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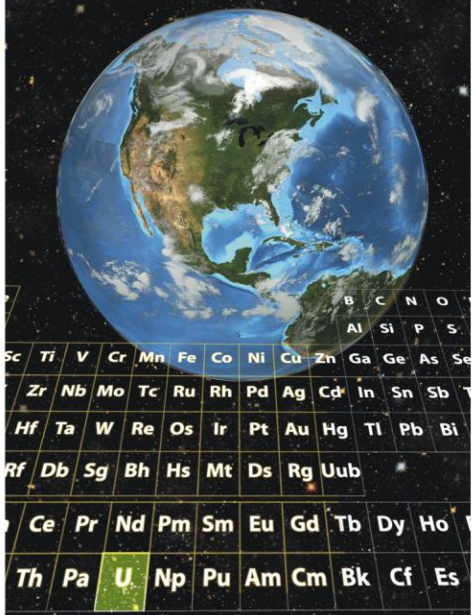
Environmental Sciences Laboratory

Applied Studies & Technology Variation in Groundwater Aquifers: Results of 2013–2014 Phase I Field Investigations

September 2015
Final



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Appendix A Specific Conductance Profile Results: Summary Statistics by Site

Abbreviations

AS&T	Applied Studies and Technology
bgs	below ground surface
btoc	below top of casing
CV	coefficient of variation (standard deviation divided by the mean)
DOE	U.S. Department of Energy
ft	foot or feet
IDL	Interactive Data Language (data visualization code)
IFRC	Integrated Field Research Challenge
IQR	interquartile range—the limits within which the middle 50% of an ordered set of observations falls (equal to the upper quartile value minus the lower quartile value)
LM	Office of Legacy Management
M	median
mg/L	milligrams per liter
max	maximum
min	minimum
µS/cm	microsiemens per centimeter
n	number of measurements or sample points
POC	point of compliance
POE	point of exposure
SC	specific conductance
SCT	specific conductance and temperature (profiling)
SD	standard deviation
SOARS	System Operation and Analysis at Remote Sites
SRE	Slick Rock East (site)
SRW	Slick Rock West (site)
T	temperature (°Celsius)
TLC	Temperature Level Conductivity (meter)
TTP	Technical Task Plan
UMTRCA	Uranium Mill Tailings Radiation Control Act

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Executive Summary

This report describes the results of Phase I of the Variation Project conducted between July 2013 and October 2014 at 15 U.S. Department of Energy Office of Legacy Management (LM) sites in the western United States. The scope of this work is described in the Technical Task Plan (TTP) titled *Variation in Groundwater Aquifers*. Specific conductance (SC) profiles were taken at 400 wells during this phase of the investigation. The catalyst for the work was an observation that concentrations of dissolved solids and specific contaminants varied with depth in some wells at an LM site. This observation led to speculation that a better understanding of the variations might lead to improved data interpretation for reporting, trend analysis, and modeling.

The purpose of this Phase I field effort was to establish a baseline of SC profiles for sites with a suitably long history of groundwater monitoring. This report provides only preliminary interpretations of the profiles; later phases of the project will consider potential sources of variation. At each well, profiles were obtained by slowly lowering a calibrated sonde down the well, stopping at each 0.5-foot interval. The sonde was left at the target depth until specific conductivity and temperature readings were stable, at which time the SC, temperature, time, and depth were recorded.

All wells showed some variation in SC because conditions are always changing, although at times the changes are too small to measure meaningfully. Measurement conditions—groundwater chemistry, hydrostratigraphic features, instrument precision, and others—all contribute to variation. SC in wells at some sites, such as the Shiprock, New Mexico, Site, varied widely, as much as 10,000 microsiemens per centimeter (µS/cm) over a vertical span of about 12 feet in a single well. Conversely, at a Slick Rock, Colorado, well, SC varied only 5 µS/cm over a vertical span of 30 feet.

To facilitate discussion of SC variation between wells, the Phase I effort established indices to distinguish between the ranges of SC profiles. Several statistical approaches were considered for expressing how the degrees of variation are defined. The coefficient of variation (CV; the standard deviation divided by the mean) was ultimately selected as the index of variation with which to evaluate the results of the Phase I investigation.

This report demonstrates that although some sites (e.g., the Shiprock disposal site floodplain and the Durango, Colorado, processing site) have wide-scale variation in SC profiles at most wells profiled, other sites have overall very little variation. In fact, most wells profiled in this investigation (about 70 percent) had low variation. Nonetheless, every site has at least one well with high enough variation in the SC profile to warrant further examination.

Whether the variation measured in some wells is important from a compliance or other perspective was not evaluated in detail. For example, at a given well with a highly variable SC profile, would sampling different parts of the well produce results that are above and below a water quality standard? That question cannot be answered at this stage of the Variation Project. However, in some cases, the variation in the vertical SC profile measured in a single afternoon could in theory explain the variation in historical measurements. If SC co-varies with contaminant concentrations (to be evaluated in Phase II), sampling at different depths could affect interpretations of temporal trends, especially if low-flow sampling techniques are employed.

Although few conclusions are possible from the results of this preliminary work, the findings of this study indicate that routine documentation of sampling depths is important at some sites, and it is recommended as a best practice at all LM sites where groundwater monitoring is included in the site's long-term care. SC profile results will be considered along with results of later phases of this project that examine anthropogenic factors, such as sampling technique (low-flow versus standard or high-volume purge), pumping or borehole effects (e.g., casing degradation), or natural factors such as density-dependent flow or aquifer heterogeneity. Other factors (described in Table 4 of the TTP) will include well depths, aquifer lithology, screen placement and length, saturated thickness, and proximity to pumped wells or surface water bodies. It was not possible at this stage of the investigation to evaluate the influence of these factors. However, the SC profile results do have implications for sampling discrete intervals within a well.

1.0 Introduction

This report documents the results of Phase I of the Applied Studies and Technology (AS&T) project titled V*ariation in Groundwater Aquifers,* herein referred to as the Variation Project. The scope of this work is described in the AS&T Technical Task Plan (TTP), which was first issued in May 2014 (DOE 2015c). The Phase I field effort entailed collection of specific conductance and temperature (SCT) profiles in groundwater monitoring wells at 15 U.S. Department of Energy (DOE) Office of Legacy Management (LM) Uranium Mill Tailings Radiation Control Act (UMTRCA) disposal or processing sites located in the western United States (Figure 1). Most (11) of these sites are located on river floodplains. Between July 2013 and October 2014, 400 monitoring wells were profiled; data from nearly 17,500 measurements are summarized here (Table 1).

1.1 Background

The catalyst for the Variation Project was the observation in 2012 that concentrations of dissolved ions, as indicated by specific conductance (SC), and contaminant concentrations vary with depth in some LM site wells. For example, both SC and uranium concentrations in samples collected from a well on the Shiprock, New Mexico, site floodplain were highly dependent on the depths from which the samples were collected. In some cases, the range in both SC and uranium observed over a decade or more in a well can be reproduced in a single afternoon by simply sampling the well at different depths. This stratification in wells could be caused by stratification in the aquifer, dead zones in the well that retain older groundwater, or by some as-yet unidentified process.

Based on results of limited chemical profiling, stratification in uranium and other contaminant concentrations was also apparent in these and other Shiprock wells. These early observations inspired the following questions:

- Is the high variation in SC observed in several Shiprock site floodplain wells unique to that site, or is it a phenomenon that occurs at other LM sites and wells?
- SC was found to co-vary with uranium and other contaminants (e.g., sulfate) in early profiling of the Shiprock wells mentioned above. To what extent is this the case at other wells or sites?
- At what depths are these (and other) wells routinely sampled? If contaminant concentrations vary vertically, and samples are collected at single (often unspecified) depths, how does this affect interpretations of the data, for reporting or modeling purposes?
- Similarly, how do sampling procedures (low-flow vs. high-volume purge) potentially impact sample results and how does this relate to site-specific compliance issues?

The goal of the Phase I field effort was to establish a baseline of specific conductance profiles for LM sites in the western United States with a long history of groundwater monitoring. These data will be used to identify sites and wells for chemical profiling in later phases of the project.

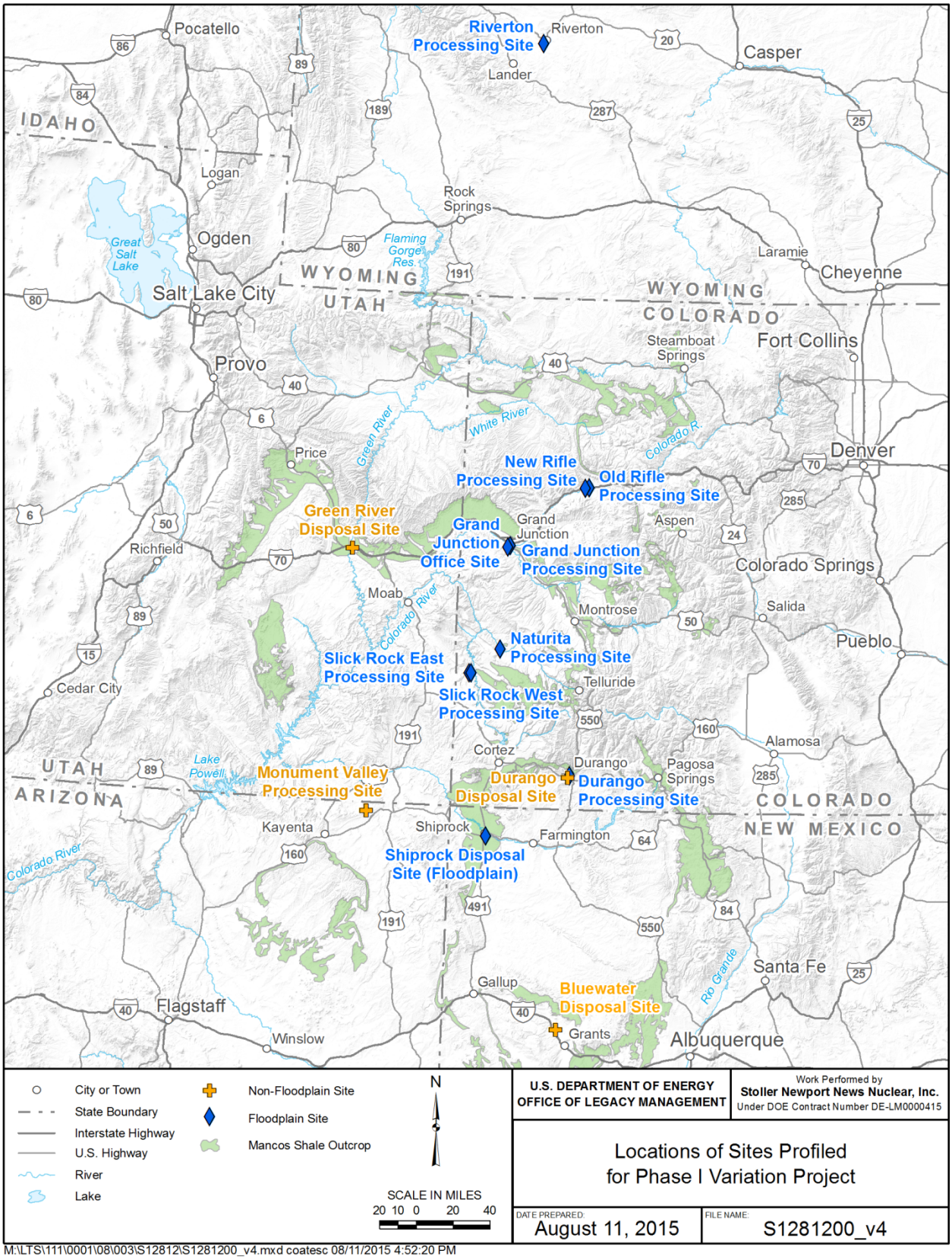


Figure 1. Locations of Sites Profiled for Phase I Variation Project

Table 1. LM Sites Profiled for Phase I of Variation Project

LM Site	Floodplain Site?	Dates Profiled	No. of Wells Profiled	No. of Data Points
Bluewater, New Mexico, Disposal Site	No	October 2014	16	1489
Durango, Colorado, Processing Site Mill Tailings Area	Yes	June 2014	13	255
Durango, Colorado, Processing Site Raffinate Ponds Area	Yes	June 2014	10	526
Durango, Colorado, Disposal Site (*Bodo* Canyon)	No	June 2014	7	203
Grand Junction, Colorado, (Office) Site	Yes	Summer 2013	8	226
Grand Junction, Colorado, (Climax) Processing Site	Yes	April 2014	4	47
Green River, Utah, Disposal Site	No	May 2014	20	1719
Monument Valley, Arizona, Processing Site	No	May, June 2014	81	6622
Naturita, Colorado, Processing Site	Yes	June 2014	26	279
New Rifle, Colorado, Processing Site	Yes	July, October 2013	41	874
Old Rifle, Colorado, Processing Site	Yes	October 2013	22	472
Riverton, Wyoming, Processing Site	Yes	September 2014	33	1443
Shiprock, New Mexico, Disposal Site—Floodplain	Yes	September 2013 April 2014	85 80	1488 1268
Slick Rock, Colorado, East Processing Site	Yes	June 2014	13	191
Slick Rock, Colorado, West Processing Site	Yes	June 2014	19	353
		Grand Total	400 [a]	17,455

Notes:

[a] Although 478 profiles were obtained during the Phase I field effort, 78 wells on the Shiprock floodplain were profiled twice: first in September 2013 and again in April 2014 following a month-long non-pumping period (Section 4.12). The total number of profiled wells listed in this table (400) does not include the second profile of wells at this site.

Two sites with limited profiling work are not listed here or discussed in this report: the Shiprock disposal site terrace (six wells were profiled in 2013) and the Tuba City disposal site. Profiling at the Tuba City disposal site in August 2014 was conducted for only a subset of wells and was done in part to support site-specific project work.

1.2 Scope of this Report

This interim status report summarizes the methods and results of the Phase I Variation Project field investigation and identifies the sites and wells where variation in SC was observed. As shown in Table 1, thousands of SCT measurements at 400 wells were collected for this study. When possible, SC profiles taken in this study are compared to historical measurements of SC and occasionally to site contaminants such as uranium. However, in general, this report provides only preliminary interpretations of the profiles. Future efforts in the Variation Project will evaluate other data collected through time in conjunction with the profile data, such as site hydrogeology, well construction details, and the nature and extent of contamination at each site. This report focuses solely on SC data, but temperature is a variable that might warrant evaluation at some wells in follow-on studies.

In the context of this report, the term "variation" is used loosely and requires clarification. Initially, the term was applied to Shiprock wells where SC variation on the order of 10,000 microsiemens per centimeter (µS/cm) was measured in a vertical span of about 12 feet. In all wells profiled for this investigation, SC varied to some degree. But in some cases it varied only slightly (e.g., less than 10 µS/cm) over extended intervals. To facilitate understanding of variation between and within sites (i.e., well-to-well variation), indices of variation (or dispersion) are derived to distinguish between low vs. mid-range vs. high-variability wells. Statistical analysis at this stage is limited to examining the distributions of these indices and is focused on the high-variability wells. The potential significance of the results is not addressed.

Following this introduction, Section 2 summarizes the general methods used in this study, Section 3 provides an introductory overview of the results, and Section 4 documents the key findings for each site profiled, focusing on the most variable wells. In Section 5, global results are reexamined, focusing on site-to-site variation and well-to-well variation within sites. Section 6 provides a preliminary scope of work anticipated for Phase II. Section 7 summarizes the major findings of the Phase I investigation. References are provided in Section 8. Appendix A provides detailed tables of summary statistics for all well SC profiles.

2.0 Methods

2.1 Field Methods

Phase I SCT profiling—the measurement of specific conductance and temperature at various depths within a well—was conducted between July 2013 and October 2014. At each of the 15 sites, the majority of existing wells were profiled, even wells not routinely sampled. However, domestic wells, other non-DOE-owned wells, and more distant background wells were generally not profiled. At each well, profiles were obtained by slowly lowering a sonde down the well, stopping at each 0.5-foot (ft) interval. The sonde was left at the target depth until specific conductivity and temperature readings were stable, at which time the specific conductivity, temperature, time, and depth were recorded.

In deeper wells with very large (e.g., >100 ft) saturated thicknesses, the measurement interval was sometimes increased (e.g., to 1 ft) if SCT readings were consistently stable, especially through sections of blank casing. In these cases, the 0.5 ft interval was resumed if readings began to vary or if the profile depth approached the screened interval of the well. Prior to the profile measurements, downhole equipment, including sampling tubes and SOARS (System Operation and Analysis at Remote Sites) sensors, were removed from each well. Removal of downhole equipment from the well proceeded slowly to minimize disruption to the water column in the well. For deeper wells with bladder pumps, the wells were allowed to sit, generally overnight, after equipment removal.

Two types of sondes were used during this effort: a Solinst Temperature Level Conductivity (TLC) meter (used only for wells less than 100 ft deep) and an Aqua Troll In Situ probe. SC probes were calibrated at the beginning of the day or upon arrival at the site, and were then checked at least several times more throughout the day. Probes were also recalibrated if readings were unstable or inconsistent with the historical record. For sites with a large number of wells (e.g., Monument Valley), two instruments were often employed. In these cases, for a subset of wells with sufficient casing width, both probes were lowered simultaneously to test the agreement in results. Also, at some wells with highly variable profiles, SC measurements were taken again later in the day or on the following day to verify results. Field observations and any deviations from these generalized methods for individual sites profiled are documented in Volume II of this report.

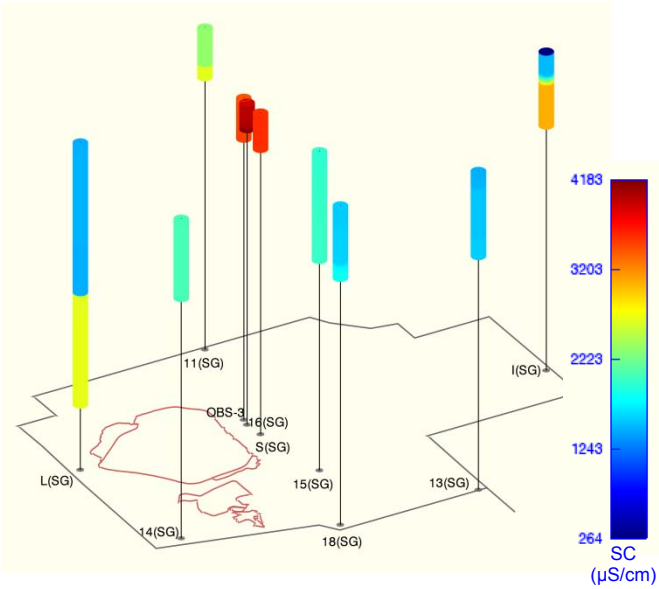
2.2 Data Visualization Approaches

Given the size and composition of the Phase I Variation Project data set, the use of data visualization tools and statistical graphics is essential to understanding the data. This section introduces the data visualization approaches most commonly applied throughout this report. To support this project, three modules were developed using the Interactive Data Language (IDL) (IDL) program (http://www.exelisvis.com):

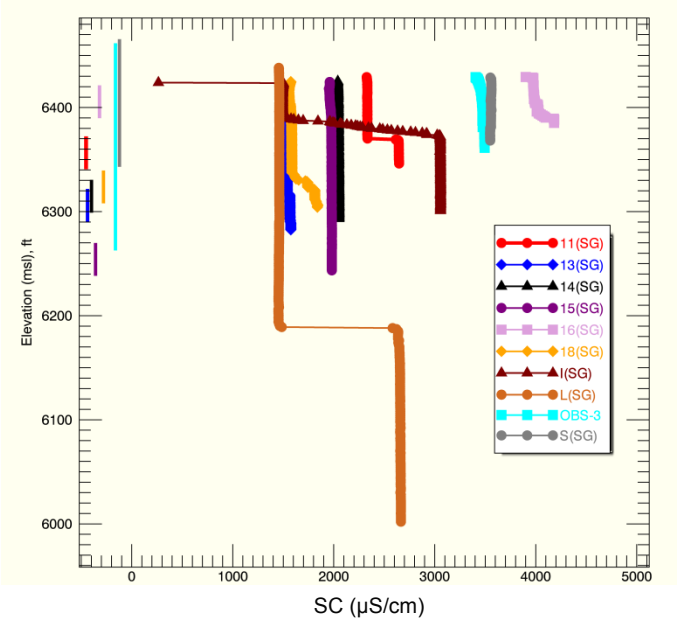
- StickBall: plots 3-dimensional vertical profiles of SC and chemical measurements
- Vertical Profiles: 2-dimensional plots of vertical profiles relative to screened intervals
- Spatial Chemistry: Bubble or contour plots of a single summary representation of the vertical profile, such as the average or mid-screen SC, or summary statistic

Figure 2 provides examples of each of these data visualization approaches.

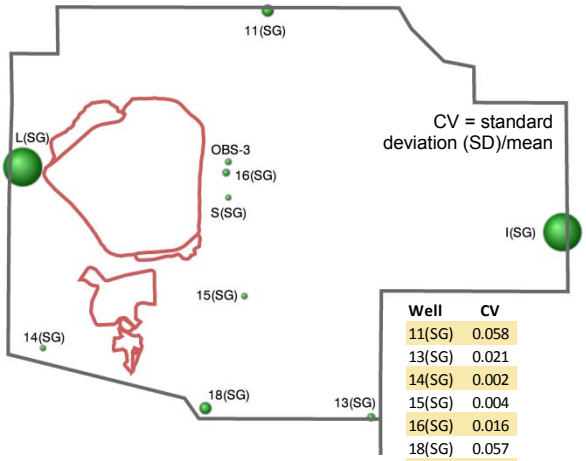
a. StickBall Plot of SC Profiles



b. Vertical Profile Plot



c. Spatial (Bubble) Plot of Coefficient of Variation (CV)



Well	CV
11(SG)	0.058
13(SG)	0.021
14(SG)	0.002
15(SG)	0.004
16(SG)	0.016
18(SG)	0.057
I(SG)	0.295
L(SG)	0.301
OBS-3	0.007
S(SG)	0.001

d. Box and Jitter Plot (Wells Ranked by Descending CV)

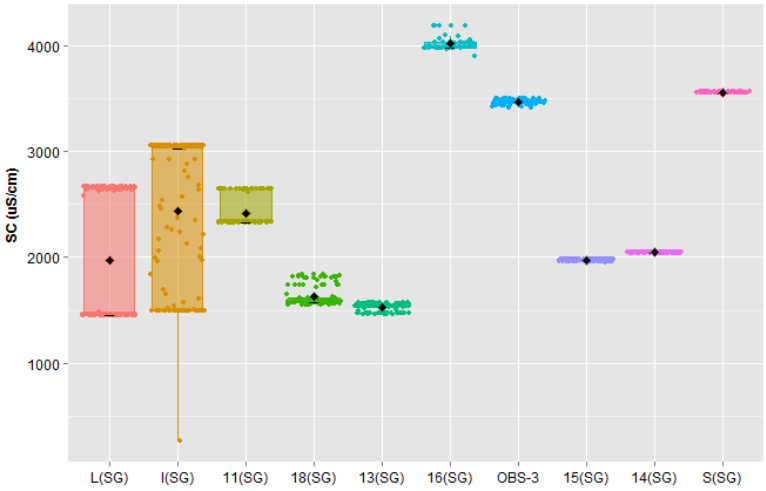


Figure 2. Data Visualization Approaches Used in this Report: Example from Bluewater, New Mexico, Site

SC in µS/cm; profile data from Bluewater San Andres aquifer wells, October 2014.

- Figure 2a, the StickBall plot, shows SC measurements by elevation.
- In the two-dimensional vertical profile representation (Figure 2b), well screens are the leftmost vertical lines plotted in the same color as the corresponding SC profile results.
- Figure 2c plots the coefficient of variation (CV) in SC measurements for each well, where the diameter of the circles is proportional to CV magnitude where CV = standard deviation(SD)/mean
- The box plots in Figure 2d show the distribution of results overlain by the raw data; data points are jittered to avoid overplotting.

In plots 2a and 2c, red and black lines denote disposal cell/tailings areas and boundary features, respectively.

The example plots in Figure 2 show SC profile data from San Andres aquifer wells at the Bluewater site. Figure 2a (StickBall) shows SC measurements by elevation; each "ball" on the stick is an individual measurement. In wells with large saturated thicknesses, individual measurements may be difficult to discern (plots appear as unicolored rods), especially when results are fairly homogeneous through parts or all of the profile. In the StickBall and the bubble plots (Figure 2c), only simplified site features are shown. In general, red, black, and blue lines denote disposal cell/tailings areas, site boundaries, and river or water features, respectively (refer to well location maps provided in each section for more detailed site features).

Figure 2b shows the same results, but in two dimensions relative to the screened interval for each well, illustrated with a vertical line near the left *y*-axis using the same color as the corresponding SC profile. In some wells profiled for this study, there was an apparent correlation between changes in slope in the SC profile and the position of the screened interval. In the example in Figure 2, the two wells with the most variability in the SC profiles, I(SG) and L(SG), have an open borehole construction through the saturated thickness (i.e., the wells are not screened).

The bubble plot in Figure 2c shows the relative degree of variation in each well as indicated by the coefficient of variation (CV), defined as the standard deviation of SC measurements divided by the mean SC. In this plot, the area of each circle is proportional to the absolute value of the CV, which in this case ranges from 0.001 to 0.3.

Figure 2d shows a more standard statistical graphic, the box plot. In this plot, wells are ordered by decreasing CV, that is, by decreasing variation in the well profiles. Raw data are also shown, and points are jittered to avoid overplotting. This approach is necessary for wells with little variation in measurements in portions of the profile. Like the IDL modules (StickBall, vertical profiles, and bubble plots in Figures 2a–2c), the box and jitter plot is used often in this report. These and related graphics were developed using R version 3.2.0 and the ggplot2 package, version 1.0.1 (Wickham 2009).

Several factors should be considered when interpreting these figures. First, scale is important, as variation in wells with lower SC magnitudes can be masked. For example, in the StickBall plot in Figure 2a, variation in well 13(SG) is not apparent because the high SC in other wells drives the scale of the plot. The number of measurements (*n*) taken in a well is also important. In the examples provided in Figure 2, the number of SCT measurements taken at each well ranged from about 50 [in 16(SG)) to nearly 230 (in L(SG)]. To inform interpretations of the data and the corresponding figures in this report, Appendix A provides tables that summarize relevant statistics for all well SC profiles. Links to these tables are provided for each site discussed in Chapter 4. An example of the type of information summarized in these tables is provided in Table A-1, which presents a summary of the SC profile data collected for the Bluewater disposal site (extract provided in the inset below).

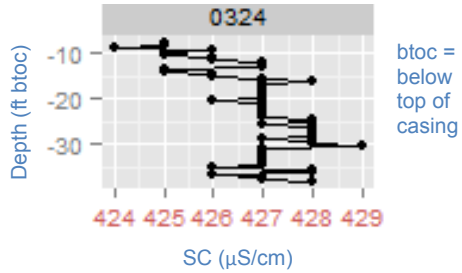
Example Extract of Data Summary Tables Provided in Appendix A, from Bluewater Site

		Oct-2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	Aquifer	*n*	Min	Max	Mid-Screen	Median	IQR	Mean	SD	Max/Min	CV	IQR/M	Nov-2014	Historical Range
16(SG)	SAG	51	3901	4183	3991	3984	49.0	4014	64.6	1.07	0.016	0.012	3952	3769 - 4553
18(SG)	SAG	136	1554	1842	1743	1584	52.3	1629	93.6	1.19	0.057	0.031	1723	1610 - 1904
I(SG)	SAG	154	264	3059	--	3035	1558.3	2438	719.5	11.6	0.295	0.513	2969	894 - 2969
L(SG)	SAG	228	1452	2665	--	1461	1199.0	1968	593.1	1.84	0.301	0.821	2613	1317 - 2913

2.3 Data Analysis Approach

Section 4.3 of the Technical Task Plan (DOE 2015c) outlined various statistical and analytical approaches to apply to Variation Project data to examine potential sources of variation in SC or contaminant profiles. Sources of variation slated for consideration included anthropogenic factors, such as sampling technique (low-flow vs. standard or high-volume purge), pumping or borehole effects (e.g., casing degradation), or natural factors such as density-dependent flow or aquifer heterogeneity. Other factors to consider include well depths, aquifer lithology, screen placement and lengths, saturated thickness, and proximity to pumped wells or surface water bodies. It was not possible at this stage of the investigation to fully evaluate the influence of these factors. However, it is necessary to define (1) how variation is quantified and (2) how the degrees of variation are defined and expressed. That is, what constitutes low versus mid-range versus high levels of variability?

Everything varies to some degree because conditions are always changing, even if they are not directly measurable. An example of very small changes in SC with depth is provided in the inset below, which shows the SC profile obtained from Slick Rock West well 0324. Over a span of about 30 ft within the well (n = 61 measurements), SC varied by just 5 µS/cm (424–429 µS/cm).



As shown in this example, SC varies in this well, at least relative to the limited scale above, but is this variation meaningful, or is it merely noise—for example, a function of the precision and accuracy of the instrument? To provide a context for evaluating the Phase I results, it was necessary to derive an index of variation so that SC profiles (or the degree of variation) could be compared within and between sites.

2.3.1 Indices of Variation

Common approaches used to quantify variation include the range, the standard deviation, and the variance. However, these measures are not useful for assessing between-site or within-site variation because of differences in SC magnitudes between wells and sites. The following unitless indices of variation (which are by definition insensitive to SC magnitude) were determined instead:

- the maximum/minimum (max/min) ratio
- the interquartile range (IQR) divided by the median, and
- the coefficient of variation (CV), equal to the standard deviation divided by the mean

Although all three measures listed above were calculated for each SC profile, the CV was found to be most useful for evaluation of the Phase I study results and corresponding within- and between-site SC profile comparisons.

The following discussion describes the merits and limitations of each index, and the rationale for ultimately selecting the CV as the basis for the analysis and comparison of variation within and between sites provided herein.

The first measure of dispersion considered, the max/min ratio, is a simple index reflecting the range of results. Although useful as an initial, screening-level index of variation (ratios close to unity would indicate little variation) this ratio was dismissed because it is not robust to outliers. The bulk of SC measurements in a well could be relatively consistent, but a single outlier (e.g., an elevated measurement in the bottom, unscreened portion of a well) would result in a deceivingly large max/min ratio. Although provided in the summary tables (Appendix A), this index is not used as a basis for interpretation of the Phase I variation project study data.

Another measure of dispersion considered was the IQR/median (at times referred to herein as IQR/M), a nonparametric index that is relatively robust to outliers. Defined as the 75th percentile minus the 25th percentile, the IQR measures the range of the central 50 percent of the data (Helsel and Hirsh 2002). The example box plot in Figure 3 identifies the IQR and median values, as well as other statistical measures referred to in this report. (This figure is also useful as a detailed explanation of some of the data presentations provided later in this report.)

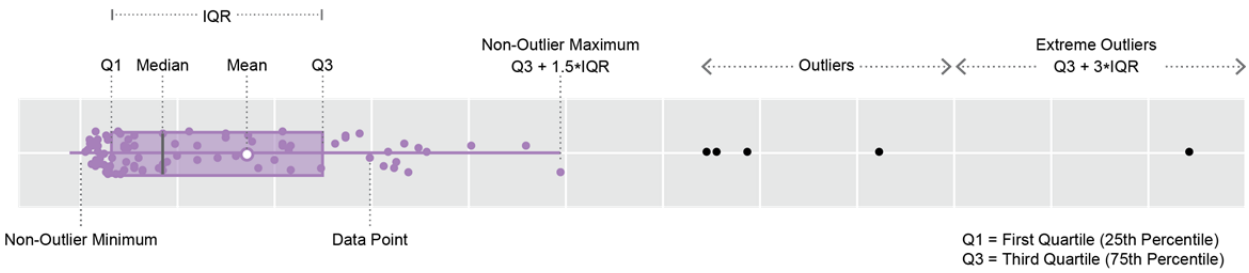


Figure 3. Example Box Plot Showing Quartiles and Interquartile Ranges

In the example in Figure 3, the data points to the right of the plot (those with values greater than IQR × 1.5) would not be accounted for if the IQR/M was used as the index of variation.[1] During the course of evaluating the Phase I SC profile data, it became apparent that for this study, where the concern is not about central tendency, but variation with depth, outliers are important.[2] As mentioned in the discussion of the limitations of the max/min ratio, at times single-point anomalies (usually well-bottom measurements) were encountered that warranted exclusion from the data set used to characterize the overall variation at a given site. But, as demonstrated in the remainder of this section and in the site-specific evaluations that follow (Section 4), in most cases, statistical outliers were found to be important.

Given the limitations of the max/min and IQR/M ratios, the CV—the ratio of the standard deviation to the mean, and a commonly applied measure of dispersion—was selected as the most useful index of variation with which to evaluate the Phase I data set.

[1] This was also the case for another nonparametric index of dispersion initially considered but not used: the median absolute deviation (MAD) divided by the median, an approach recommended by Rousseeuw and Croux (1993).

[2] In *Statistical Methods in Water Resources* (Helsel and Hirsh 2002), the authors state: "Outliers may be the most important points in the data set, and should be investigated further." http://water.usgs.gov/pubs/twri/twri4a3/

Figure 4 provides an example of why the CV was chosen. This figure plots Phase I results for the seven wells profiled at the Durango disposal site, identifying the corresponding CV and IQR/M calculated for each well's SC profile. Table 2 provides corresponding summary statistics.

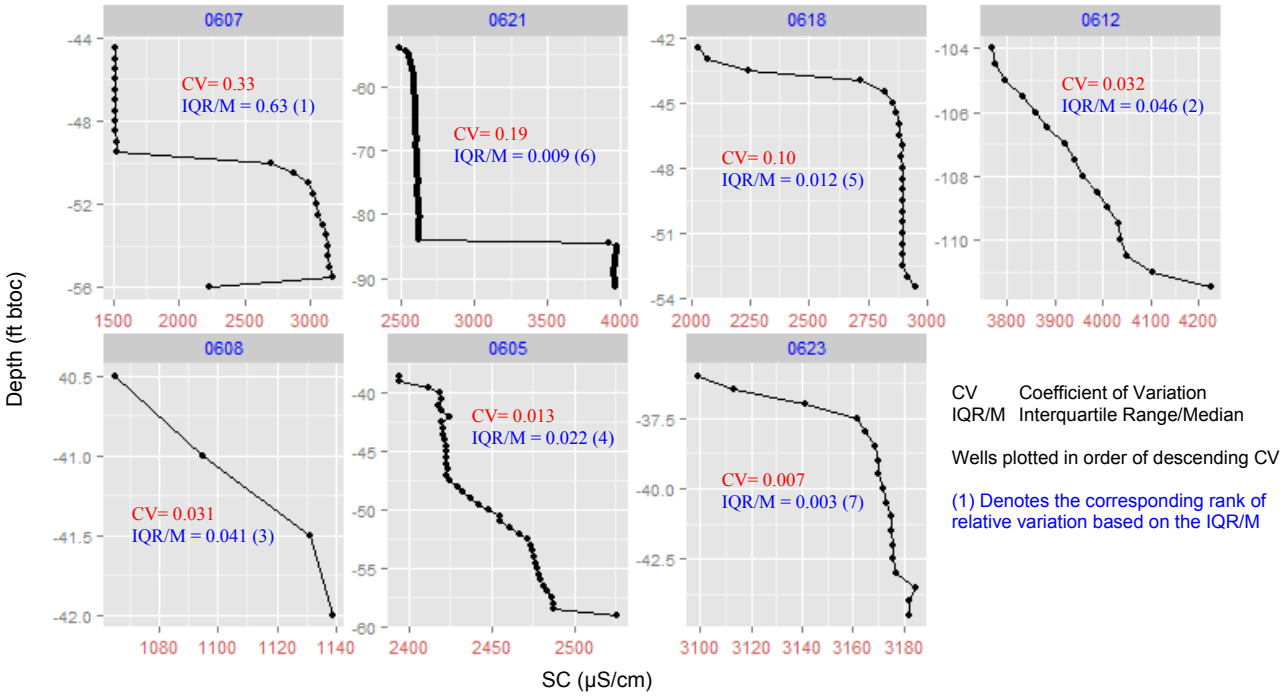


Figure 4. Comparison of SC Profiles and Variation Indices, Example from Durango Disposal Site

Table 2. Summary Statistics for Durango Disposal Site Comparing Variation Index Ranks

		SC Profile Summary Statistics (µS/cm)							Indices of Dispersion			Variation Ranks		
Well	**Aquifer**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**CV**	**IQR/M**	**Max/Min**
0607	CF	24	1507	3176	2465	1554	4414	769	2.1	0.33	0.63	1	1	1
0621	CF	76	2487	3978	2617	23	3612	544	1.6	0.19	0.009	2	6	2
0618	AL	23	2026	2956	2897	36	5624	271	1.5	0.10	0.012	3	5	3
0612	CF	16	3769	4224	3951	181	2170	127	1.1	0.032	0.05	4	2	4
0608	AL	4	1065	1139	1113	46	1941	34.2	1.07	0.031	0.04	5	3	5
0605	CF*	42	2394	2526	2435	54	7783	30.8	1.06	0.013	0.02	6	4	6
0623	AL*	18	3099	3185	3173	10	3465	23.5	1.03	0.007	0.003	7	7	7

Wells ranked in order of descending CV. AL = alluvial aquifer well; CF = Cliff House Sandstone well; * = Background Well
shaded cells denote discrepancies in ranks between CV and IQR/M

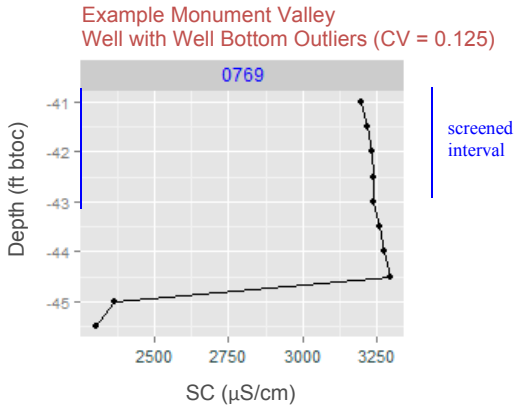
As shown in Figure 4, although the CV and the IQR/M yield the same top and bottom ranks (most vs. least variable well SC profiles), ranks for the remaining five wells differ. For example, well 0621, where the profile changed markedly below 80 ft, ranked second based on the CV but close to last (6/7) using the nonparametric IQR/M index. Due to the large number of measurements in this well (n = 76), the elevated SC measurements at depth are treated as outliers and therefore not accounted for in the IQR/M ratio. These data are important, however, as most of these higher measurements correspond to the screened interval of the well (Figure 22).

In the preceding example, CV variation ranks are the same as those based on the max/min ratios, in part because there are no single far outliers in this data set. But, for reasons discussed previously, the max/min ratio is only useful as a screening-level index. The type of comparison demonstrated in Figure 4 was repeated for a subset of wells at several other sites profiled for this investigation. Based on that assessment of relative ranks (CV vs. IQR/M), the CV was selected as the most reasonable index of variation for comparison of SC profiles within and between sites. Other indices of variation, the max/min and IQR/M ratios, are provided in Appendix A.

2.3.2 Data Management

In this report, there are differences between how data are summarized within a site and how those data are treated for between-site comparisons. Because a goal of this evaluation is to represent the degree of variation characteristic of each site (i.e., applying to most wells profiled), some wells considered to bias or unduly weight the data set were excluded from the summary plots. For between-site comparisons, data from most background wells were excluded because they are not representative of site conditions (these wells usually had very little variation in the SC profiles). Replicate profiles from the Shiprock floodplain site—with wells profiled in both September 2013 and April 2014—were also excluded, as inclusion of both sets of data would result in a disproportionate amount of wells with high variation.

It was not possible to examine all 478 SC profiles in detail for this interim status report. As a result, some anomalous measures of dispersion are occasionally encountered. For example, for a small subset of wells with high CVs, it was found that marked decreases in SC in the well's "dead zone" accounted for the high CV, while the remainder of the profile was fairly homogeneous. (A "dead zone" is a portion of the well, often below the screened interval, that has little or no groundwater flow through it—i.e., it contains stagnant water.) The following example from a Monument Valley site well demonstrates this point:



In cases like these, although no data were deleted, the corresponding CV for the well (0.125 in this example) would be excluded from the data set used to derive sitewide indices (e.g., the summary plots and between-site comparisons provided in Section 4).

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3.0 Overview of Profiling Results

The previous section described the approach used to quantify variation for this study, and from that discussion it is apparent that a well profile with a CV of 0.10 is more variable than one with a CV of 0.01. However, the magnitude of the CV that is potentially important—one where the degree of variation is sufficiently high to warrant further study or greater attention to sampling depths—has not been defined. That is the goal of this section. To establish a context for evaluating the site-specific results, the following discussion provides a preliminary overview of Phase I results across all sites profiled and establishes thresholds for comparison. Based on the distribution of the CVs found across sites, five levels of variation are defined: very low ($CV < 0.01$), low ($0.01 \le CV < 0.03$), mid-level ($0.03 \le CV < 0.1$), high ($0.1 \le CV < 0.3$), and very high ($CV \ge 0.3$). The basis for these determinations is discussed later in this section.

To introduce the Phase I results, Figure 5 shows a histogram of the CVs derived for the majority of wells profiled during Phase I of this study.[3] As shown in this figure, the distribution of CVs by well ($n = 375$ wells) is strongly left-skewed: about two-thirds (67%) of the well SC profiles have CVs less than 0.05, and half (50%) have CVs ≤ 0.03.

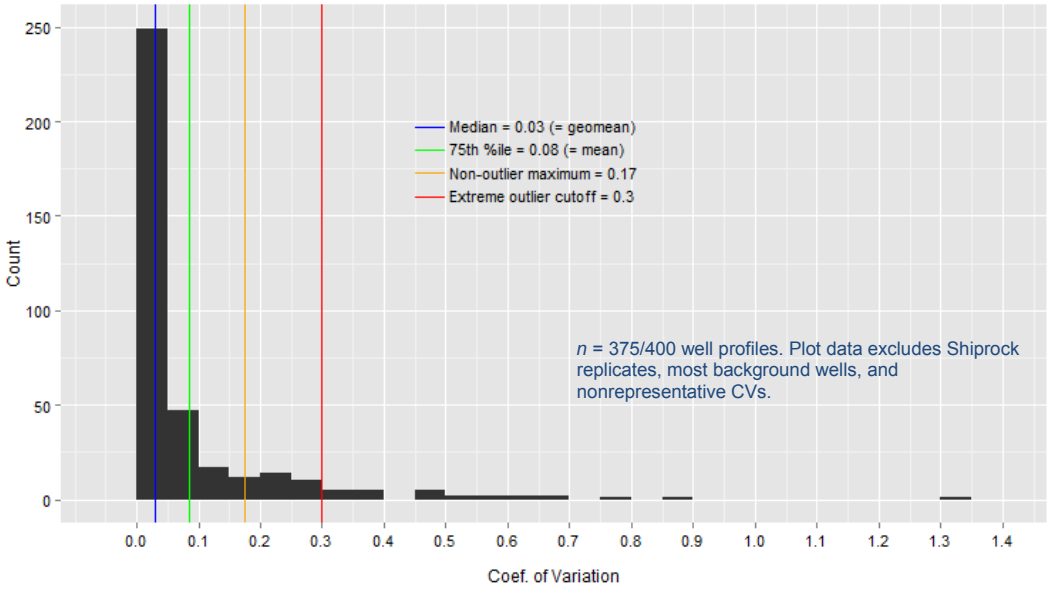

Figure 5. Histogram of CVs by Well, All Sites (n = 375 SC Profiles)

To provide greater resolution on these results, Figure 6 shows box plots of the CVs derived for all profiled wells categorized by site. This figure plots the same data as that in the preceding histogram, except that it includes results from the second Shiprock floodplain profiling effort. Each box in Figure 6 shows the overall distribution of the CVs found at each site, and each point represents an individual well and the corresponding CV. Figure 7, a partitioned version of the histogram in Figure 5, shows the distributions of CVs for each well grouped by site/profile event and color-coded by CV magnitude.

[3] Data from the second (April 2014) round of Shiprock floodplain profiles were excluded from histogram plots so as not to bias interpretations of study-wide variation (Section 2.3.2). CVs considered not representative of actual variation in groundwater in a well were also excluded (see previous Monument Valley well example).

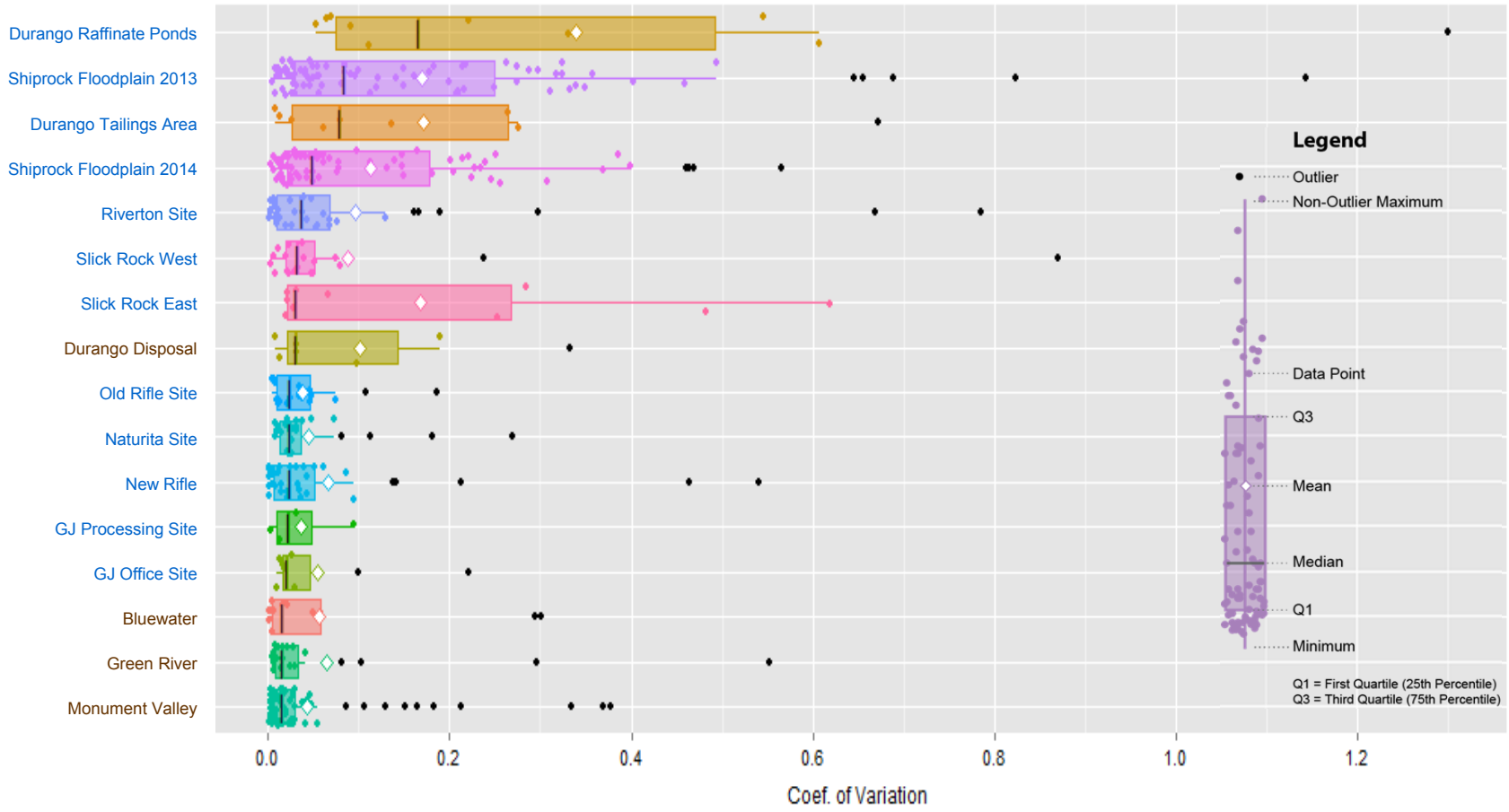

Figure 6. Box Plot of Coefficients of Variation in Wells Across Sites, Ranked by Median CV

n = 452 of 478 well SC profiles; most background wells and nonrepresentative CVs were excluded from the plot data set.
Sites are listed in order of descending variation based on the median CV. Each point represents the CV calculated for an individual well's SC profile. These points are jittered to avoid overplotting; black points to the right of most plots are outliers (see Figure 3 example). In the site labels, blue font denotes river floodplain sites and brown font denotes non-floodplain sites, consistent with the categories in Table 1.

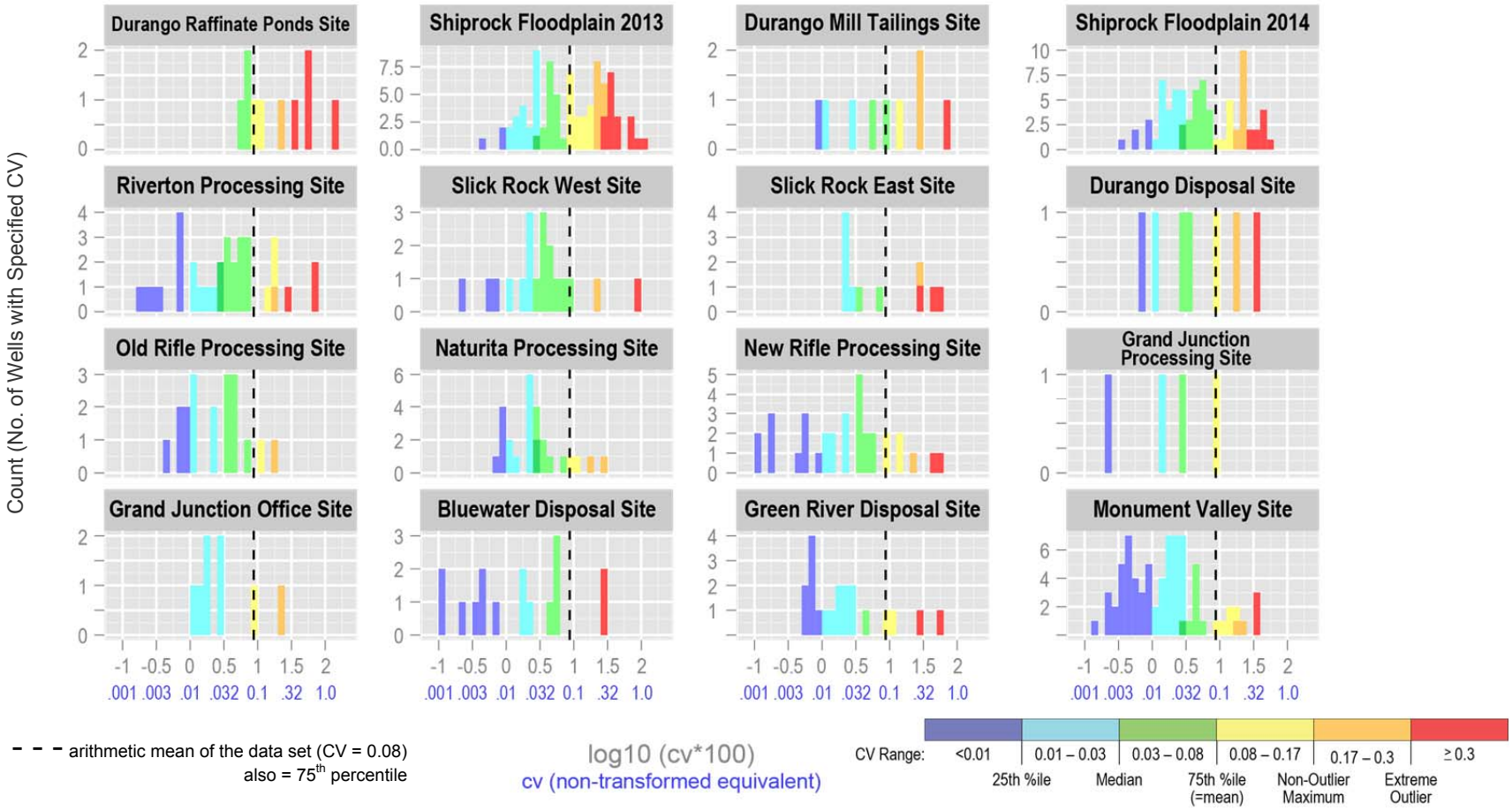

Figure 7. Histograms of CVs by Well Grouped by Site and Profile Event

n = 452 of 478 well SC profiles. Most background wells and nonrepresentative CVs were excluded from the plot data set. Sites are ordered according to their respective median CVs, consistent with the presentation in Figure 6. Data were log-transformed using CV expressed as a percentage (i.e., CV × 100); the corresponding non-transformed CV values are shown below the *y*-axis labels. Because of the sometimes large differences in the number of wells profiled at each site (Table 3), *y*-axes identifying well counts are unique for each plot.

Overlap in colors in some of the plots reflects the fact that the histogram bins, the evenly spaced intervals used to divide the entire range of values, don't always correspond to the CV range categories defined in the legend. For example, for the Naturita site, the bin with the dark green bar reflects the fact that two wells had CVs less than 0.03, and another two had CVs slightly greater than 0.03. These specific breakdowns aren't important, because the main purpose of this figure is to show the general distribution of CVs by well and by site.

At the onset of this study, it was thought that the Shiprock floodplain might be unique in the level of vertical variation found in the wells. Figure 6 demonstrates that this is not the case. While Shiprock ranks high in terms of overall variation, Durango processing sites (raffinate ponds and mill tailings areas) also have many wells with high variation. The box plots in Figure 6 are arranged in order of descending median CV, representing each site or (in the case of Shiprock) profile event. For the sites with the highest overall variation in SC profiles, median CVs are easily distinguishable from those calculated for other sites. However, as the site medians decrease, these distinctions are less apparent. Therefore, it is important to also examine the number and distribution of individual points—that is, the CVs corresponding to each well's SC profile, especially those points to the right of each box (or 75th percentile). A key finding demonstrated in this figure is that, although some sites are characterized by overall low variation (e.g., Monument Valley), every site has at least one well with high enough variation in the SC profile to warrant further examination.

The grouped histogram plot in Figure 7 was developed to provide more insight regarding the distributions of CVs within sites, and also the relative numbers of profiles collected at each site. Because of the skewness of the distribution, data were log-transformed; each bar in the histograms is color-coded based on the non-parametric study-wide distribution of CVs (e.g., 25th percentile, median, outliers, and extreme outliers; see Figure 3 example). As shown in Figure 7, most Durango raffinate ponds site wells fall in high variability category (CVs ≥ 0.1), while the majority of Monument Valley site wells fall into the low variability category (CV < 0.03). However, this figure also demonstrates that a site ranking based on single (median) values does not capture the full range or nature of variation at most sites. This rank is also highly dependent on the number of wells profiled at each site, which varied greatly as shown in Table 3.

Table 3. CV Summary Statistics by Site, Sorted by Descending Median CV

Rank	Site	Site Code	*n*	Median	Mean	SD	Geo Mean	Min	25th %ile	75th %ile	Non-Outlier Max.	Max
1	Durango Raffinate	DUR02	10	0.166	0.34	0.39	0.194	0.053	0.075	0.49	1.12	1.30
2	Shiprock 2013	SHP01 2013	85	0.085	0.17	0.20	0.086	0.005	0.030	0.25	0.58	1.14
3	Durango Tailings	DUR01	9	0.080	0.17	0.21	0.076	0.008	0.026	0.26	0.62	0.67
4	Shiprock 2014	SHP01 2014	78	0.050	0.11	0.13	0.056	0.004	0.021	0.18	0.41	0.57
5	Riverton	RVT01	33	0.039	0.10	0.18	0.032	0.002	0.010	0.07	0.16	0.79
6	Slick Rock West	SRK05	19	0.034	0.09	0.20	0.033	0.002	0.020	0.05	0.10	0.87
7	Durango Disposal	DUR03	7	0.032	0.10	0.12	0.048	0.007	0.022	0.14	0.33	0.33
8	Slick Rock East	SRK06	11	0.032	0.17	0.21	0.071	0.020	0.021	0.27	No Outliers	0.62
9	Old Rifle	RFO01	19	0.025	0.04	0.04	0.023	0.005	0.010	0.05	0.10	0.19
10	Naturita	NAT01	26	0.024	0.04	0.06	0.027	0.008	0.012	0.04	0.07	0.27
11	New Rifle	RFN01	33	0.024	0.07	0.12	0.021	0.001	0.006	0.05	0.12	0.54
12	GJ Processing	GRJ01	4	0.022	0.04	0.04	0.018	0.003	0.010	0.05	No Outliers	0.09
13	GJ Office	GJO01	8	0.022	0.05	0.07	0.030	0.010	0.016	0.05	0.09	0.22
14	Bluewater	BLU01	16	0.017	0.06	0.10	0.015	0.001	0.004	0.06	0.14	0.30
15	Green River	GRN01	20	0.017	0.06	0.13	0.022	0.005	0.007	0.03	0.07	0.55
16	Monument Valley	MON01	74	0.016	0.04	0.08	0.016	0.001	0.005	0.03	0.07	0.38
	Site-Wide CV Summary:		375	0.03	0.08	0.15	0.03	0.001	0.01	0.08	0.17	1.30

0.005 Low variation, CV < 0.03 0.25 High Variation , 0.1 < CV < 0.3 0.58 Very high Variation, CV ≥ 0.3

Site codes consistent with SEEPro/EQuIS database codes, used in Figure 10 and several Section 4 insets. Except for Bluewater site well L(SG), background wells were excluded from this summary due to very low variation measured in these wells.

For example, Monument Valley's rank as the least variable site in the Phase I study (using the median CV) stems in part from the fact that 74 wells were profiled. Because of this large number, the high variation in SC measured in some wells is not captured by the single-value rank. The preceding examples highlight the arbitrariness inherent in defining degrees of variation. There is an element of judgment, and the CV alone, essentially a capture of the SC profile in a single number, is not meaningful unless the shape and range of the profile and other factors, such as well construction and lithology, are evaluated.

Figure 8 provides example SC profiles for a subset of wells across sites representing different levels of variation based on the CV. With the exception of Figure 8a, which applies to a well with open-borehole construction, well screen intervals are illustrated with a blue line in the leftmost portion of each plot. As shown in this figure, every profile is different. A marked threshold characterizes the first profile (plot 8a), with a CV of 0.3 (SC nearly doubles at the contact with the San Andres Formation). A gradual step is found in plot 8b (CV = 0.1), and a similar but less gradual change in the profile is found in plot 8c (CV = 0.08), where a marked slope change corresponds to the beginning of the screened interval.

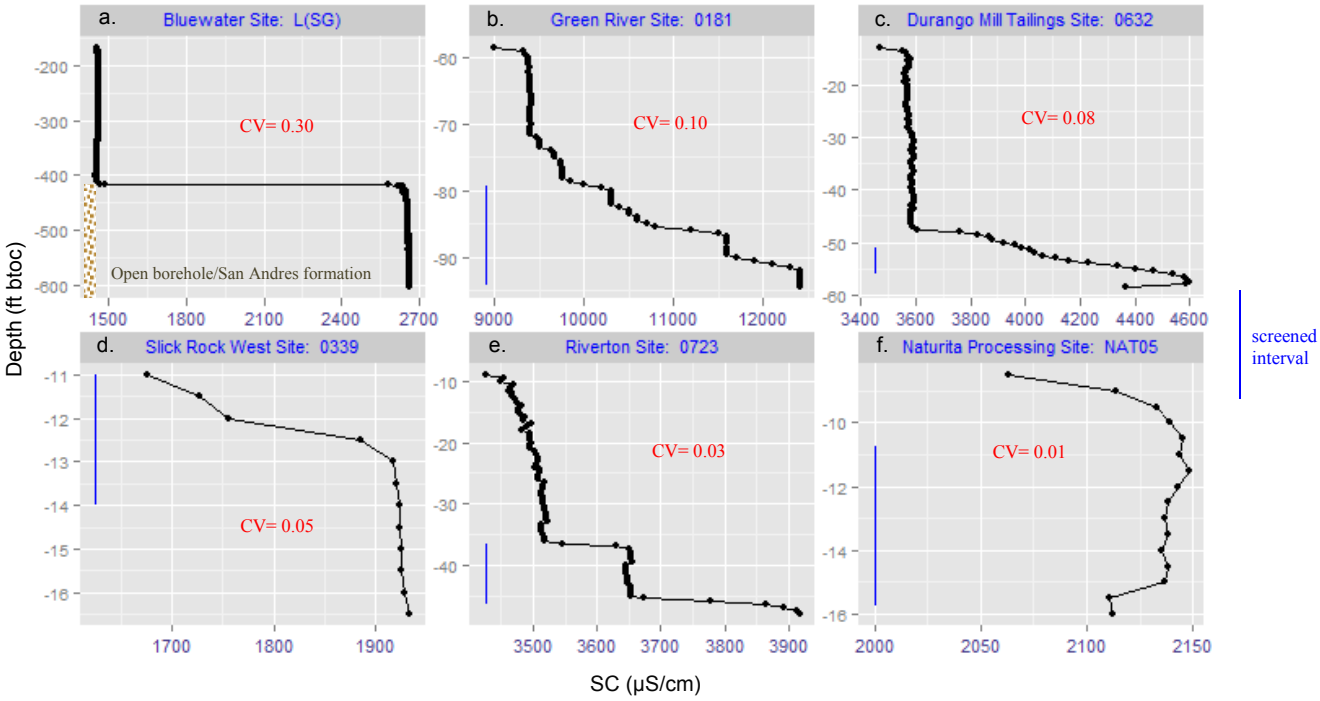

Figure 8. SC Profiles from Selected Wells Representing Different Levels of Variation Based on the CV

Plots 8d through 8f, representing categories of less variation, reaffirm the concept presented in Section 1.2 that SC profiles in most wells vary to some degree. In these plots, there is dispersion in the profiles, but over smaller SC magnitudes. Plot 8e, showing the SC profile for Riverton semiconfined aquifer well 0723, demonstrates that the number of measurements can affect the CV magnitude. Although the CV for this well profile is fairly low (0.03), the slope of the SC values changes at both the top and bottom of the screened interval (plot 8e). The large number of measurements (≈50) in the upper blank casing, where SCs are relatively stable, probably explains the lower CV for the well as a whole.

The CV classifications chosen to define degrees of variation for this study are shown in Figure 9, a log-transformed version of the initial histogram provided in Figure 5. The transform was done to enable closer examination of the distribution of CVs in the left tail of the histogram—that is, the close to 250 SC profiles with CVs ≤ 0.05; the logarithm of the CVs expressed as a percentage (CV × 100) was used. The histogram of the log-transformed data set has a shape resembling a normal distribution, and the overall distribution of CVs by well is much more apparent. To facilitate review, the corresponding non-transformed CVs are provided above the *x*-axis labels.

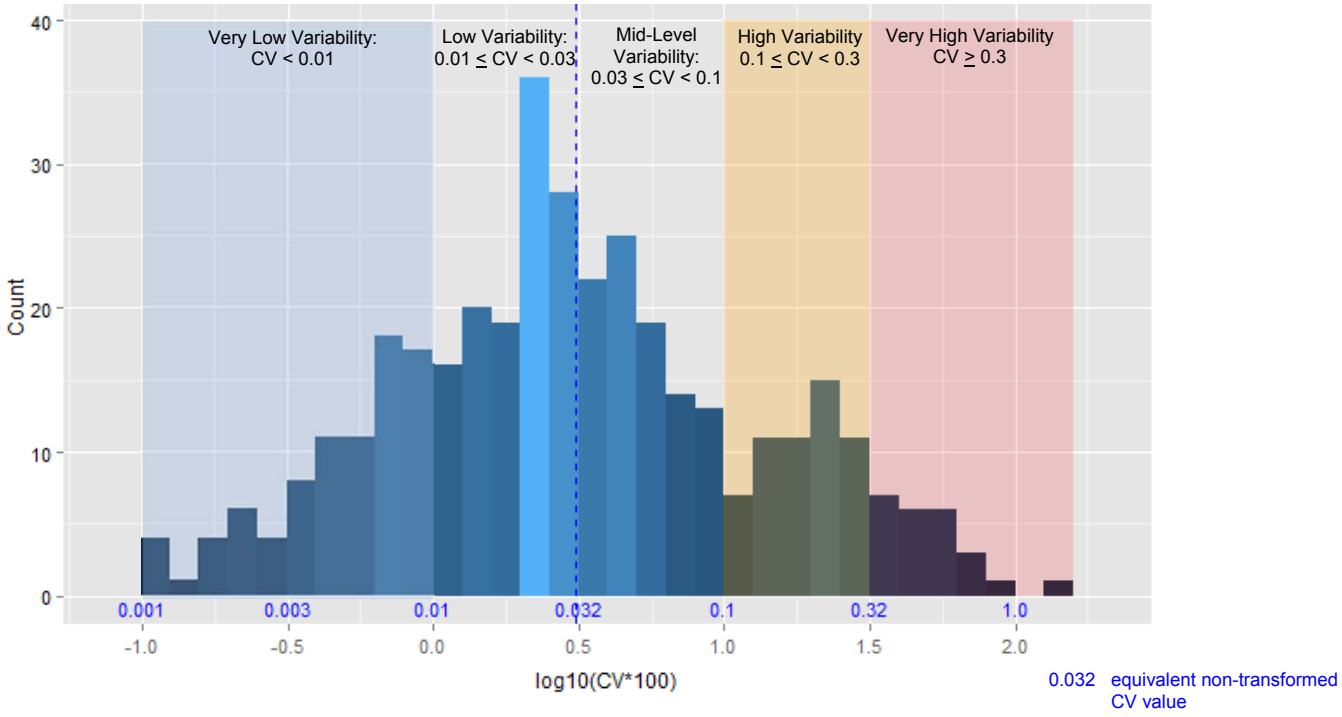

Figure 9. Distribution of CVs and Cutoffs for Defining Ranges of Variability

In Figure 8, low- and high-variability categories are based on the Phase I study-wide nonparametric estimators listed at the bottom of Table 3 and in the legend to Figure 7. For example, very low-variability profiles are defined as those with CVs less than 0.01, the study-wide 25th percentile. Low-variability profiles have CVs between 0.01 and 0.03, the study-wide median (and geometric mean). The very high-variability category includes all wells with CVs ≥ 0.3, the study-wide cutoff for extreme outliers. The mid-level (0.03 ≤ CV < 0.1) and high-variability (0.1 ≤ CV < 0.3) categories were more subjectively defined, as they are based more on visual examination of the log-transformed distribution shown in Figure 9 than on discrete summary statistics. (Use of summary statistics such as the 75th percentile [study-wide CV of 0.08] or the non-outlier maximum [CV = 0.17] proved to be unwieldy for both discussion and illustration purposes.)

The categories defined above are intended only as general guidelines to aid interpretations of the site-specific results that follow. All results should be interpreted with the caveat presented earlier: the CV alone is not meaningful unless the shape and range of a well's SC profile are examined along with other factors, such as well construction and lithology.

As a prelude to Section 4, Figure 10 shows the relative ranking of sites profiled during Phase I of the Variation Project. Again, this is intended only as a general framework within which to compare sites. Because this ranking is based on the median CV, some wells with high variation at low-ranking sites such as Bluewater and Monument Valley are not reflected. One of the purposes of the next section is to evaluate those exceptions.

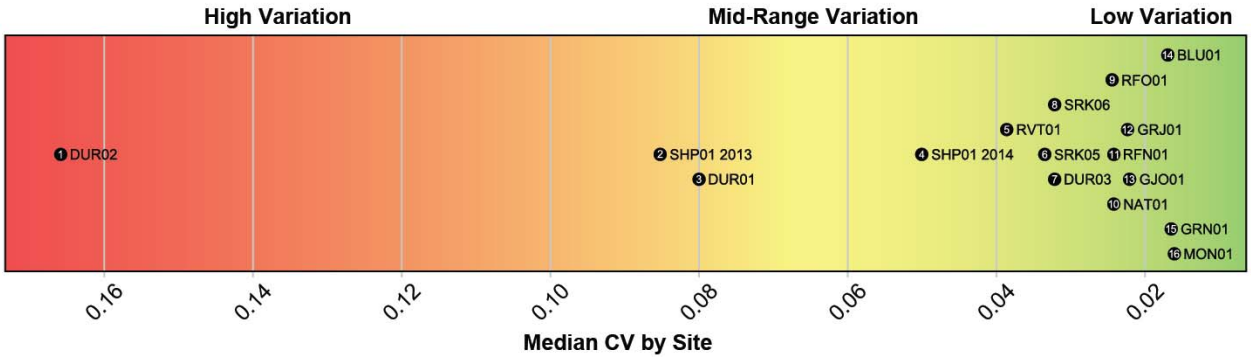

Figure 10. Relative Ranks of Variation in SC Profiles Based on Phase I Results

Ranks based on the median of CVs determined for all well SC profiles at a given site. Site codes are cross-referenced in Table 3, which also lists relevant summary statistics. This schematic is intended as an overview, as even sites with low ranks (e.g., the Green River disposal site or GRN01) had some wells with high variation.

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4.0 Site-Specific Results

This section summarizes results of SC profiling for each of the 15 sites included in the Phase I field study. For each site, a synopsis of overall results is provided, but the focus is on the sites and wells with the most highly varying SC profiles. Appendix A provides detailed site-specific summary tables documenting the CV and other indices of variation for each well's SC profile.

4.1 Bluewater, New Mexico, Disposal Site

SC profiling was conducted at the Bluewater disposal site October 21–23, 2014. Sixteen wells were profiled—6 screened in the alluvial aquifer and 10 in the San Andres aquifer (Figure 11).

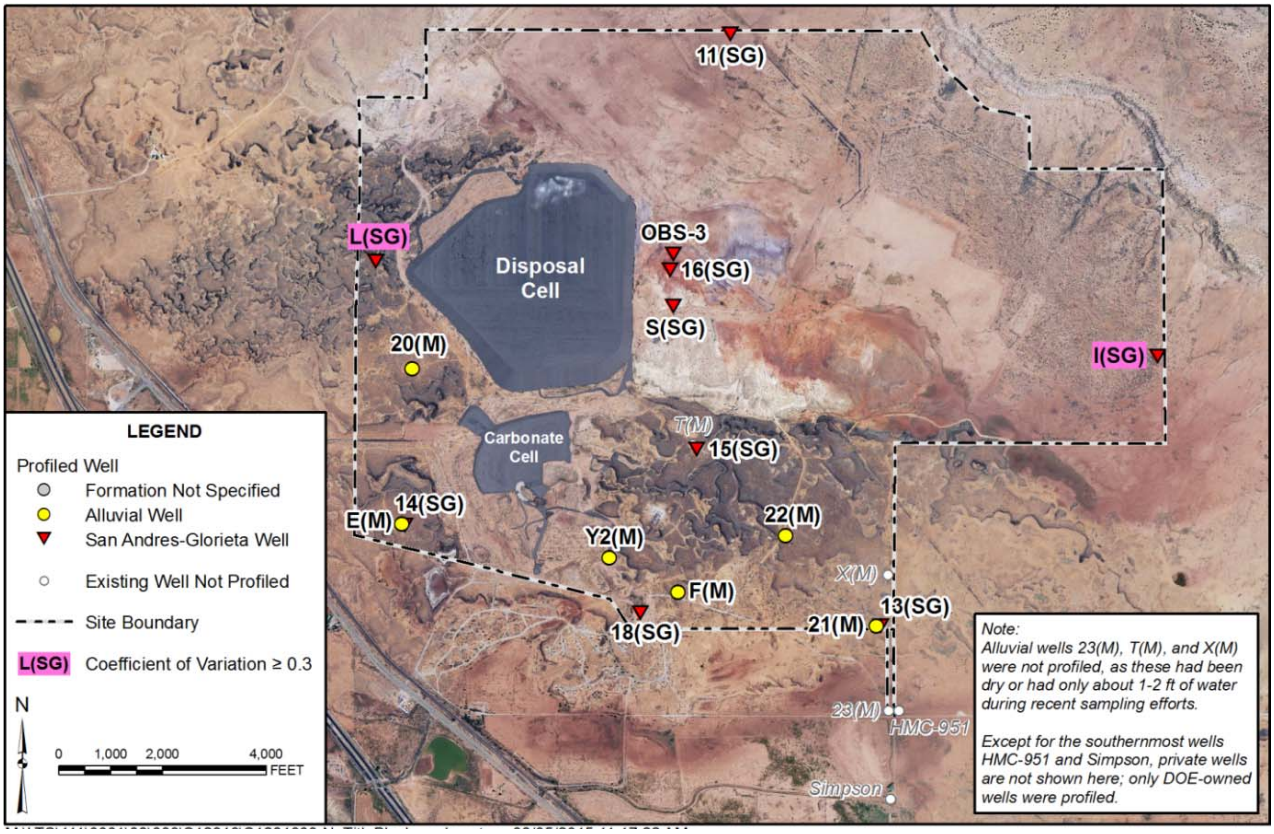
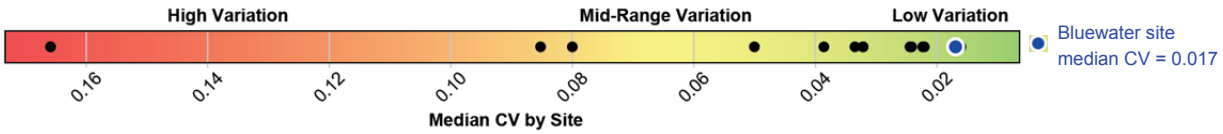


Figure 11. Wells Profiled at the Bluewater, New Mexico, Disposal Site, October 2014

As shown in the inset below, which was adapted from Figure 10, the Bluewater site ranked low based on the median CV for the site, denoted by the larger point toward the right side of the plot.



Despite this low rank overall, as shown in Figure 6 (see outliers) and discussed below, several Bluewater wells had highly varying profiles. Vertical SC profiles for wells profiled in October 2014 are shown in the StickBall plot in Figure 12; supporting data are provided in Appendix A, Table A-1.

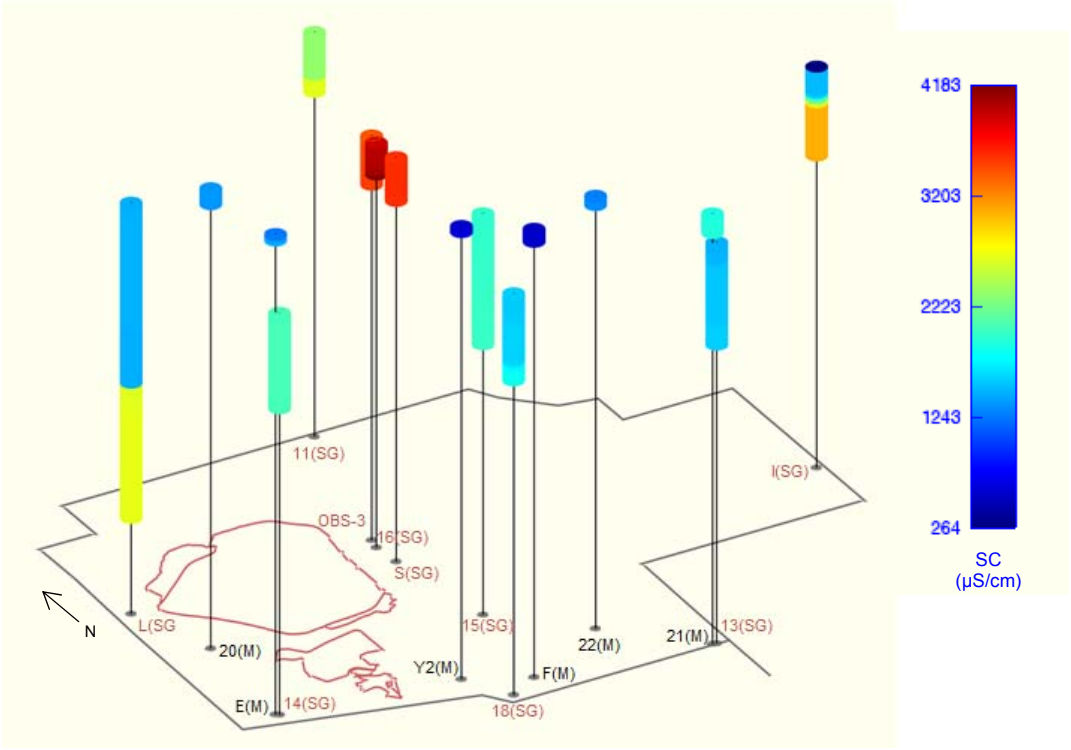
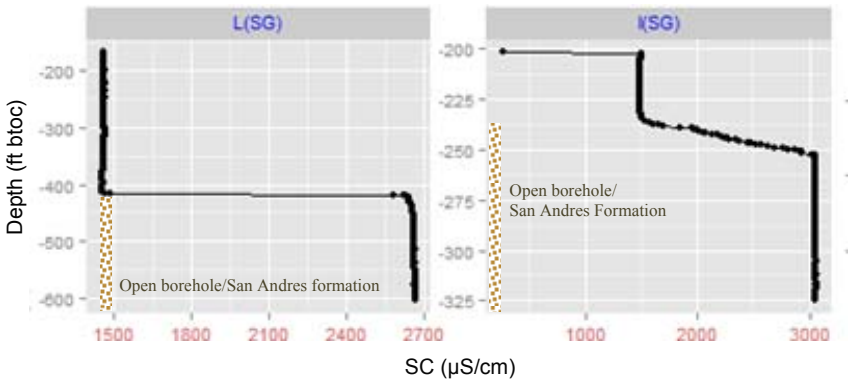


Figure 12. StickBall Plots of Specific Conductance in Bluewater Site Wells, October 2014

Red and black lines denote disposal cell/tailings areas and the site boundary, respectively.
Red labels denote San Andres aquifer wells; remaining wells are alluvial wells.

Of the 16 wells profiled at the Bluewater site, the two San Andres aquifer wells with open-borehole construction, L(SG) and I(SG), had notable variation in their SC profiles (CVs = 0.3; see inset below). L(SG) is a background well, and I(SG) is the farthest downgradient well used to monitor the San Andres aquifer and a point-of-exposure (POE) well at the site. Remaining profiled Bluewater site wells had low- to mid-range variation.



Well L(SG) has about 410 feet of solid casing, with about 200 feet of open borehole through the San Andres/Glorieta Formations. The marked threshold in this well's SC profile, where SC nearly doubles, corresponds to the beginning of the open borehole/San Andres contact (within the open borehole, SCs were consistent at about 2700 µS/cm).

This threshold, as well as the significant variation measured in the SC profile for POE well I(SG), is apparent in Figure 13. This figure plots the same data shown in Figure 12, but without the vertical (depth) component. To provide a historical context for the most highly varying wells (top 5 ranks), the black vertical line to the left of the plots shows the range of historical SC measurements since 2000. For L(SG) and POE well I(SG), the range of SC measured in the vertical profile in one day could in theory explain the range of historical results.

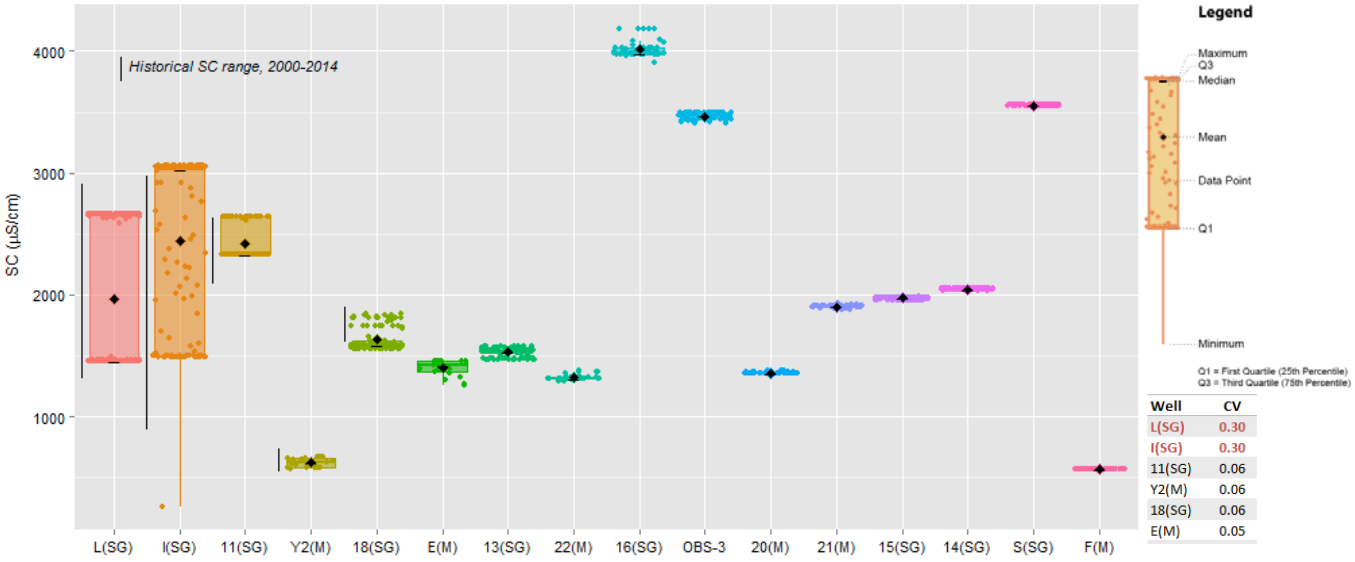


Figure 13. Box Plots of SC in Bluewater Site Wells, Ordered by Descending CV

Note: SC profiles could not be completed at San Andres wells S(SG) and OBS-3, so the low variability shown for these wells in this figure may not be representative of the full profiles. CVs are listed to the right for those wells with CVs > 0.03; CVs for remaining wells were < 0.03 (7 of 16 profiles had CVs < 0.01, Table A-1).

At L(SG), the range in historical SC since 2000 (1317–2913 µS/cm) might reflect the fact that until 2012 the well was sampled using low-flow sampling methods, but samples were apparently collected within the blank casing, because the remainder of the well (the uncased borehole) had filled in with sediment, likely grout that sifted down into the borehole. The sediment was pumped out in 2012; since then, samples have been collected from within the open borehole.

Although the variation found in background well L(SG) may not be important from a regulatory perspective, it is potentially relevant to site characterization efforts. Vertical variation in chemistry measured in POE well I(SG), however, is important from a regulatory perspective, as demonstrated in Figure 14. This figure plots historical monitoring results for well I(SG) for SC and uranium, a key contaminant of concern at the Bluewater site. To facilitate comparison with historical results, SC values measured during the October 2014 profiling effort are also plotted along the right *y*-axis.

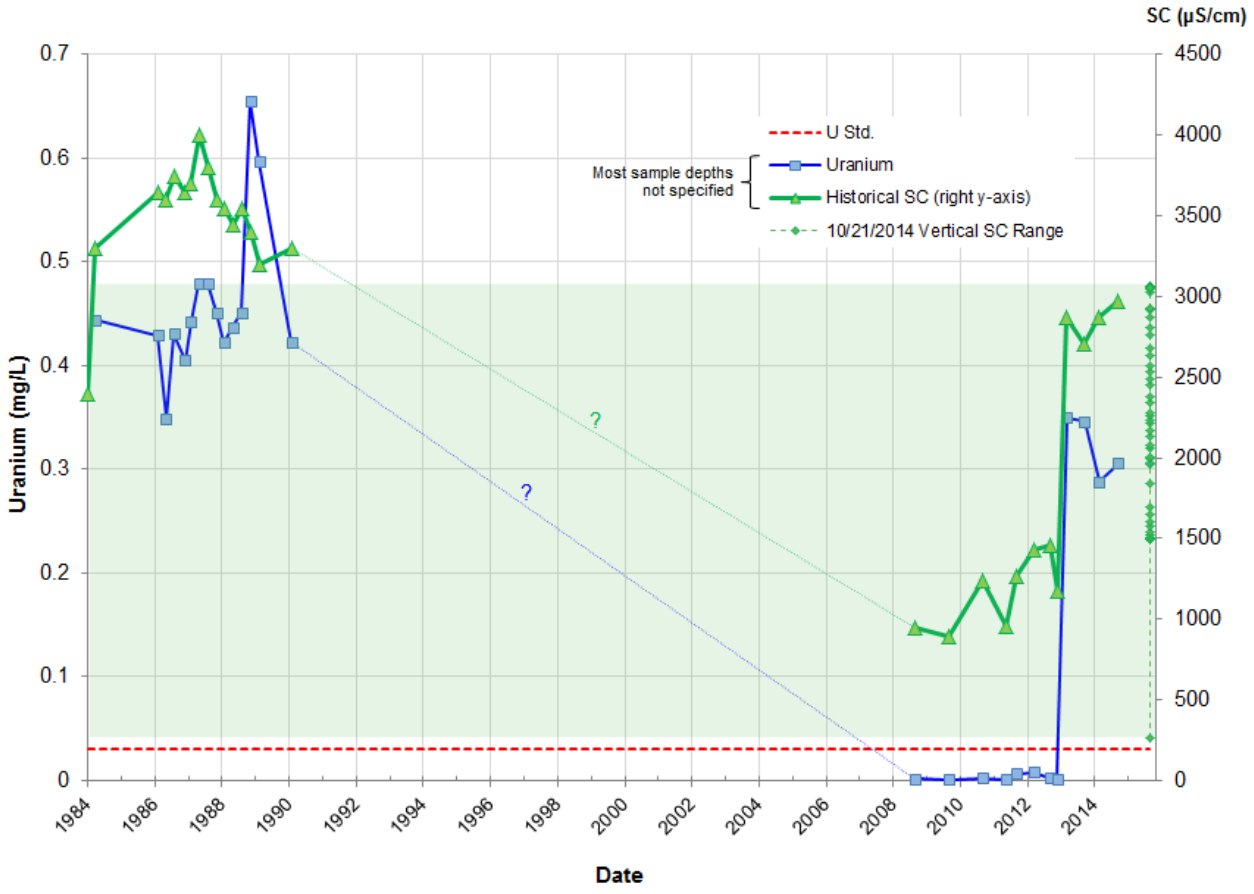


Figure 14. Historical SC and Uranium Trends in Bluewater Well I(SG) vs. Vertical Profile

Green-shaded area denotes range of SC measured vertically in a single day. The gap in the data between 1990 and 2008 stems in part from site remediation activities conducted between 1991 and 1995; the site was transferred to DOE in 1997. The dotted lines in the central segment of the plot are provided only to illustrate the magnitude of differences in SC and uranium between 1990 and 2008. No monitoring data were collected during that period, and historical fluctuations are not known.

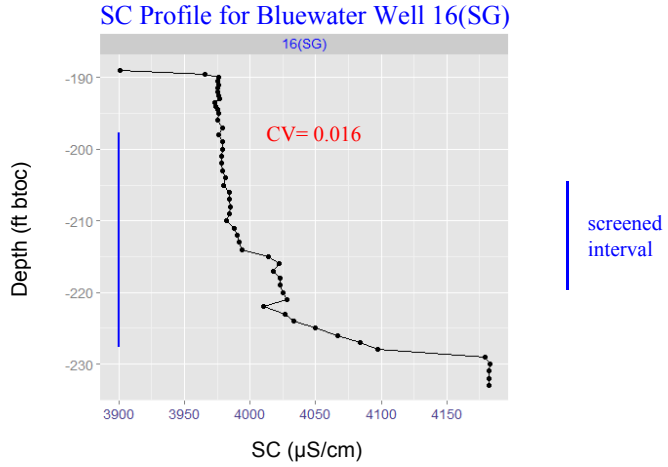
The lower uranium concentrations measured between 2008 and 2013, 0.001–0.008 milligram per liter (mg/L), were assumed to indicate that uranium contamination was decreasing at well I(SG) (DOE 2014a). When DOE resumed monitoring of the well in 2008, low-flow samples were collected from within the solid casing just above the open borehole portion (there was an apparent discrepancy between the well log and actual well construction). In May 2013, a downhole camera was used to verify well construction information, and limited vertical profiling of SC and uranium was also conducted, providing the first evidence of vertical stratification in the well. This preliminary profiling revealed increases in both SC and uranium with depth in the open borehole.

Since those observations, samples have been collected from within the open borehole (vs. the solid casing), which accounts for apparent increases in SC and uranium after 2012 (Figure 14). The low concentrations of uranium measured in samples collected at shallower elevations in well I(SG) between 2008 through 2012 were not reflective of actual conditions in the San Andres aquifer. Rather, the higher concentrations measured at greater depths are now considered

representative of the surrounding aquifer, contradicting an earlier hypothesis that uranium concentrations at this location had decreased.

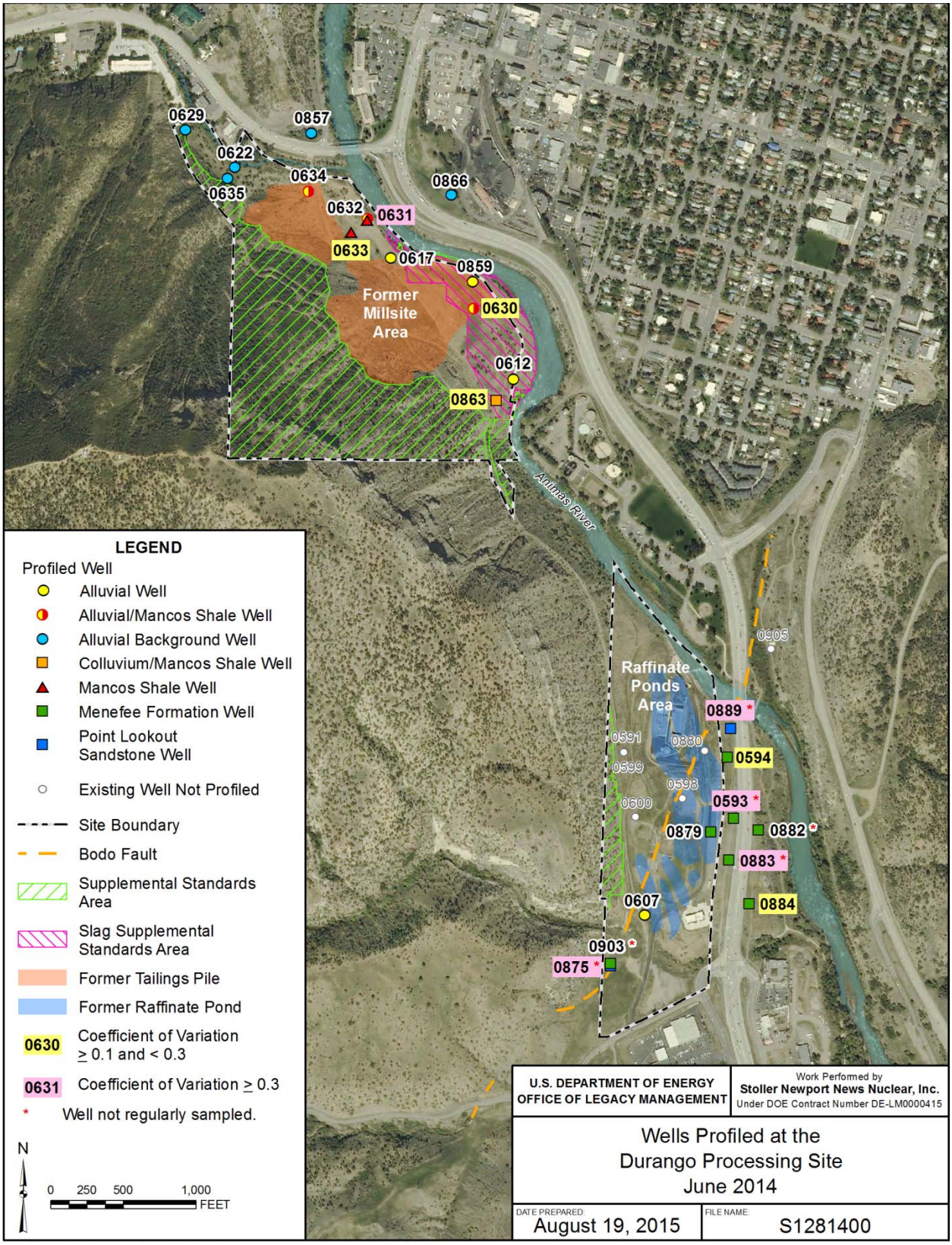
Given the apparent correlation between SC and uranium shown in Figure 14, the range of SCs measured in the well during one afternoon in October 2014 could potentially explain the range of SC and uranium concentrations measured since 2008. Although Bluewater ranked low overall based on the median CV for the site (Figure 6), the variability in a single well—POE well I(SG)— is important, because the interpretation of groundwater contaminant trends and plume movement at the site depends on the data from (and the methods used to monitor) this well.

Complete profiles could not be obtained at two point-of-compliance (POC) wells screened in the San Andres aquifer, OBS-3 and S(SG), located directly east of and a short distance downgradient from the main tailings disposal cell (Figure 11). Uranium concentrations in these POC wells have been highly variable as a result of intra-borehole chemical reactions that are not representative of the surrounding aquifer material (DOE 2014a). Given these observations, and the fact that the wells are also highly corroded, DOE has recommended that wells OBS-3 and L(SG) be decommissioned. Because of the importance of this region of the site to assessing contaminant movement over time, a new well, 16(SG), was installed just south of OBS-3 in June 2012. Well 16(SG) is now considered most representative of contaminant conditions immediately downgradient of the disposal cell (DOE 2014a). As shown in the inset below, SC measurements did not vary much in this well (3901–4183 µS/cm), especially within the screened interval.



4.2 Durango, Colorado, Processing Site

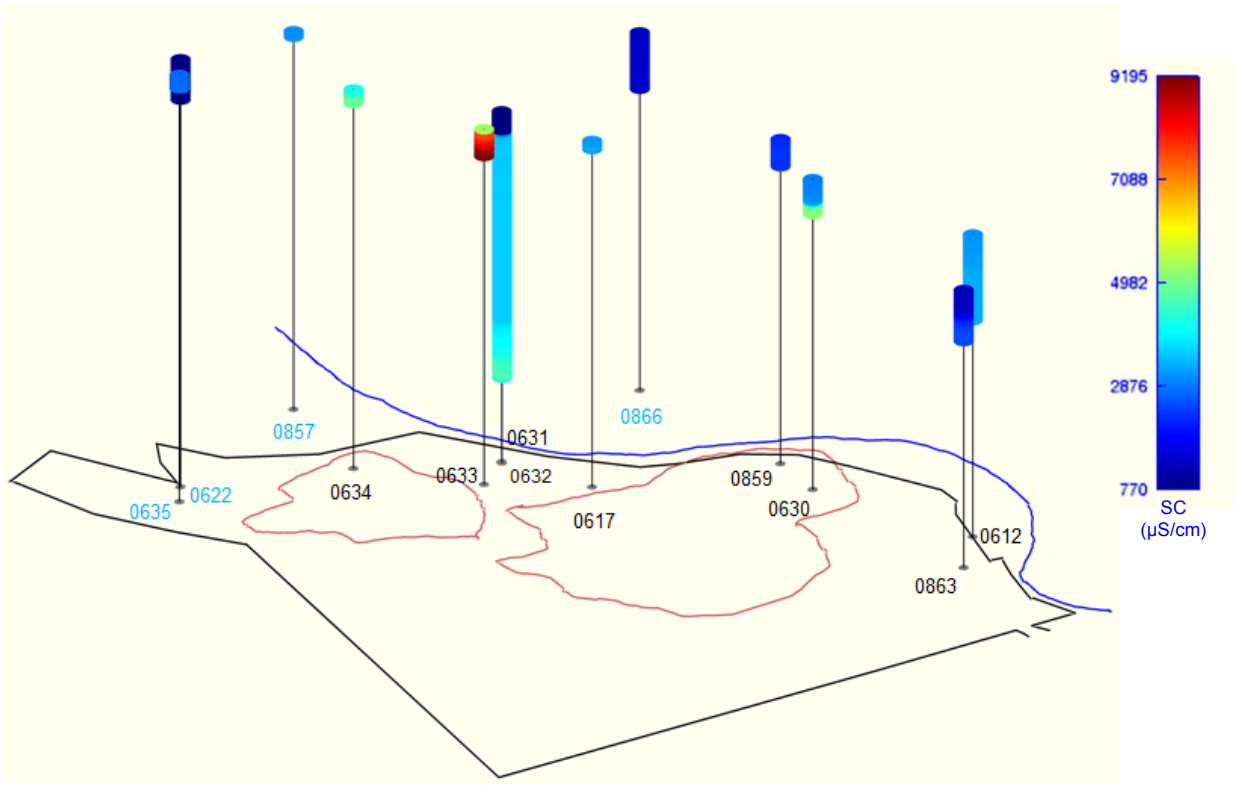
SC profiling was conducted at the Durango processing site June 26–27, 2014. Thirteen wells were profiled at the mill tailings area, and 10 wells were profiled at the raffinate ponds area (Figure 15). Both areas ranked high in terms of overall variation relative to most other sites profiled for this study (Figure 6, Figure 10). SC profiles for the Durango processing site wells are shown in Figure 16, a simplified schematic reflecting the overall scope and results of the June 2014 profiling effort. Variation in some wells is apparent—for example, at mill tailings area well 0633 and raffinate ponds area wells 0593 and 0889. However, some of the variation in other profiles is masked due to the high SC magnitudes in these wells.



Note: Four wells within the raffinate ponds area boundary (0591, 0598, 0599, and 0600) could not be accessed at the time of profiling; well 0880 could not be found.

Figure 15. Wells Profiled at the Durango, Colorado, Processing Site, June 2014

a. Durango Processing Site Mill Tailings Area



b. Durango Processing Site Raffinate Ponds Area

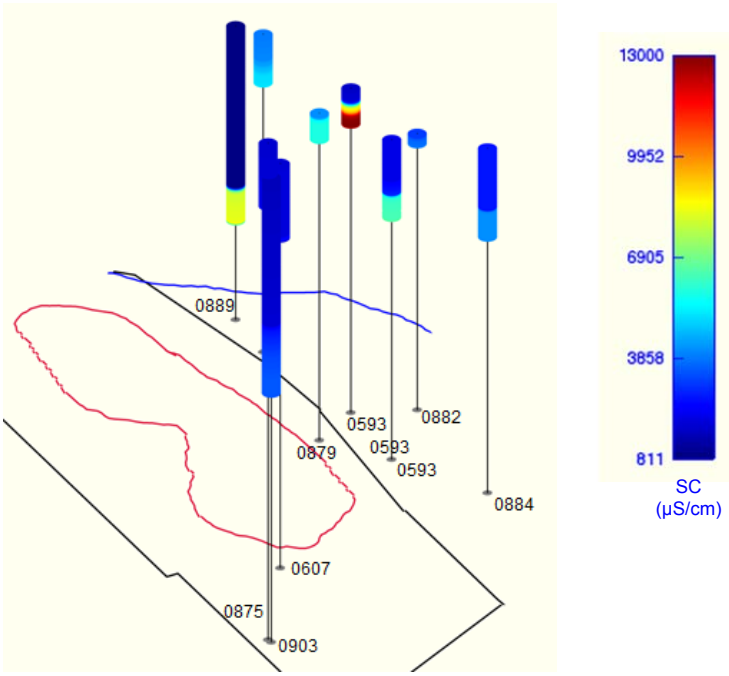
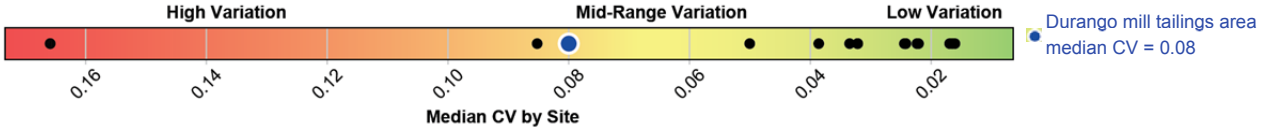


Figure 16. Stickball Plots of Specific Conductance (µS/cm) at the Durango Processing Site

Red, black, and blue lines denote former processing areas, the site boundary, and the Animas River, respectively. In plot 16a, wells with blue labels are background wells for the mill tailings area. Variation is most apparent in mill tailings area well 0633 and raffinate ponds area wells 0593 and 0889.

4.2.1 Mill Tailings Area

As discussed in Section 3 (Table 3, Figure 10), the Durango mill tailings area processing site ranked third in study-wide variability based on the median CV for the site of 0.08.



Of the 13 wells profiled at the Durango processing site mill tailings area, 4 are considered background wells (DOE 2014b, Figure 15). These wells were profiled because of their proximity to the site and because they are regularly sampled. However, because of their low variation (CVs ≤ 0.015), corresponding profile results are not discussed further, nor were they included in the study-wide comparisons discussed in Section 3. Nearly half (4/9) of the onsite mill tailings area wells had highly varying SC profiles (CVs ≥ 0.1), and two had profiles in the mid-level category (Table A-2).

Figure 17 plots SC by depth for the six most highly varying mill tailings area wells; plots are listed in order of descending CV. Screen placement is denoted by the blue lines to the left of each plot; *x*- and *y*- axis scales are unique for each well. There are two common denominators for this subset of SC profiles: (1) SC increases with depth, sometimes markedly, within the screened interval; and (2) all wells are screened, at least partially, in the Mancos Shale. In the three most variable wells—0631, 0863, and 0630 (CVs > 0.1)—SC increases at or near the bedrock (Mancos Shale) contact, but then appears to stabilize.

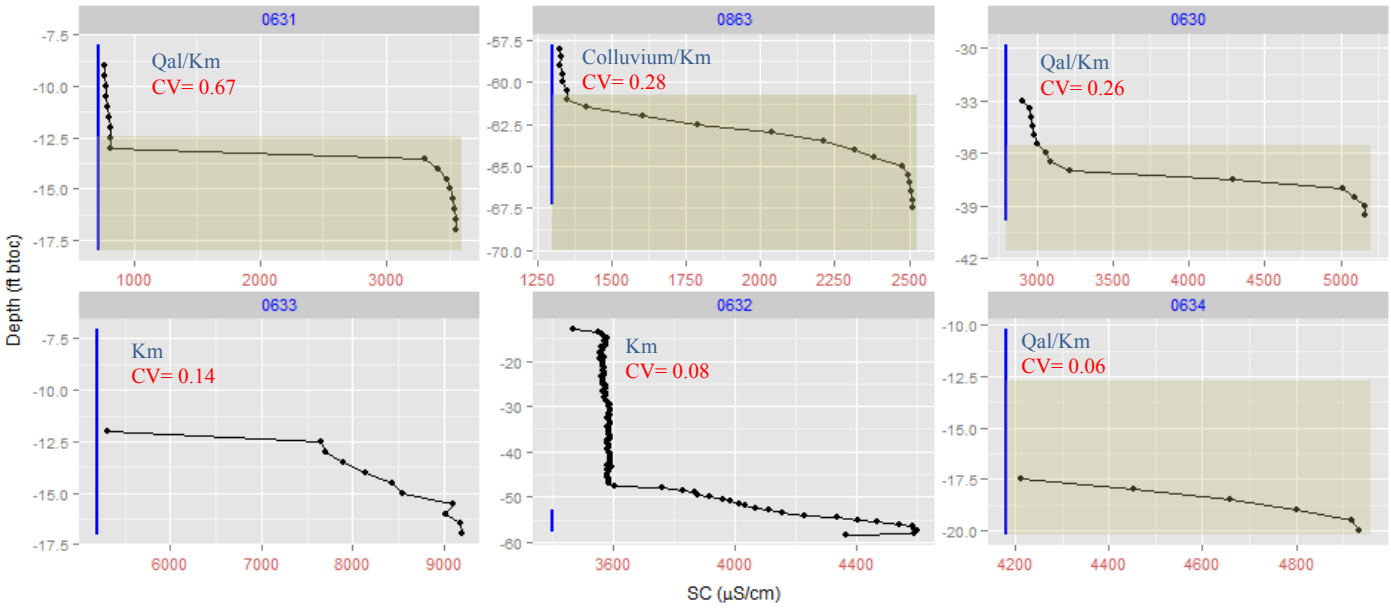


Figure 17. SC Profiles in Durango Mill Tailings Area Wells: Top 6 CV Ranks

Screened interval denoted by blue line (|) near the y-axis of each plot. Wells 0630, 0631, and 0634 are screened in both the alluvium (Qal) and in the Mancos Shale (Km); well 0863 is screened in the colluvium and in the Mancos. For these wells, the Mancos Shale is denoted by the shaded region.

In well 0633, screened entirely in the Mancos Shale, SC increased steadily, from 5318 to 9195 µS/cm, through the saturated portion of the screened interval. SC also increased within the short (5 ft) screened interval at Mancos Shale well 0632; measurements were stable through the overlying blank casing. There was only about 3 ft of water in well 0634 at the time of profiling; SC increased by only about 15 percent (from 4211 to 4934 µS/cm) within the Mancos Shale in this well (CV = 0.06; Table A-2).

A limited review of historical SC and uranium data was conducted to assess whether the variation observed in some of the mill tailings area wells might explain historical variation in these parameters.[4] At well 0631, with the highest CV (0.67), there is an apparent correlation between SC and uranium (Figure 18). Uranium has been elevated in this well, ranging from 0.075 to 0.63 mg/L. Given proximity to the Animas River, changes in river flows might explain some or all of the fluctuation observed in well 0631. However, as with a number of wells in this study, the range in SC measured in the vertical profile for well 0631 could explain the range in SC over time.

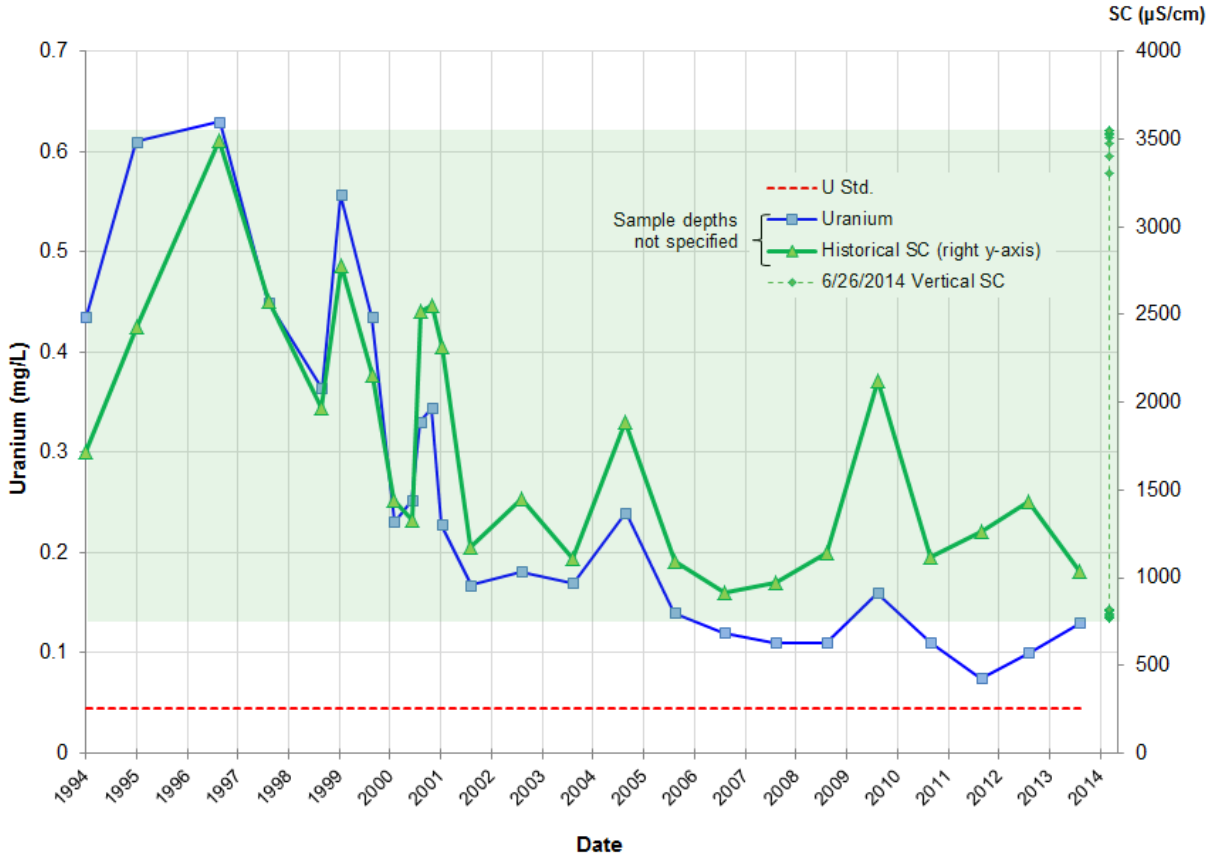


Figure 18. Historical Trends of SC and Uranium in Durango Mill Tailings Area Alluvial Well 0631

Shaded area denotes range of SC measured vertically in a single day.

[4] As noted in Section 1.2 (Scope of this Report), it was not possible during this phase of the Variation Project to review the historical monitoring record for most wells, even those with highly varying SC profiles.

Well 0863 had the second most variable SC profile of the mill tailings area wells, with a CV of 0.28 (Table A-2). This well is screened mostly in the colluvium, but also partially in the Mancos Shale.[5] At this well, SC nearly doubled (from 1324 to 2514 µS/cm) within the screened interval in the region of the colluvium/Mancos Shale contact (Figure 17). Contaminant concentrations have been low in this well, however, so the observed variation may not be important from a compliance perspective.

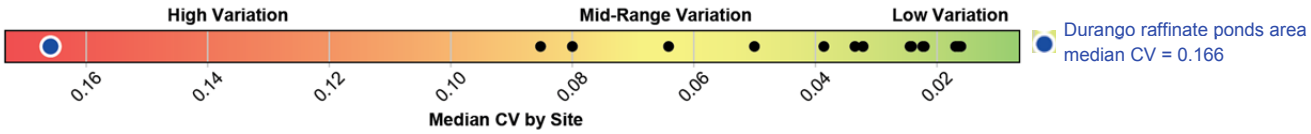
At well 0630 (3rd rank with a CV of 0.26), where uranium concentrations have been consistently high (0.23–0.29 mg/L), there is no apparent correlation between SC and uranium based on historical monitoring results. At Mancos Shale well 0633 (4th rank with a CV of 0.14), the range in the SC profile was the largest of all wells profiled at the site, 5318-9195 µS/cm (vs. historical range of 4020–7708 µS/cm). Both uranium and sulfate have been elevated in this well, and there is also an apparent correlation between sulfate and SC. This correlation between SC and sulfate is consistent with analytical results of samples from groundwater seeps in Mancos Shale throughout the Colorado Plateau (DOE 2011).

The lower CV (0.08) calculated for the SC profile for Mancos Shale well 0632 is explained by the large number of consistent measurements within the blank casing (Figure 17, Table A-2). However, the increase in SC within the screened interval may warrant further examination. This well has been sampled only once, in April 2001, apparently due to a lack of water (DOE 2014b), a condition that no longer applies. SC and uranium concentrations measured in the single (2001) sample were 3030 µS/cm and 0.018 mg/L, respectively.

Uranium has fluctuated widely in well 0634 (0.01 to 0.18 mg/L), above and below the 0.044 mg/L 40 CFR 192 standard. However, there is no apparent correlation between uranium concentrations and SC based on historical monitoring results. As stated previously, the short saturated thickness limits any conclusions that can be drawn regarding variation in this well.

4.2.2 Raffinate Ponds Area

Relative to other LM sites investigated during the Phase I study, the raffinate ponds area at the Durango processing site had the highest overall variation in the SC profiles (Figure 6, Figure 10), with a median CV of 0.17.



Based on the categories defined in Section 3 (Figure 9), 6 of the 10 wells profiled had highly variable SC profiles (CVs ≥ 0.1); four of those wells had very high variation (CVs ≥ 0.3). CVs for the remaining four wells profiled ranged from 0.05 to 0.09 (Table A-3). No wells at this site fell into the low variation category (CV < 0.03). Five wells within the site boundary—0591, 0598, 0599, 0600, and 0880—could not be accessed at the time of profiling (Figure 15).

[5] According to the well log for well 0863, the Mancos Shale occurs at a depth of 67–74.5 ft below ground surface (bgs). However, based on notes in the log indicating increasing clay content at 60 ft bgs, it appears that the contact with weathered Mancos may actually be at that (60 ft) depth.

Figure 19 plots SC by depth for the most highly varying raffinate ponds area wells. Four of the most variable wells at the site, with CVs ≥ 0.3—wells 0889, 0593, 0883, and 0875—have not been sampled since 2001–2002. At that time, uranium concentrations were low in all four wells (<0.003 mg/L). Based on the five early measurements, sulfate correlated with SC in well 0889, but concentrations were fairly low (<2700 mg/L). Sulfate concentrations were high, however, in well 0593 (6730–10,000 mg/L) and correlated with SC. This well had the highest SC and also the greatest range in the profile (1705–13,000 µS/cm).

Given the historically low uranium in these wells, variation in the SC profiles might not be important from a compliance perspective. However, Figure 19 is a good example of how, theoretically, if SC co-varies with contaminant concentrations, sampling at different depths could affect interpretations of temporal trends. At wells 0884 and 0889, not sampling consistently within the screened interval (e.g., inadvertently sampling from the upper blank casing) could result in anomalous trends in the data. The SC profile in well 0593 is different in that SC varied greatly (≈10,000 µS/cm) within the screened interval over just 10 ft.

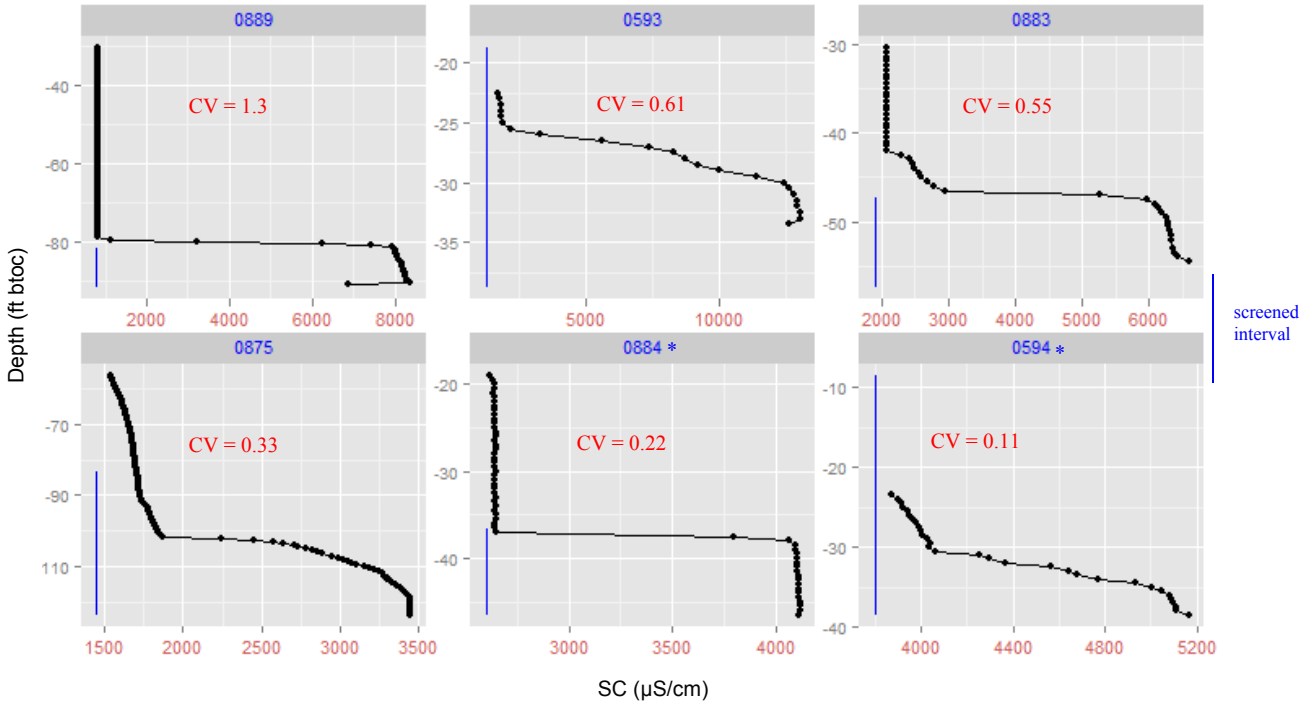


Figure 19. SC Profiles in Durango Raffinate Ponds Area Wells with CVs ≥ 0.1

* denotes well that is regularly sampled; remaining wells have not been sampled since 2001 or 2002.

Only two of the raffinate ponds area wells with high variation in the SC profiles (CV > 0.1) have been regularly sampled: 0594 and 0884 (Figure 19). However, the vertical stratification in SC does not seem to explain the historical variation in SC found in these wells. For well 0594, the vertical SC profile does not explain the range in historical results, and there also no apparent correlation between SC and uranium based on the annual monitoring data. At well 0884, recent historical SC measurements (about 4000 µS/cm) are generally consistent with the higher SC values measured within the screened interval during the vertical profile (Figure 20).

In most cases SC and uranium appear to co-vary in this well, so fluctuations in both SC and uranium in this well are probably explained by other factors (e.g., water levels), and not variable sampling depths.

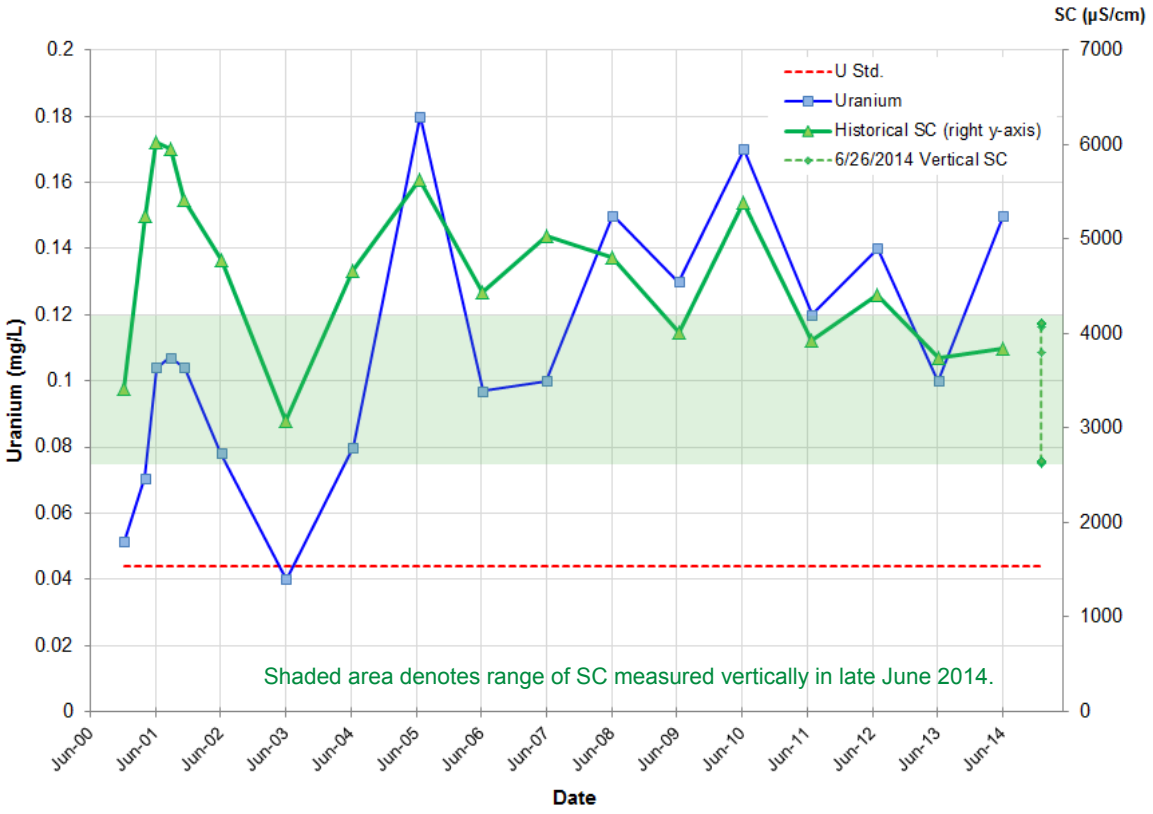
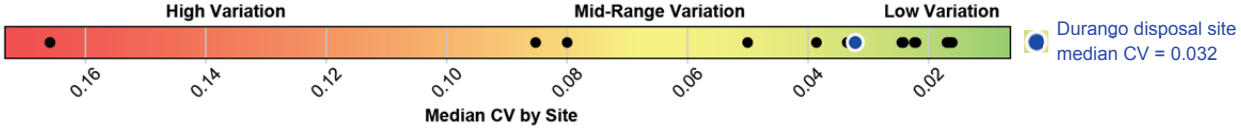


Figure 20. Historical Trends of SC and Uranium in Durango Raffinate Ponds Area Well 0884

4.3 Durango, Colorado, Disposal (Bodo Canyon) Site

SCT profiling was conducted at the Durango disposal site on June 25, 2014. Seven wells were profiled in the vicinity of the disposal cell (Figure 21, Table A-4). Four wells are completed in the uppermost aquifer (bedrock of the Cliff House Sandstone and the Menefee Formations), including one upgradient background well (0605). Three wells—0608, 0618, and upgradient well 0623—are completed in the alluvium, which is not considered an aquifer due to its limited extent (DOE 2015a). Wells 0607, 0612, and 0621 are POC wells at the site. Two wells drilled into the tailings (MW-1 and P7) were not profiled. As discussed in Section 3, the Durango disposal site ranked seventh in study-wide variability based on the median CV for the site of 0.03 (denoted by larger blue point in the inset below; also see Table 3 and Figure 10).



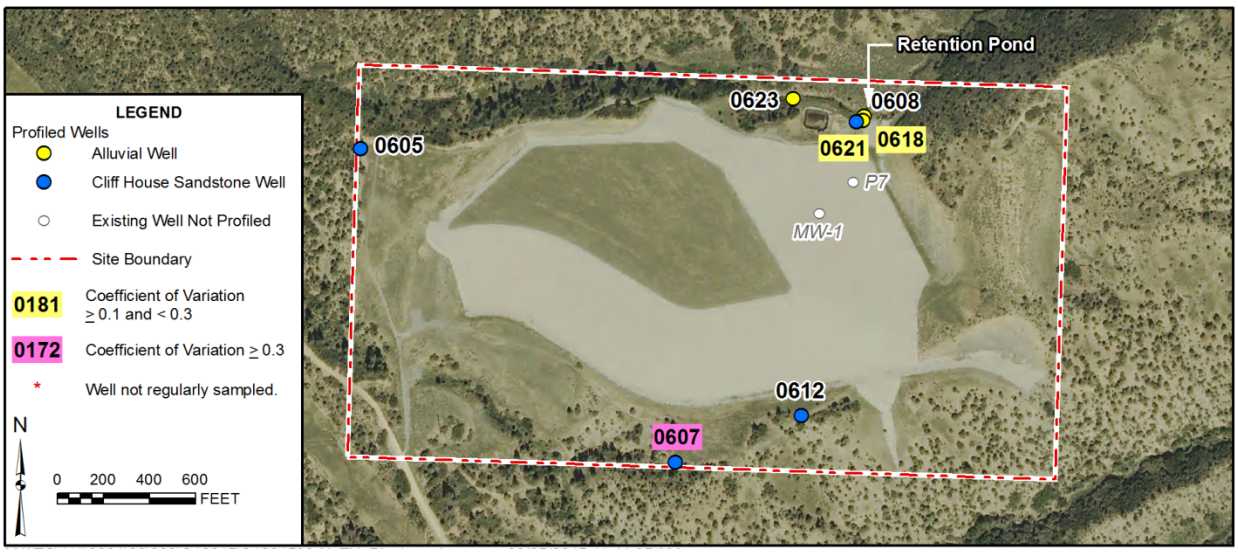


Figure 21. Wells Profiled at the Durango, Colorado, Disposal Site, June 2014

Three of the five non-background wells at the site had high variation in the SC profiles: POC wells 0607 and 0621 and alluvial well 0618. These profiles are shown below (Figure 22), ordered by descending CV.

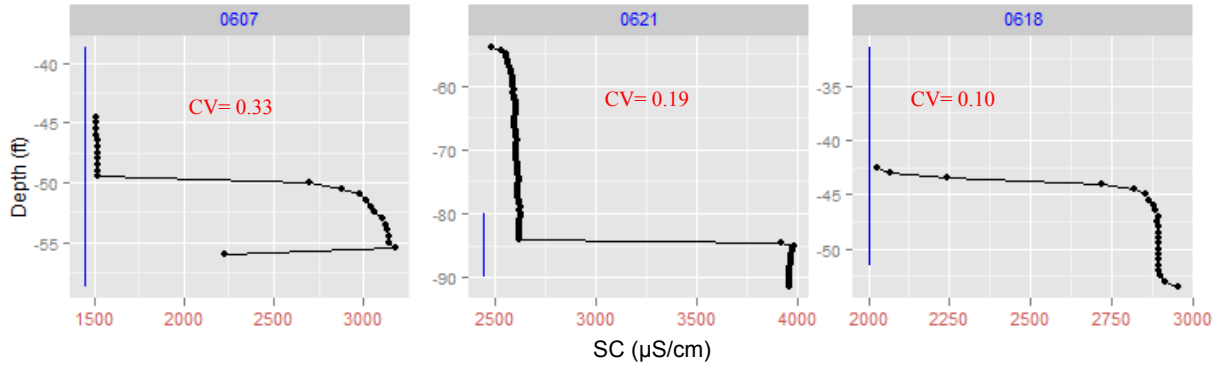


Figure 22. Specific Conductance Profiles in Durango Disposal Site Wells, CVs ≥ 0.1

In POC well 0607 (highest rank in terms of variation), SC magnitudes more than double in the central portion of the screened interval. Limited review of historical monitoring data for this well and for 0621 indicates no correlation between SC and uranium, which has been at or below detection limits (0.003–0.01 mg/L) in both wells.

However, at alluvial well 0618, downgradient from the toe drain and the retention pond, historical SC trends appear to correlate roughly with those for uranium, which has increased by nearly an order of magnitude since 2003 (Figure 23). This is another example of a case in which most or all of the range in SC over a decade can be explained by the range of the vertical profile taken in a single day. This increasing uranium trend in well 0618 has been the catalyst for increased sampling frequencies (now monthly) and a proposed study of the current and future flux rates to the groundwater system. Future profiling of this well (e.g., for SC, uranium, and other constituents) might shed some light on observed historical trends.

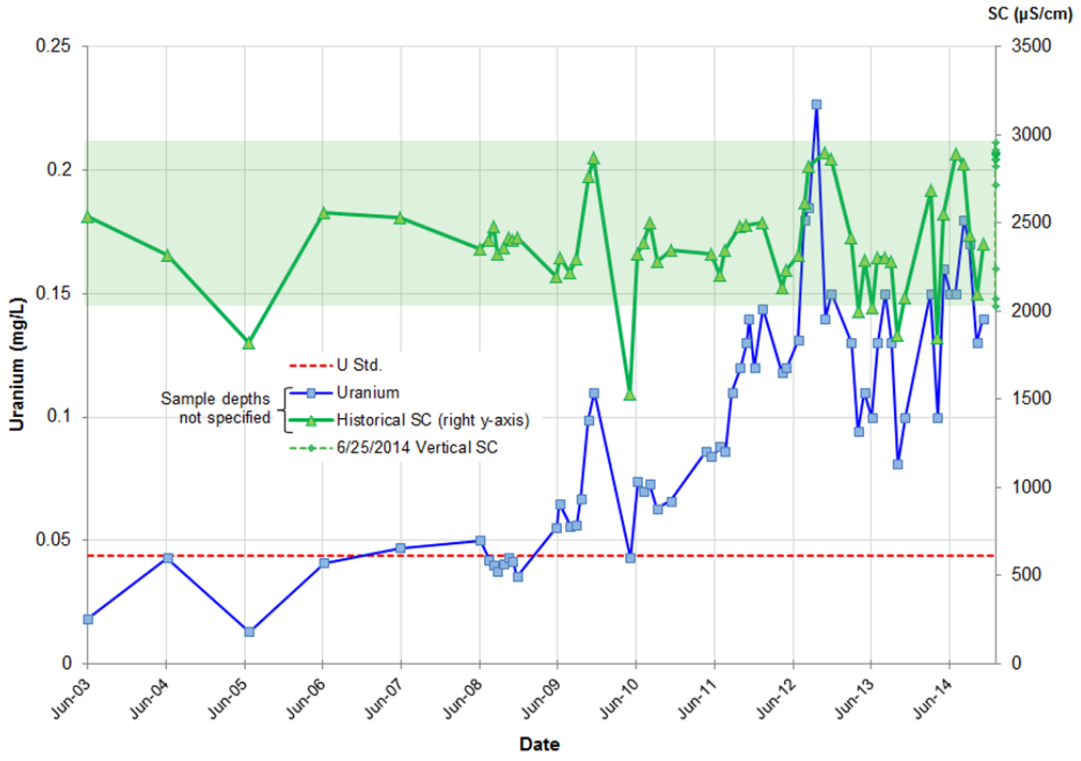
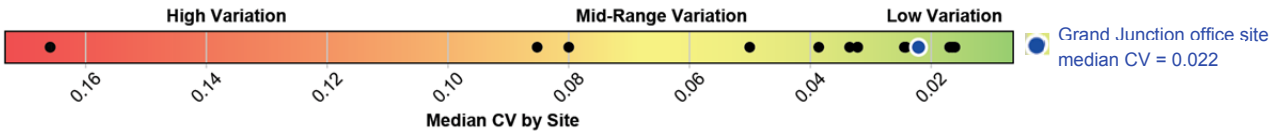


Figure 23. Historical Trends of SC and Uranium in Durango Disposal Site Well 0618

Shaded area denotes range of SC measured vertically in a single day.

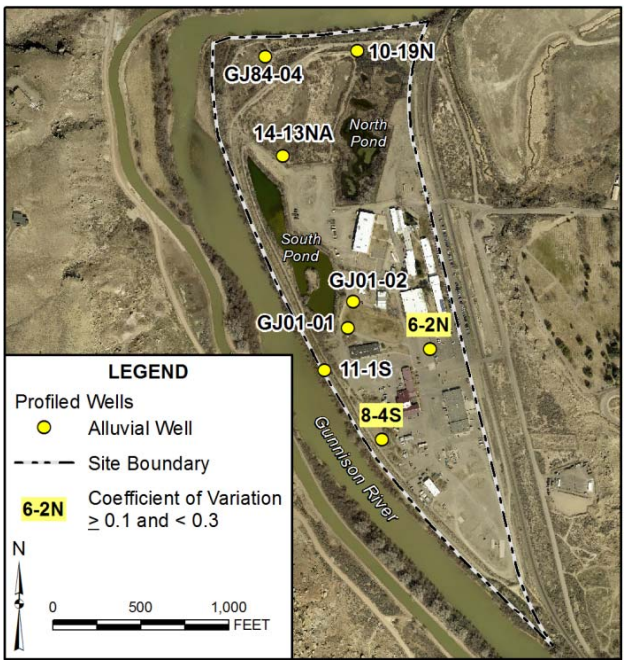
4.4 Grand Junction, Colorado, Office Site

SC profiling was conducted at the Grand Junction office site, one of the first sites to be profiled for the Variation Project, in July and August 2013. Eight alluvial wells were profiled, shown in the location map and StickBall plot in Figure 24. Overall, the site ranked low (13th of 16 site profiles) based on the median CV for the site of 0.02 (denoted by larger blue point in the inset below, which was adapted from Figure 10).



This relatively low site rank reflects the fact that six (75%) of the eight wells had very little variability in the SC profiles, with CVs ≤ 0.03 (Figure 25, Table A-5). However, two wells, 8-4S and 6-2N, had SC profiles with CVs of 0.1 or greater. In March 2013, a SOARS station was installed at well 8-4S to monitor water levels and conductivity in the well in support of the AS&T plume persistence project. Review of the SOARS data, indicating variable SC with depth and over time, was a catalyst for profiling at the site.

a. Aerial Photo of Grand Junction Office Site



b. StickBall Plot of SC Profiles (µS/cm)

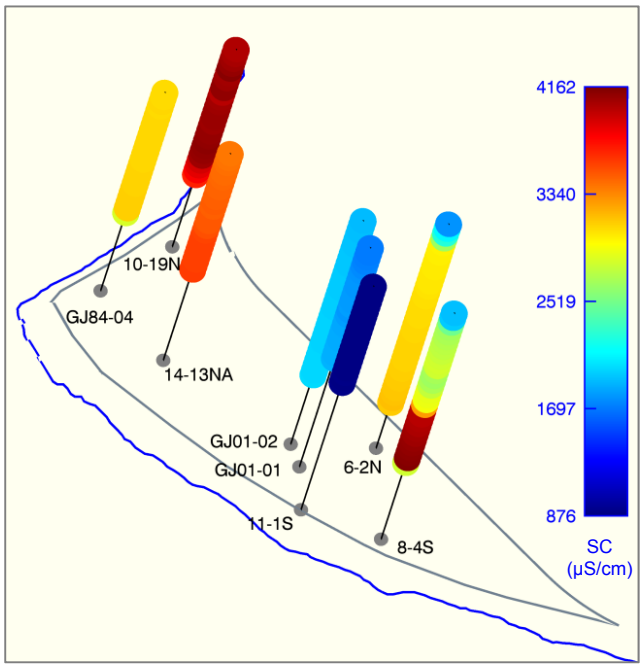


Figure 24. Grand Junction Office Site Profile Locations and Corresponding StickBall Plot

In the StickBall plot (Figure 24b), the image is tilted somewhat to facilitate review of results for closely spaced wells.

a. SC by Elevation in All Profiled Wells

b. SC by Elevation in Wells with CVs ≥ 0.1

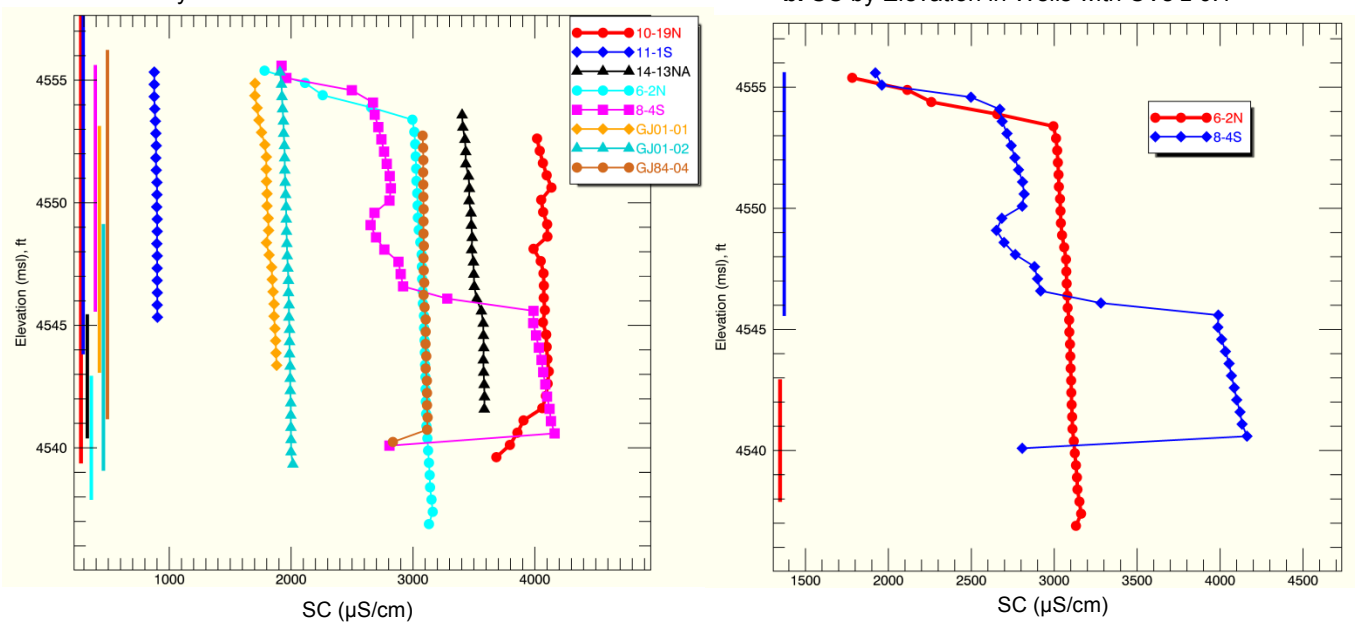


Figure 25. Vertical SC Profiles in Grand Junction Office Site Wells

Vertical lines next to *y* axes denote screened intervals.

As shown in Figure 25, most Grand Junction office site SC profiles are fairly flat. Well 6-2N had a fairly high CV of 0.1, due to increases in SC in the uppermost part of the water column. However, there was little variation through the remainder of the profile, and SCs were homogeneous throughout the screened interval. This example demonstrates an important point made in Section 3, the caveat regarding use of the CV as the sole indicator of variation.

The profiles in Figure 25 indicate that only well 8-4S has notable variation in the SC profile (CV = 0.22). Historically, uranium has been elevated in this well (0.1–0.67 mg/L); the maximum is the most recent (February 2015) measurement. Although the range in vertical SC measurements from the July 2013 profile (1922–4162 µS/cm) could explain most of the range in SC measurements since 2000 (1672–4614 µS/cm), there is no apparent correlation between SC and uranium and molybdenum, the primary contaminants in this well.

4.5 Grand Junction, Colorado, Processing (Climax) Site

SC profiling was conducted at the Grand Junction processing site in April 2014. Only four alluvial wells were profiled: 0590, 0748, 1001, and 1036 (Figure 26). These are the only existing wells at the site except for a Bureau of Reclamation well that was not accessible at the time of profiling. Data supporting this discussion are provided in Appendix A, Table A-6.

Figure 26. Wells Profiled at the Grand Junction Processing Site, April 2014

On the basis of the median CV of 0.02, the Grand Junction processing site ranked low (12th of 15 sites), although with only four wells profiled, a site rank is probably not meaningful. (Site median CV denoted by larger blue point in the inset below, adapted from Figure 10).

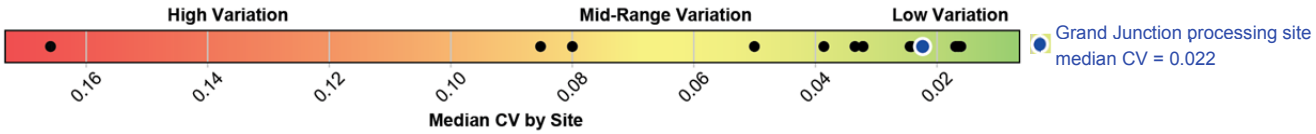


Figure 27 shows corresponding StickBall and vertical profile plots. One well, 0748, had high variation (CV of 0.095; Table A-6). Due to the small number of wells profiled and the fact that this site is not regularly monitored, not much interpretation is possible. SC and uranium measured in well 0748 in January 2011 were 6484 µS/cm and 0.049 mg/L, respectively (there are no other results for this well in the LM database). The 2011 SC measurement is consistent with the maximum measured in the vertical profile (6456 µS/cm). Based on the changes in SC in just 6 ft of casing in well 0748, if this well were regularly monitored, and especially if results were used as the basis for compliance decisions, it might be important to record and account for sample depths.

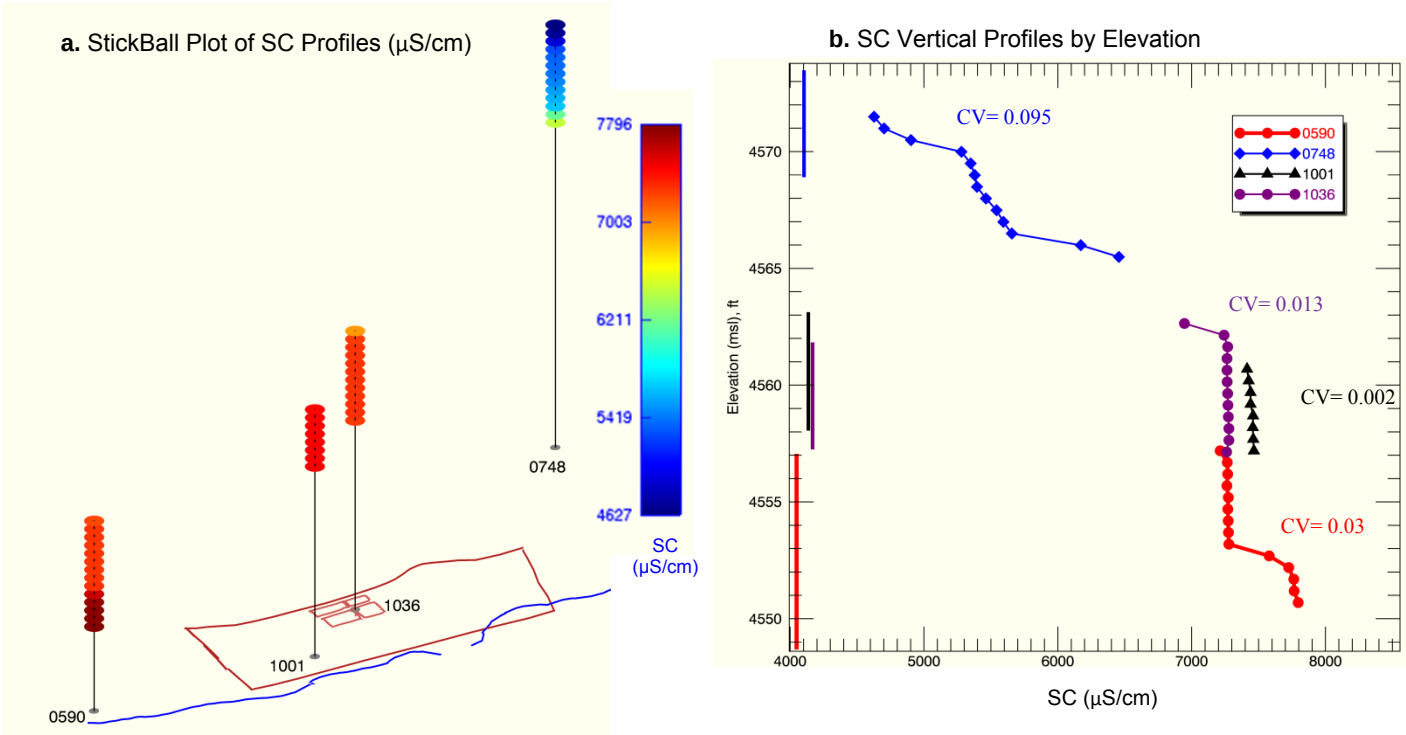


Figure 27. StickBall and Vertical Profile Plots of SC at the Grand Junction Processing Site

In 27a, red and blue lines denote former tailings areas and the Colorado River, respectively.

4.6 Green River, Utah, Disposal Site

SC profiling was conducted at the Green River disposal site in May 2014 (Figure 28). Eleven of the 20 wells profiled are completed in the middle sandstone unit of the Cedar Mountain Formation in the vicinity of the disposal cell. Four wells completed in the deeper basal sandstone unit of the Cedar Mountain Formation and five alluvial wells along Browns Wash were also profiled (Appendix A, Table A-7).

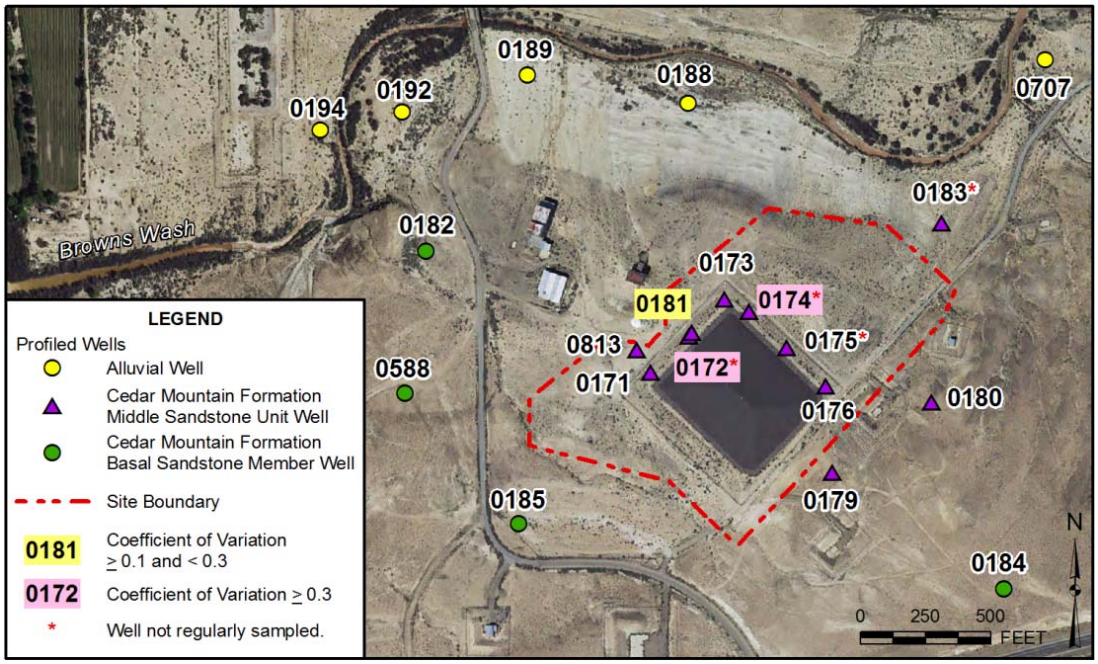
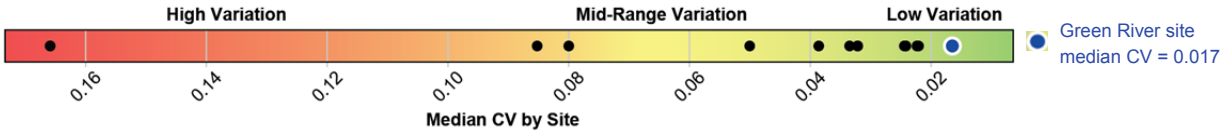


Figure 28. Wells Profiled at the Green River Disposal Site, May 2014

As shown in the inset below, which was adapted from Figure 10, the Green River disposal site ranked low based on the median CV for the site (0.017), denoted by the larger point to the right of the plot. This low rank reflects the fact that the majority (15/20, or 75%) of the wells profiled had CVs less than or equal to 0.03.



StickBall plots of SC results for wells with the highest SC variation, those screened in the middle sandstone unit, are shown in Figure 29. Of this subset, three wells in the vicinity of the disposal cell had highly varying SC profiles (CVs ≥ 0.1): wells 0172 (CV = 0.55), 0174 (CV = 0.3), and 0181 (CV = 0.10). Vertical profiles of SC for these three wells are plotted in Figure 30. Of these wells, only well 0181, which is colocated with well 0172, is routinely sampled (Table A-7).

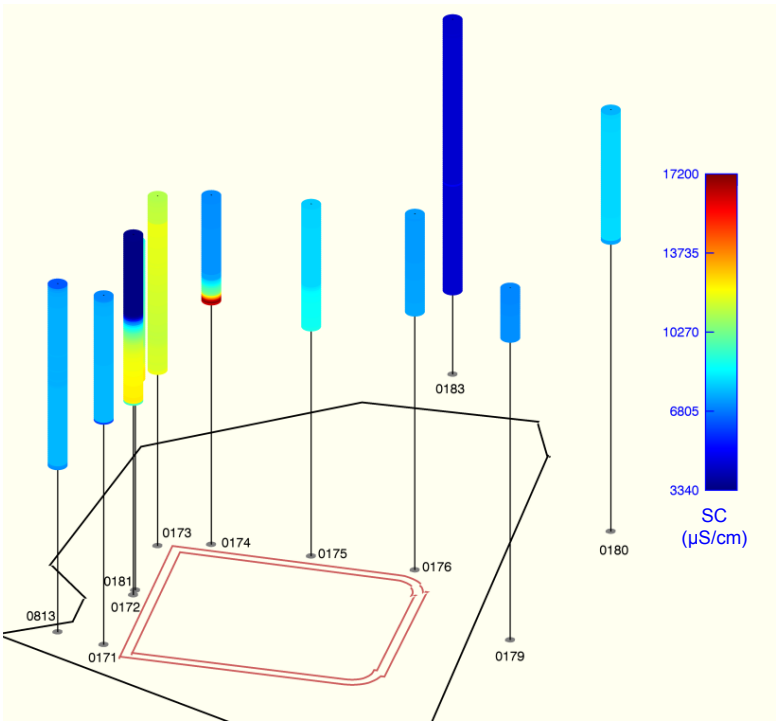


Figure 29. StickBall Plot of SC in Middle Sandstone Unit Wells Near the Green River Disposal Cell

In this figure, the SC profile for well 0181 (8993–12400 µS/cm) is masked by that for adjacent (and more variable well) 0172, with an SC range of 3340–12400 µS/cm.

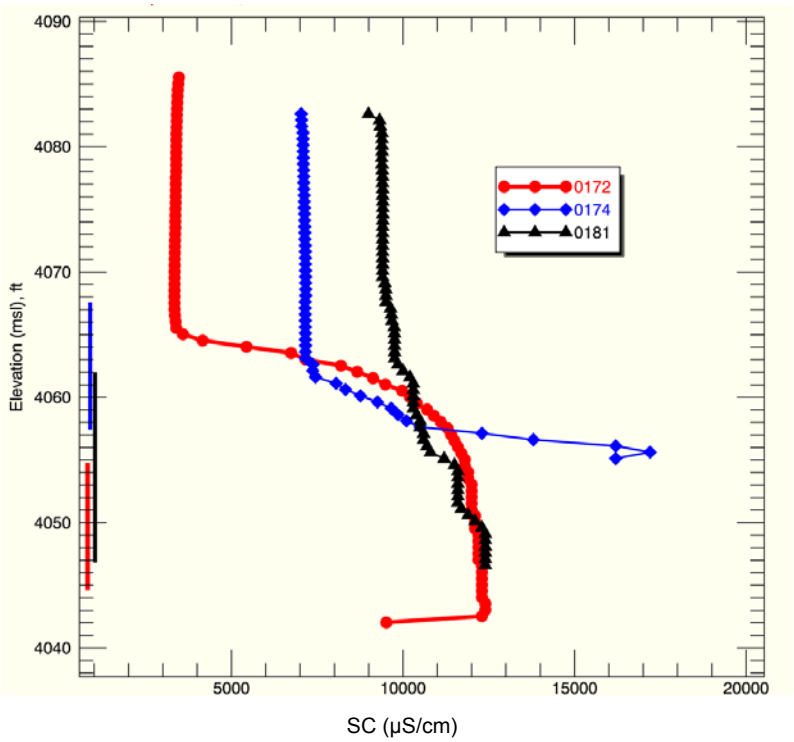


Figure 30. Vertical Profiles of SC for Top 3 CV Ranks in Green River Disposal Site Wells

Vertical lines next to *y* axes denote screened intervals. Of these three wells, only well 0181 is routinely sampled.

In this interim phase of the study, only a limited review of site data was conducted to assess the potential relevance of variation found at the site. The range in the vertical SC profile for well 0172, the well with the highest variation, 3340–12,400 µS/cm, is generally consistent with historical monitoring results. Between 2000 and September 2006, the last time this well was sampled, SCs ranged from 1164 to 14,930 µS/cm (average of 10,833 µS/cm). If sample depths varied during the period this well was monitored, the historical range in SC could be explained by the single-day vertical profile. In contrast, the vertical SC profile at well 0174, with the second highest variation (CV = 0.3) and also no longer sampled, is not consistent with the corresponding historical record. In the 2014 vertical profile, SC ranged from 7033 to 17,200 µS/cm, the largest range obtained in the site SC profiles. In the three samples collected since 2000 (last sample from July 2002), SC ranged from 6500 to 7380 µS/cm. Uranium concentrations in both wells (0172 and 0174) have been low (<0.01 mg/L) since the late 1990s.

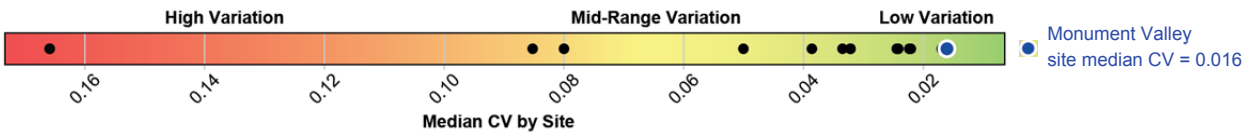
SCs measured during routine sampling at well 0181, with the third highest rank but a much flatter profile than wells 0172 and 0174 (Figure 30), have typically been about 11,000 µS/cm. These historical results are fairly consistent with the range of SCs measured during the 2014 vertical profile (8993–12,400 µS/cm; Table A-7).

In all three middle sandstone unit wells discussed above, SCs measured within the screened interval or in the bottom unscreened portion of the well ranged from about 12,000 to 17,000 µS/cm, indicating relatively high aquifer salinity. This could suggest that groundwater movement in the subsurface is potentially affected by water density.

The highest SCs (on the order of 40,000 µS/cm) were measured in alluvial well 0194 near Browns Wash; the CV for this profile was 0.08. The contaminant plume in the Browns Wash alluvium has had consistently high levels of uranium (>0.3 mg/L, DOE 2014c). Based on historical monitoring results, there is also a fairly strong correlation between SC and uranium in this well. However, the SC profile for well 0194 taken in 2014, which ranged from about 37,000 to 43,000 µS/cm, is not consistent with the range of SC measured since 2002 (≈2300–70,000, Table A-7). It is consistent with SC measured during annual monitoring since 2010 (34,480–52,470, average of about 42,580 µS/cm). During the May 2014 profile event, the saturated thickness in well 0194 was less than 2 ft (only three 0.5 ft-interval measurements were taken), which might account for the high salinity and elevated contaminant concentrations in this well.

4.7 Monument Valley, Arizona, Processing Site

SC profiling was conducted at the Monument Valley processing site in May and June of 2014. Eighty-one wells were profiled, 63 screened in the alluvial aquifer, 12 in the DeChelly aquifer, and 6 in the Shinarump aquifer (Figure 31, Table A-8). Of the 15 sites profiled during Phase I of this study, the Monument Valley site ranked lowest in terms of overall variation based on the median CV (see inset below, adapted from Figure 10).



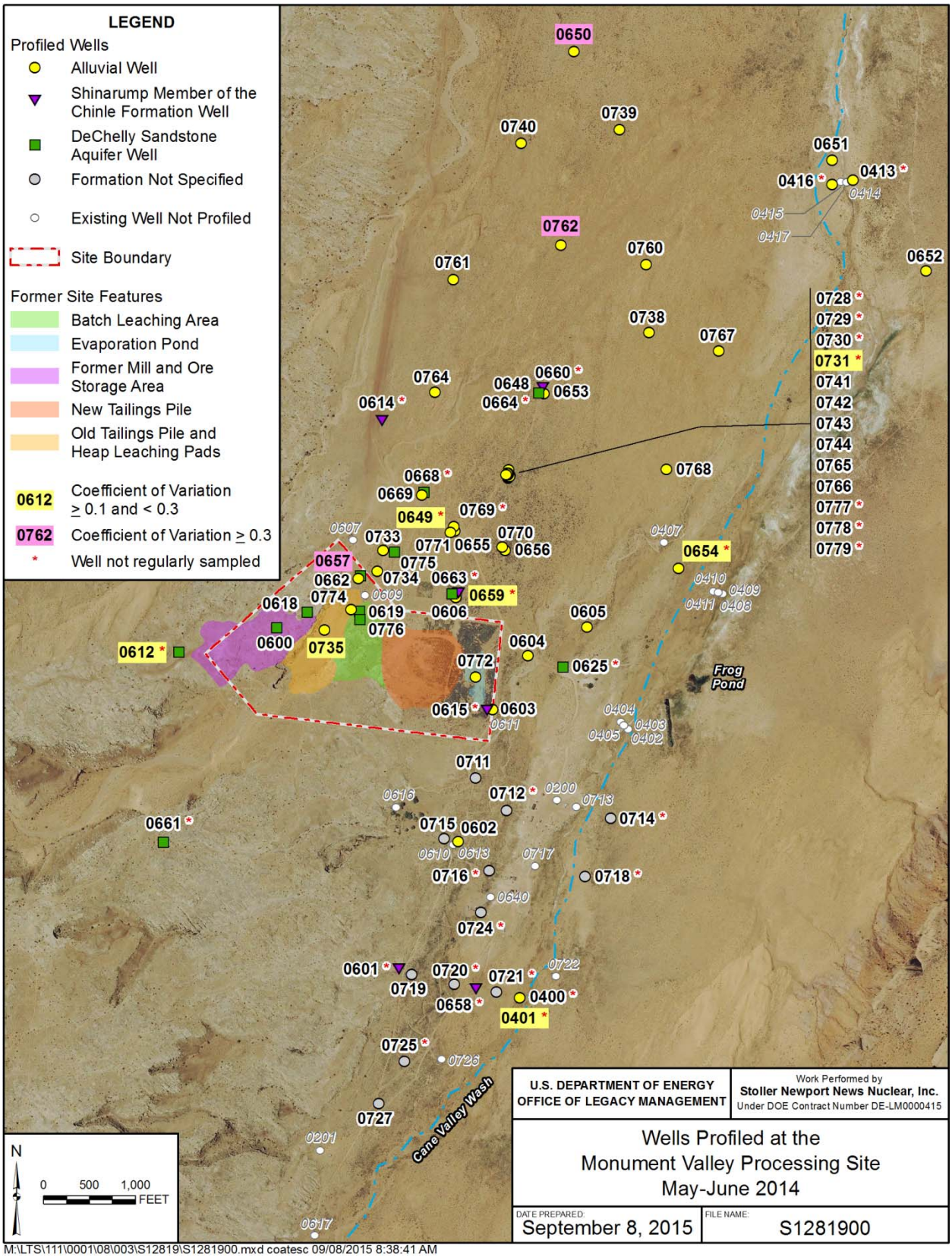


Figure 31. Wells Profiled at the Monument Valley, Arizona, Processing Site, May–June 2014

This low site rank may be due to the large number of wells profiled at the site (81) relative to most other sites (Table 3). Also, although the southernmost wells are upgradient of the former processing area, these were not excluded from global summaries at this stage of the study because site hydrologic conditions were not fully assessed, another factor potentially accounting for the low site variation rank. Vertical SC profiles for all wells profiled at the Monument Valley site are shown in the StickBall plot in Figure 32. Due to the large number and depth of some of the wells, the degree of variation at the site is difficult to interpret in this figure, but the scope of the profiling effort is apparent.

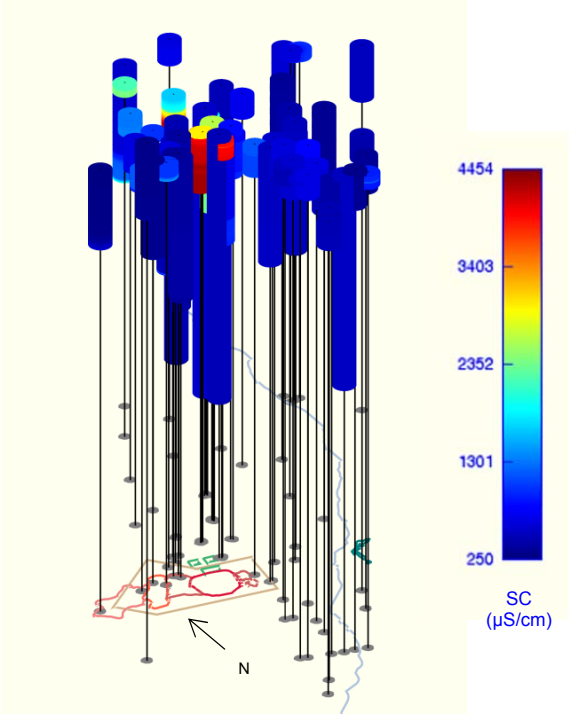


Figure 32. StickBall Plots of SC in Monument Valley Processing Site Wells

Orange and red lines denote processing areas, green lines show the phytoremediation land farm and revegetation test plots, and the tan line represents the site boundary. The features at the far right of the plot are Cane Valley Wash and the frog pond.

Figure 33 plots the mean SCs and corresponding CVs for each well profiled at the site. This schematic is intended as a generalized overview of profile results; well names are not shown due to the number and density of wells (refer to Figure 31). Although only a cursory review of site data was done, the distribution of SC seems to be consistent with that found for sulfate at the site (DOE 2005, 2013b). There is also an apparent correlation between SC magnitude and the level of variation in the wells; both are highest in regions downgradient (north) of the former tailings areas.

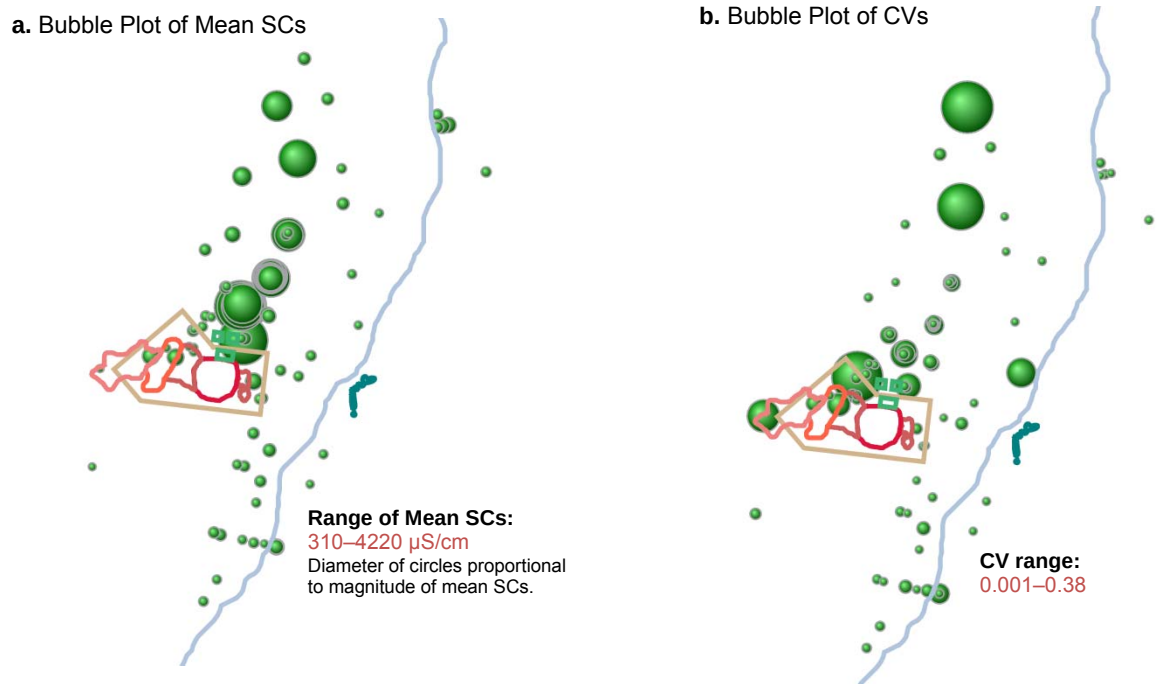


Figure 33. Bubble Plots of Mean SCs and Corresponding CVs in Monument Valley Site Wells

Points or "bubbles" with gray rings correspond to areas with dense networks of wells, where points overlay one another.

Figure 34 plots SC by depth for the most highly varying Monument Valley site wells (with CVs ≥ 0.3): wells 0650, 0657, and 0762. At far downgradient wells 0650 and 0762, SC measurements are interesting in that the profile slope changes significantly within the screened interval, in particular at well 0762.

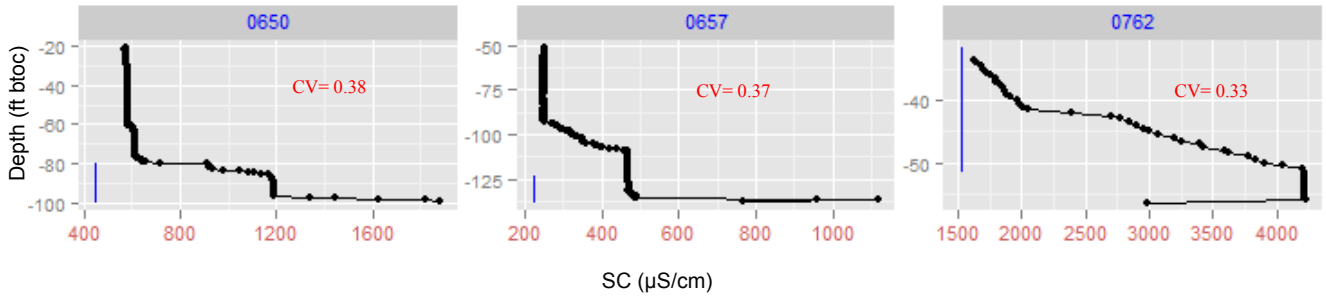


Figure 34. SC Profiles in Monument Valley Site Wells with CVs ≥ 0.3 (Top 3 Variation Ranks)

Blue line next to *y* axes denotes screened interval

Figure 35 shows historical trends of SC and sulfate for well 0650, the farthest downgradient alluvial well and the most highly variable well at the site based on CV rank. In this figure, sulfate and SC have been increasing and appear to co-vary. These trends are probably real (i.e., not an artifact of inconsistent sample depths). Even though the range of SC measured within the screened interval could explain monitoring results since 2008, a bladder pump is installed in this well so the sampling depths have presumably been constant.

Also, the most recent (December 2014) SC measurement is consistent with vertical SC measurements taken within the screened interval (Figure 34).

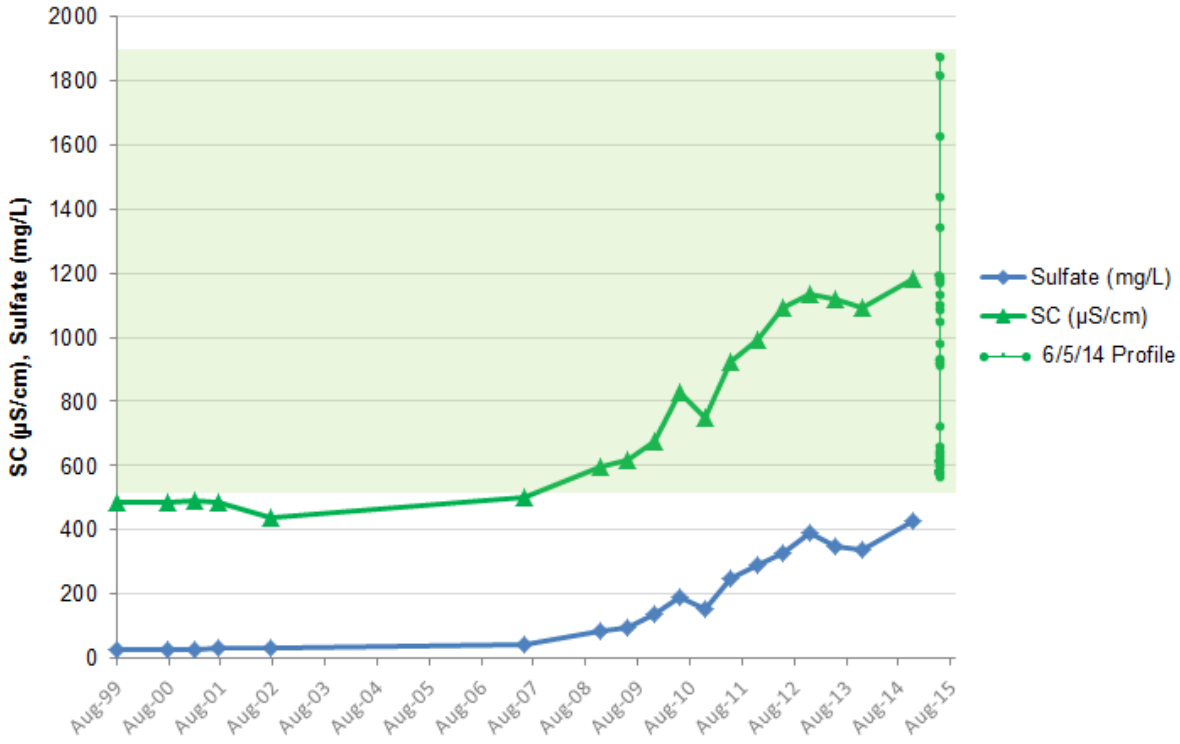
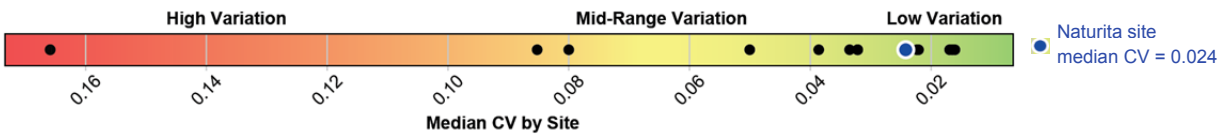


Figure 35. Historical Trends of SC and Sulfate in Monument Valley Site Well 0650
Shaded area denotes range of SC measured vertically in a single day.

As discussed in Section 2.3, it was not possible to clean all the data collected to date at this stage of the study. After summarizing the SC profile data for Monument Valley and examining some initial profiles, it was apparent that some wells with high CV ranks (e.g., CV > 0.1) had for the most part homogenous profiles. The high CVs stemmed from outlier points in the bottom, unscreened portions of wells. These anomalies, noted in Appendix A (Table A-8) will be accounted for in subsequent evaluations.

4.8 Naturita, Colorado, Processing Site

SC profiling was conducted at the Naturita processing site June 9–10, 2014; 26 alluvial wells were profiled (Figure 36). Overall, the Naturita site ranked fairly low (10th of 16 site profiles) based on the median CV for the site of 0.024 (see inset below, Table 3, and Figure 10). Summary statistics for the site SC profiles are provided in Table A-9.



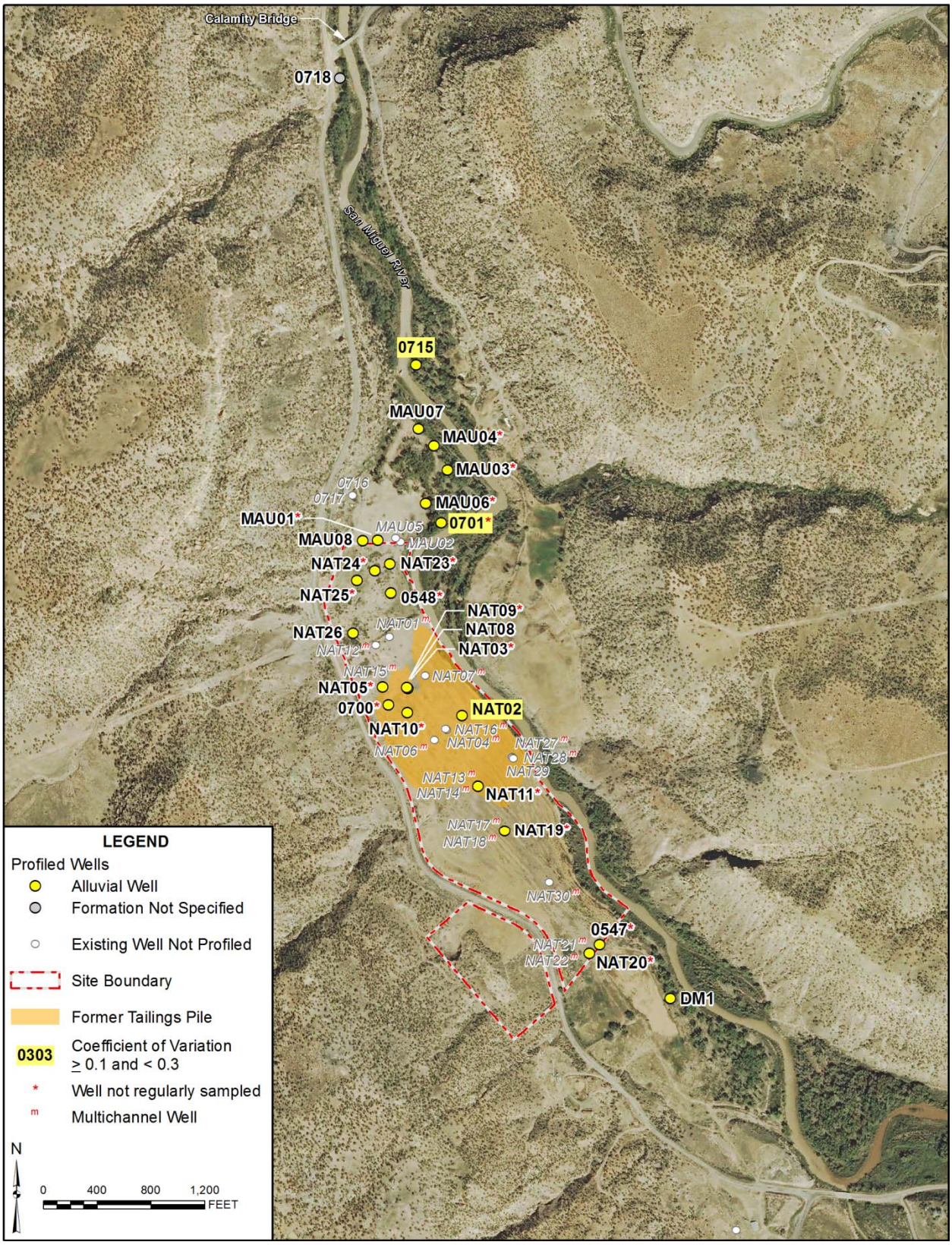


Figure 36. Wells Profiled at the Naturita, Colorado, Processing Site, June 2014

SC profile results for the Naturita site are shown in the StickBall and vertical profile plots in Figure 37 and Figure 38.

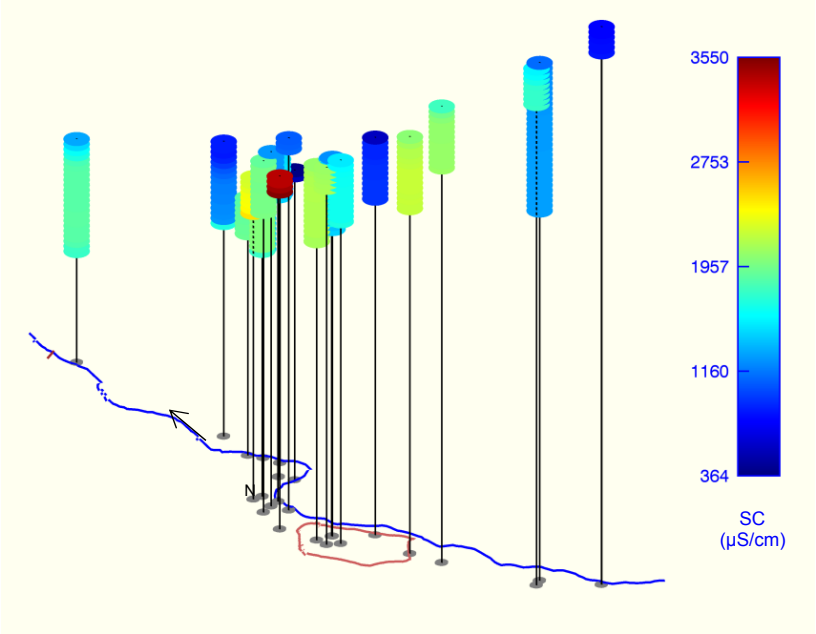


Figure 37. StickBall Plots of Specific Conductance (µS/cm) in Naturita Processing Site Wells

Red and blue lines denote the former tailings pile area and the San Miguel River, respectively.

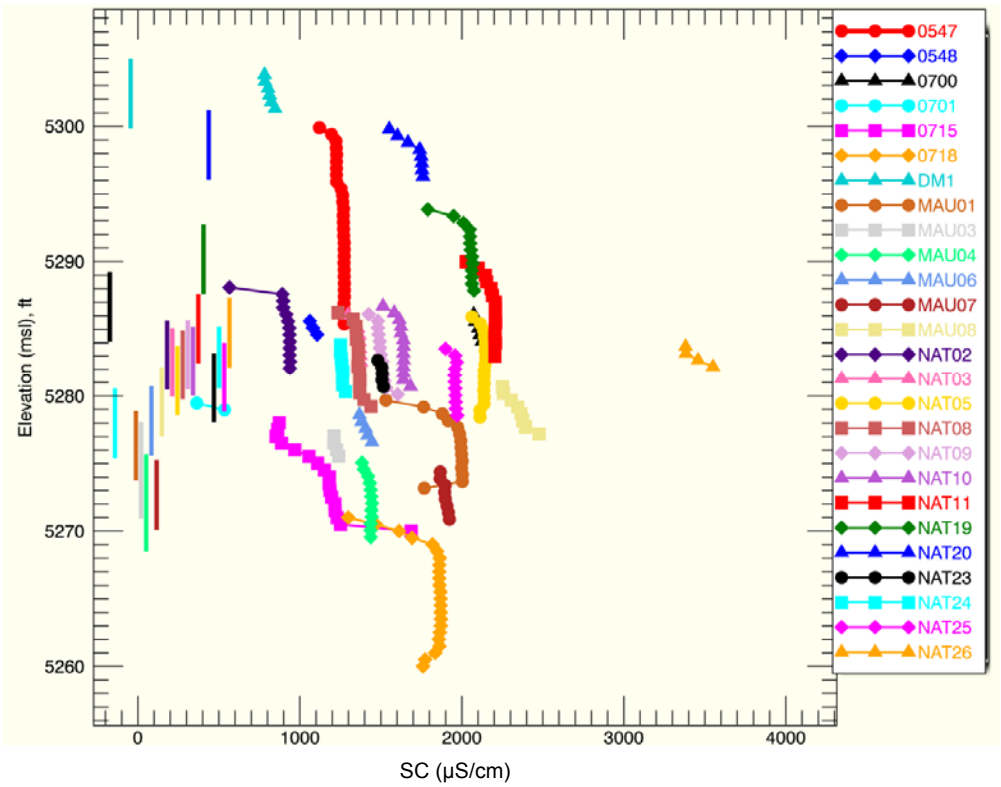


Figure 38. Vertical Profiles of SC in Naturita Processing Site Wells, June 2014

Screen placement is indicated by corresponding color-coded lines to the left of each plot.

Based on examination of the SC profiles, the Naturita site is one of the less interesting sites in terms of variation. Most wells profiled, even those within the former tailings area and those close to the San Miguel River, had very little variation in the profiles. There are two exceptions, however: the profiles for farthest downgradient wells 0715 (CV = 0.18) and 0718 (CV = 0.08), the northernmost locations shown in Figure 36. A zoom-view of these two SC profiles is shown in Figure 39.

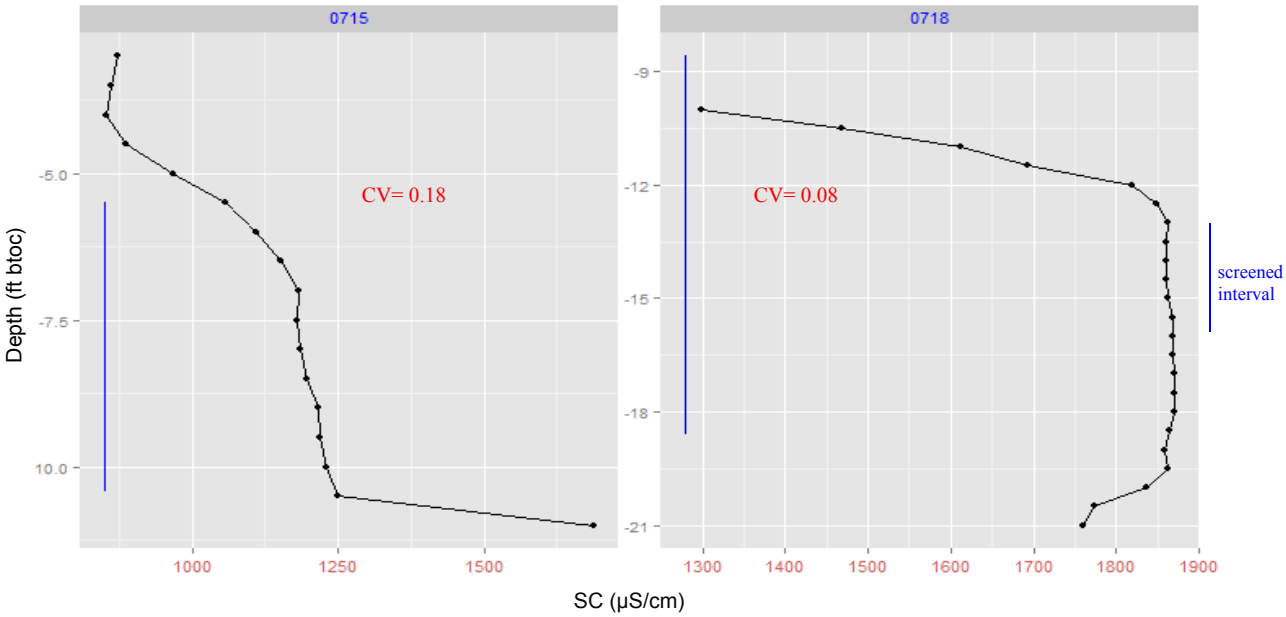


Figure 39. SC Profiles in Naturita Site Downgradient Wells 0715 and 0718

Uranium has been increasing in both these downgradient wells and appears to co-vary (at least roughly) with SC. In the case of well 0715, which had the highest CV, SC measurements are fairly constant within the screened interval. This is not the case for well 0718, however, where there is a notable change in slope within the screened interval. If uranium does co-vary with SC in well 0718, it might be important to document the depths at which samples are collected, especially given that this well is farthest downgradient from the site.

Figure 39 also demonstrates the point made in Section 3 that relative CV ranks do not always correspond to ranks of meaningful variation based on visual examination of the profiles. For example, although the CV for well 0715 (0.18) is greater than that for well 0718 (0.08), the magnitude of the variation in the SC profile for 0718 is more pronounced, especially within the screen interval.

Two other Naturita site wells had SC profiles with relatively high CV ranks—NAT02 (CV = 0.11) and MAU01 (CV = 0.07)—but the profiles were homogeneous through the screened interval (Figure 38). The SC profile for the well with the highest calculated CV for the site, 0701 (CV = 0.27), is discounted, as only two measurements were taken because there was only about a foot of water in the well. Also, the magnitude and range of SC in this well was quite small (364-535 µS/cm). Supporting data are provided in Appendix A, Table A-9.

4.9 New Rifle, Colorado, Processing Site

SC profiling was conducted at the New Rifle processing site in July and October 2013 (Figure 40). Forty-one wells were profiled, including 32 alluvial wells, 2 wells screened in the Wasatch Formation, and 7 City-owned wastewater treatment dewatering wells (Table A-10).

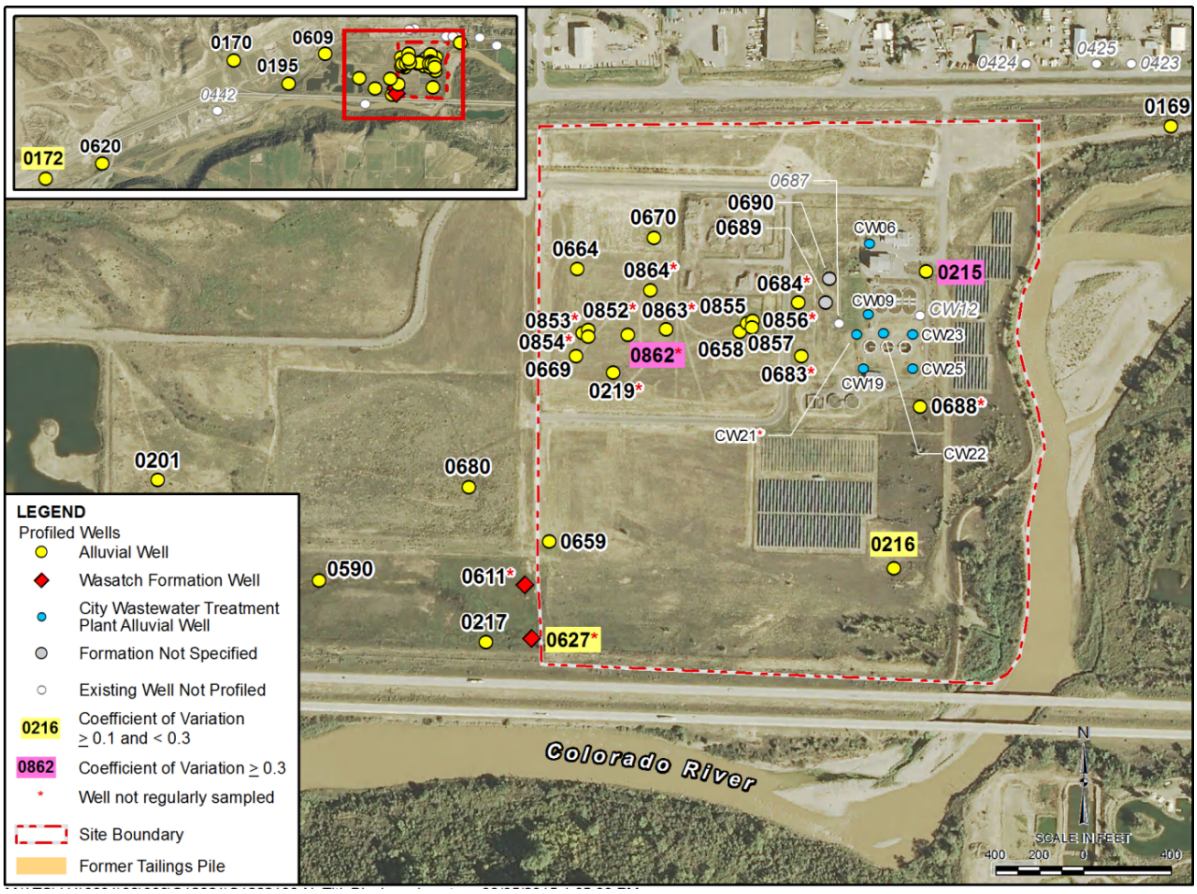
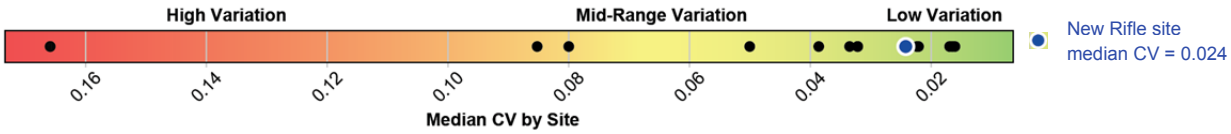


Figure 40. Wells Profiled at the New Rifle, Colorado, Processing Site: July and October 2013

Overall, the New Rifle site ranked 11th of 16 site profiles based on the median CV of 0.024 (see inset below, adapted from Figure 10). This median CV is about equal to those calculated for the Naturita, Old Rifle, and Grand Junction sites (Table 3).



Of the 41 profiles, results for only 34 are discussed here. SC profile results for the seven large-diameter city wells (denoted with a "CW-" prefix in Figure 40) are not addressed because some of the profiles and corresponding CVs were anomalous due to extreme outlier bottom measurements. The bottom of the well was difficult to discern in some of these wells, and no completion or well construction information was available during development of this Phase I report. Also, the results do not appear to impart any meaningful information regarding site conditions or the degree of variation at the site.

SC profile results for the remaining (non CW-) wells are shown in Figure 41 (StickBall plot) and Figure 42 (two-dimensional plot showing well screens). Because of the number of wells profiled (Table A-10), the spatial extent of the study area, and the high SCs measured in westernmost well 0172, the degree of variation at the site is difficult to interpret in Figure 41. Finer resolution is provided in the vertical profile plot in Figure 42 and in Figure 43, which plot SCs by depth for the five wells with the greatest variation in the profiles (CV ≥ 0.1).

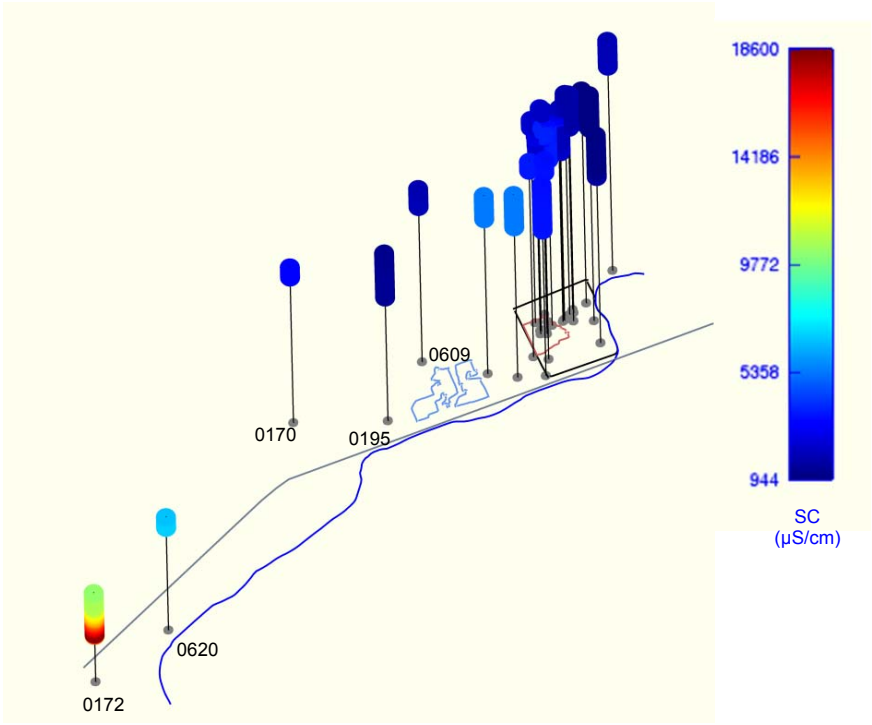


Figure 41. StickBall Plots of SC in New Rifle Processing Site Alluvial Wells

Due to the density of wells, especially those onsite, most locations are not labeled (see Figure 40). Variation in onsite wells is masked given high magnitude SC in westernmost well 0172.

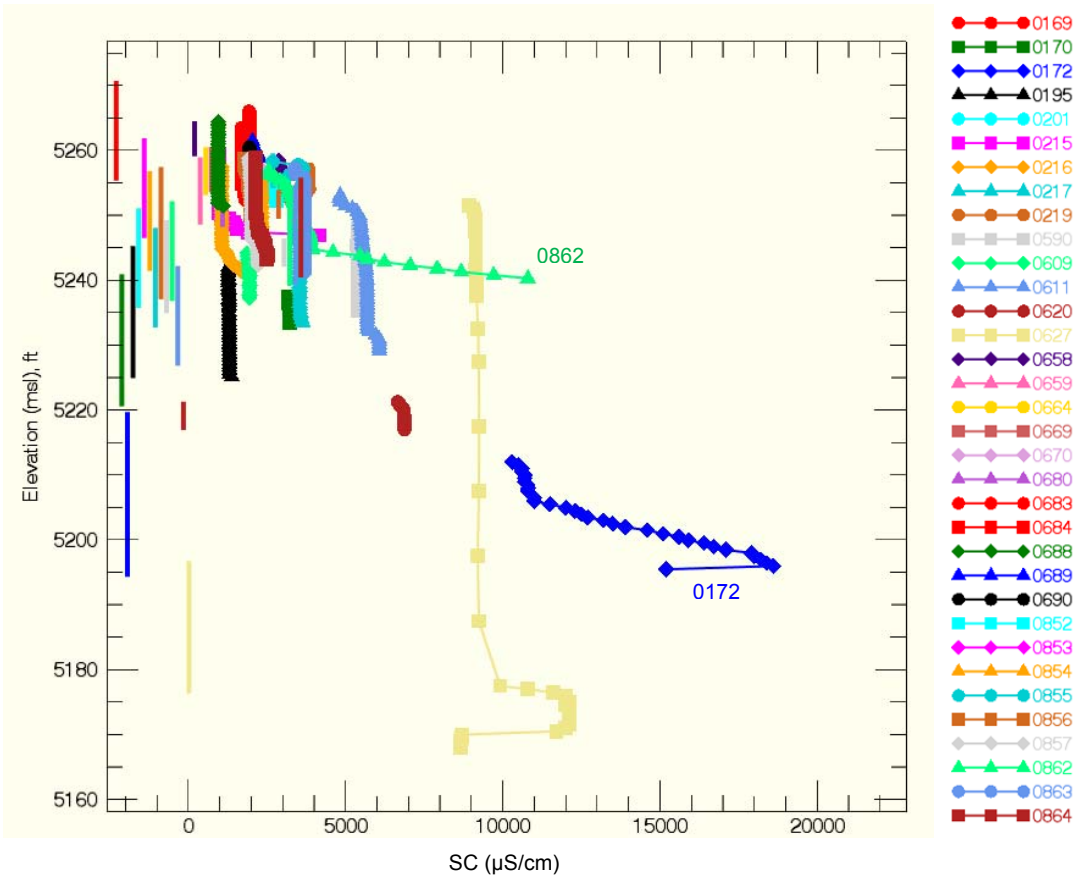


Figure 42. Vertical Profiles of SC in New Rifle Site Wells

Screened intervals plotted along *y*-axis in same color as SC profile plot.

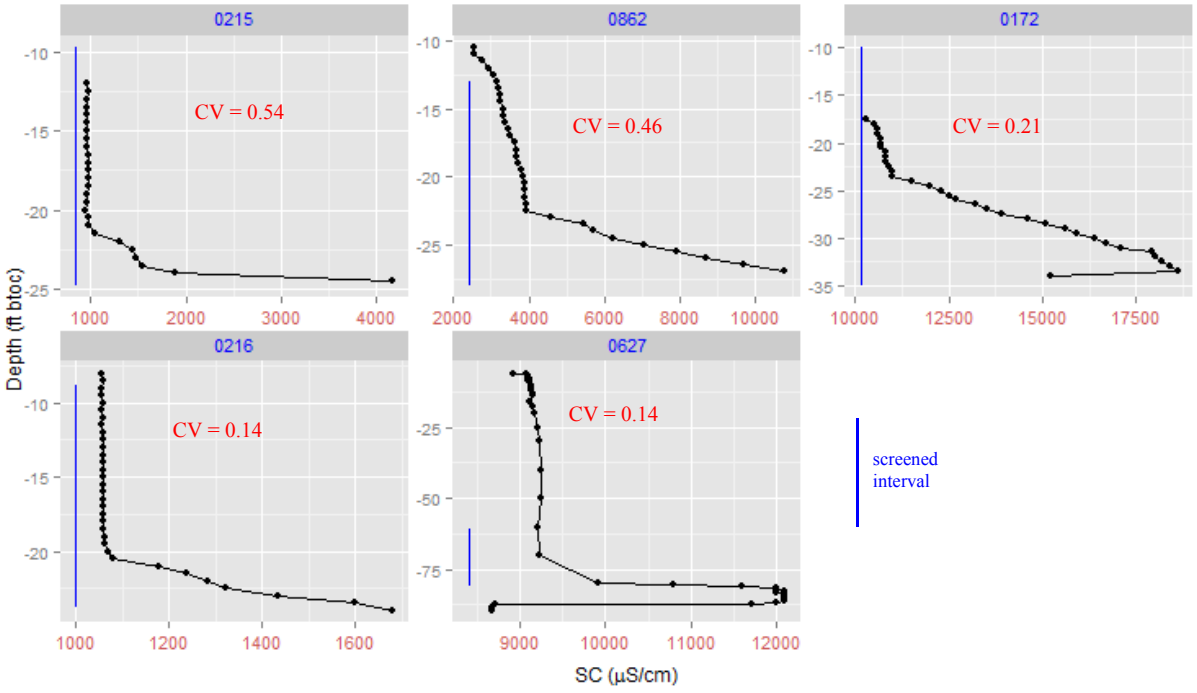


Figure 43. SC Profiles in New Rifle Site Wells with CVs ≥ 0.1

Apart from the five wells shown in Figure 43, remaining SC profiles were fairly homogeneous (Figure 42). Some onsite wells within or near the tailings area had mid-range variation (e.g., 0658, 0855, and 0864), but the range in SC was relatively small. For example, although SCs in well 0864 increased gradually throughout the screened interval, the range in SC was only about 400 µS/cm. The remaining wells had profiles with CVs ≤ 0.05, and most were less than 0.03 (Table A-10).

Of the five wells with CVs ≥ 0.1—0215, 0862, 0172, 0215, and 0627—only results from westernmost well 0172 appear to shed some light on historical trends. Although wells 0215 and 0216 had notable increases in SC toward the bottom of the screened interval (Figure 43), based on a cursory review of site data, this stratification does not appear to explain fluctuations in SC or uranium over time, especially given other influences (e.g., changing river flows). These wells have been key locations for monitoring flushing of the uranium plume in the main body of the site (DOE 2013a). Well 0862 (CV = 0.46) has been sampled infrequently (in 2000, 2008, and 2009 only) and well 0627, screened in the Wasatch Formation (CV= 0.14), has not been sampled since June 1999. Therefore, the importance of the profile results relative to site compliance issues or historical contaminant trends cannot be assessed for these wells.

The well with the third highest rank in terms of variation, well 0172 (CV = 0.2), coincides with the westernmost extent of the site's institutional controls boundary. This well had the highest SCs measured of all wells profiled at the New Rifle site: 10,300–18,600 µS/cm. There is some evidence that the well may have been impacted in the past by spills of wastewater from a gas well in the vicinity. Also, it is not clear whether the elevated uranium in this downgradient area is site-related (DOE 2013a). As shown in Figure 44, the range in SC measurements taken in a single day could explain most of the range in SC measured over time in this well (Figure 44). There is an apparent rough correlation between SC and U, and if this well continues to be monitored, documentation of sample depths is recommended.

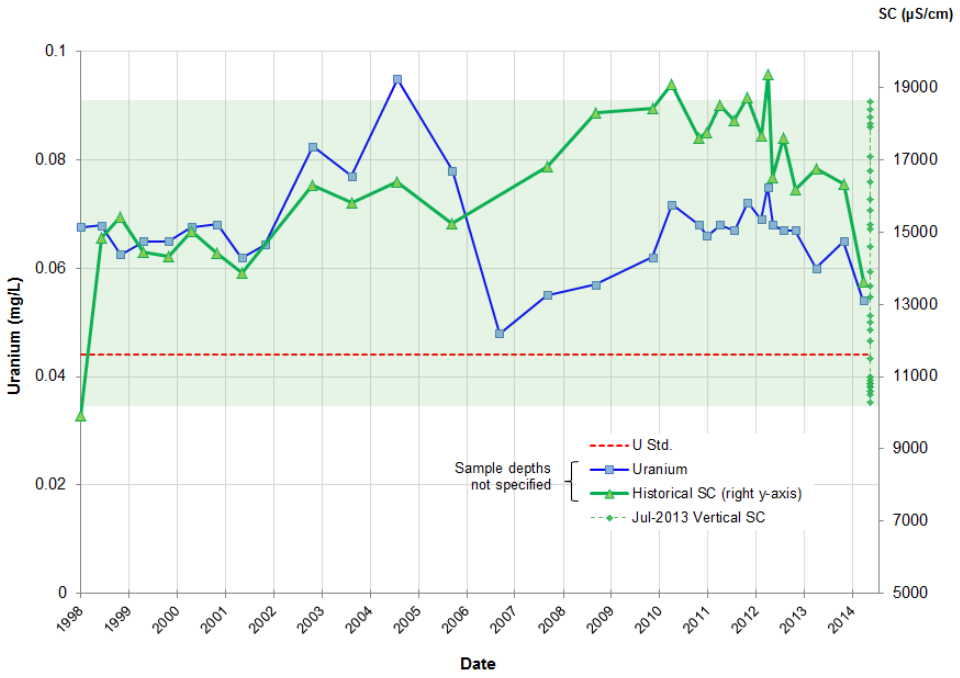


Figure 44. Historical Trends of SC and Uranium in New Rifle Site Well 0172

4.10 Old Rifle, Colorado, Processing Site

SC profiling was conducted at the Old Rifle site in late October 2013. Twenty-two alluvial wells were profiled, including 2 background wells (0292A and 0658) and 10 wells used to monitor water chemistry under an Integrated Field Research Challenge (IFRC) program evaluating uranium biosequestration, sponsored by the DOE Office of Science. Figure 45 shows the locations of wells profiled at the site and identifies the wells with the greatest vertical variation in SC (CVs ≥ 0.1). SC profile results are summarized in Appendix A, Table A-11.

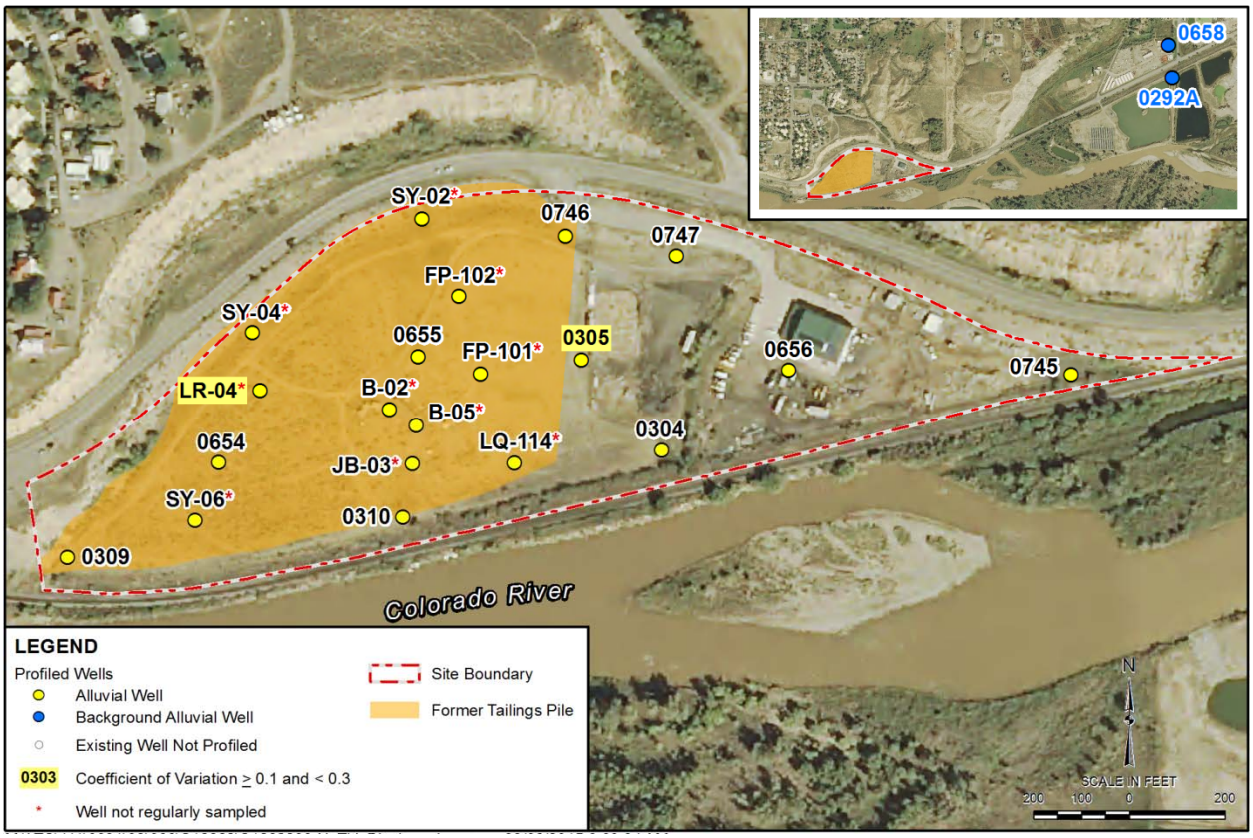
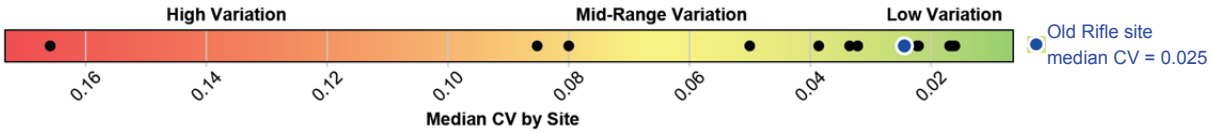


Figure 45. Locations of Wells Profiled at the Old Rifle, Colorado, Processing Site

IFRC wells are those with alpha-numeric IDs.

Overall, the Old Rifle site ranked 9th of 16 site profiles based on the median CV of 0.025 (see inset below). This median CV is about equal to those calculated for the Naturita, Old Rifle, and Grand Junction sites (Table 3). SC profile results are shown in the StickBall plot in Figure 46, Figure 47 plots the corresponding two-dimensional profiles, and Figure 48 plots SCs by depth for the four wells with the greatest vertical variation in SC (Table A-11).



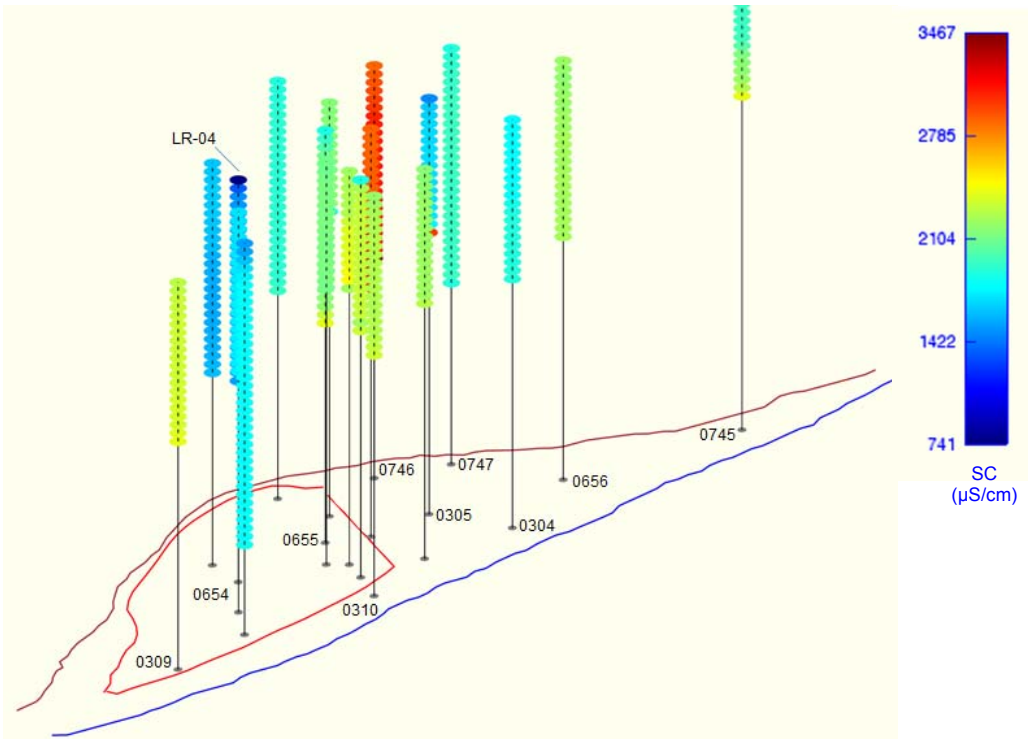
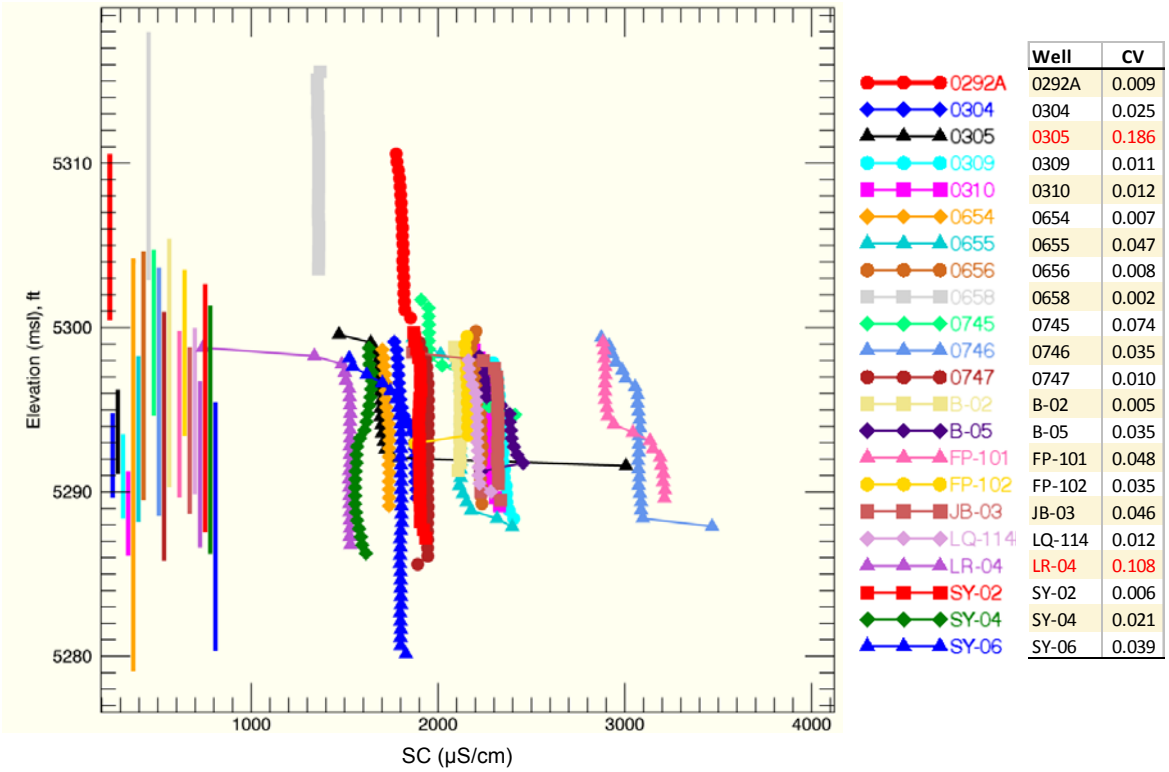


Figure 46. StickBall Plot of SC in Old Rifle, Colorado, Processing Site Wells

Figure intended as a general overview of profiling results (background wells not shown). Due to the density of wells, apart from high-variability IFRC well LR-04, only DOE-owned wells are shown here (see detailed map in Figure 45).



Well	CV
0292A	0.009
0304	0.025
0305	0.186
0309	0.011
0310	0.012
0654	0.007
0655	0.047
0656	0.008
0658	0.002
0745	0.074
0746	0.035
0747	0.010
B-02	0.005
B-05	0.035
FP-101	0.048
FP-102	0.035
JB-03	0.046
LQ-114	0.012
LR-04	0.108
SY-02	0.006
SY-04	0.021
SY-06	0.039

Figure 47. Vertical Profiles of SC in Old Rifle Site Wells

Screened intervals plotted along *y*-axis. Corresponding CVs listed to the right of plot legend; CVs in red font are ≥ 0.1.

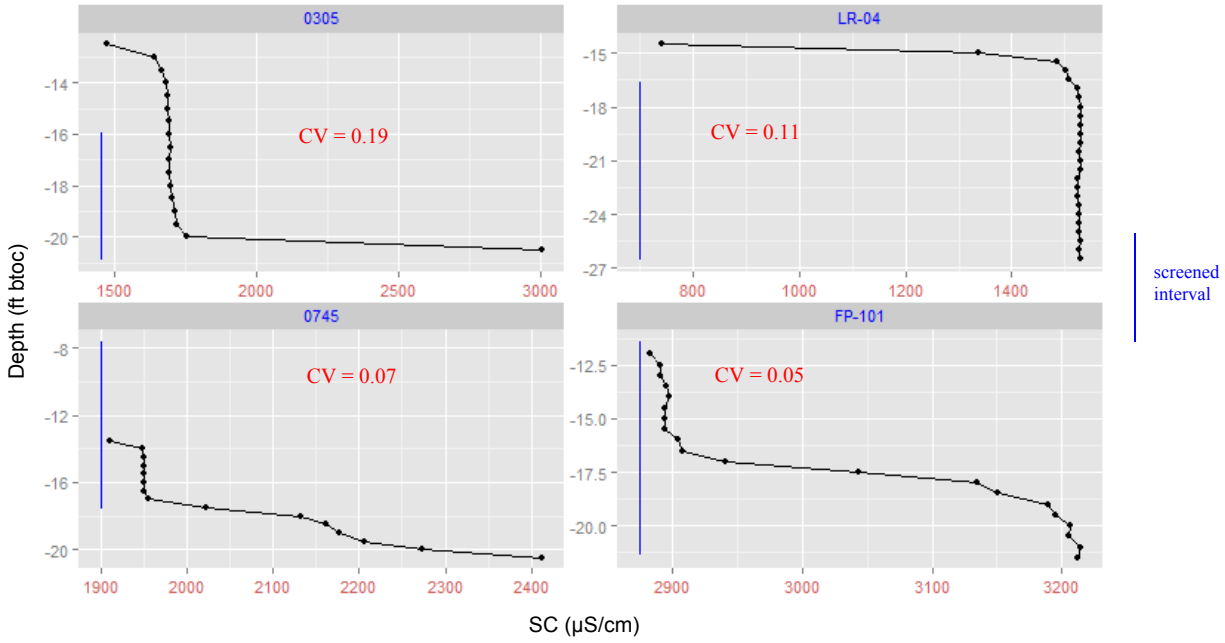
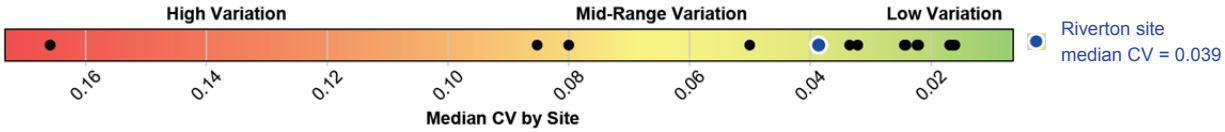


Figure 48. Vertical Profiles of SC for Top 4 Ranks in Old Rifle Site Wells

Overall, there was very little variation in most SC profiles at the Old Rifle site. The wells with the greatest vertical variation in SC were wells 0305 and IFRC well LR-04, which is not monitored. The high CV for well 0305 (0.19) is explained by the 3000 µS/cm outlier measurement at the bottom of the screened interval, which is also the bottom of the well. Remaining SC measurements at well 0305 were constant at about 1700 µS/cm (Figure 48). Brief examination of historical monitoring results for well 0305 suggests a rough correlation between SC (1372–2577 µS/cm) and corresponding uranium concentrations, which have fluctuated above and below the 0.044 mg/L standard (0.03–0.11 mg/L). Relative to other sites profiled for this study, the magnitude of SCs measured in Old Rifle site wells was quite low, 741–3467 µS/cm (Table A-11).

4.11 Riverton, Wyoming, Processing Site

SC profiling conducted at the Riverton processing site in September 2014 coincided with the 2014 annual sampling event. Thirty-three Riverton site wells were profiled: 17 surficial (alluvial) aquifer wells, 13 semiconfined aquifer wells, and three confined aquifer wells (Figure 49, Table A-12). In terms of overall variation, the Riverton site ranked in the upper third of the 15 sites profiled: ranking 5th, following Durango processing sites and the two Shiprock floodplain profile events (Table 3). The median CV for the site was 0.04 (see inset below, adapted from Figure 10).



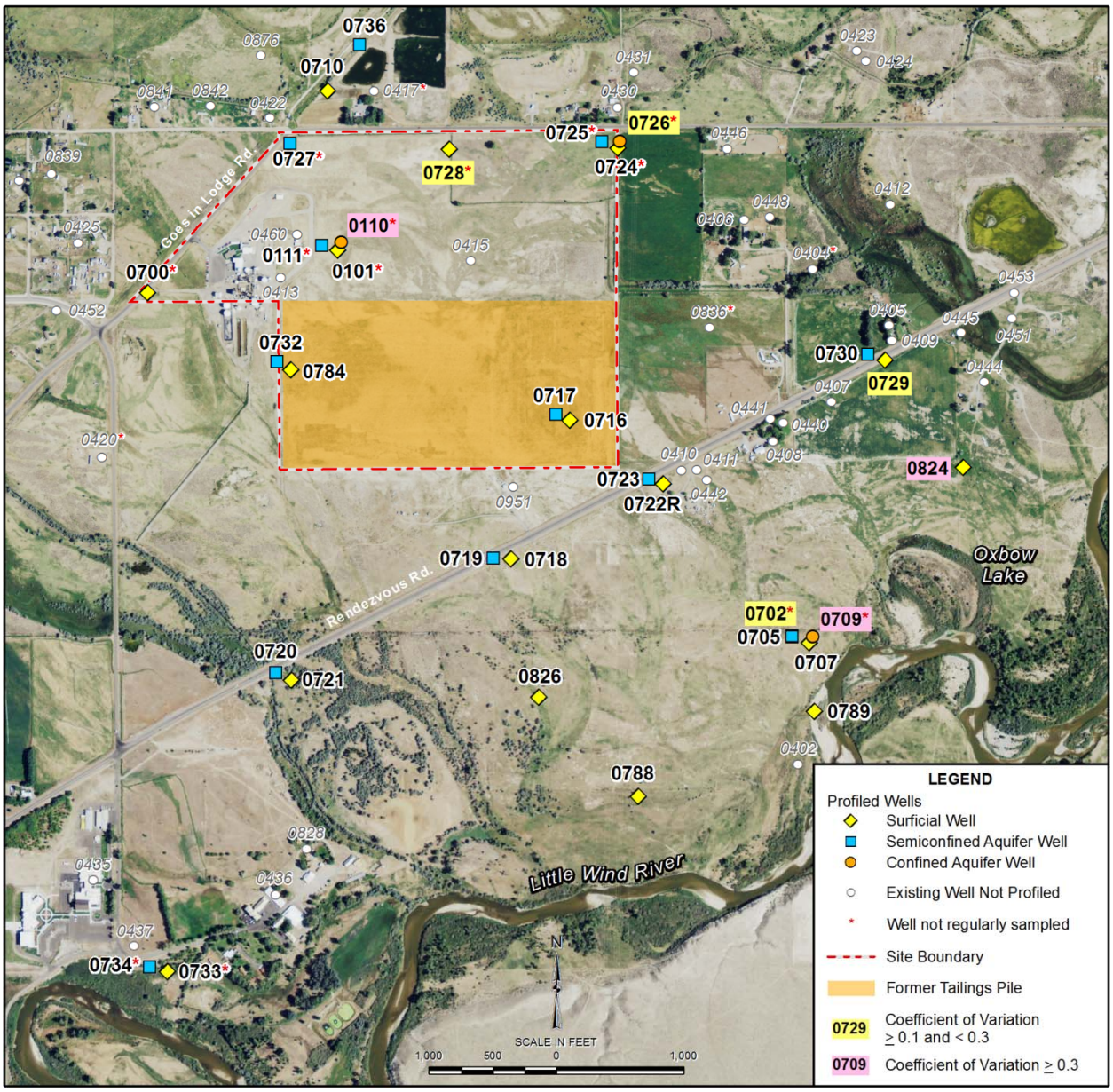


Figure 49. Wells Profiled at the Riverton, Wyoming, Processing Site, September 2014

Detailed results of the Phase I Riverton site profiling effort were documented in an internal memorandum submitted in October 2014.[6] Figure 50 provides StickBall and vertical profile plots of SC for site wells screened in the surficial aquifer, the most important aquifer with respect to regulatory compliance at the site (DOE 2015b). Figure 51 plots the vertical SC profiles for five surficial aquifer wells with historically elevated uranium concentrations due to their location within key portions of the shallow uranium plume at the site.

[6] *Preliminary Results of Sep-2014 Variation Project SCT Profiling at Riverton Processing Site*, email submittal dated 10/6/2014.

a. StickBall Plot of SC Profiles (µS/cm)

b. SC Vertical Profiles by Elevation

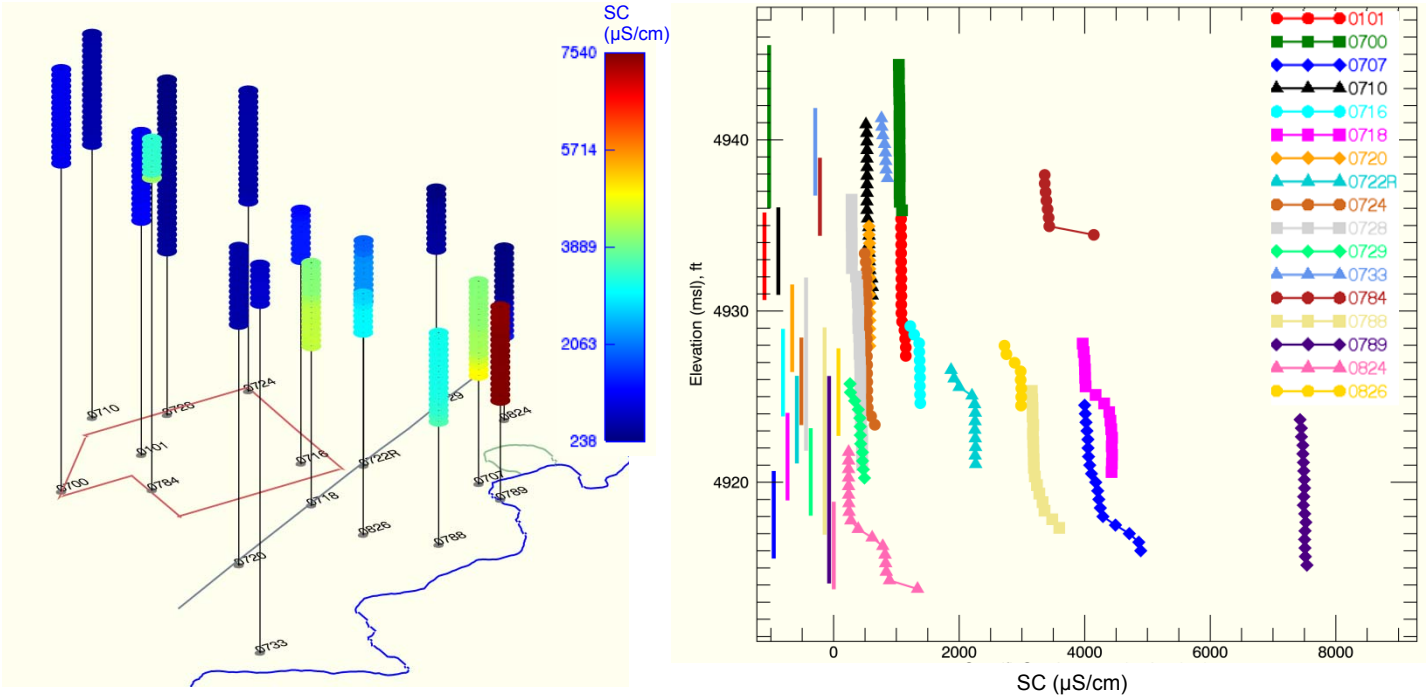


Figure 50. StickBall and Vertical Profile Plots of SC in Riverton Site Surficial Aquifer Wells

In plot 50a, red, blue, and green lines denote the site boundary, Little Wind River, and Oxbow Lake features, respectively; the gray line is Rendezvous Road (more detailed features are shown in Figure 49). Vertical lines to left of SC profiles in plot b denote corresponding screened intervals.

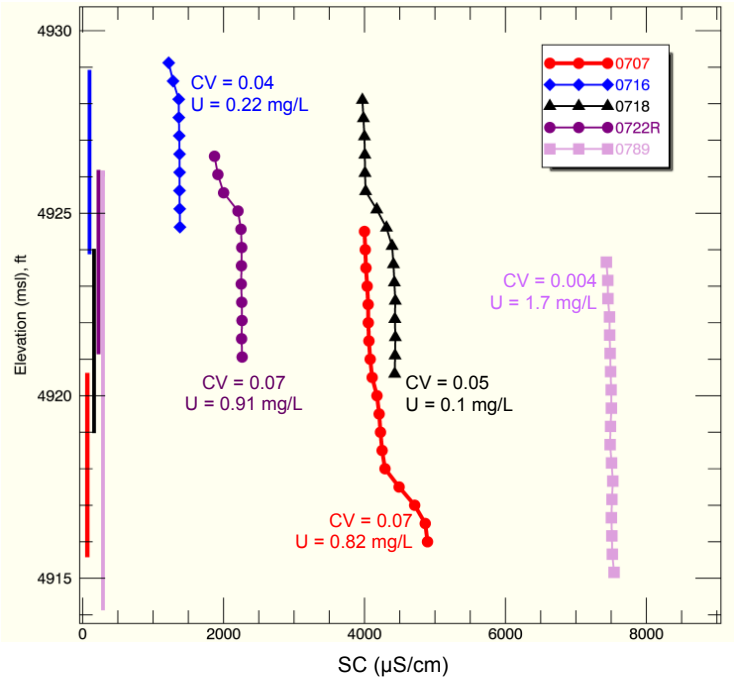


Figure 51. SC Profiles in Riverton Surficial Aquifer Wells with Elevated Uranium

Uranium (U) results from DOE 2015b (Figure 11)

As shown in Figure 51, the profile results for the subset of wells with historically high uranium indicate relatively minor variation with depth in each borehole. Four of these wells fell into the mid-range variability category (CVs of 0.04–0.07). Well 0789, which is located near the Little Wind River and has shown some of the highest uranium concentrations in recent years, had the least variable SC profile (SC range of 7431–7540 µS/cm, CV of 0.004) of all the surficial aquifer wells included in the investigation, and one of the least variable profiles for all site wells.

The four highest CVs in surficial aquifer wells were observed at wells 0824 (CV = 0.67), 0729 (CV = 0.19), 0728 (CV = 0.17), and 0784 (CV = 0.08; Table A-12). Comparison of the locations for each of these wells with some of the uranium plumes plotted for the surficial aquifer in recent years indicates that none of them is particularly important from a compliance perspective. For the most part, they appear to fall on the margins of recently mapped uranium plumes and outside the contour used to delineate the location extent of areas with uranium concentrations higher than the UMTRCA MCL for uranium (0.044 mg/L).

Figure 52 plots SC profile results for the semiconfined and confined aquifer wells at the site. As shown in this figure, most of these wells had relatively minor variation of SC with borehole depth.

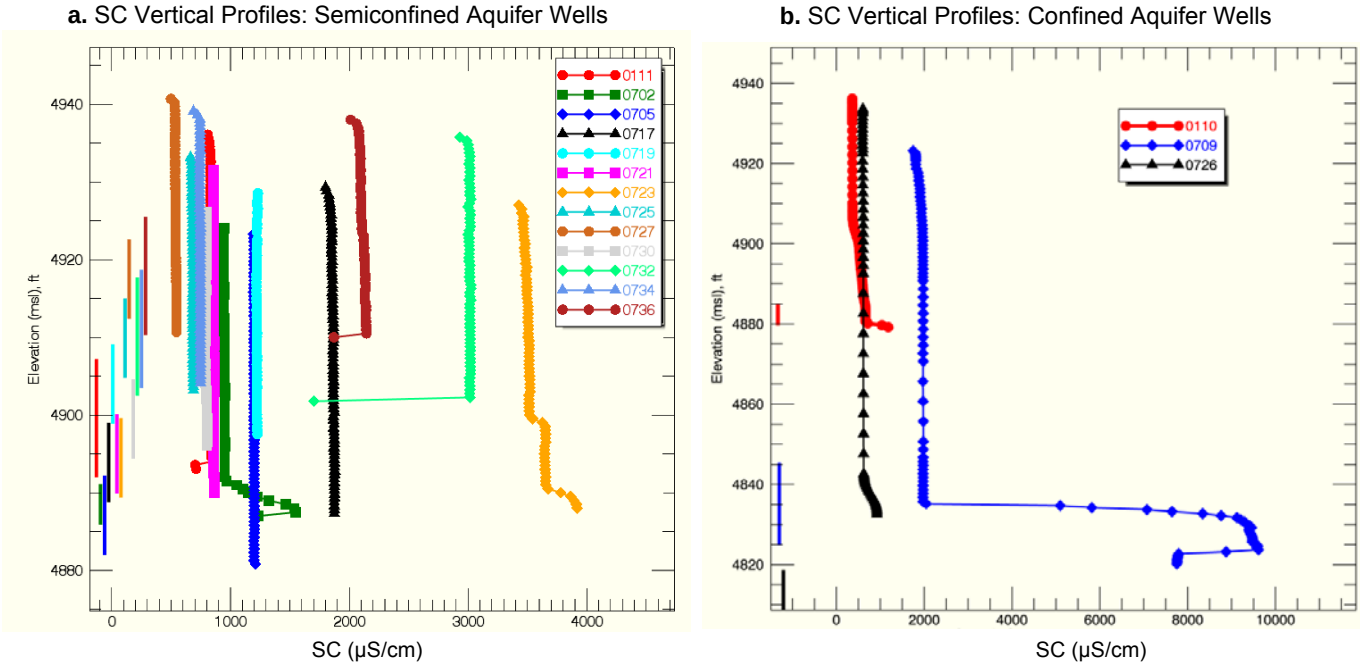
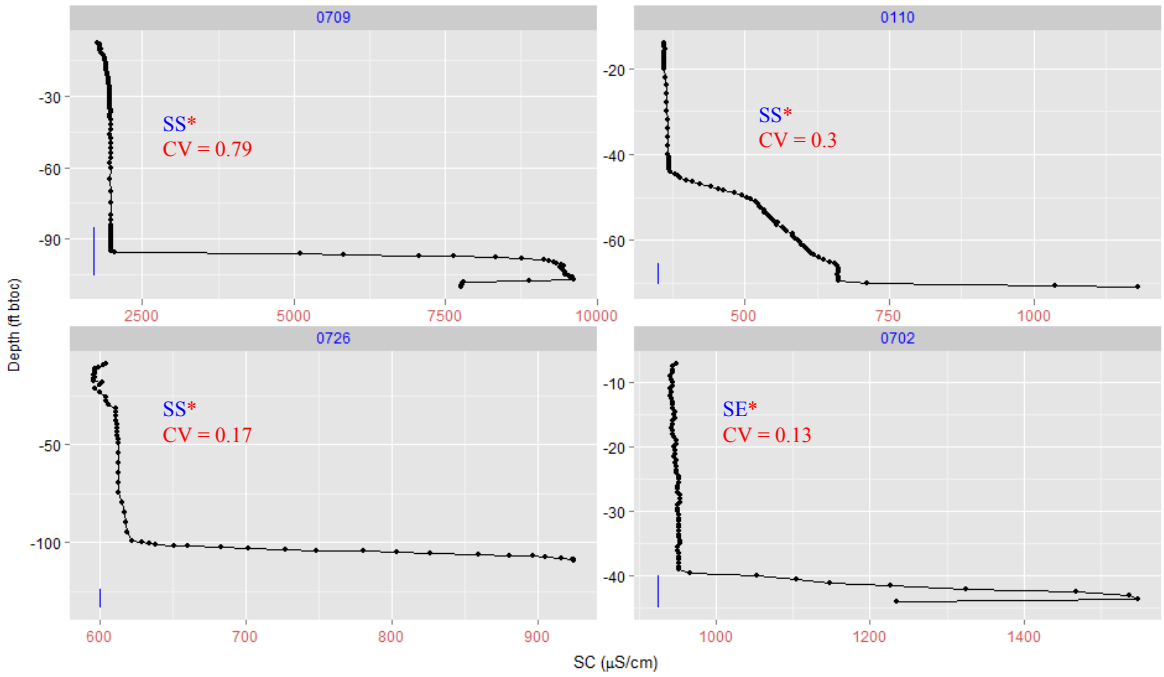


Figure 52. Vertical Profiles of SC in Riverton Site (a) Semiconfined and (b) Confined Aquifer Wells

SC profiles for the subset of wells with greater variation are repeated in Figure 53, which plots SC by depth for the nine most variable wells at the Riverton site (based on the CV). SC profiles for a subset of semiconfined and confined aquifer wells with the highest variation are shown in Figure 53a. Figure 53b plots SC profiles for the most variable wells screened in the surficial aquifer.

a. Semiconfined and Confined Aquifer Wells with Highest CV Ranks



b. Surficial Aquifer Wells with Highest CV Ranks

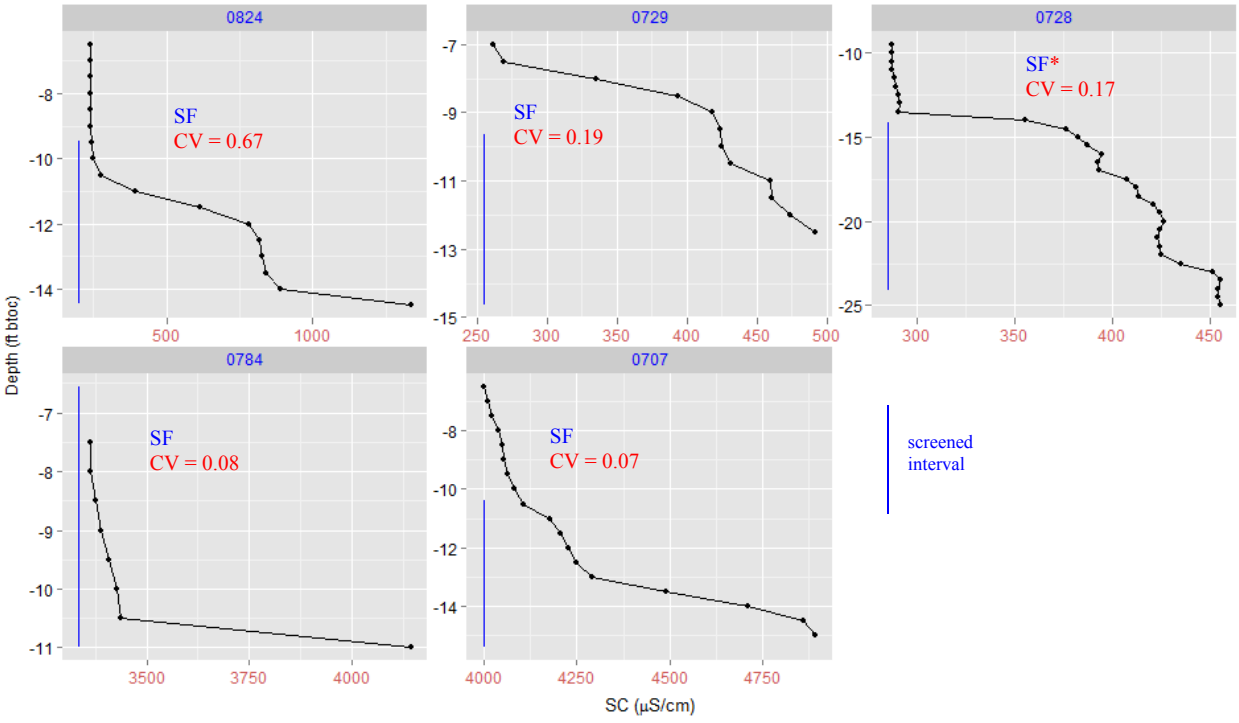


Figure 53. SC Profiles in Riverton Site Wells with the Greatest Degree of Variation

Shown are results for the top nine ranks based on the CV. Figure 53a plots SC profiles for the highest ranking semiconfined and confined aquifer wells; Figure 53b shows the highest ranking surficial aquifer wells. In each sub-figure, wells are listed in order of descending CV. SF denotes the surficial aquifer, SE the semiconfined aquifer, and SS the confined aquifer. A red asterisk (*) denotes wells that are not normally sampled (probably reflecting a historical lack of contamination). Screen placements are indicated by the blue lines (|) near the y-axis in each plot.

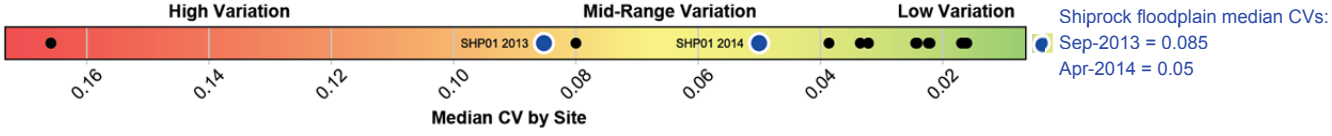
Confined-aquifer well 0709 had the highest vertical variation in SC among all site wells (CV = 0.79). This well, a member of the 0702/0705/0707/0709 well cluster west of the Oxbow Lake (Figure 49), has not been sampled since early 1997 (the uranium concentration had been <0.001 mg/L). At the depth corresponding to the maximum SC in well 0709, the pH was 11.3; this value was thought to be indicative of grout contamination in the well. However, the range of SC measured in the vertical profile (1748–9613 µS/cm) does correspond somewhat with the early historical (1987–1997) range (1320–7000 µS/cm). The remaining wells shown in Figure 53a—confined aquifer wells 0110 and 0726 and semiconfined aquifer well 0702—have not been sampled in recent years because of a historical lack of detected contamination.

The greatest degree of variation in surficial aquifer wells was measured in well 0824 (Figure 53b, CV = 0.67). Despite the relatively high variation in this well, it is unclear whether contaminant concentrations associated with it are important with regard to site compliance. Although SC appears to co-vary with sulfate in well 0824, sulfate concentrations have been low (<350 mg/L), and uranium concentrations (0.008–0.02 mg/L) have consistently been below the 0.044 mg/L UMTRCA standard. Most of the remaining wells shown in Figure 53, although variable, had fairly low SC, and the range in the variation was small. Because of a historical lack of contamination, none of the four highly varying semiconfined and confined aquifer wells (Figure 53a) are monitored. This is also true for surficial aquifer well 0728. Wells in the 0702/0705/0707/0709 cluster had the highest SC, and slope changes in the SC profile seem to correspond to the screened interval.

SC profiling results for the Riverton site highlight the fact that using the CV as a metric to explain or quantify variation may not always point to variation that is important from a compliance (or other) perspective. Despite the fact that the CVs for 7 of the 33 wells profiled (21 percent) were ≥ 0.1 (representing high variability; Figure 9), a limited review of site data indicates that this variation has not confounded interpretations of historical monitoring results.

4.12 Shiprock, New Mexico, Disposal Site, Floodplain

As discussed in the introduction, observed stratification of SC measurements in some wells on the Shiprock floodplain in 2012 was the catalyst for the Variation Project. During Phase I of this study, SC profiling was conducted twice on the Shiprock floodplain: in September 2013 and April 2014. A total of 478 profiles (close to 2800 measurements) were obtained (Figure 54, Table A-13, Table A-14). Most alluvial wells on the floodplain were profiled in both 2013 and 2014. Except for shallow well 0608, wells screened in the Mancos Shale were profiled only in September 2013. Alluvial background wells 0787 and 0850 were profiled in April 2014 only. Except for the Durango processing sites (Table 3), the Shiprock floodplain had the highest overall variation in the SC profiles, with median CVs of 0.085 (2013) and 0.05 (2014). In terms of the number or prevalence of wells with highly varying profiles (e.g., CV ≥ 1), Shiprock far outranked all sites profiled during the Phase I field investigation.



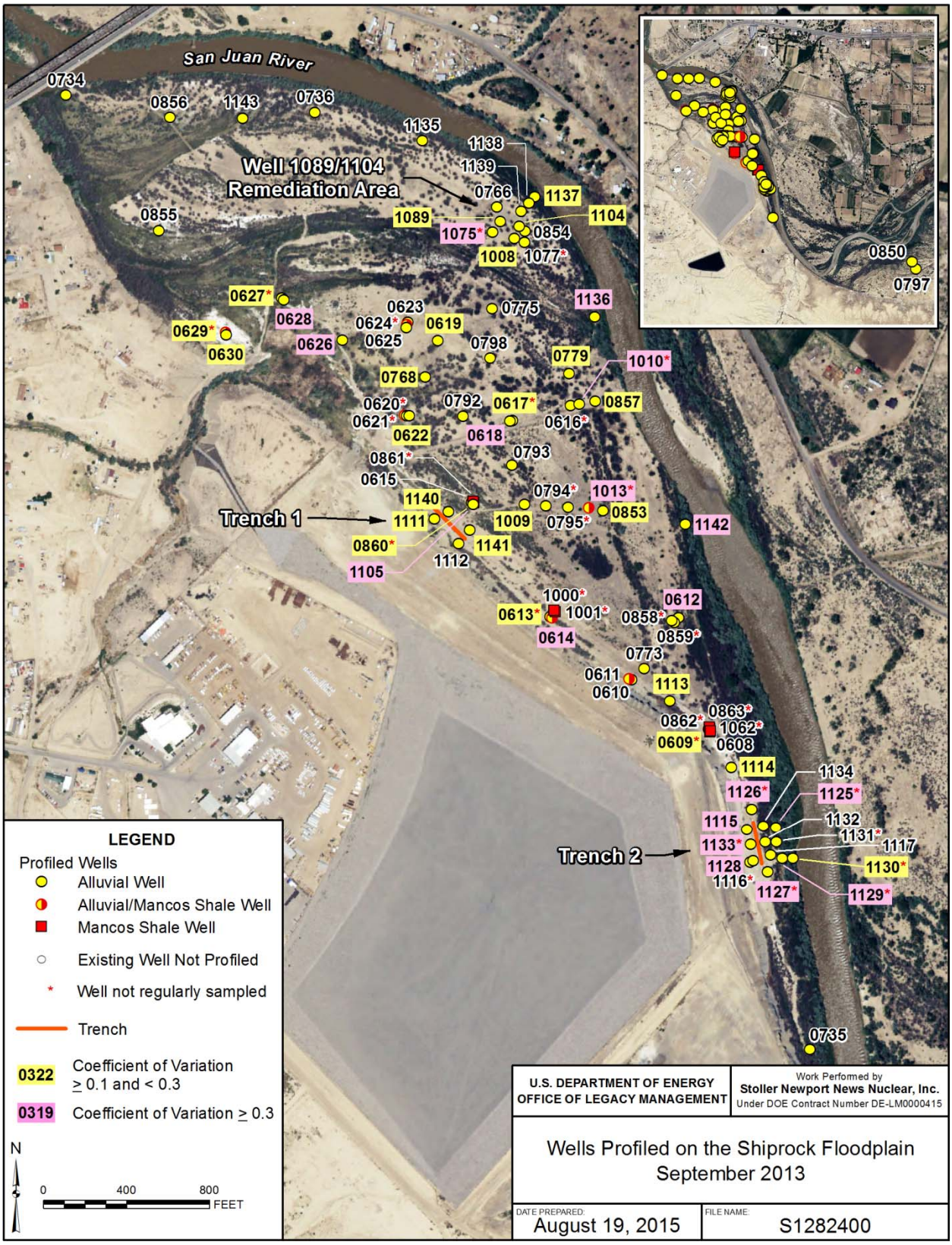


Figure 54. Shiprock Wells Profiled, September 2013 and April 2014

September 2013 profiles were taken during a period of active pumping (Figure 55a), when flow rates for Trench 1 and Trench 2 pumping wells were about 13 and 7 gallons per minute (gpm), respectively, and rates of extraction at wells 1089 and 1104, near the San Juan River, were about 5.5 and 2.5 gpm, respectively. The April 2014 profiling effort coincided with the final days of a month-long non-pumping period (Figure 55b).

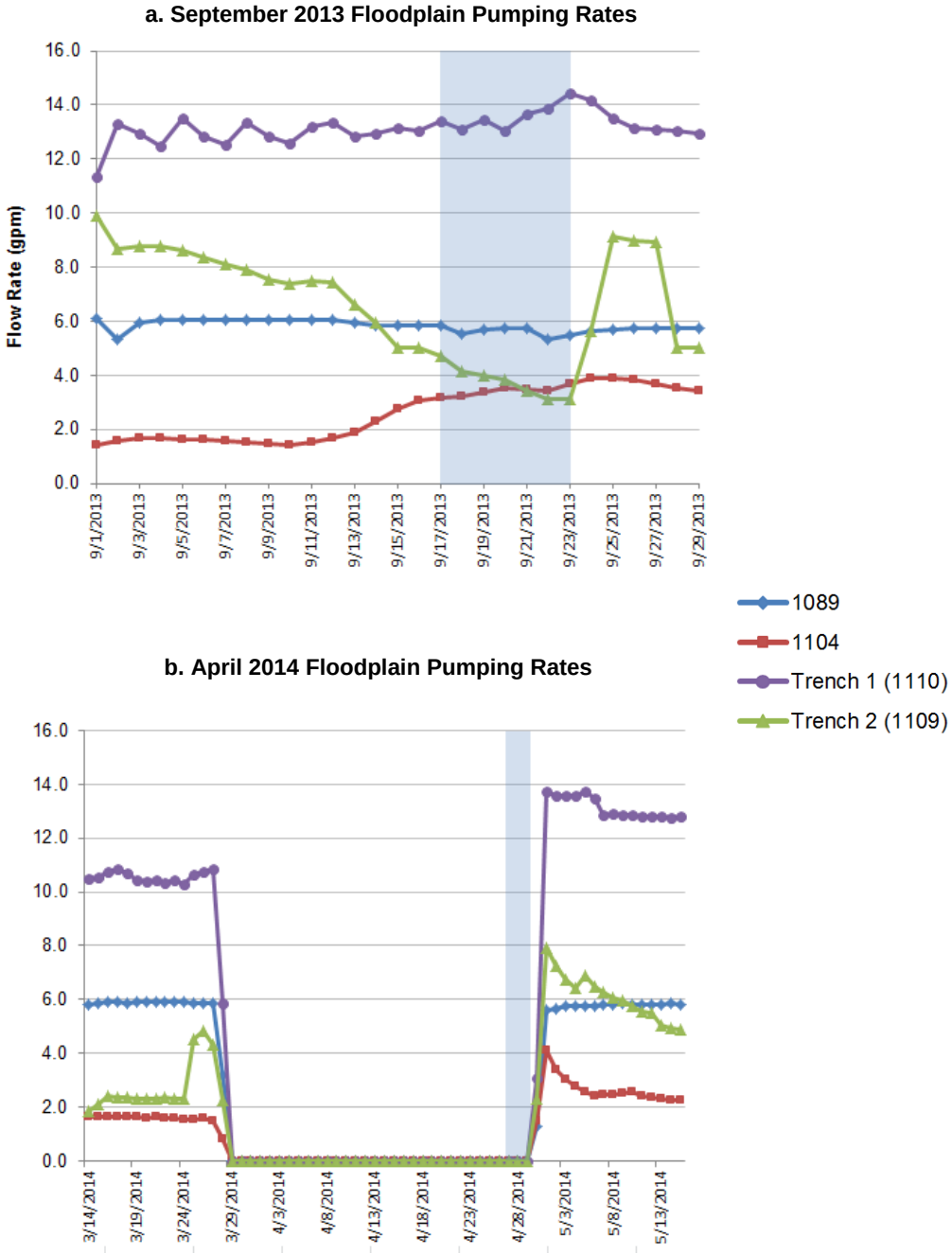


Figure 55. Flow Rates for Floodplain Pumping Wells During 2013 and 2014 Profiling Efforts

Blue shaded areas correspond to dates of SC profiling.

Unlike other sites with high variation (e.g., the Durango processing sites), the Shiprock floodplain has so many wells with significant variation that it was not possible to assimilate all the data for this interim report, or to relate the results to historical contaminant measurements except for a small subset of wells. The figures in this section demonstrate the magnitude of variability measured in the SC profiles at Shiprock floodplain wells. The detailed map in Figure 54, showing the locations of all wells profiled, highlights the prevalence of stratified wells on the floodplain (i.e., those with CVs ≥ 0.1). The StickBall plot in Figure 56 shows SC profile results from September 2013, when the highest degree of variation overall was measured. Due to the large number of wells, the degree of variation at the site is difficult to interpret in this figure, but the scope of the profiling effort is apparent. Also, the high SC in some wells masks variation found in others (e.g., easternmost well 0735 with SC > 20,000 µS/cm).

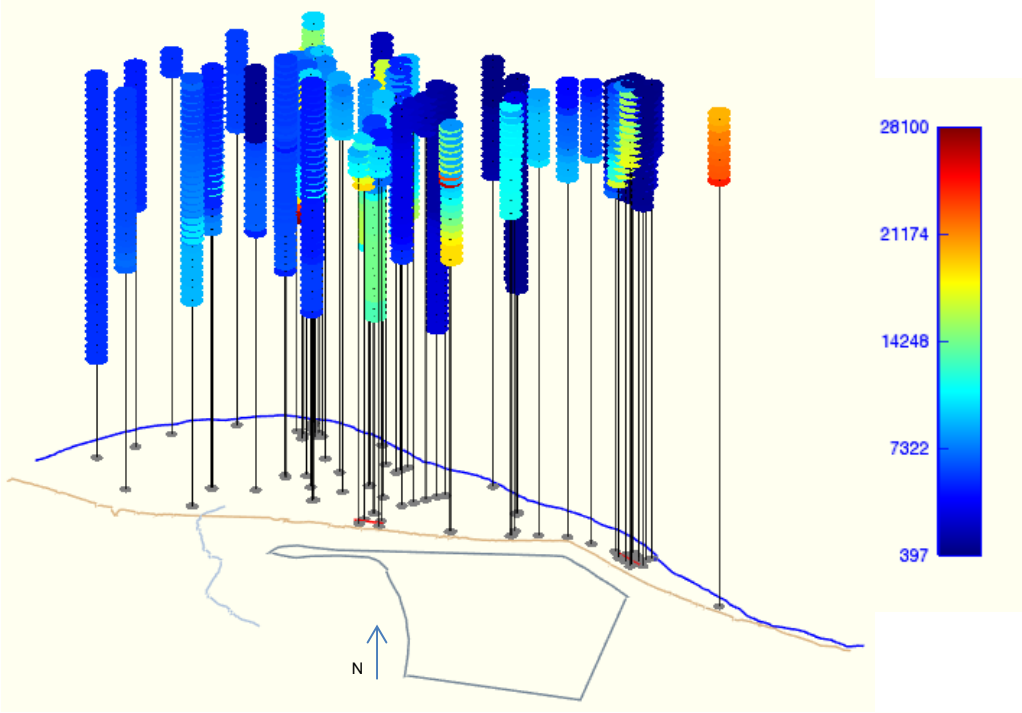


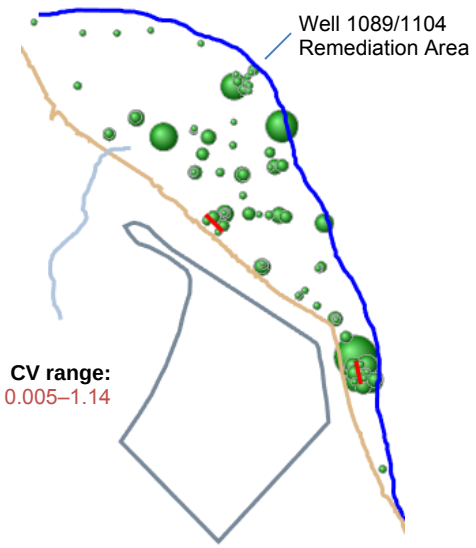
Figure 56. StickBall Plot of SC (µS/cm) in Shiprock Floodplain Alluvial Wells, September 2013

Features shown are the disposal cell, Bob Lee Wash, the escarpment (tan line), the trenches (red lines), and the San Juan River. Elevated outlier results from westernmost alluvial well 0734 were excluded from this figure because of high SCs measured at that time (40,000 µS/cm).

As a complement to the preceding figure, Figure 57 shows bubble plots of CVs derived for both profiling efforts, demonstrating the relative magnitude of variation in SC profiles at the site (background wells are excluded). The greatest degree of variation was found in the Trench 1 and Trench 2 areas, the 1089/1104 remediation area, and other areas containing the highest concentrations of uranium (Figure 58a). Figure 58b presents a bubble plot of uranium concentrations measured during the most recent monitoring event at the site in March 2015.

Most of the remaining figures in this section plot the SC profile results for both the 2013 and 2014 field efforts. The groups used to categorize the SC profile results for the approximately 80 Shiprock floodplain wells profiled are shown in Figure 59.

a. Bubble Plot of CVs: September 2013



b. Bubble Plot of CVs: April 2014

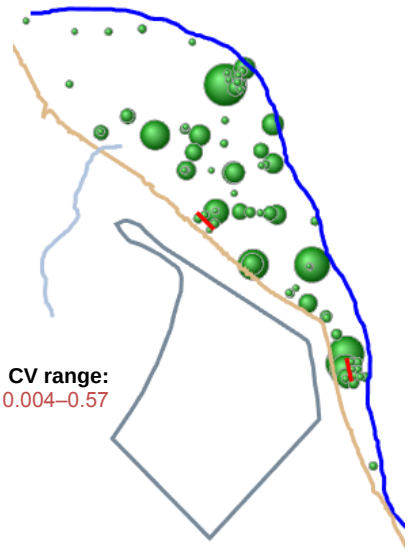
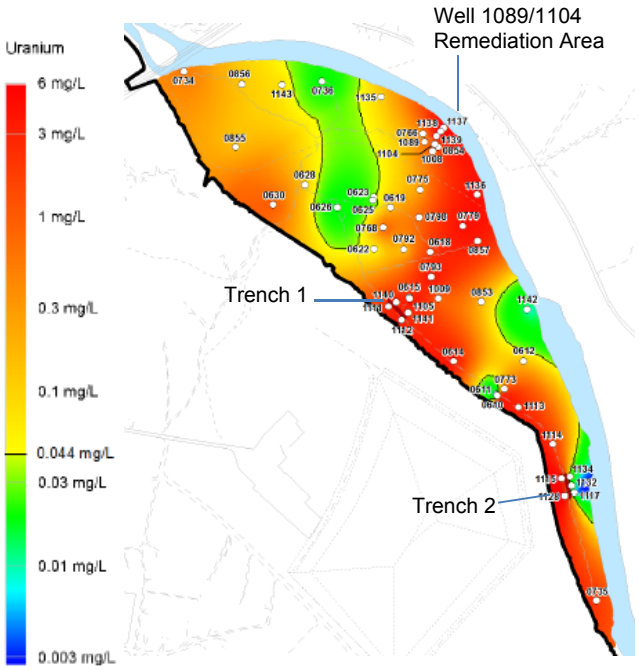


Figure 57. Bubble Plots of CVs for SC Profiles in Shiprock Floodplain Wells, 2013 vs. 2014

Features shown are the disposal cell, Bob Lee Wash, the escarpment, the trenches, and the San Juan River.

a. Generalized Uranium Plume Map, 2013–2014



b. Bubble Plot of Uranium, March 2015 Results

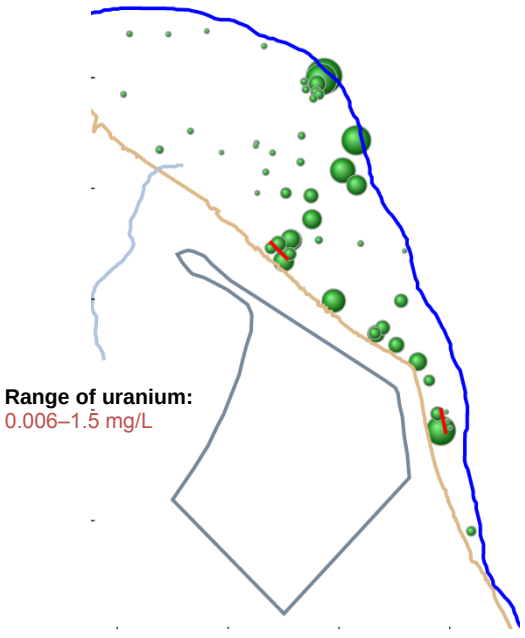


Figure 58. Distribution of Uranium on the Shiprock Floodplain, 2013–2015

Plume map in plot 58a adapted from 2014 annual report; bubble plot in 58b plots most recent (March 2015) data.

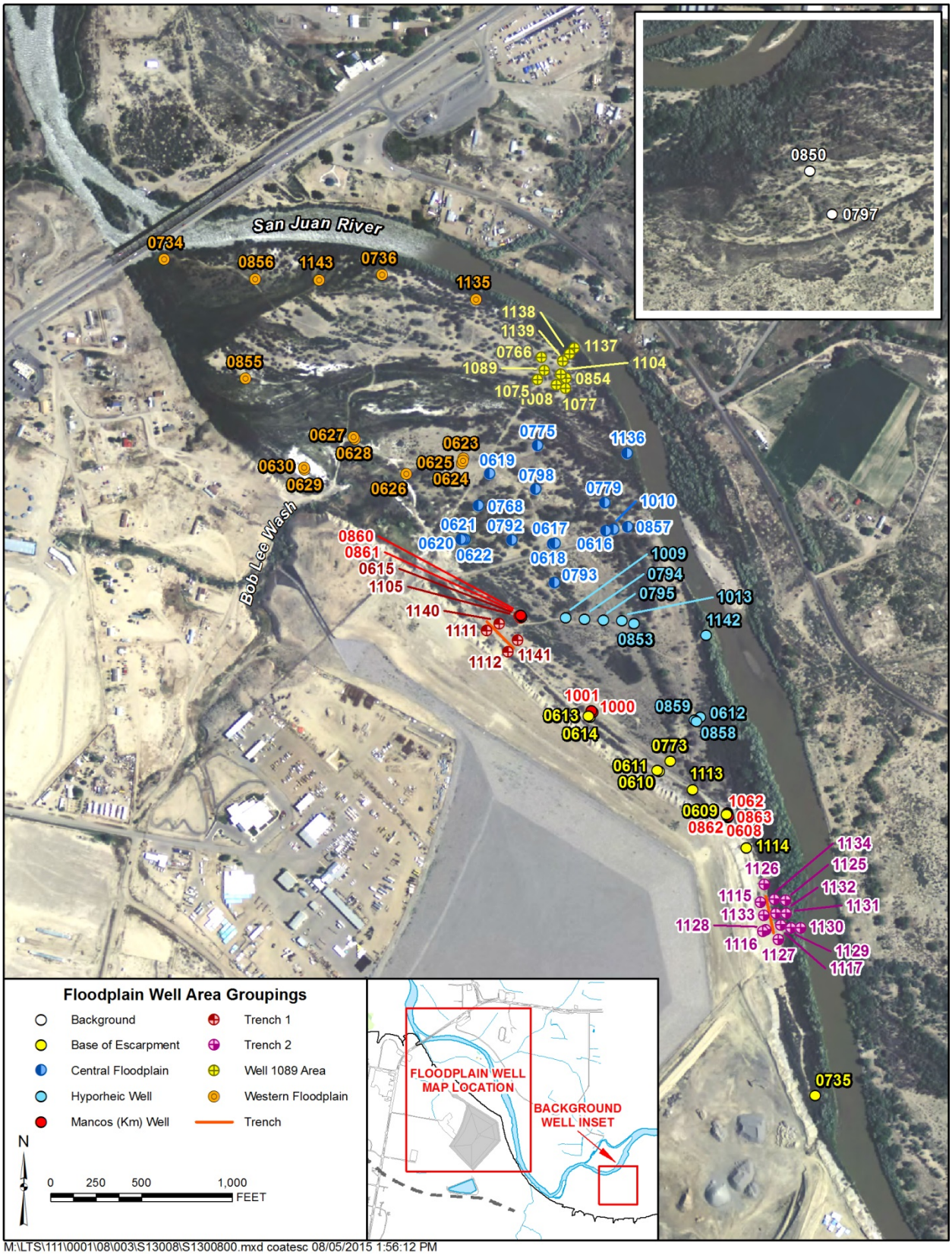


Figure 59. Shiprock Floodplain Well Groupings

Each floodplain well profiled during the Phase I field effort was assigned to one of nine different groups, depending on spatial location and the formation monitored by the wells (Figure 59). Appendix A (Table A-13b and Table A-14b) documents the SC profile summary statistics based on these groupings. The remaining figures in this section show the differences in the SC profiles (2013 vs. 2014) for most of these well groups, with the focus being on those groups with the most highly variable well profiles.

Figure 60 plots SC by depth for the most highly variable wells (CVs ≥ 0.1) in the central floodplain. In each of these nine wells, SC increased markedly with depth in both the 2013 and 2014 profiling efforts. Also, the magnitude of SC at the bottom of these wells is quite high, generally ranging from about 7,000 to 16,000 µS/cm. (In the 2013 profile for well 0779, SC approached 24,000 µS/cm). These profiles, and the SC magnitudes reached near or at the well bottoms, are typical of parts of the floodplain highly impacted by contamination stemming from former uranium mill operations at the Shiprock site, indicating that the contamination is characterized by high salinity.

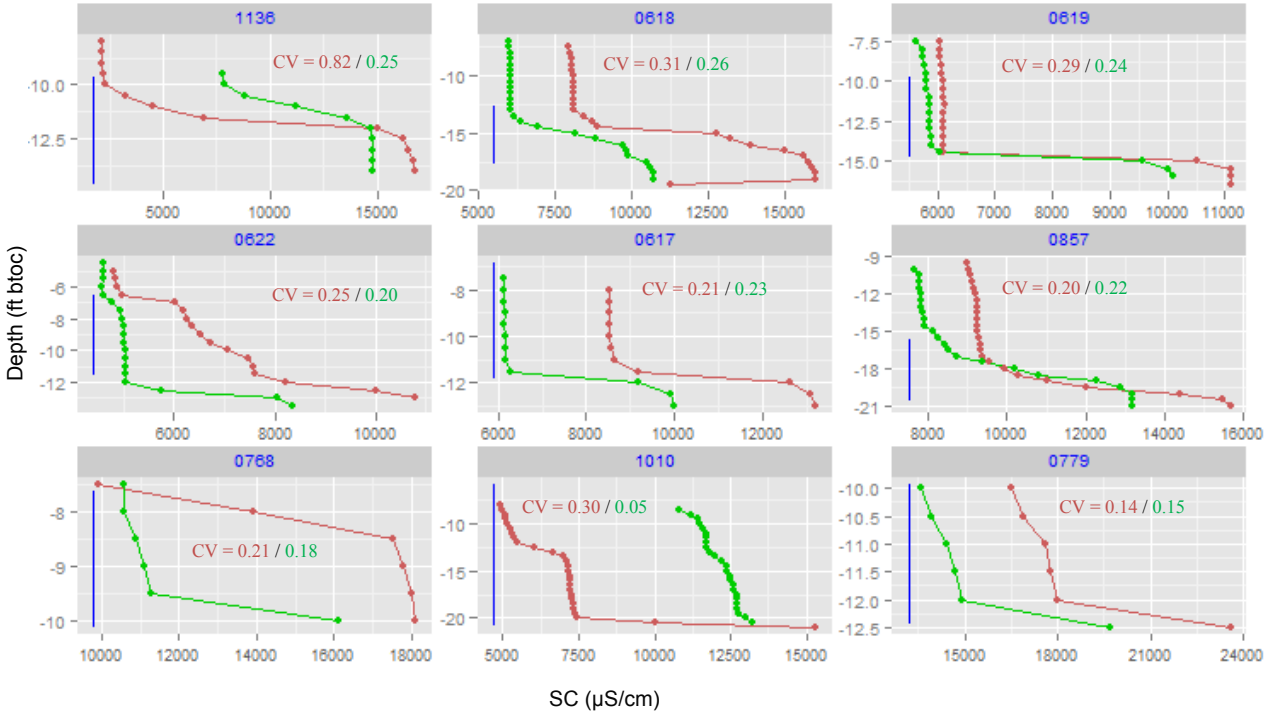


Figure 60. Specific Conductance Profiles for Central Floodplain Wells with CVs ≥ 0.1

Red line plot denotes September 2013 profile; green line plot corresponds to April 2014 profile.
Wells listed in order of descending average CV; screened intervals are denoted by blue line (|) along the *y*-axis.

In wells 1136 and 0618, SC is fairly constant in the blank casing above the screened portion of the well but then increases markedly over the screened interval (Figure 60). In other central floodplain wells, however (e.g., wells 0619 and 0617), SC is constant through the screened interval but then increases steeply in the lower (unscreened) blank casing. Figure 61 plots historical trends of SC and uranium in near-river well 1136, the well with the greatest degree of variation in SC with depth (based on the average CV for both 2013 and 2014 profiles). This figure is just one example of many cases on the Shiprock floodplain in which the variation in a well's SC profile could explain the variation in historical monitoring results.

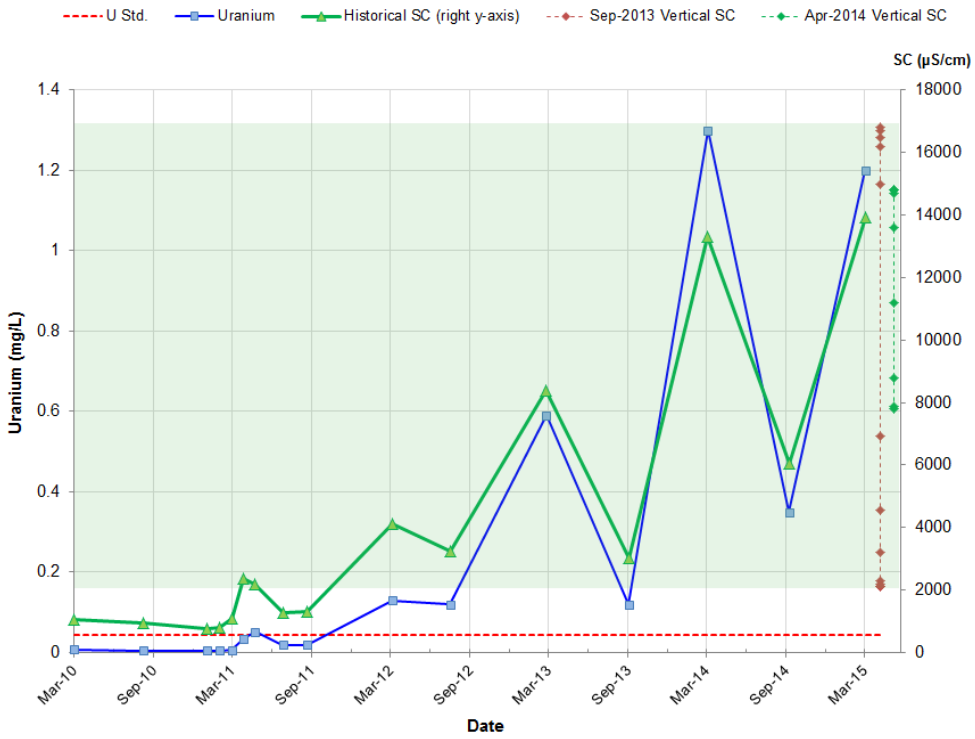


Figure 61. Historical Trends of SC and Uranium in Central Floodplain Well 1136

At well 1136 (installed in January 2010), there is an apparent strong correlation between SC and uranium, both of which are highly variable. In this well, the magnitude and range of SCs measured during the September 2013 profiling event—over a span of about 6.5 ft of water, and almost entirely within the screened interval—could theoretically explain the range in SCs measured since 2012. (This profile is represented by the red points along the right y-axis in Figure 61; also refer to the first SC profile in Figure 60.) Despite this observation, there appears to be a seasonal component to the trends for SC and uranium in well 1136. Because of the proximity to the San Juan River (about 50 ft from the well, Figure 54), changing river levels and flows probably influence the temporal variation in water quality in this well. Nonetheless, these results highlight the need to document sampling depths at some LM site wells.

Figure 62 plots SC profiles for both monitoring and remediation pumping wells in the 1089/1104 remediation area near the San Juan River. As found for most central floodplain wells, SCs measured during the April 2014 profiling were generally lower than those measured in 2013.

At wells 1104 and 1139, SC measured in April 2014 was about 50 percent lower than the SC measured in September 2013. The Phase I profile results for this region might be explained by a number of factors, such as physical stresses on the alluvial groundwater system (i.e., several years of pumping at wells 1089 and 1104), seasonal and year-to-year changes in water levels in the nearby San Juan River, or inflow of uncontaminated water from the river. Another possible explanation is that the Mancos Shale sediments directly underlying the floodplain alluvium can be a source of high salinity and contamination (e.g., see SC profile for well 1075 in Figure 62). Further evaluation of these potential factors will be done during Phase II of the Variation Project.

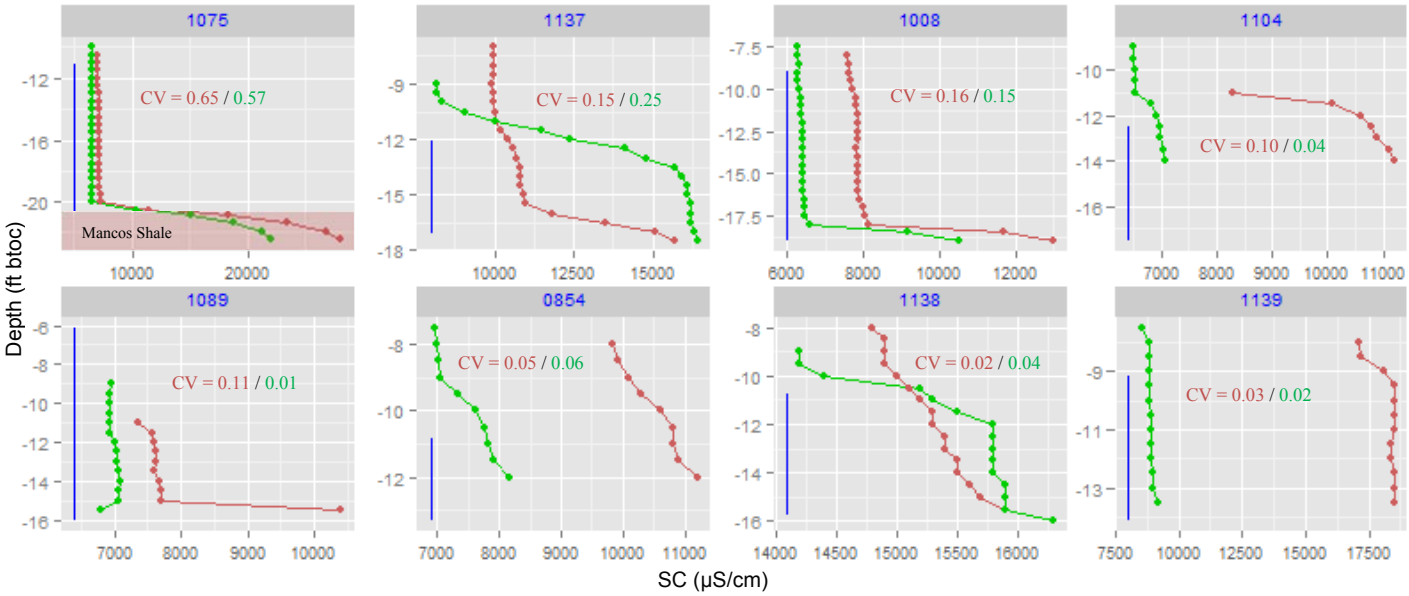


Figure 62. Specific Conductance Profiles for Shiprock Well 1089 Area, Top Eight CV Ranks

Red line plot denotes September 2013 profile; green line plot corresponds to April 2014 profile.
Wells listed in order of descending average CV; screened intervals are denoted by blue line (|) along the *y*-axis.

Figure 63 plots SC profiles for Trench 1 area wells. In four of these wells—1140, 1141, 1111, and 0615—there was only about 2 to 3 ft of water, so it was not possible to measure SC over the full screened interval (well construction and screen information will be verified in Phase II). As found throughout the floodplain, SC increases with depth in most Trench 1 area wells.

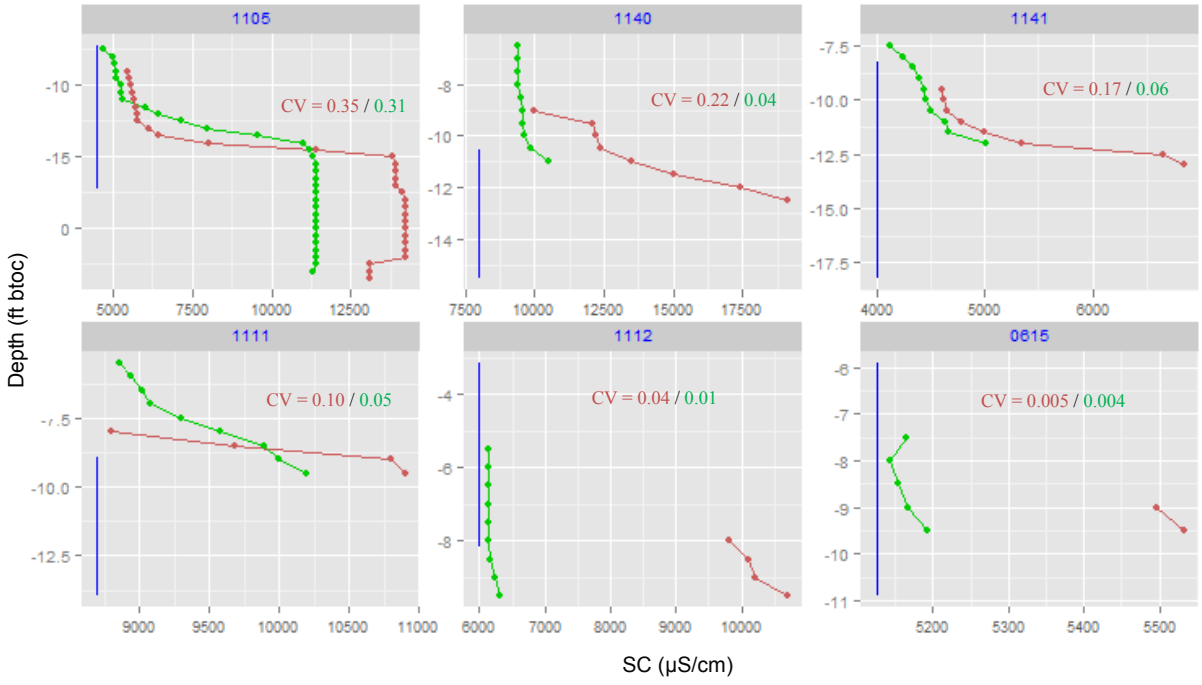


Figure 63. Specific Conductance Profiles for Trench 1 Area Wells

Red line plot denotes September 2013 profile; green line plot corresponds to April 2014 profile.
Wells listed in order of descending average CV; screened intervals are denoted by blue line (|) along the *y*-axis

Similar to the example shown for central floodplain well 1136 (Figure 61), Figure 64 plots historical monitoring results for SC and uranium at one of the most highly variable Trench 2 area wells, near-escarpment well 1115 (actual profiles shown in Figure 65). This figure demonstrates how SC tends to correlate with uranium at the Shiprock site (this is also true for other contaminants such as sulfate). Additionally, the range of SC measured vertically in both 2013 and 2014 is comparable to the range of SC measured in the well since June 2006.

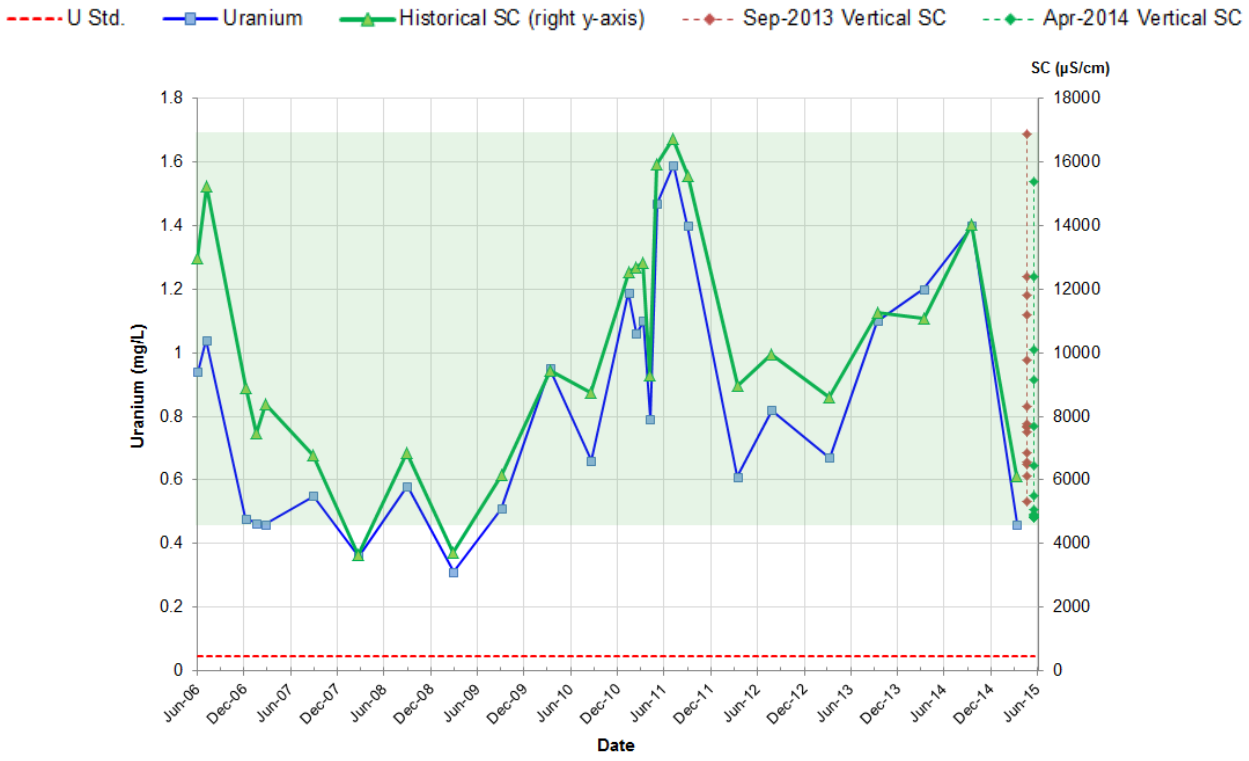
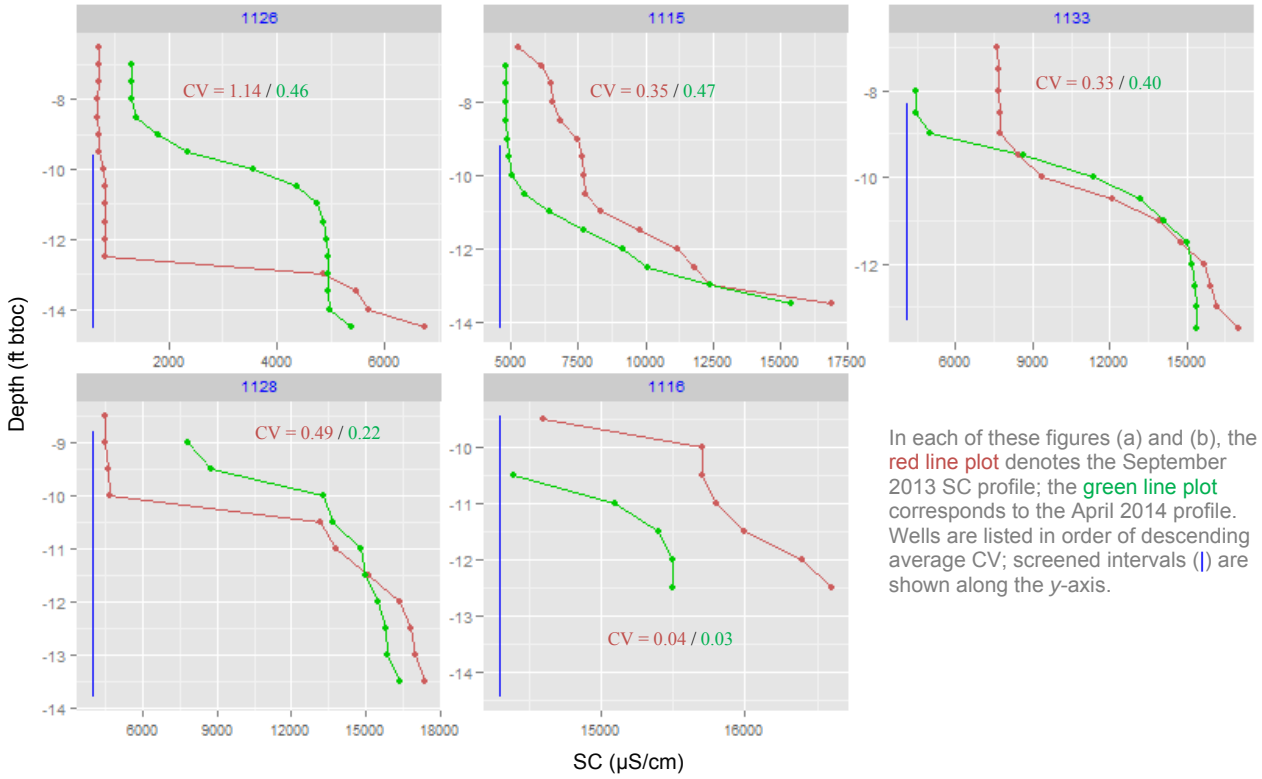


Figure 64. Historical Trends of SC and Uranium in Trench 2 Well 1115

Figure 65 plots Phase I (2013 and 2014) results for the Trench 2 area wells with the most highly varying SC profiles. At most wells on the escarpment side of the trench, SC increased markedly over the screened interval—at least doubling and in one case (well 1115) tripling. In most of these wells (1115, 1116, 1128, and 1133), groundwater is quite saline near the bottom of the alluvium (SC > 15,000 µS/cm; Figure 65a). The relatively low SC measured in well 1126, north of the trench (689-6744 µS/cm), might reflect that fact that pumping from the trench induces inflow of uncontaminated river water to this local area.

SC profiles for the non-trench area base of escarpment wells (Figure 66) have the same characteristics found for many other wells on the Shiprock floodplain—marked increases in SC with depth, and fairly high salinity at the base of the alluvium. Despite the relatively low salinity (i.e., low SC) in hyporheic area wells (Figure 67), the region of the floodplain where groundwater tends to be affected by inflow of uncontaminated river water (Figure 59), CVs for some of these profiles are high (≥ 0.1), and the shapes of profiles can vary greatly between the two profiling periods.

a. Trench 2 Escarpment Side Wells and Well 1126



In each of these figures (a) and (b), the red line plot denotes the September 2013 SC profile; the green line plot corresponds to the April 2014 profile. Wells are listed in order of descending average CV; screened intervals (|) are shown along the *y*-axis.

b. Riverside Wells with CVs ≥ 0.1

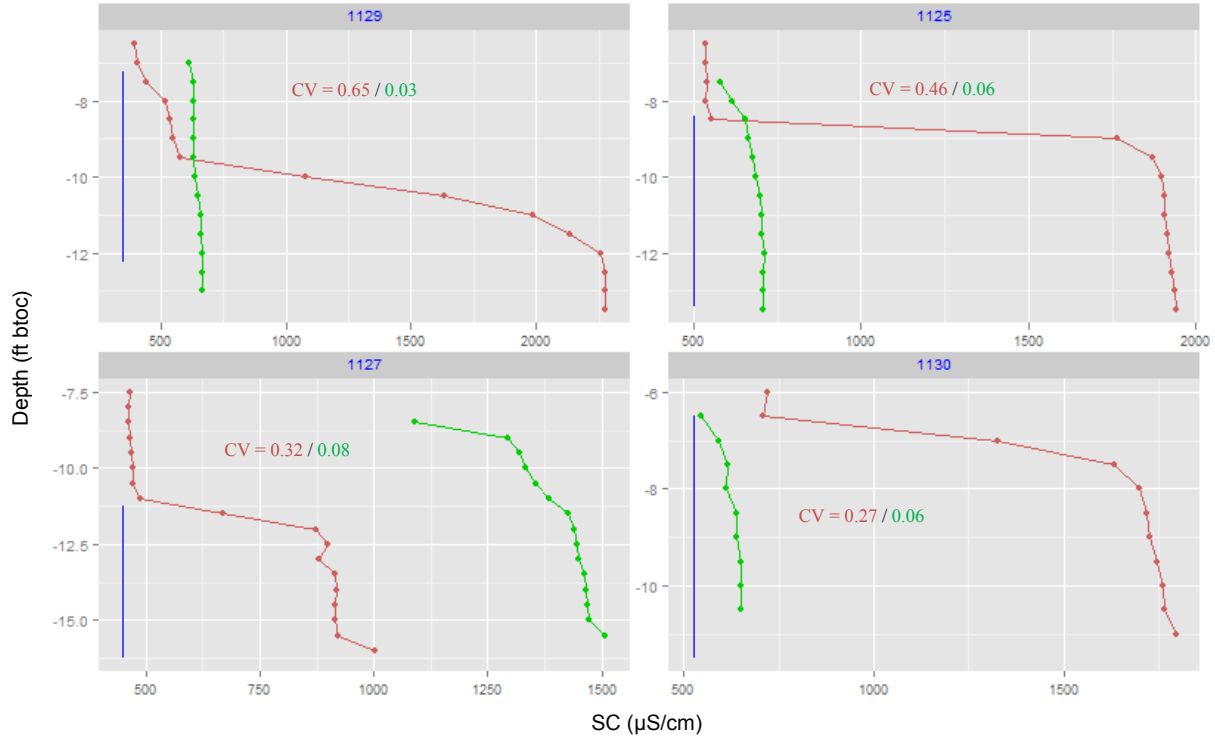


Figure 65. SC Profile Results for Trench 2 Area Wells

This figure is subdivided because of the large differences in SC magnitude between wells on the escarpment side of the trench (a) and those on the river side of the trench (b).

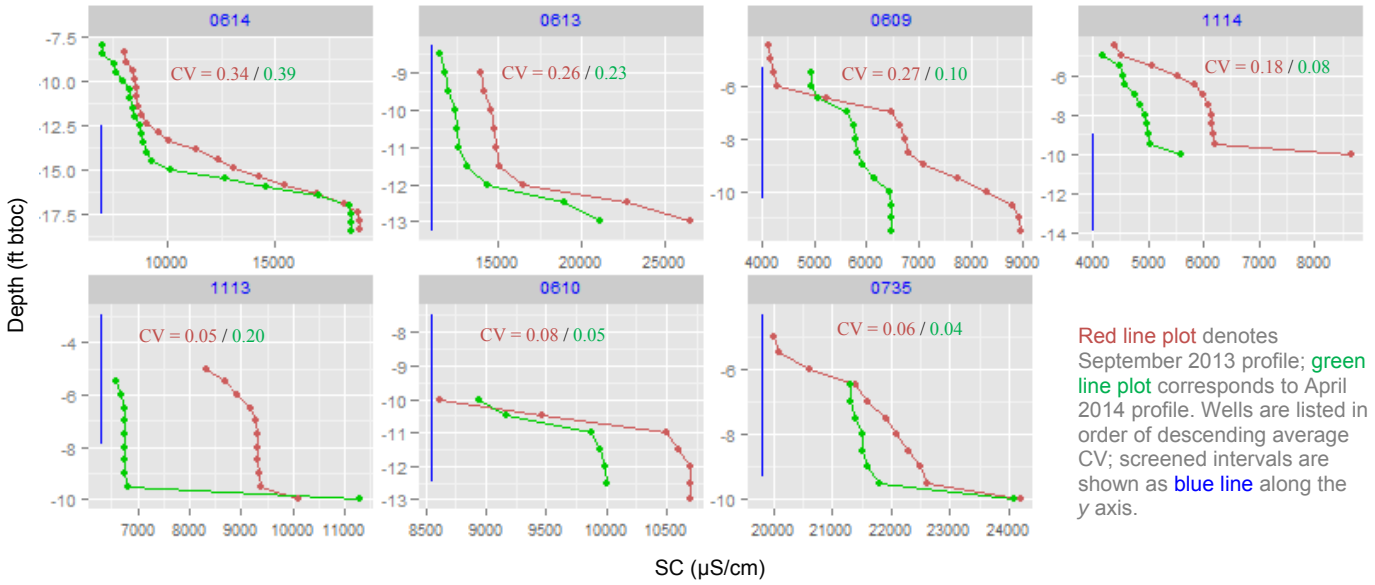


Figure 66. SC Profiles for Base of Escarpment Alluvial Wells with Mid- to High-Level Variation

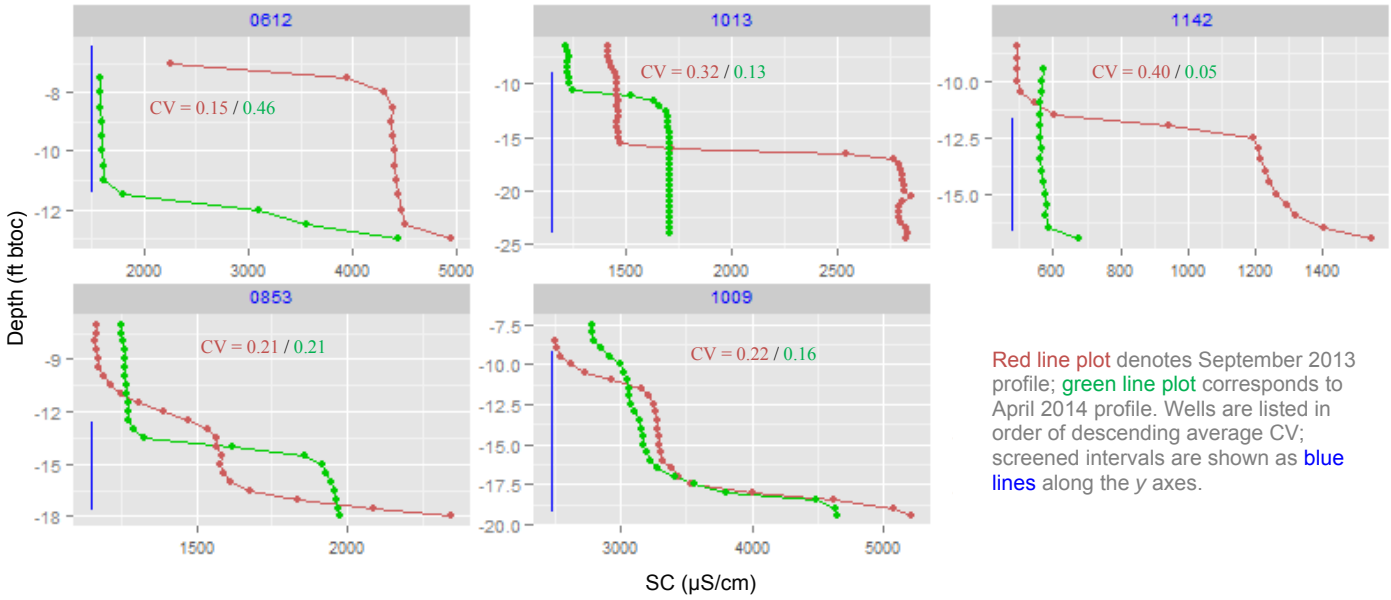


Figure 67. SC Profiles for Shiprock Floodplain Hyporheic Wells with CVs ≥ 0.1

As stated in the introduction to this section, because of the large number of wells on the Shiprock floodplain with highly variable SC profiles (Table A-13, Table A-14), it was not possible to develop meaningful interpretations of these results except for just a few wells or examples. Despite this broad treatment, the widespread and often marked variation in SC profiles measured at this site warrants further investigation. One conclusion that can be drawn based on these results is it may be important to record sampling depths during routine monitoring events at this site. This is particularly true for wells in portions of the floodplain alluvium that are influenced by both remediation pumping and interactions with nearby portions of the San Juan River, such as the Trench 2 and 1089/1104 areas.

4.13 Slick Rock, Colorado, Processing Sites

SC profiling was conducted at the Slick Rock processing sites in June 2014. This site consists of two former uranium-ore processing facilities, referred to as the Slick Rock East (SRE) site and, approximately 1 mile downstream from SRE, the Slick Rock West (SRW) site. Both sites are located along the Dolores River in San Miguel County (Figure 68). Thirteen alluvial wells were profiled at SRE, including two background wells. Nineteen wells were profiled at SRW. Appendix A (Table A-15, Table A-16) provides supporting information.

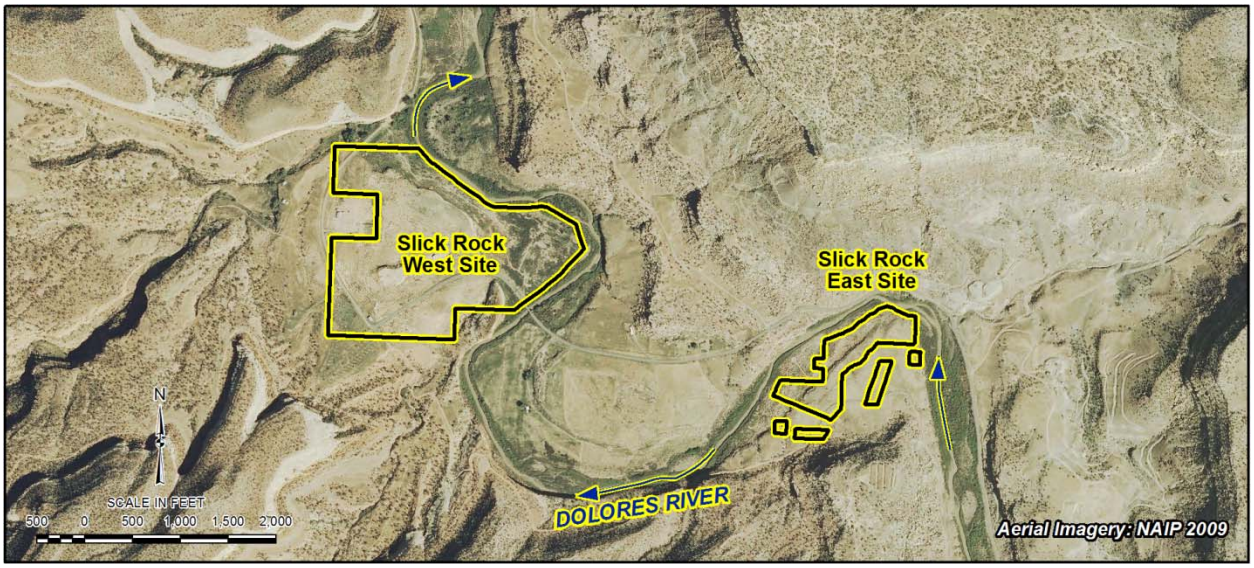
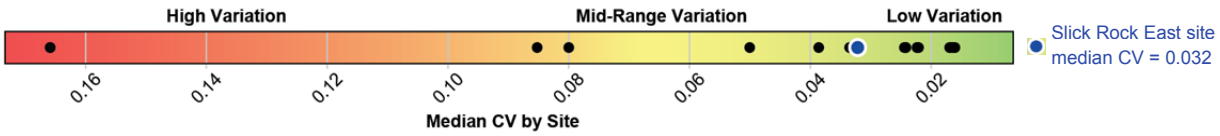


Figure 68. Aerial View of Slick Rock, Colorado, Processing Sites

4.13.1 Slick Rock East Site

As shown in Figure 69 and in the supporting data tables in Appendix A (Table A-15), of the 13 alluvial wells profiled at the SRE site, five had notable variation in the SC profiles (CVs ≥ 0.1). These wells are, in order of descending CV—0304, 0302, 0308, 0303, and 0300. Of these top ranks, one (0300) is a background well and only three (0300, 0303, and 0309) are routinely sampled. Overall, the Slick Rock East site ranked 8th of 16 site profiles based on the median CV of 0.032 (see inset below, adapted from Figure 10). This median CV is about equal to those calculated for the Durango Disposal and Slick Rock West sites (Table 3).



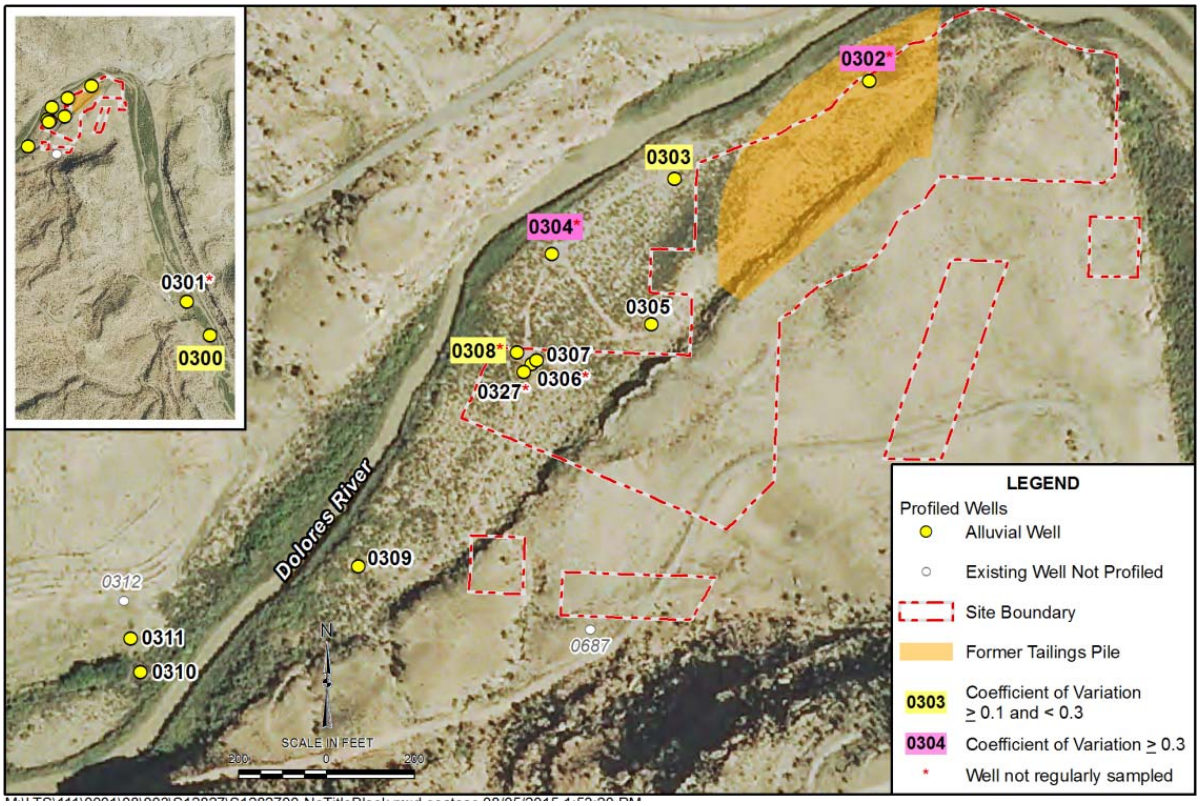


Figure 69. Wells Profiled at the Slick Rock East Processing Site, June 2014

Vertical profiles for all SRE wells profiled are plotted in Figure 70. Figure 71 plots SC by depth for the most variable subset of those wells, sorted in order of variation based on the CV. Similar to observations made for the Riverton processing site, despite the fact that about 40 percent of the SC profiles for the SRE site had CVs ≥ 0.1 (Table A-15), based on a limited review of site data, there is no indication that this variation has confounded interpretations of historical monitoring data in any way. In part, this is because half of the wells with notable variation are not sampled, so there is no context for evaluating whether the observed variation is meaningful (or not).

The high SCs and variation observed in background well 0300 could be of interest as long as this well is used as the basis for characterizing background conditions. At this well, uranium concentrations have increased from 0.01 mg/L (2000−2001 baseline) to 0.046 mg/L in 2014. Also, on average, recent SC levels in this well (about 12,000–15,000 µS/cm) have been higher than those in any other SRE well.

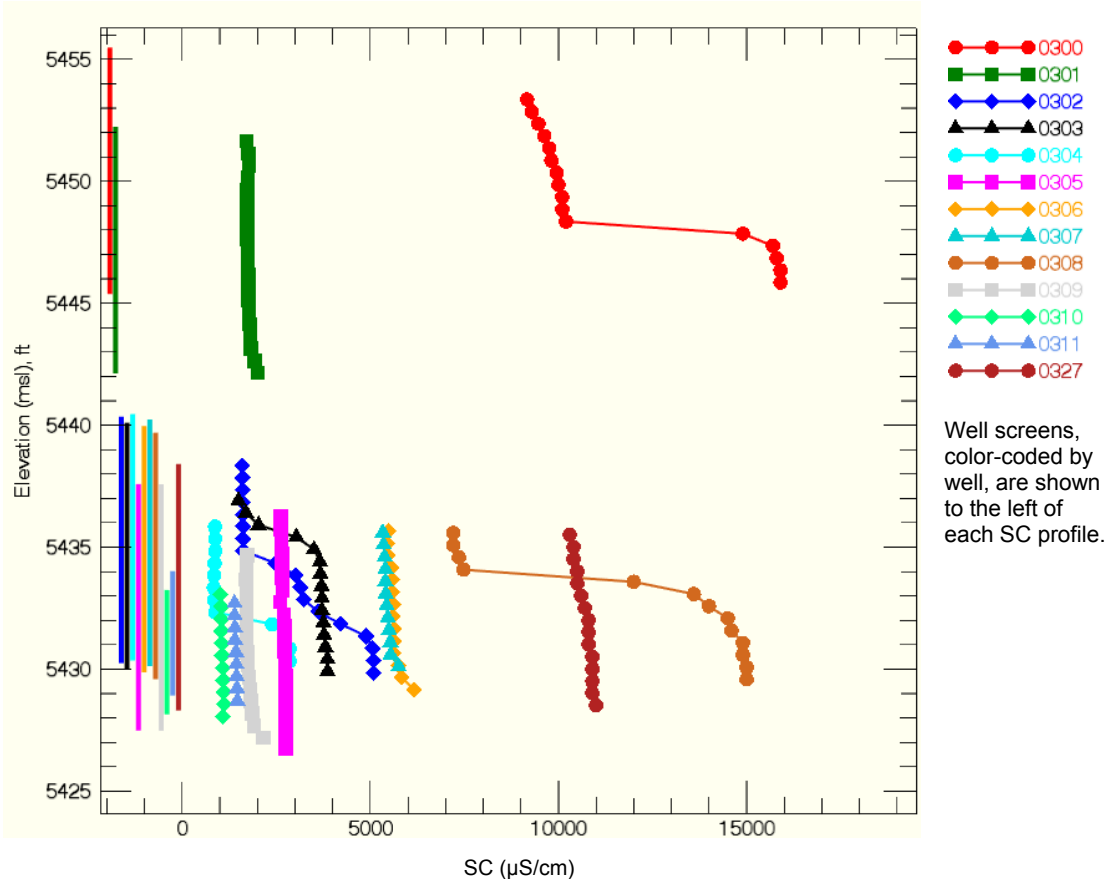


Figure 70. Vertical Profiles of SC in Slick Rock East Wells

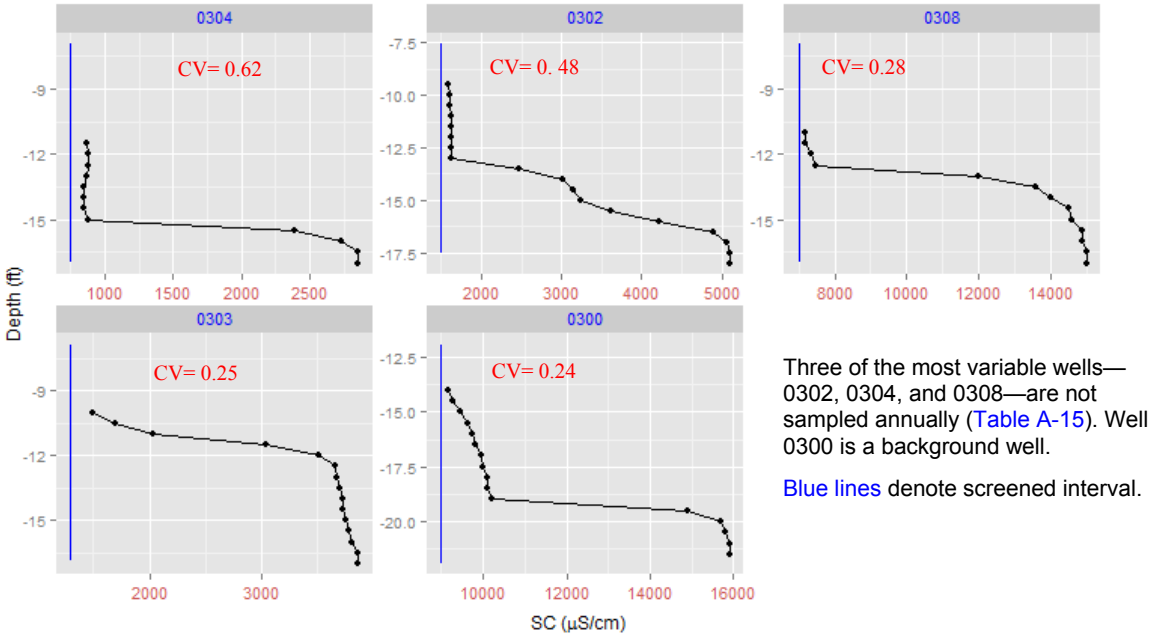


Figure 71. SC Profile Results for Slick Rock East Wells with CVs ≥ 0.1

4.13.2 Slick Rock West Site

Of the 19 alluvial wells profiled at the SRW site, two (wells 0319 and 0322) had notable variation in SC profiles (CVs ≥ 0.1; Figure 72). Well 0509, third rank in terms of variation, had a CV of 0.08. Only one of these wells, 0319, is normally sampled. Supporting data are provided in Appendix A, Table A-16.

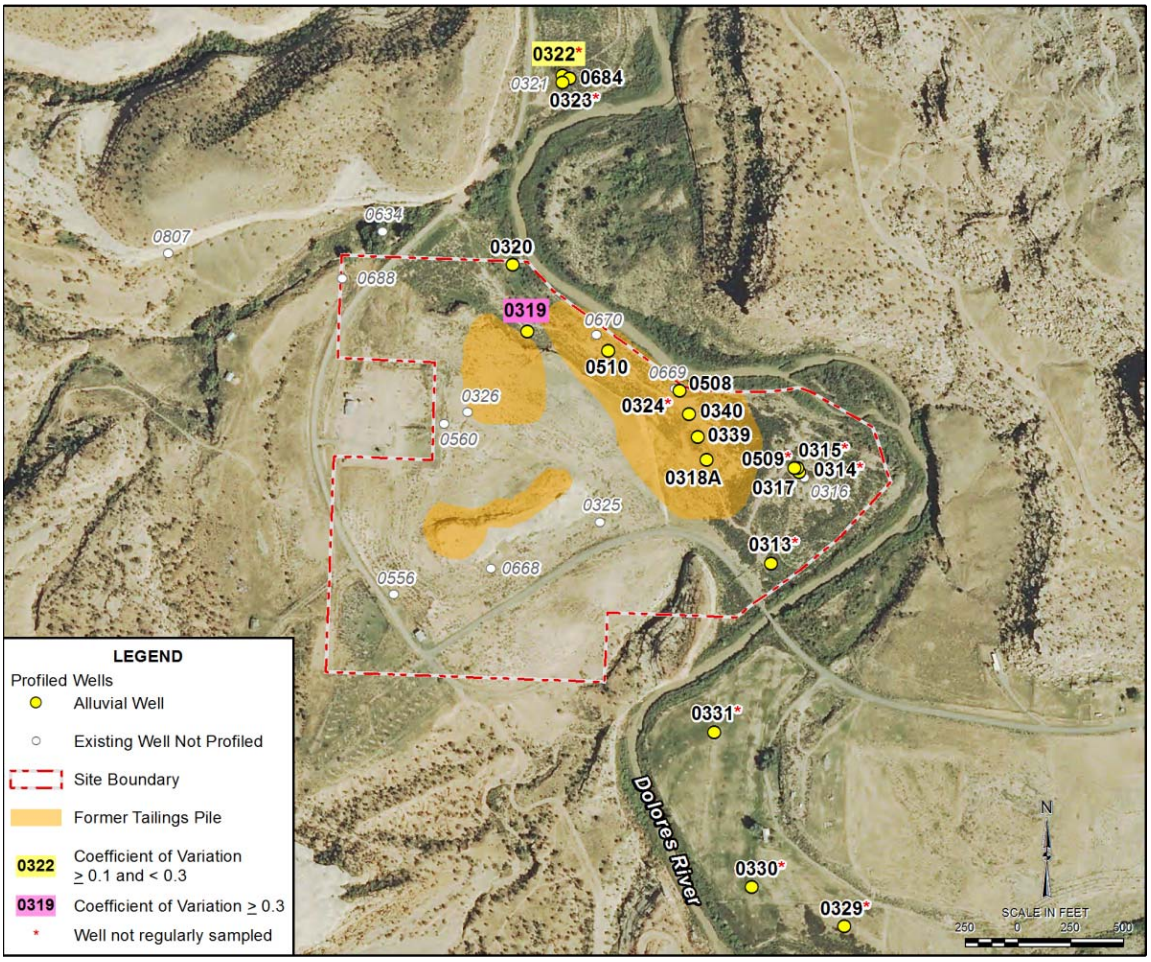
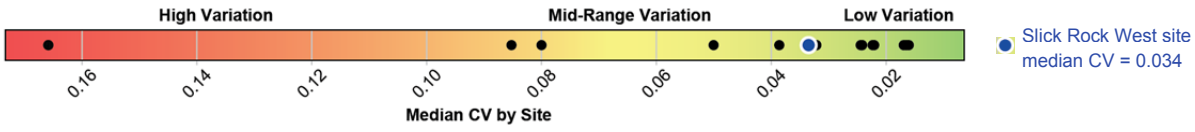


Figure 72. Wells Profiled at the Slick Rock West Site, June 2014

Overall, the Slick Rock West site ranked 6th of 16 site profiles based on the median CV of 0.034 (see inset below, adapted from Figure 10). This median CV is about equal to those calculated for the Durango Disposal and Slick Rock East sites (Table 3).



Vertical profiles for all SRW wells are plotted in Figure 73; Figure 74 plots SC by depth for the three most variable SRW wells, those with CVs > 0.08.

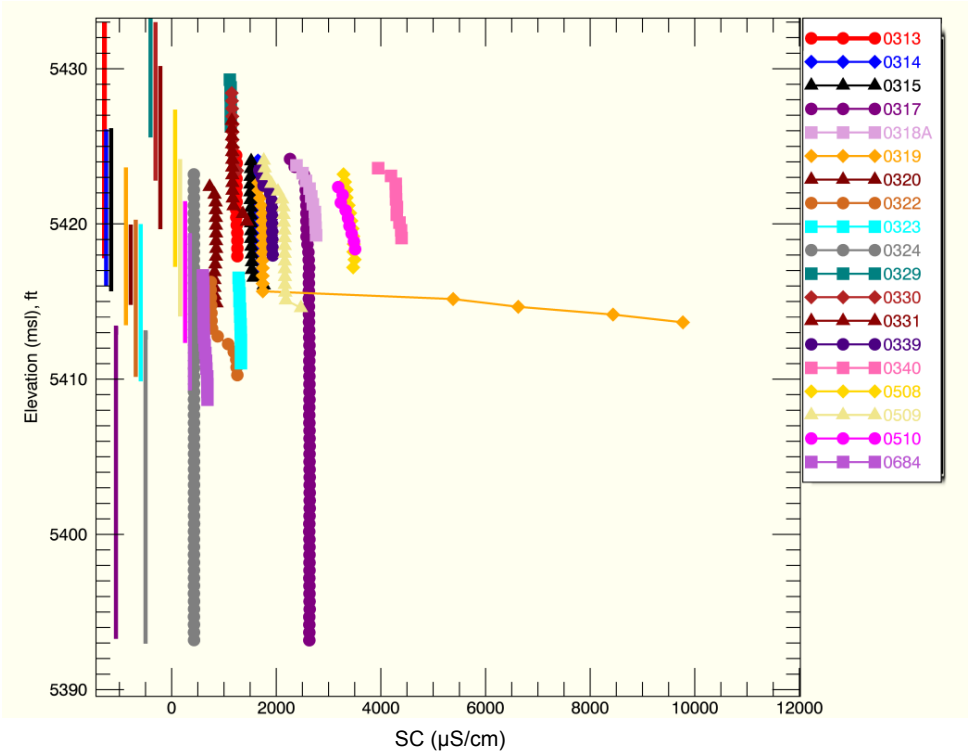


Figure 73. Vertical Profiles of SC in Slick Rock West Site Wells

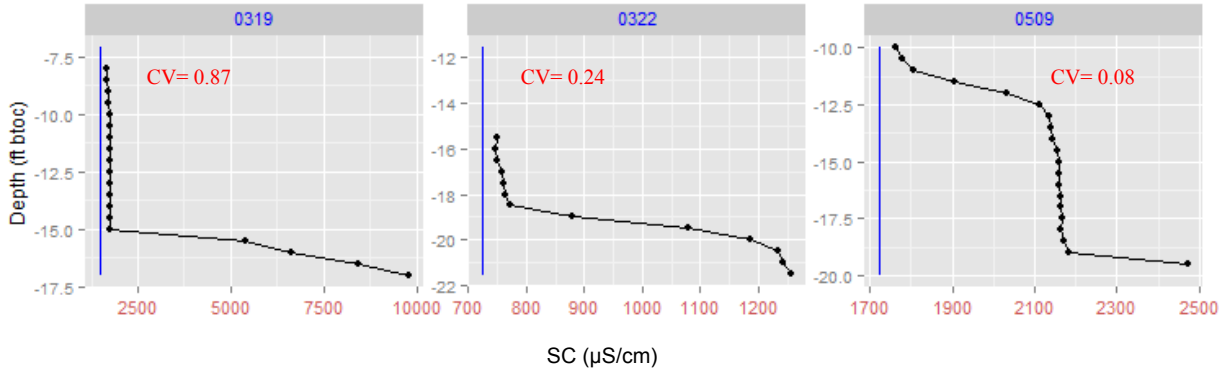


Figure 74. SC Profiles for Slick Rock West Site Wells with CVs ≥ 0.08

Screened intervals denoted by blue lines near y-axis. Of these wells, only well 0319 is routinely sampled.

SRW well 0319 is considered a "hot spot" for BTEX (benzene, toluene, ethylbenzene, xylenes); elevated selenium has also been measured in this well. A brief review of historical results indicates no apparent correlation between SC and the known contaminants in this well. Uranium has not been analyzed since early 2002, when concentrations were low (<0.0025 mg/L). The SRE and SRW sites ranked 6th and 8th (of 16 site profiles) based on the median CV (Table 3). However, based on this preliminary (Phase I) evaluation, the variation observed at these sites is probably not important from a compliance perspective. This is largely because the most variable wells are not those with elevated constituents of concern.

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5.0 Discussion

The findings documented in Section 4 demonstrate that although some sites, such as the Shiprock floodplain and the Durango processing sites, have wide-scale variation in SC profiles at most wells, other sites have overall very little variation (Figure 75). Nonetheless, every site has at least one well with high enough variation in the SC profile to warrant further examination. Table 4 summarizes the major findings of the Phase I field effort and identifies the wells at each site with the greatest degree of variation in the SC profiles.

Whether the vertical variation in SC measured in some wells is important from a compliance or other perspective was not evaluated in depth in this phase of the study. However, in some cases, the variation in the vertical profile measured in a single afternoon could in theory explain the variation in historical monitoring results. If SC co-varies with contaminant concentrations (to be evaluated in Phase II), sampling at different depths could affect interpretations of temporal contaminant trends, especially if low-flow sampling techniques are employed. The preliminary findings of this study suggest that routine documentation of sampling depths is important at some LM sites (e.g., Durango and Shiprock), and is recommended as a best practice approach at all LM sites where groundwater monitoring is included in the site's long-term care.

Most wells profiled in this investigation had low variation (refer to the histogram in Figure 5). If low variation in SC is a predictor of low variation in the contaminant profiles (this has not yet been established), then it is likely that historical interpretations of trends are valid for most wells at most monitored LM sites (if other relevant factors are accounted for).

Results of the 2013 and 2014 profiling efforts on the Shiprock floodplain indicate that there are temporal differences in the profiles. The site was profiled in different seasons and under different groundwater, river flow, and pumping conditions. The reproducibility of SC (and contaminant) profiles will be further evaluated in Phase II of this investigation.

Apart from the findings discussed above, few site-specific conclusions can be drawn based on this preliminary Phase I work. For example, it is not known at this time whether the stratification in SC measured at various sites and wells is representative of vertical variations in SC in the surrounding aquifers. That is, how do intra-well profiles relate to profiles in the subsurface? Phase I SC profile results will be considered along with results of later project phases to assess possible explanations for the observed variation in wells. Factors to be examined include anthropogenic factors, such as sampling technique (low-flow versus purge), borehole effects (e.g., casing degradation), or natural factors such as density-dependent flow or aquifer heterogeneity. Other factors that will be assessed for their potential influence on intra-well variation include well depths, aquifer lithology, screen placement and length, saturated thickness, and proximity to pumped wells or surface water bodies.

It is premature to assume that the same degree of variation in SC found vertically would be replicated for specific contaminants; that endpoint will be evaluated during the Phase II field investigation discussed in Section 6.

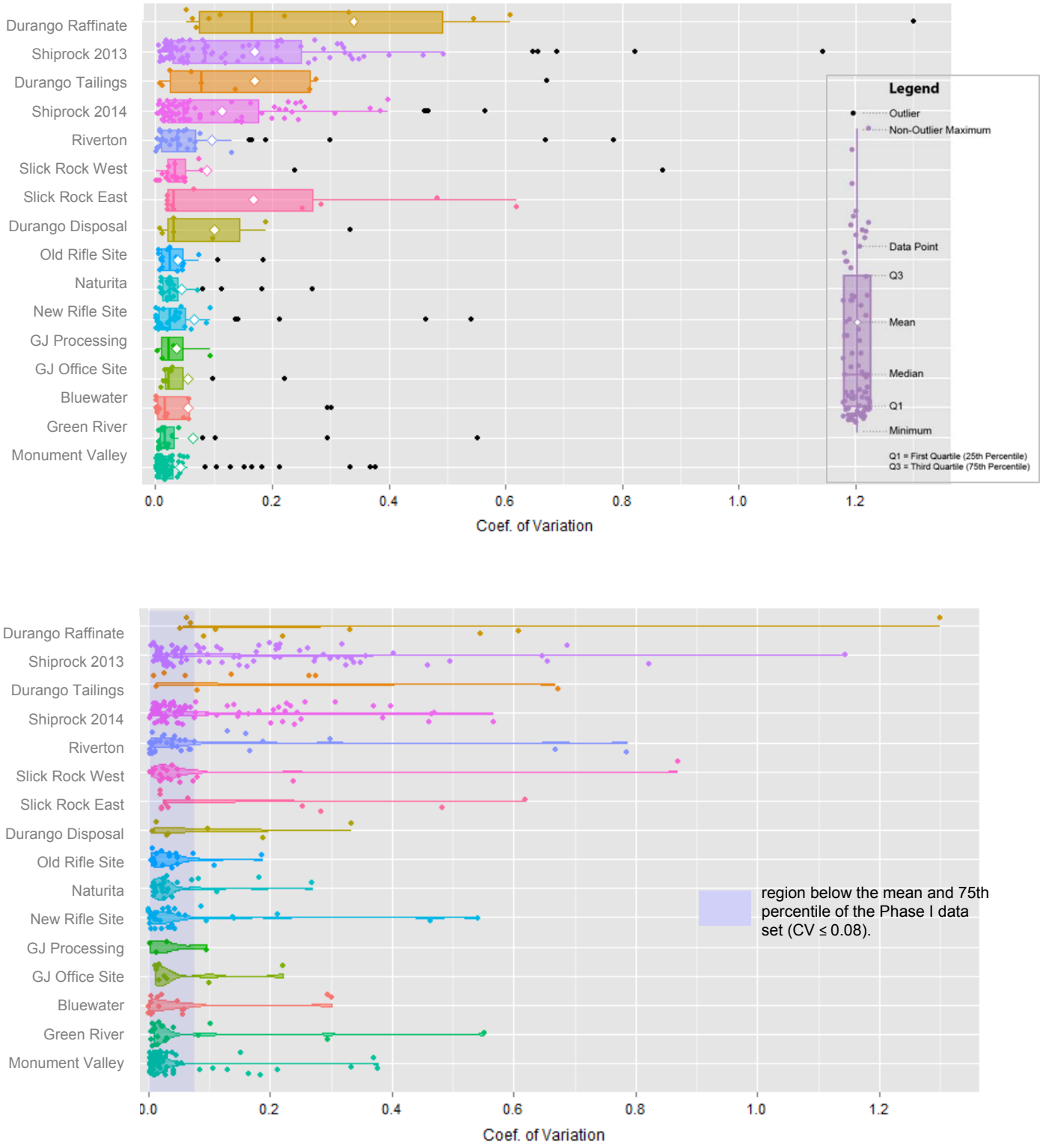

Figure 75. Box and Violin Plots of Phase I Profile Data, Ranked by Median CV

The uppermost box and jitter plot duplicates the summary plot provided in Section 3 (Figure 6); each point represents an individual well. The lower "violin" plot shows the same data in a slightly different format, illustrating the probability density of the data at different values. For those sites where the majority of wells had low to mid-level variation in the SC profiles, this density appears as a bag-like shape in the left portion of the plot. The blue-shaded region in the plot denotes the region below the mean and the 75th percentile of the data set (CV ≤ 0.08, Figure 5).

Table 4. Summary of Variation Project Phase I Findings

Site	Wells with the Greatest Variation in SC Profiles (CVs ≥ 0.1)	Comment
Bluewater Disposal Site	San Andres wells L(SG), I(SG)	Both wells are San Andres aquifer wells with open-hole construction; L(SG) is a background well, upgradient of the main site disposal cell. I(SG) is a POE well, the farthest downgradient location at the site. Historical monitoring data indicate that SC co-varies with uranium in well I(SG).
Durango Mill Tailings Processing Site	Wells 0631, 0863, 0630, and 0633	SC profile for well 0631 indicates potential impact on interpretation of site data if SC and uranium and other contaminants co-vary as suggested by historical data. Two wells with high variation, 0632 and 0633, are screened in the Mancos Shale.
Durango Raffinate Pond Processing Site	Wells 0889, 0593, 0883, 0875 , 0884, and 0594	The four most variable wells at the raffinate ponds site, those with CVs ≥ 0.3, have not been sampled since 2001–2002 because of low uranium concentrations.
Durango Disposal Site	Menefee wells 0607 and 0621; alluvial well 0618	Most variable wells are POC wells at the site. At well 0618, uranium has been increasing since 2003. SC profile could explain historical SC trends in this well, which appear to correlate with uranium.
Grand Junction (Office) Site	Wells 8-4S and 6-2N	Eight alluvial wells were profiled; notable variation observed only at well 8-4S.
Grand Junction (Climax) Processing Site	No wells with significant variation. All profiles had CVs < 0.1.	Only four wells were profiled, given lack of access to BLM wells. The site is not routinely monitored, limiting conclusions that can be drawn.
Green River Disposal Site	Cedar Mountain Middle sandstone unit wells 0172, 0174, and 0181 (near disposal cell) and alluvial well 0194	Well 0194, ranked 4th with a CV of 0.08, is an important indicator of contamination in the Browns Wash alluvium. Generally high SC values in this region may suggest density-dependent flow conditions.
Monument Valley Processing Site	Alluvial wells 0650, 0762, 0654, 0649, 0735, and 0401; DeChelly wells 0657 and 0612; and Shinarump well 0659	Most wells with high variation are within or downgradient of former processing area. Region at site with the most variable wells correlates somewhat with sulfate plume at the site.
Naturita Processing Site	Farthest downgradient alluvial wells 0715 and 0718	Both wells 0715 and 0718 have high and variable uranium levels that appear to co-vary with SC.
New Rifle Processing Site	Onsite alluvial wells 0215, 0216, and 0862, far downgradient well 0172, and Wasatch well 0627	Of the five wells with CVs ≥ 0.1, only results from westernmost well 0172 are potentially important with respect to interpreting historical trends.
Old Rifle Processing Site	Alluvial DOE (site) well 0305 and IFRC well LR-04	Very little variation overall at this site; no indication that interpretations of historical data might be confounded by any variation in the vertical profiles.
Riverton Processing Site	Surficial aquifer wells 0728 and 0729, semiconfined aquifer wells 0702, and three confined aquifer wells that are not normally sampled.	Most wells with high-level variation are deeper and are not normally sampled. Surficial well 0789, near the Little Wind River with the highest uranium concentrations, had one of the least variable SC profiles.
Shiprock Floodplain	Significant variation in many wells, not possible to enumerate in this summary.	High-level variation in SC profiles (CV ≥ 0.1) in many wells. Historical monitoring results indicate a sometimes strong correlation between SC and other site contaminants (e.g., uranium, sulfate), so sample depth is an important consideration at this site.
Slick Rock Processing Sites	Slick Rock East wells 0304, 0302, 0308, 0303, and 0300; Slick Rock West wells 0319 and 0322	The most notable variation at these sites was found in background well 0300, where uranium recently exceeded the MCL. The most variable SC profiles were measured in wells that are not normally sampled.

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6.0 Conceptual Framework for Phase II Site Selection and Scope

Phase I results will be used to define a scope for Phase II, which will focus on the high-variability sites. The primary goal of the Phase II field effort will be to determine if there is a correlation between SC and contaminant levels in the wells. Based on these concepts and the results of the Phase I field investigation, sites considered for further evaluation in Phase II include:

- Shiprock floodplain
- Durango processing site mill tailings area
- Durango processing site raffinate ponds area

Other sites (e.g., Green River, New Rifle, or Riverton) may be included pending further evaluation of these Phase I results. Phase II work at the Durango raffinate ponds processing will include profiling of the five onsite non-DOE wells that could not be accessed during the Phase I effort. More-limited work may be done at other sites with little overall variation, but several highly variable wells—for example, Grand Junction Office site well 8-4S. The Phase II scope will include chemical profiling, radon-222 measurements, circulation testing, and modeling.

Chemical Profiling. In selected wells, samples will be collected using low-flow purge methods at 0.5 to 1 ft intervals. Samples will be analyzed for uranium and major ions and potentially other constituents, depending on the site. Most wells selected for chemical profiling will be those with the greatest degree of variation in SC profiles. However, a proportion of mid- and low-range variability wells will also be profiled because there is no evidence yet that little to no variation in SC implies corresponding lack of variation in contaminant profiles.

Radon-222 Profiling. Radon-222 will be profiled in selected wells to evaluate fluid flow and the degree of stagnation within the well. Radioactive decay of uranium-series isotopes produces radon within the aquifer material, and radon-222 measurements in a subset of wells can provide an estimate of the length of time the water has resided in the well.

Circulation Testing. In a subset of wells, a downhole circulation pump will be used to homogenize the water temperature and chemistry by circulating the water from the bottom of the well to the top of the water column. Rebound SCT data collected at multiple depths can be used to evaluate rates of groundwater inflow and delineate groundwater entry points within the screened interval.

Modeling. Modeling will be used to test the validity of multiple hypotheses regarding the chemical and thermal stratification observed in the wells. Single well models invoking density flow will be used to simulate the results of the profiling and circulation testing. For wells showing distinctive vertical stratification of chemical concentration, attempts will be made to estimate inflows and associated concentrations across the well's screened interval. The role of density-dependent flow as a mechanism impacting vertical profiles of SC will also be evaluated.

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7.0 Summary and Conclusions

7.1 Implications of Phase I Field Study Results

Although the proportion of wells with notable variation varied between sites, at all sites, several wells showed vertical stratification. Whether this variation is important from a compliance or other perspective was not evaluated in detail at this interim stage of the investigation. For those wells for which the historical record was evaluated, in some cases, the vertical variation in SC could explain the variation in monitored SC over time. For example, at Bluewater site POE well I(SG), the vertical variation in SC (and uranium) measurements is important because the interpretation of groundwater contaminant trends and plume movement at the site depends on the methods used to monitor this well.

Most wells profiled in this investigation, however, had low to low-mid-level variation in the SC profiles (CV < 0.05, Figure 5). At the majority of sites (Durango and Shiprock are exceptions), this finding is particularly true if only measurements within the screened interval are considered. If low variation in SC is a predictor of similar low variation in the contaminant profiles, it is likely that historical interpretations of trends are valid for most wells at most LM sites profiled in the Phase I investigation.

7.2 Future Work

Field season 2015 will consist of chemical profiles. Fiscal years 2015 and 2016 will focus on completing chemical profiles of a large number of wells at about five to six LM sites. Circulation testing and low-flow sampling to profile uranium concentrations will be conducted on selected wells. Concurrent with these efforts will be a modeling exercise that attempts to explain the profiles by incorporating density and chemical variations in the aquifer. The modeling effort will increase in fiscal years 2015 and 2016. Additional efforts that scale up in 2015 and 2016 include (1) review of chemical data in SEEPro/EQuIS (LM's environmental database) in conjunction with the well profiling and (2) application of appropriate statistical analyses.

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Appendix A

Specific Conductance Profile Results: Summary Statistics by Site

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Appendix A Tables

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Table A-1. Bluewater, New Mexico, Disposal Site

Bluewater, New Mexico, Disposal Site Specific Conductance Profile Results, October 2014

Table A-1a. Summary Statistics for Bluewater Site SC Profile Results: Sorted on Aquifer, Well ID

		Oct-2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Nov-2014**	**Historical Range**
20(M)	AL	45	1352	1376	1355	1355	6.5	1358	6.1	1.02	0.004	0.004	1332	1267 - 1511
21(M)	AL	55	1881	1927	1906	1906	4.0	1904	8.1	1.02	0.004	0.002	1833	1726 - 1934
22(M)	AL	27	1287	1373	1310	1315	10.0	1321	23.6	1.07	0.018	0.007	1278	1251 - 1442
E(M)	AL	19	1251	1459	1395	1418	98.0	1395	68.2	1.17	0.049	0.064	1443	1018 - 2042
F(M)	AL	37	564	567	567	567	1.0	567	0.7	1.01	0.001	0.002	550	535 - 733
Y2(M)	AL	18	574	665	622	628	77.8	622	35.8	1.16	0.058	0.119	647	552 - 740
11(SG)	SAG	96	2326	2647	2645	2333	309.8	2420	140.5	1.14	0.058	0.133	2596	2093 - 2634
13(SG)	SAG	147	1465	1575	1566	1539	5.0	1533	32.2	1.08	0.021	0.003	1503	1419 - 1567
14(SG)	SAG	141	2036	2052	2051	2047	6.0	2047	4.1	1.01	0.002	0.003	2013	1810 - 2267
15(SG)	SAG	189	1952	1983	1981	1979	5.0	1976	7.7	1.02	0.004	0.003	1923	1695 - 2085
16(SG)	SAG	51	3901	4183	3982	3984	49.0	4014	64.6	1.07	0.016	0.012	3952	3769 - 4553
18(SG)	SAG	136	1554	1842	1742	1584	52.3	1629	93.6	1.19	0.057	0.031	1723	1610 - 1904
I(SG)	SAG	154	264	3059	--	3035	1558.3	2438	719.5	11.6	0.295	0.513	2969	894 - 3075
L(SG)	SAG	228	1452	2665	--	1461	1199.0	1968	593.1	1.84	0.301	0.821	2613	1317 - 2913
OBS-3*	SAG	76	3404	3497	3494	3472	35.8	3467	23.4	1.03	0.007	0.010	3493	3092 - 3993
S(SG)*	SAG	70	3548	3562	3555	3557	5.3	3556	4.3	1.00	0.001	0.001	3915	3280 - 7701
	Total: 1489								*min:*	1.0	0.001	0.001		
									max:	11.6	0.30	0.82		
									average:	1.8	0.06	0.11		

AL alluvial aquifer
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SAG San Andres aquifer
SD standard deviation
* denotes well with incomplete profile

Historical range includes data from 2000 through June 2015 (all wells profiled are regularly sampled). SC results from the November 2014 sampling event are listed as these dates correspond most closely to the October 2014 profiling.

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Link to discussion in main text: Bluewater, New Mexico, Disposal Site (Section 4.1)

Table A-1b. Summary Statistics for Bluewater Site SC Profile Results: Sorted by CV

		Oct-2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Nov-2014**	**Historical Range**
L(SG)	SAG	228	1452	2665	--	1461	1199.0	1968	593.1	1.84	0.30	0.821	2613	1317 - 2913
I(SG)	SAG	154	264	3059	--	3035	1558.3	2438	719.5	11.6	0.30	0.513	2969	894 - 3075
11(SG)	SAG	96	2326	2647	2645	2333	309.8	2420	140.5	1.14	0.058	0.133	2596	2093 - 2634
Y2(M)	AL	18	574	665	622	628	77.8	622	35.8	1.16	0.058	0.119	647	552 - 740
18(SG)	SAG	136	1554	1842	1742	1584	52.3	1629	93.6	1.19	0.057	0.031	1723	1610 - 1904
E(M)	AL	19	1251	1459	1395	1418	98.0	1395	68.2	1.17	0.049	0.064	1443	1018 - 2042
13(SG)	SAG	147	1465	1575	1566	1539	5.0	1533	32.2	1.08	0.021	0.003	1503	1419 - 1567
22(M)	AL	27	1287	1373	1310	1315	10.0	1321	23.6	1.07	0.018	0.007	1278	1251 - 1442
16(SG)	SAG	51	3901	4183	3982	3984	49.0	4014	64.6	1.07	0.016	0.012	3952	3769 - 4553
OBS-3*	SAG	76	3404	3497	3494	3472	35.8	3467	23.4	1.03	0.007	0.010	3493	3092 - 3993
20(M)	AL	45	1352	1376	1355	1355	6.5	1358	6.1	1.02	0.004	0.004	1332	1267 - 1511
21(M)	AL	55	1881	1927	1906	1906	4.0	1904	8.1	1.02	0.004	0.002	1833	1726 - 1934
15(SG)	SAG	189	1952	1983	1981	1979	5.0	1976	7.7	1.02	0.004	0.003	1923	1695 - 2085
14(SG)	SAG	141	2036	2052	2051	2047	6.0	2047	4.1	1.01	0.002	0.003	2013	1810 - 2267
S(SG)*	SAG	70	3548	3562	3555	3557	5.3	3556	4.3	1.00	0.001	0.001	3915	3280 - 7701
F(M)	AL	37	564	567	567	567	1.0	567	0.7	1.01	0.001	0.002	550	535 - 733

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3

Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)

Remaining wells have low variation (CV < 0.03) in the SC profiles.

AL	alluvial aquifer
CV	coefficient of variation, equal to standard deviation divided by the mean
IQR	interquartile range
IQR/M	IQR/median (non-parametric alternative to the CV)
Min	minimum; Max = maximum
n	number of profile measurements
SAG	San Andres aquifer
SD	standard deviation
*	denotes well with incomplete profile

Link to discussion in main text: Bluewater, New Mexico, Disposal Site (Section 4.1)

Table A-2. Durango, Colorado, Processing Site Mill Tailings Area

Durango Mill Tailings Area, Specific Conductance Profile Results, June 2014

Table A-2a. Summary Statistics for Durango Mill Tailings Area SC Profiles: Sorted on Well ID

Background alluvial wells are listed last.

		June 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-2014**	**Historical Range**
0612	AL	33	3086	3346	3291	3308	142	3258	84.3	1.1	0.026	0.043	3589	3010 - 5810
0617	AL_Colluvium	4	3169	3229	3206	3212	24.0	3206	26.1	1.0	0.008	0.007	3196	3152 - 4201
0630	AL_KM	14	2912	5161	2938	3083	1861	3708	981	1.8	0.264	0.604	3020	2967 - 4470
0631	AL_KM	17	770	3553	797	820	2711	2060	1384	4.6	0.672	3.306	1077	914 - 2550
0632*	KM	92	3472	4597	4158	3586	25.8	3726	298	1.3	0.080	0.007	not sampled	3030 *n* = 1 sample
0633	KM_AL	11	5318	9195	8198	8434	1257	8198	1119	1.7	0.137	0.149	6873	4020 - 7708
0634	AL_KM	6	4211	4934	4663	4731	384	4663	285	1.2	0.061	0.081	4738	3963 - 4738
0859*	AL	11	2215	2301	2215	2290	31.0	2276	28.1	1.0	0.012	0.014	not sampled	1832 - 2536
0863	Colluvium	20	1328	2514	1914	1914	1134	1907	525	1.9	0.275	0.593	2212	1620 - 2299
0622	AL (Bkgrnd)	16	843	855	843	853	6.0	851	3.9	1.0	0.005	0.007	915	765 - 1356
0629	AL (Bkgrnd)	1	3938	3938									4287	2200 - 4287
0635	AL (Bkgrnd)	6	2733	2775	2755	2758	14.3	2755	14.9	1.0	0.005	0.005	3266	1980 - 3266
0857	AL (Bkgrnd)	3	3055	3147	3103	3106	46.0	3103	46.1	1.0	0.015	0.015	3580	2360 - 4040
0866	AL (Bkgrnd)	22	1346	1430	1419	1425	13.8	1415	21.0	1.1	0.015	0.010	1501	1003 - 1501
	Total: 256								*min:*	1.0	0.005	0.005		
									max:	4.6	0.67	3.3		
									average:	1.5	0.12	0.37		

*	denotes well that is not routinely sampled
AL	alluvial aquifer
Bkgrnd	background well
CV	coefficient of variation, equal to standard deviation divided by the mean
IQR	interquartile range
IQR/M	IQR/median
KM	Mancos Shale
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation

Historical range includes data from 2000 through June 2015. SC results from the early June 2014 annual sampling event are listed as these dates correspond most closely to the late June 2014 profiling.

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Link to discussion in main text: Durango Processing Site Mill Tailings Area (Section 4.2.1)

Table A-2b. Summary Statistics for Durango Mill Tailings Area SC Profiles: Sorted by CV

		June 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-2014**	**Historical Range**
0631	AL_KM	17	770	3553	797	820	2711	2060	1384	4.6	0.67	3.306	1077	914 - 2550
0863	Colluvium	20	1328	2514	1914	1914	1134	1907	525	1.9	0.28	0.593	2212	1620 - 2299
0630	AL_KM	14	2912	5161	2938	3083	1861	3708	981	1.8	0.26	0.604	3020	2967 - 4470
0633	KM_AL	11	5318	9195	8198	8434	1257	8198	1119	1.7	0.14	0.149	6873	4020 - 7708
0632*	KM	92	3472	4597	4158	3586	25.8	3726	298	1.3	0.08	0.007	--	3030 -
0634	AL_KM	6	4211	4934	4663	4731	384	4663	285	1.2	0.06	0.081	4738	3963 - 4738
0612	AL	33	3086	3346	3291	3308	142	3258	84.3	1.1	0.026	0.043	3589	3010 - 5810
0857	AL (Bkgrnd)	3	3055	3147	3103	3106	46.0	3103	46.1	1.0	0.015	0.015	3580	2360 - 4040
0866	AL (Bkgrnd)	22	1346	1430	1419	1425	13.8	1415	21.0	1.1	0.015	0.010	1501	1003 - 1501
0859*	AL	11	2215	2301	2215	2290	31.0	2276	28.1	1.0	0.012	0.014	--	1832 - 2536
0617	AL_Colluvium	4	3169	3229	3206	3212	24.0	3206	26.1	1.0	0.008	0.007	3196	3152 - 4201
0635	AL (Bkgrnd)	6	2733	2775	2755	2758	14.3	2755	14.9	1.0	0.005	0.005	3266	1980 - 3266
0622	AL (Bkgrnd)	16	843	855	843	853	6.0	851	3.9	1.0	0.005	0.007	915	765 - 1356

Red-shaded row denotes well with very high variation in the SC profile: CVs ≥ 0.3
Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells have low variation (CV < 0.03) in the SC profiles.

*	denotes well that is not routinely sampled
AL	alluvial aquifer
Bkgrnd	background well
CV	coefficient of variation, equal to standard deviation divided by the mean
IQR	interquartile range
IQR/M	IQR/median
KM	Mancos Shale
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation

Link to discussion in main text: Durango Processing Site Mill Tailings Area (Section 4.2.1)

Table A-3a. Summary Statistics for Durango Raffinate Ponds Area SC Profiles: Sorted on Well ID

		June 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-2014**	**Historical Range**
0593*	MF	23	1705	13000	9674	8685	10565	7783	4728	7.62	0.61	1.22	not sampled	3090 - 14,290
0594	MF	31	3872	5164	3872	4255	986	4414	489	1.33	0.11	0.23	4458	3082 - 7380
0607	AL_MF	47	1849	2496	1941	1913	30	1941	103	1.35	0.05	0.02	2291	1601 - 3553
0875*	PL	135	1535	3450	2242	1726	1246	2170	719	2.25	0.33	0.72	not sampled	1147 - 2580
0879	MF	17	4114	5866	5624	5845	47.0	5624	516	1.43	0.09	0.01	7433	7847 - 11,175
0882*	MF	7	3140	3900	3612	3689	222	3612	252	1.24	0.07	0.06	not sampled	8402 - 13,700
0883*	MF	48	2067	6587	6273	2191	4011	3465	1889	3.19	0.55	1.83	not sampled	4560 - 6420
0884	MF	56	2621	4115	4106	2647	1458	3134	692	1.57	0.22	0.55	3840	3080 - 6020
0889*	PL	122	811	8380	8134	817	4.0	2130	2769	10.3	1.30	0.005	not sampled	2800 - 7240
0903*	MF	40	1773	2125	1804	1925	237	1932	124	1.20	0.06	0.12	not sampled	2180 - 3020
		Total:	*526*						*min:*	1.2	0.05	0.005		
									max:	10.3	1.3	1.8		
									average:	3.2	0.34	0.48		

* denotes well that is not routinely sampled
AL alluvial aquifer
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
MF Menefee Formation
Min minimum; Max = maximum
n number of profile measurements
PL Point Lookout Sandstone well
SD standard deviation

Historical range includes data from 2000 through June 2015. SC results from the early June 2014 annual sampling event are listed as these dates correspond most closely to the late June 2014 profiling.

Link to discussion in main text: Durango Processing Site Raffinate Ponds Area (Section 4.2.2)

Table A-3b. Summary Statistics for Durango Raffinate Ponds Area SC Profiles: Sorted by CV

		June 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-2014**	**Historical Range**
0889*	PL	122	811	8380	8134	817	4.0	2130	2769	10.3	1.30	0.005	--	2800 - 7240
0593*	MF	23	1705	13,000	9674	8685	10,565	7783	4728	7.62	0.61	1.22	--	3090 - 14,290
0883*	MF	48	2067	6587	6273	2191	4011	3465	1889	3.19	0.55	1.83	--	4560 - 6420
0875*	PL	135	1535	3450	2242	1726	1246	2170	719	2.25	0.33	0.72	--	1147 - 2580
0884	MF	56	2621	4115	4106	2647	1458	3134	692	1.57	0.22	0.55	3840	3080 - 6020
0594	MF	31	3872	5164	3872	4255	986	4414	489	1.33	0.11	0.23	4458	3082 - 7380
0879	MF	17	4114	5866	5624	5845	47.0	5624	516	1.43	0.09	0.01	7433	7847 - 11,175
0882*	MF	7	3140	3900	3612	3689	222	3612	252	1.24	0.07	0.06	--	8402 - 13,700
0903*	MF	40	1773	2125	1804	1925	237	1932	124	1.20	0.06	0.12	--	2180 - 3020
0607	AL_MF	47	1849	2496	1941	1913	30	1941	103	1.35	0.05	0.02	2291	1601 - 3553

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3
Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
No wells had low variation (CV < 0.03) in the SC profiles.

Table A-4. Durango, Colorado, Disposal Site

Durango Disposal Site Specific Conductance Profile Results, June 2014

Table A-4a. Summary Statistics for Durango Disposal Site SC Profiles: Sorted on Well ID

		June 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-14**	**Historical Range**
0605	CF (Bkgrnd)	42	2394	2526	2423	2435	54	7783	31	1.06	0.01	0.02	2344	2256 - 2544
0607	CF	24	1507	3176	1517	2465	1554	4414	769	2.11	0.33	0.63	3235	1896 - 3560
0608	AL	4	1065	1139	1108	1113	46	1941	34	1.07	0.03	0.04	1204	1054 - 2290
0612	CF	16	3769	4224	3950	3951	181	2170	127	1.12	0.03	0.05	3917	3350 - 4106
0618	AL	23	2026	2956	2783	2897	36	5624	271	1.46	0.10	0.012	2767	1534 - 2900
0621	CF	76	2487	3978	2625	2617	23	3612	544	1.60	0.19	0.009	4074	3820 - 4544
0623	AL (Bkgrnd)	18	3099	3185	3165	3173	10	3465	23	1.03	0.01	0.003	3626	2062 - 3626
	Total:	*203*							*min:*	1.0	0.01	0.003		
									max:	2.1	0.33	0.63		
									average:	1.3	0.10	0.11		

AL alluvial well
Bkgrnd background well
CF Cliff House Sandstone well
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

Historical range includes data from 2000 through July 2015 (all wells profiled are regularly sampled). SC results from the early June 2014 annual sampling event are listed as these dates correspond most closely to the late June 2014 profiling.

Link to discussion in main text: Durango, Colorado, Disposal (Bodo Canyon) Site (Section 4.3)

Table A-4b. Summary Statistics for Durango Disposal Site SC Profiles: Sorted by CV

		June 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-14**	**Historical Range**
0607	CF	24	1507	3176	1517	2465	1554	4414	769	2.11	0.33	0.63	3235	1896 - 3560
0621	CF	76	2487	3978	2625	2617	23	3612	544	1.60	0.19	0.009	4074	3820 - 4544
0618	AL	23	2026	2956	2783	2897	36	5624	271	1.46	0.10	0.012	2767	1534 - 2900
0612	CF	16	3769	4224	3950	3951	181	2170	127	1.12	0.032	0.046	3917	3350 - 4106
0608	AL	4	1065	1139	1108	1113	46	1941	34	1.07	0.031	0.041	1204	1054 - 2290
0605	CF (Bkgrnd)	42	2394	2526	2423	2435	54	7783	31	1.06	0.013	0.022	2344	2256 - 2544
0623	AL (Bkgrnd)	18	3099	3185	3165	3173	10	3465	23	1.03	0.007	0.003	3626	2062 - 3626

Red-shaded row denotes well with very high variation in the SC profile: CVs $\geq$ 0.3

Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 $\leq$ CV < 0.3.

Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 $\leq$ CV < 0.1); wells in this category fall on the boundary of the low-range variability level. Remaining wells have low variation (CV < 0.03) in the SC profiles.

Table A-5. Grand Junction, Colorado, Office Site

Grand Junction Office Site Specific Conductance Profile Results, July–August 2013

Table A-5a. Summary Statistics for Grand Junction Office Site SC Profiles: Sorted on Well ID

		2013 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Feb-14**	**Historical Range**
10-19N	AL	27	3684	4136	4037	4071	53	4037	106	1.12	0.026	0.013	5089	3955 - 8169
11-1S	AL	21	876	903	894	898	11	894	9.2	1.03	0.010	0.012	557	557 - 1683
14-13NA	AL	25	3403	3587	3505	3496	117	3505	63	1.05	0.018	0.033	3280	2966 - 3604
6-2N	AL	38	1782	3162	2990	3080	78	2990	295	1.77	0.099	0.025	2835	2033 - 3160
8-4S	AL	32	1922	4162	3172	2814	1304	3172	700	2.17	0.221	0.464	2436	1672 - 4614
GJ01-01	AL	24	1703	1881	1798	1807	61	1808	53.5	1.10	0.030	0.034	1609	1475 - 2116
GJ01-02*	AL	33	1908	2015	1987	1973	44	1968	26.9	1.06	0.014	0.022	not sampled	1460 - 1573
GJ84-04	AL	26	2835	3120	3086	3089	19	3086	52.7	1.10	0.017	0.006	3145	1852 - 3815
	Total: 226							*min:*		1.0	0.01	0.006		
								max:		2.2	0.22	0.46		
								average:		1.3	0.058	0.085		

* denotes well that is not routinely sampled
AL alluvial well
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

Historical range includes data from 2000 through February 2015. SC results from the February 2014 annual sampling event are listed as these dates correspond more closely to the late summer 2013 profiling.

Link to discussion in main text: Grand Junction, Colorado, Office Site (Section 4.4)

Table A-5b. Summary Statistics for Grand Junction Office Site SC Profiles: Sorted by CV

		2013 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Feb-14**	**Historical Range**
8-4S	AL	32	1922	4162	3172	2814	1304	3172	700	2.17	0.22	0.464	2436	1672 - 4614
6-2N	AL	38	1782	3162	2990	3080	78	2990	295	1.77	0.10	0.025	2835	2033 - 3160
GJ01-01	AL	24	1703	1881	1798	1807	61	1808	53.5	1.10	0.030	0.034	1609	1475 - 2116
10-19N	AL	27	3684	4136	4037	4071	53	4037	106	1.12	0.026	0.013	5089	3955 - 8169
14-13NA	AL	25	3403	3587	3505	3496	117	3505	63	1.05	0.018	0.033	3280	2966 - 3604
GJ84-04	AL	26	2835	3120	3086	3089	19	3086	52.7	1.10	0.017	0.006	3145	1852 - 3815
GJ01-02*	AL	33	1908	2015	1987	1973	44	1968	26.9	1.06	0.014	0.022	-	1460 - 1573
11-1S	AL	21	876	903	894	898	11	894	9.2	1.03	0.010	0.012	557	557 - 1683

Yellow-shaded rows denote well with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded row denotes well with mid-level variability in the SC profile (0.03 ≤ CV < 0.1); the single well in this category falls on the boundary of the low-range variability level.
Remaining wells have low variation (CV < 0.03) in the SC profiles.

Table A-6. Grand Junction, Colorado, Processing (Climax) Site

Grand Junction Processing Site Specific Conductance Profile Results, April 2014

Table A-6a. Summary Statistics for Grand Junction Processing Site SC Profiles: Sorted on Well ID

		April 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jan-2011**	**Historical Range**
0590	AL	14	7213	7796	7271	7275	419	7429	0.058	1.08	0.032	0.032	7004	7004 - 12,690
0748	AL	13	4627	6456	5424	5396	313	5424	0.058	1.40	0.095	0.095	6484	6484
1001	AL	8	7414	7465	7445	7449	22.8	7445	0.003	1.01	0.002	0.002	8360	358 - 8360
1036	AL	12	6946	7278	7270	7267	8.5	7240	0.001	1.05	0.013	0.013	8016	8016 - 8091
	Total:	*47*							*min:*	1.0	0.00	0.002		
									max:	1.4	0.09	0.09		
									average:	1.1	0.035	0.035		

AL alluvial well
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

Historical range includes data from 2000 through January 2011, the most recent sampling event.

Link to discussion in main text: Grand Junction, Colorado, Processing (Climax) Site (Section 4.5)

Table A-6b. Summary Statistics for Grand Junction Processing Site SC Profiles: Sorted by CV

		April 2014 Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jan-2011**	**Historical Range**
0748	AL	13	4627	6456	5424	5396	313	5424	0.058	1.40	0.1	0.095	6484	6484
0590	AL	14	7213	7796	7271	7275	419	7429	0.058	1.08	0.032	0.032	7004	7004 - 12,690
1036	AL	12	6946	7278	7270	7267	8.5	7240	0.001	1.05	0.013	0.013	8016	8016 - 8091
1001	AL	8	7414	7465	7445	7449	22.8	7445	0.003	1.01	0.002	0.002	8360	358 - 8360

Yellow-shaded row denotes well with highly variable SC profile: 0.1 ≤ CV < 0.3.
Gray-shaded row denotes well with mid-level variability in the SC profile (0.03 ≤ CV < 0.1); the single well in this category falls on the boundary of the low-range variability level.
Remaining wells have low variation (CV < 0.03) in the SC profiles.

Table A-7. Green River, Utah, Disposal Site

Green River Disposal Site Specific Conductance Profile Results, May 2014

Table A-7a. Summary Statistics for Green River Disposal Site SC Profiles: Sorted on Well ID

		May 2014 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-2014**	**Historical Range**
0171	CM	66	5972	7663	7628	7616	35	7568	224	1.28	0.030	0.005	7520	6770 - 8182
0172*	CM	88	3340	12,400	12,000	6,089	8,548	7352	4062	3.71	0.552	1.404	not sampled	1164 - 14,930
0173	CM	92	11,100	11,910	11,481	11,565	325	11,564	192	1.07	0.017	0.028	11,222	7780 - 17,189
0174*	CM	56	7033	17,200	7158	7154	271	8169	2413	2.45	0.295	0.038	not sampled	6500 - 7380
0175*	CM	65	7927	8981	8718	8081	657	8303	340	1.13	0.041	0.081	not sampled	5358 - 5740
0176	CM	52	7233	7419	7368	7295	95	7324	55	1.03	0.008	0.013	7810	7449 - 8500
0179	CM	27	6968	7120	7061	7079	91	7067	50	1.02	0.007	0.013	7390	6662 - 7622
0180*	CM	69	7387	8159	8095	8077	32	8052	132	1.10	0.016	0.004	not sampled	7680 - 8360
0181	CM	73	8993	12,400	10,600	9,754	1,394	10,261	1,055	1.38	0.103	0.143	11,505	1020 - 12,715
0182	CB	281	2526	2907	2902	2869	76	2844	68	1.15	0.024	0.027	2800	2690 - 2920
0183*	CM	143	4407	4944	4448	4441	6	4443	43	1.12	0.010	0.001	4622	4622 - 4622
0184	CB	161	2593	2853	2845	2718	8	2726	42	1.10	0.015	0.003	2720	2355 - 2828
0185	CB	190	2597	2728	2708	2706	5	2699	18	1.05	0.007	0.002	2625	2438 - 2655
0188	AL	7	10,300	10,600	10,414	10,400	200	10,414	121	1.03	0.012	0.019	11,580	8134 - 14578
0189	AL	5	11,400	12,200	11,760	11,700	500	11,760	336	1.07	0.029	0.043	12,470	10,283 - 47,350
0192	AL	3	10,500	10,600	10,567	10,600	50	10,567	58	1.01	0.005	0.005	11,650	9298 - 12,892
0194	AL	3	36,633	43,080	39,656	39,256	3,223	39,656	3,242	1.18	0.082	0.082	44,305	2266 - 69,800
0588	CB	237	2962	3109	3020	3016	5	3013	16	1.05	0.005	0.002	2880	2750 - 4600
0707	AL	5	10,400	10,600	10,500	10,500	0	10,500	71	1.02	0.007	0	11,980	9632 - 12,209
0813	CM	96	6327	7665	7656	7558	105	7558	162	1.21	0.021	0.014	7305	6770 - 8100
	Total:	*1719*							*min:*	1.0	0.005	0.00		
									max:	3.7	0.55	1.4		
									average:	1.3	0.064	0.096		

*	denotes well that is not routinely sampled
AL	alluvial aquifer
CB	Cedar Mountain Formation Basal Sandstone Member
CM	Cedar Mountain Formation Middle Sandstone Unit
CV	coefficient of variation, equal to standard deviation divided by the mean
IQR	interquartile range
IQR/M	IQR/median
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation

Historical range includes data from 2000 through June 2015. SC results from the mid-June 2014 annual sampling event are listed as these dates correspond most closely to the late May 2014 profiling.

Link to discussion in main text: Green River, Utah, Disposal Site (Section 4.6)

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Table A-7b. Summary Statistics for Green River Disposal Site SC Profiles: Sorted by CV

		May 2014 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jun-2014**	**Historical Range**
0172*	CM	88	3340	12,400	12,000	6,089	8,548	7352	4062	3.71	0.55	1.404	not sampled	1164 - 14,930
0174*	CM	56	7033	17,200	7158	7154	271	8169	2413	2.45	0.30	0.038	not sampled	6500 - 7380
0181	CM	73	8993	12,400	10,600	9,754	1,394	10,261	1,055	1.38	0.10	0.143	11,505	1020 - 12,715
0194	AL	3	36,633	43,080	39,656	39,256	3,223	39,656	3,242	1.18	0.08	0.082	44,305	2266 - 69,800
0175*	CM	65	7927	8981	8718	8081	657	8303	340	1.13	0.04	0.081	not sampled	5358 - 5740
0171	CM	66	5972	7663	7628	7616	35	7568	224	1.28	0.030	0.005	7520	6770 - 8182
0189	AL	5	11,400	12,200	11,760	11,700	500	11,760	336	1.07	0.029	0.043	12,470	10,283 - 47,350
0182	CB	281	2526	2907	2902	2869	76	2844	68	1.15	0.024	0.027	2800	2690 - 2920
0813	CM	96	6327	7665	7656	7558	105	7558	162	1.21	0.021	0.014	7305	6770 - 8100
0173	CM	92	11,100	11,910	11,481	11,565	325	11,564	192	1.07	0.017	0.028	11,222	7780 - 17,189
0180*	CM	69	7387	8159	8095	8077	32	8052	132	1.10	0.016	0.004	not sampled	7680 - 8360
0184	CB	161	2593	2853	2845	2718	8	2726	42	1.10	0.015	0.003	2720	2355 - 2828
0188	AL	7	10,300	10,600	10,414	10,400	200	10,414	121	1.03	0.012	0.019	11,580	8134 - 14578
0183*	CM	143	4407	4944	4448	4441	6	4443	43	1.12	0.010	0.001	4622	4622 - 4622
0176	CM	52	7233	7419	7368	7295	95	7324	55	1.03	0.008	0.013	7810	7449 - 8500
0179	CM	27	6968	7120	7061	7079	91	7067	50	1.02	0.007	0.013	7390	6662 - 7622
0707	AL	5	10,400	10,600	10,500	10,500	0	10,500	71	1.02	0.007	0.00	11,980	9632 - 12,209
0185	CB	190	2597	2728	2708	2706	5	2699	18	1.05	0.007	0.002	2625	2438 - 2655
0192	AL	3	10,500	10,600	10,567	10,600	50	10,567	58	1.01	0.005	0.005	11,650	9298 - 12,892
0588	CB	237	2962	3109	3020	3016	5	3013	16	1.05	0.005	0.002	2880	2750 - 4600

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3
Yellow-shaded row denotes well with highly variable SC profile: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells had low variation (CV < 0.03) in the SC profiles.

*	denotes well that is not routinely sampled
AL	alluvial aquifer
CB	Cedar Mountain Formation Basal Sandstone Member
CM	Cedar Mountain Formation Middle Sandstone Unit
CV	coefficient of variation, equal to standard deviation divided by the mean
IQR	interquartile range
IQR/M	IQR/median
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation

Historical range includes data from 2000 through June 2015. SC results from the mid-June 2014 annual sampling event are listed as these dates correspond most closely to the late May 2014 profiling.

Link to discussion in main text: Green River, Utah, Disposal Site (Section 4.6)

Table A-8. Monument Valley, Arizona, Processing Site

Monument Valley Site Specific Conductance Profile Results, May–June 2014

Table A-8a. Summary Statistics for Monument Valley Site SC Profiles: Sorted on Well ID
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			May–June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	Aquifer	Location	*n*	Min	Max	Mid-Screen	Median	IQR	Mean	SD	Max/Min	CV	IQR/M	Dec-14	Historical Range
0400*	AL	South (UG)	17	882	908	885	892	8	894	7.1	1.03	0.008	0.009	not sampled	530 - 879
0401*	AL	South (UG)	8	950	1,208	952	957	59	1013	107.0	1.27	0.106	0.062	not sampled	980
0413*	AL	Distal	12	983	995	993	992	7	990	4.1	1.01	0.004	0.007	not sampled	750
0415*	AL	Distal	11	913	963	947	947	14	942	14.6	1.05	0.015	0.014	not sampled	1000
0416*	AL	Distal	9	638	642	639	641	3	640	1.5	1.01	0.002	0.005	not sampled	1100
0600†	DC	Onsite	27	918	1,161	1,128	1,159	4	1,128	78.1	1.26	0.069	0.003	not sampled	(no data)
0601*	SR	South (UG)	2	609	623	616	616	7	616	9.9	1.02	0.016	0.011	not sampled	400 - 750
0602	AL	South (UG)	49	570	587	585	585	1	584	2.4	1.03	0.004	0.002	684	613 - 703
0603	AL	Onsite	88	582	589	588	585	5	585	2.3	1.01	0.004	0.009	611	573 - 676
0604	AL	Near Offsite	41	563	566	564	564	1	564	0.8	1.01	0.001	0.002	590	553 - 661
0605	AL	Near Offsite	41	538	546	542	542	2	542	1.9	1.01	0.003	0.004	595	579 - 3090
0606	AL	Near Offsite	23	3,656	4,044	3,898	3,982	38	3,971	79.3	1.11	0.020	0.009	3927	2542 - 3927
0612*	DC	Near Offsite	106	276	590	290	295	16	316	66.9	2.14	0.212	0.053	not sampled	240 - 322
0614*	SR	North	41	622	661	661	661	1	660	6.1	1.06	0.009	0.002	not sampled	510 - 961
0615*	SR	Onsite	160	526	542	535	530	3	531	3.2	1.03	0.006	0.006	not sampled	379 - 603
0618	DC	Onsite	132	317	326	320	320	2	320	1.8	1.03	0.006	0.006	310	310 - 645
0619	DC	Onsite	193	369	384	383	374	11	378	5.5	1.04	0.015	0.029	375	358 - 475
0625*	DC	Near Offsite	90	321	521	517	520	1	517	21.2	1.62	0.041	0.002	not sampled	200 - 573
0648	AL	North	110	1,753	2,685	2,580	2,592	137	2,570	109.0	1.53	0.042	0.053	2400	2117 - 3350
0649*	AL	Near Offsite	40	2,929	4,454	3,279	4,271	1,316	3,839	632.9	1.52	0.165	0.308	not sampled	4260 - 5067
0650	AL	North	158	570	1,880	1,183	580	125	738	278.4	3.30	0.377	0.215	1181	437 - 1181
0651	AL	Distal	146	590	639	598	596	3	600	10.9	1.08	0.018	0.005	631	622 - 657
0652	AL	Distal	72	504	525	525	522	5	522	3.8	1.04	0.007	0.010	561	555 - 584
0653†	AL	North	80	1,171	2,298	2,272	2,025	263	2,121	168.9	1.96	0.080	0.130	2382	2216 - 3140
0654*	AL	Distal	73	334	521	516	338	5	372	68.2	1.56	0.183	0.015	not sampled	298 - 430
0655	AL	Near Offsite	43	2,368	3,719	3,607	3,425	330	3,356	287.3	1.57	0.086	0.096	4166	3244 - 4166
0656†	AL	Near Offsite	47	728	883	883	876	22	856	48.7	1.21	0.057	0.025	906	906 - 1527
0657	DC	Onsite	172	250	1,118	471	279	218	349	128.8	4.47	0.369	0.783	423	327 - 1588
0658*	SR	South (UG)	297	520	540	538	537	1	537	2.1	1.04	0.004	0.002	not sampled	420 - 556
0659*	SR	Near Offsite	144	682	979	954	688	125	754	114.3	1.44	0.152	0.181	not sampled	260 - 6930
0660*	SR	North	250	477	495	482	481	0	482	4.2	1.04	0.009	0.000	not sampled	250 - 4820
0661*	DC	South (UG)	101	304	335	313	304	13	310	9.2	1.10	0.030	0.043	not sampled	110 - 321
0662	AL	Onsite	28	631	709	632	634	3	640	18.5	1.12	0.029	0.004	674	674 - 1485
0663*	DC	Near Offsite	371	344	494	493	493	1	492	7.9	1.44	0.016	0.002	not sampled	300 - 502
0664*	DC	North	399	527	570	562	560	1	560	2.3	1.08	0.004	0.002	not sampled	240 - 505
0668*	DC	Near Offsite	334	366	476	476	475	0	474	9.7	1.30	0.020	0.000	not sampled	210 - 485
0669†	AL	Near Offsite	18	592	760	705	719	42	705	55.8	1.28	0.079	0.058	743	634 - 876
0711		South (UG)	42	636	643	637	638	2	638	1.4	1.01	0.002	0.003	663	642 - 729
0712*		South (UG)	45	767	800	780	774	7	777	8.6	1.04	0.011	0.009	843	843 - 843
0714*		South (UG)	34	435	448	439	437	4	438	2.4	1.03	0.005	0.008	444	444 - 444
0715		South (UG)	25	478	520	480	480	2	483	9.0	1.09	0.019	0.004	527	493 - 585
0716*		South (UG)	39	615	734	640	634	12	647	31.0	1.19	0.048	0.018	987	987 - 987
0718*		South (UG)	48	354	359	359	358	1	357	1.3	1.01	0.004	0.003	352	352 - 352
0719		South (UG)	29	660	672	667	663	4	665	3.3	1.02	0.005	0.006	687	680 - 761
0720*		South (UG)	57	414	469	465	419	12	430	20.0	1.13	0.047	0.029	489	489 - 489
0721*		South (UG)	50	313	433	340	338	1	339	14.3	1.38	0.042	0.003	320	320 - 320
0724*		South (UG)	34	453	465	456	456	2	456	2.0	1.03	0.004	0.004	456	456 - 456
0725*		South (UG)	53	436	477	437	438	2	439	7.8	1.09	0.018	0.005	453	453 - 453
0727		South (UG)	32	474	499	486	480	9	483	7.4	1.05	0.015	0.019	534	534 - 622
0728*	AL	Near Offsite	78	2,147	2,350	2,236	2,235	51	2,253	55.0	1.09	0.024	0.023	not sampled	(no data)
0729*	AL	Near Offsite	95	1,826	2,018	1,860	1,845	44	1,865	48.5	1.11	0.026	0.024	not sampled	(no data)
0730*	AL	Near Offsite	79	1,590	2,192	2,058	2,053	16	2,051	57.0	1.38	0.028	0.008	not sampled	(no data)
0731*†	AL	Near Offsite	78	1,106	2,364	2,347	2,321	170	2,226	213.3	2.14	0.096	0.073	not sampled	(no data)
0733	AL	Near Offsite	14	553	559	555	557	4	556	1.9	1.01	0.003	0.006	607	540 - 607
0734	AL	Near Offsite	60	454	488	462	465	9	466	7.6	1.07	0.016	0.020	512	487 - 625
0735	AL	Onsite	19	1,010	1,391	1,013	1,013	123	1,096	142.2	1.38	0.130	0.121	975	677 - 2178
0738	AL	North	28	702	713	705	704	2	704	2.1	1.02	0.003	0.003	728	728 - 875
0739	AL	North	30	660	707	704	702	14	694	15.4	1.07	0.022	0.019	742	742 - 950
0740	AL	North	13	2,171	2,402	2,379	2,370	125	2,317	88.7	1.11	0.038	0.053	2,531	2315 - 2605

Table A-8a. Summary Statistics for Monument Valley Site SC Profiles: Sorted on Well ID
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			May–June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	**Location**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Dec-14**	**Historical Range**
0741	AL	Near Offsite	78	1,848	2,359	2,341	2,347	71	2,317	70.2	1.28	0.030	0.030	2,279	2279 - 2560
0742	AL	Near Offsite	86	2,069	2,354	2,322	2,314	75	2,285	65.5	1.14	0.029	0.032	2,320	2320 - 2595
0743	AL	Near Offsite	80	1,877	2,272	2,191	2,195	15	2,192	39.9	1.21	0.018	0.007	2,107	1961 - 5274
0744	AL	Near Offsite	47	2,871	2,997	2,960	2,963	42	2,960	27.9	1.04	0.009	0.014	2,370	2370 - 2739
0760	AL	North	101	483	489	488	487	2	487	1.5	1.01	0.003	0.004	522	426 - 542
0761	AL	North	26	1281	1319	1305	1303	22	1305	13.0	1.03	0.010	0.017	1315	1163 - 1467
0762	AL	North	47	1630	4230	1886	2982	2090	2962	988.8	2.60	0.334	0.701	3605	2170 - 3930
0764	AL	North	9	1002	1009	1005	1005	4	1005	2.5	1.01	0.003	0.004	547	547 - 1350
0765	AL	Near Offsite	106	2021	2142	2096	2095	5	2099	17.4	1.06	0.008	0.002	2034	1869 - 3110
0766†	AL	Near Offsite	49	1534	2204	2137	2124	133	2103	110.0	1.44	0.052	0.063	2193	2174 - 3120
0767	AL	North	119	363	377	370	369	3	369	2.3	1.04	0.006	0.008	405	370 - 421
0768	AL	Distal	65	433	442	439	437	3	437	1.9	1.02	0.004	0.007	472	461 - 1838
0769*†	AL	Near Offsite	10	2303	3293	3062	3234	56	3062	384.2	1.43	0.125	0.017	not sampled	(no data)
0770	AL	Near Offsite	67	834	978	955	869	114	888	48.6	1.17	0.055	0.131	989	934 - 1396
0771	AL	Near Offsite	76	3963	4323	4301	4260	164	4220	101.7	1.09	0.024	0.038	4085	3949 - 5200
0772	AL	Onsite	39	1,070	1,157	1,075	1,075	7	1,091	30.8	1.08	0.028	0.007	949	694 - 982
0774	AL	Onsite	17	353	377	357	354	0	357	7.2	1.07	0.020	0.000	384	372 - 500
0775	DC	Near Offsite	240	391	401	396	392	2	393	2.6	1.03	0.007	0.005	385	367 - 424
0776	DC	Onsite	198	336	409	401	394	12	396	9.6	1.22	0.024	0.030	391	387 - 463
0777*	AL	Near Offsite	16	2614	2646	2632	2632	17	2633	10.6	1.01	0.004	0.006	3352	3070 - 3650
0778*	AL	Near Offsite	114	2200	2351	2349	2347	22	2332	33.5	1.07	0.014	0.009	2792	2792 - 3130
0779*	AL	Near Offsite	117	2211.38	2361.09	2332	2332	8	2323	28	1.07	0.012	0.004	not sampled	(no data)
	Total:		*Total:*	*6622*											
										min:	1.0	0.001	0.00		
										max:	4.5	0.38	0.78		
										average:	1.3	0.046	0.046		

*	denotes well that is not routinely sampled
AL	alluvial aquifer
CV	coefficient of variation, equal to standard deviation divided by the mean
DC	DeChelly Sandstone aquifer
IQR	interquartile range
IQR/M	IQR/median
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation
SR	Shinarump Member of the Chinle Formation
UG	upgradient well
†	denotes well with anomalously high CV due to extreme well bottom measurements

For wells that are routinely sampled, the historical range of SC is since 2000. For wells that are not routinely sampled for which there are no data since 2000, the SC range is based on all records in the SEEPro/EQuIS database. SC results from the most recent December 2014 annual sampling event are also provided. Formations and well construction information was not available for most of the non-DOE owned wells.

Link to discussion in main text: Monument Valley, Arizona, Processing Site (Section 4.7)

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Table A-8b. Summary Statistics for Monument Valley Site SC Profiles: Sorted by CV

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			May–June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	Aquifer	Location	*n*	Min	Max	Mid-Screen	Median	IQR	Mean	SD	Max/Min	CV	IQR/M	Dec-14	Historical Range
0650	AL	North	158	570	1,880	1,183	580	125	738	278.4	3.30	0.38	0.215	1181	437 - 1181
0657	DC	Onsite	172	250	1,118	471	279	218	349	128.8	4.47	0.37	0.783	423	327 - 1588
0762	AL	North	47	1630	4230	1886	2982	2090	2962	988.8	2.60	0.33	0.701	3605	2170 - 3930
0612*	DC	Near Offsite	106	276	590	290	295	16	316	66.9	2.14	0.21	0.053	not sampled	240 - 322
0654*	AL	Distal	73	334	521	516	338	5	372	68.2	1.56	0.18	0.015	not sampled	298 - 430
0649*	AL	Near Offsite	40	2,929	4,454	3,279	4,271	1,316	3,839	632.9	1.52	0.16	0.308	not sampled	4260 - 5067
0659*	SR	Near Offsite	144	682	979	954	688	125	754	114.3	1.44	0.15	0.181	not sampled	260 - 6930
0735	AL	Onsite	19	1,010	1,391	1,013	1,013	123	1,096	142.2	1.38	0.13	0.121	975	677 - 2178
0769*†	AL	Near Offsite	10	2303	3293	3062	3234	56	3062	384.2	1.43	0.13	0.017	not sampled	(no data)
0401*	AL	South (UG)	8	950	1,208	952	957	59	1013	107.0	1.27	0.11	0.062	not sampled	980
0731*†	AL	Near Offsite	78	1,106	2,364	2,347	2,321	170	2,226	213.3	2.14	0.096	0.073	not sampled	(no data)
0655	AL	Near Offsite	43	2,368	3,719	3,607	3,425	330	3,356	287.3	1.57	0.086	0.096	4166	3244 - 4166
0653†	AL	North	80	1,171	2,298	2,272	2,025	263	2,121	168.9	1.96	0.080	0.130	2382	2216 - 3140
0669†	AL	Near Offsite	18	592	760	705	719	42	705	55.8	1.28	0.079	0.058	743	634 - 876
0600†	DC	Onsite	27	918	1,161	1,128	1,159	4	1,128	78.1	1.26	0.069	0.003	not sampled	(no data)
0656†	AL	Near Offsite	47	728	883	883	876	22	856	48.7	1.21	0.057	0.025	906	906 - 1527
0770	AL	Near Offsite	67	834	978	955	869	114	888	48.6	1.17	0.055	0.131	989	934 - 1396
0766†	AL	Near Offsite	49	1534	2204	2137	2124	133	2103	110.0	1.44	0.052	0.063	2193	2174 - 3120
0716*		South (UG)	39	615	734	640	634	12	647	31.0	1.19	0.048	0.018	987	987 - 987
0720*		South (UG)	57	414	469	465	419	12	430	20.0	1.13	0.047	0.029	489	489 - 489
0648	AL	North	110	1,753	2,685	2,580	2,592	137	2,570	109.0	1.53	0.042	0.053	2400	2117 - 3350
0721*		South (UG)	50	313	433	340	338	1	339	14.3	1.38	0.042	0.003	320	320 - 320
0625*	DC	Near Offsite	90	321	521	517	520	1	517	21.2	1.62	0.041	0.002	not sampled	200 - 573
0740	AL	North	13	2,171	2,402	2,379	2,370	125	2,317	88.7	1.11	0.038	0.053	2,531	2315 - 2605
0741	AL	Near Offsite	78	1,848	2,359	2,341	2,347	71	2,317	70.2	1.28	0.030	0.030	2,279	2279 - 2560
0661*	DC	South (UG)	101	304	335	313	304	13	310	9.2	1.10	0.030	0.043	not sampled	110 - 321
0662	AL	Onsite	28	631	709	632	634	3	640	18.5	1.12	0.029	0.004	674	674 - 1485
0742	AL	Near Offsite	86	2,069	2,354	2,322	2,314	75	2,285	65.5	1.14	0.029	0.032	2,320	2320 - 2595
0772	AL	Onsite	39	1,070	1,157	1,075	1,075	7	1,091	30.8	1.08	0.028	0.007	949	694 - 982
0730*	AL	Near Offsite	79	1,590	2,192	2,058	2,053	16	2,051	57.0	1.38	0.028	0.008	not sampled	(no data)
0729*	AL	Near Offsite	95	1,826	2,018	1,860	1,845	44	1,865	48.5	1.11	0.026	0.024	not sampled	(no data)
0728*	AL	Near Offsite	78	2,147	2,350	2,236	2,235	51	2,253	55.0	1.09	0.024	0.023	not sampled	(no data)
0776	DC	Onsite	198	336	409	401	394	12	396	9.6	1.22	0.024	0.030	391	387 - 463
0771	AL	Near Offsite	76	3963	4323	4301	4260	164	4220	101.7	1.09	0.024	0.038	4085	3949 - 5200
0739	AL	North	30	660	707	704	702	14	694	15.4	1.07	0.022	0.019	742	742 - 950
0668*	DC	Near Offsite	334	366	476	476	475	0	474	9.7	1.30	0.020	0.000	not sampled	210 - 485
0774	AL	Onsite	17	353	377	357	354	0	357	7.2	1.07	0.020	0.000	384	372 - 500
0606	AL	Near Offsite	23	3,656	4,044	3,898	3,982	38	3,971	79.3	1.11	0.020	0.009	3927	2542 - 3927
0715		South (UG)	25	478	520	480	480	2	483	9.0	1.09	0.019	0.004	527	493 - 585
0743	AL	Near Offsite	80	1,877	2,272	2,191	2,195	15	2,192	39.9	1.21	0.018	0.007	2,107	1961 - 5274
0651	AL	Distal	146	590	639	598	596	3	600	10.9	1.08	0.018	0.005	631	622 - 657
0725*		South (UG)	53	436	477	437	438	2	439	7.8	1.09	0.018	0.005	453	453 - 453
0734	AL	Near Offsite	60	454	488	462	465	9	466	7.6	1.07	0.016	0.020	512	487 - 625
0601*	SR	South (UG)	2	609	623	616	616	7	616	9.9	1.02	0.016	0.011	not sampled	400 - 750
0663*	DC	Near Offsite	371	344	494	493	493	1	492	7.9	1.44	0.016	0.002	not sampled	300 - 502
0415*	AL	Distal	11	913	963	947	947	14	942	14.6	1.05	0.015	0.014	not sampled	1000
0727		South (UG)	32	474	499	486	480	9	483	7.4	1.05	0.015	0.019	534	534 - 622
0619	DC	Onsite	193	369	384	383	374	11	378	5.5	1.04	0.015	0.029	375	358 - 475
0778*	AL	Near Offsite	114	2200	2351	2349	2347	22	2332	33.5	1.07	0.014	0.009	2792	2792 - 3130
0779*	AL	Near Offsite	117	2211.38	2361.09	2332	2332	8	2323	28	1.07	0.012	0.004	not sampled	(no data)
0712*		South (UG)	45	767	800	780	774	7	777	8.6	1.04	0.011	0.009	843	843 - 843
0761	AL	North	26	1281	1319	1305	1303	22	1305	13.0	1.03	0.010	0.017	1315	1163 - 1467
0744	AL	Near Offsite	47	2,871	2,997	2,960	2,963	42	2,960	27.9	1.04	0.009	0.014	2,370	2370 - 2739
0614*	SR	North	41	622	661	661	661	1	660	6.1	1.06	0.009	0.002	not sampled	510 - 961
0660*	SR	North	250	477	495	482	481	0	482	4.2	1.04	0.009	0.000	not sampled	250 - 4820
0765	AL	Near Offsite	106	2021	2142	2096	2095	5	2099	17.4	1.06	0.008	0.002	2034	1869 - 3110
0400*	AL	South (UG)	17	882	908	885	892	8	894	7.1	1.03	0.008	0.009	not sampled	530 - 879
0652	AL	Distal	72	504	525	525	522	5	522	3.8	1.04	0.007	0.010	561	555 - 584
0775	DC	Near Offsite	240	391	401	396	392	2	393	2.6	1.03	0.007	0.005	385	367 - 424
0767	AL	North	119	363	377	370	369	3	369	2.3	1.04	0.006	0.008	405	370 - 421
0615*	SR	Onsite	160	526	542	535	530	3	531	3.2	1.03	0.006	0.006	not sampled	379 - 603
0618	DC	Onsite	132	317	326	320	320	2	320	1.8	1.03	0.006	0.006	310	310 - 645

Table A-8b. Summary Statistics for Monument Valley Site SC Profiles: Sorted by CV

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			May–June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)		
Well	**Aquifer**	**Location**	***n***	**Min**	**Max**	**Mid-Screen**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Dec-14**	**Historical Range**	
0714*		South (UG)	34	435	448	439	437	4	438	2.4	1.03	0.005	0.008	444	444	- 444
0719		South (UG)	29	660	672	667	663	4	665	3.3	1.02	0.005	0.006	687	680	- 761
0724*		South (UG)	34	453	465	456	456	2	456	2.0	1.03	0.004	0.004	456	456	- 456
0768	AL	Distal	65	433	442	439	437	3	437	1.9	1.02	0.004	0.007	472	461	- 1838
0413*	AL	Distal	12	983	995	993	992	7	990	4.1	1.01	0.004	0.007	not sampled	750	
0602	AL	South (UG)	49	570	587	585	585	1	584	2.4	1.03	0.004	0.002	684	613	- 703
0664*	DC	North	399	527	570	562	560	1	560	2.3	1.08	0.004	0.002	not sampled	240	- 505
0777*	AL	Near Offsite	16	2614	2646	2632	2632	17	2633	10.6	1.01	0.004	0.006	3352	3070	- 3650
0603	AL	Onsite	88	582	589	588	585	5	585	2.3	1.01	0.004	0.009	611	573	- 676
0658*	SR	South (UG)	297	520	540	538	537	1	537	2.1	1.04	0.004	0.002	not sampled	420	- 556
0718*		South (UG)	48	354	359	359	358	1	357	1.3	1.01	0.004	0.003	352	352	- 352
0605	AL	Near Offsite	41	538	546	542	542	2	542	1.9	1.01	0.003	0.004	595	579	- 3090
0733	AL	Near Offsite	14	553	559	555	557	4	556	1.9	1.01	0.003	0.006	607	540	- 607
0760	AL	North	101	483	489	488	487	2	487	1.5	1.01	0.003	0.004	522	426	- 542
0738	AL	North	28	702	713	705	704	2	704	2.1	1.02	0.003	0.003	728	728	- 875
0764	AL	North	9	1002	1009	1005	1005	4	1005	2.5	1.01	0.003	0.004	547	547	- 1350
0416*	AL	Distal	9	638	642	639	641	3	640	1.5	1.01	0.002	0.005	not sampled	1100	
0711		South (UG)	42	636	643	637	638	2	638	1.4	1.01	0.002	0.003	663	642	- 729
0604	AL	Near Offsite	41	563	566	564	564	1	564	0.8	1.01	0.001	0.002	590	553	- 661

*	denotes well that is not routinely sampled
AL	alluvial aquifer
CV	coefficient of variation, equal to standard deviation divided by the mean
DC	DeChelly Sandstone aquifer
IQR	interquartile range
IQR/M	IQR/median
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation
SR	Shinarump Member of the Chinle Formation
UG	upgradient well
†	denotes well with anomalously high CV due to extreme well bottom measurements

For wells that are routinely sampled, the historical range of SC is since 2000. For wells that are not routinely sampled for which there are no data since 2000, the SC range is based on all records in the SEEPro/EQuIS database. SC results from the most recent December 2014 annual sampling event are also provided. Formations and well construction information was not available for most of the non-DOE owned wells.

Link to discussion in main text: Monument Valley, Arizona, Processing Site (Section 4.7)

Table A-9. Naturita, Colorado, Processing Site

Naturita Processing Site Specific Conductance Profile Results, June 2014

Table A-9a. Summary Statistics for Naturita Site Alluvial Well SC Profiles: Sorted on Well ID

	June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jul-2014**	**Historical Range**
0547*	30	1121	1275	1270	47	1253	34	1.14	0.027	0.037	not sampled	742 - 1323
0548*	3	1062	1107	1,081	23	1083	23	1.04	0.021	0.021	not sampled	1187 - 2070
0700*	5	2073	2123	2103	27	2099	20	1.02	0.010	0.013	not sampled	1800 - 2560
0701*	2	364	535	450	86	450	121	1.47	0.269	0.190	not sampled	346 - 878
0715	17	853	1687	1,180	247	1,124	204	1.98	0.182	0.209	1089 (07/13)	101 - 1245
0718	23	1299	1871	1861	70	1792	146	1.44	0.082	0.038	2205	1340 - 2261
DM1	6	782	847	809	32	809	25	1.08	0.031	0.040	513	509 - 1187
MAU01*	14	1531	2003	1990	110	1915	139	1.31	0.073	0.055	not sampled	2750 - 2890
MAU03*	4	1210	1240	1219	19	1222	14	1.02	0.012	0.015	not sampled	631 - 1165
MAU04*	12	1384	1446	1437	12	1429	20	1.04	0.014	0.008	not sampled	685 - 1140
MAU06*	5	1368	1445	1,406	38	1,404	31	1.06	0.022	0.027	not sampled	579 - 1452
MAU07	8	1866	1923	1898	23	1896	21	1.03	0.011	0.012	1667	1063 - 2915
MAU08	8	2250	2477	2355	88	2346	75	1.10	0.032	0.037	1891	1891 - 5235
NAT02	13	566	940	935	41	897	101	1.66	0.113	0.044	965	788 - 1290
NAT03*	8	1297	1377	1368	19	1356	27	1.06	0.020	0.014	not sampled	1354 - 2360
NAT05*	16	2,063	2148	2,138	12	2,130	21	1.04	0.010	0.005	not sampled	3040 - 3070
NAT08	15	1,235	1439	1,361	21	1,358	42	1.17	0.031	0.015	1355	1344 - 2100
NAT09*	13	1,425	1604	1,501	30	1,504	40	1.13	0.027	0.020	not sampled	2080 - 2220
NAT10*	13	1,513	1683	1,639	17	1,624	40	1.11	0.025	0.010	not sampled	2140 - 2360
NAT11*	15	2026	2209	2204	41	2177	52	1.09	0.024	0.018	not sampled	1943 - 2560
NAT19*	13	1,790	2075	2,055	14	2,026	78	1.16	0.039	0.007	not sampled	1569 - 1960
NAT20*	8	1552	1760	1745	102	1697	81	1.13	0.048	0.058	not sampled	963 - 1451
NAT23*	5	1,481	1516	1,507	3	1,503	13	1.02	0.009	0	not sampled	1170 - 1870
NAT24*	8	1,251	1281	1,261	10	1,261	10	1.02	0.008	0	not sampled	1430 - 2240
NAT25*	11	1,899	1971	1,959	5	1,956	19	1.04	0.010	0	not sampled	2429 - 4310
NAT26	4	3381	3550	3421	99	3443	80	1.05	0.023	0.029	3000	3000 - 3671
	279						*min:*	1.0	0.008	0.002		
							max:	2.0	0.27	0.21		
							average:	1.2	0.045	0.036		

* denotes well that is not routinely sampled
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

All wells profiled are alluvial wells. Historical range includes data from 2000 through July 2015. For wells that are routinely sampled, the SC field measurements from the July 2014 annual sampling event are listed, as these dates correspond most closely to the June 2014 profiling. Well 0715 has not been sampled since 2013 – the most recent (July 2013) SC measured was 1089 µS/cm. For those wells that are not routinely sampled, in most cases the last sampling was in fall 2003. The profile for well 0701, with the highest CV of 0.27, should be discounted given that only 2 measurements were taken.

Link to discussion in main text: Naturita, Colorado, Processing Site (Section 4.8)

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Table A-9b. Summary Statistics for Naturita Site Alluvial Well SC Profiles: Sorted by CV

	June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Jul-2014**	**Historical Range**
0701*	2	364	535	450	86	450	121	1.47	0.269	0.190	not sampled	346 - 878
0715	17	853	1687	1,180	247	1,124	204	1.98	0.182	0.209	1089 (07/13)	101 - 1245
NAT02	13	566	940	935	41	897	101	1.66	0.113	0.044	965	788 - 1290
0718	23	1299	1871	1861	70	1792	146	1.44	0.082	0.038	2205	1340 - 2261
MAU01*	14	1531	2003	1990	110	1915	139	1.31	0.073	0.055	not sampled	2750 - 2890
NAT20*	8	1552	1760	1745	102	1697	81	1.13	0.048	0.058	not sampled	963 - 1451
NAT19*	13	1,790	2075	2,055	14	2,026	78	1.16	0.039	0.007	not sampled	1569 - 1960
MAU08	8	2250	2477	2355	88	2346	75	1.10	0.032	0.037	1891	1891 - 5235
NAT08	15	1,235	1439	1,361	21	1,358	42	1.17	0.031	0.015	1355	1344 - 2100
DM1	6	782	847	809	32	809	25	1.08	0.031	0.040	513	509 - 1187
NAT09*	13	1,425	1604	1,501	30	1,504	40	1.13	0.027	0.020	not sampled	2080 - 2220
NAT10*	13	1,513	1683	1,639	17	1,624	40	1.11	0.025	0.010	not sampled	2140 - 2360
NAT11*	15	2026	2209	2204	41	2177	52	1.09	0.024	0.018	not sampled	1943 - 2560
NAT26	4	3381	3550	3421	99	3443	80	1.05	0.023	0.029	3000	3000 - 3671
MAU06*	5	1368	1445	1,406	38	1,404	31	1.06	0.022	0.027	not sampled	579 - 1452
0548*	3	1062	1107	1,081	23	1083	23	1.04	0.021	0.021	not sampled	1187 - 2070
NAT03*	8	1297	1377	1368	19	1356	27	1.06	0.020	0.014	not sampled	1354 - 2360
MAU04*	12	1384	1446	1437	12	1429	20	1.04	0.014	0.008	not sampled	685 - 1140
MAU03*	4	1210	1240	1219	19	1222	14	1.02	0.012	0.015	not sampled	631 - 1165
MAU07	8	1866	1923	1898	23	1896	21	1.03	0.011	0.012	1667	1063 - 2915
NAT05*	16	2,063	2148	2,138	12	2,130	21	1.04	0.010	0.005	not sampled	3040 - 3070
NAT25*	11	1,899	1971	1,959	5	1,956	19	1.04	0.010	0	not sampled	2429 - 4310
0700*	5	2073	2123	2103	27	2099	20	1.02	0.010	0.013	not sampled	1800 - 2560
NAT23*	5	1,481	1516	1,507	3	1,503	13	1.02	0.009	0	not sampled	1170 - 1870
NAT24*	8	1,251	1281	1,261	10	1,261	10	1.02	0.008	0	not sampled	1430 - 2240

Yellow-shaded rows denotes well with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells had low variation (CV < 0.03) in the SC profiles.
The profile for well 0701, with the highest CV of 0.27, should be discounted given that only 2 measurements were taken.

* denotes well that is not routinely sampled
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

All wells profiled are alluvial wells. Historical range includes data from 2000 through July 2015. For wells that are routinely sampled, the SC field measurements from the July 2014 annual sampling event are listed, as these dates correspond most closely to the June 2014 profiling. Well 0715 has not been sampled since 2013 – the most recent (July 2013) SC measured was 1089 µS/cm. For those wells that are not routinely sampled, in most cases the last sampling was in fall 2003.

Link to discussion in main text: Naturita, Colorado, Processing Site (Section 4.8)

Table A-10. New Rifle, Colorado, Processing Site

New Rifle Site Specific Conductance Profile Results, July and October 2013

Table A-10a. Summary Statistics for New Rifle Site Well SC Profiles: Sorted on Well ID

			SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	**Area**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Nov-13**	**Historical Range**
0169	AL (Bkgrnd)	Upgradient	21	1942	2039	1970	56	1980	32.2	1.05	0.016	0.028	1941	1788 - 2752
0170	AL	Distal	9	3175	3,227	3,205	25	3205	17.9	1.02	0.006	0.008	3164	3045 - 4720
0172	AL	Distal	34	10,300	18,600	12,600	5,025	13,491	2863	1.81	0.212	0.399	16,773	1475 - 19,381
0195	AL	Distal	35	1,278	1,378	1,296	19	1,298	18.0	1.08	0.014	0.015	1025	1025 - 6460
0201	AL	Distal	19	5,370	5,398	5,378	7	5,379	6.2	1.01	0.001	0.001	4124	3878 - 10,460
0215	AL	Onsite	26	950	4,174	977	66	1,204	652	4.39	0.541	0.068	1264	685 - 2628
0216	AL	Onsite	33	1,056	1,681	1,059	10	1,129	160	1.59	0.142	0.009	1100	805 - 2595
0217	AL	Near Offsite	36	3,492	3,641	3,540	27	3,541	30.9	1.04	0.009	0.008	3523	3030 - 5111
0219	AL	Onsite Tailings	8	3,772	3,839	3,824	8	3,819	20.2	1.02	0.005	0.002	not sampled	3519 - 5410
0590	AL	Near Offsite	26	5,370	5,410	5,382	8	5,382	9.1	1.01	0.002	0.001	5515	1987 - 12,670
0609	AL	Distal	15	1,862	1,951	1,940	36	1,928	27.2	1.05	0.014	0.019	1175 (08/14)	1157 - 1843
0611	WS	Near Offsite	49	4,795	6,072	5,660	174	5,597	285	1.27	0.051	0.031	not sampled	9700 - 27,000
0620	AL	Distal	10	6,657	6,878	6,867	34	6,831	74.2	1.03	0.011	0.005	6985	5094 - 7862
0627	WS	Near Offsite	41	8,666	12,100	9,202	2,886	10,053	1388	1.40	0.138	0.314	not sampled	3400 - 13,920
0658	AL	Onsite	6	2,873	3,570	2,961	82	3,040	264	1.24	0.087	0.028	3050	2696 - 5630
0659	AL	Onsite Tailings	11	3,493	3,556	3,546	12	3,540	19.1	1.02	0.005	0.003	3542	3175 - 7759
0664	AL	Onsite Tailings	7	2,366	2,394	2,379	13	2,378	10.0	1.01	0.004	0.005	2361	2169 - 4160
0669	AL	Onsite Tailings	6	2,694	2,953	2,703	45	2,752	101.4	1.10	0.037	0.016	2874	2305 - 5070
0670	AL	Onsite	3	2,381	2,481	2,411	50	2,424	51.3	1.04	0.021	0.021	2197	2088 - 2986
0680	AL	Near Offsite	8	3,667	3,684	3,672	12	3,675	7.0	1.00	0.002	0.003	not sampled	3670 - 5080
0683	AL	Onsite	24	1,693	1,938	1,700	27	1,725	56.4	1.14	0.033	0.016	not sampled	949 - 2796
0684	AL	Onsite	16	1,704	1,710	1,707	2	1,707	1.7	1.00	0.001	0.001	not sampled	1294 - 3005
0688	AL	Onsite	27	944	1,108	951	3	957	30.4	1.17	0.032	0.003	not sampled	676 - 1160
0689	AL	Onsite	6	2,044	2,217	2,123	119	2,127	72.6	1.08	0.034	0.056	not sampled	2172 - 2462
0690	AL	Onsite	4	1,948	1,957	1,953	4	1,953	3.8	1.00	0.002	0.002	not sampled	1957 - 2677
0852	AL	Onsite Tailings	9	2,451	2,788	2,513	138	2,566	110	1.14	0.043	0.055	not sampled	2240 - 4795
0853	AL	Onsite Tailings	17	2,160	2,278	2,256	21	2,255	27.6	1.05	0.012	0.009	not sampled	2425 - 3090
0854	AL	Onsite Tailings	28	2,229	2,457	2,333	13	2,344	48.8	1.10	0.021	0.006	not sampled	2479 - 3420
0855	AL	Onsite	9	2,682	3,673	3,641	148	3,475	329	1.37	0.095	0.041	3003	2257 - 6027
0856	AL	Onsite	20	1,791	2,002	1,936	115	1,923	76.5	1.12	0.040	0.059	not sampled	1829 - 3270
0857	AL	Onsite	34	1,934	2,216	2,013	23	2,043	89.2	1.15	0.044	0.012	not sampled	2700 - 3710
0862	AL	Onsite Tailings	34	2,553	10,800	3,698	1,164	4,463	2068	4.23	0.463	0.315	not sampled	4840 - 6200
0863	AL	Onsite Tailings	33	3,387	3,718	3,707	14	3,677	89.1	1.10	0.024	0.004	not sampled	3766 - 6480
0864	AL	Onsite Tailings	32	2,126	2,548	2,144	143	2,222	135	1.20	0.061	0.066	not sampled	2307 - 3450
CW06	AL	Onsite CW	21	561	1,757	563	5	622	260	3.13	0.418	0.009	not sampled	618 - 2320
CW09	AL	Onsite CW	29	796	1,835	1,153	671	1,375	338	2.31	0.246	0.582	not sampled	1295 - 1815
CW19	AL	Onsite CW	27	1,770	2,011	1,785	14	1,822	75.7	1.14	0.042	0.008	not sampled	752 - 1887
CW21	AL	Onsite CW	30	1,008	1,818	1,011	798	1,296	384	1.80	0.296	0.789	not sampled	1404 - 1825
CW22	AL	Onsite CW	21	1,172	1,877	1,174	362	1,352	276	1.60	0.204	0.308	not sampled	708 - 1705
CW23	AL	Onsite CW	24	1,617	1,809	1,632	171	1,700	85.1	1.12	0.050	0.105	not sampled	775 - 1375
CW25	AL	Onsite CW	26	924	1869	946	57	1042	255	2.02	0.245	0.060	not sampled	756 - 1350
	Total:		*874*						*min:*	1.0	0.001	0.001		
									max:	4.4	0.54	0.79		
									average:	1.4	0.091	0.085		

* denotes well that is not routinely sampled
AL alluvial aquifer
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation
WS Wasatch Formation well

Historical range includes data from 2000 through June 2015. For wells that are routinely sampled, the SC field measurements from the November 2013 semiannual sampling event are listed, as these dates correspond most closely to the 2013 profiling.

Link to discussion in main text: New Rifle, Colorado, Processing Site (Section 4.9)

Table A-10b. Summary Statistics for New Rifle Site Well SC Profiles: Sorted by CV

			SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	**Area**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Nov-13**	**Historical Range**
0215	AL	Onsite	26	950	4,174	977	66	1,204	652	4.39	0.54	0.068	1264	685 - 2628
0862	AL	Onsite Tailings	34	2,553	10,800	3,698	1,164	4,463	2068	4.23	0.46	0.315	not sampled	4840 - 6200
0172	AL	Distal	34	10,300	18,600	12,600	5,025	13,491	2863	1.81	0.21	0.399	16,773	1475 - 19,381
0216	AL	Onsite	33	1,056	1,681	1,059	10	1,129	160	1.59	0.14	0.009	1100	805 - 2595
0627	WS	Near Offsite	41	8,666	12,100	9,202	2,886	10,053	1388	1.40	0.14	0.314	not sampled	3400 - 13,920
0855	AL	Onsite	9	2,682	3,673	3,641	148	3,475	329	1.37	0.095	0.041	3003	2257 - 6027
0658	AL	Onsite	6	2,873	3,570	2,961	82	3,040	264	1.24	0.087	0.028	3050	2696 - 5630
0864	AL	Onsite Tailings	32	2,126	2,548	2,144	143	2,222	135	1.20	0.061	0.066	not sampled	2307 - 3450
0611	WS	Near Offsite	49	4,795	6,072	5,660	174	5,597	285	1.27	0.051	0.031	not sampled	9700 - 27,000
0857	AL	Onsite	34	1,934	2,216	2,013	23	2,043	89.2	1.15	0.044	0.012	not sampled	2700 - 3710
0852	AL	Onsite Tailings	9	2,451	2,788	2,513	138	2,566	110	1.14	0.043	0.055	not sampled	2240 - 4795
0856	AL	Onsite	20	1,791	2,002	1,936	115	1,923	76.5	1.12	0.040	0.059	not sampled	1829 - 3270
0669	AL	Onsite Tailings	6	2,694	2,953	2,703	45	2,752	101.4	1.10	0.037	0.016	2874	2305 - 5070
0689	AL	Onsite	6	2,044	2,217	2,123	119	2,127	72.6	1.08	0.034	0.056	not sampled	2172 - 2462
0683	AL	Onsite	24	1,693	1,938	1,700	27	1,725	56.4	1.14	0.033	0.016	not sampled	949 - 2796
0688	AL	Onsite	27	944	1,108	951	3	957	30.4	1.17	0.032	0.003	not sampled	676 - 1160
0863	AL	Onsite Tailings	33	3,387	3,718	3,707	14	3,677	89.1	1.10	0.024	0.004	not sampled	3766 - 6480
0670	AL	Onsite	3	2,381	2,481	2,411	50	2,424	51.3	1.04	0.021	0.021	2197	2088 - 2986
0854	AL	Onsite Tailings	28	2,229	2,457	2,333	13	2,344	48.8	1.10	0.021	0.006	not sampled	2479 - 3420
0169	AL (Bkgrnd)	Upgradient	21	1942	2039	1970	56	1980	32.2	1.05	0.016	0.028	1941	1788 - 2752
0609	AL	Distal	15	1,862	1,951	1,940	36	1,928	27.2	1.05	0.014	0.019	1175 (08/14)	1157 - 1843
0195	AL	Distal	35	1,278	1,378	1,296	19	1,298	18.0	1.08	0.014	0.015	1025	1025 - 6460
0853	AL	Onsite Tailings	17	2,160	2,278	2,256	21	2,255	27.6	1.05	0.012	0.009	not sampled	2425 - 3090
0620	AL	Distal	10	6,657	6,878	6,867	34	6,831	74.2	1.03	0.011	0.005	6985	5094 - 7862
0217	AL	Near Offsite	36	3,492	3,641	3,540	27	3,541	30.9	1.04	0.009	0.008	3523	3030 - 5111
0170	AL	Distal	9	3175	3,227	3,205	25	3205	17.9	1.02	0.006	0.008	3164	3045 - 4720
0659	AL	Onsite Tailings	11	3,493	3,556	3,546	12	3,540	19.1	1.02	0.005	0.003	3542	3175 - 7759
0219	AL	Onsite Tailings	8	3,772	3,839	3,824	8	3,819	20.2	1.02	0.005	0.002	not sampled	3519 - 5410
0664	AL	Onsite Tailings	7	2,366	2,394	2,379	13	2,378	10.0	1.01	0.004	0.005	2361	2169 - 4160
0690	AL	Onsite	4	1,948	1,957	1,953	4	1,953	3.8	1.00	0.002	0.002	not sampled	1957 - 2677
0680	AL	Near Offsite	8	3,667	3,684	3,672	12	3,675	7.0	1.00	0.002	0.003	not sampled	3670 - 5080
0590	AL	Near Offsite	26	5,370	5,410	5,382	8	5,382	9.1	1.01	0.002	0.001	5515	1987 - 12,670
0201	AL	Distal	19	5,370	5,398	5,378	7	5,379	6.2	1.01	0.001	0.001	4124	3878 - 10,460
0684	AL	Onsite	16	1,704	1,710	1,707	2	1,707	1.7	1.00	0.001	0.001	not sampled	1294 - 3005
CW06	AL	Onsite CW	21	561	1,757	563	5	622	260	3.13	0.418	0.009	not sampled	618 - 2320
CW21	AL	Onsite CW	30	1,008	1,818	1,011	798	1,296	384	1.80	0.296	0.789	not sampled	1404 - 1825
CW09	AL	Onsite CW	29	796	1,835	1,153	671	1,375	338	2.31	0.246	0.582	not sampled	1295 - 1815
CW25	AL	Onsite CW	26	924	1869	946	57	1042	255	2.02	0.245	0.060	not sampled	756 - 1350
CW22	AL	Onsite CW	21	1,172	1,877	1,174	362	1,352	276	1.60	0.204	0.308	not sampled	708 - 1705
CW23	AL	Onsite CW	24	1,617	1,809	1,632	171	1,700	85.1	1.12	0.050	0.105	not sampled	775 - 1375
CW19	AL	Onsite CW	27	1,770	2,011	1,785	14	1,822	75.7	1.14	0.042	0.008	not sampled	752 - 1887

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3
Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells had low variation (CV < 0.03) in the SC profiles.

SC profile results for most CW- (city wastewater treatment plant) wells were anomalous and some had dead zone outliers. Therefore, CVs for these wells are sorted separately in the bottom of the table; these (CV) values should be discounted or interpreted with care.

Link to discussion in main text: New Rifle, Colorado, Processing Site (Section 4.9)

Table A-11. Old Rifle, Colorado, Processing Site

Old Rifle Site Specific Conductance Profile Results, October 2013

Table A-11a. Summary Statistics for Old Rifle Site Well SC Profiles: Sorted on Well ID

		SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)		
Well	**Description**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Nov-13**	**Historical Range**	
0658	Background	25	1353	1369	1361	3	1,360	3.3	1.01	0.002	0.002	1408	1293	- 2179
0292A	Background	21	1776	1853	1810	18	1,808	16.4	1.04	0.009	0.010	1810	1794	- 2856
0304	DOE well	20	1766	1886	1832	90	1833	45.0	1.07	0.025	0.049	1900	1336	- 2701
0305	DOE well	17	1470	3006	1693	22	1758	326.9	2.04	0.186	0.013	1734	1372	- 2577
0309	DOE well	20	2294	2405	2338	34	2,343	26.0	1.05	0.011	0.015	2355	1744	- 2540
0310	DOE well	20	2193	2329	2266	8	2,265	27.5	1.06	0.012	0.004	2284	1778	- 3055
0655	DOE well	24	1865	2397	2121	9	2,121	99.8	1.29	0.047	0.004	2125	1825	- 2861
0656	DOE well	22	2176	2237	2227	29	2,218	17.9	1.03	0.008	0.013	2123	1427	- 2726
0654*	DOE well	20	1702	1741	1736	18	1,729	12.1	1.02	0.007	0.010	not sampled	1825	- 1891
0745*	DOE well	15	1910	2412	1955	227	2,064	152.8	1.26	0.074	0.116	1788 (06/13)	1788	
0746*	DOE well	24	2874	3467	3074	64	3,060	107.0	1.21	0.035	0.021	3285 (06/13)	3285	
0747*	DOE well	29	1875	1949	1945	6	1,938	18.6	1.04	0.010	0.003	1655 (06/13)	1655	
B-02*	IFRC well	16	2089	2121	2117	9	2,113	9.6	1.02	0.005	0.004	not sampled	--	
B-05*	IFRC well	15	2221	2456	2338	141	2,327	81.5	1.11	0.035	0.060	not sampled	--	
FP-101*	IFRC well	20	2883	3215	2925	300	3,022	144.5	1.12	0.048	0.102	not sampled	--	
FP-102*	IFRC well	14	1875	2162	2156	8	2,135	75.0	1.15	0.035	0.003	not sampled	--	
JB-03*	IFRC well	19	1864	2335	2319	8	2,287	105.9	1.25	0.046	0.003	not sampled	--	
LQ-114*	IFRC well	17	2163	2283	2210	24	2,207	27.2	1.06	0.012	0.011	not sampled	--	
LR-04*	IFRC well	25	741	1531	1527	5	1,485	159.7	2.07	0.108	0.003	not sampled	--	
SY-02*	IFRC well	26	1870	1934	1902	7	1,901	12.1	1.03	0.006	0.004	not sampled	--	
SY-04*	IFRC well	26	1556	1647	1591	68	1,596	34.0	1.06	0.021	0.043	not sampled	--	
SY-06*	IFRC well	37	1525	1828	1800	6	1,777	68.5	1.20	0.039	0.003	not sampled	--	
	Total: 472							*min:*	1.0	0.002	0.002			
								max:	2.1	0.19	0.12			
								average:	1.2	0.035	0.023			

No SC or uranium data are recorded in the SEEPro/EQuIS database for IFRC wells.

* denotes well that is not routinely sampled
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

All wells profiled at the Old Rifle site are installed in the alluvial aquifer. Historical range includes data from 2000 through June 2015. For wells that are routinely sampled, the SC field measurements from the November 2013 semiannual sampling event are listed, as these dates correspond most closely to the late October 2013 profiling. Based on the SEEPro/EQuIS database, wells 0745, 0746, and 0747 have only been sampled once, in June 2013. Relevant data for IFRC wells was not available at the time this interim Phase I report was developed.

Link to discussion in main text: Old Rifle, Colorado, Processing Site (Section 4.10)

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Table A-11b. Summary Statistics for Old Rifle Site Well SC Profiles: Sorted by CV

		SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Description**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Nov-13**	**Historical Range**
0305	DOE well	17	1470	3006	1693	22	1758	326.9	2.04	0.19	0.013	1734	1372 - 2577
LR-04*	IFRC well	25	741	1531	1527	5	1,485	159.7	2.07	0.11	0.003	not sampled	--
0745*	DOE well	15	1910	2412	1955	227	2,064	152.8	1.26	0.074	0.116	1788 (06/13)	1788
FP-101*	IFRC well	20	2883	3215	2925	300	3,022	144.5	1.12	0.048	0.102	not sampled	--
0655	DOE well	24	1865	2397	2121	9	2,121	99.8	1.29	0.047	0.004	2125	1825 - 2861
JB-03*	IFRC well	19	1864	2335	2319	8	2,287	105.9	1.25	0.046	0.003	not sampled	--
SY-06*	IFRC well	37	1525	1828	1800	6	1,777	68.5	1.20	0.039	0.003	not sampled	--
FP-102*	IFRC well	14	1875	2162	2156	8	2,135	75.0	1.15	0.035	0.003	not sampled	--
B-05*	IFRC well	15	2221	2456	2338	141	2,327	81.5	1.11	0.035	0.060	not sampled	--
0746*	DOE well	24	2874	3467	3074	64	3,060	107.0	1.21	0.035	0.021	3285 (06/13)	3285
0304	DOE well	20	1766	1886	1832	90	1833	45.0	1.07	0.025	0.049	1900	1336 - 2701
SY-04*	IFRC well	26	1556	1647	1591	68	1,596	34.0	1.06	0.021	0.043	not sampled	--
LQ-114*	IFRC well	17	2163	2283	2210	24	2,207	27.2	1.06	0.012	0.011	not sampled	--
0310	DOE well	20	2193	2329	2266	8	2,265	27.5	1.06	0.012	0.004	2284	1778 - 3055
0309	DOE well	20	2294	2405	2338	34	2,343	26.0	1.05	0.011	0.015	2355	1744 - 2540
0747*	DOE well	29	1875	1949	1945	6	1,938	18.6	1.04	0.010	0.003	1655 (06/13)	1655
0292A	Background	21	1776	1853	1810	18	1,808	16.4	1.04	0.009	0.010	1810	1794 - 2856
0656	DOE well	22	2176	2237	2227	29	2,218	17.9	1.03	0.008	0.013	2123	1427 - 2726
0654*	DOE well	20	1702	1741	1736	18	1,729	12.1	1.02	0.007	0.010	not sampled	1825 - 1891
SY-02*	IFRC well	26	1870	1934	1902	7	1,901	12.1	1.03	0.006	0.004	not sampled	--
B-02*	IFRC well	16	2089	2121	2117	9	2,113	9.6	1.02	0.005	0.004	not sampled	--
0658	Background	25	1353	1369	1361	3	1,360	3.3	1.01	0.002	0.002	1408	1293 - 2179

Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells had low variation (CV < 0.03) in the SC profiles.

*	denotes well that is not routinely sampled
CV	coefficient of variation, equal to standard deviation divided by the mean
IQR	interquartile range
IQR/M	IQR/median
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation

All wells profiled at the Old Rifle site are installed in the alluvial aquifer. Historical range includes data from 2000 through June 2015. For wells that are routinely sampled, the SC field measurements from the November 2013 semiannual sampling event are listed, as these dates correspond most closely to the late October 2013 profiling. Based on the SEEPro/EQuIS database, wells 0745, 0746, and 0747 have only been sampled once, in June 2013. Relevant data for IFRC wells was not available at the time this interim Phase I report was developed.

Link to discussion in main text: Old Rifle, Colorado, Processing Site (Section 4.10)

Table A-12. Riverton, Wyoming, Processing Site

Riverton Site Specific Conductance Profile Results, September 2014

Table A-12a. Summary Statistics for Riverton Site Well SC Profiles: Sorted Aquifer, Well ID

		SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Range**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Sep-2014**	**Historical Range**
0101*	SF	17	1073	1150	77	1078	33	1093	28	1.07	0.026	0.031	not sampled	450 - 1774
0700*	SF	18	1039	1091	52	1051	7.5	1051	11	1.05	0.010	0.007	not sampled	757 - 1622
0707	SF	18	3999	4893	894	4142	293	4251	292	1.22	0.069	0.071	3713	3182 - 11,640
0710	SF	21	515	616	101	534	36	553	30	1.20	0.054	0.067	456	434 - 1304
0716	SF	10	1221	1381	160	1373	33	1349	53	1.13	0.039	0.024	1313	1116 - 2200
0718	SF	16	3969	4437	468	4351	425	4241	206	1.12	0.049	0.098	4393	3318 - 6505
0720	SF	15	562	577	15	574	3.0	573	4.2	1.03	0.007	0.005	587	582 - 1719
0722R	SF	12	1871	2263	392	2252	206	2170	148	1.21	0.068	0.091	2123	992 - 2627
0724*	SF	21	495	656	161	530	10	538	32	1.33	0.060	0.019	not sampled	490 - 777
0728*	SF	32	287	455	168	401	135	381	63	1.59	0.166	0.34	not sampled	373 - 566
0729	SF	12	262	492	230	425	111	404	76	1.88	0.189	0.26	514	514 - 1008
0733*	SF	8	763	859	96	819	62	810	34.5	1.13	0.043	0.076	not sampled	141 - 868
0784	SF	8	3363	4145	782	3400	67	3489	267	1.23	0.076	0.020	2150	1652 - 6270
0788	SF	17	3158	3595	437	3188	131	3250	125	1.14	0.038	0.041	3032	1783 - 8527
0789	SF	18	7431	7540	109	7495	33	7491	27	1.01	0.004	0.004	7579	6210 - 16,600
0824	SF	17	238	1337	1099	275	585	512	342	5.62	0.668	2.13	828	568 - 1264
0826	SF	8	2722	2990	268	2980	203	2911	113	1.10	0.039	0.068	2883	1298 - 4653
0111*	SE	87	703	859	156	835	2.0	832	20	1.22	0.024	0.002	not sampled	440 - 738
0702	SE	75	940	1548	608	950	8.0	989	129	1.65	0.130	0.008	not sampled	1100
0705	SE	86	1194	1210	16	1199	2.0	1199	2.2	1.01	0.002	0.002	1197	1042 - 1349
0717	SE	85	1800	1878	78	1865	18	1862	14	1.04	0.008	0.010	1716	1560 - 2155
0719	SE	62	1217	1231	14	1222	3.0	1223	3.0	1.01	0.002	0.002	1203	974 - 1394
0721	SE	84	854	865	11	860	4.0	860	2.4	1.01	0.003	0.005	856	779 - 990
0723	SE	79	3426	3917	491	3514	151	3556	107	1.14	0.030	0.043	3240	3240 - 4256
0725*	SE	61	664	689	25	682	6	681	4.7	1.04	0.007	0.009	not sampled	514 - 890
0727*	SE	61	498	546	48	538	8	538	7.0	1.10	0.013	0.015	not sampled	500 - 694
0730	SE	61	785	804	19	795	11	795	5.7	1.02	0.007	0.014	791	791 - 1089
0732*	SE	69	1702	3025	1323	3015	6.5	2995	158	1.78	0.053	0.002	not sampled	2810 - 3940
0734*	SE	71	689	749	60	746	3.0	744	7.6	1.09	0.010	0.004	not sampled	545
0736*	SE	57	1871	2144	273	2106	39	2107	41	1.15	0.019	0.018	2326	2326 - 2326
0110*	SS	85	359	1181	822	503	231	501	149	3.29	0.298	0.46	not sampled	210 - 764
0709*	SS	94	1748	9613	7865	1976	5803	4070	3196	5.50	0.785	2.94	not sampled	1320 - 7000
0726*	SS	58	596	924	328	613	84	669	108	1.55	0.161	0.14	not sampled	378 - 603
		Total: 1443							*min:*	1.0	0.002	0.002		
									max:	5.6	0.79	2.94		
									average:	1.5	0.096	0.213		

* denotes well that is not routinely sampled (e.g., well monitored for water levels only)
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation
SF surficial aquifer; SE = semiconfined (sandstone) aquifer; SS = sandstone (confined) aquifer

For Riverton site wells that are routinely sampled, the historical range of SC listed is since 2000. For wells that are not routinely sampled for which there are no data since 2000, the SC range is based on all records in the SEEPro/EQuIS database. SC results from the September 2014 annual sampling event are provided because this sampling coincided with the Phase I profiling effort.

Link to discussion in main text: Riverton, Wyoming, Processing Site (Section 4.11)

Table A-12b. Summary Statistics for Riverton Site Well SC Profiles: Sorted by CV

		SC Profile Results: Summary Statistics (SC in µS/cm)								Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Range**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Sep-2014**	**Historical Range**
0709*	SS	94	1748	9613	7865	1976	5803	4070	3196	5.50	0.79	2.94	not sampled	1320 - 7000
0824	SF	17	238	1337	1099	275	585	512	342	5.62	0.67	2.13	828	568 - 1264
0110*	SS	85	359	1181	822	503	231	501	149	3.29	0.30	0.46	not sampled	210 - 764
0729	SF	12	262	492	230	425	111	404	76	1.88	0.19	0.26	514	514 - 1008
0728*	SF	32	287	455	168	401	135	381	63	1.59	0.17	0.34	not sampled	373 - 566
0726*	SS	58	596	924	328	613	84	669	108	1.55	0.16	0.14	not sampled	378 - 603
0702	SE	75	940	1548	608	950	8.0	989	129	1.65	0.13	0.008	not sampled	1100
0784	SF	8	3363	4145	782	3400	67	3489	267	1.23	0.076	0.020	2150	1652 - 6270
0707	SF	18	3999	4893	894	4142	293	4251	292	1.22	0.069	0.071	3713	3182 - 11,640
0722R	SF	12	1871	2263	392	2252	206	2170	148	1.21	0.068	0.091	2123	992 - 2627
0724*	SF	21	495	656	161	530	10	538	32	1.33	0.060	0.019	not sampled	490 - 777
0710	SF	21	515	616	101	534	36	553	30	1.20	0.054	0.067	456	434 - 1304
0732*	SE	69	1702	3025	1323	3015	6.5	2995	158	1.78	0.053	0.002	not sampled	2810 - 3940
0718	SF	16	3969	4437	468	4351	425	4241	206	1.12	0.049	0.098	4393	3318 - 6505
0733*	SF	8	763	859	96	819	62	810	34.5	1.13	0.043	0.076	not sampled	141 - 868
0716	SF	10	1221	1381	160	1373	33	1349	53	1.13	0.039	0.024	1313	1116 - 2200
0826	SF	8	2722	2990	268	2980	203	2911	113	1.10	0.039	0.068	2883	1298 - 4653
0788	SF	17	3158	3595	437	3188	131	3250	125	1.14	0.038	0.041	3032	1783 - 8527
0723	SE	79	3426	3917	491	3514	151	3556	107	1.14	0.030	0.043	3240	3240 - 4256
0101*	SF	17	1073	1150	77	1078	33	1093	28	1.07	0.026	0.031	not sampled	450 - 1774
0111*	SE	87	703	859	156	835	2.0	832	20	1.22	0.024	0.002	not sampled	440 - 738
0736*	SE	57	1871	2144	273	2106	39	2107	41	1.15	0.019	0.018	2326	2326 - 2326
0727*	SE	61	498	546	48	538	8	538	7.0	1.10	0.013	0.015	not sampled	500 - 694
0700*	SF	18	1039	1091	52	1051	7.5	1051	11	1.05	0.010	0.007	not sampled	757 - 1622
0734*	SE	71	689	749	60	746	3.0	744	7.6	1.09	0.010	0.004	not sampled	545
0717	SE	85	1800	1878	78	1865	18	1862	14	1.04	0.008	0.010	1716	1560 - 2155
0720	SF	15	562	577	15	574	3.0	573	4.2	1.03	0.007	0.005	587	582 - 1719
0730	SE	61	785	804	19	795	11	795	5.7	1.02	0.007	0.014	791	791 - 1089
0725*	SE	61	664	689	25	682	6	681	4.7	1.04	0.007	0.009	not sampled	514 - 890
0789	SF	18	7431	7540	109	7495	33	7491	27	1.01	0.004	0.004	7579	6210 - 16,600
0721	SE	84	854	865	11	860	4.0	860	2.4	1.01	0.003	0.005	856	779 - 990
0719	SE	62	1217	1231	14	1222	3.0	1223	3.0	1.01	0.002	0.002	1203	974 - 1394
0705	SE	86	1194	1210	16	1199	2.0	1199	2.2	1.01	0.002	0.002	1197	1042 - 1349

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3
Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells had low variation (CV < 0.03) in the SC profiles.

* denotes well that is not routinely sampled (e.g., well monitored for water levels only)
SF surficial aquifer; SE = semiconfined (sandstone) aquifer; SS = sandstone (confined) aquifer

Note:
The stratification and high SCs in confined aquifer well 0709 was attributed to grout contamination in the well; refer to 9/25/2014 annual sampling trip report.

Link to discussion in main text: Riverton, Wyoming, Processing Site (Section 4.11)

Table A-13. Shiprock, New Mexico, Disposal Site Floodplain, 2013

Shiprock Floodplain Specific Conductance Profile Results, September 2013

Table A-13a. Summary Statistics for Shiprock Floodplain 2013 SC Profiles: Sorted by Well ID
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			September 2013 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Sep-2013	Historical Range
0608	KM	Km Wells	27	9059	10,300	9876	9862	9884	1.14	0.028	0.021	9915	7218 - 18,360
0609 *	AL	BOE Qal	15	4136	8953	4851	6737	6565	2.16	0.274	0.485	not sampled	7949 - 11,470
0610	AL	BOE Qal	7	8624	10,700	10,184	10,600	10,184	1.24	0.080	0.068	9430	50 - 17,940
0611	AL-KM	BOE Qal	17	10,800	11,500	11,100	11,200	11,188	1.06	0.019	0.027	10,870	8859 - 13,580
0612	AL	Hyporheic Wells	13	2257	4950	3942	4398	4247	2.19	0.149	0.014	3074	850 - 4556
0613 *	AL	BOE Qal	9	13,900	26,500	17,011	14,900	17,011	1.91	0.263	0.128	not sampled	28,730
0614	AL-KM	BOE Qal	21	8068	18,900	9224	10,100	12,149	2.34	0.338	0.668	10,364	7540 - 27,078
0615	AL	Trench 1 Qal	2	5497	5533	5515	5515	5515	1.01	0.005	0.003	5761	5761 - 32,594
0616 *	AL	Central FP	3	7855	8162	8015	8028	8015	1.04	0.019	0.019	not sampled	4910 - 9740
0617 *	AL	Central FP	11	8506	13,200	9809	8577	9809	1.55	0.208	0.277	not sampled	8290 - 19,895
0618	AL	Central FP	25	7961	16,000	8465	8465	10,734	2.01	0.312	0.687	8855	6860 - 21,517
0619	AL	Central FP	19	6036	11,100	6094	6094	7106	1.84	0.288	0.006	5859	5506 - 20,920
0620 *	AL-KM	Central FP	35	4524	5652	4657	4612	4819	1.25	0.085	0.049	not sampled	9610 - 11,110
0621 *	AL	Central FP	27	4641	5106	4670	4677	4726	1.10	0.027	0.007	not sampled	7147 - 10,550
0622	AL	Central FP	17	4812	10,800	6183	6510	6840	2.24	0.249	0.239	5330	4589 - 10,220
0623	AL	Western FP	23	5547	6022	5632	5652	5712	1.09	0.026	0.024	5311	5143 - 7310
0624 *	AL-KM	Western FP	32	4933	6324	5813	5764	5808	1.28	0.039	0.016	not sampled	6164 - 11,780
0625	AL	Western FP	14	4597	5960	5427	5436	5451	1.30	0.056	0.017	5224	5107 - 6830
0626	AL	Western FP	25	957	6566	5956	5638	3903	6.86	0.688	0.971	6913	4219 - 7581
0627 *	AL	Western FP	23	4683	7633	4903	4903	5215	1.63	0.177	0.053	not sampled	5096 - 5096
0628	AL	Western FP	19	4813	11,800	5838	5990	6812	2.45	0.325	0.261	5688	4440 - 11,753
0629 *	AL-KM	Western FP	34	6086	9004	7052	7011	7474	1.48	0.120	0.230	not sampled	7553 - 7553
0630	AL	Western FP	23	5768	10,300	6835	7025	7282	1.79	0.209	0.277	7300	4553 - 8879
0734	AL	Western FP	6	37,900	38,700	38,317	38,350	38,317	1.02	0.009	0.014	29,950	33 - 29,950
0735	AL	BOE Qal	11	20,000	24,200	20,100	21,900	21,755	1.21	0.056	0.064	21,360	2035 - 26,440
0736	AL	Western FP	4	5237	5333	5266	5248	5266	1.02	0.009	0.008	5621	5200 - 15,040
0766	AL	Well 1089 Area	5	7535	8034	7734	7682	7734	1.07	0.025	0.025	7725	6940 - 29,500
0768	AL	Central FP	6	9928	18,100	15,871	17,650	15,871	1.82	0.209	0.178	12,012	6735 - 28,848
0773	AL	BOE Qal	4	2994	3186	3052	3014	3052	1.06	0.030	0.022	3213	2737 - 9800
0775	AL	Central FP	3	7500	7666	7577	7564	7577	1.02	0.011	0.011	7477	6961 - 18,690
0779	AL	Central FP	6	16,500	23,600	18,400	17,700	18,400	1.43	0.142	0.049	16,920	6260 - 30,570
0792	AL	Central FP	8	7407	9700	8472	8496	8472	1.31	0.084	0.074	7450	7077 - 31,078
0793	AL	Central FP	6	9322	10,400	9806	9775	9806	1.12	0.047	0.076	10,420	5049 - 11,669
0794 *	AL	Hyporheic Wells	4	2321	2377	2350	2352	2350	1.02	0.010	0.011	not sampled	3356 - 6430
0795 *	AL	Hyporheic Wells	6	1954	2442	2068	1990	2068	1.25	0.090	0.035	not sampled	1193 - 4470
0798	AL	Central FP	9	8562	9776	8594	8868	8972	1.14	0.042	0.014	8679	8435 - 24,290
0853	AL	Hyporheic Wells	23	1164	2349	1472	1472	1470	2.02	0.214	0.274	1481	970 - 2960
0854	AL	Well 1089 Area	9	9822	11,200	10,720	10,600	10,493	1.14	0.046	0.066	11,475	8263 - 31,790
0855	AL	Western FP	27	5541	6920	5879	5883	5975	1.25	0.060	0.065	6497	5360 - 8497
0856	AL	Western FP	43	5071	5336	5262	5136	5168	1.05	0.016	0.026	5389	4892 - 6673
0857	AL	Central FP	24	8978	15,700	9309	9279	10,236	1.75	0.200	0.088	9097	1347 - 10,275
0858 *	AL	Hyporheic Wells	32	627	745	649	650	659	1.19	0.045	0.075	not sampled	716 - 1188
0859 *	AL	Hyporheic Wells	30	621	658	648	634	636	1.06	0.019	0.036	not sampled	721 - 721
0860 *	KM	Km Wells	56	23,200	35,700	35,264	31,750	31,245	1.54	0.121	0.185	not sampled	11,540 - 25,300
0861 *	KM	Km Wells	12	28,800	30,700	29,908	29,950	29,908	1.07	0.022	0.035	not sampled	30,540 - 30,540
0862 *	KM	Km Wells	12	27,600	32,000	27,930	30,850	30,558	1.16	0.046	0.063	not sampled	11,480 - 28,500
0863 *	KM	Km Wells	40	21,300	27,100	25,720	26,600	25,720	1.27	0.064	0.052	not sampled	11,530 - 26,210
1000 *	KM	Km Wells	27	21,300	27,100	21,400	21,400	22,378	1.27	0.084	0.030	not sampled	4350 - 21,540
1001 *	KM	Km Wells	27	14,900	15,700	15,500	15,500	15,430	1.05	0.013	0.010	not sampled	2660 - 14,920
1008	AL	Well 1089 Area	23	7588	13,000	7832	7834	8212	1.71	0.161	0.011	7750	7046 - 25,023
1009	AL	Hyporheic Wells	23	2509	5212	3246	3283	3382	2.08	0.216	0.111	2917	2917 - 7490
1010 *	AL	Central FP	27	4901	15,300	5332	7150	6887	3.12	0.298	0.273	not sampled	3680 - 19,849
1013 *	AL-KM	Hyporheic Wells	37	1414	2850	1467	1475	2074	2.02	0.324	0.908	not sampled	2587 - 2950
1062 *	KM	Km Wells	58	25,100	29,000	28,140	27,850	27,659	1.16	0.026	0.031	not sampled	8300 - 24,870

Table A-13a. Summary Statistics for Shiprock Floodplain 2013 SC Profiles: Sorted by Well ID
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			September 2013 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Sep-2013	Historical Range
1075 *	AL	Well 1089 Area	25	6916	28,100	6927	7142	10,018	4.06	0.655	0.015	not sampled	8831 - 32,402
1077 *	AL	Well 1089 Area	13	9555	10,100	9993	10,100	9993	1.06	0.016	0.012	not sampled	12,607 - 26,975
1089	AL	Well 1089 Area	10	7356	10,400	7884	7620	7884	1.41	0.113	0.014	8050	7500 - 19,700
1104	AL	Well 1089 Area	7	8296	11,200	10,800	10,800	10,428	1.35	0.097	0.060	11,620	7250 - 24,290
1105	AL	Trench 1 Qal	30	5441	14,200	5511	13,450	10,923	2.61	0.357	0.620	6040	6040 - 28,902
1111	AL	Trench 1 Qal	4	8805	10,900	10,047	10,241	10,047	1.24	0.099	0.133	11,750	10,434 - 18,850
1112	AL	Trench 1 Qal	4	9808	10,700	10,700	10,150	10,202	1.09	0.036	0.029	10,290	5689 - 21,990
1113	AL	BOE Qal	11	8324	10,100	9376	9308	9201	1.21	0.049	0.030	9500	6930 - 19,890
1114	AL	BOE Qal	12	4403	8652	6217	6052	5904	1.97	0.183	0.121	5900	3491 - 15,290
1115	AL	Trench 2 BOE	15	5310	16,900	7640	7686	8826	3.18	0.349	0.490	11,270	3628 - 16,744
1116 *	AL	Trench 2 BOE	7	14,600	16,600	14,600	15,800	15,829	1.14	0.041	0.032	not sampled	12,977 - 17,434
1117	AL	Trench 2 East	15	562	632	590	627	608	1.12	0.049	0.081	800	408 - 806
1125 *	AL	Trench 2 East	15	536	1941	1206	1898	1446	3.62	0.459	0.722	not sampled	572 - 716
1126 *	AL	Trench 2 BOE	17	689	6744	796	822	1913	9.79	1.143	0.167	not sampled	3462 - 16,950
1127 *	AL	Trench 2 East	18	464	1004	715	772	704	2.16	0.318	0.577	not sampled	419 - 1225
1128	AL	Trench 2 BOE	11	4480	17,400	4553	13,800	11,631	3.88	0.495	0.867	11,900	10,636 - 18,797
1129 *	AL	Trench 2 East	15	397	2276	487	1081	1289	5.73	0.646	1.541	not sampled	588 - 588
1130 *	AL	Trench 2 East	11	708	1797	1239	1719	1509	2.54	0.274	0.159	not sampled	624 - 624
1131 *	AL	Trench 2 East	15	495	547	530	538	532	1.11	0.029	0.025	not sampled	419 - 686
1132	AL	Trench 2 East	18	509	616	524	540	542	1.21	0.055	0.077	595	484 - 770
1133 *	AL	Trench 2 BOE	14	7600	17,000	7734	10,743	11,562	2.24	0.333	0.721	not sampled	11,691 - 17,350
1134	AL	Trench 2 East	18	527	621	565	560	574	1.18	0.055	0.091	730	544 - 1534
1135	AL	Western FP	15	5629	5956	5633	5734	5730	1.06	0.015	0.020	5770	5241 - 10,391
1136	AL	Central FP	13	2102	16,800	2108	4547	8208	7.99	0.823	3.081	3020	773 - 13,305
1137	AL	Well 1089 Area	22	9939	15,700	10,360	10,500	11,001	1.58	0.149	0.086	12,137	3907 - 19,186
1138	AL	Well 1089 Area	16	14,800	15,900	15,118	15,300	15,275	1.07	0.021	0.034	16,186	3528 - 18,718
1139	AL	Well 1089 Area	12	17,100	18,500	17,542	18,500	18,225	1.08	0.028	0.009	19,340	1350 - 19,620
1140	AL	Trench 1 Qal	8	10,000	19,100	12,240	12,950	13,963	1.91	0.217	0.264	12,655	10,318 - 18,755
1141	AL	Trench 1 Qal	8	4604	6847	5315	4893	5315	1.49	0.173	0.211	4399	4149 - 8156
1142	AL	Hyporheic Wells	18	492	1546	601	1203	972	3.14	0.402	0.621	1043	500 - 1043
1143	AL	Western FP	22	4765	5280	4926	4916	4942	1.11	0.032	0.056	6314	4843 - 6314
		Total: 1488						*min:*	1.0	0.005	0.003		
								max:	9.8	1.14	3.08		
								average:	1.9	0.2	0.2		

* denotes well not routinely sampled

AL	Alluvium (referred to as Qal under group descriptions)
BOE	base of escarpment
CV	coefficient of variation, equal to standard deviation divided by the mean
FP	floodplain
IQR	interquartile range
IQR/M	IQR/median
KM	Mancos Shale (also Km)
Min	minimum; Max = maximum
n	number of profile measurements
ZOC	zone of completion

Historical range includes data from 2000 to present.

Link to discussion in main text: Shiprock, New Mexico, Disposal Site, Floodplain (Section 4.12)

Table A-3c (page 29) presents the same information, but sorted by the coefficient of variation (CV).

Table A-13b. Summary Statistics for Shiprock Floodplain 2013 SC Profiles: Sorted by Group/Area
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			September 2013 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Sep-2013	Historical Range
0609 *	AL	BOE Qal	15	4136	8953	4851	6737	6565	2.16	0.274	0.485	not sampled	7949 - 11,470
0610	AL	BOE Qal	7	8624	10,700	10,184	10,600	10,184	1.24	0.080	0.068	9430	50 - 17,940
0611	AL-KM	BOE Qal	17	10,800	11,500	11,100	11,200	11,188	1.06	0.019	0.027	10,870	8859 - 13,580
0613 *	AL	BOE Qal	9	13,900	26,500	17,011	14,900	17,011	1.91	0.263	0.128	not sampled	28,730
0614	AL-KM	BOE Qal	21	8068	18,900	9224	10,100	12,149	2.34	0.338	0.668	10,364	7540 - 27,078
0735	AL	BOE Qal	11	20,000	24,200	20,100	21,900	21,755	1.21	0.056	0.064	21,360	2035 - 26,440
0773	AL	BOE Qal	4	2994	3186	3052	3014	3052	1.06	0.030	0.022	3213	2737 - 9800
1113	AL	BOE Qal	11	8324	10,100	9376	9308	9201	1.21	0.049	0.030	9500	6930 - 19,890
1114	AL	BOE Qal	12	4403	8652	6217	6052	5904	1.97	0.183	0.121	5900	3491 - 15,290
0616 *	AL	Central FP	3	7855	8162	8015	8028	8015	1.04	0.019	0.019	not sampled	4910 - 9740
0617 *	AL	Central FP	11	8506	13,200	9809	8577	9809	1.55	0.208	0.277	not sampled	8290 - 19,895
0618	AL	Central FP	25	7961	16,000	8465	8465	10,734	2.01	0.312	0.687	8855	6860 - 21,517
0619	AL	Central FP	19	6036	11,100	6094	6094	7106	1.84	0.288	0.006	5859	5506 - 20,920
0620 *	AL-KM	Central FP	35	4524	5652	4657	4612	4819	1.25	0.085	0.049	not sampled	9610 - 11,110
0621 *	AL	Central FP	27	4641	5106	4670	4677	4726	1.10	0.027	0.007	not sampled	7147 - 10,550
0622	AL	Central FP	17	4812	10,800	6183	6510	6840	2.24	0.249	0.239	5330	4589 - 10,220
0768	AL	Central FP	6	9928	18,100	15,871	17,650	15,871	1.82	0.209	0.178	12,012	6735 - 28,848
0775	AL	Central FP	3	7500	7666	7577	7564	7577	1.02	0.011	0.011	7477	6961 - 18,690
0779	AL	Central FP	6	16,500	23,600	18,400	17,700	18,400	1.43	0.142	0.049	16,920	6260 - 30,570
0792	AL	Central FP	8	7407	9700	8472	8496	8472	1.31	0.084	0.074	7450	7077 - 31,078
0793	AL	Central FP	6	9322	10,400	9806	9775	9806	1.12	0.047	0.076	10,420	5049 - 11,669
0798	AL	Central FP	9	8562	9776	8594	8868	8972	1.14	0.042	0.014	8679	8435 - 24,290
0857	AL	Central FP	24	8978	15,700	9309	9279	10,236	1.75	0.200	0.088	9097	1347 - 10,275
1010 *	AL	Central FP	27	4901	15,300	5332	7150	6887	3.12	0.298	0.273	not sampled	3680 - 19,849
1136	AL	Central FP	13	2102	16,800	2108	4547	8208	7.99	0.823	3.081	3020	773 - 13,305
0615	AL	Trench 1 Qal	2	5497	5533	5515	5515	5515	1.01	0.005	0.003	5761	5761 - 32,594
1105	AL	Trench 1 Qal	30	5441	14,200	5511	13,450	10,923	2.61	0.357	0.620	6040	6040 - 28,902
1111	AL	Trench 1 Qal	4	8805	10,900	10,047	10,241	10,047	1.24	0.099	0.133	11,750	10,434 - 18,850
1112	AL	Trench 1 Qal	4	9808	10,700	10,700	10,150	10,202	1.09	0.036	0.029	10,290	5689 - 21,990
1140	AL	Trench 1 Qal	8	10,000	19,100	12,240	12,950	13,963	1.91	0.217	0.264	12,655	10,318 - 18,755
1141	AL	Trench 1 Qal	8	4604	6847	5315	4893	5315	1.49	0.173	0.211	4399	4149 - 8156
1115	AL	Trench 2 BOE	15	5310	16,900	7640	7686	8826	3.18	0.349	0.490	11,270	3628 - 16,744
1116 *	AL	Trench 2 BOE	7	14,600	16,600	14,600	15,800	15,829	1.14	0.041	0.032	not sampled	12,977 - 17,434
1126 *	AL	Trench 2 BOE	17	689	6744	796	822	1913	9.79	1.143	0.167	not sampled	3462 - 16,950
1128	AL	Trench 2 BOE	11	4480	17,400	4553	13,800	11,631	3.88	0.495	0.867	11,900	10,636 - 18,797
1133 *	AL	Trench 2 BOE	14	7600	17,000	7734	10,743	11,562	2.24	0.333	0.721	not sampled	11,691 - 17,350
1117	AL	Trench 2 East	15	562	632	590	627	608	1.12	0.049	0.081	800	408 - 806
1125 *	AL	Trench 2 East	15	536	1941	1206	1898	1446	3.62	0.459	0.722	not sampled	572 - 716
1127 *	AL	Trench 2 East	18	464	1004	715	772	704	2.16	0.318	0.577	not sampled	419 - 1225
1129 *	AL	Trench 2 East	15	397	2276	487	1081	1289	5.73	0.646	1.541	not sampled	588 - 588
1130 *	AL	Trench 2 East	11	708	1797	1239	1719	1509	2.54	0.274	0.159	not sampled	624 - 624
1131 *	AL	Trench 2 East	15	495	547	530	538	532	1.11	0.029	0.025	not sampled	419 - 686
1132	AL	Trench 2 East	18	509	616	524	540	542	1.21	0.055	0.077	595	484 - 770
1134	AL	Trench 2 East	18	527	621	565	560	574	1.18	0.055	0.091	730	544 - 1534
0766	AL	Well 1089 Area	5	7535	8034	7734	7682	7734	1.07	0.025	0.025	7725	6940 - 29,500
0854	AL	Well 1089 Area	9	9822	11,200	10,720	10,600	10,493	1.14	0.046	0.066	11,475	8263 - 31,790
1008	AL	Well 1089 Area	23	7588	13,000	7832	7834	8212	1.71	0.161	0.011	7750	7046 - 25,023
1075 *	AL	Well 1089 Area	25	6916	28,100	6927	7142	10,018	4.06	0.655	0.015	not sampled	8831 - 32,402
1077 *	AL	Well 1089 Area	13	9555	10,100	9993	10,100	9993	1.06	0.016	0.012	not sampled	12,607 - 26,975
1089	AL	Well 1089 Area	10	7356	10,400	7884	7620	7884	1.41	0.113	0.014	8050	7500 - 19,700
1104	AL	Well 1089 Area	7	8296	11,200	10,800	10,800	10,428	1.35	0.097	0.060	11,620	7250 - 24,290
1137	AL	Well 1089 Area	22	9939	15,700	10,360	10,500	11,001	1.58	0.149	0.086	12,137	3907 - 19,186
1138	AL	Well 1089 Area	16	14,800	15,900	15,118	15,300	15,275	1.07	0.021	0.034	16,186	3528 - 18,718
1139	AL	Well 1089 Area	12	17,100	18,500	17,542	18,500	18,225	1.08	0.028	0.009	19,340	1350 - 19,620

0.655: CVs ≥ 0.3 0.149 0.1 ≤ CV < 0.3.

Table A-13b. Summary Statistics for Shiprock Floodplain 2013 SC Profiles: Sorted by Group/Area
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			September 2013 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Sep-2013	Historical Range
0612	AL	Hyporheic Wells	13	2257	4950	3942	4398	4247	2.19	0.149	0.014	3074	850 - 4556
0794 *	AL	Hyporheic Wells	4	2321	2377	2350	2352	2350	1.02	0.010	0.011	not sampled	3356 - 6430
0795 *	AL	Hyporheic Wells	6	1954	2442	2068	1990	2068	1.25	0.090	0.035	not sampled	1193 - 4470
0853	AL	Hyporheic Wells	23	1164	2349	1472	1472	1470	2.02	0.214	0.274	1481	970 - 2960
0858 *	AL	Hyporheic Wells	32	627	745	649	650	659	1.19	0.045	0.075	not sampled	716 - 1188
0859 *	AL	Hyporheic Wells	30	621	658	648	634	636	1.06	0.019	0.036	not sampled	721 - 721
1009	AL	Hyporheic Wells	23	2509	5212	3246	3283	3382	2.08	0.216	0.111	2917	2917 - 7490
1013 *	AL-KM	Hyporheic Wells	37	1414	2850	1467	1475	2074	2.02	0.324	0.908	not sampled	2587 - 2950
1142	AL	Hyporheic Wells	18	492	1546	601	1203	972	3.14	0.402	0.621	1043	500 - 1043
0608	KM	Km Wells	27	9059	10,300	9876	9862	9884	1.14	0.028	0.021	9915	7218 - 18,360
0860 *	KM	Km Wells	56	23,200	35,700	35,264	31,750	31,245	1.54	0.121	0.185	not sampled	11,540 - 25,300
0861 *	KM	Km Wells	12	28,800	30,700	29,908	29,950	29,908	1.07	0.022	0.035	not sampled	30,540 - 30,540
0862 *	KM	Km Wells	12	27,600	32,000	27,930	30,850	30,558	1.16	0.046	0.063	not sampled	11,480 - 28,500
0863 *	KM	Km Wells	40	21,300	27,100	25,720	26,600	25,720	1.27	0.064	0.052	not sampled	11,530 - 26,210
1000 *	KM	Km Wells	27	21,300	27,100	21,400	21,400	22,378	1.27	0.084	0.030	not sampled	4350 - 21,540
1001 *	KM	Km Wells	27	14,900	15,700	15,500	15,500	15,430	1.05	0.013	0.010	not sampled	2660 - 14,920
1062 *	KM	Km Wells	58	25,100	29,000	28,140	27,850	27,659	1.16	0.026	0.031	not sampled	8300 - 24,870
0623	AL	Western FP	23	5547	6022	5632	5652	5712	1.09	0.026	0.024	5311	5143 - 7310
0624 *	AL-KM	Western FP	32	4933	6324	5813	5764	5808	1.28	0.039	0.016	not sampled	6164 - 11,780
0625	AL	Western FP	14	4597	5960	5427	5436	5451	1.30	0.056	0.017	5224	5107 - 6830
0626	AL	Western FP	25	957	6566	5956	5638	3903	6.86	0.688	0.971	6913	4219 - 7581
0627 *	AL	Western FP	23	4683	7633	4903	4903	5215	1.63	0.177	0.053	not sampled	5096 - 5096
0628	AL	Western FP	19	4813	11,800	5838	5990	6812	2.45	0.325	0.261	5688	4440 - 11,753
0629 *	AL-KM	Western FP	34	6086	9004	7052	7011	7474	1.48	0.120	0.230	not sampled	7553 - 7553
0630	AL	Western FP	23	5768	10,300	6835	7025	7282	1.79	0.209	0.277	7300	4553 - 8879
0734	AL	Western FP	6	37,900	38,700	38,317	38,350	38,317	1.02	0.009	0.014	29,950	33 - 29,950
0736	AL	Western FP	4	5237	5333	5266	5248	5266	1.02	0.009	0.008	5621	5200 - 15,040
0855	AL	Western FP	27	5541	6920	5879	5883	5975	1.25	0.060	0.065	6497	5360 - 8497
0856	AL	Western FP	43	5071	5336	5262	5136	5168	1.05	0.016	0.026	5389	4892 - 6673
1135	AL	Western FP	15	5629	5956	5633	5734	5730	1.06	0.015	0.020	5770	5241 - 10,391
1143	AL	Western FP	22	4765	5280	4926	4916	4942	1.11	0.032	0.056	6314	4843 - 6314

0.655: CVs ≥ 0.3 0.149 0.1 ≤ CV < 0.3.

* denotes well not routinely sampled

AL	Alluvium (referred to as Qal under group descriptions)
BOE	base of escarpment
CV	coefficient of variation, equal to standard deviation divided by the mean
FP	floodplain
IQR	interquartile range
IQR/M	IQR/median
KM	Mancos Shale (also Km)
Min	minimum; Max = maximum
n	number of profile measurements
ZOC	zone of completion

Historical range includes data from 2000 to present.

Link to discussion in main text: Shiprock, New Mexico, Disposal Site, Floodplain (Section 4.12)

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Table A-13c. Summary Statistics for Shiprock Floodplain 2013 SC Profiles: Sorted by CV
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			September 2013 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Sep-2013	Historical Range
1126 *	AL	Trench 2 BOE	17	689	6744	796	822	1913	9.79	1.14	0.167	not sampled	3462 - 16,950
1136	AL	Central FP	13	2102	16,800	2108	4547	8208	7.99	0.82	3.081	3020	773 - 13,305
0626	AL	Western FP	25	957	6566	5956	5638	3903	6.86	0.69	0.971	6913	4219 - 7581
1075 *	AL	Well 1089 Area	25	6916	28,100	6927	7142	10,018	4.06	0.65	0.015	not sampled	8831 - 32,402
1129 *	AL	Trench 2 East	15	397	2276	487	1081	1289	5.73	0.65	1.541	not sampled	588 - 588
1128	AL	Trench 2 BOE	11	4480	17,400	4553	13,800	11,631	3.88	0.49	0.867	11,900	10,636 - 18,797
1125 *	AL	Trench 2 East	15	536	1941	1206	1898	1446	3.62	0.46	0.722	not sampled	572 - 716
1142	AL	Hyporheic Wells	18	492	1546	601	1203	972	3.14	0.40	0.621	1043	500 - 1043
1105	AL	Trench 1 Qal	30	5441	14,200	5511	13,450	10,923	2.61	0.36	0.620	6040	6040 - 28,902
1115	AL	Trench 2 BOE	15	5310	16,900	7640	7686	8826	3.18	0.35	0.490	11,270	3628 - 16,744
0614	AL-KM	BOE Qal	21	8068	18,900	9224	10,100	12,149	2.34	0.34	0.668	10,364	7540 - 27,078
1133 *	AL	Trench 2 BOE	14	7600	17,000	7734	10,743	11,562	2.24	0.33	0.721	not sampled	11,691 - 17,350
0628	AL	Western FP	19	4813	11,800	5838	5990	6812	2.45	0.32	0.261	5688	4440 - 11,753
1013 *	AL-KM	Hyporheic Wells	37	1414	2850	1467	1475	2074	2.02	0.32	0.908	not sampled	2587 - 2950
1127 *	AL	Trench 2 East	18	464	1004	715	772	704	2.16	0.32	0.577	not sampled	419 - 1225
0618	AL	Central FP	25	7961	16,000	8465	8465	10,734	2.01	0.31	0.687	8855	6860 - 21,517
1010 *	AL	Central FP	27	4901	15,300	5332	7150	6887	3.12	0.30	0.273	not sampled	3680 - 19,849
0619	AL	Central FP	19	6036	11,100	6094	6094	7106	1.84	0.29	0.006	5859	5506 - 20,920
1130 *	AL	Trench 2 East	11	708	1797	1239	1719	1509	2.54	0.27	0.159	not sampled	624 - 624
0609 *	AL	BOE Qal	15	4136	8953	4851	6737	6565	2.16	0.27	0.485	not sampled	7949 - 11,470
0613 *	AL	BOE Qal	9	13,900	26,500	17,011	14,900	17,011	1.91	0.26	0.128	not sampled	28,730
0622	AL	Central FP	17	4812	10,800	6183	6510	6840	2.24	0.25	0.239	5330	4589 - 10,220
1140	AL	Trench 1 Qal	8	10,000	19,100	12,240	12,950	13,963	1.91	0.22	0.264	12,655	10,318 - 18,755
1009	AL	Hyporheic Wells	23	2509	5212	3246	3283	3382	2.08	0.22	0.111	2917	2917 - 7490
0853	AL	Hyporheic Wells	23	1164	2349	1472	1472	1470	2.02	0.21	0.274	1481	970 - 2960
0630	AL	Western FP	23	5768	10,300	6835	7025	7282	1.79	0.21	0.277	7300	4553 - 8879
0768	AL	Central FP	6	9928	18,100	15,871	17,650	15,871	1.82	0.21	0.178	12,012	6735 - 28,848
0617 *	AL	Central FP	11	8506	13,200	9809	8577	9809	1.55	0.21	0.277	not sampled	8290 - 19,895
0857	AL	Central FP	24	8978	15,700	9309	9279	10,236	1.75	0.20	0.088	9097	1347 - 10,275
1114	AL	BOE Qal	12	4403	8652	6217	6052	5904	1.97	0.18	0.121	5900	3491 - 15,290
0627 *	AL	Western FP	23	4683	7633	4903	4903	5215	1.63	0.18	0.053	not sampled	5096 - 5096
1141	AL	Trench 1 Qal	8	4604	6847	5315	4893	5315	1.49	0.17	0.211	4399	4149 - 8156
1008	AL	Well 1089 Area	23	7588	13,000	7832	7834	8212	1.71	0.16	0.011	7750	7046 - 25,023
1137	AL	Well 1089 Area	22	9939	15,700	10,360	10,500	11,001	1.58	0.15	0.086	12,137	3907 - 19,186
0612	AL	Hyporheic Wells	13	2257	4950	3942	4398	4247	2.19	0.15	0.014	3074	850 - 4556
0779	AL	Central FP	6	16,500	23,600	18,400	17,700	18,400	1.43	0.14	0.049	16,920	6260 - 30,570
0860 *	KM	Km Wells	56	23,200	35,700	35,264	31,750	31,245	1.54	0.12	0.185	not sampled	11,540 - 25,300
0629 *	AL-KM	Western FP	34	6086	9004	7052	7011	7474	1.48	0.12	0.230	not sampled	7553 - 7553
1089	AL	Well 1089 Area	10	7356	10,400	7884	7620	7884	1.41	0.11	0.014	8050	7500 - 19,700
1111	AL	Trench 1 Qal	4	8805	10,900	10,047	10,241	10,047	1.24	0.099	0.133	11,750	10,434 - 18,850
1104	AL	Well 1089 Area	7	8296	11,200	10,800	10,800	10,428	1.35	0.097	0.060	11,620	7250 - 24,290
0795 *	AL	Hyporheic Wells	6	1954	2442	2068	1990	2068	1.25	0.090	0.035	not sampled	1193 - 4470
0620 *	AL-KM	Central FP	35	4524	5652	4657	4612	4819	1.25	0.085	0.049	not sampled	9610 - 11,110
1000 *	KM	Km Wells	27	21,300	27,100	21,400	21,400	22,378	1.27	0.084	0.030	not sampled	4350 - 21,540
0792	AL	Central FP	8	7407	9700	8472	8496	8472	1.31	0.084	0.074	7450	7077 - 31,078
0610	AL	BOE Qal	7	8624	10,700	10,184	10,600	10,184	1.24	0.080	0.068	9430	50 - 17,940
0863 *	KM	Km Wells	40	21,300	27,100	25,720	26,600	25,720	1.27	0.064	0.052	not sampled	11,530 - 26,210
0855	AL	Western FP	27	5541	6920	5879	5883	5975	1.25	0.060	0.065	6497	5360 - 8497
0735	AL	BOE Qal	11	20,000	24,200	20,100	21,900	21,755	1.21	0.056	0.064	21,360	2035 - 26,440
0625	AL	Western FP	14	4597	5960	5427	5436	5451	1.30	0.056	0.017	5224	5107 - 6830
1134	AL	Trench 2 East	18	527	621	565	560	574	1.18	0.055	0.091	730	544 - 1534
1132	AL	Trench 2 East	18	509	616	524	540	542	1.21	0.055	0.077	595	484 - 770
1117	AL	Trench 2 East	15	562	632	590	627	608	1.12	0.049	0.081	800	408 - 806
1113	AL	BOE Qal	11	8324	10,100	9376	9308	9201	1.21	0.049	0.030	9500	6930 - 19,890
0793	AL	Central FP	6	9322	10,400	9806	9775	9806	1.12	0.047	0.076	10,420	5049 - 11,669

Table A-13c. Summary Statistics for Shiprock Floodplain 2013 SC Profiles: Sorted by CV
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			September 2013 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Sep-2013	Historical Range
0862 *	KM	Km Wells	12	27,600	32,000	27,930	30,850	30,558	1.16	0.046	0.063	not sampled	11,480 - 28,500
0854	AL	Well 1089 Area	9	9822	11,200	10,720	10,600	10,493	1.14	0.046	0.066	11,475	8263 - 31,790
0858 *	AL	Hyporheic Wells	32	627	745	649	650	659	1.19	0.045	0.075	not sampled	716 - 1188
0798	AL	Central FP	9	8562	9776	8594	8868	8972	1.14	0.042	0.014	8679	8435 - 24,290
1116 *	AL	Trench 2 BOE	7	14,600	16,600	14,600	15,800	15,829	1.14	0.041	0.032	not sampled	12,977 - 17,434
0624 *	AL-KM	Western FP	32	4933	6324	5813	5764	5808	1.28	0.039	0.016	not sampled	6164 - 11,780
1112	AL	Trench 1 Qal	4	9808	10,700	10,700	10,150	10,202	1.09	0.036	0.029	10,290	5689 - 21,990
1143	AL	Western FP	22	4765	5280	4926	4916	4942	1.11	0.032	0.056	6314	4843 - 6314
0773	AL	BOE Qal	4	2994	3186	3052	3014	3052	1.06	0.030	0.022	3213	2737 - 9800
1131 *	AL	Trench 2 East	15	495	547	530	538	532	1.11	0.029	0.025	not sampled	419 - 686
1139	AL	Well 1089 Area	12	17,100	18,500	17,542	18,500	18,225	1.08	0.028	0.009	19,340	1350 - 19,620
0608	KM	Km Wells	27	9059	10,300	9876	9862	9884	1.14	0.028	0.021	9915	7218 - 18,360
0621 *	AL	Central FP	27	4641	5106	4670	4677	4726	1.10	0.027	0.007	not sampled	7147 - 10,550
0623	AL	Western FP	23	5547	6022	5632	5652	5712	1.09	0.026	0.024	5311	5143 - 7310
1062 *	KM	Km Wells	58	25,100	29,000	28,140	27,850	27,659	1.16	0.026	0.031	not sampled	8300 - 24,870
0766	AL	Well 1089 Area	5	7535	8034	7734	7682	7734	1.07	0.025	0.025	7725	6940 - 29,500
0861 *	KM	Km Wells	12	28,800	30,700	29,908	29,950	29,908	1.07	0.022	0.035	not sampled	30,540 - 30,540
1138	AL	Well 1089 Area	16	14,800	15,900	15,118	15,300	15,275	1.07	0.021	0.034	16,186	3528 - 18,718
0616 *	AL	Central FP	3	7855	8162	8015	8028	8015	1.04	0.019	0.019	not sampled	4910 - 9740
0859 *	AL	Hyporheic Wells	30	621	658	648	634	636	1.06	0.019	0.036	not sampled	721 - 721
0611	AL-KM	BOE Qal	17	10,800	11,500	11,100	11,200	11,188	1.06	0.019	0.027	10,870	8859 - 13,580
1077 *	AL	Well 1089 Area	13	9555	10,100	9993	10,100	9993	1.06	0.016	0.012	not sampled	12,607 - 26,975
0856	AL	Western FP	43	5071	5336	5262	5136	5168	1.05	0.016	0.026	5389	4892 - 6673
1135	AL	Western FP	15	5629	5956	5633	5734	5730	1.06	0.015	0.020	5770	5241 - 10,391
1001 *	KM	Km Wells	27	14,900	15,700	15,500	15,500	15,430	1.05	0.013	0.010	not sampled	2660 - 14,920
0775	AL	Central FP	3	7500	7666	7577	7564	7577	1.02	0.011	0.011	7477	6961 - 18,690
0794 *	AL	Hyporheic Wells	4	2321	2377	2350	2352	2350	1.02	0.010	0.011	not sampled	3356 - 6430
0736	AL	Western FP	4	5237	5333	5266	5248	5266	1.02	0.009	0.008	5621	5200 - 15,040
0734	AL	Western FP	6	37,900	38,700	38,317	38,350	38,317	1.02	0.009	0.014	29,950	33 - 29,950
0615	AL	Trench 1 Qal	2	5497	5533	5515	5515	5515	1.01	0.005	0.003	5761	5761 - 32,594

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3
Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells had low variation (CV < 0.03) in the SC profiles.

* denotes well not routinely sampled
AL Alluvium (referred to as Qal under group descriptions)
BOE base of escarpment
CV coefficient of variation, equal to standard deviation divided by the mean
FP floodplain
IQR interquartile range
IQR/M IQR/median
KM Mancos Shale (also Km)
Min minimum; Max = maximum
n number of profile measurements
ZOC zone of completion

Historical range includes data from 2000 to present.

Link to discussion in main text: Shiprock, New Mexico, Disposal Site, Floodplain (Section 4.12)

Table A-14. Shiprock, New Mexico, Disposal Site Floodplain, 2014

Shiprock Floodplain Specific Conductance Profile Results, September 2014

Table A-14a. Summary Statistics for Shiprock Floodplain 2014 SC Profiles: Sorted by Well ID
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			April 2014 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Mar-2014	Historical Range
0608	KM	Km Wells	26	7533	9801	9430	9413	9269	1.30	0.055	0.050	9848	7218 - 18,360
0609 *	AL	BOE Qal	13	4930	6474	5015	5832	5836	1.31	0.098	0.137	not sampled	7949 - 11,470
0610	AL	BOE Qal	6	8940	10,000	9655	9916	9655	1.12	0.049	0.063	9732	50 - 17,940
0611	AL-KM	BOE Qal	16	10,900	11,600	11,000	11,350	11,288	1.06	0.025	0.053	10,700	8859 - 13,580
0612	AL	Hyporheic Wells	12	1579	4439	1579	1609	2143	2.81	0.460	0.334	1935	850 - 4556
0613 *	AL	BOE Qal	10	11,500	21,100	14,020	12,550	14,020	1.83	0.234	0.151	not sampled	28,730 - 28,730
0614	AL-KM	BOE Qal	22	7017	18,500	8754	8879	11,110	2.64	0.386	0.653	9244	7540 - 27,078
0615	AL	Trench 1 Qal	5	5143	5192	5164	5165	5164	1.01	0.004	0.002	5931	5761 - 32,594
0616 *	AL	Central FP	2	8470	8711	8591	8591	8591	1.03	0.020	0.014	not sampled	4910 - 9740
0617 *	AL	Central FP	12	6116	9974	6116	6163	7046	1.63	0.228	0.140	not sampled	8290 - 19,895
0618	AL	Central FP	25	5994	10,700	6173	6064	7478	1.79	0.257	0.604	6860	6860 - 21,517
0619	AL	Central FP	18	5630	10,100	5814	5859	6502	1.79	0.240	0.017	6036	5506 - 20,920
0620 *	AL-KM	Central FP	36	4227	4643	4618	4630	4604	1.10	0.016	0.003	not sampled	9610 - 11,110
0621 *	AL	Central FP	28	4311	4720	4711	4686	4606	1.09	0.029	0.050	not sampled	7147 - 10,550
0622	AL	Central FP	19	4573	8363	4920	5007	5259	1.83	0.205	0.070	4589	4589 - 10,220
0623	AL	Western FP	25	5094	5363	5325	5325	5280	1.05	0.014	0.022	5430	5143 - 7310
0624 *	AL-KM	Western FP	31	5205	5847	5360	5348	5375	1.12	0.022	0.003	not sampled	6164 - 11,780
0625	AL	Western FP	13	4168	5398	5265	5358	5199	1.30	0.069	0.021	5380	5107 - 6830
0626	AL	Western FP	25	2321	6404	4067	3995	3628	2.76	0.370	0.442	4219	4219 - 7581
0627 *	AL	Western FP	25	4666	6841	5051	5039	5209	1.47	0.112	0.015	not sampled	5096 - 5096
0628	AL	Western FP	19	6399	9464	6890	7011	7386	1.48	0.148	0.055	9561	4440 - 11,753
0629 *	AL-KM	Western FP	33	7718	8242	8222	8201	8114	1.07	0.020	0.021	not sampled	7553 - 7553
0630	AL	Western FP	24	6718	9556	7330	7462	7791	1.42	0.140	0.280	7788	4553 - 8879
0734	AL	Western FP	3	7447	7583	7514	7511	7514	1.02	0.009	0.009	well dry	33 - 29,950
0735	AL	BOE Qal	8	21,300	24,100	21,813	21,500	21,813	1.13	0.043	0.013	24,429	2035 - 26,440
0736	AL	Western FP	3	4501	4844	4726	4832	4726	1.08	0.041	0.035	5299	5200 - 15,040
0766	AL	Well 1089 Area	6	6382	6620	6545	6582	6545	1.04	0.014	0.011	6940	6940 - 29,500
0768	AL	Central FP	6	10,600	16,100	11,767	11,000	11,767	1.52	0.182	0.052	16,562	6735 - 28,848
0773	AL	BOE Qal	3	2850	2927	2895	2907	2895	1.03	0.014	0.013	2750	2737 - 9800
0775	AL	Central FP	4	6499	6810	6678	6701	6678	1.05	0.023	0.033	6961	6961 - 18,690
0779	AL	Central FP	6	13,600	19,700	15,200	14,550	15,200	1.45	0.149	0.057	15,366	6260 - 30,570
0792	AL	Central FP	8	6496	6604	6496	6582	6567	1.02	0.006	0.004	7077	7077 - 31,078
0793	AL	Central FP	7	9694	9990	9836	9862	9836	1.03	0.013	0.024	11,669	5049 - 11,669
0794 *	AL	Hyporheic Wells	5	2165	2581	2335	2247	2335	1.19	0.078	0.117	not sampled	3356 - 6430
0795 *	AL	Hyporheic Wells	8	2380	2519	2458	2473	2458	1.06	0.021	0.029	not sampled	1193 - 4470
0797	AL	Background	7	7326	7670	7460	7455	7444	1.05	0.014	0.008	8147	1468 - 9325
0798	AL	Central FP	10	7440	8569	8086	8124	8110	1.15	0.034	0.004	8435	8435 - 24,290
0850	AL	Background	20	5090	5324	5205	5269	5245	1.05	0.015	0.022	5765	425 - 6664
0853	AL	Hyporheic Wells	23	1249	1979	1275	1275	1518	1.58	0.214	0.518	1736	970 - 2960
0854	AL	Well 1089 Area	10	6955	8180	7710	7479	7465	1.18	0.061	0.105	8263	8263 - 31,790
0855	AL	Western FP	24	5976	6516	6445	6448	6376	1.09	0.027	0.021	6580	5360 - 8497
0856	AL	Western FP	40	5524	5750	5670	5683	5669	1.04	0.009	0.004	5757	4892 - 6673
0857	AL	Central FP	23	7648	13,200	8315	8251	9357	1.73	0.225	0.326	10,275	1347 - 10,275
0858 *	AL	Hyporheic Wells	32	883	970	968	968	958	1.10	0.018	0.021	not sampled	716 - 1188
0859 *	AL	Hyporheic Wells	29	958	980	976	971	972	1.02	0.006	0.010	not sampled	721 - 721
1008	AL	Well 1089 Area	24	6253	10,500	6375	6402	6665	1.68	0.149	0.013	7046	7046 - 25,023
1009	AL	Hyporheic Wells	25	2781	4648	3077	3141	3297	1.67	0.164	0.082	3234	2917 - 7490
1010 *	AL	Central FP	25	10,800	13,200	11,700	12,400	12,164	1.22	0.051	0.081	not sampled	3680 - 19,849
1013 *	AL-KM	Hyporheic Wells	36	1217	1710	1708	1707	1579	1.41	0.131	0.147	not sampled	2587 - 2950
1075 *	AL	Well 1089 Area	26	6424	22,100	6431	6461	8583	3.44	0.566	0.002	not sampled	8831 - 32,402
1077 *	AL	Well 1089 Area	14	6747	7072	7009	7062	7009	1.05	0.015	0.004	not sampled	12,607 - 26,975
1089	AL	Well 1089 Area	14	6793	7074	6933	6971	6978	1.04	0.011	0.016	7500	7500 - 19,700
1104	AL	Well 1089 Area	11	6482	7086	6965	6820	6761	1.09	0.037	0.067	7250	7250 - 24,290

Table A-14a. Summary Statistics for Shiprock Floodplain 2014 SC Profiles: Sorted by Well ID
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			April 2014 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Mar-2014	Historical Range
1105	AL	Trench 1 Qal	32	4677	11,400	5123	11,300	9180	2.44	0.307	0.490	13,087	6040 - 28,902
1111	AL	Trench 1 Qal	9	8859	10,200	9432	9302	9432	1.15	0.053	0.094	10,434	10,434 - 18,850
1112	AL	Trench 1 Qal	9	6135	6318	6318	6145	6174	1.03	0.010	0.003	8815	5689 - 21,990
1113	AL	BOE Qal	10	6594	11,300	6809	6753	7189	1.71	0.201	0.003	7616	6930 - 19,890
1114	AL	BOE Qal	11	4181	5594	5037	4863	4820	1.34	0.077	0.091	5122	3491 - 15,290
1115	AL	Trench 2 BOE	14	4808	15,400	4907	5278	7202	3.20	0.469	0.747	11,095	3628 - 16,744
1116 *	AL	Trench 2 BOE	5	14,400	15,500	15,180	15,400	15,180	1.08	0.031	0.026	not sampled	12,977 - 17,434
1117	AL	Trench 2 East	14	724	822	733	751	761	1.14	0.046	0.041	806	408 - 806
1125 *	AL	Trench 2 East	13	578	710	660	699	678	1.23	0.061	0.066	not sampled	572 - 716
1126 *	AL	Trench 2 BOE	16	1301	5377	3580	4567	3573	4.13	0.465	0.714	not sampled	3462 - 16,950
1127 *	AL	Trench 2 East	15	1090	1508	1429	1440	1394	1.38	0.076	0.083	not sampled	419 - 1225
1128	AL	Trench 2 BOE	10	7801	16,400	8389	14,900	13,695	2.10	0.221	0.156	17,160	10,636 - 18,797
1129 *	AL	Trench 2 East	13	612	667	630	635	644	1.09	0.029	0.049	not sampled	588 - 588
1130 *	AL	Trench 2 East	9	545	650	586	638	621	1.19	0.056	0.060	not sampled	624 - 624
1131 *	AL	Trench 2 East	13	614	663	620	652	643	1.08	0.031	0.061	not sampled	419 - 686
1132	AL	Trench 2 East	16	698	735	701	703	708	1.05	0.016	0.021	770	484 - 770
1133 *	AL	Trench 2 BOE	12	4433	15,400	4723	13,650	11,463	3.47	0.399	0.548	not sampled	11,691 - 17,350
1134	AL	Trench 2 East	17	829	880	833	841	854	1.06	0.025	0.050	859	544 - 1534
1135	AL	Western FP	13	4842	5103	4855	5007	4983	1.05	0.015	0.018	5241	5241 - 10,391
1136	AL	Central FP	10	7800	14,800	12,316	14,150	12,316	1.90	0.251	0.382	13,305	773 - 13,305
1137	AL	Well 1089 Area	18	8166	16,400	12,220	15,250	13,425	2.01	0.246	0.380	19,186	3907 - 19,186
1138	AL	Well 1089 Area	15	14,200	16,300	15,218	15,800	15,453	1.15	0.043	0.038	18,718	3528 - 18,718
1139	AL	Well 1089 Area	13	8522	9220	8861	8940	8900	1.08	0.017	0.010	12,898	1350 - 19,620
1140	AL	Trench 1 Qal	10	9360	10,500	9681	9507	9607	1.12	0.036	0.026	10,318	10,318 - 18,755
1141	AL	Trench 1 Qal	10	4124	5022	4264	4457	4484	1.22	0.056	0.056	4149	4149 - 8156
1142	AL	Hyporheic Wells	16	562	677	562	565	576	1.20	0.049	0.026	645	500 - 1043
1143	AL	Western FP	20	4427	4724	4562	4489	4572	1.07	0.025	0.052	5123	4843 - 6314

* denotes well not routinely sampled
AL Alluvium (referred to as Qal under group descriptions)
BOE base of escarpment
CV coefficient of variation, equal to standard deviation divided by the mean
FP floodplain
IQR interquartile range
IQR/M IQR/median
KM Mancos Shale (also Km)
Min minimum; Max = maximum
n number of profile measurements
ZOC zone of completion

Historical range includes data from 2000 to present.

Link to discussion in main text: Shiprock, New Mexico, Disposal Site, Floodplain (Section 4.12)

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Table A-14b. Summary Statistics for Shiprock Floodplain 2014 SC Profiles: Sorted by CV
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			April 2014 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Mar-2014	Historical Range
1075 *	AL	Well 1089 Area	26	6424	22,100	6431	6461	8583	3.44	0.57	0.002	not sampled	8831 - 32,402
1115	AL	Trench 2 BOE	14	4808	15,400	4907	5278	7202	3.20	0.47	0.747	11,095	3628 - 16,744
1126 *	AL	Trench 2 BOE	16	1301	5377	3580	4567	3573	4.13	0.46	0.714	not sampled	3462 - 16,950
0612	AL	Hyporheic Wells	12	1579	4439	1579	1609	2143	2.81	0.46	0.334	1935	850 - 4556
1133 *	AL	Trench 2 BOE	12	4433	15,400	4723	13,650	11,463	3.47	0.40	0.548	not sampled	11,691 - 17,350
0614	AL-KM	BOE Qal	22	7017	18,500	8754	8879	11,110	2.64	0.39	0.653	9244	7540 - 27,078
0626	AL	Western FP	25	2321	6404	4067	3995	3628	2.76	0.37	0.442	4219	4219 - 7581
1105	AL	Trench 1 Qal	32	4677	11,400	5123	11,300	9180	2.44	0.31	0.490	13,087	6040 - 28,902
0618	AL	Central FP	25	5994	10,700	6173	6064	7478	1.79	0.26	0.604	6860	6860 - 21,517
1136	AL	Central FP	10	7800	14,800	12,316	14,150	12,316	1.90	0.25	0.382	13,305	773 - 13,305
1137	AL	Well 1089 Area	18	8166	16,400	12,220	15,250	13,425	2.01	0.25	0.380	19,186	3907 - 19,186
0619	AL	Central FP	18	5630	10,100	5814	5859	6502	1.79	0.24	0.017	6036	5506 - 20,920
0613 *	AL	BOE Qal	10	11,500	21,100	14,020	12,550	14,020	1.83	0.23	0.151	not sampled	28,730 - 28,730
0617 *	AL	Central FP	12	6116	9974	6116	6163	7046	1.63	0.23	0.140	not sampled	8290 - 19,895
0857	AL	Central FP	23	7648	13,200	8315	8251	9357	1.73	0.22	0.326	10,275	1347 - 10,275
1128	AL	Trench 2 BOE	10	7801	16,400	8389	14,900	13,695	2.10	0.22	0.156	17,160	10,636 - 18,797
0853	AL	Hyporheic Wells	23	1249	1979	1275	1275	1518	1.58	0.21	0.518	1736	970 - 2960
0622	AL	Central FP	19	4573	8363	4920	5007	5259	1.83	0.20	0.070	4589	4589 - 10,220
1113	AL	BOE Qal	10	6594	11,300	6809	6753	7189	1.71	0.20	0.003	7616	6930 - 19,890
0768	AL	Central FP	6	10,600	16,100	11,767	11,000	11,767	1.52	0.18	0.052	16,562	6735 - 28,848
1009	AL	Hyporheic Wells	25	2781	4648	3077	3141	3297	1.67	0.16	0.082	3234	2917 - 7490
1008	AL	Well 1089 Area	24	6253	10,500	6375	6402	6665	1.68	0.15	0.013	7046	7046 - 25,023
0779	AL	Central FP	6	13,600	19,700	15,200	14,550	15,200	1.45	0.15	0.057	15,366	6260 - 30,570
0628	AL	Western FP	19	6399	9464	6890	7011	7386	1.48	0.15	0.055	9561	4440 - 11,753
0630	AL	Western FP	24	6718	9556	7330	7462	7791	1.42	0.14	0.280	7788	4553 - 8879
1013 *	AL-KM	Hyporheic Wells	36	1217	1710	1708	1707	1579	1.41	0.13	0.147	not sampled	2587 - 2950
0627 *	AL	Western FP	25	4666	6841	5051	5039	5209	1.47	0.11	0.015	not sampled	5096 - 5096
0609 *	AL	BOE Qal	13	4930	6474	5015	5832	5836	1.31	0.10	0.137	not sampled	7949 - 11,470
0794 *	AL	Hyporheic Wells	5	2165	2581	2335	2247	2335	1.19	0.078	0.117	not sampled	3356 - 6430
1114	AL	BOE Qal	11	4181	5594	5037	4863	4820	1.34	0.077	0.091	5122	3491 - 15,290
1127 *	AL	Trench 2 East	15	1090	1508	1429	1440	1394	1.38	0.076	0.083	not sampled	419 - 1225
0625	AL	Western FP	13	4168	5398	5265	5358	5199	1.30	0.069	0.021	5380	5107 - 6830
0854	AL	Well 1089 Area	10	6955	8180	7710	7479	7465	1.18	0.061	0.105	8263	8263 - 31,790
1125 *	AL	Trench 2 East	13	578	710	660	699	678	1.23	0.061	0.066	not sampled	572 - 716
1130 *	AL	Trench 2 East	9	545	650	586	638	621	1.19	0.056	0.060	not sampled	624 - 624
1141	AL	Trench 1 Qal	10	4124	5022	4264	4457	4484	1.22	0.056	0.056	4149	4149 - 8156
0608	KM	Km Wells	26	7533	9801	9430	9413	9269	1.30	0.055	0.050	9848	7218 - 18,360
1111	AL	Trench 1 Qal	9	8859	10,200	9432	9302	9432	1.15	0.053	0.094	10,434	10,434 - 18,850
1010 *	AL	Central FP	25	10,800	13,200	11,700	12,400	12,164	1.22	0.051	0.081	not sampled	3680 - 19,849
1142	AL	Hyporheic Wells	16	562	677	562	565	576	1.20	0.049	0.026	645	500 - 1043
0610	AL	BOE Qal	6	8940	10,000	9655	9916	9655	1.12	0.049	0.063	9732	50 - 17,940
1117	AL	Trench 2 East	14	724	822	733	751	761	1.14	0.046	0.041	806	408 - 806
1138	AL	Well 1089 Area	15	14,200	16,300	15,218	15,800	15,453	1.15	0.043	0.038	18,718	3528 - 18,718
0735	AL	BOE Qal	8	21,300	24,100	21,813	21,500	21,813	1.13	0.043	0.013	24,429	2035 - 26,440
0736	AL	Western FP	3	4501	4844	4726	4832	4726	1.08	0.041	0.035	5299	5200 - 15,040
1104	AL	Well 1089 Area	11	6482	7086	6965	6820	6761	1.09	0.037	0.067	7250	7250 - 24,290
1140	AL	Trench 1 Qal	10	9360	10,500	9681	9507	9607	1.12	0.036	0.026	10,318	10,318 - 18,755
0798	AL	Central FP	10	7440	8569	8086	8124	8110	1.15	0.034	0.004	8435	8435 - 24,290
1131 *	AL	Trench 2 East	13	614	663	620	652	643	1.08	0.031	0.061	not sampled	419 - 686
1116 *	AL	Trench 2 BOE	5	14,400	15,500	15,180	15,400	15,180	1.08	0.031	0.026	not sampled	12,977 - 17,434

Table A-14b. Summary Statistics for Shiprock Floodplain 2014 SC Profiles: Sorted by CV
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			April 2014 SC Profile Results: Summary Statistics (SC in µS/cm)									Historical SC Results (µS/cm)	
Well	ZOC	Area/Group	*n*	Min	Max	Mid-Screen SC	Median	Mean	Max/Min	CV	IQR/M	Mar-2014	Historical Range
1129 *	AL	Trench 2 East	13	612	667	630	635	644	1.09	0.029	0.049	not sampled	588 - 588
0621 *	AL	Central FP	28	4311	4720	4711	4686	4606	1.09	0.029	0.050	not sampled	7147 - 10,550
0855	AL	Western FP	24	5976	6516	6445	6448	6376	1.09	0.027	0.021	6580	5360 - 8497
1143	AL	Western FP	20	4427	4724	4562	4489	4572	1.07	0.025	0.052	5123	4843 - 6314
1134	AL	Trench 2 East	17	829	880	833	841	854	1.06	0.025	0.050	859	544 - 1534
0611	AL-KM	BOE Qal	16	10,900	11,600	11,000	11,350	11,288	1.06	0.025	0.053	10,700	8859 - 13,580
0775	AL	Central FP	4	6499	6810	6678	6701	6678	1.05	0.023	0.033	6961	6961 - 18,690
0624 *	AL-KM	Western FP	31	5205	5847	5360	5348	5375	1.12	0.022	0.003	not sampled	6164 - 11,780
0795 *	AL	Hyporheic Wells	8	2380	2519	2458	2473	2458	1.06	0.021	0.029	not sampled	1193 - 4470
0629 *	AL-KM	Western FP	33	7718	8242	8222	8201	8114	1.07	0.020	0.021	not sampled	7553 - 7553
0616 *	AL	Central FP	2	8470	8711	8591	8591	8591	1.03	0.020	0.014	not sampled	4910 - 9740
0858 *	AL	Hyporheic Wells	32	883	970	968	968	958	1.10	0.018	0.021	not sampled	716 - 1188
1139	AL	Well 1089 Area	13	8522	9220	8861	8940	8900	1.08	0.017	0.010	12,898	1350 - 19,620
0620 *	AL-KM	Central FP	36	4227	4643	4618	4630	4604	1.10	0.016	0.003	not sampled	9610 - 11,110
1132	AL	Trench 2 East	16	698	735	701	703	708	1.05	0.016	0.021	770	484 - 770
1135	AL	Western FP	13	4842	5103	4855	5007	4983	1.05	0.015	0.018	5241	5241 - 10,391
1077 *	AL	Well 1089 Area	14	6747	7072	7009	7062	7009	1.05	0.015	0.004	not sampled	12,607 - 26,975
0850	AL	Background	20	5090	5324	5205	5269	5245	1.05	0.015	0.022	5765	425 - 6664
0623	AL	Western FP	25	5094	5363	5325	5325	5280	1.05	0.014	0.022	5430	5143 - 7310
0797	AL	Background	7	7326	7670	7460	7455	7444	1.05	0.014	0.008	8147	1468 - 9325
0773	AL	BOE Qal	3	2850	2927	2895	2907	2895	1.03	0.014	0.013	2750	2737 - 9800
0766	AL	Well 1089 Area	6	6382	6620	6545	6582	6545	1.04	0.014	0.011	6940	6940 - 29,500
0793	AL	Central FP	7	9694	9990	9836	9862	9836	1.03	0.013	0.024	11,669	5049 - 11,669
1089	AL	Well 1089 Area	14	6793	7074	6933	6971	6978	1.04	0.011	0.016	7500	7500 - 19,700
1112	AL	Trench 1 Qal	9	6135	6318	6318	6145	6174	1.03	0.010	0.003	8815	5689 - 21,990
0734	AL	Western FP	3	7447	7583	7514	7511	7514	1.02	0.009	0.009	well dry	33 - 29,950
0856	AL	Western FP	40	5524	5750	5670	5683	5669	1.04	0.009	0.004	5757	4892 - 6673
0859 *	AL	Hyporheic Wells	29	958	980	976	971	972	1.02	0.006	0.010	not sampled	721 - 721
0792	AL	Central FP	8	6496	6604	6496	6582	6567	1.02	0.006	0.004	7077	7077 - 31,078
0615	AL	Trench 1 Qal	5	5143	5192	5164	5165	5164	1.01	0.004	0.002	5931	5761 - 32,594

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3
Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3.
Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1)
Remaining wells had low variation (CV < 0.03) in the SC profiles.

* denotes well not routinely sampled
AL Alluvium (referred to as Qal under group descriptions)
BOE base of escarpment
CV coefficient of variation, equal to standard deviation divided by the mean
FP floodplain
IQR interquartile range
IQR/M IQR/median
KM Mancos Shale (also Km)
Min minimum; Max = maximum
n number of profile measurements
ZOC zone of completion

Historical range includes data from 2000 to present.

Link to discussion in main text: Shiprock, New Mexico, Disposal Site, Floodplain (Section 4.12)

Table A-15. Slick Rock (Colorado) East Processing Site

Slick Rock East (SRE) Site Specific Conductance Profile Results, June 2014

Table A-15a. Summary Statistics for Slick Rock East SC Profiles: Sorted by Well ID

		June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Sep-2014**	**Historical Range**
0300	AL Bkgrnd	14	9168	15900	10050	5845	11,604	2833	1.73	0.244	0.58	11,962	5310 - 14,887
0301*	AL Bkgrnd	15	1706	2012	1753	61	1778	75	1.18	0.042	0.021	not sampled	1950 - 2720
0302*	AL	17	1594	5093	2745	2765	2930	1416	3.20	0.483	0.013	not sampled	2300 - 2800
0303	AL	63	1497	3864	3702	736	3286	830	2.58	0.253	0.190	3516	2130 - 3828
0304*	AL	10	840	2856	879	1,787	1478	914	3.40	0.619	0.209	not sampled	537 - 1158
0305	AL	19	2605	2761	2726	93	2699	54	1.06	0.020	0.038	2874	2665 - 4600
0306*	AL	16	5450	6155	5606	123	5639	181	1.13	0.032	0.040	not sampled	6840
0307	AL	13	5334	5756	5424	139	5459	115	1.08	0.021	0.055	5587	5442 - 8842
0308*	AL	12	7201	15000	14000	7486	12,133	3443	2.08	0.284	0.015	not sampled	3800
0309	AL	61	1696	2149	1718	110	1779	118	1.27	0.066	0.008	1813	1813 - 6675
0310	AL	7	1024	1,119	1068	47	1069	31	1.09	0.029	0.027	949	596 - 1435
0311	AL	11	1392	1467	1431	56	1425	29	1.05	0.021	0.012		690 - 8970
0327*	AL	17	10,300	11,000	10800	400	10693	225	1.07	0.021	0.010	not sampled	8100 -
	Total:	*275*						*min:*	1.1	0.020	0.008		
								max:	3.4	0.62	0.58		
								average:	1.7	0.164	0.094		

* denotes well not routinely sampled

AL	Alluvial aquifer
Bkgrnd	upgradient well (background)
CV	coefficient of variation, equal to standard deviation divided by the mean
IQR	interquartile range
IQR/M	IQR/median
Min	minimum; Max = maximum
n	number of profile measurements
SD	standard deviation

For SRE site wells that are routinely sampled, the historical range of SC listed is since 2000. For wells that are not routinely sampled for which there are no data since 2000, the SC range is based on all records in the SEEPro/EQuIS database. SC results from the September 2014 annual sampling event are provided because this sampling coincided most closely with the June 2014 profiling.

Link to discussion in main text: Slick Rock East Site (Section 4.13.1)

Table A-15b. Summary Statistics for Slick Rock East SC Profiles: Sorted by CV

		June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)							Measures of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Sep-2014**	**Historical Range**
0304*	AL	10	840	2856	879	1,787	1478	914	3.40	0.62	0.209	not sampled	537 - 1158
0302*	AL	17	1594	5093	2745	2765	2930	1416	3.20	0.48	0.013	not sampled	2300 - 2800
0308*	AL	12	7201	15000	14000	7486	12,133	3443	2.08	0.28	0.015	not sampled	3800
0303	AL	63	1497	3864	3702	736	3286	830	2.58	0.25	0.190	3516	2130 - 3828
0300	AL Bkgrnd	14	9168	15900	10050	5845	11,604	2833	1.73	0.24	0.58	11,962	5310 - 14,887
0309	AL	61	1696	2149	1718	110	1779	118	1.27	0.066	0.008	1813	1813 - 6675
0301*	AL Bkgrnd	15	1706	2012	1753	61	1778	75	1.18	0.042	0.021	not sampled	1950 - 2720
0306*	AL	16	5450	6155	5606	123	5639	181	1.13	0.032	0.040	not sampled	6840
0310	AL	7	1024	1,119	1068	47	1069	31	1.09	0.029	0.027	949	596 - 1435
0327*	AL	17	10,300	11,000	10800	400	10693	225	1.07	0.021	0.010	not sampled	8100 -
0307	AL	13	5334	5756	5424	139	5459	115	1.08	0.021	0.055	5587	5442 - 8842
0311	AL	11	1392	1467	1431	56	1425	29	1.05	0.021	0.012		690 - 8970
0305	AL	19	2605	2761	2726	93	2699	54	1.06	0.020	0.038	2874	2665 - 4600

Red-shaded rows denote wells with very high variation in the SC profiles: CVs ≥ 0.3; Yellow-shaded rows denote wells with highly variable SC profiles: 0.1 ≤ CV < 0.3. Gray-shaded rows denote wells with mid-level variability in the SC profiles (0.03 ≤ CV < 0.1). Remaining wells had low variation (CV < 0.03) in the SC profiles.

Table A-16. Slick Rock (Colorado) West Processing Site

Slick Rock West (SRW) Processing Site Specific Conductance Profile Results, June 2014

Table A-16a. Summary Statistics for Slick Rock East SC Profiles: Sorted by Well ID

		June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Sep-2014**	**Historical Range**
0313*	AL	14	1232	1257	1241	20	1243.4	9.2	1.02	0.007	0.02	not sampled	1410 - 1749
0314*	AL	15	1608	1710	1625	37	1634.5	31.0	1.06	0.019	0.021	not sampled	1812 -
0315*	AL	17	1504	1761	1520	21	1535.6	59.9	1.17	0.039	0.013	not sampled	1747 - 1812
0317	AL	63	2263	2639	2632	12	2611.9	61.4	1.17	0.024	0.190	2741	1610 - 2988
0318A	AL	10	2,386	2760	2684	197	2645.5	125.0	1.16	0.047	0.209	2006	1711 - 2258
0319	AL	19	1657	9774	1740	10	2951.3	2567.6	5.90	0.870	0.038	3299	3299 - 12640
0320	AL	16	727	857	842	30	830.8	30.9	1.18	0.037	0.040	852	824 - 1181
0322*	AL	13	747	1256	773	458	937.0	222.9	1.68	0.238	0.055	not sampled	672
0323*	AL	12	1280	1325	1315	26	1309.9	15.4	1.04	0.012	0.015	not sampled	635
0324*	JE	61	424	429	427	2	426.9	1.0	1.01	0.002	0.008	not sampled	641 - 1321
0329*	AL	7	1112	1,132	1131	3	1127.6	7.0	1.02	0.006	0.027	not sampled	1240 - 1447
0330*	AL	11	1148	1250	1165	18	1172.3	27.7	1.09	0.024	0.012	not sampled	1110 - 1257
0331*	AL	14	1150	1438	1159	17	1194.1	88.7	1.25	0.074	0.037	not sampled	1390 - 1873
0339	AL	12	1675	1934	1922	138	1870.1	93.5	1.15	0.050	0.044	2017	1887 - 2282
0340	AL	10	3948	4395	4297	103	4274.7	128.8	1.11	0.030	0.014	3537	3537 - 5168
0508	AL	13	3,286	3,497	3434	128	3412.9	71.1	1.06	0.021	0.005	3166	3166 - 5400
0509*	AL	20	1,761	2,472	2159	112	2097.0	167.5	1.40	0.080	0.015	not sampled	1499 - 1865
0510	AL	9	3,184	3,507	3371	212	3357.3	112.7	1.10	0.034	0.020	3673	2267 - 5292
0684	AL	17	599	685	618	65	635.9	32.6	1.14	0.051	0.010	761	592 - 1291

* denotes well not routinely sampled
AL Alluvial aquifer
Bkgrnd upgradient well (background)
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
JE Jurassic formation
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

For SRW site wells that are routinely sampled, the historical range of SC listed is since 2000. For wells that are not routinely sampled for which there are no data since 2000, the SC range is based on all records in the SEEPro/EQuIS database. SC results from the September 2014 annual sampling event are provided because this sampling coincided most closely with the June 2014 profiling.

Link to discussion in main text: Slick Rock West Site (Section 4.13.2)

The table on the following page presents the same information, but sorted by the coefficient of variation (CV).

Table A-16b. Summary Statistics for Slick Rock East SC Profiles: Sorted by CV

		June 2014 SC Profile Results: Summary Statistics (SC in µS/cm)							Indices of Dispersion			Historical SC Results (µS/cm)	
Well	**Aquifer**	***n***	**Min**	**Max**	**Median**	**IQR**	**Mean**	**SD**	**Max/Min**	**CV**	**IQR/M**	**Sep-2014**	**Historical Range**
0319	AL	19	1657	9774	1740	10	2951.3	2567.6	5.90	0.87	0.038	3299	3299 - 12640
0322*	AL	13	747	1256	773	458	937.0	222.9	1.68	0.24	0.055	not sampled	672
0509*	AL	20	1,761	2,472	2159	112	2097.0	167.5	1.40	0.080	0.015	not sampled	1499 - 1865
0331*	AL	14	1150	1438	1159	17	1194.1	88.7	1.25	0.074	0.037	not sampled	1390 - 1873
0684	AL	17	599	685	618	65	635.9	32.6	1.14	0.051	0.010	761	592 - 1291
0339	AL	12	1675	1934	1922	138	1870.1	93.5	1.15	0.050	0.044	2017	1887 - 2282
0318A	AL	10	2,386	2760	2684	197	2645.5	125.0	1.16	0.047	0.209	2006	1711 - 2258
0315*	AL	17	1504	1761	1520	21	1535.6	59.9	1.17	0.039	0.013	not sampled	1747 - 1812
0320	AL	16	727	857	842	30	830.8	30.9	1.18	0.037	0.040	852	824 - 1181
0510	AL	9	3,184	3,507	3371	212	3357.3	112.7	1.10	0.034	0.020	3673	2267 - 5292
0340	AL	10	3948	4395	4297	103	4274.7	128.8	1.11	0.030	0.014	3537	3537 - 5168
0330*	AL	11	1148	1250	1165	18	1172.3	27.7	1.09	0.024	0.012	not sampled	1110 - 1257
0317	AL	63	2263	2639	2632	12	2611.9	61.4	1.17	0.024	0.190	2741	1610 - 2988
0508	AL	13	3,286	3,497	3434	128	3412.9	71.1	1.06	0.021	0.005	3166	3166 - 5400
0314*	AL	15	1608	1710	1625	37	1634.5	31.0	1.06	0.019	0.021	not sampled	1812 -
0323*	AL	12	1280	1325	1315	26	1309.9	15.4	1.04	0.012	0.015	not sampled	635
0313*	AL	14	1232	1257	1241	20	1243.4	9.2	1.02	0.007	0.02	not sampled	1410 - 1749
0329*	AL	7	1112	1,132	1131	3	1127.6	7.0	1.02	0.006	0.027	not sampled	1240 - 1447
0324*	JE	61	424	429	427	2	426.9	1.0	1.01	0.002	0.008	not sampled	641 - 1321

* denotes well not routinely sampled
AL Alluvial aquifer
Bkgrnd upgradient well (background)
CV coefficient of variation, equal to standard deviation divided by the mean
IQR interquartile range
IQR/M IQR/median
JE Jurassic formation
Min minimum; Max = maximum
n number of profile measurements
SD standard deviation

For SRW site wells that are routinely sampled, the historical range of SC listed is since 2000. For wells that are not routinely sampled for which there are no data since 2000, the SC range is based on all records in the SEEPro/EQuIS database. SC results from the September 2014 annual sampling event are provided because this sampling coincided most closely with the June 2014 profiling.

Link to discussion in main text: Slick Rock West Site (Section 4.13.2)

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