	7.12	0.70	0.08	-53.5	1.5	0.0
	04/22/2003	51	1.30	10.12	646	7.46	7.40	0.81	-36.9	1.2	0.0
P-102	12/04/2002	53	NA	9.33	1127	6.82	0.01	0.001	-47.8	4.4	0.0
P-103	12/04/2002	54	2.90	9.49	956	7.00	10.40	1.17	-60.50	3.0	0.0
	04/21/2003	58	1.30	10.50	388	7.28	6.30	0.71	-29.90	3.2	0.0
P-107	12/04/2002	66	3.40	9.40	791	7.22	7.60	0.86	-28.00	0.6	0.0
	04/21/2003	74	1.70	9.62	646	7.43	6.70	0.76	37.30	1.2	0.0
P-107D*	12/04/2002	19	NA	7.90	594	7.64	NT	NT	NT	0	0.0
	04/21/2003	27	0.55	10.50	388	7.28	NT	NT	NT	NT	NT
P-111	12/05/2002	44	[1.6]	9.76	639	7.43	-0.20	-0.03	-88.30	1.1	0.0
	04/22/2003	39	1.80	12.06	486	7.71	6.50	0.67	-74.20	1.0	0.0
P-111D	12/05/2002	62	2.50	9.75	910	7.32	-0.20	-0.02	-75.60	1.0	0.0
	04/23/2003	64	1.40	9.98	706	7.63	8.10	0.94	-20.50	0.7	0.0
P-113A	12/03/2002	12	NA	10.39	579	7.26	179.50	20.00	111.80	0	0.0
	04/23/2003	15	0.87	10.37	465	7.50	27.00	2.98	42.00	1	0.0
P-113B	12/03/2002	47	[1.7]	10.18	960	6.80	3.40	0.39	27.20	1.2	0.0
	04/23/2003	56	0.58	10.13	715	7.22	9.20	1.05	-54.30	1.1	0.0
P-114 (Ehster)	12/03/2002	44	2.00	11.10	695	7.71	NT	NT	NT	3.2	0.0
	04/23/2003	63	1.20	10.00	669	7.71	7.50	0.85	-117.00	0.4	0.0

NT: Not taken

* Probe cannot be sent downhole at this well due to dedicated pump

December 2002 sulfide test was done using laboratory analysis The April 2003 analysis was conducted using a Hach field kit

Table 1*
Geochemical Patterns Expected with Reductive Dechlorination

Analyte	Concentration in Source Zone or Change from Background	Explanation
Arsenic (As^{+3})	Increase over background	Mobilized under anaerobic conditions if As present. May exceed ES standards.
Chloride (Cl^{-})	> 2x background	From dechlorination. Environmental factors may interfere (e.g., road salt). Initial contaminant concentrations may be too low to detect a significant increase in Cl^{-}.
Dissolved Oxygen (D.O.)	< 0.5 mg/l	Oxygen suppresses reductive dechlorination. Cis-DCE, 1,1-DCE, 1,1-DCA, VC, methylene chloride, and chloromethane may degrade aerobically.
Ethane	Present	Daughter product of reductive dechlorination of 1,1,1-TCA. Also produced from ethene.
Ethene	Present	Daughter product of reductive dechlorination of VC.
Ferrous Iron (Fe^{+2})	Increase over background	Reductive dechlorination may take place under iron reducing conditions. VC may be oxidized under these conditions.
Hydrogen (H_2)	> 1 nM	Reductive dechlorination possible. VC may accumulate.
Hydrogen (H_2)	< 1 nM	VC oxidized. Reductive dechlorination may not occur.
Manganese (Mn^{+2})	Increase over background	If present on soil surfaces, Mn serves as an electron donor. Reductive dechlorination may not take place under Mn reducing conditions.
Methane	Increase over background	Indicates the most reduced groundwater conditions. VC accumulates at methane >0.5 mg/l.
Nickel	Increase over background	Mobilized under anaerobic conditions if Ni present. May exceed ES standards.
Nitrate (NO_3^{-})	< 1 mg/l	Presence of NO^{-3} suppresses reductive dechlorination. Methylene chloride, VC, other low chlorinated compounds may degrade in the presence of NO^{-3}.
Oxidation Reduction Potential (ORP) with Ag/AgCl electrode	<-100 mV <50 mV	Reductive dechlorination likely. Reductive dechlorination possible.
pH	5 < pH > 9	Optimal range for microbial activity.
Specific Conductance	Increase over background	General water quality parameter; helps determine that sample is collected from the same groundwater system.
Sulfate (SO_4^{-2})	Decrease compared to background	Reductive dechlorination may occur under SO_4^{-2} reducing conditions. However, high levels of SO_4^{-2} can inhibit reductive dechlorination.
Sulfide (S^{-2})	Increase over background	Reductive dechlorination may occur. S^{-2} may not be detected because of precipitation with Fe^{+2}.
Temperature		Affects microbial energetics. At cooler temps, dechlorination can proceed at lower H_2 levels.
Total Inorganic Carbon (TIC)	Increase over background	Measures CO_2 species produced by microbial metabolism. (See Appendix D)
Total Organic Carbon (TOC)	> 20 mg/l	Source of organic carbon necessary as driver for reductive dechlorination to proceed. Anthropogenic sources of carbon include BETX.

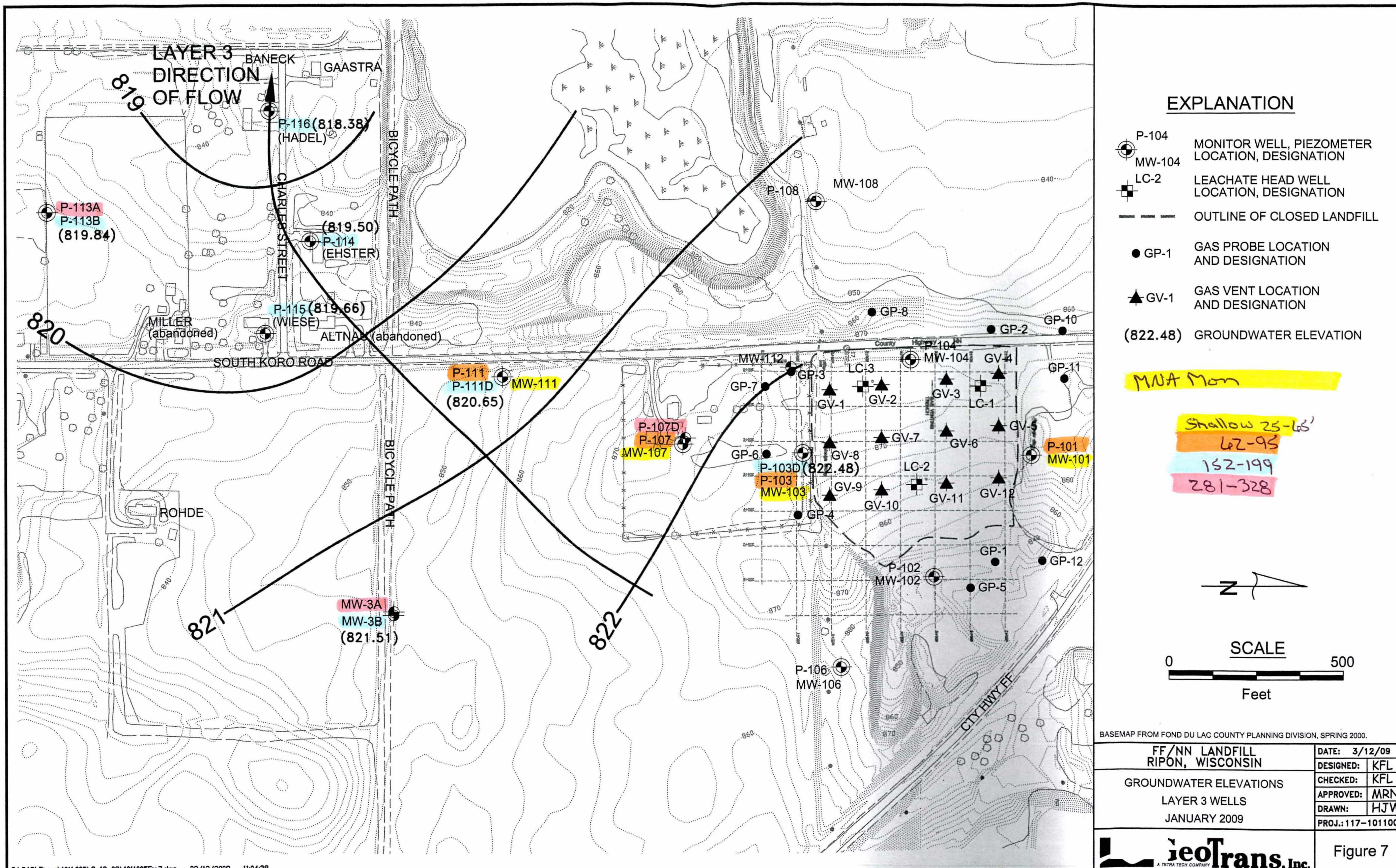
* Adapted from Wiedemeier, 1998.

Table 3-1 **Natural Attenuation (Geochemical) Parameters**
FF/NN Landfill
Ripon, WI

From 2-20-03 Report Revised Mon Plan

	Reason for taking	How taken *	Concerns in Sample Collection	Recommend?
Chloride	To verify water is coming from same aquifer; final breakdown product	In plastic bottle (lab procedure)	Additional concentrations (in ppb) not discernable above background levels	No - we know where water is coming from
Dissolved Oxygen (DO)	To determine if environment is aerobic	Downhole with meter	Grundfos pumps, where used, may be aerating water during purge process	**Yes**
Ethane	Is a breakdown product of chlorinated ethanes	In 40mL vials (lab procedure)	Sample may get aerated during sampling process, off-gassing ethene	No (no chlorinated ethanes at site)
Ethene	Is a breakdown product of chlorinated ethenes	In 40mL vials (lab procedure)	Sample may get aerated during sampling process, off-gassing ethene	No - Dec 02 samples all non-detect
Hydrogen	Useful for when other methods for determining redox environment are ineffective	Closed system sampling (bubble strip sampling - lab analysis)	Sampling equipment expensive and difficult to use, and process is time-consuming	No - Expensive and time-consuming. Not necessary unless other methods of determining redox are ineffective
Iron II	Defines the redox environment -- Vinyl chloride may be oxidized in iron-reducing environment	Field test kit	Sampling method may oxidize iron to iron III	**Yes**
Manganese II	Can serve as an electron donor for reductive dechlorination	Field test kit	Sampling method may change valence state of manganese	No - High background levels may be too high for field test kit
Methane	Indicates the most reduced groundwater conditions.	In 40mL vials (lab procedure)	Sample may get aerated during sampling process, off-gassing methene	No - Dec 02 samples were mostly non-detect; detects were very low levels
Nitrate	Nitrate suppresses reductive dechlorination	In plastic bottle (lab procedure)	None	**Yes**
Oxidation Reduction Potential (ORP)	A measure of redox environment	Downhole with meter	Grundfos pumps, where used, may be aerating water during purge process	**Yes**
pH	Always taken when groundwater sampling	Downhole with meter	None	**Yes**
Specific Conductance	Always taken when groundwater sampling	Downhole with meter	None	**Yes**
Sulfate	Concentrations indicates redox environment is not sulfur-reducing	In plastic bottle (lab procedure)	None	**Yes**
~~Sulfide~~	Indicates significantly reduced environment	In plastic bottle (lab procedure)	Sulfide may get oxidized or precipitated during sampling	No - Dec 02 samples all non-detect
Temperature	Always taken when groundwater sampling	Downhole with meter	None	**Yes**
TOC	Measures organic carbon available which may serve as cometabolic food source or as competition for chlorinated solvents	In plastic bottle (lab procedure)	None	**Yes**

*** Sample methods noted in text of groundwater monitoring plan**


LAYER 3
DIRECTION
OF FLOW
819
820
821
822
BANECK
GAASTRA
P-116 (818.38)
(HADEL)
P-113A
P-113B
(819.84)
(819.50)
P-114
(EHSTER)
P-115 (819.66)
(WIESE)
MILLER
(abandoned)
ALTNAU (abandoned)
SOUTH KORO ROAD
CHARLES STREET
BICYCLE PATH
P-111
P-111D
MW-111
(820.65)
ROHDE
MW-3A
MW-3B
(821.51)
P-108
MW-108
GP-8
GP-2
GP-10
GP-11
P-104
MW-104
MW-112
GP-3
GP-7
LC-3
GV-1
GV-2
GV-3
GV-4
LC-1
GV-5
GV-6
GV-7
GV-8
GV-9
GV-10
GV-11
GV-12
LC-2
P-107D
P-107
MW-107
GP-6
P-103D (822.48)
P-103
MW-103
GP-4
P-101
MW-101
GP-1
GP-12
P-102
MW-102
GP-5
P-106
MW-106
CTY HWY FF
EXPLANATION
P-104
MW-104
MONITOR WELL, PIEZOMETER LOCATION, DESIGNATION
LC-2
LEACHATE HEAD WELL LOCATION, DESIGNATION
OUTLINE OF CLOSED LANDFILL
GP-1
GAS PROBE LOCATION AND DESIGNATION
GV-1
GAS VENT LOCATION AND DESIGNATION
(822.48)
GROUNDWATER ELEVATION
MNA Mon
Shallow 25-65'
62-95
152-199
281-328
N
SCALE
0
500
Feet
BASEMAP FROM FOND DU LAC COUNTY PLANNING DIVISION, SPRING 2000.
FF/NN LANDFILL
RIPON, WISCONSIN
GROUNDWATER ELEVATIONS
LAYER 3 WELLS
JANUARY 2009
DATE: 3/12/09
DESIGNED: KFL
CHECKED: KFL
APPROVED: MRN
DRAWN: HJW
PROJ.: 117-1011005
GeoTrans, Inc.
A TETRA TECH COMPANY
Figure 7
S:\CAD\Ripon\1011.005\3-12-09\1011005Fig7.dwg 03/12/2009 11:04:39

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August 12, 2009

Ms. Jennifer Easterly, RPM
Wisconsin Department of Natural Resources
625 E. County Road Y, Suite 700
Oshkosh, WI 54901-9731

Re: Ripon FF/NN Landfill
Proposed MNA Monitoring Plan

Dear Jennie:

At our meeting on June 24, 2009 you indicated that you were looking to put off the ROD amendment for the Ripon FF/NN Landfill (Site) until additional groundwater monitoring data was collected to support a recommendation that monitored natural attenuation (MNA) was an appropriate alternative for groundwater contaminants at the Site. This document presents a proposed groundwater monitoring plan to provide you with the information you need.

Current Analysis
Multiple lines of evidence are typically required to demonstrate the effectiveness of chlorinated solvent remediation. The goal of an MNA evaluation is to confirm that the plume is stable or receding, and that there are no unacceptable risks posed to human health or the environment.

The primary line of evidence that natural attenuation of an organic contaminant is occurring is indicated by a significant decrease in contaminant concentrations over time, or by a significant decrease in chemical concentrations along a groundwater flow path down-gradient from a source area when the plume is known to be relatively stable. As demonstrated in our April 2009 Progress Report for the Site, there has been a significant decrease in contaminant concentrations in groundwater over time.

The current condition at the Site is that the parent product TCE has totally degraded to non-detectable levels in 6 of 7 wells and in the 1 well where it is still present (MW-103) it is at a concentration below the ES. The TCE daughter product DCE has totally degraded to non-detectable levels in 7 of 11 wells and in the 4 wells where it is still present it is at a concentration below the ES and only exceeds the PAL at 1 well (MW-103). The remaining daughter product VC has totally degraded to non-detectable levels in 9 of 13 wells and in the 4 wells that it is still present (3 wells in Layer 3 and 1well in Layer 4) the highest concentration is 6.5 ug/L.

Indirect (i.e., secondary) lines of evidence that support MNA typically include trends in geochemical or redox indicators which demonstrate biodegradation is occurring down-gradient from a source area, or an increase in daughter product concentrations down-gradient from a source area. Under anaerobic conditions, chlorinated VOC's can be biodegraded by reductive dechlorination which entails the sequential replacement of chlorine atoms by hydrogen to produce more reduced, less-chlorinated products. Rates of reduction are highest for the more chlorinated compounds like TCE and decrease with the degree of chlorination to a point when oxidation rates become faster. While the reductive dechlorination of TCE and DCE are dominated by anaerobic processes, the reduction of VC is typically an aerobic process, although anaerobic microbial VC oxidation can occur under iron-reducing conditions.

At the Site the parent and first-order daughter product, TCE and DCE, respectively, have been nearly totally degraded and the only daughter product remaining above the ES is VC. The VC is only present in the deepest (Layers 3 and 4) and furthest wells from the Site. Sequential anaerobic/aerobic biodegradation of TCE can take place as reductive dechlorination proceeds under anaerobic conditions and then the dechlorination by-product (VC) flows out of the anaerobic zone into an aerobic environment. In the Layer 3 and 4 groundwater units the dissolved oxygen has historically been >0.5 mg/L but <2.0 mg/L. DO greater than 0.5 mg/L is considered an aerobic state (EPA, 1998), which would not promote reductive dechlorination but could oxidize VC aerobically.

Proposed MNA Monitoring Plan
The proposed MNA monitoring plan for the Site is summarized on Table 1. The plan includes semiannual water level measurements for all wells, semiannual groundwater MNA parameter monitoring for all Layer 2, 3 and 4 wells with dedicated QED sampling equipment, and semiannual or annual groundwater VOC sampling of all wells. Other elements of the monitoring plan include semiannual groundwater VOC sampling of 3 residential wells (Baneck, Gaastra and Rohde), semiannual gas VOC sampling of 4 gas extraction wells/vents and 1 gas probe, and annual leachate VOC sampling (if leachate is present).

MNA Parameters
Because VC is the sole remaining contaminant of concern and because VC reduction is most commonly an aerobic process via direct oxidation, MNA parameters that can demonstrate oxidative conditions will be monitored. MNA parameter monitoring will be conducted on wells vertically and horizontally up-gradient, within and down-gradient of the VC plume. Based on EPA (1998) guidance the following parameters will be monitored:

Analysis	Concentrations for VC Oxidation
Dissolved Oxygen	> 0.5 mg/L
Oxidation Reduction Potential	> 50 mV
Iron II	ND (< 0.2 mg/L)
Nitrite	ND (< 0.08 mg/L)
Sulfide	ND (< 0.2 mg/L)
Methane	< 0.5 mg/L

The DO and ORP along with temperature, pH and conductivity will be measured using a QED MP20 MicroPurge Flow Cell Meter. Because of problems in the past with ORP calibration, a second standard will be used to confirm operation and a second meter will be used for back up confirmation that the meter is accurate.

The iron II, nitrite and sulfide will be measured in the field using CHEMetrics analyte-specific Vacu-vials® for photometric analysis using a CHEMetrics Model V-2000 LED photometer.

For dissolved methane, groundwater samples will be collected and submitted to Pace Analytical Laboratories for analysis using Method 8000.

VOC Sampling
Groundwater sampling for VOCs will follow the current frequency of semiannual and annual sampling of wells as shown on Table 1. Groundwater samples will be collected using low-flow sampling techniques for Layer 2, 3 and 4 wells which have been outfitted with dedicated QED equipment. The remaining wells (all Layer 1 and 3 Layer 2 wells) will be sampled by purging 3 casing volumes and collecting a sample with a bailer.

Reporting
Semiannual progress reports will be prepared and submitted to the WDNR within 30 days of receipt of analytical results.

****

If you have any questions please feel free to contact me.

Sincerely,

GeoTrans, Inc.

Michael R. Noel, P.G.
Vice President, Principal Hydrogeologist

Enclosures

cc: Bernard Schorle, USEPA w/ Both Enclosures
Nelson Olavarria, Cooper Industries, w/o Enclosures
Steve Barg, City of Ripon, w/o Enclosures

Groundwater Monitoring Schedule
FF/NN Landfill, Ripon, WI

Stratigraphic Layer	Sampling Point:	Location Relative to Landfill	Water Level	MNA Parameters	VOCs	Vinyl Chloride Concentration Apr 09	Equipment Type
Layer 1 Wells (25-65 ft bgs)	MW-101	Up-gradient	SA	SA	A	ND	Bailer
	MW-102	Side-gradient	SA		A	ND	Bailer
	MW-103	Down-gradient	SA	SA	SA	ND	Bailer
	MW-104	Within Landfill	SA		SA	ND	Bailer
	MW-106	Side-gradient	SA		A	ND	Bailer
	MW-107	Down-gradient	SA	SA	SA	ND	Bailer
	MW-108	Side-gradient	SA		SA	ND	Bailer
	MW-111	Down-gradient	SA	SA	A	ND	Bailer
	MW-112	Down-gradient	SA		SA	ND	Bailer
Layer 2 Wells (62-95 ft bgs)	P-101	Up-gradient	SA	SA	A	ND	Bailer
	P-102	Side-gradient	SA		SA	ND	Bailer
	P-103	Down-gradient	SA	SA	SA	ND	QED
	P-104	Beneath Landfill	SA		A	ND	QED
	P-106	Side-gradient	SA		SA	ND	QED
	P-107	Down-gradient	SA	SA	SA	ND	QED
	P-108	Side-gradient	SA		A	ND	Bailer
	P-111	Down-gradient	SA	SA	A	ND	QED
Layer 3 Wells (152-199 ft bgs)	MW-3B	Down-gradient	SA	SA	SA	ND	QED
	P-103D	Down-gradient	SA	SA	SA	ND	QED
	P-111D	Down-gradient	SA	SA	SA	5.5 ug/L	QED
	P-113B	Down-gradient	SA	SA	SA	ND	QED
	P-114	Down-gradient	SA	SA	SA	6.5 ug/L	QED
	P-115	Down-gradient	SA	SA	SA	1.3 ug/L	QED
	P-116	Down-gradient	SA	SA	SA	ND	QED
Layer 4 Wells (281-328 ft bgs)	MW-3A	Down-gradient	SA	SA	SA	ND	QED
	P-107D	Down-gradient	SA	SA	SA	2.5 ug/L	QED
	P-113A	Down-gradient	SA	SA	A	ND	QED
Private Wells	Baneck	Down-gradient			SA	ND	Spigot
	Gaastra	Down-gradient			SA	ND	Spigot
	Rohde	Down-gradient			SA	ND	Spigot
Landfill	Leachate LH-1	Within Landfill	A		A	ND	Disposable bailers
	Leachate LH-2	Within Landfill	A		A	ND	Disposable bailers
	Leachate LH-3	Within Landfill	A		A	ND	Disposable bailers
	Gas VOCs LH-1	Within Landfill			SA	ND	Summa Canister
	Gas VOCs LH-2	Within Landfill			SA	ND	Summa Canister
	Gas VOCs LH-3	Within Landfill			SA	ND	Summa Canister
	Gas VOCs GV-6	Within Landfill			SA	ND	Summa Canister
	Gas VOCs GP-3	Down-gradient			SA	ND	Summa Canister
	Cap Inspection	On Landfill			SA		

MNA = Monitored Natural Attenuation field parameters (Ph, Cond, Temp, DO, ORP, Fe(II), Nitrite and Sulfide)

SA = Semianual (Apr and Oct); A = Annual (Apr)