# 5. BACKGROUND SOIL AND GROUNDWATER

This section presents information concerning the background sampling program and discusses the results of the soil and groundwater sample analyses designated by Science Applications International Corporation (SAIC) as background for the Group 3 Phase II investigation. The background data were used to evaluate the magnitude and extent of detected contamination and to determine the chemicals of potential concern (COPCs) for the human health and ecological risk assessments.

A background comparison for inorganic chemicals was conducted using two different methods: analysis of variance (ANOVA) (to support the baseline risk assessment) and upper tolerance limits (UTLs) (to evaluate the nature and extent of contamination). Section 4.1.1.2 describes the statistical methods used to compare background and site data. The ANOVA methods identify site-related chemicals, as specified in U.S. Environmental Protection Agency (EPA) Region VIII guidance (EPA 1994d). Inorganic chemicals determined to be site-related were selected as COPCs. For the nature and extent evaluation, UTLs were calculated using the background data set. The UTL comparison was not used to select COPCs. The UTLs help identify the extent of contamination by defining a threshold; concentrations above the threshold are considered site-related and those below are considered indistinguishable from background. In the ANOVA comparison, no threshold level is identified. Rather, an analyte is considered site-related or not based on the distribution of the entire data set. Therefore, for a given analyte, all detected values are considered either site-related or not site-related. Appendix K presents the background comparison.

5.1 BACKGROUND SOIL SAMPLING PROGRAM

The background soil data base used to support the Group 3 Phase II investigation includes samples collected as part of 1991 field investigation activities and samples collected during the 2000 Phase IIB field activities. The 1991 samples were collected during previous RFI installation-wide sampling activities conducted at DCD. Available samples used from the 1991 data set are from locations predominantly in the southeastern portion of the installation. The objective of the Phase IIB background sampling effort was to collect additional samples to supplement the existing 1991 background soil data base with background samples within the general area of the Group 3 solid waste management units (SWMUs). Background samples collected during both efforts were from locations with no visible contamination (i.e., stressed vegetation and surface stains), no history of hazardous materials/waste handling operations, and that were unaffected by any SWMU-specific activities. Figure 5-1 shows the background sample locations that comprised the Group 3 Phase II data base. Background soil samples were collected at depths ranging from the surface to 10 feet below land surface (BLS) and analyzed for total metals. Background soils were treated as a single unit based on consistent soil characteristics identified from the surface to 10 feet BLS, and the lack of statistical differences between surface and subsurface samples. The single data set provides a greater statistical power. Table 5-1 lists the background samples and the associated sample depths. Table 5-2 provides the UTL and a statistical summary for each chemical detected.

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KEY MAP

AREA 1 | AREA 2 | AREA 3
AREA 4 | AREA 5 | AREA 6
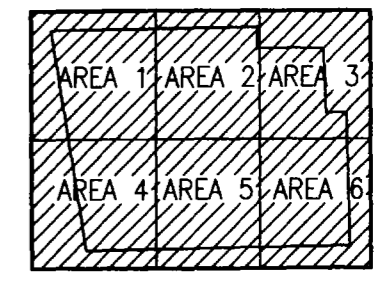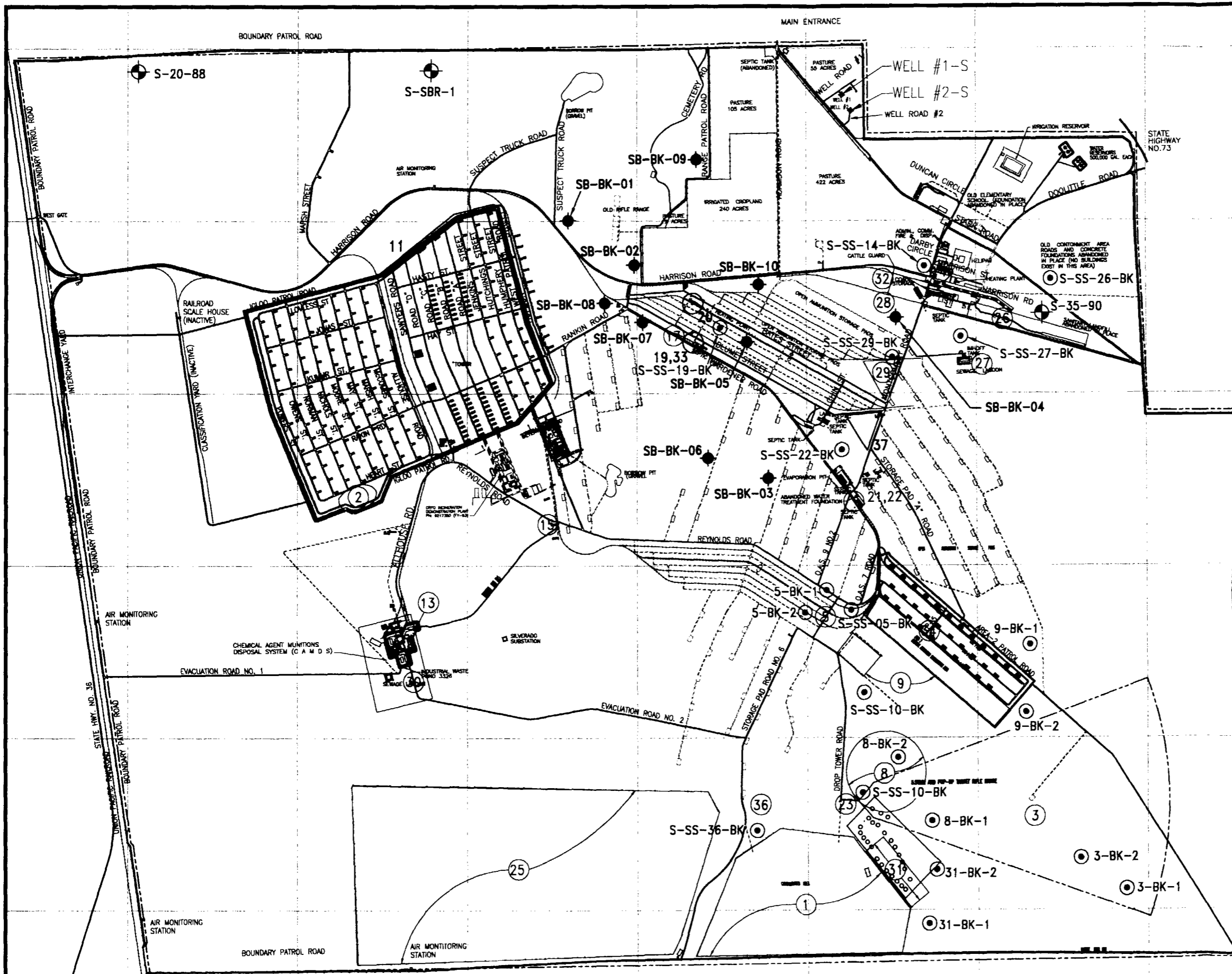
LEGEND:

EXISTING

.... BUILDING
.... STRUCTURE, UNDERGROUND
.... ROADS & STRUCTURES ABANDONED IN PLACE
.... ROADS & PARKING
.... TRAIL OR EARTH ROAD
.... RAILROAD
.... FENCE
.... RESERVATION BOUNDARY
.... OPEN REVETMENT STORAGE
(2) .... SWMU
(11) .... GROUP 3 SWMU
.... PHASE IIB BACKGROUND SAMPLE
.... PHASE I BACKGROUND MONITORING WELL
.... PHASE I BACKGROUND SOIL SAMPLE

NOTES:

1.) TOTAL DEPOT ACREAGE: 19,364.

2.) BASE MAP INFO. WAS SCANNED AND IS ACCURATE TO 1:1000.

0 1000 2000 3000

SCALE: 1" = 3000'

N
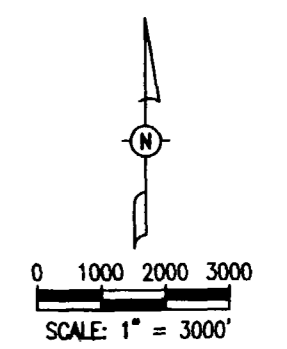
Deseret Chemical Depot
Tooele, Utah

LOCATION OF BACKGROUND SOIL AND GROUNDWATER SAMPLES

Figure:	Project:	File Name:	Date:
5-1	01-0827-03-6523-042	7109/RFIBSL	NOV. 2000

Map labels include: S-20-88, S-SBR-1, SB-BK-09, SB-BK-01, SB-BK-02, SB-BK-10, SB-BK-08, SB-BK-07, SB-BK-05, SB-BK-06, SB-BK-03, SB-BK-04, S-SS-14-BK, S-SS-26-BK, S-35-90, S-SS-29-BK, S-SS-27-BK, S-SS-19-BK, S-SS-22-BK, S-SS-36-BK, S-SS-10-BK, S-SS-05-BK, WELL #1-S, WELL #2-S, WELL ROAD #2, 5-BK-1, 5-BK-2, 8-BK-1, 8-BK-2, 9-BK-1, 9-BK-2, 3-BK-1, 3-BK-2, 31-BK-1, 31-BK-2, 19,33, 21,22

Roads: BOUNDARY PATROL ROAD, HARRISON ROAD, SUSPECT TRUCK ROAD, RANKIN ROAD, REYNOLDS ROAD, IGLOO PATROL ROAD, EVACUATION ROAD NO. 1, EVACUATION ROAD NO. 2, STATE HWY. NO. 36, STATE HIGHWAY NO. 73, DOOLITTLE ROAD, DROP TOWER ROAD, DUNCAN CIRCLE, DARBY CIRCLE, WELSH STREET, HASTY ST.

Table 5-1. Background Soil Samples
Deseret Chemical Depot, Tooele, Utah

Site ID	Depth	Site ID	Depth
3-BK-1	2	S-SS-26-BK	1.5
31-BK-1	2	S-SS-27-BK	1.5
31-BK-2	2	S-SS-29-BK	1.5
5-BK-1	2	S-SS-36-BK	1.5
5-BK-2	2	SB-BK-01	0,1,5
8-BK-1	2	SB-BK-02	0,1,5,10
8-BK-2	2	SB-BK-03	0,1,5,10
9-BK-1	2	SB-BK-04	0,1,5
9-BK-2	2	SB-BK-05	0,1,5,10
S-SS-05-BK	1.5	SB-BK-06	0,1,5,10
S-SS-08-BK	1.5,3	SB-BK-07	0,1,5,10
S-SS-10-BK	1.5	SB-BK-08	0,1,5
S-SS-14-BK	1.5	SB-BK-09	0,1,5
S-SS-19-BK	1.5	SB-BK-10	0,1,5
S-SS-22-BK	1.5		

Table 5-2. Background Soil UTLs
Deseret Chemical Depot, Tooele, Utah

Parameter	Units	Proportion of Detects All Samples[a]	Detects Minimum	Detects Maximum	Arithmetic Mean[b]	95% UTL of Background Data Set	Maximum Concentration Location	Maximum Concentration Depth
Aluminum	µg/g	47/47	2,260	25,200	14,545	24,256	5-BK-2	2
Antimony	µg/g	1/57	12	12	4.5	12.0	31-BK-2	2
Arsenic	µg/g	58/62	3.0	53	13	3.4	S-SS-19-BK	1.5
Barium	µg/g	47/47	15	423	147	423	5-BK-1	2
Beryllium	µg/g	57/57	0.19	1.2	0.65	1.20	3-BK-1	2
Cadmium	µg/g	41/57	0.27	21	1.1	21.0	S-SS-22-BK	1.5
Calcium	µg/g	47/47	6,650	250,000	103,597	250,000	31-BK-2	2
Chromium	µg/g	57/57	8.1	56	22	56.0	S-SS-36-BK	1.5
Cobalt	µg/g	44/47	1.7	11	6.4	10.0	SB-BK-06	5
Copper	µg/g	57/57	2.9	162	17	162	SB-BK-07	0
Iron	µg/g	47/47	3,230	24,300	13,571	21,340	3-BK-1	2
Lead	µg/g	57/57	3.7	401	32	401	SB-BK-07	0
Magnesium	µg/g	47/47	7,280	35,700	12,213	35,700	SB-BK-02	10
Manganese	µg/g	47/47	108	739	365	649	SB-BK-10	0
Mercury	µg/g	15/57	0.030	0.36	0.043	0.360	SB-BK-07	0
Nickel	µg/g	47/57	6.0	36	15	33.0	SB-BK-02	5
Potassium	µg/g	47/47	453	7,500	3,619	6,751	SB-BK-03	5
Selenium	µg/g	18/57	0.18	0.72	0.72	2.9	SB-BK-08	1
Silver	µg/g	38/57	0.095	3.7	0.62	0.47	SB-BK-07	0
Sodium	µg/g	54/57	189	5,610	1,680	5,610	3-BK-1	2
Thallium	µg/g	32/57	0.44	34	6.7	34.0	9-BK-2	2
Vanadium	µg/g	47/47	8.4	63	34	55	3-BK-1	2
Zinc	µg/g	57/57	23	385	77	385	SB-BK-07	0

[a] For the Proportion of Detects – All samples, counts were based on the unaveraged data set.

[b] Nondetects were treated at one-half the detection limit in the calculation of the arithmetic mean, standard deviation, and 95 percent UCL.

It is recognized that samples were collected on the installation and locations could be affected by mission-related activities (e.g., vehicular traffic). Lead was detected in all of the samples analyzed for lead (57 total) at concentrations ranging from 3.69 to 401 µg/g with the one sample at SB-BK-07 (0 feet BLS) that reaches the EPA soil screening level of 400 µg/g (EPA 1994f).

Because of the lognormal distribution of the background lead data, a nonparametric UTL was calculated. In this instance, the maximum concentration equaled the UTL, 401 µg/g. (See Section 4.1.1.2 for an explanation of UTL calculations.) The arithmetic mean of the background data set for lead, however, is 32 µg/g (an order of magnitude less than the UTL). The arithmetic mean is used as the exposure point concentration when evaluating site exposures to lead. The UTL is used as a threshold value to determine the extent of site contamination, and in the case of lead at the Group 3 SWMU would be considered a conservative concentration.

Concentrations of lead in SB-BK-07 decreased by almost two orders of magnitude to 21.3 µg/g at 10 feet BLS. Only 3 more of the 57 samples exceeded 50 µg/g, none of which was in the same boring. These samples included SB-BK-02 at 10 feet BLS (167 µg/g), S-SS-36-BK at 1.5 feet BLS (184 µg/g), and S-SS-19-BK at 1.5 feet BLS (254 µg/g). The samples at 1.5 feet BLS from S-SS-19-BK and S-SS-36-BK were the only samples collected from the respective borings. The concentration of lead in the three additional samples collected from SB-BK-02 (0, 1, and 5 feet BLS) were below 45 µg/g.

5.2 BACKGROUND GROUNDWATER SAMPLING PROGRAM

Groundwater samples were collected and evaluated during the Phase II field investigation activities at two of the Group 3 SWMUs: SWMU 11 and SWMU 19. SWMU-specific background groundwater samples were not collected as part of the Phase II field investigation. An upgradient monitoring well was installed and sampled during the Phase II field activities at SWMU 19; however, inorganic analysis was not conducted because they were not a concern at this SWMU.

Three existing monitoring wells (i.e., S-20-88, S-35-90, S-SBR-1) located northwest of the areas under investigation were selected as representative of background groundwater concentrations for SWMU 11 (see Figure 5-1). Samples were not collected from these background wells during the Phase II activities; therefore, only historical inorganic data were used for evaluation. These three wells were identified for background comparison because they are not in a position to be affected from activities at another SWMU. Table 5-3 presents the background groundwater UTLs and a statistical summary for each chemical detected.

Table 5-3. Background Groundwater UTLs
Deseret Chemical Depot, Tooele, Utah

Parameter	Units	Proportion of Detects All Samples[a]	Detects		Arithmetic Mean[b]	95% UTL of Background Data Set	Maximum Concentration	
			Minimum	Maximum			Location	Depth
Antimony	µg/L	1/9	4.5	4.5	15	19	S-SBR-1	119.4
Arsenic	µg/L	6/9	3.7	28	8.8	28	S-35-90	271.6
Barium	µg/L	1/2	200	200	106	200	S-SBR-1	119.4
Beryllium	µg/L	2/9	0.50	0.81	2.0	3	S-SBR-1	119.4
Cadmium	µg/L	1/9	11	11	3.1	11	S-SBR-1	128.5
Chloride	µg/L	4/5	28,000	1.4E+06	716,333	1400000	S-35-90	271.6
Chromium	µg/L	3/9	29	36	15	36	S-SBR-1	140
Copper	µg/L	5/9	11	48	14	48	S-SBR-1	140
Lead	µg/L	6/9	1.5	58	15	58	S-35-90	271.6
Nickel	µg/L	3/10	17	45	20	45	S-SBR-1	140
Nitrite, Nitrate	µg/L	2/3	1,300	5,600	3,750	5600	S-20-88	94.7
Silver	µg/L	1/9	2.0	2.0	1.9	2	S-20-88	97
Sodium	µg/L	7/7	15,600	61,000	43,894	61000	S-SBR-1	128.5
Zinc	µg/L	7/10	36	1,200	266	1200	S-SBR-1	128

[a] For the Proportion of Detects – All samples, counts were based on the unaveraged data set.

[b] Nondetects were treated at one-half the detection limit in the calculation of the arithmetic mean, standard deviation, and 95 percent UCL.