

May 10, 2016
Parametrix No. 553-1625-014

Mr. Richard H. Morck, P.E.
Landmarc Technologies, Inc.
14816 439th Place SE
North Bend, WA 98045-9248

Re: March 2016 Groundwater Sampling Event, Newcastle Demolition Landfill

Dear Mr. Morck:

INTRODUCTION

This report summarizes the groundwater monitoring data collected in March 2016 at the Newcastle Demolition Landfill. Sample collection and data analyses were conducted in accordance with the Newcastle Demolition Landfill Post-Closure Plan (Parametrix 1998).

The landfill was formerly owned and operated by Coal Creek Development Corporation, and accepted demolition and inert waste until 1992. It was formally closed in June 1993 and has since been developed as a golf course by Newcastle Golf LLC.

The Newcastle Demolition Landfill is located in an area historically mined for coal (Parametrix 1991). The underlying geology of the site consists of a thick sequence of inclined interbedded coal, sandstone, and shale beds of the Eocene Renton Formation. The site is underlain by a complex network of coal mine workings that appear to control much of the groundwater flow beneath the site. Southwesterly regional groundwater flow is substantially intercepted by the mine workings that drain to the west and discharge directly or indirectly into the Richmond Tunnel that flows into Coal Creek. The monitoring wells are installed within bedrock between the workings, and the observed water levels are at elevations expected for groundwater influenced by the draining of the mine workings by the Richmond Tunnel.

MONITORING PROGRAM HISTORY

The downgradient monitoring wells on the golf course (MW-2, MW-3, and MW-4) were disturbed during golf course construction beginning in 1996. Some interim repairs were made during the golf course construction to allow groundwater monitoring to continue, although final completion of the well monuments did not occur until February 2000. At that time the wells were redeveloped, and were thought to be suitable for detecting potential impacts to groundwater quality from the former landfill. However, during the golf course construction period there may have been some impacts to groundwater quality in the monitoring wells due to surface water or soil intrusion. The history of activity associated with the wells during golf course construction was summarized in the November 1999 report (Parametrix 2000).

Damage to well MW-4 indicated by high turbidity was first noted in December 2000. Attempts to redevelop the well in February 2001 were unsuccessful. Well MW-4 was decommissioned and replaced in August 2001 with new monitoring well MW-5. MW-5 is located approximately 500 ft northwest of MW-4 (see Figures 1 and 2). The installation of well MW-5 was documented in a letter from Parametrix to Landmarc Technologies (Parametrix 2001).

From 1996 through 2000, a variable groundwater monitoring schedule was established by the Seattle-King County Department of Public Health (Coal Creek Development Corporation 1996). However, the downgradient wells, particularly well MW-3, were frequently dry during much of the year. During the September 2001 sampling event, all the wells were dry except for upgradient well MW-1. Therefore, no samples were collected, and an alternative sampling schedule was proposed to the Health Department (now known as Public Health – Seattle & King County). The proposed sampling schedule consisted of sampling in January and April when water volumes were expected to be adequate for sampling, and measuring depth to groundwater during the fall when groundwater levels were expected to be at their lowest point.

The current groundwater monitoring program for the closed Newcastle Demolition Landfill consists of sampling four groundwater monitoring wells (MW-1, MW-2, MW-3, and MW-5) and two off-site surface water stations (SW-6 and SW-7). Well MW-1 is upgradient of the landfill, and the other wells and stations are downgradient or downstream of the landfill. Surface water station SW-6, located at the Richmond Tunnel mine discharge, is thought to be representative of groundwater intercepted by a network of mine workings beneath the site that discharges into Coal Creek. Surface water station SW-7 is located farther downstream along Coal Creek. The monitoring well locations are shown on Figures 1 and 2, and the surface water station locations are shown on Figure 3. The locations of the downgradient wells with respect to landfill and golf course features are shown on Figure 2.

In September 2006, recommendations were submitted by Landmarc Technologies, Inc. to Public Health for reducing the monitoring frequency and parameters at the Newcastle Demolition Landfill (Parametrix 2006). It was recommended that the frequency of groundwater monitoring be reduced to annual, and analyses for volatile organic compounds, semi-volatile organic compounds, and metals (except for arsenic) be discontinued. These parameters are not required by Chapter 173-304 Washington Administrative Code (WAC), and the historical data since landfill closure have not indicated any detections of these parameters associated with impacts from the landfill. Reduction in monitoring frequency and parameters based on consistent lack of contamination from the landfill is in accordance with the language of the Post-Closure Monitoring Plan. These recommendations were implemented beginning with the February 2007 event.

MARCH 2016 SAMPLING EVENT

Samples were collected on March 10, 2016, by Parametrix personnel. Samples were collected from wells MW-1 and MW-2 using dedicated Hydrostar pumps, and from wells MW-3 and MW-5 using dedicated electrical submersible pumps. Samples were collected using low-flow purging methods. Samples to be analyzed for dissolved metals were field-filtered through 0.45-micron filters. A duplicate sample was collected at monitoring well MW-5 (designated MW-6).

Samples were delivered directly to Analytical Resources, Inc. (ARI) in Seattle, Washington, for analysis. Samples were measured for field parameters (pH, specific conductivity, and temperature), and analyzed for chloride, nitrite, nitrate, ammonia, sulfate, hardness (dissolved calcium and magnesium), dissolved arsenic, dissolved iron, dissolved manganese, dissolved zinc, chemical oxygen demand (COD), total organic carbon (TOC), and total dissolved solids (TDS). Additional field parameters measured included Dissolved oxygen (DO) and oxygen reduction potential (redox).

SAMPLING RESULTS

The analytical results for the monitoring wells and surface water stations are summarized in Table 1. The laboratory report and chain-of-custody forms are presented in Appendix A.

Data Validation

Parametrix conducted a quality assurance (QA) review of the laboratory data, including holding times, field duplicate results, and blank results. The laboratory QA internal standard data were also reviewed, including matrix spikes, matrix spike duplicates, surrogate recoveries, and laboratory control samples. The QA review indicated acceptable accuracy and precision, and no qualifiers were necessary.

Data Analysis

Data analysis consisted of comparing groundwater data (from monitoring wells and surface water station SW-6) to established state groundwater quality standards (GWQSs; 173-200 WAC) and state maximum contaminant levels (MCLs) for drinking water (246-290 WAC), preparing time-series plots, and conducting Mann-Kendall trend analyses for selected analytes.

Comparison of Data to Groundwater Quality Standards

The following constituents were present in groundwater at concentrations above secondary GWQSs and/or MCLs (established based on aesthetic characteristics such as taste, appearance, and/or staining):

- Specific conductivity in samples from wells MW-1 (upgradient), MW-2, MW-3, and surface water station SW-6;
- Total dissolved solids in samples from well MW-1 (upgradient), and surface water station SW-6;
- Sulfate in the sample from well MW-1 (upgradient);
- Dissolved iron in samples from wells MW-1 (upgradient), MW-2, MW-3, MW-5, and surface water station SW-6;
- Dissolved manganese in samples from wells MW-1 (upgradient), MW-2, MW-5, and surface water station SW-6.

Dissolved arsenic concentrations in samples from wells MW-1 (upgradient), MW-3, and surface water stations SW-6 and SW-7 exceeded the carcinogenic GWQS but not the MCL. The dissolved arsenic concentration in well MW-5 slightly exceeded the MCL.

The presence of constituents above their GWQS and/or MCL upgradient from the landfill at MW-1 indicates that the aesthetic characteristics of groundwater in the landfill vicinity are a natural artifact of the local geochemistry.

Time-Series Plots

Groundwater and surface water time-series plots were prepared for dissolved arsenic, ammonia, dissolved calcium, chloride, chemical oxygen demand (COD), hardness, dissolved iron, dissolved manganese, specific conductivity, sulfate, and total organic carbon (TOC). These constituents were selected for statistical analyses to include parameters that were elevated in leachate with respect to groundwater (Pacific Groundwater Group 1994a). Dissolved arsenic has been added because it was a constituent of interest discussed in Ecology's Periodic Review (Ecology 2013). These plots are presented in Appendix B and show data collected since 1994. Based on the time-series plots, the following observations can be made:

- Sulfate and hardness (and dissolved calcium) concentrations continued to be highest in upgradient well MW-1.

- In MW-2, concentrations of dissolved iron, dissolved manganese, and TOC continued to be lower than the relatively high concentrations measured between 1999 and 2000. Specific conductivity and concentrations of chloride and hardness (and dissolved calcium) have increased during the past few years.
- In MW-3, concentrations of most parameters have remained stable or decreased over the last few years. Specific conductivity, and concentrations of ammonia, chloride, hardness (and dissolved calcium), dissolved iron, dissolved manganese, and TOC continued to be lower compared to the relatively high values observed during 2002.
- In MW-5, stable or decreasing trends in most parameters have been observed in the last few years. Dissolved manganese and dissolved iron concentrations, however, have showed slight increases since 2009. Because this is a low-yield well, continuing development over several years is likely to occur, resulting in improving water quality.
- At SW-6, concentrations of hardness, sulfate, and dissolved manganese have decreased since over the history of monitoring.

Mann-Kendall Tests

The Mann-Kendall test for trends (Gilbert 1987, Gibbons 1994) was used to evaluate the Newcastle Demolition Landfill groundwater data (Pacific Groundwater Group 1994a,b,c). Trends in each well were evaluated separately because the upgradient well continues to show higher concentrations of some constituents than the downgradient wells. The trend analyses used all data collected between April 1988 and March 2016 (except for specific conductivity results for the second 1998 semi-annual monitoring event, which are suspected to be erroneously low due to an error in calibrating the meter). All non-detected values were given a value equal to the reporting limit (Gilbert 1987, Gibbons 1994).

The results of the trend analyses are summarized in Table 2. The Mann-Kendall tests indicate the following:

- MW-1: statistically significant increasing trends in chloride, COD, dissolved iron, and TOC; statistically significant decreasing trends in dissolved arsenic and dissolved manganese, upgradient from the landfill;
- MW-2: statistically significant increasing trends in ammonia, dissolved calcium, chloride, hardness, dissolved iron, specific conductivity, and TOC; a statistically significant decreasing trend in dissolved arsenic;
- MW-3: statistically significant increasing trends in ammonia, specific conductivity, and TOC; statistically significant decreasing trends in dissolved calcium, chloride, hardness, and dissolved manganese; and
- MW-5: a statistically significant increasing trend in dissolved iron and dissolved manganese; statistically significant decreasing trends in dissolved calcium, chloride, hardness, and sulfate.

GROUNDWATER LEVEL MONITORING RESULTS

Groundwater levels were measured at three of the four monitoring wells prior to sampling. Depth to water could not be measured at MW-1 and MW-3 due to wellhead and equipment constraints. The measurements are presented in Table 3 with calculated water elevations.

DISCUSSION AND CONCLUSIONS

Analysis of the March 2016 groundwater data from the Newcastle Demolition Landfill indicates the following:

- The differences in groundwater chemistry between monitoring wells suggest that the observed water chemistry is influenced by local geochemical conditions, and therefore do not clearly demonstrate landfill impacts. Concentrations exceeding secondary GWQs or MCLs (specific conductivity, TDS, sulfate, dissolved iron, and dissolved manganese) occurred in the upgradient well and in downgradient wells and the surface water station. Dissolved arsenic concentrations exceeded the carcinogenic GWQS in all wells (including the upgradient well) and the surface water stations. All arsenic concentrations were below the MCL except for well MW-5. Statistically significant increasing trends in indicator parameters were also observed in both upgradient and downgradient wells.
- Some of the variations in concentrations may be related to changed geochemical conditions associated with golf course development activities. The March 2016 data for wells MW-2 and MW-3 indicate continuing lower concentrations for parameters that were elevated following the golf course construction period during 1996 through 2000, including dissolved iron, manganese, and TOC.

Please contact me at (206) 394-3667 or lgilbert@parametrix.com if you have questions regarding this report.

Sincerely,

Parametrix



Lisa A. Gilbert, LHG
Project Hydrogeologist

cc: Darshan S. Dhillon, Public Health – Seattle & King County
Eugene Freeman, Cleanup Program, NWRO, Washington State Department of Ecology
David South, Cleanup Program, NWRO, Washington State Department of Ecology

REFERENCES

- Coal Creek Development Corporation. 1996. Letter to Parametrix. February 2, 1996.
- Gibbons, R.D. 1994. Statistical Methods for Groundwater Monitoring. John Wiley and Sons, Inc. New York
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- Pacific Groundwater Group. 1994c. Statistical Review, Newcastle Landfill, Second Quarter 1994. Prepared for Coal Creek Development Corporation. December 14, 1994.
- Parametrix, Inc. 1991. Newcastle Landfill Closure Plan. Prepared for Coal Creek Development Corporation. May 1991.

Parametrix, Inc. 1998. Newcastle Demolition Landfill Post-Closure Plan. Prepared for Preston, Gates & Ellis. October 1998.

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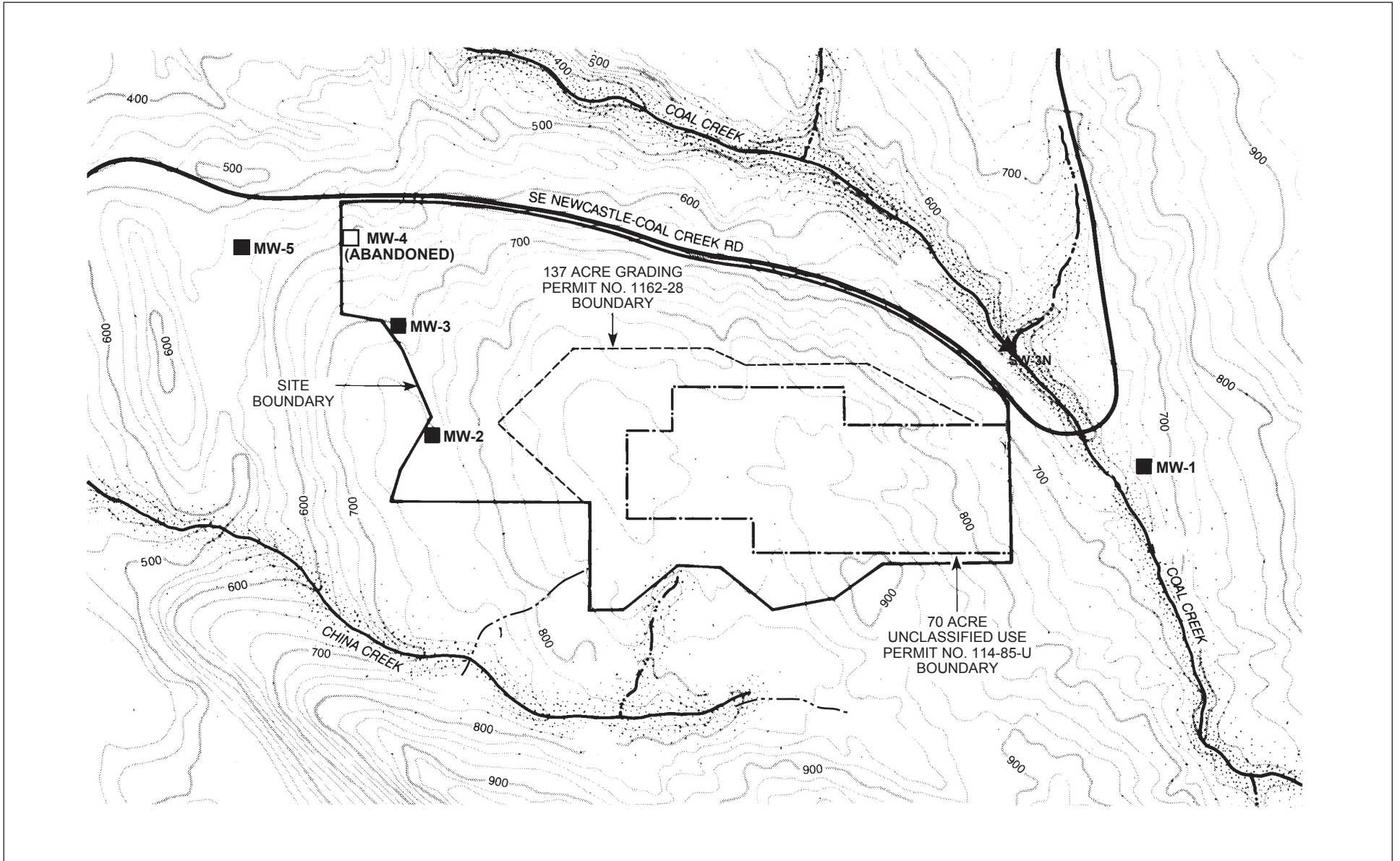
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Parametrix, Inc. 2006. Recommendations for Reduction in Groundwater Monitoring, Newcastle Demolition Landfill. Prepared for Landmarc Technologies, Inc. September 7, 2006.

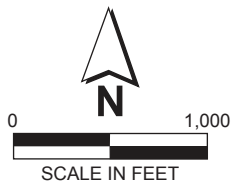
Washington State Department of Ecology (Ecology). 2013. Periodic Review, Newcastle Coal Creek Landfill Facility Site ID Number 2044. Northwest Region Office, Toxics Cleanup Program, February 2013.

Figures



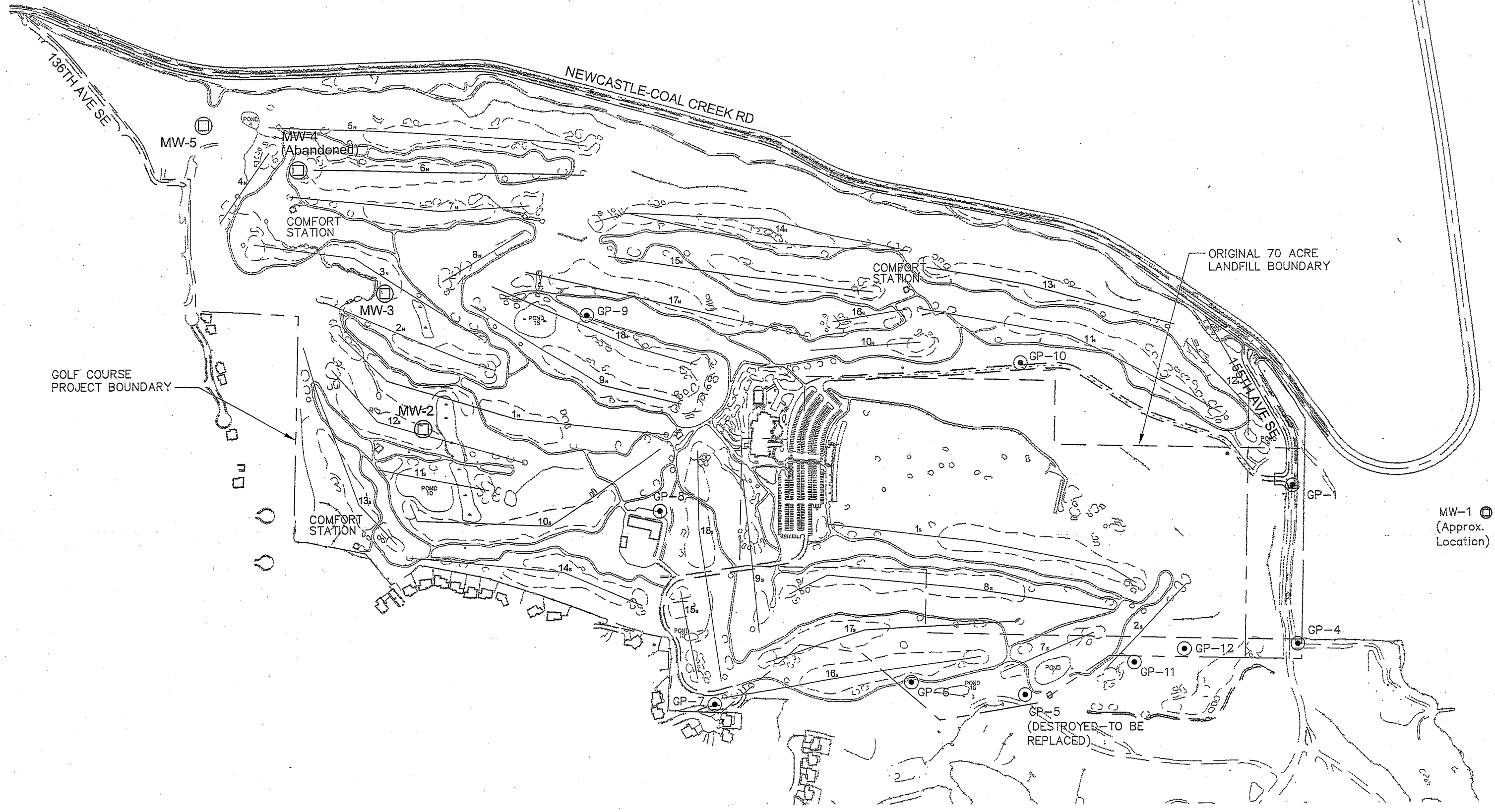


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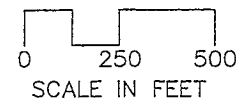


■ MW-1 Groundwater Monitoring Well



Figure 1
Groundwater Monitoring
Locations in Site Vicinity
Newcastle Demolition Landfill





FILE: K3747001P01T01-F02
DATE: 04/10/03



LEGEND

- MW-2  Groundwater Monitoring Well (Field Located 10/22/01)
- GP-1  Gas Probe Location (Field Located 10/22/01)

-  COMFORT STATION Comfort Station (Restroom)
-  Pond and "Creek" System

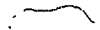

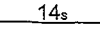
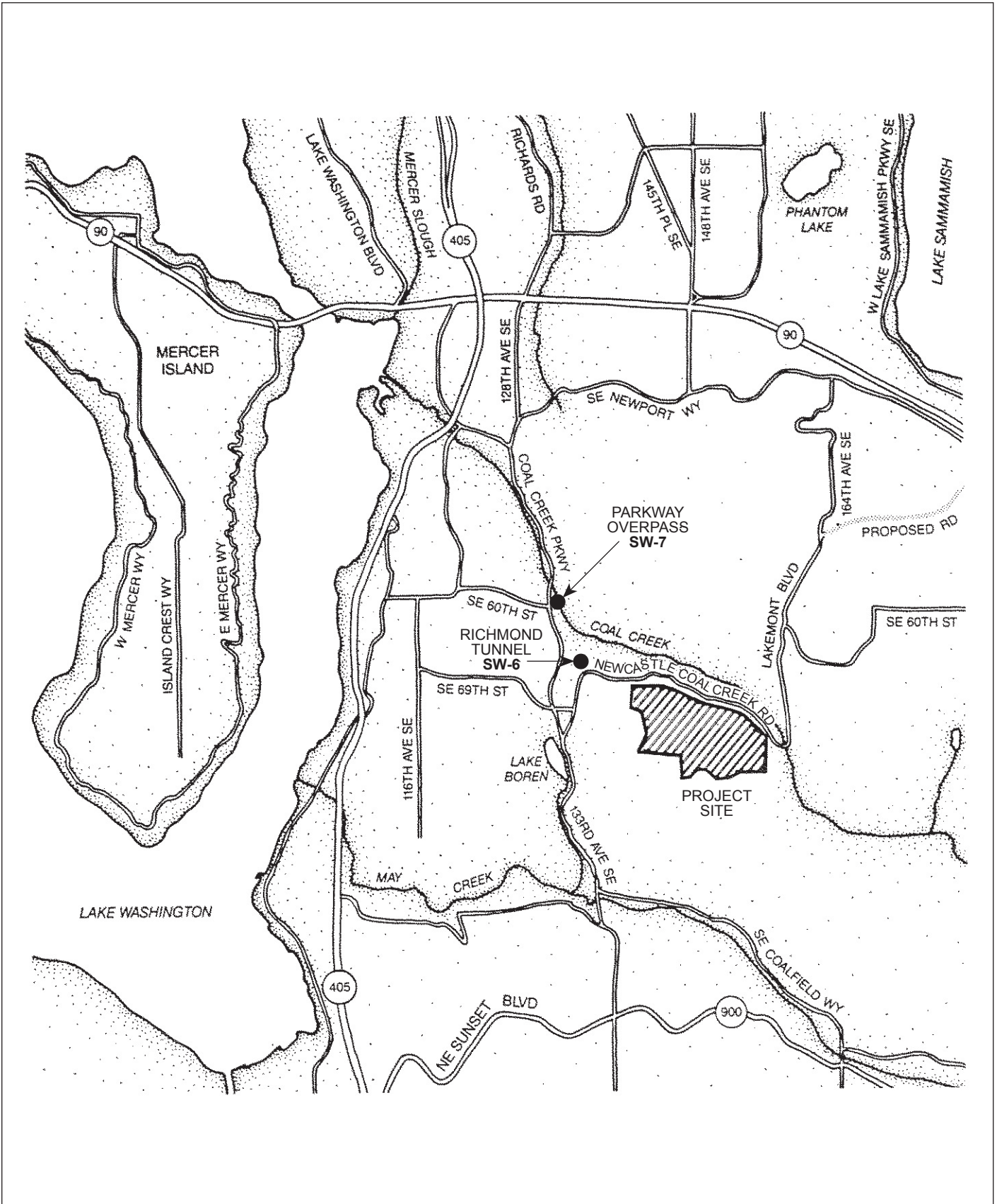
-  Storm Drainage Control Facility
-  Golf Cart Path
-  Golf Course Fairway Alignment and Number

Figure 2
Groundwater Monitoring Well Locations and Golf Course Features, Newcastle Demolition Landfill Area



Parametrix 555-3747-001/01(01) 5/09 (B)



● Surface Water Monitoring Site

Figure 3
Off-site Monitoring Locations
Newcastle Demolition Landfill

Tables



Table 1. Newcastle Groundwater and Surface Water Data

Parameter	Units	GWQS	MCL	Groundwater					Surface Water	
				MW-1 3/10/2016	MW-2 3/10/2016	MW-3 3/10/2016	MW-5 3/10/2016	MW-6 (MW-5 Dup) 3/10/2016	SW-6 3/10/2016	SW-7 3/10/2016
Field Data										
Temperature	°C			9.30	10.63	11.61	11.69	--	11.92	9.18
pH	standard	6.5-8.5 **		7.15	7.35	7.66	6.57	--	7.27	8.11
Specific Conductivity	uS/cm		700 **	952	762	742	611	--	892	170
DO	mg/L			1.07	1.13	1.39	1.95	--	9.27	10.72
Redox	mV			-18.0	-30.1	-43.3	31.3	--	98.0	81.4
Conventionals										
Total Dissolved Solids	mg/L	500 **	500 **	673	426	449	331	333	540	104
Chloride	mg/L	250 **	250 **	2.9	15.0	6.7	3.6	3.2	4.2	3.2
Ammonia	mg-N/L			0.113	0.564	0.317	0.066	0.065	0.145	0.044
Nitrate	mg-N/L	10 *	10 *	0.014	0.035	0.082	0.010 U	0.010 U	0.086	0.873
Nitrite	mg-N/L		1 *	0.010 U	0.010 U	0.010 U	0.012	0.017	0.010 U	0.010 U
Nitrate + Nitrite	mg-N/L			0.014	0.035	0.082	0.010 U	0.010 U	0.086	0.873
Sulfate	mg/L	250 **	250 **	273	10.6	32.6	67.9	66.5	162	24.2
Chemical Oxygen Demand	mg/L			10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
Total Organic Carbon	mg/L			1.06	3.54	3.29	2.77	2.71	1.66	4.20
Dissolved Hardness	mg/L			550	290	73	310	300	360	62
Dissolved Metals										
Arsenic	mg/L	0.00005 ***	0.01 *	0.0004	0.0002 U	0.0029	0.0189	0.0191	0.0050	0.0009
Calcium	mg/L			144	71.0	15.4	71.4	71.0	71.8	15.0
Iron	mg/L	0.3 **	0.3 **	0.830	0.740	0.570	5.92	5.93	2.72	0.100
Magnesium	mg/L			45.2	28.2	8.30	30.8	30.8	44.5	5.95
Manganese	mg/L	0.05 **	0.05 **	0.156	0.118	0.011	0.647	0.649	0.251	0.025
Zinc	mg/L	5 **	5 **	0.010	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U

Notes:

GWQS = Water Quality Standards for Ground Waters of the State of Washington (173-200 WAC)

MCL = Maximum Contaminant Level, Washington State Drinking Water Regulations (Chapter 246-290 WAC)

* = Primary contaminant criteria

** = Secondary contaminant criteria

*** = Carcinogenic contaminant criteria

= Exceeds GWQS or MCL

U = Compound undetected at the specified reporting limit

Table 2. Results of Mann-Kendall Tests for Trend, Newcastle Demolition Landfill, March 2016

Well ID	Analyte	n	S	Variance	Z	Trend
MW-1	Ammonia-N ¹	56	254	19996.0	1.79	Positive
	Arsenic	18	-98	666.0	-3.76	Negative
	Calcium, Dissolved	53	-49	16956.3	-0.37	No Trend
	Chloride	56	453	19907.7	3.20	Positive
	COD	56	221	9560.3	2.25	Positive
	Hardness	55	-63	18905.0	-0.45	No Trend
	Iron, Dissolved	56	413	19997.7	2.91	Positive
	Manganese, Dissolved	56	-359	19995.7	-2.53	Negative
	Specific Conductivity	55	26	18974.0	0.18	No Trend
	Sulfate	56	-6	19990.0	-0.04	No Trend
TOC	56	475	17715.0	3.56	Positive	
MW-2	Ammonia-N	50	306	14288.7	2.55	Positive
	Arsenic	18	-98	602.0	-3.95	Negative
	Calcium, Dissolved	45	535	10449.0	5.22	Positive
	Chloride	50	803	14263.0	6.72	Positive
	COD	50	172	14112.0	1.44	No Trend
	Hardness	47	529	11832.3	4.85	Positive
	Iron, Dissolved	50	588	14284.0	4.91	Positive
	Manganese, Dissolved ¹	49	223	13449.0	1.91	Positive
	Specific Conductivity	47	491	11891.0	4.49	Positive
	Sulfate	49	-66	13450.0	-0.56	No Trend
TOC	50	438	14282.0	3.66	Positive	
MW-3	Ammonia-N	36	170	5388.0	2.30	Positive
	Arsenic	16	1	487.7	0.00	No Trend
	Calcium, Dissolved	33	-142	4163.3	-2.19	Negative
	Chloride	37	-234	5837.3	-3.05	Negative
	COD ¹	37	145	5676.3	1.91	Positive
	Hardness	34	-186	4537.3	-2.75	Negative
	Iron, Dissolved ¹	37	151	5843.0	1.96	Positive
	Manganese, Dissolved	36	-342	5383.3	-4.65	Negative
	Specific Conductivity	37	243	5845.0	3.17	Positive
	Sulfate	37	-10	5842.0	-0.12	No Trend
TOC	37	243	5841.0	3.17	Positive	

n = Sample size

S = Mann-Kendall test statistic. Positive number implies an increasing trend; negative number implies a decreasing trend.

Z = Approximate normal test statistic; calculated based on S and the estimated variance when the sample size is greater than 10.

The comparison level (critical value of Z) at $1.0 - (\alpha / 2) = (0.05 / 2) = 97.5\%$ confidence level = 1.97737 for a two-tailed Mann-Kendall test.

If the absolute value of the calculated Z statistic ($|Z| > 1.97737$), a significant trend is present in the data. There is no trend in the data when $|Z| < 1.97737$.

¹ When run as a one-tailed test, there is a trend (i.e., $|Z| > 1.65463$). The comparison level (critical value of Z) at $1.0 - (\alpha) = (0.05) = 95\%$ confidence level = 1.65463.

Trends significant at a confidence level of 97.5% are shown in **BOLD BLACK FONT**.

Table 2. Results of Mann-Kendall Tests for Trend, Newcastle Demolition Landfill, March 2016 (continued)

Well ID	Analyte	n	S	Variance	Z	Trend
MW-5	Ammonia-N	18	-11	695.0	-0.38	No Trend
	Arsenic ¹	12	-24	212.7	-1.58	No Trend
	Calcium, Dissolved	18	-97	697.0	-3.64	Negative
	Chloride¹	18	-58	696.0	-2.16	Negative
	COD ¹	18	-36	676.7	-1.35	No Trend
	Hardness	18	-101	685.0	-3.82	Negative
	Iron, Dissolved	18	55	697.0	2.05	Positive
	Manganese, Dissolved	18	70	696.0	2.62	Positive
	Specific Conductivity ¹	18	-52	696.0	-1.93	Negative
	Sulfate	18	-112	696.0	-4.21	Negative
	TOC	18	-4	696.0	-0.11	No Trend

n = Sample size

S = Mann-Kendall test statistic. Positive number implies an increasing trend;
negative number implies a decreasing trend.

Z = Approximate normal test statistic; calculated based on S and the estimated
variance when the sample size is greater than 10.

The comparison level (critical value of Z) at $1.0 - (\alpha / 2) = (0.05 / 2) = 97.5\%$ confidence level = 1.97737
for a two-tailed Mann-Kendall test.

If the absolute value of the calculated Z statistic ($|Z| > 1.97737$), a significant trend is present in the data.
There is no trend in the data when $|Z| < 1.97737$.

¹ When run as a one-tailed test, there is a trend (i.e., $|Z| > 1.65463$). The comparison level (critical
value of Z) at $1.0 - (\alpha) = (0.05) = 95\%$ confidence level = 1.65463.

Table 3. Groundwater Elevations for Newcastle Landfill, March 2016

Well	Date	Reference Elevation¹	Depth to Groundwater²	Groundwater Elevation¹
MW-1	3/10/2016	649	NM	NM
MW-2	3/10/2016	753	23.50	730
MW-3	3/10/2016	716	NM	716
MW-5	3/10/2016	542	56.18	486

Notes:

¹ Reference Elevation and Groundwater Elevation approximate

² Depth to groundwater measured from well seal

NM = Not Measured

Appendix A

Laboratory Report and Chain-of-Custody Forms





Analytical Resources, Incorporated
Analytical Chemists and Consultants

1 April 2016

Lisa Gilbert
Parametrix, Inc.
719 2nd Avenue, Suite 200
Seattle, WA 98104

RE: Project No. Newcastle LF, 553-1625-014 (02/02)
ARI Job No: AXK3

Dear Lisa:


Please find enclosed the original Chain-of-Custody documentation and the final reports for the samples from the project referenced above. Analytical Resources, Inc. (ARI) accepted seven water samples in good condition on March 10, 2016. The samples were analyzed for dissolved metals, hardness and conventional parameters as requested.

No analytical complications were noted.

As always, a copy of this report and all raw data will remain on file at ARI. If you have questions, or require further information, please contact me at your convenience.

Sincerely,

ANALYTICAL RESOURCES, INC.


Mark D. Harris
Project Manager
206/695-6210
<markh@arilabs.com>

Enclosures

cc: File AXK3

MDH/mdh

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: AXK3	Turn-around Requested:	Page: L of 2
ARI Client Company: Parametrix	Phone: 206 394-3667	Ice Present? YES
Client Contact: Lisa Gilbert		No. of Coolers: 2 Cooler Temps: 2.6, 5.9

Client Project Name: Newcastle LE	Samplers: Adam Ramey Lisa Gilbert
Client Project #: 5534025014 (02/02)	

Sample ID	Date	Time	Matrix	No. Containers	Childs (No. Break)	Ammonia (No. TOC)	DSS Filter	DSS Filter Address	Analysis Requested	Notes/Comments
MW-1	3-10-16	9:30	water	3	✓	✓	✓			
MW-2	3-10-16	11:17		3	✓	✓	✓			
MW-3	3-10-16	2:13		3	✓	✓	✓			
MW-5	3-10-16	2:43		3	✓	✓	✓			
MW-6	3-10-16	3:25		3	✓	✓	✓			
MW-7	3-10-16	3:38	↓	3	✓	✓	✓			
MW-6	3-10-16	2:43	↓	3	✓	✓	✓			

Comments/Special Instructions	Relinquished by: (Signature)	Received by: (Signature)
	Relinquished by: (Printed Name)	Received by: (Printed Name)
	Relinquished by: (Company)	Received by: (Company)
	Relinquished by: (Date & Time)	Received by: (Date & Time)

Limits of Liability: ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)
www.arilabs.com





Cooler Receipt Form

ARI Client: Paranetrix

Project Name: Newcastle LF

COC No(s): _____ (NA)

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: AXK3

Tracking No: _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of to cooler? YES (NO)

Were custody papers included with the cooler? (YES) NO

Were custody papers properly filled out (ink, signed, etc.) (YES) NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry) 2.6 5.9

Time: _____

If cooler temperature is out of compliance fill out form 00070F

Cooler Accepted by: TR Date: 3-10-16 Time: 1730

Temp Gun ID#: D005276

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler? YES (NO)

What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: _____

Was sufficient ice used (if appropriate)? NA (YES) NO

Were all bottles sealed in individual plastic bags? (YES) NO

Did all bottles arrive in good condition (unbroken)? (YES) NO

Were all bottle labels complete and legible? (YES) NO

Did the number of containers listed on COC match with the number of containers received? (YES) NO

Did all bottle labels and tags agree with custody papers? (YES) NO

Were all bottles used correct for the requested analyses? (YES) NO

Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs)... NA (YES) NO

Were all VOC vials free of air bubbles? (NA) YES NO

Was sufficient amount of sample sent in each bottle? (YES) NO

Date VOC Trip Blank was made at ARI: _____ (NA)

Was Sample Split by ARI: (NA) YES Date/Time: _____ Equipment: _____ Split by: _____

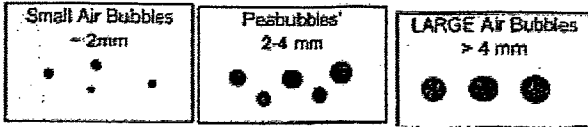
Samples Logged by: AV Date: 3/11/16 Time: 802

**** Notify Project Manager of discrepancies or concerns ****

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

By: _____ Date: _____



Small → "sm" (< 2 mm)
 Peabubbles → "pb" (2 to < 4 mm)
 Large → "lg" (4 to < 6 mm)
 Headspace → "hs" (> 6 mm)

PC: Mark
VTSR: 03/10/16

Inquiry Number: NONE
Analysis Requested: 03/11/16
Contact: Gilbert, Lisa
Client: Parametrix, Inc.
Logged by: AV
Sample Set Used: Yes-078
Validatable Package: No
Deliverables:

Project #: 5531625014 (02/02)
Project: NewCastle LF
Sample Site: NewCastle
SDG No:
Analytical Protocol: In-house

LOGNUM ARI ID	CLIENT ID	CN >12	WAD >12	NH3 <2	COD <2	FOG <2	MET <2	PHEN <2	PHOS <2	TKN <2	NO23 <2	TOC <2	S2 >9	TPHD <2	Fe2+ <2	DMET DOC FLT FLT	PARAMETER	ADJUSTED TO	LOT NUMBER	AMOUNT ADDED	DATE/BY
16-4032 AXK3A	MW-1			PPPPPP	PPPPPP		DIS					PPPPPP				Y					
16-4033 AXK3B	MW-2			PPPPPP	PPPPPP		DIS					PPPPPP				Y					
16-4034 AXK3C	MW-3			PPPPPP	PPPPPP		DIS					PPPPPP				Y					
16-4035 AXK3D	MW-5			PPPPPP	PPPPPP		DIS					PPPPPP				Y					
16-4036 AXK3E	SW-6			PPPPPP	PPPPPP		DIS					PPPPPP				Y					
16-4037 AXK3F	SW-7			PPPPPP	PPPPPP		DIS					PPPPPP				Y					
16-4038 AXK3G	MW-6			PPPPPP	PPPPPP		DIS					PPPPPP				Y					

P-pass

AXK3 : 00004

Checked By AV Date 3/11/16

Sample ID Cross Reference Report



ARI Job No: AXK3
Client: Parametrix, Inc.
Project Event: 5531625014(02/02)
Project Name: NewCastle LF

Sample ID	ARI Lab ID	ARI LIMS ID	Matrix	Sample Date/Time	VTSR
1. MW-1	AXK3A	16-4032	Water	03/10/16 09:30	03/10/16 17:30
2. MW-2	AXK3B	16-4033	Water	03/10/16 11:17	03/10/16 17:30
3. MW-3	AXK3C	16-4034	Water	03/10/16 12:31	03/10/16 17:30
4. MW-5	AXK3D	16-4035	Water	03/10/16 14:43	03/10/16 17:30
5. SW-6	AXK3E	16-4036	Water	03/10/16 15:25	03/10/16 17:30
6. SW-7	AXK3F	16-4037	Water	03/10/16 15:38	03/10/16 17:30
7. MW-6	AXK3G	16-4038	Water	03/10/16 14:43	03/10/16 17:30



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: Total Dissolved Solids-EPA 160.1

Matrix: Water

Holding Time: 7 Days

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/14/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/14/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/14/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/14/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/14/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/14/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/14/16
Method Blank	MB031416	N/A	N/A	N/A	03/14/16
Lab Control	LCS031416	N/A	N/A	N/A	03/14/16
MW-1	AXK3ADP	03/10/16	03/10/16	N/A	03/14/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: Chloride-EPA 325.2

Matrix: Water

Holding Time: 28 Days

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/15/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/15/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/15/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/15/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/15/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/15/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/15/16
Method Blank	MB031516	N/A	N/A	N/A	03/15/16
Standard Ref.	SRM031516	N/A	N/A	N/A	03/15/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: N-Ammonia-EPA 350.1M

Matrix: Water

Holding Time: 28 Days

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/23/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/23/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/23/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/23/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/23/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/23/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/23/16
Method Blank	MB032316	N/A	N/A	N/A	03/23/16
Standard Ref.	SRM032316	N/A	N/A	N/A	03/23/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: N-Nitrate-Calculated

Matrix: Water

Holding Time: 48 Hours

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/11/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/11/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/11/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/11/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/11/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/11/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/11/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: N-Nitrite-EPA 353.2

Matrix: Water

Holding Time: 48 Hours

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/11/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/11/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/11/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/11/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/11/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/11/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/11/16
Method Blank	MB031116	N/A	N/A	N/A	03/11/16
Standard Ref.	SRM031116	N/A	N/A	N/A	03/11/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: Nitrate + Nitrite-EPA 353.2

Matrix: Water

Holding Time: 48 Hours (unpreserved)
28 Days (preserved)

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/11/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/11/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/11/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/11/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/11/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/11/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/11/16
Method Blank	MB031116	N/A	N/A	N/A	03/11/16
Standard Ref.	SRM031116	N/A	N/A	N/A	03/11/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: Sulfate-EPA 375.2

Matrix: Water

Holding Time: 28 Days

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/17/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/17/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/17/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/17/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/17/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/17/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/17/16
Method Blank	MB031716	N/A	N/A	N/A	03/17/16
Standard Ref.	SRM031716	N/A	N/A	N/A	03/17/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: Chemical Oxygen Demand-EPA 410.4

Matrix: Water

Holding Time: 28 Days

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/29/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/29/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/29/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/29/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/29/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/29/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/29/16
Method Blank	MB032916	N/A	N/A	N/A	03/29/16
Standard Ref.	SRM032916	N/A	N/A	N/A	03/29/16



Client Project ID: 5531625014 (02/02), NewCastle LF

ARI Job No: AXK3

Parameter: Total Organic Carbon-EPA 9060

Matrix: Water

Holding Time: 28 Days

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	N/A	03/11/16
MW-2	AXK3B	03/10/16	03/10/16	N/A	03/11/16
MW-3	AXK3C	03/10/16	03/10/16	N/A	03/11/16
MW-5	AXK3D	03/10/16	03/10/16	N/A	03/11/16
SW-6	AXK3E	03/10/16	03/10/16	N/A	03/11/16
SW-7	AXK3F	03/10/16	03/10/16	N/A	03/11/16
MW-6	AXK3G	03/10/16	03/10/16	N/A	03/11/16
Method Blank	MB031116	N/A	N/A	N/A	03/11/16
Standard Ref.	SRM031116	N/A	N/A	N/A	03/11/16



Client Project ID: 5531625014(02/02), NewCastle LF

ARI Job No: AXK3

Parameter: ICP Dissolved Metals-6010C

Matrix: Water

Holding Time: 6 Months

Date Reported: 04/01/16

Client Sample ID	ARI Sample ID	Date Sampled	Date Received	Date Extracted	Date Analyzed
MW-1	AXK3A	03/10/16	03/10/16	03/16/16	03/16/16
MW-2	AXK3B	03/10/16	03/10/16	03/16/16	03/16/16
MW-3	AXK3C	03/10/16	03/10/16	03/16/16	03/16/16
MW-5	AXK3D	03/10/16	03/10/16	03/16/16	03/16/16
SW-6	AXK3E	03/10/16	03/10/16	03/16/16	03/16/16
SW-7	AXK3F	03/10/16	03/10/16	03/16/16	03/16/16
MW-6	AXK3G	03/10/16	03/10/16	03/16/16	03/16/16
Method Blank	MB031616	N/A	N/A	03/16/16	03/16/16
Lab Control	LCS031616	N/A	N/A	03/16/16	03/16/16



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Data Reporting Qualifiers

Effective 12/31/13

Inorganic Data

- U Indicates that the target analyte was not detected at the reported concentration
- * Duplicate RPD is not within established control limits
- B Reported value is less than the CRDL but \geq the Reporting Limit
- N Matrix Spike recovery not within established control limits
- NA Not Applicable, analyte not spiked
- H The natural concentration of the spiked element is so much greater than the concentration spiked that an accurate determination of spike recovery is not possible
- L Analyte concentration is ≤ 5 times the Reporting Limit and the replicate control limit defaults to ± 1 RL instead of the normal 20% RPD

Organic Data

- U Indicates that the target analyte was not detected at the reported concentration
- * Flagged value is not within established control limits
- B Analyte detected in an associated Method Blank at a concentration greater than one-half of ARI's Reporting Limit or 5% of the regulatory limit or 5% of the analyte concentration in the sample.
- J Estimated concentration when the value is less than ARI's established reporting limits
- D The spiked compound was not detected due to sample extract dilution
- E Estimated concentration calculated for an analyte response above the valid instrument calibration range. A dilution is required to obtain an accurate quantification of the analyte.



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- Q Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20%RSD, <20%Drift or minimum RRF).
- S Indicates an analyte response that has saturated the detector. The calculated concentration is not valid; a dilution is required to obtain valid quantification of the analyte
- NA The flagged analyte was not analyzed for
- NR Spiked compound recovery is not reported due to chromatographic interference
- NS The flagged analyte was not spiked into the sample
- M Estimated value for an analyte detected and confirmed by an analyst but with low spectral match parameters. This flag is used only for GC-MS analyses
- N The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification"
- Y The analyte is not detected at or above the reported concentration. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit.
- EMPC Estimated Maximum Possible Concentration (EMPC) defined in EPA Statement of Work DLM02.2 as a value "calculated for 2,3,7,8-substituted isomers for which the quantitation and /or confirmation ion(s) has signal to noise in excess of 2.5, but does not meet identification criteria" (Dioxin/Furan analysis only)
- C The analyte was positively identified on only one of two chromatographic columns. Chromatographic interference prevented a positive identification on the second column
- P The analyte was detected on both chromatographic columns but the quantified values differ by $\geq 40\%$ RPD with no obvious chromatographic interference
- X Analyte signal includes interference from polychlorinated diphenyl ethers. (Dioxin/Furan analysis only)
- Z Analyte signal includes interference from the sample matrix or perfluorokerosene ions. (Dioxin/Furan analysis only)



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Geotechnical Data

- A** The total of all fines fractions. This flag is used to report total fines when only sieve analysis is requested and balances total grain size with sample weight.
- F** Samples were frozen prior to particle size determination
- SM** Sample matrix was not appropriate for the requested analysis. This normally refers to samples contaminated with an organic product that interferes with the sieving process and/or moisture content, porosity and saturation calculations
- SS** Sample did not contain the proportion of "fines" required to perform the pipette portion of the grain size analysis
- W** Weight of sample in some pipette aliquots was below the level required for accurate weighting

SAMPLE RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *WJR*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014 (02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Client ID: MW-1
ARI ID: 16-4032 AXK3A

Analyte	Date Batch	Method	Units	RL	Sample
Total Dissolved Solids	03/14/16 031416#1	EPA 160.1	mg/L	10.0	673
Chloride	03/15/16 031516#1	EPA 325.2	mg/L	1.0	2.9
N-Ammonia	03/23/16 032316#1	EPA 350.1M	mg-N/L	0.010	0.113
N-Nitrate	03/11/16	Calculated	mg-N/L	0.010	0.014
N-Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	< 0.010 U
Nitrate + Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	0.014
Sulfate	03/17/16 031716#1	EPA 375.2	mg/L	40.0	273
Chemical Oxygen Demand	03/29/16 032916#1	EPA 410.4	mg/L	10.0	< 10.0 U
Total Organic Carbon	03/11/16 031116#1	EPA 9060	mg/L	0.50	1.06

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *CWS*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014(02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Client ID: MW-2
ARI ID: 16-4033 AXK3B

Analyte	Date Batch	Method	Units	RL	Sample
Total Dissolved Solids	03/14/16 031416#1	EPA 160.1	mg/L	10.0	426
Chloride	03/15/16 031516#1	EPA 325.2	mg/L	2.0	15.0
N-Ammonia	03/23/16 032316#1	EPA 350.1M	mg-N/L	0.010	0.564
N-Nitrate	03/11/16	Calculated	mg-N/L	0.010	0.035
N-Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	< 0.010 U
Nitrate + Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	0.035
Sulfate	03/17/16 031716#1	EPA 375.2	mg/L	2.0	10.6
Chemical Oxygen Demand	03/29/16 032916#1	EPA 410.4	mg/L	10.0	< 10.0 U
Total Organic Carbon	03/11/16 031116#1	EPA 9060	mg/L	0.50	3.54

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *CNS*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014(02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Client ID: MW-3
ARI ID: 16-4034 AXK3C

Analyte	Date Batch	Method	Units	RL	Sample
Total Dissolved Solids	03/14/16 031416#1	EPA 160.1	mg/L	10.0	449
Chloride	03/15/16 031516#1	EPA 325.2	mg/L	1.0	6.7
N-Ammonia	03/23/16 032316#1	EPA 350.1M	mg-N/L	0.010	0.317
N-Nitrate	03/11/16	Calculated	mg-N/L	0.010	0.082
N-Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	< 0.010 U
Nitrate + Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	0.082
Sulfate	03/17/16 031716#1	EPA 375.2	mg/L	4.0	32.6
Chemical Oxygen Demand	03/29/16 032916#1	EPA 410.4	mg/L	10.0	< 10.0 U
Total Organic Carbon	03/11/16 031116#1	EPA 9060	mg/L	0.50	3.29

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *CWS*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014 (02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Client ID: MW-5
ARI ID: 16-4035 AXK3D

Analyte	Date Batch	Method	Units	RL	Sample
Total Dissolved Solids	03/14/16 031416#1	EPA 160.1	mg/L	10.0	331
Chloride	03/15/16 031516#1	EPA 325.2	mg/L	1.0	3.6
N-Ammonia	03/23/16 032316#1	EPA 350.1M	mg-N/L	0.010	0.066
N-Nitrate	03/11/16	Calculated	mg-N/L	0.010	< 0.010 U
N-Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	0.012
Nitrate + Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	< 0.010 U
Sulfate	03/17/16 031716#1	EPA 375.2	mg/L	10.0	67.9
Chemical Oxygen Demand	03/29/16 032916#1	EPA 410.4	mg/L	10.0	< 10.0 U
Total Organic Carbon	03/11/16 031116#1	EPA 9060	mg/L	0.50	2.77

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
 AXK3-Parametrix, Inc.



Matrix: Water
 Data Release Authorized: *ML*
 Reported: 03/31/16

Project: NewCastle LF
 Event: 5531625014(02/02)
 Date Sampled: 03/10/16
 Date Received: 03/10/16

Client ID: SW-6
 ARI ID: 16-4036 AXK3E

Analyte	Date Batch	Method	Units	RL	Sample
Total Dissolved Solids	03/14/16 031416#1	EPA 160.1	mg/L	10.0	540
Chloride	03/15/16 031516#1	EPA 325.2	mg/L	1.0	4.2
N-Ammonia	03/23/16 032316#1	EPA 350.1M	mg-N/L	0.010	0.145
N-Nitrate	03/11/16	Calculated	mg-N/L	0.010	0.086
N-Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	< 0.010 U
Nitrate + Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	0.086
Sulfate	03/17/16 031716#1	EPA 375.2	mg/L	40.0	162
Chemical Oxygen Demand	03/29/16 032916#1	EPA 410.4	mg/L	10.0	< 10.0 U
Total Organic Carbon	03/11/16 031116#1	EPA 9060	mg/L	0.50	1.66

RL Analytical reporting limit
 U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *mk*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014 (02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Client ID: SW-7
ARI ID: 16-4037 AXK3F

Analyte	Date Batch	Method	Units	RL	Sample
Total Dissolved Solids	03/14/16 031416#1	EPA 160.1	mg/L	5.0	10.4
Chloride	03/15/16 031516#1	EPA 325.2	mg/L	1.0	3.2
N-Ammonia	03/23/16 032316#1	EPA 350.1M	mg-N/L	0.010	0.044
N-Nitrate	03/11/16	Calculated	mg-N/L	0.010	0.873
N-Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	< 0.010 U
Nitrate + Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	0.873
Sulfate	03/17/16 031716#1	EPA 375.2	mg/L	2.0	24.2
Chemical Oxygen Demand	03/29/16 032916#1	EPA 410.4	mg/L	10.0	< 10.0 U
Total Organic Carbon	03/11/16 031116#1	EPA 9060	mg/L	0.50	4.20

RL Analytical reporting limit
U Undetected at reported detection limit

SAMPLE RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *OK*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014 (02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Client ID: MW-6
ARI ID: 16-4038 AXK3G

Analyte	Date Batch	Method	Units	RL	Sample
Total Dissolved Solids	03/14/16 031416#1	EPA 160.1	mg/L	10.0	333
Chloride	03/15/16 031516#1	EPA 325.2	mg/L	1.0	3.2
N-Ammonia	03/23/16 032316#1	EPA 350.1M	mg-N/L	0.010	0.065
N-Nitrate	03/11/16	Calculated	mg-N/L	0.010	< 0.010 U
N-Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	0.017
Nitrate + Nitrite	03/11/16 031116#1	EPA 353.2	mg-N/L	0.010	< 0.010 U
Sulfate	03/17/16 031716#1	EPA 375.2	mg/L	10.0	66.5
Chemical Oxygen Demand	03/29/16 032916#1	EPA 410.4	mg/L	10.0	< 10.0 U
Total Organic Carbon	03/11/16 031116#1	EPA 9060	mg/L	0.50	2.71

RL Analytical reporting limit
U Undetected at reported detection limit

METHOD BLANK RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *CRK*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014 (02/02)
Date Sampled: NA
Date Received: NA

Analyte	Method	Date	Units	Blank	ID
Total Dissolved Solids	EPA 160.1	03/14/16	mg/L	< 5.0 U	
Chloride	EPA 325.2	03/15/16	mg/L	< 1.0 U	FB
N-Ammonia	EPA 350.1M	03/23/16	mg-N/L	< 0.010 U	FB
N-Nitrite	EPA 353.2	03/11/16	mg-N/L	< 0.010 U	FB
Nitrate + Nitrite	EPA 353.2	03/11/16	mg-N/L	< 0.010 U	FB
Sulfate	EPA 375.2	03/17/16	mg/L	< 2.0 U	FB
Chemical Oxygen Demand	EPA 410.4	03/29/16	mg/L	< 10.0 U	
Total Organic Carbon	EPA 9060	03/11/16	mg/L	< 0.50 U	

FB Filtration Blank

LAB CONTROL RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *W*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014(02/02)
Date Sampled: NA
Date Received: NA

Analyte/Method	QC ID	Date	Units	LCS	Spike Added	Recovery
Total Dissolved Solids EPA 160.1	ICVL	03/14/16	mg/L	489	500	97.8%

STANDARD REFERENCE RESULTS-CONVENTIONALS
 AXK3-Parametrix, Inc.



Matrix: Water
 Data Release Authorized: *WIK*
 Reported: 03/31/16

Project: NewCastle LF
 Event: 5531625014(02/02)
 Date Sampled: NA
 Date Received: NA

Analyte/SRM ID	Method	Date	Units	SRM	True Value	Recovery
Chloride ERA #260115	EPA 325.2	03/15/16	mg/L	4.9	5.0	98.0%
N-Ammonia ERA #360114	EPA 350.1M	03/23/16	mg-N/L	0.463	0.500	92.6%
N-Nitrite ERA #100115	EPA 353.2	03/11/16	mg-N/L	0.488	0.500	97.6%
Nitrate + Nitrite ERA #320614	EPA 353.2	03/11/16	mg-N/L	0.488	0.500	97.6%
Sulfate ERA 060415	EPA 375.2	03/17/16	mg/L	14.8	15.0	98.7%
Chemical Oxygen Demand Orion #TX1	EPA 410.4	03/29/16	mg/L	109	100	109.0%
Total Organic Carbon ERA #0205-15-01	EPA 9060	03/11/16	mg/L	19.6	20.0	98.0%

REPLICATE RESULTS-CONVENTIONALS
AXK3-Parametrix, Inc.



Matrix: Water
Data Release Authorized: *WDL*
Reported: 03/31/16

Project: NewCastle LF
Event: 5531625014 (02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Analyte	Method	Date	Units	Sample	Replicate(s)	RPD/RSD
ARI ID: AXK3A Client ID: MW-1						
Total Dissolved Solids	EPA 160.1	03/14/16	mg/L	673	676	0.4%

INORGANICS ANALYSIS DATA SHEET

DISSOLVED METALS


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Sample ID: MW-1
SAMPLE

Lab Sample ID: AXK3A

LIMS ID: 16-4032

Matrix: Water

Data Release Authorized: 

Reported: 03/18/16

QC Report No: AXK3-Parametrix, Inc.

Project: NewCastle LF

5531625014 (02/02)

Date Sampled: 03/10/16

Date Received: 03/10/16

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	0.4	
6010C	03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	144,000	
6010C	03/16/16	6010C	03/16/16	7439-89-6	Iron	50	830	
6010C	03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	45,200	
6010C	03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	156	
6010C	03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	


Calculated Dissolved Hardness (ug-CaCO3/L): 550000

U-Analyte undetected at given LOQ

LOQ-Limit of Quantitation

ANALYTICAL CHEMISTRY ANALYSIS DATA SHEET
DISSOLVED METALS
 1 of 1

Sample ID: MW-2
 SAMPLE

Sample ID: AXK3B
 ID: 16-4033
 Matrix: Water
 Release Authorized: 
 Date: 03/18/16

QC Report No: AXK3-Parametrix, Inc.
 Project: NewCastle LF
 5531625014(02/02)
 Date Sampled: 03/10/16
 Date Received: 03/10/16

Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	0.2	U
03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	71,000	
03/16/16	6010C	03/16/16	7439-89-6	Iron	50	740	
03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	28,200	
03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	118	
03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	U

Related Dissolved Hardness (ug-CaCO3/L): 290000

Analyte undetected at given LOQ
 Limit of Quantitation

INORGANICS ANALYSIS DATA SHEET

DISSOLVED METALS


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Sample ID: MW-3
SAMPLE

Lab Sample ID: AXK3C

LIMS ID: 16-4034

Matrix: Water

Data Release Authorized: 

Reported: 03/18/16

QC Report No: AXK3-Parametrix, Inc.

Project: NewCastle LF

5531625014(02/02)

Date Sampled: 03/10/16

Date Received: 03/10/16

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	2.9	
6010C	03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	15,400	
6010C	03/16/16	6010C	03/16/16	7439-89-6	Iron	50	570	
6010C	03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	8,300	
6010C	03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	11	
6010C	03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	U

Calculated Dissolved Hardness (ug-CaCO3/L): 73000


U-Analyte undetected at given LOQ

LOQ-Limit of Quantitation

**INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS**

Page 1 of 1

Sample ID: MW-5
SAMPLE

Lab Sample ID: AXK3D
LIMS ID: 16-4035
Matrix: Water
Data Release Authorized: 
Reported: 03/18/16

QC Report No: AXK3-Parametrix, Inc.
Project: NewCastle LF
5531625014(02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16


Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	18.9	
6010C	03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	71,400	
6010C	03/16/16	6010C	03/16/16	7439-89-6	Iron	50	5,920	
6010C	03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	30,800	
6010C	03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	647	
6010C	03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	U

Calculated Dissolved Hardness (ug-CaCO3/L): 310000

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: SW-6
SAMPLE

Lab Sample ID: AXK3E
LIMS ID: 16-4036
Matrix: Water
Data Release Authorized: 
Reported: 03/18/16

QC Report No: AXK3-Parametrix, Inc.
Project: NewCastle LF
5531625014(02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	5.0	
6010C	03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	71,800	
6010C	03/16/16	6010C	03/16/16	7439-89-6	Iron	50	2,720	
6010C	03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	44,500	
6010C	03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	251	
6010C	03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	U

Calculated Dissolved Hardness (ug-CaCO3/L): 360000

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: SW-7
SAMPLE

Lab Sample ID: AXK3F
LIMS ID: 16-4037
Matrix: Water
Data Release Authorized:
Reported: 03/18/16



QC Report No: AXK3-Parametrix, Inc.
Project: NewCastle LF
5531625014(02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	0.9	
6010C	03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	15,000	
6010C	03/16/16	6010C	03/16/16	7439-89-6	Iron	50	100	
6010C	03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	5,950	
6010C	03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	25	
6010C	03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	U

Calculated Dissolved Hardness (ug-CaCO3/L): 62000

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

INORGANICS ANALYSIS DATA SHEET

DISSOLVED METALS

Sample ID: MW-6

SAMPLE

Page 1 of 1

Lab Sample ID: AXK3G
LIMS ID: 16-4038
Matrix: Water
Data Release Authorized:
Reported: 03/18/16



QC Report No: AXK3-Parametrix, Inc.
Project: NewCastle LF
5531625014(02/02)
Date Sampled: 03/10/16
Date Received: 03/10/16

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	19.1	
6010C	03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	71,000	
6010C	03/16/16	6010C	03/16/16	7439-89-6	Iron	50	5,930	
6010C	03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	30,800	
6010C	03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	649	
6010C	03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	U

Calculated Dissolved Hardness (ug-CaCO3/L): 300000

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

**INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS**

Sample ID: METHOD BLANK

Page 1 of 1

Lab Sample ID: AXK3MB
LIMS ID: 16-4038
Matrix: Water
Data Release Authorized:
Reported: 03/18/16



QC Report No: AXK3-Parametrix, Inc.
Project: NewCastle LF
5531625014 (02/02)
Date Sampled: NA
Date Received: NA

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	µg/L	Q
200.8	03/16/16	200.8	03/17/16	7440-38-2	Arsenic	0.2	0.2	U
6010C	03/16/16	6010C	03/16/16	7440-70-2	Calcium	50	50	U
6010C	03/16/16	6010C	03/16/16	7439-89-6	Iron	50	50	U
6010C	03/16/16	6010C	03/16/16	7439-95-4	Magnesium	50	50	U
6010C	03/16/16	6010C	03/16/16	7439-96-5	Manganese	1	1	U
6010C	03/16/16	6010C	03/16/16	7440-66-6	Zinc	10	10	U

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

INORGANICS ANALYSIS DATA SHEET
DISSOLVED METALS
Page 1 of 1

Sample ID: LAB CONTROL

Lab Sample ID: AXK3LCS
LIMS ID: 16-4038
Matrix: Water
Data Release Authorized:
Reported: 03/18/16



QC Report No: AXK3-Parametrix, Inc.
Project: NewCastle LF
5531625014(02/02)
Date Sampled: NA
Date Received: NA

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Analysis Method	Spike Found	Spike Added	% Recovery
Arsenic	200.8	24.3	25.0	97.2%
Calcium	6010C	9890	10000	98.9%
Iron	6010C	2020	2000	101%
Magnesium	6010C	10600	10000	106%
Manganese	6010C	496	500	99.2%
Zinc	6010C	520	500	104%

Reported in µg/L

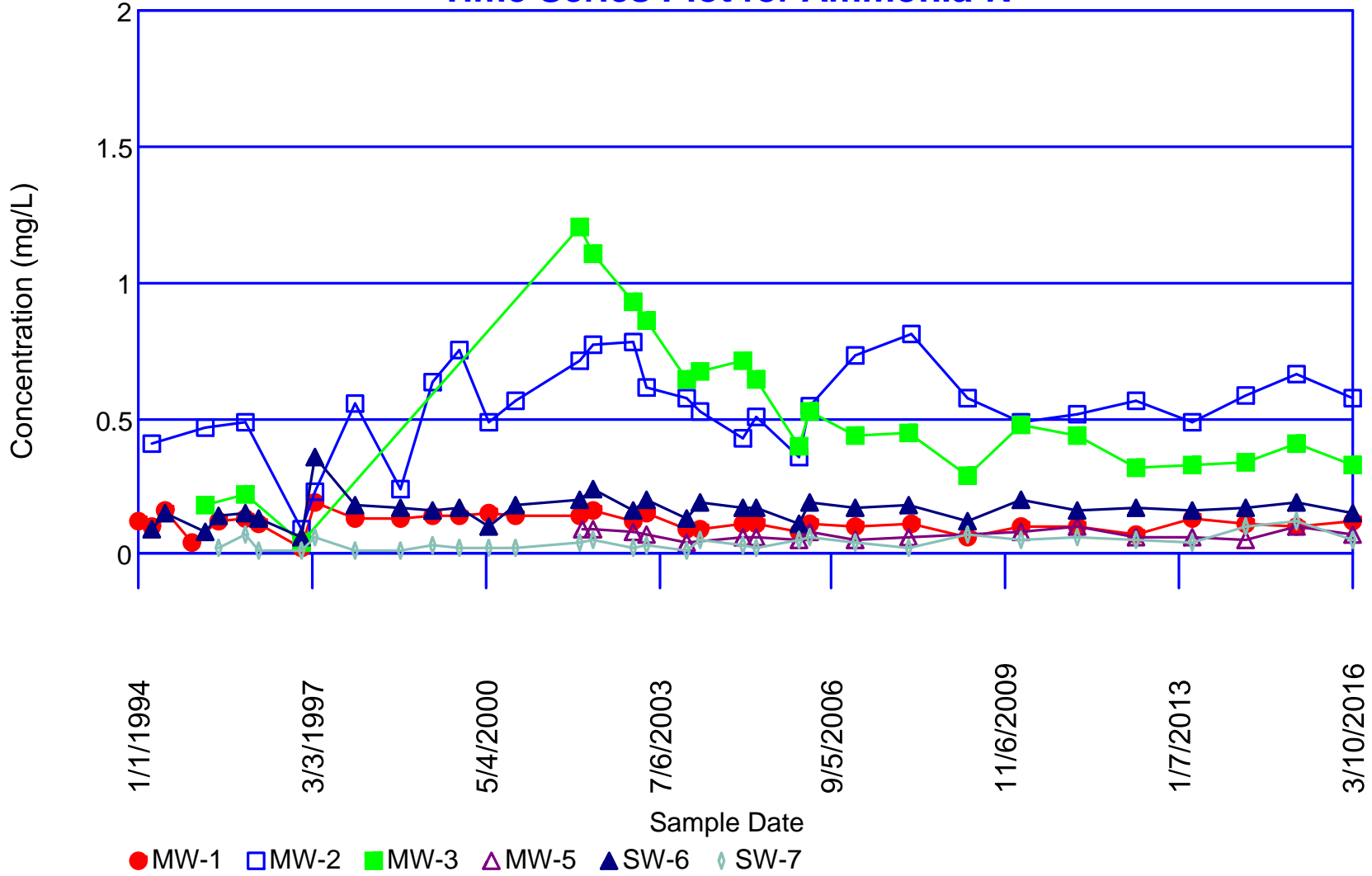
N-Control limit not met
Control Limits: 80-120%

Appendix B

Time-Series Plots

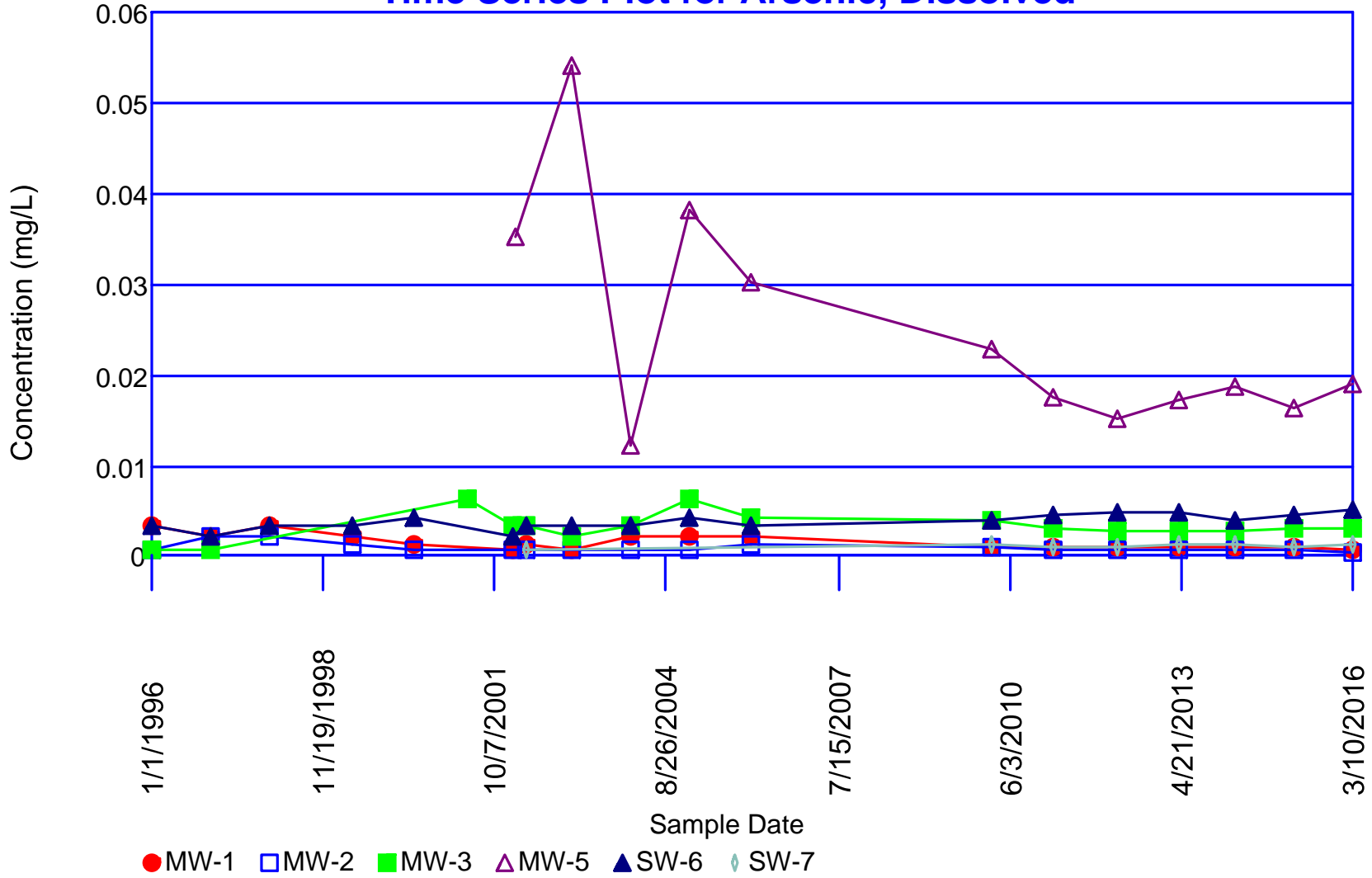


Newcastle Landfill Time Series Plot for Ammonia-N



Newcastle Landfill

Time Series Plot for Arsenic, Dissolved

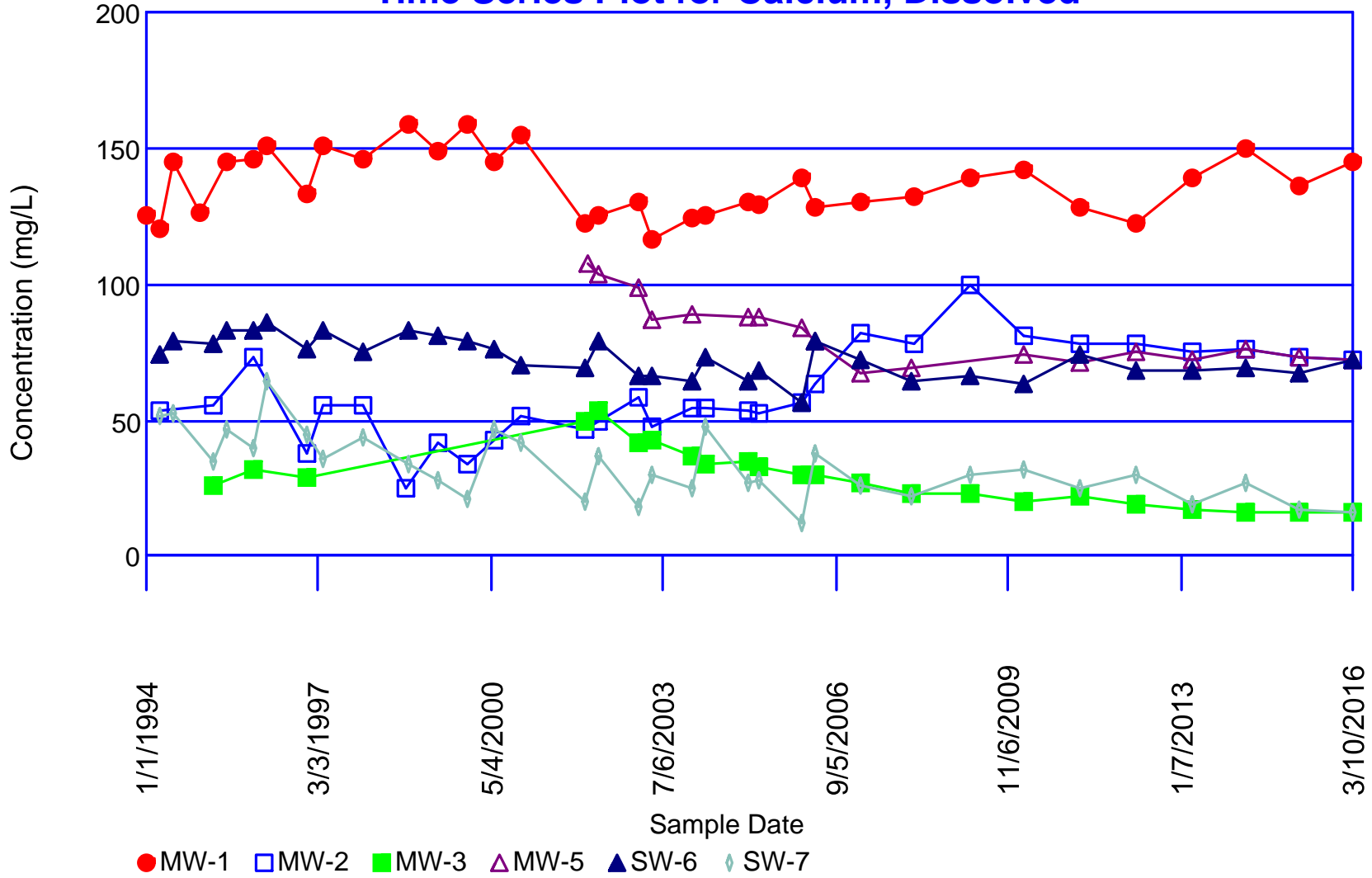


Arsenic, Dissolved

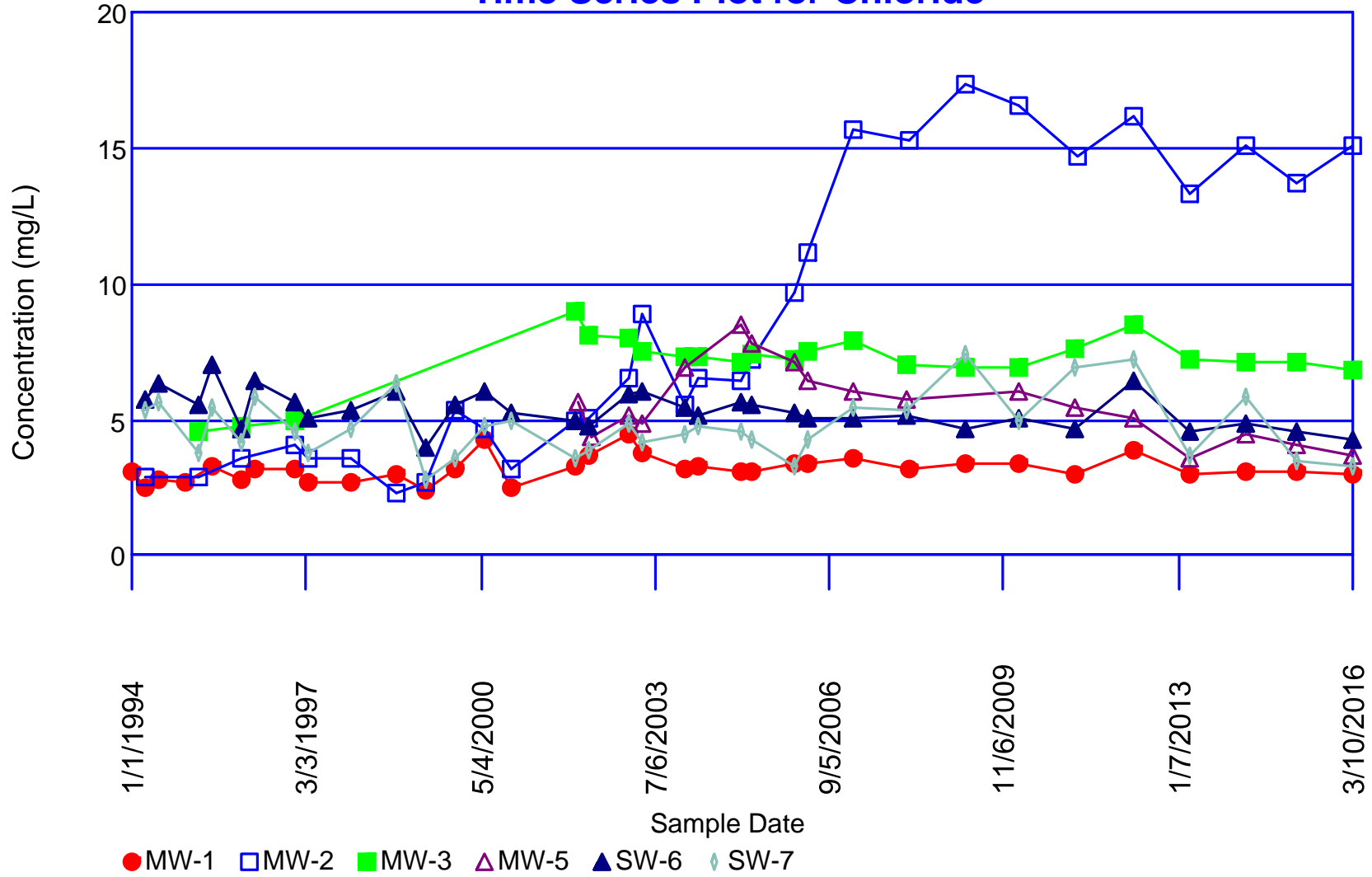
Non-Detects Replaced with 1/2 DL

Newcastle Landfill

Time Series Plot for Calcium, Dissolved



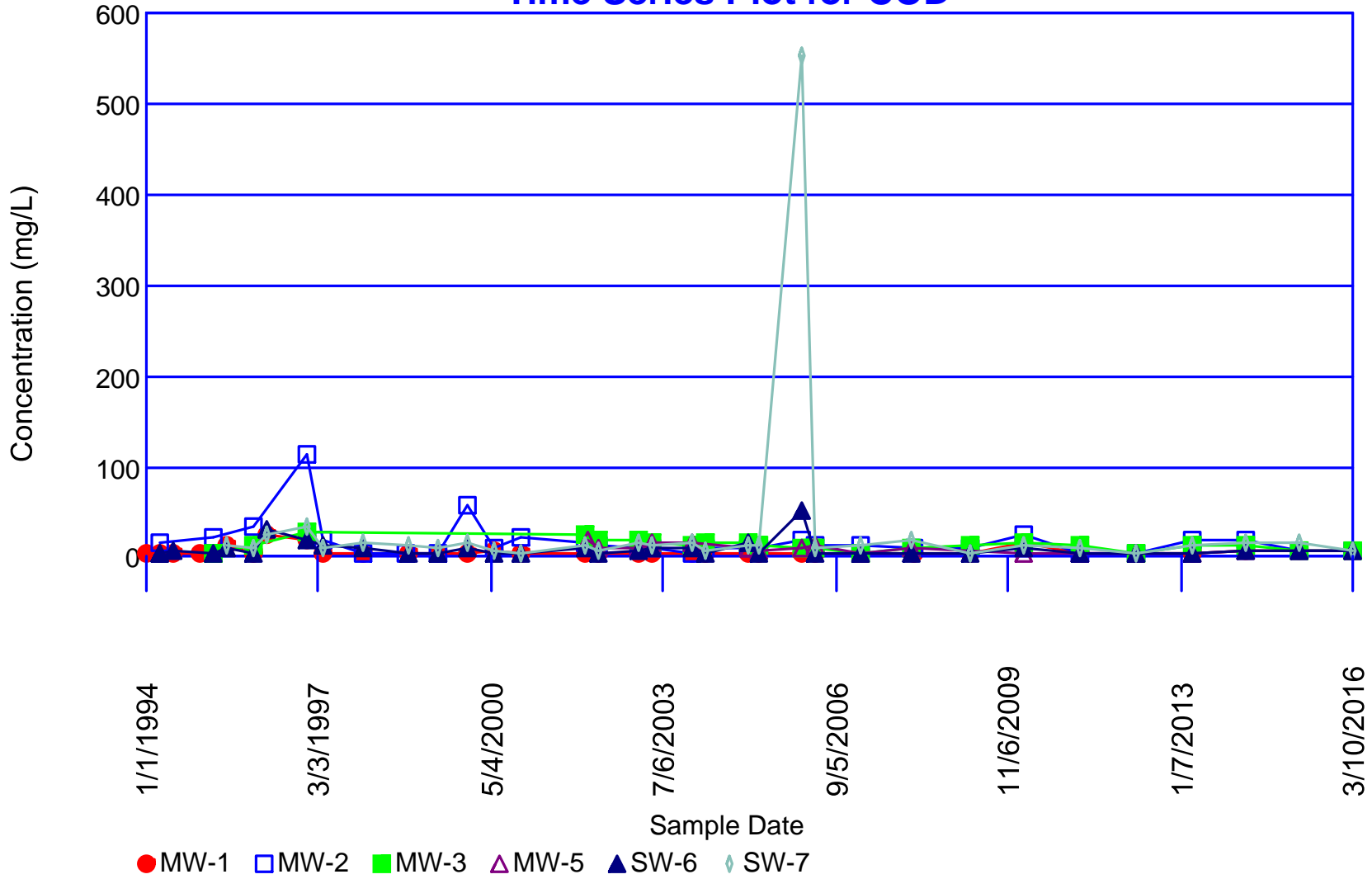
Newcastle Landfill Time Series Plot for Chloride



Chloride

Non-Detects Replaced with 1/2 DL

Newcastle Landfill Time Series Plot for COD

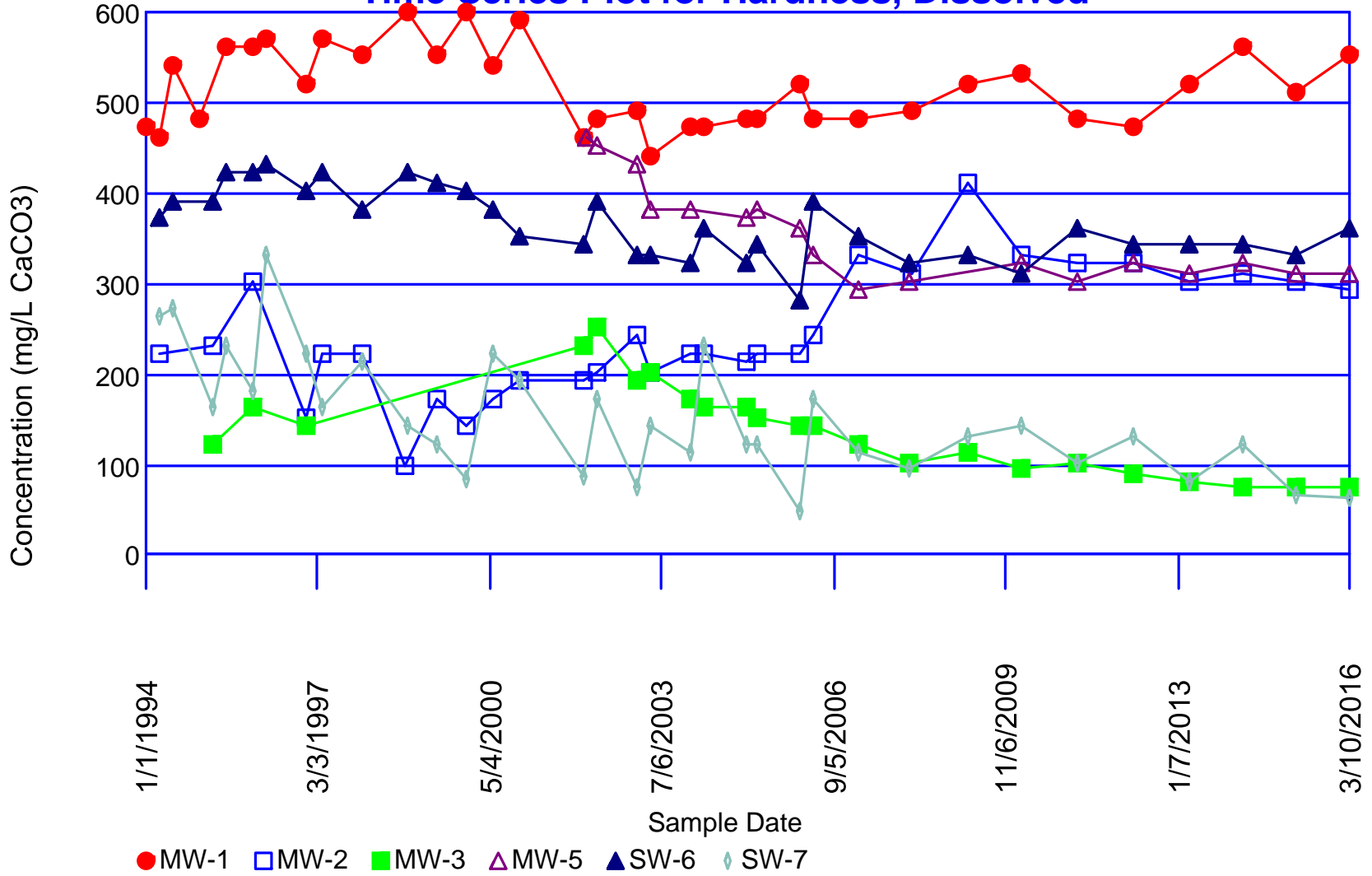


COD

Non-Detects Replaced with 1/2 DL

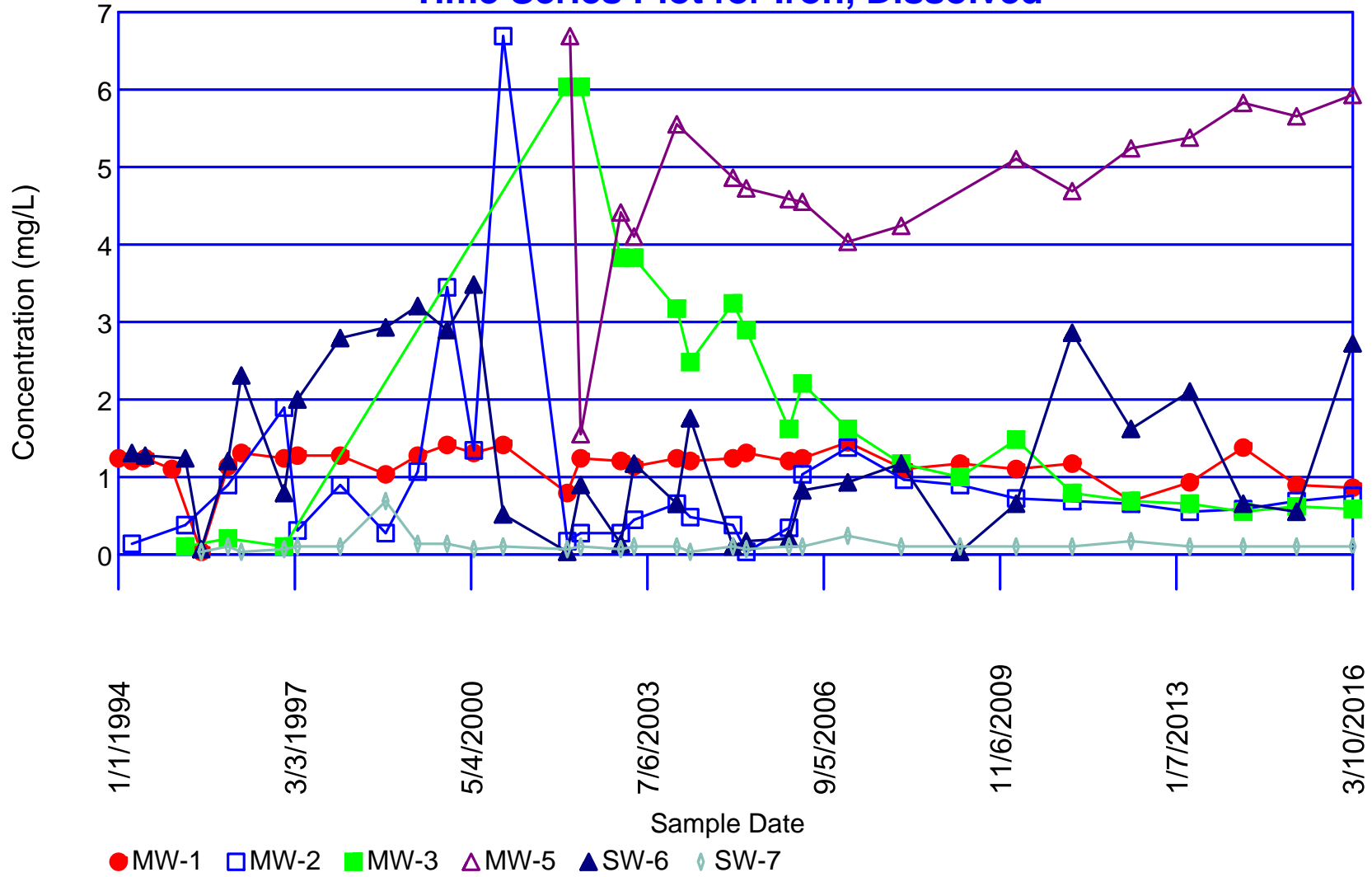
Newcastle Landfill

Time Series Plot for Hardness, Dissolved



Newcastle Landfill

Time Series Plot for Iron, Dissolved

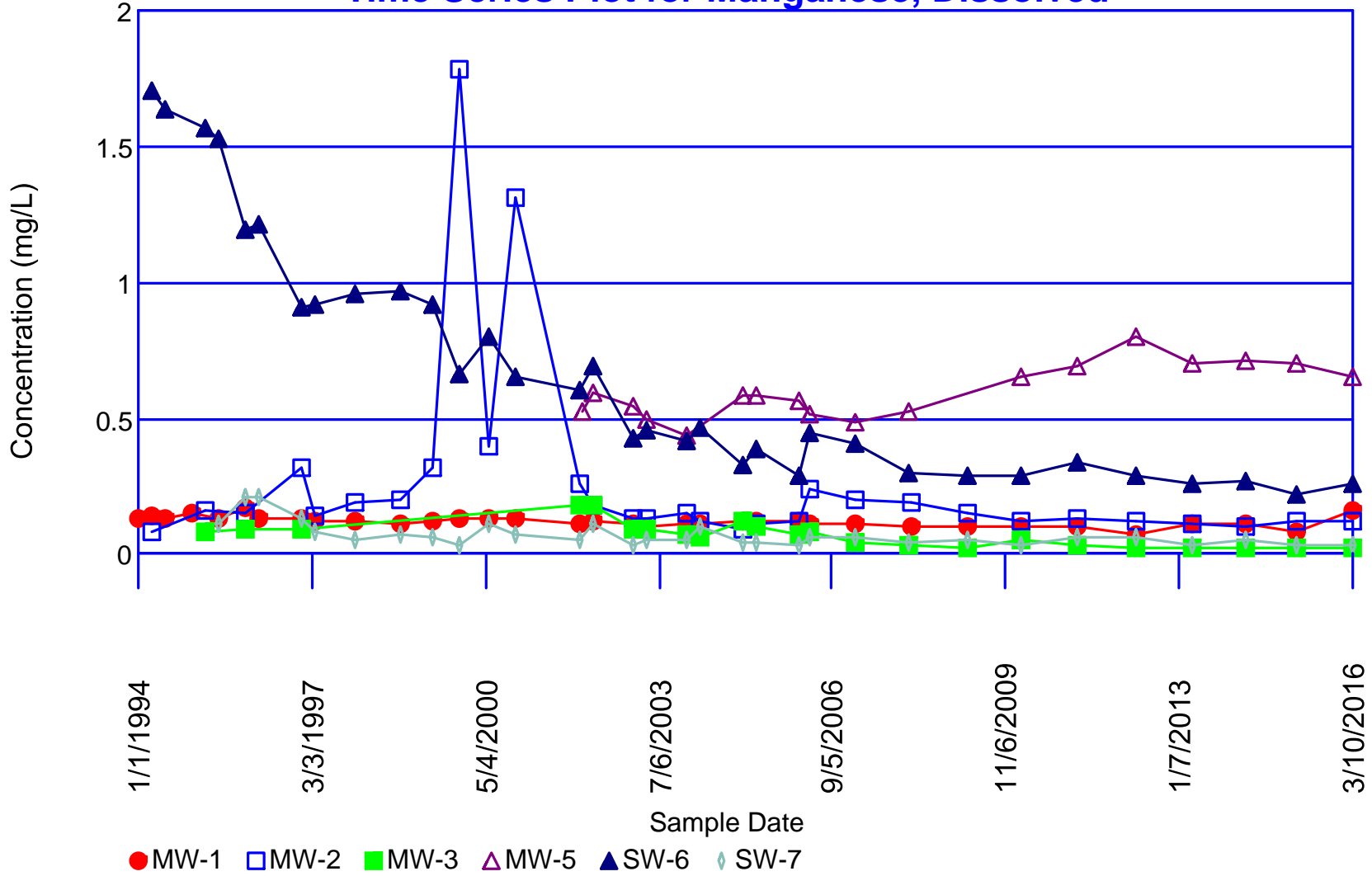


Iron, Dissolved

Non-Detects Replaced with 1/2 DL

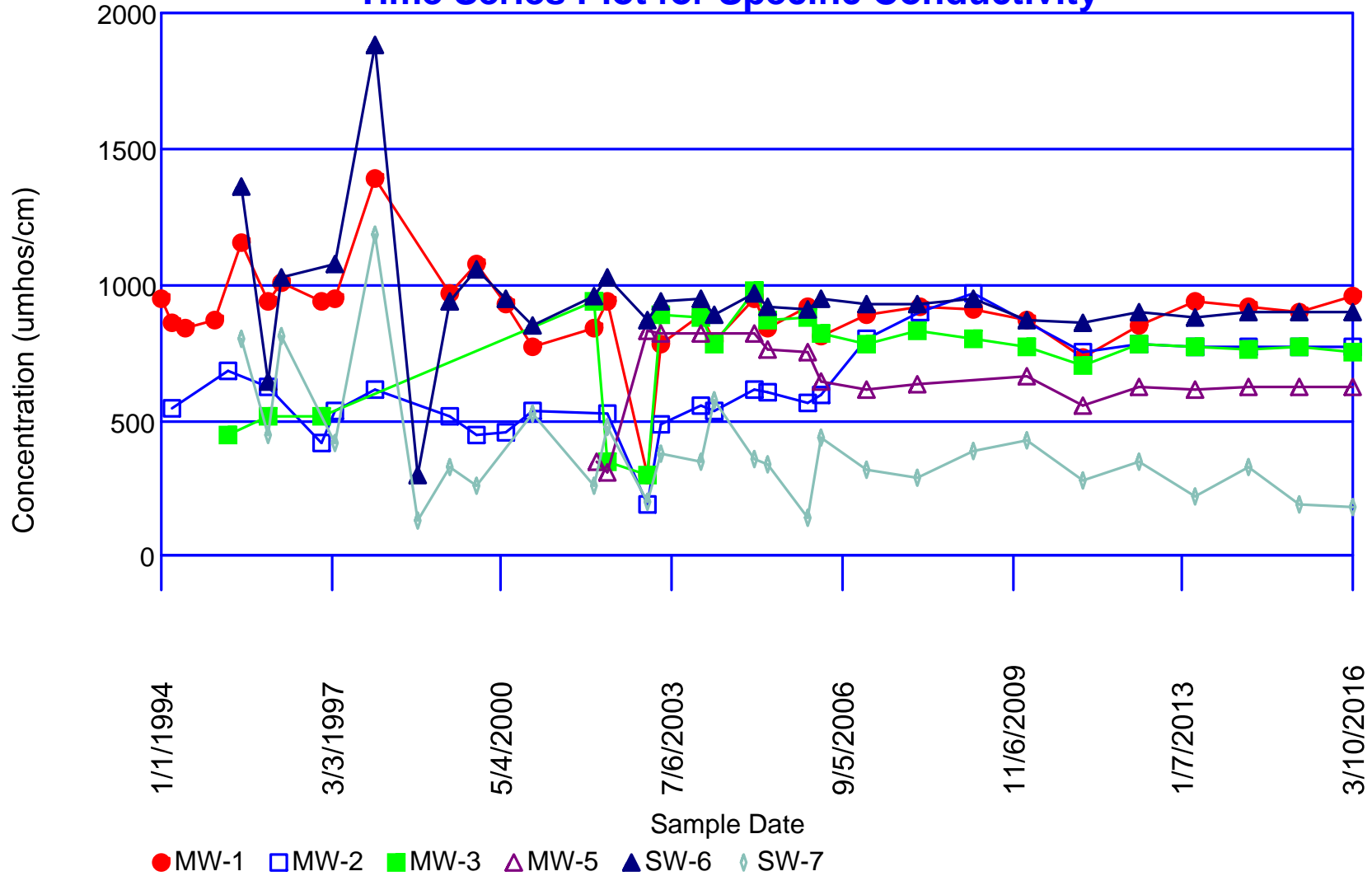
Newcastle Landfill

Time Series Plot for Manganese, Dissolved



Newcastle Landfill

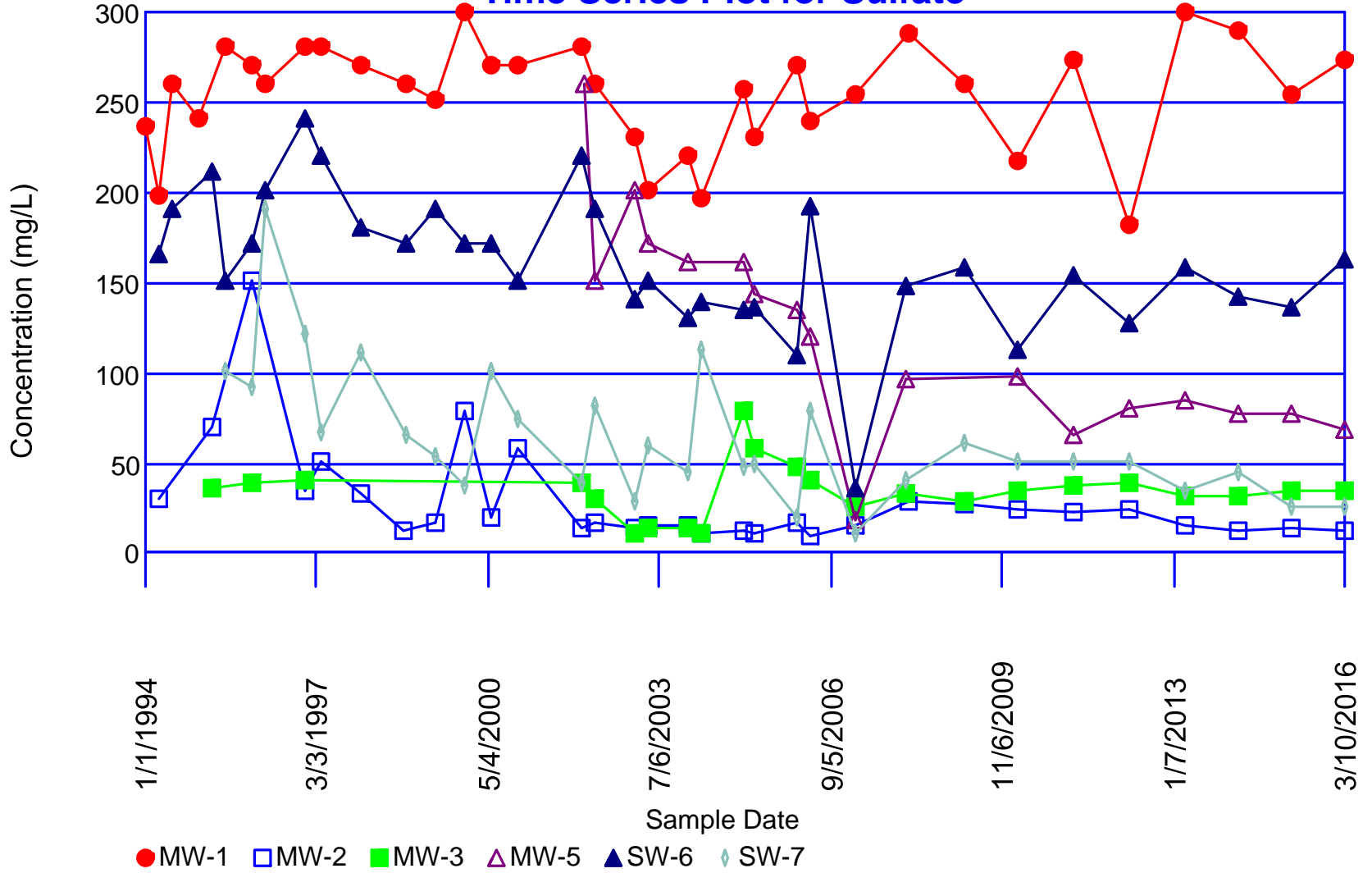
Time Series Plot for Specific Conductivity



Specific Conductivity

Non-Detects Replaced with 1/2 DL

Newcastle Landfill Time Series Plot for Sulfate



Newcastle Landfill Time Series Plot for TOC

