LMS/GRN/S00611

Data Validation Package

June 2011
Groundwater and Surface Water Sampling at the Green River, Utah, Disposal Site

September 2011

U.S. DEPARTMENT OF ENERGY | Legacy Management

TJME20

This page intentionally left blank

Contents

This page intentionally left blank

Sampling Event Summary

Site: Green River, Utah, Disposal Site

Sampling Period: June 20–21, 2011

The 2008 Preliminary Final *Groundwater Compliance Action Plan for the Green River, Utah, Disposal Site* requires annual groundwater monitoring at the site to observe the effectiveness of the groundwater compliance strategy.

Groundwater samples were collected from point-of-compliance (POC) wells 0171, 0173, 0176, 0179, 0181, and 0813 to monitor the performance of the disposal cell. Groundwater samples also were collected from alluvium monitoring wells 0188, 0189, 0192, 0194 and basal sandstone monitoring wells 0182, 0184, 0185, and 0588 as a best management practice. Surface locations 0846 and 0847 were sampled to monitor for degradation of water quality in the backwater area of Browns Wash and in the Green River immediately downstream of Browns Wash. Sampling and analysis were conducted as specified in *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351, continually updated). The water level was measured at each sampled well.

All six POC wells are completed in the middle sandstone unit of the Cedar Mountain Formation and are monitored to measure contaminant concentrations for comparison to proposed alternate concentration limits (ACLs), as provided in Table 1. Contaminant concentrations in the POC wells remain below their respective ACLs.

Table 1. Analytical Results[1] and Proposed ACL Values for the POC Wells

Monitoring Well	Arsenic		Nitrate		Selenium		Uranium	
	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result
0171	5.0	0.0011	1,000	44	5.0	0.140	4.4	0.100
0173		0.0016		230		0.088		0.019
0176		0.0003		68		0.860		0.003
0179		0.0007		19		0.300		0.170
0181		0.0038		80		0.011		0.013
0813		0.0630		Not Detected		0.0006		0.018

[1]Analytical results and ACLs are in milligrams per Liter.

The alluvium monitoring wells are sampled as a best management practice. The results are not compared to ACLs because the alluvial groundwater is not classified as an aquifer. As expected, some of these wells continue to have elevated concentrations of nitrate and uranium because processing activities contaminated the alluvial groundwater. Analytical results for the alluvium monitoring wells are provided in Table 2.

Groundwater in the basal sandstone unit has not been contaminated by site-related activities, but is also monitored as a best management practice. Analytical results for the basal sandstone monitoring wells also are provided in Table 2

Table 2. Analytical Results[1] for the Alluvium and Basal Sandstone Monitoring Wells

Monitoring Well	Arsenic	Nitrate	Selenium	Uranium
Alluvium Monitoring Wells				
0188	0.0003	9.5	0.034	0.074
0189	0.0006	39	0.067	0.34
0192	0.0003	79	0.11	0.48
0194	0.0025	370	0.024	4.1
Basal Sandstone Monitoring Wells				
0182	0.0035	0.02	0.0001	0.001
0184	0.0018	0.08	0.0004	0.003
0185	0.0010	0.12	0.0001	0.001
0588	0.0084	0.04	0.0001	0.0001

[1]Analytical results are in milligrams per Liter

The surface water locations are in the ephemeral Browns Wash (0847) (backwater of the Green River) and at the confluence of Browns Wash and the Green River (0846). Though the contaminated Browns Wash groundwater discharges to the Green River alluvial aquifer and the Green River, contaminant concentrations remain below the applicable surface water standards. Surface water sample results for contaminants of concern are provided in Table 3.

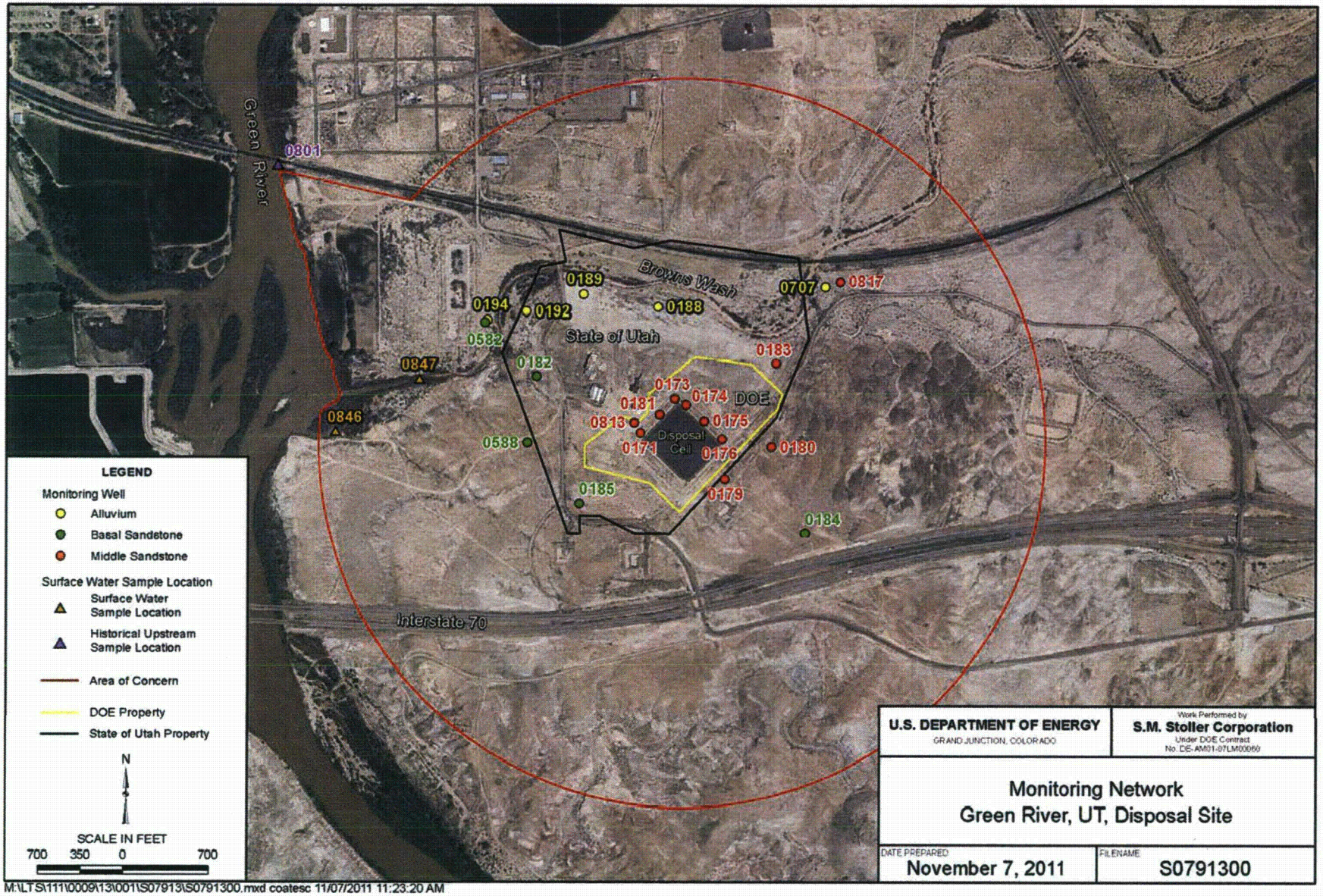
Table 3. Analytical Results[1] and Standards[2]/Benchmarks[3] for Surface Water

Location	Arsenic		Nitrate		Selenium		Uranium	
	Standard	Sample Result	Standard	Sample Result	Standard	Sample Result	Benchmark	Sample Result
0846	0.150	0.0013	4	0.03	0.0046	0.0004	0.0044	0.0013
0847		0.0018		0.12		0.0009		0.0022

[1] Sample results are milligrams per liter.
[2] Standards for arsenic, nitrate, and selenium are aquatic wildlife standards from Utah Rule R317-2, Standards of Quality for Waters of the State, Table 2.14.2.
[3] Uranium benchmark is based on an historical data set from an upstream Green River location.

J. E. Price — September 20, 11

Jeffrey Price — Date
Site Lead, S.M. Stoller Corporation



Green River Sample Location Map

This page intentionally left blank

Data Assessment Summary

This page intentionally left blank

Water Sampling Field Activities Verification Checklist

Project	Green River, Utah	**Date(s) of Water Sampling**	June 20–21, 2011
Date(s) of Verification	August 16, 2011	**Name of Verifier**	Steve Donivan

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures?	Yes	
List other documents, SOPs, instructions.		Work Order letter dated May 24, 2011.
2. Were the sampling locations specified in the planning documents sampled?	Yes	Well 0180 was not sampled because it was mistakenly chosen during the sample planning phase. Well 0184, which was the intended sample location, was sampled instead of 0180.
3. Was a pre-trip calibration conducted as specified in the above-named documents?	Yes	Pre-trip calibration was performed on June 16, 2011.
4. Was an operational check of the field equipment conducted daily?	Yes	Three operational checks were performed.
Did the operational checks meet criteria?	Yes	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	Yes	
6. Was the category of the well documented?	Yes	
7. Were the following conditions met when purging a Category I well:		
Was one pump/tubing volume purged prior to sampling?	Yes	
Did the water level stabilize prior to sampling?	Yes	
Did pH, specific conductance, and turbidity measurements stabilize prior to sampling?	Yes	
Was the flow rate less than 500 mL/min?	Yes	
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	

Water Sampling Field Activities Verification Checklist (continued)

	Response (Yes, No, NA)	Comments
8. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 mL/min?	Yes	
Was one pump/tubing volume removed prior to sampling?	Yes	
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected at location 0184.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with nondedicated equipment?	NA	Dedicated equipment was used at all locations.
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	
12. Were QC samples assigned a fictitious site identification number?	Yes	Location ID 2169 was used for the duplicate sample.
Was the true identity of the samples recorded on the Quality Assurance Sample Log or in the Field Data Collection System (FDCS) report?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
15. Were the number and types of samples collected as specified?	Yes	
16. Were chain of custody records completed and was sample custody maintained?	Yes	
17. Are field data sheets signed and dated by both team members (hardcopies) or are dates present for the "Date Signed" fields (FDCS)?	Yes	
18. Was all other pertinent information documented on the field data sheets?	Yes	
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
20. Were water levels measured at the locations specified in the planning documents?	Yes	

Laboratory Performance Assessment

General Information

Report Number (RIN):	11063891
Sample Event:	June 20-21, 2011
Site(s):	Green River, Utah; Disposal Site
Laboratory:	ALS Laboratory Group, Fort Collins, Colorado
Work Order No.:	1106325
Analysis:	Metals and Inorganics
Validator:	Steve Donivan
Review Date:	August 11, 2011

This validation was performed according to the *Environmental Procedures Catalog* (LMS/PRO/S04325, continually updated), "Standard Practice for Validation of Laboratory Data." The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 4.

Table 4. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Ammonia as N, NH_3-N	WCH-A-005	EPA 350.1	EPA 350.1
Metals: As, Se, U	LMM-02	SW-846 3005A	SW-846 6020A
Nitrate + Nitrite as N, NO_3+NO_2-N	WCH-A-022	EPA 353.2	EPA 353.2

Data Qualifier Summary

None of the analytical results required qualification.

Sample Shipping/Receiving

ALS Laboratory Group in Fort Collins, Colorado, received 17 water samples on June 23, 2011, accompanied by a Chain of Custody (COC) form. The receiving documentation included copies of the shipping labels listing the air waybill numbers. The COC form was checked to confirm that all of the samples were listed on the form with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received cool and intact with a temperature inside the iced cooler at 5.8 °C, which complies with requirements. All samples were received in the correct container types and were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods. All calibration and laboratory spike standards were prepared from independent sources.

Method EPA 350.1, Ammonia as N
The initial calibration was performed using six calibration standards on June 24, 2011, resulting in a calibration curve correlation coefficient value greater than 0.995 and an intercept less than 3 times the method detection limit (MDL). Initial and continuing calibration verification checks were made at the required frequency resulting in four verification checks that met the acceptance criteria.

Method EPA 353.2, Nitrate + Nitrite as N
The initial calibration was performed using seven calibration standards on June 27, 2011, resulting in a calibration curve correlation coefficient value greater than 0.995 and an intercept less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency resulting in seven verification checks that met the acceptance criteria.

Method SW-846 6020A, Arsenic, Selenium, and Uranium
Calibrations were performed on July 7, 2011, using four calibration standards resulting in calibration curves with correlation coefficient values greater than 0.995. The absolute values of the calibration curve intercepts were less than 3 times the MDLs. Initial and continuing calibration verification checks were made at the required frequency resulting in five verification checks. All calibration checks met the acceptance criteria. A reporting limit verification check was made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit. The check results were within the acceptance criteria range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All method, initial calibration, and continuing calibration blank results associated with the samples were below the practical quantitation limits with the exception of two sulfate calibration blanks. The samples associated with these blanks had sulfate concentrations greater than 10 times the blank concentration. In cases where a non-radiochemical blank exceeds the MDL, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than 5 times the blank concentration.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples, ICSA and ICSAB, were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate samples are analyzed as a measure of method performance in the sample matrix. Matrix spike performance is not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The spike analyses resulted in acceptable recoveries for all analytes evaluated.

Laboratory Replicate Analysis

The laboratory replicate sample results demonstrate acceptable laboratory precision. The relative percent difference values for the matrix spike duplicate samples were less than 20 percent, demonstrating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. The control sample results were acceptable for all analytes.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data were evaluated when the concentration of the undiluted sample was greater 100 times the PQL for 6020A analytes. The serial dilution results met the acceptance criteria for all analytes evaluated.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The required detection limits were met for all analytes.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD file arrived on July 18, 2011. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 11063891 Lab Code: PAR Validator: Steve Donivan Validation Date: 8/11/2011

Project: Green River Analysis Type: ☑ Metals ☑ General Chem ☐ Rad ☐ Organics

# of Samples: 17 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

☑ Holding Times	All analyses were completed within the applicable holding times.
☑ Detection Limits	The reported detection limits are equal to or below contract requirements.
☐ Field/Trip Blanks	
☑ Field Duplicates	There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 11063891 Lab Code: PAR Date Due: 7/21/2011

Matrix: Water Site Code: GRN Date Completed: 7/21/2011

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Arsenic	ICP/MS	07/07/2011	0.0000	1.0000	OK	OK	OK	OK	OK	99.0	105.0	108.0	2.0	109.0		111.0
Selenium	ICP/MS	07/07/2011	0.0000	1.0000	OK	OK	OK	OK	OK	102.0	113.0	118.0	2.0	107.0	4.0	116.0
Uranium	ICP/MS	07/07/2011	0.0000	1.0000	OK	OK	OK	OK	OK	99.0		113.0	5.0	104.0	2.0	90.0

SAMPLE MANAGEMENT SYSTEM

Wet Chemistry Data Validation Worksheet

RIN: 11063891 **Lab Code:** PAR **Date Due:** 7/21/2011

Matrix: Water **Site Code:** GRN **Date Completed:** 7/21/2011

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
AMMONIA AS N	06/24/2011	0.000	1.0000	OK	OK	OK	OK	OK	102.00	91.0	88.0	4.00	
Nitrate+Nitrite as N	06/27/2011	0.000	1.0000	OK	OK	OK	OK	OK	101.00	105.0	105.0	0	

Sampling Quality Control Assessment

The following information summarizes and assesses quality control for this sampling event.

Sampling Protocol

Wells were sampled with a peristaltic pump and dedicated tubing or a dedicated bladder pump. Surface water locations were sampled using a peristaltic pump and disposable tubing.

Sample results for monitoring wells that met the Category I, II, or III low-flow sampling criteria were qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method.

Wells 0182, 0184, 0189, and 0194 were classified as Category II or Category III because of water level drawdown. The sample results for these wells were qualified with a "Q" flag, indicating the data are qualitative because of the sampling technique.

Equipment Blank Assessment

An equipment blank was not collected because dedicated equipment was used to sample all locations.

Field Duplicate Assessment

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. Duplicate samples were collected from well 0184. The duplicate results met the recommended laboratory duplicate criteria of less than 20 percent relative difference for results that are greater than 5 times the practical quantitation limit, indicating acceptable overall precision.

SAMPLE MANAGEMENT SYSTEM

Validation Report: Field Duplicates

RIN: 11063891 Lab Code: PAR Project: Green River Validation Date: 8/11/2011

Duplicate: 2169 Sample: 0184

Analyte	Sample Result	Sample Flag	Sample Error	Sample Dilution	Duplicate Result	Duplicate Flag	Duplicate Error	Duplicate Dilution	RPD	RER	Units
AMMONIA AS N	0.1	U		1	0.1	U		1			MG/L
Arsenic	1.8			1	1.7			1	5.71		UG/L
Nitrate+Nitrite as N	0.078			1	0.078			1	0		MG/L
Selenium	0.35			1	0.31			1	12.12		UG/L
Uranium	2.9			1	2.8			1	3.51		UG/L

Certification

All laboratory analytical quality control criteria were met except as qualified in this report. The data qualifiers listed on the SEEPro database reports are defined on the last page of each report. All data in this package are considered validated and available for use.

Laboratory Coordinator: Steve Donivan — Steve Donivan — 9-13-2011 — Date

Data Validation Lead: Steve Donivan — Steve Donivan — 9-13-2011 — Date

This page intentionally left blank

Attachment 1
Assessment of Anomalous Data

This page intentionally left blank

Potential Outliers Report

This page intentionally left blank

Potential Outliers Report

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

There were no potential outliers identified, and the data for this event are acceptable as qualified.

Data Validation Outliers Report - No Field Parameters
Comparison: All Historical Data
Laboratory: ALS Laboratory Group
RIN: 11063891
Report Date: 8/16/2011

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current Result	Current Qualifiers Lab	Current Qualifiers Data	Historical Maximum Result	Historical Maximum Qualifiers Lab	Historical Maximum Qualifiers Data	Historical Minimum Result	Historical Minimum Qualifiers Lab	Historical Minimum Qualifiers Data	Number of Data Points N	Number of Data Points N Below Detect	Statistical Outlier
GRN01	0176	N001	06/20/2011	Selenium	0.86			0.85		F	0.101		F	29	0	No
GRN01	0189	N001	06/21/2011	Ammonia Total as N	43			39		FQ	0.56		FQJ	7	0	No
GRN01	0189	N001	06/21/2011	Nitrate + Nitrite as Nitrogen	39			810		FQ	40		FQ	7	0	No
GRN01	0192	N001	06/21/2011	Nitrate + Nitrite as Nitrogen	79			190		F	100		F	6	0	No
GRN01	0192	N001	06/21/2011	Selenium	0.11			0.097		F	0.042		F	6	0	No
GRN01	0588	N001	06/21/2011	Selenium	0.000081	B		0.096			0.0001	U	F	27	21	No

STATISTICAL TESTS:
The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test
Outliers are identified using Dixon's Test when there are 25 or fewer data points.
Outliers are identified using Rosner's Test when there are 26 or more data points.
See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

Attachment 2
Data Presentation

This page intentionally left blank

Groundwater Quality Data

This page intentionally left blank

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0171 WELL POC Monitoring Well (Down Gradient)

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	N001	76	-	86	415			#		
Ammonia Total as N	mg/L	06/20/2011	N001	76	-	86	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	N001	76	-	86	0.0011			#	0.000074	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	N001	76	-	86	44			#	0.5	
Oxidation Reduction Potential	mV	06/20/2011	N001	76	-	86	55			#		
pH	s.u.	06/20/2011	N001	76	-	86	6.93			#		
Selenium	mg/L	06/20/2011	N001	76	-	86	0.14			#	0.00016	
Specific Conductance	umhos /cm	06/20/2011	N001	76	-	86	6899			#		
Temperature	C	06/20/2011	N001	76	-	86	16.61			#		
Turbidity	NTU	06/20/2011	N001	76	-	86	2.21			#		
Uranium	mg/L	06/20/2011	N001	76	-	86	0.1			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0173 WELL POC Monitoring Well (Down Gradient)

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	N001	92 - 102	550			#		
Ammonia Total as N	mg/L	06/20/2011	N001	92 - 102	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	N001	92 - 102	0.0016			#	0.000074	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	N001	92 - 102	230			#	2	
Oxidation Reduction Potential	mV	06/20/2011	N001	92 - 102	-103			#		
pH	s.u.	06/20/2011	N001	92 - 102	7.01			#		
Selenium	mg/L	06/20/2011	N001	92 - 102	0.088			#	0.00016	
Specific Conductance	umhos /cm	06/20/2011	N001	92 - 102	13850			#		
Temperature	C	06/20/2011	N001	92 - 102	17.05			#		
Turbidity	NTU	06/20/2011	N001	92 - 102	0.76			#		
Uranium	mg/L	06/20/2011	N001	92 - 102	0.019			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0176 WELL POC Monitoring Well (Cross Gradient)

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	N001	72	-	82	485			#		
Ammonia Total as N	mg/L	06/20/2011	N001	72	-	82	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	N001	72	-	82	0.00029			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	N001	72	-	82	68			#	0.5	
Oxidation Reduction Potential	mV	06/20/2011	N001	72	-	82	-100			#		
pH	s.u.	06/20/2011	N001	72	-	82	6.77			#		
Selenium	mg/L	06/20/2011	N001	72	-	82	0.86			#	0.00016	
Specific Conductance	umhos /cm	06/20/2011	N001	72	-	82	7449			#		
Temperature	C	06/20/2011	N001	72	-	82	17.08			#		
Turbidity	NTU	06/20/2011	N001	72	-	82	0.63			#		
Uranium	mg/L	06/20/2011	N001	72	-	82	0.0025			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0179 WELL POC Monitoring Well (Up Gradient)

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	N001	78	-	88	696			#		
Ammonia Total as N	mg/L	06/20/2011	N001	78	-	88	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	N001	78	-	88	0.00074			#	0.000074	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	N001	78	-	88	19			#	0.5	
Oxidation Reduction Potential	mV	06/20/2011	N001	78	-	88	49			#		
pH	s.u.	06/20/2011	N001	78	-	88	6.7			#		
Selenium	mg/L	06/20/2011	N001	78	-	88	0.3			#	0.00016	
Specific Conductance	umhos /cm	06/20/2011	N001	78	-	88	6921			#		
Temperature	C	06/20/2011	N001	78	-	88	19.67			#		
Turbidity	NTU	06/20/2011	N001	78	-	88	1.47			#		
Uranium	mg/L	06/20/2011	N001	78	-	88	0.17			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0181 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	N001	77	-	92	420			#		
Ammonia Total as N	mg/L	06/20/2011	N001	77	-	92	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	N001	77	-	92	0.0038			#	0.000074	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	N001	77	-	92	80			#	0.5	
Oxidation Reduction Potential	mV	06/20/2011	N001	77	-	92	21			#		
pH	s.u.	06/20/2011	N001	77	-	92	7.21			#		
Selenium	mg/L	06/20/2011	N001	77	-	92	0.011			#	0.00016	
Specific Conductance	umhos /cm	06/20/2011	N001	77	-	92	10950			#		
Temperature	C	06/20/2011	N001	77	-	92	17.29			#		
Turbidity	NTU	06/20/2011	N001	77	-	92	0.56			#		
Uranium	mg/L	06/20/2011	N001	77	-	92	0.013			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0182 WELL

Parameter	Units	Sample Date	ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/21/2011	N001	140 - 150	920			#		
Ammonia Total as N	mg/L	06/21/2011	N001	140 - 150	0.1	U		#	0.1	
Arsenic	mg/L	06/21/2011	N001	140 - 150	0.0035			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/21/2011	N001	140 - 150	0.022			#	0.01	
Oxidation Reduction Potential	mV	06/21/2011	N001	140 - 150	57			#		
pH	s.u.	06/21/2011	N001	140 - 150	8.31			#		
Selenium	mg/L	06/21/2011	N001	140 - 150	0.000075	B		#	0.000032	
Specific Conductance	umhos /cm	06/21/2011	N001	140 - 150	2852			#		
Temperature	C	06/21/2011	N001	140 - 150	17.13			#		
Turbidity	NTU	06/21/2011	N001	140 - 150	4.07			#		
Uranium	mg/L	06/21/2011	N001	140 - 150	0.001			#	0.0000029	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0184 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	0001	169 - 184	775			#		
Ammonia Total as N	mg/L	06/20/2011	0001	169 - 184	0.1	U		#	0.1	
Ammonia Total as N	mg/L	06/20/2011	0002	169 - 184	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	0001	169 - 184	0.0018			#	0.000015	
Arsenic	mg/L	06/20/2011	0002	169 - 184	0.0017			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	0001	169 - 184	0.078			#	0.01	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	0002	169 - 184	0.078			#	0.01	
Oxidation Reduction Potential	mV	06/20/2011	N001	169 - 184	41			#		
pH	s.u.	06/20/2011	N001	169 - 184	7.96			#		
Selenium	mg/L	06/20/2011	0001	169 - 184	0.00035			#	0.000032	
Selenium	mg/L	06/20/2011	0002	169 - 184	0.00031			#	0.000032	
Specific Conductance	umhos /cm	06/20/2011	N001	169 - 184	2565			#		
Temperature	C	06/20/2011	N001	169 - 184	20.74			#		
Turbidity	NTU	06/20/2011	N001	169 - 184	41.8			#		
Uranium	mg/L	06/20/2011	0001	169 - 184	0.0029			#	0.0000029	
Uranium	mg/L	06/20/2011	0002	169 - 184	0.0028			#	0.0000029	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0185 WELL

Parameter	Units	Sample Date	ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	N001	131 - 141	870			#		
Ammonia Total as N	mg/L	06/20/2011	N001	131 - 141	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	N001	131 - 141	0.00099			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	N001	131 - 141	0.12			#	0.01	
Oxidation Reduction Potential	mV	06/20/2011	N001	131 - 141	-96			#		
pH	s.u.	06/20/2011	N001	131 - 141	8.45			#		
Selenium	mg/L	06/20/2011	N001	131 - 141	0.000061	B		#	0.000032	
Specific Conductance	umhos /cm	06/20/2011	N001	131 - 141	2438			#		
Temperature	C	06/20/2011	N001	131 - 141	19.33			#		
Turbidity	NTU	06/20/2011	N001	131 - 141	1.46			#		
Uranium	mg/L	06/20/2011	N001	131 - 141	0.00067			#	0.0000029	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0188 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/21/2011	N001	7.5	-	12.5	360			#		
Ammonia Total as N	mg/L	06/21/2011	N001	7.5	-	12.5	8.4			#	0.2	
Arsenic	mg/L	06/21/2011	N001	7.5	-	12.5	0.00027			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/21/2011	N001	7.5	-	12.5	9.5			#	0.1	
Oxidation Reduction Potential	mV	06/21/2011	N001	7.5	-	12.5	-160			#		
pH	s.u.	06/21/2011	N001	7.5	-	12.5	7.06			#		
Selenium	mg/L	06/21/2011	N001	7.5	-	12.5	0.034			#	0.00016	
Specific Conductance	umhos /cm	06/21/2011	N001	7.5	-	12.5	10580			#		
Temperature	C	06/21/2011	N001	7.5	-	12.5	16.31			#		
Turbidity	NTU	06/21/2011	N001	7.5	-	12.5	1.43			#		
Uranium	mg/L	06/21/2011	N001	7.5	-	12.5	0.074			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0189 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/21/2011	N001	14	-	19	450			#		
Ammonia Total as N	mg/L	06/21/2011	N001	14	-	19	43			#	1	
Arsenic	mg/L	06/21/2011	N001	14	-	19	0.00064			#	0.000074	
Nitrate + Nitrite as Nitrogen	mg/L	06/21/2011	N001	14	-	19	39			#	0.5	
Oxidation Reduction Potential	mV	06/21/2011	N001	14	-	19	-130			#		
pH	s.u.	06/21/2011	N001	14	-	19	6.92			#		
Selenium	mg/L	06/21/2011	N001	14	-	19	0.067			#	0.00016	
Specific Conductance	umhos /cm	06/21/2011	N001	14	-	19	11560			#		
Temperature	C	06/21/2011	N001	14	-	19	17.3			#		
Turbidity	NTU	06/21/2011	N001	14	-	19	5.82			#		
Uranium	mg/L	06/21/2011	N001	14	-	19	0.34			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0192 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/21/2011	N001	5.02	-	9.96	410			#		
Ammonia Total as N	mg/L	06/21/2011	N001	5.02	-	9.96	3.3			#	0.1	
Arsenic	mg/L	06/21/2011	N001	5.02	-	9.96	0.00028			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/21/2011	N001	5.02	-	9.96	79			#	0.5	
Oxidation Reduction Potential	mV	06/21/2011	N001	5.02	-	9.96	-124			#		
pH	s.u.	06/21/2011	N001	5.02	-	9.96	6.99			#		
Selenium	mg/L	06/21/2011	N001	5.02	-	9.96	0.11			#	0.00016	
Specific Conductance	umhos /cm	06/21/2011	N001	5.02	-	9.96	10320			#		
Temperature	C	06/21/2011	N001	5.02	-	9.96	17.45			#		
Turbidity	NTU	06/21/2011	N001	5.02	-	9.96	8.59			#		
Uranium	mg/L	06/21/2011	N001	5.02	-	9.96	0.48			#	0.000015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0194 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/21/2011	0001	12.5	-	17.5	1424			#		
Ammonia Total as N	mg/L	06/21/2011	0001	12.5	-	17.5	0.1	U		#	0.1	
Arsenic	mg/L	06/21/2011	0001	12.5	-	17.5	0.0025			#	0.000074	
Nitrate + Nitrite as Nitrogen	mg/L	06/21/2011	0001	12.5	-	17.5	370			#	2	
Oxidation Reduction Potential	mV	06/21/2011	N001	12.5	-	17.5	-72			#		
pH	s.u.	06/21/2011	N001	12.5	-	17.5	7.3			#		
Selenium	mg/L	06/21/2011	0001	12.5	-	17.5	0.024			#	0.0016	
Specific Conductance	umhos /cm	06/21/2011	N001	12.5	-	17.5	34480			#		
Temperature	C	06/21/2011	N001	12.5	-	17.5	17.78			#		
Turbidity	NTU	06/21/2011	N001	12.5	-	17.5	16			#		
Uranium	mg/L	06/21/2011	0001	12.5	-	17.5	4.1			#	0.00015	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0588 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/21/2011	N001	123	-	143	590			#		
Ammonia Total as N	mg/L	06/21/2011	N001	123	-	143	0.1	U		#	0.1	
Arsenic	mg/L	06/21/2011	N001	123	-	143	0.0084			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/21/2011	N001	123	-	143	0.043			#	0.01	
Oxidation Reduction Potential	mV	06/21/2011	N001	123	-	143	-230			#		
pH	s.u.	06/21/2011	N001	123	-	143	8.36			#		
Selenium	mg/L	06/21/2011	N001	123	-	143	0.000081	B		#	0.000032	
Specific Conductance	umhos /cm	06/21/2011	N001	123	-	143	2782			#		
Temperature	C	06/21/2011	N001	123	-	143	18.44			#		
Turbidity	NTU	06/21/2011	N001	123	-	143	3.72			#		
Uranium	mg/L	06/21/2011	N001	123	-	143	0.00014			#	0.0000029	

Groundwater Quality Data by Location (USEE100) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0813 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	N001	77.7	-	97.7	750			#		
Ammonia Total as N	mg/L	06/20/2011	N001	77.7	-	97.7	0.14			#	0.1	
Arsenic	mg/L	06/20/2011	N001	77.7	-	97.7	0.063			#	0.000074	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	N001	77.7	-	97.7	0.01	U		#	0.01	
Oxidation Reduction Potential	mV	06/20/2011	N001	77.7	-	97.7	-23			#		
pH	s.u.	06/20/2011	N001	77.7	-	97.7	6.74			#		
Selenium	mg/L	06/20/2011	N001	77.7	-	97.7	0.00064			#	0.000032	
Specific Conductance	umhos /cm	06/20/2011	N001	77.7	-	97.7	7075			#		
Temperature	C	06/20/2011	N001	77.7	-	97.7	19.68			#		
Turbidity	NTU	06/20/2011	N001	77.7	-	97.7	3.16			#		
Uranium	mg/L	06/20/2011	N001	77.7	-	97.7	0.018			#	0.000015	

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:
- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.

J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q	Qualitative result due to sampling technique.	R	Unusable result.
U	Parameter analyzed for but was not detected.	X	Location is undefined.		

QA QUALIFIER:

#	Validated according to quality assurance guidelines.

This page intentionally left blank

Surface Water Quality Data

This page intentionally left blank

Surface Water Quality Data by Location (USEE102) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0846 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	0001	220			#		
Ammonia Total as N	mg/L	06/20/2011	0001	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	0001	0.0013			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	0001	0.034			#	0.01	
Selenium	mg/L	06/20/2011	0001	0.00042			#	0.000032	
Uranium	mg/L	06/20/2011	0001	0.0013			#	0.0000029	
Oxidation Reduction Potential	mV	06/20/2011	N001	14.4			#		
pH	s.u.	06/20/2011	N001	7.95			#		
Specific Conductance	umhos/cm	06/20/2011	N001	407			#		
Temperature	C	06/20/2011	N001	20.45			#		
Turbidity	NTU	06/20/2011	N001	187			#		

Surface Water Quality Data by Location (USEE102) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011
Location: 0847 SURFACE LOCATION

Parameter	Units	Sample Date	Sample ID	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Alkalinity, Total (as $CaCO_3$)	mg/L	06/20/2011	0001	180			#		
Ammonia Total as N	mg/L	06/20/2011	0001	0.1	U		#	0.1	
Arsenic	mg/L	06/20/2011	0001	0.0018			#	0.000015	
Nitrate + Nitrite as Nitrogen	mg/L	06/20/2011	0001	0.12			#	0.01	
Selenium	mg/L	06/20/2011	0001	0.00089			#	0.000032	
Uranium	mg/L	06/20/2011	0001	0.0022			#	0.0000029	
Oxidation Reduction Potential	mV	06/20/2011	N001	21			#		
pH	s.u.	06/20/2011	N001	8.37			#		
Specific Conductance	umhos/cm	06/20/2011	N001	638			#		
Temperature	C	06/20/2011	N001	24.21			#		
Turbidity	NTU	06/20/2011	N001	474			#		

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:
- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.

U Analytical result below detection limit.
W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F Low flow sampling method used.
L Less than 3 bore volumes purged prior to sampling.
U Parameter analyzed for but was not detected.
G Possible grout contamination, pH > 9.
Q Qualitative result due to sampling technique.
X Location is undefined.
J Estimated value.
R Unusable result.

QA QUALIFIER:

Validated according to quality assurance guidelines.

This page intentionally left blank

Static Water Level Data

This page intentionally left blank

STATIC WATER LEVELS (USEE700) FOR SITE GRN01, Green River Disposal Site
REPORT DATE: 8/16/2011

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Measurement Time	Depth From Top of Casing (Ft)	Water Elevation (Ft)	Water Level Flag
0171	D	4140.1	06/20/2011	10:05:40	54.19	4085.91	
0173	D	4141.23	06/20/2011	11:00:06	55.3	4085.93	
0176	D	4143.4	06/20/2011	11:30:22	55.43	4087.97	
0179	C	4161.39	06/20/2011	13:45:06	74.7	4086.69	
0180	C	4159.11	06/21/2011	10:40:00	56.88	4102.23	
0181	D	4141.1	06/20/2011	10:30:11	54.82	4086.28	
0182	D	4101.52	06/21/2011	09:55:57	15.74	4085.78	
0183	C	4100.6	06/21/2011	11:00:00	12.75	4087.85	
0184	C	4192.98	06/20/2011	14:20:17	106.8	4086.18	
0185	U	4135.46	06/20/2011	13:15:12	50.09	4085.37	
0188	O	4075.11	06/21/2011	11:15:39	11.34	4063.77	
0189	O	4075.96	06/21/2011	11:30:16	18.81	4057.15	
0192	O	4065.83	06/21/2011	13:10:36	11.13	4054.7	
0194	D	4067.76	06/21/2011	12:45:23	16.12	4051.64	
0582	C	4067	06/21/2011	12:50:00			F
0588	U	4113.92	06/21/2011	10:30:44	28.72	4085.2	
0707	U	4083.03	06/21/2011	10:55:00	13.75	4069.28	
0813	D	4136.36	06/20/2011	14:55:50	50.32	4086.04	
0817	C	4085.31	06/21/2011	10:50:00			F

FLOW CODES: B BACKGROUND C CROSS GRADIENT D DOWN GRADIENT F OFF SITE
N UNKNOWN O ON SITE U UPGRADIENT

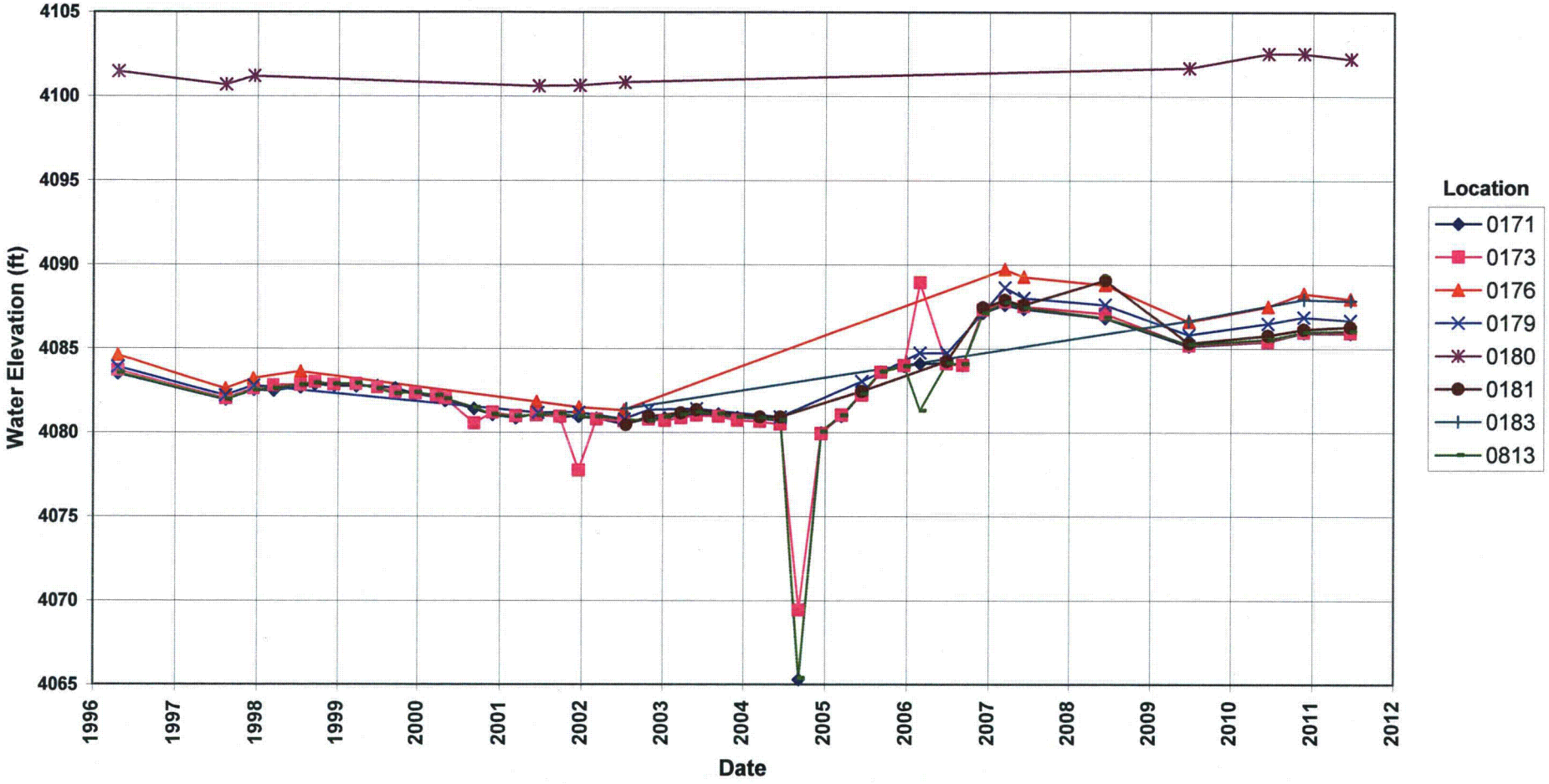
WATER LEVEL FLAGS: D Dry F FLOWING

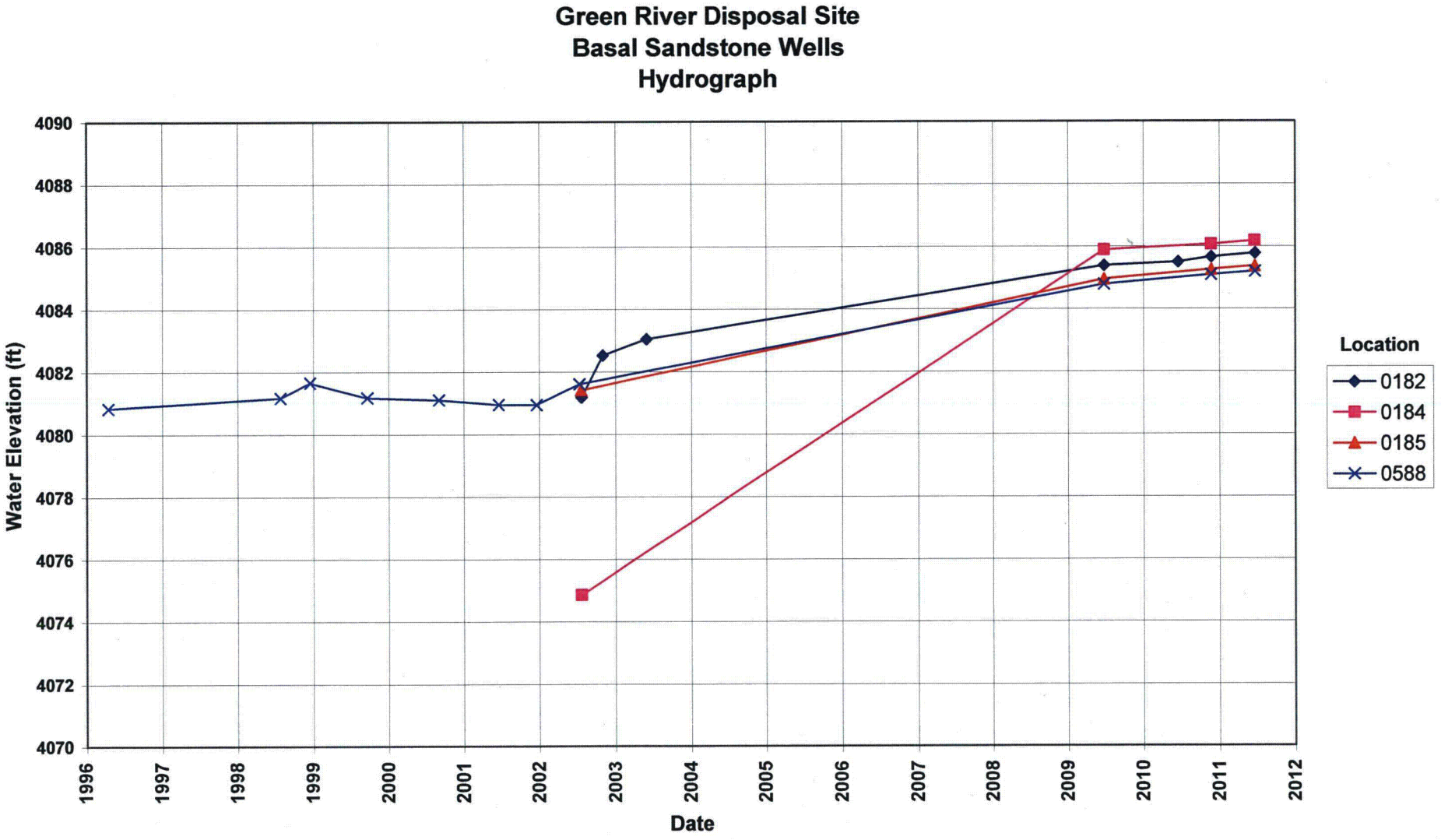
This page intentionally left blank

Hydrographs

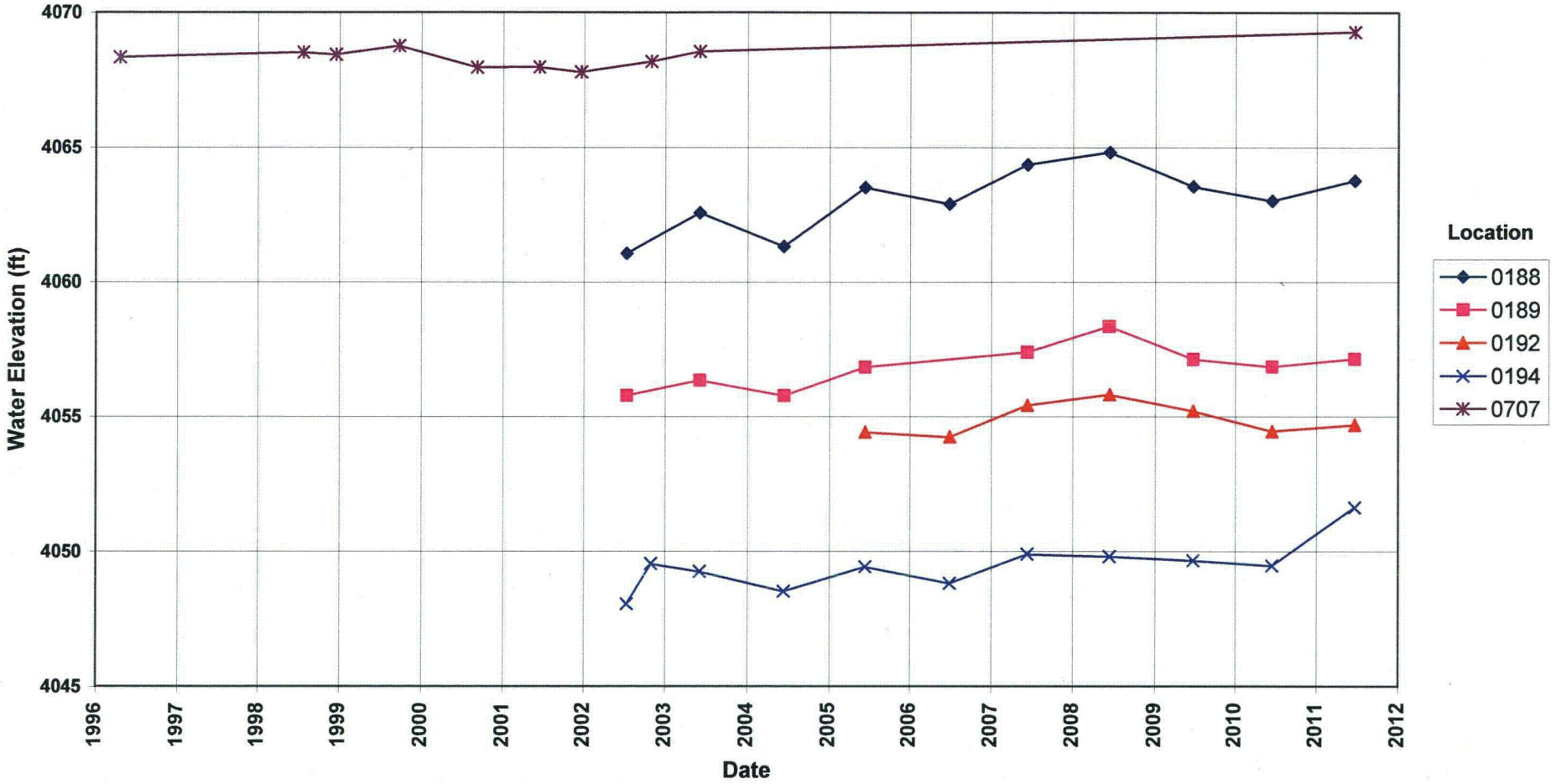
This page intentionally left blank

Green River Disposal Site
Middle Sandstone Unit Wells
Hydrograph




Green River Disposal Site
Basal Sandstone Wells
Hydrograph
Water Elevation (ft)
4090
4088
4086
4084
4082
4080
4078
4076
4074
4072
4070
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0182
0184
0185
0588

Green River Disposal Site
Alluvium Wells
Hydrograph



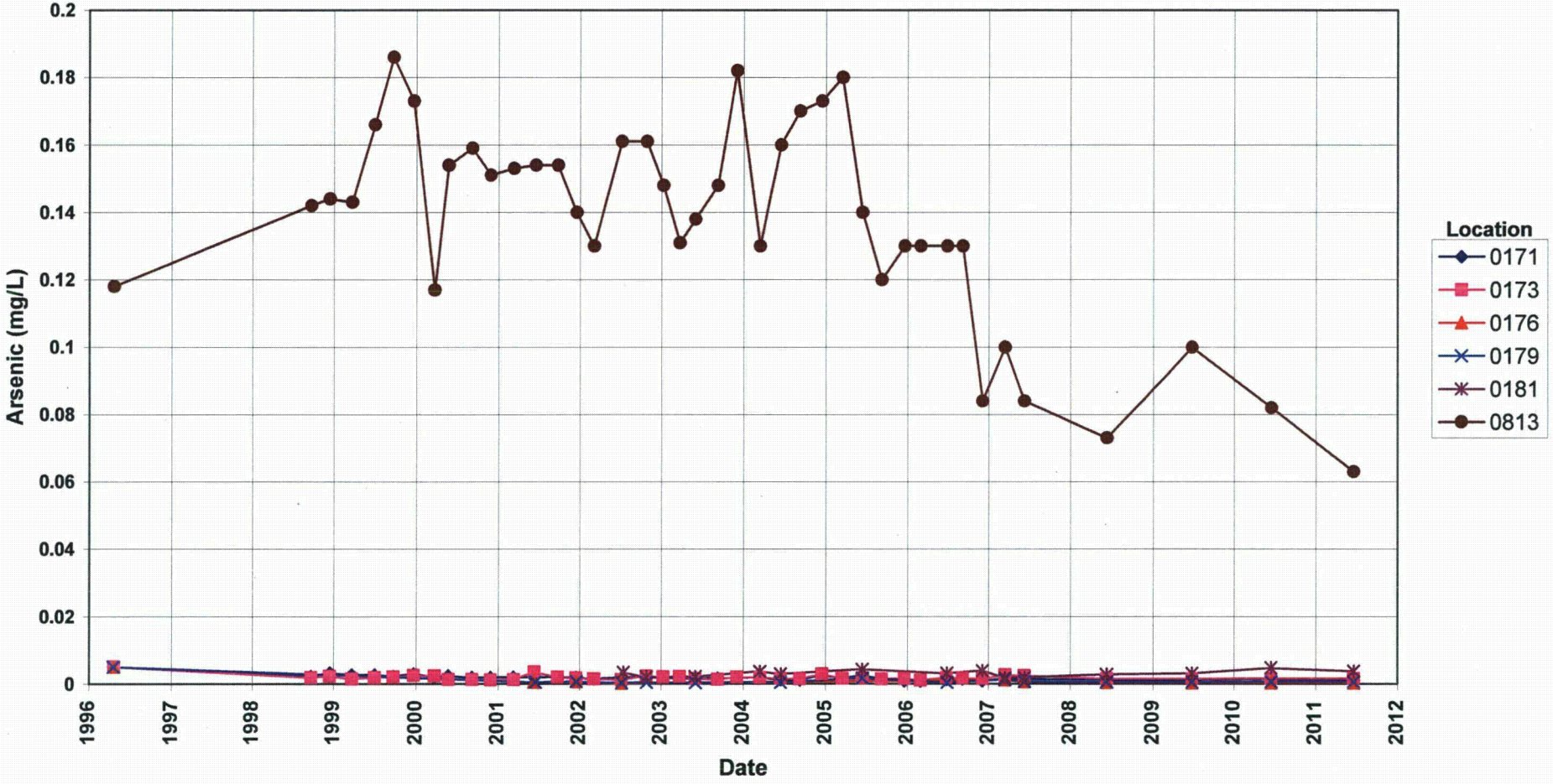
This page intentionally left blank

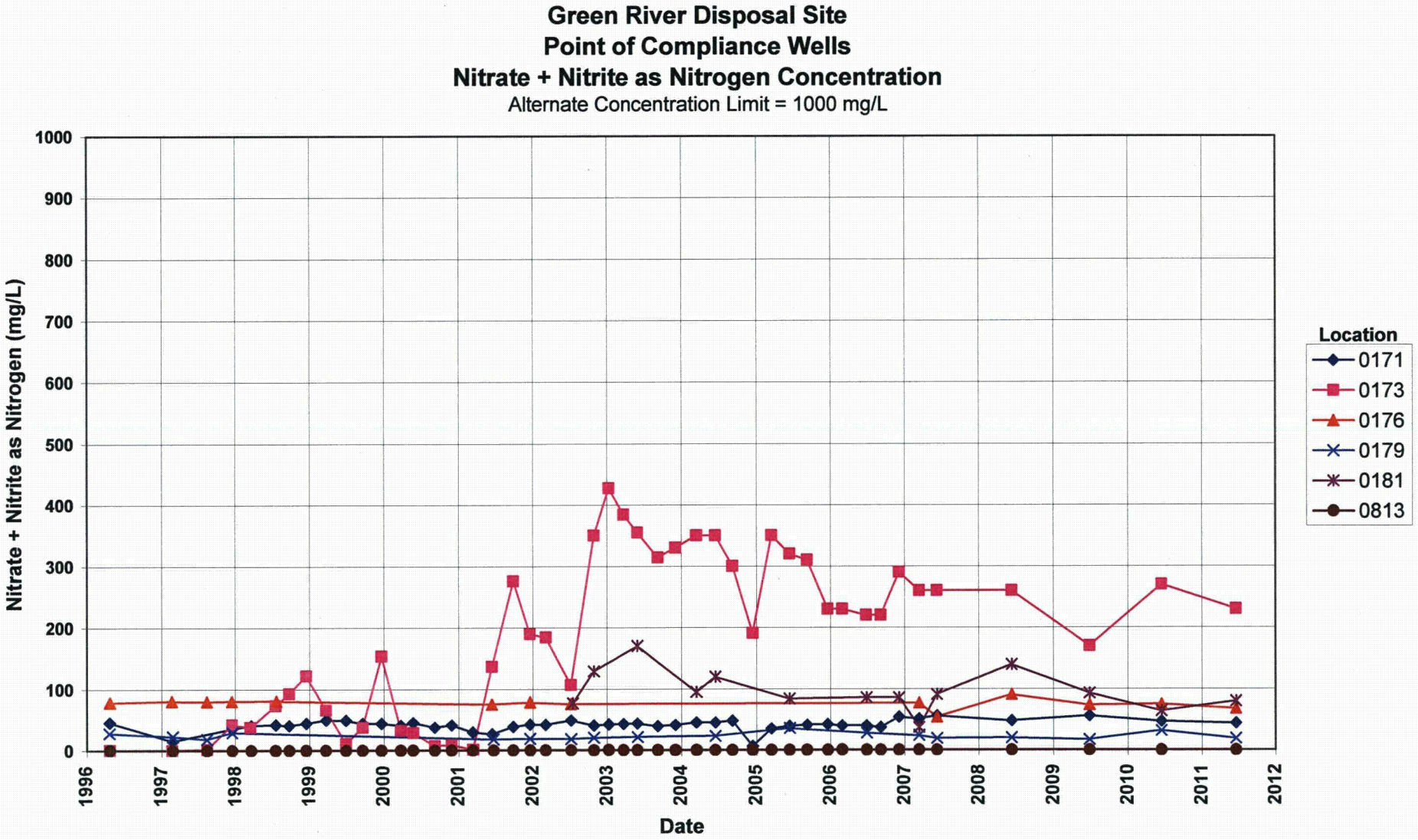
Time-Concentration Graphs

This page intentionally left blank

Green River Disposal Site
Point of Compliance Wells
Arsenic Concentration

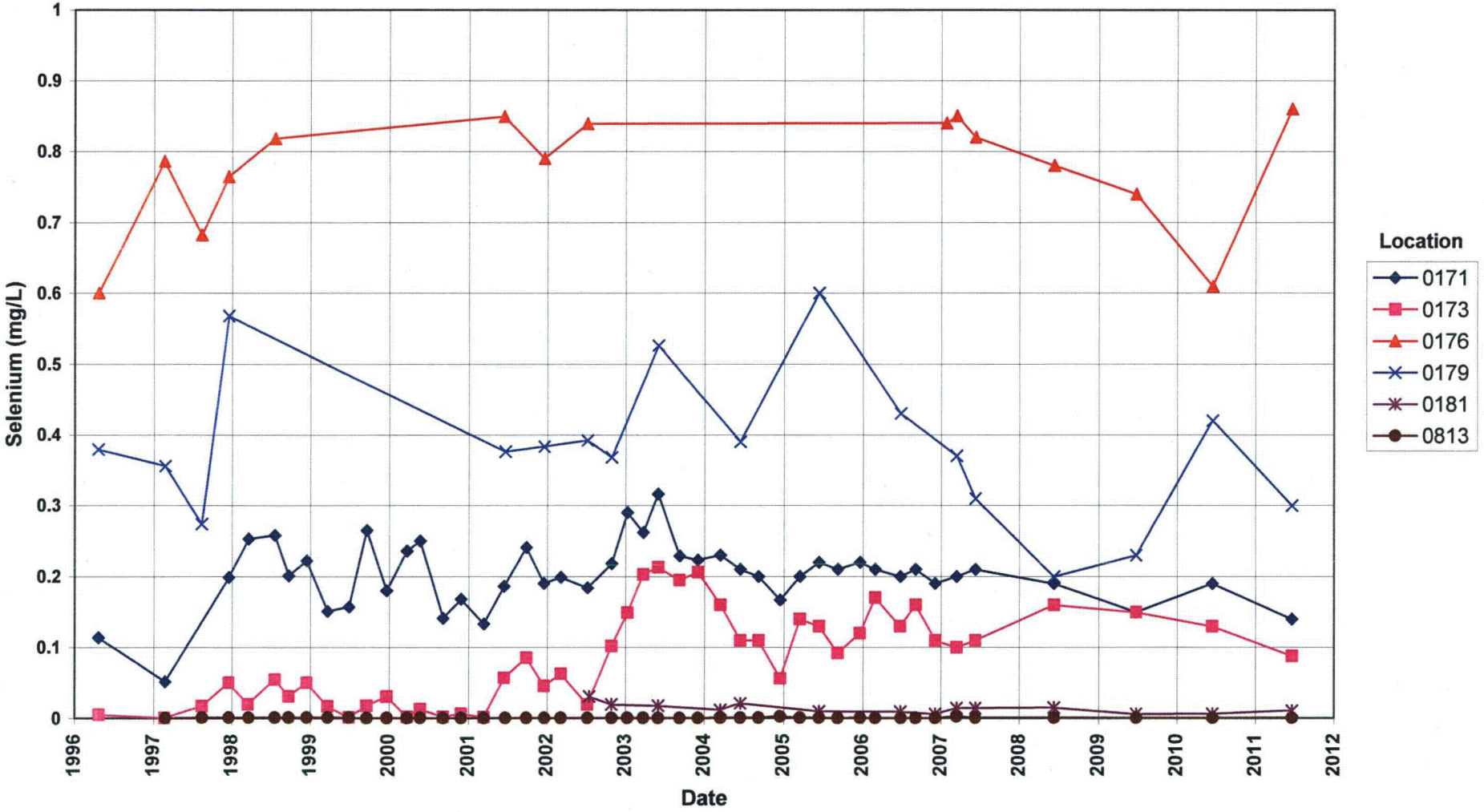
Alternate Concentration Limit = 5.0 mg/L



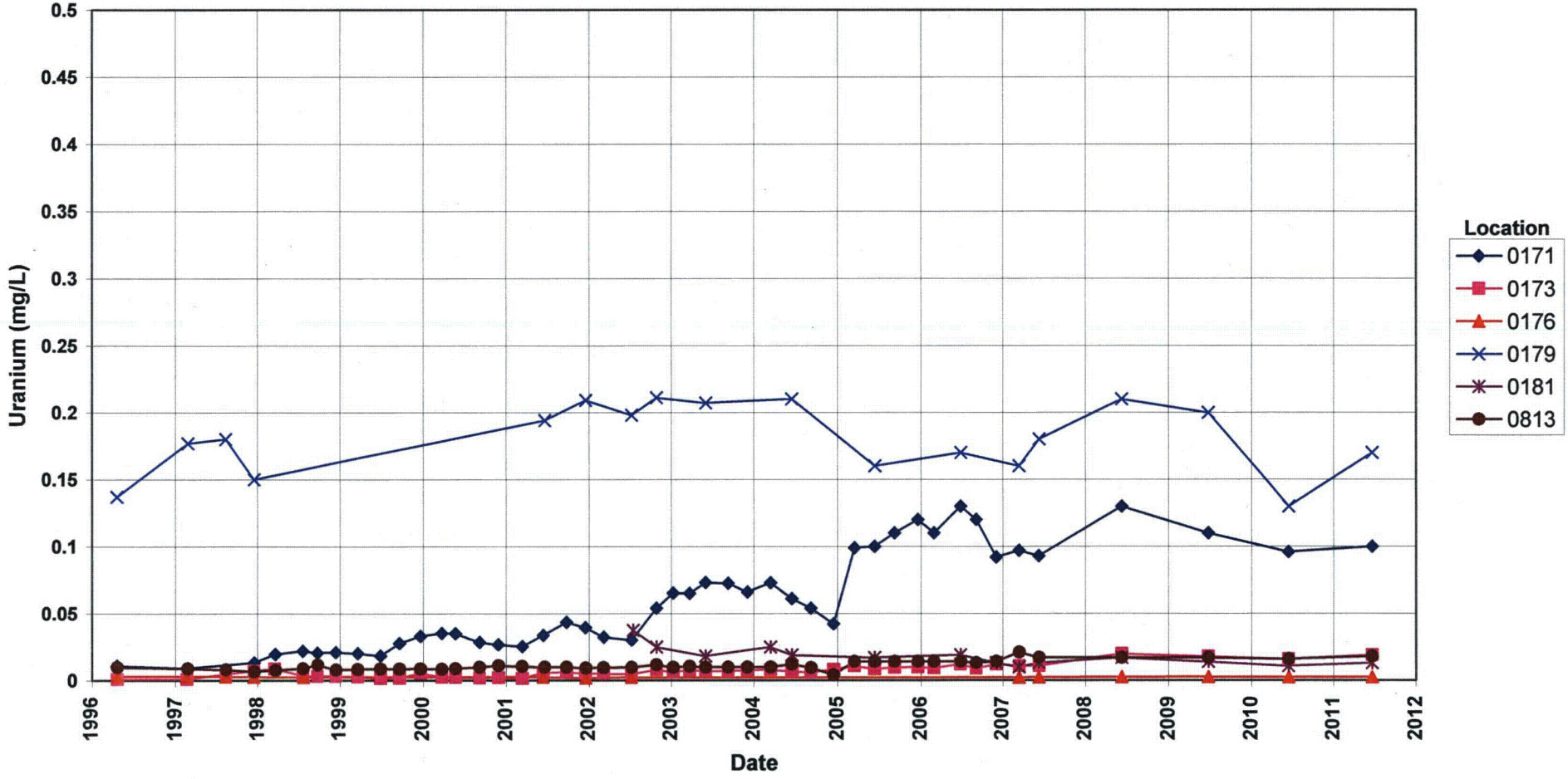

Green River Disposal Site
Point of Compliance Wells
Nitrate + Nitrite as Nitrogen Concentration
Alternate Concentration Limit = 1000 mg/L
Nitrate + Nitrite as Nitrogen (mg/L)
1000
900
800
700
600
500
400
300
200
100
0
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0171
0173
0176
0179
0181
0813

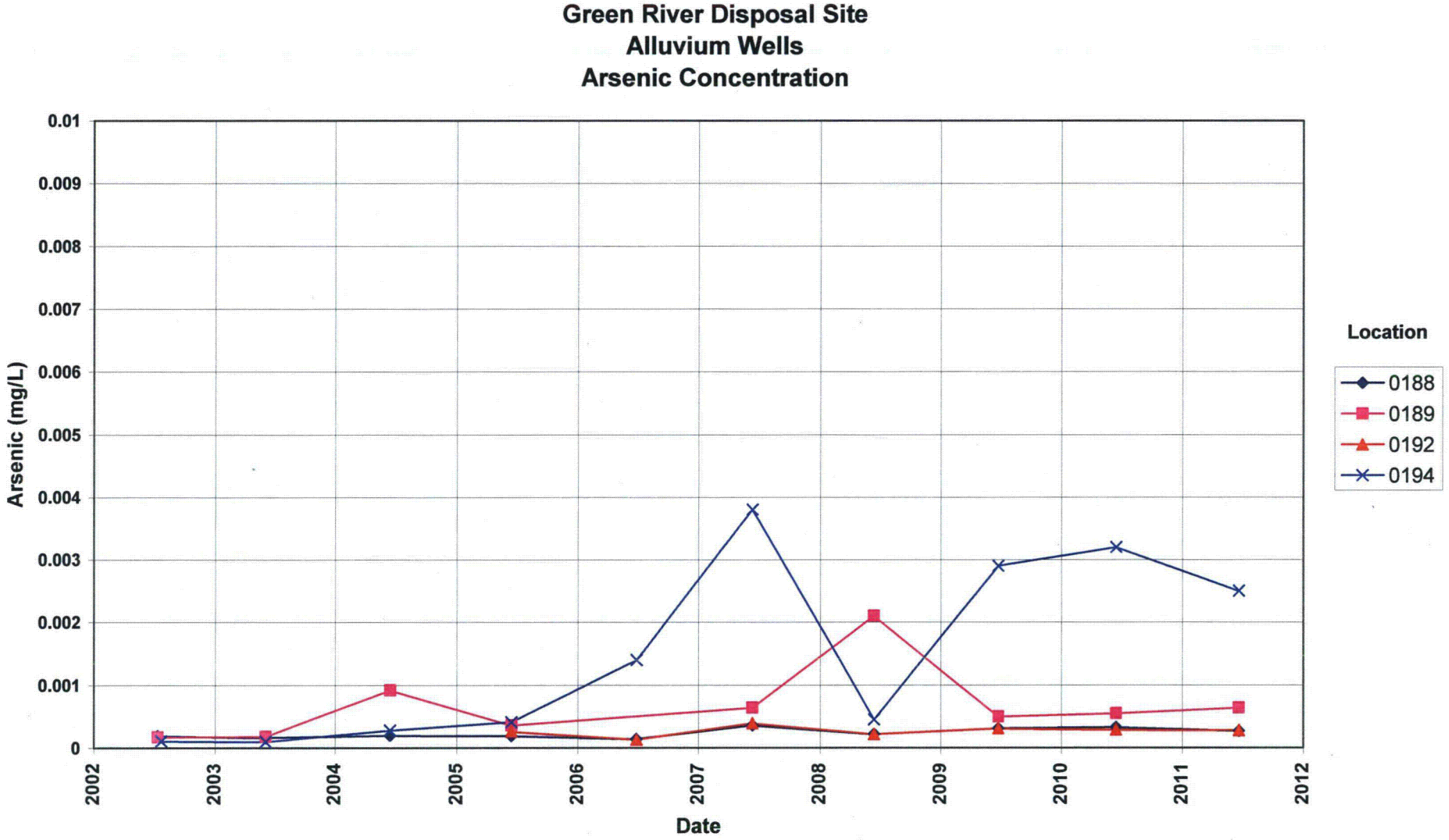
Green River Disposal Site
Point of Compliance Wells
Selenium Concentration

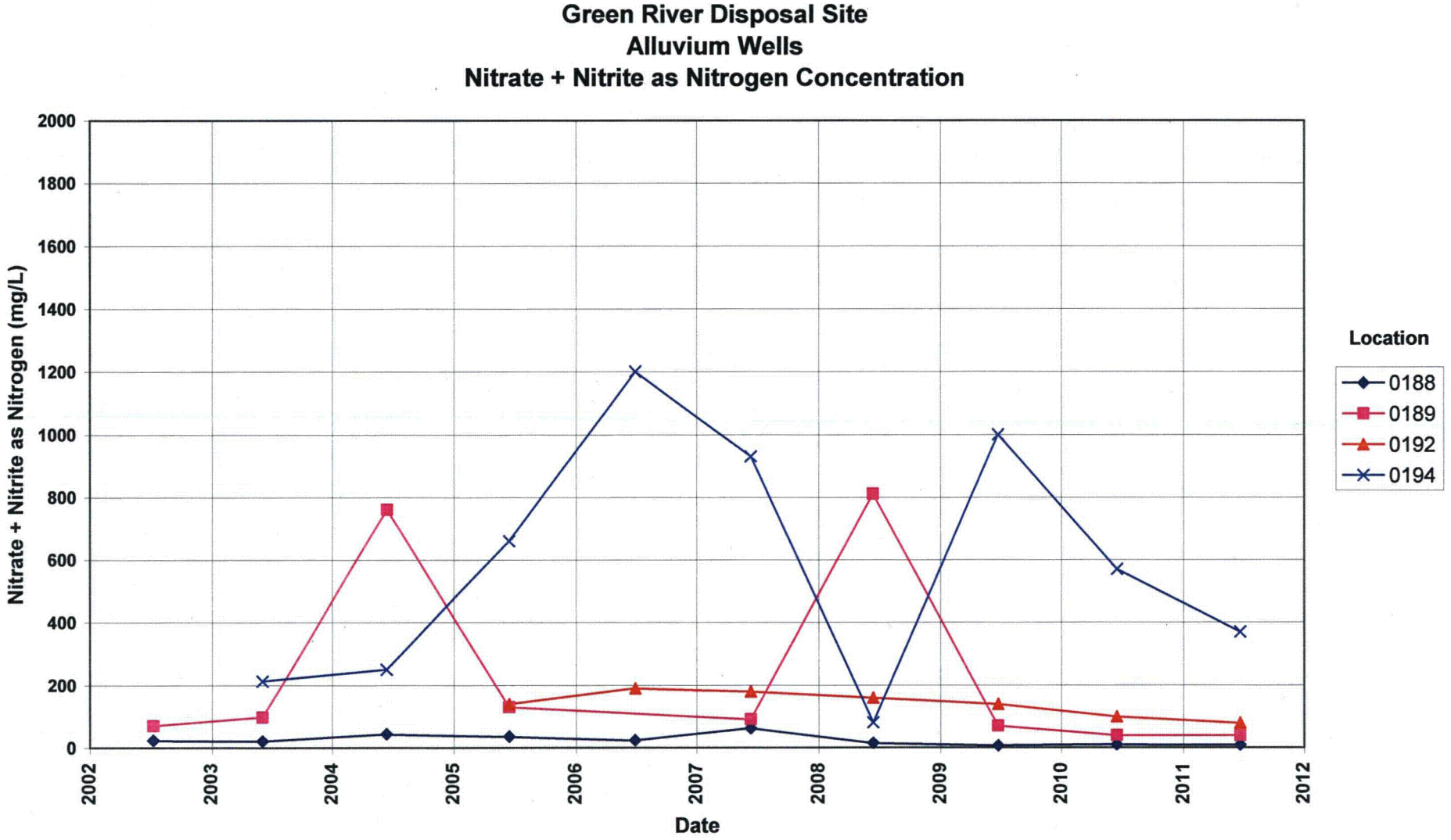
Alternate Concentration Limit = 5.0 mg/L

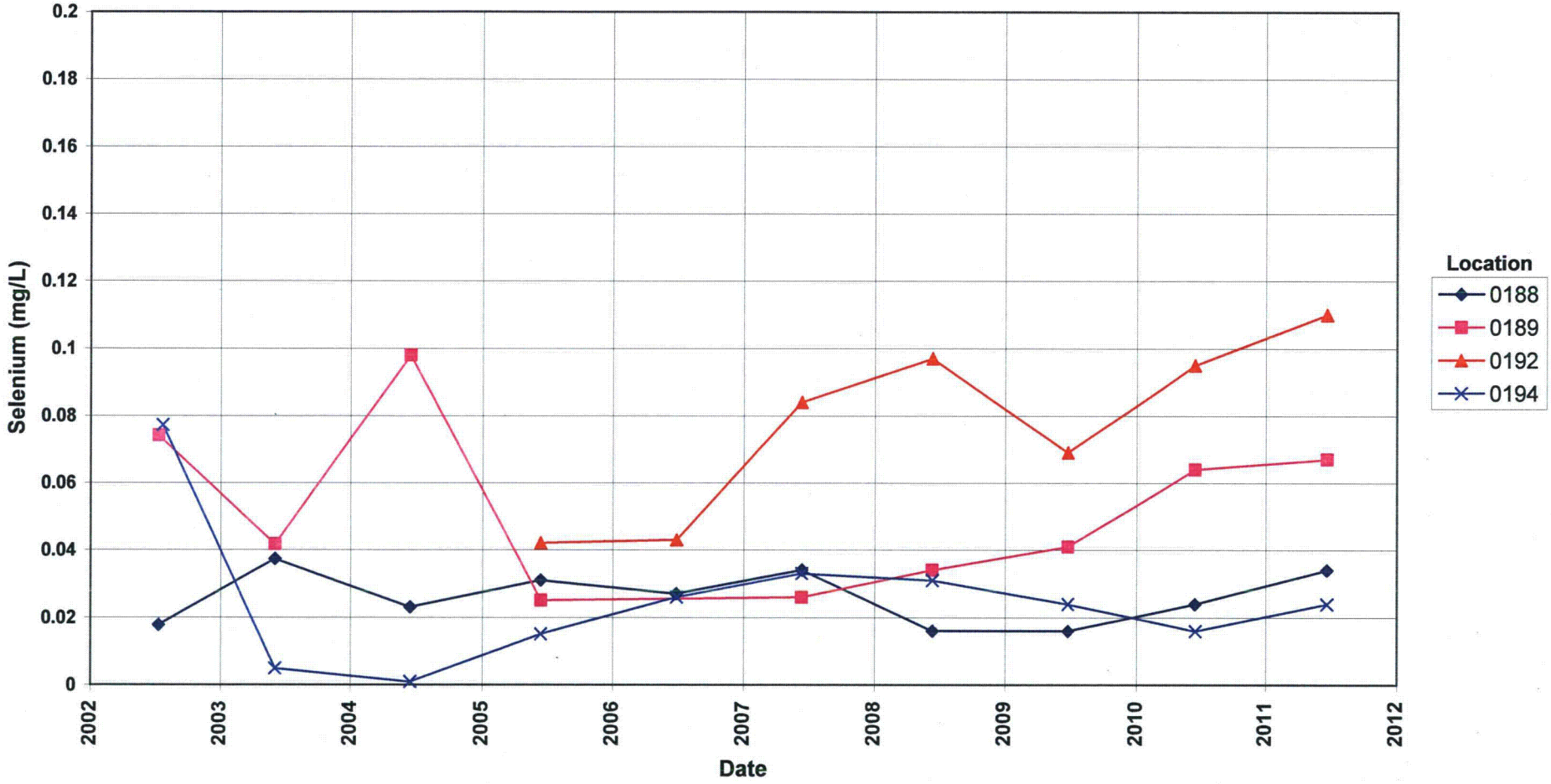


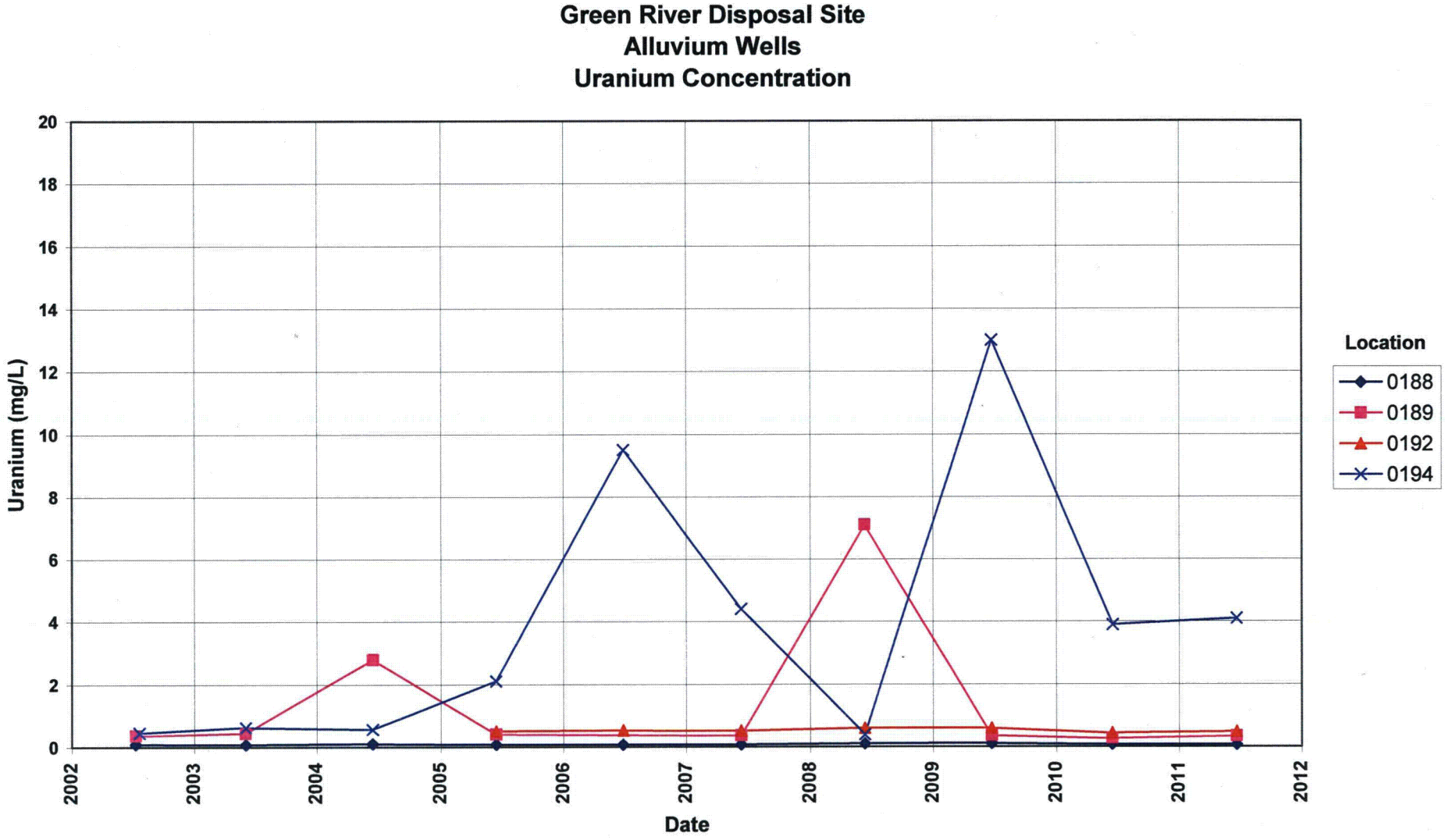
Green River Disposal Site
Point of Compliance Wells
Uranium Concentration
Alternate Concentration Limit = 4.4 mg/L



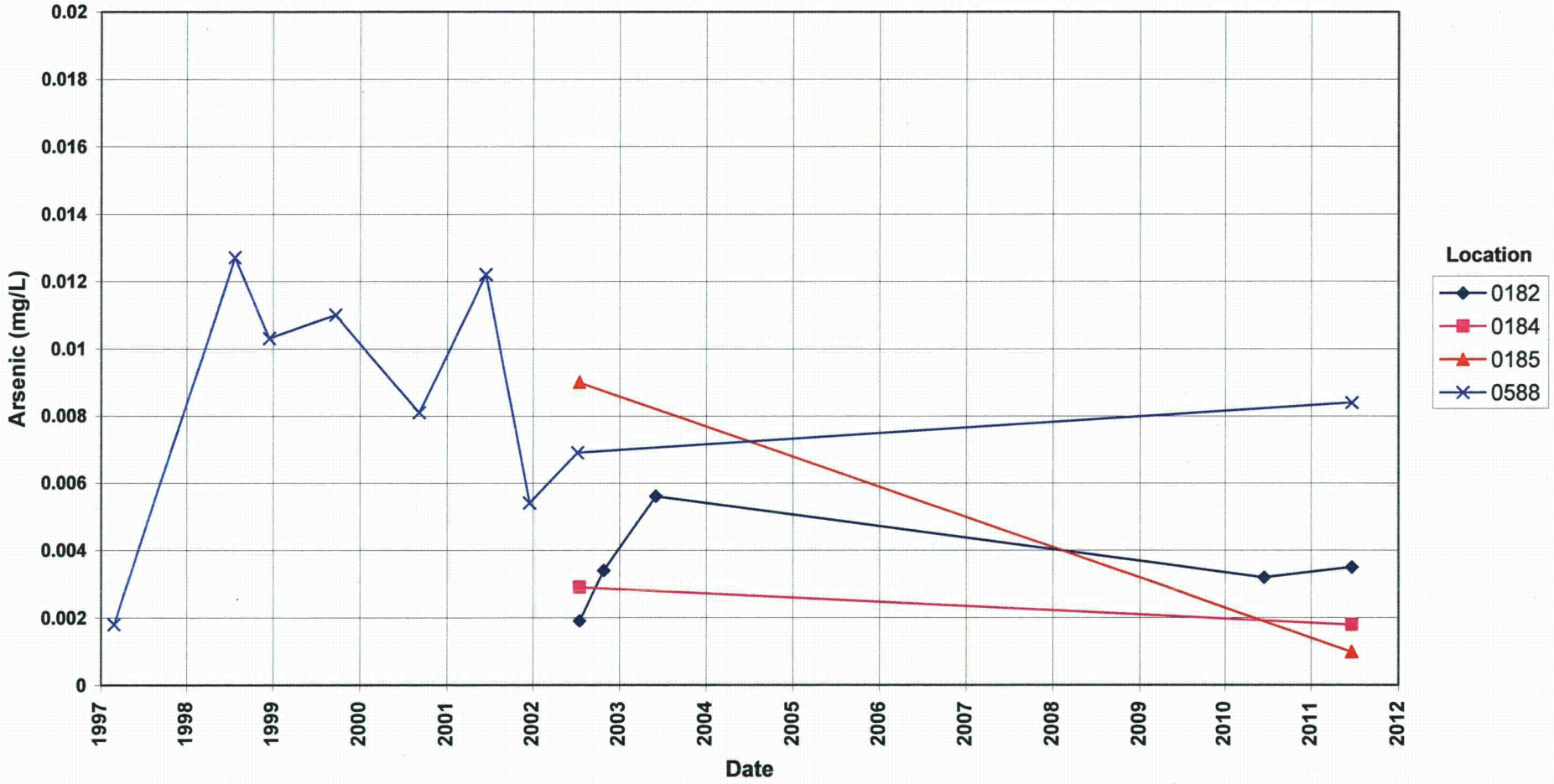

Green River Disposal Site
Alluvium Wells
Arsenic Concentration
Arsenic (mg/L)
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0188
0189
0192
0194

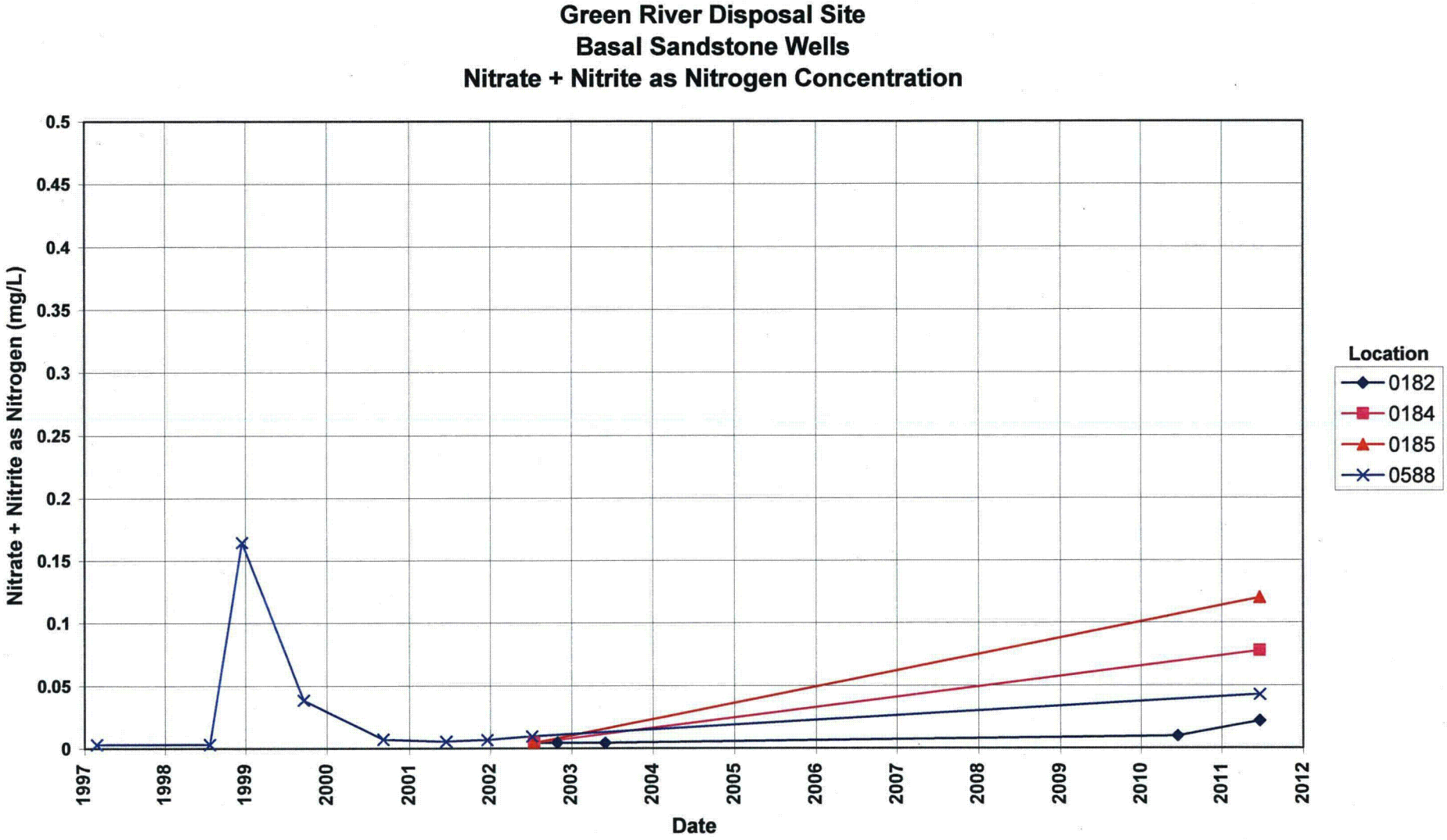

Green River Disposal Site
Alluvium Wells
Nitrate + Nitrite as Nitrogen Concentration
Nitrate + Nitrite as Nitrogen (mg/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0188
0189
0192
0194

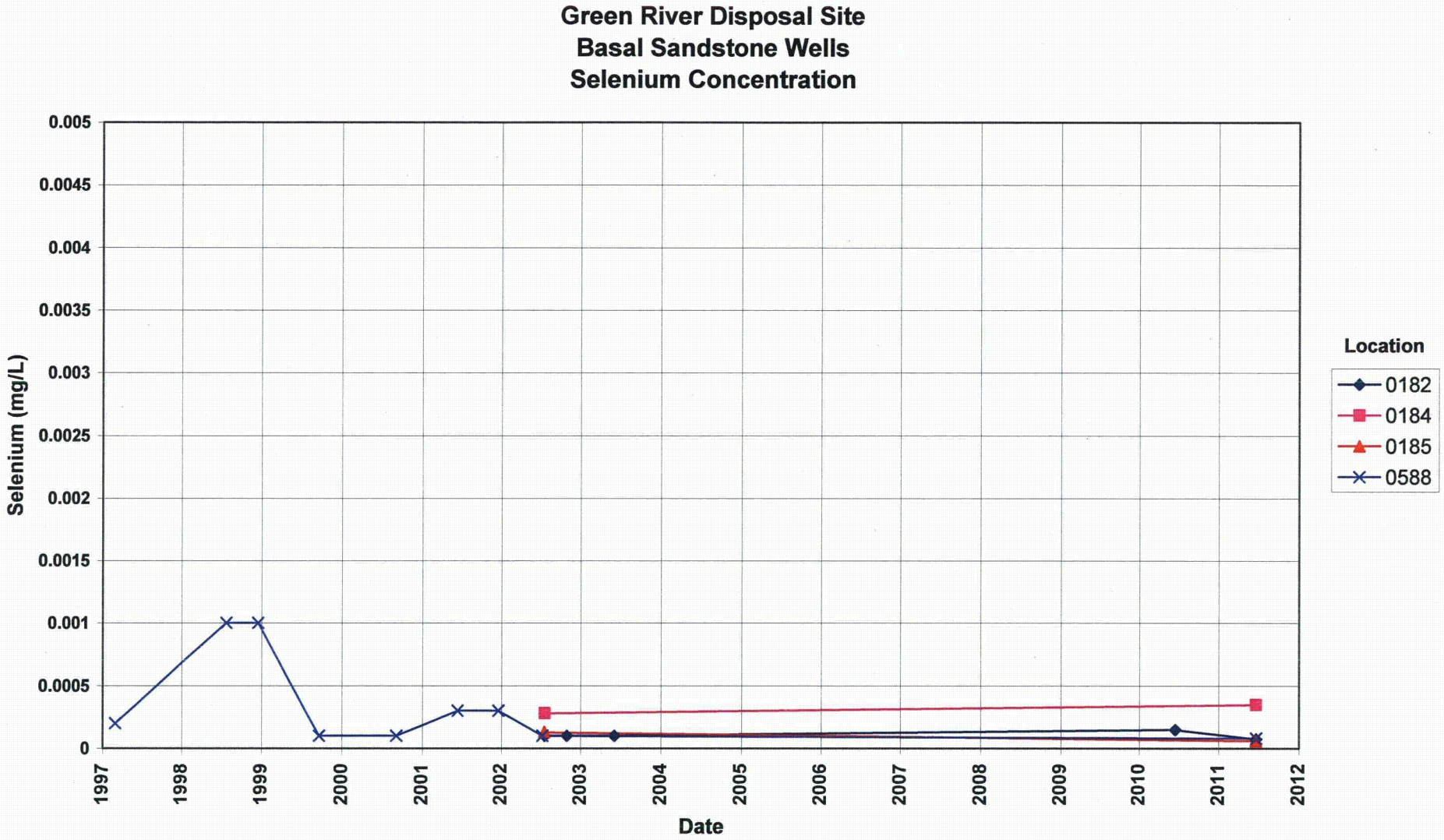

Green River Disposal Site
Alluvium Wells
Selenium Concentration
Selenium (mg/L)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0188
0189
0192
0194

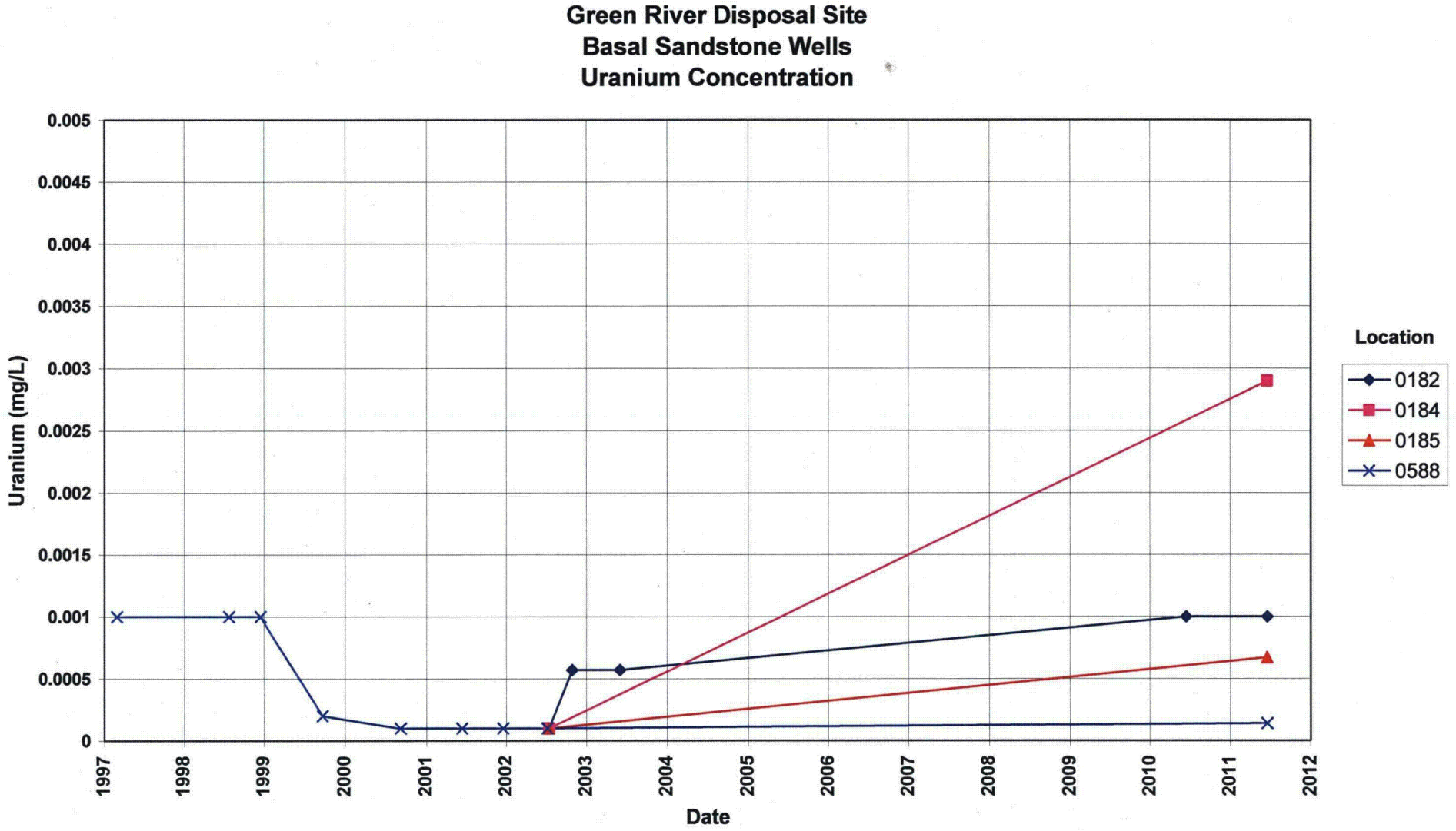

Green River Disposal Site
Alluvium Wells
Uranium Concentration
Uranium (mg/L)
20
18
16
14
12
10
8
6
4
2
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0188
0189
0192
0194

Green River Disposal Site
Basal Sandstone Wells
Arsenic Concentration




Green River Disposal Site
Basal Sandstone Wells
Nitrate + Nitrite as Nitrogen Concentration
Nitrate + Nitrite as Nitrogen (mg/L)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0182
0184
0185
0588


Green River Disposal Site
Basal Sandstone Wells
Selenium Concentration
Selenium (mg/L)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0182
0184
0185
0588


Green River Disposal Site
Basal Sandstone Wells
Uranium Concentration
Uranium (mg/L)
0.005
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Date
Location
0182
0184
0185
0588

Attachment 3
Sampling and Analysis Work Order

This page intentionally left blank

Stoller

established 1959

Task Order LM00-501
Control Number 11-0658

May 24, 2011

U.S. Department of Energy
Office of Legacy Management
ATTN: Richard Bush
Site Manager
2597 Legacy Way
Grand Junction, CO 81503

SUBJECT: Contract No. DE-AM01-07LM00060, S.M. Stoller Corporation (Stoller)
June 2011 Environmental Sampling at Green River, Utah

REFERENCE: Task Order LM00-501-02-107-402, Green River, UT, Disposal Site

Dear Mr. Bush:

The purpose of this letter is to inform you of the upcoming sampling event at Green River, UT. Enclosed are the map and tables specifying sample locations and analytes for monitoring at the Green River Disposal Site. Water quality data will be collected from monitoring wells and surface locations at this site as part of the annual environmental sampling currently scheduled to begin the week of June 20, 2011.

The following lists show the monitoring wells (with zone of completion) and surface locations scheduled to be sampled during this event.

Monitoring Wells*

0171 Cm	0176 Cm	0180 Cb	0182 Cb	0188 Al	0192 Al	0588 Cb
0173 Cm	0179 Cm	0181 Cm	0185 Cb	0189 Al	0194 Al	0813 Cm

*NOTE: Al = Alluvium; Cb = Cedar Mountain Basal Sandstone Member; Cm = Middle Sandstone Unit

Surface Locations

0846	0847

All samples will be collected as directed in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*. Access agreements are being reviewed and are expected to be complete by the beginning of fieldwork.

Please contact me at (970) 248-6592 if you have any questions.

Sincerely,

Jeffrey E. Price
Site Lead

JP/lcg/lb

Enclosures (3)

cc: (electronic)
Steve Donivan, Stoller
Bev Gallagher, Stoller
Lauren Goodknight, Stoller
Jeff Price, Stoller
EDD Delivery
rc-grand.junction
File: GRN 410.02 (A)

Sampling Frequencies for Locations at Green River, Utah

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
171			X			Telemetry
173			X			Telemetry
176			X			Telemetry
179			X			Telemetry
180			X			Telemetry
181			X			
182			X			Telemetry
183					X	Telemetry; WL only
184			X			Telemetry; WL only
185			X			Telemetry
188			X			
189			X			
192			X			
194			X			
582					X	Telemetry; WL only
588			X			Telemetry
813			X			Telemetry
817					X	Telemetry; WL only
Surface Locations						
846			X			
847			X			

Annual sampling conducted in June

Site-wide water levels. Do water levels first prior to sampling. Record exact time that water levels are measured.

Constituent Sampling Breakdown

Site	Green River				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/yr	10	2			
Field Measurements					
Alkalinity	X	X			
Dissolved Oxygen					
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Turbidity	X	X			
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)	X	X	0.1	EPA 350.1	WCH-A-005
Arsenic	X	X	0.0001	SW-846 6020	LMM-02
Calcium					
Chloride					
Chromium					
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X	X	0.05	EPA 353.1	WCH-A-022
Potassium					
Radium-226					
Radium-228					
Selenium	X	X	0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Uranium	X	X	0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	5	5			

Note: All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Attachment 4
Trip Report

This page intentionally left blank

Stoller

established 1959

Memorandum

DATE: June 24, 2011

TO: Green River File

FROM: Jeff Price

SUBJECT: Trip Report

Site: Green River, Utah

Dates of Sampling Event: June 20-21, 2011

Team Members: Gretchen Baer and Jeff Price.

Number of Locations Sampled: Water samples for arsenic, selenium, uranium, ammonia as N and nitrate + nitrite as N, were collected from 14 monitoring wells and two surface locations.

Locations Not Sampled/Reason: Well 0180 was not sampled because it was mistakenly chosen during the sample planning phase. Well 0184, which was the intended sample location, was sampled instead of 0180.

Location Specific Information: The intent of collecting surface location 0847 is to sample the upper reach of the Green River water that backs up into Browns Wash. Depending on the stage of the river, the location of surface sample 0847 will vary. See attached figure for location of 0847, as well as all other sampled locations.

Quality Control Sample Cross Reference: The following are the false identifications assigned to the quality control samples.

False ID	Ticket Number	True ID	Sample Type	Associated Matrix
2169	JHT 103	0184	Duplicate	Groundwater

Report Identification Number (RIN) Assigned: All samples were assigned to RIN 11063891.

Sample Shipment: Samples were shipped overnight via FedEx to ALS Laboratory Group, Fort Collins, Colorado, on June 22, 2011.

Water Level Measurements: Water levels were measured at all wells.

Well Inspection Summary: All sampled wells were in adequate condition.

Field Variance: None.

Equipment: Wells were sampled with a peristaltic pump and dedicated tubing or a dedicated bladder pump. Surface water locations were sampled using a peristaltic pump and disposable tubing.

Regulatory: Phil Goble, Utah Division of Radiation Control, was on site on June 20 to witness the sampling event.

Institutional Controls

Fences, Gates, Locks: All fences, gates, and locks are OK.
Signs: OK
Trespassing/Site Disturbances: None.

Site Issues:

Disposal Cell/Drainage Structure Integrity: No issues observed.
Vegetation/Noxious Weed Concerns: None observed.
Maintenance Requirements: None observed.
Safety Issues: None.
Access Issues: None.

Access Issues: None.

Corrective Action Required/Taken: None.

(JP/lb)

cc: (electronic)
Richard Bush, DOE
Steve Donivan, Stoller
Jeff Price, Stoller
EDD Delivery
File: GRN 410.02(A)

Data Validation Package for the Green River, Utah, Disposal Site, June 2011

The U.S. Department of Energy (DOE) has prepared a Data Validation Package containing the groundwater and surface water monitoring data generated from the June 2011annual sampling event at the Green River, Utah Disposal Site. This package includes worksheets and reports that document the sampling activities and validation procedures conducted. **At your request, you are receiving a hard copy of the report.**

The report can also be found on the Internet at the DOE Legacy Management (LM) website – www.lm.doe.gov. From the LM website home page, select the United States map icon titled Legacy Management Sites. Then select the Green River Site from the drop-down list. The report will be available on the Green River Disposal Site page of the LM website under Site Documents and Links.

U.S. DEPARTMENT OF ENERGY | Legacy Management