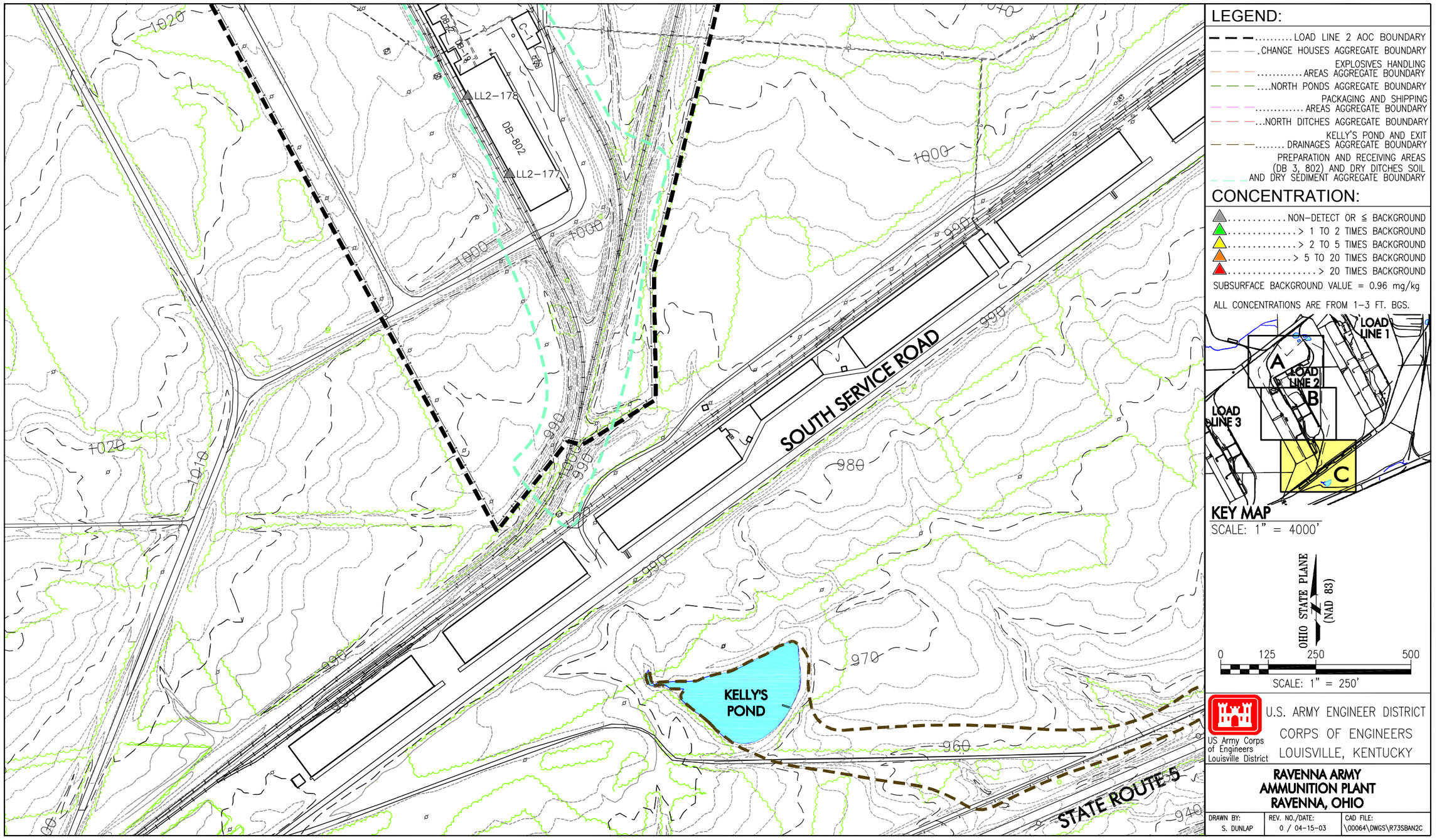


Figure 4-23. Distribution and Relative Concentration of Antimony in Subsurface Soil at Load Line 2 - Southern Section

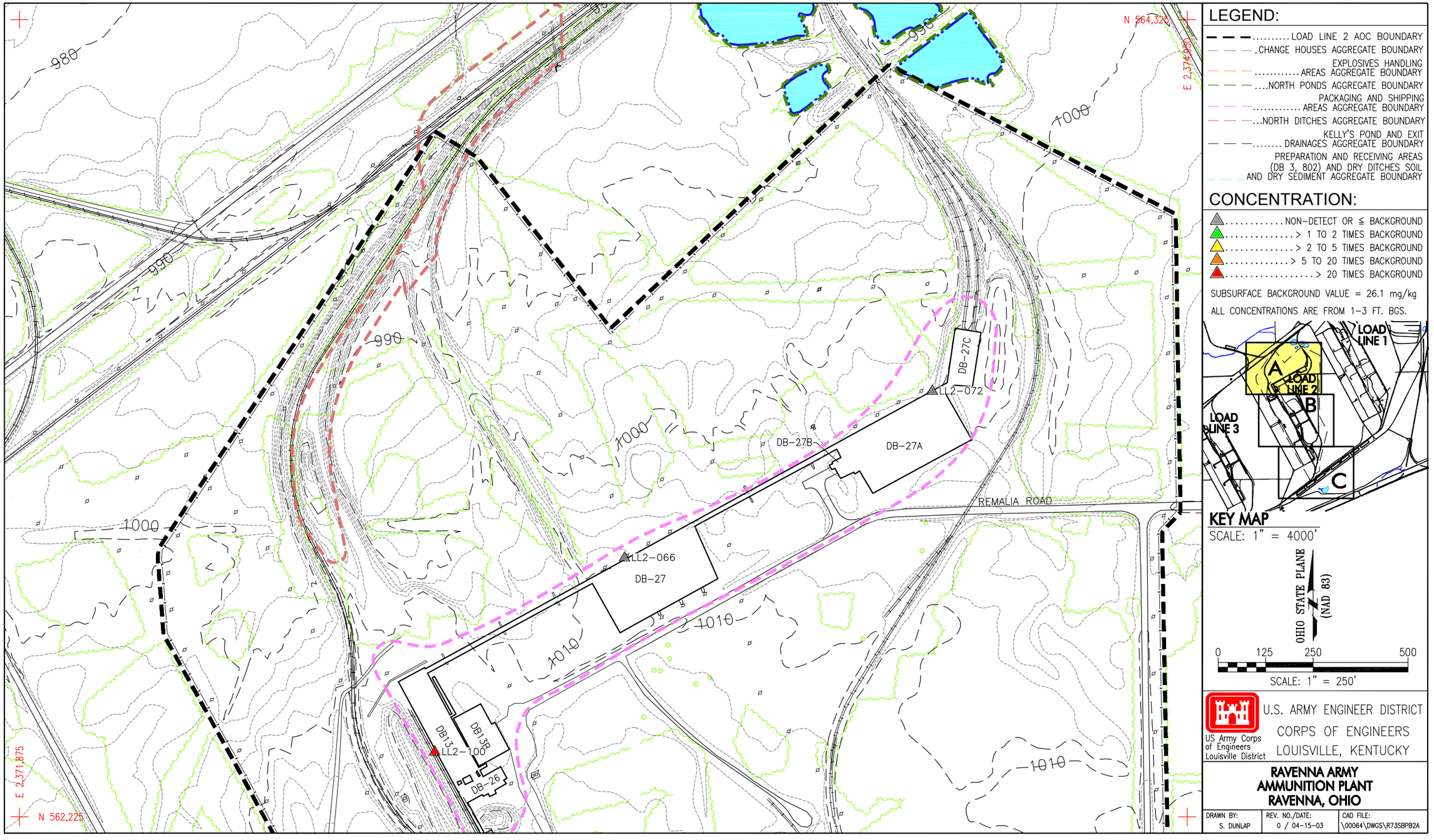


Figure 4-24. Distribution and Relative Concentration of Lead in Sunsurface Soil at Load Line 2 - Northern Section

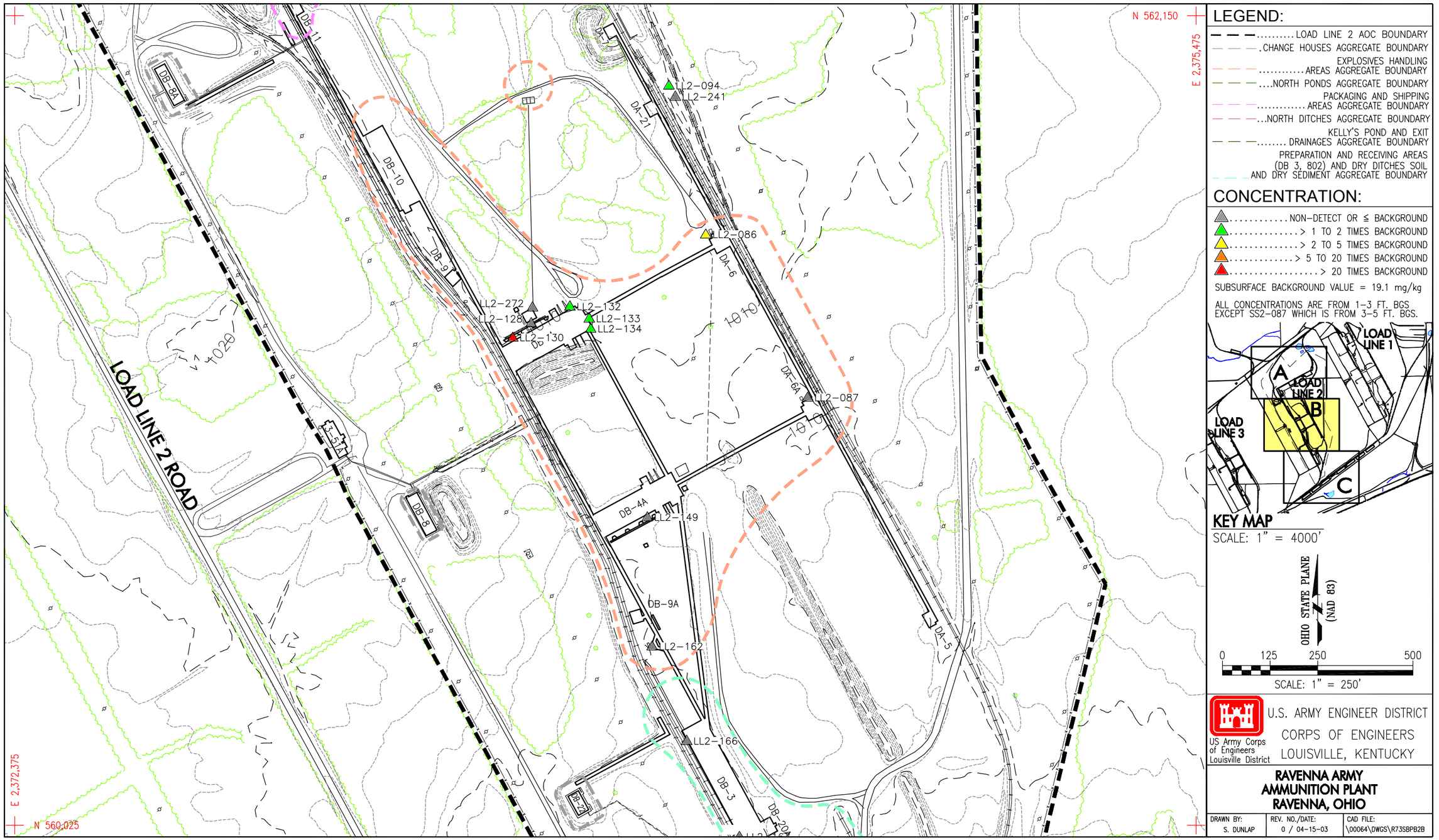


Figure 4-25. Distribution and Relative Concentration of Lead in Subsurface Soil at Load Line 2 - Central Section

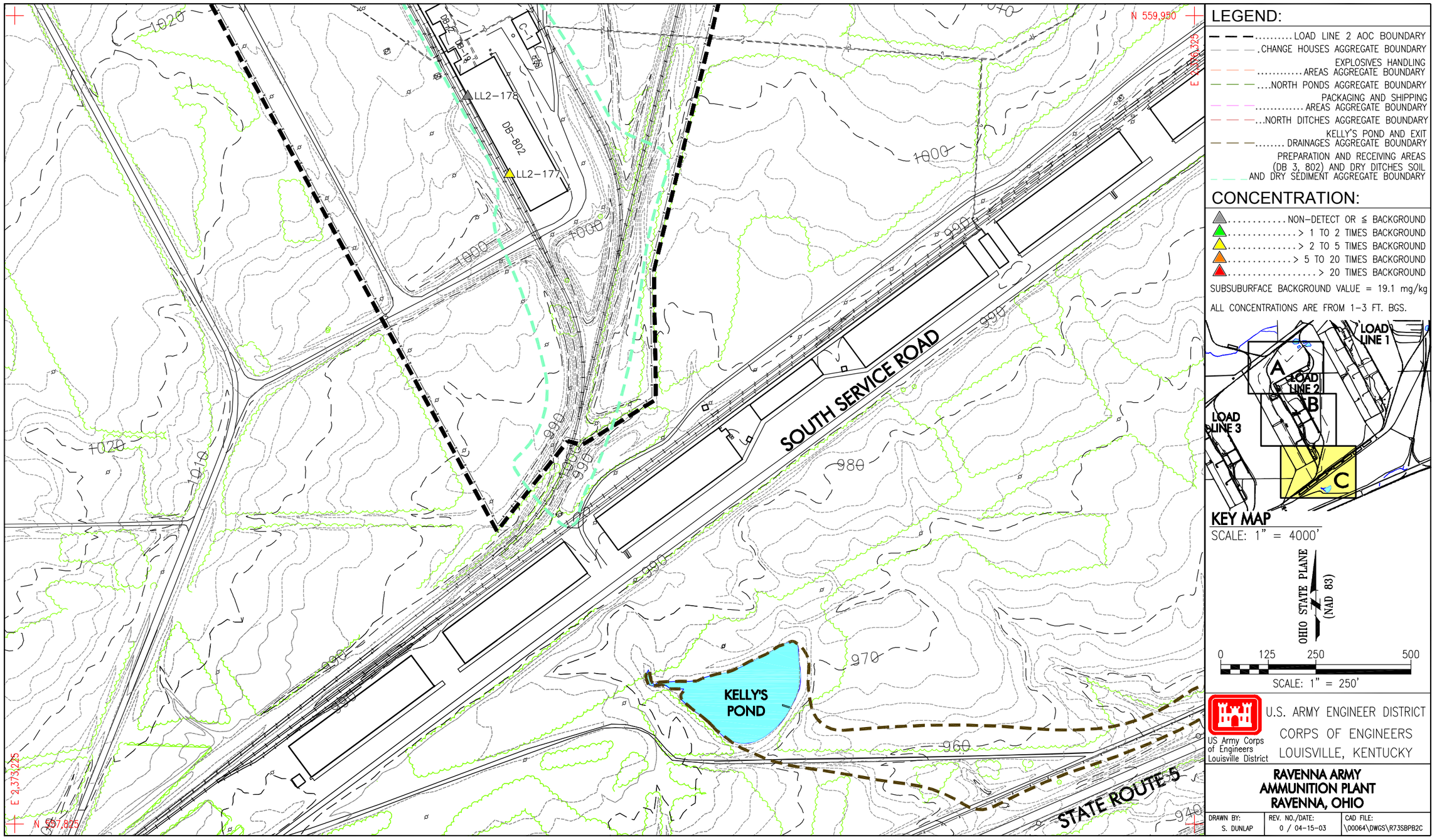


Figure 4-26. Distribution and Relative Concentration of Lead in Subsurface Soil at Load Line 2 - Southern Section

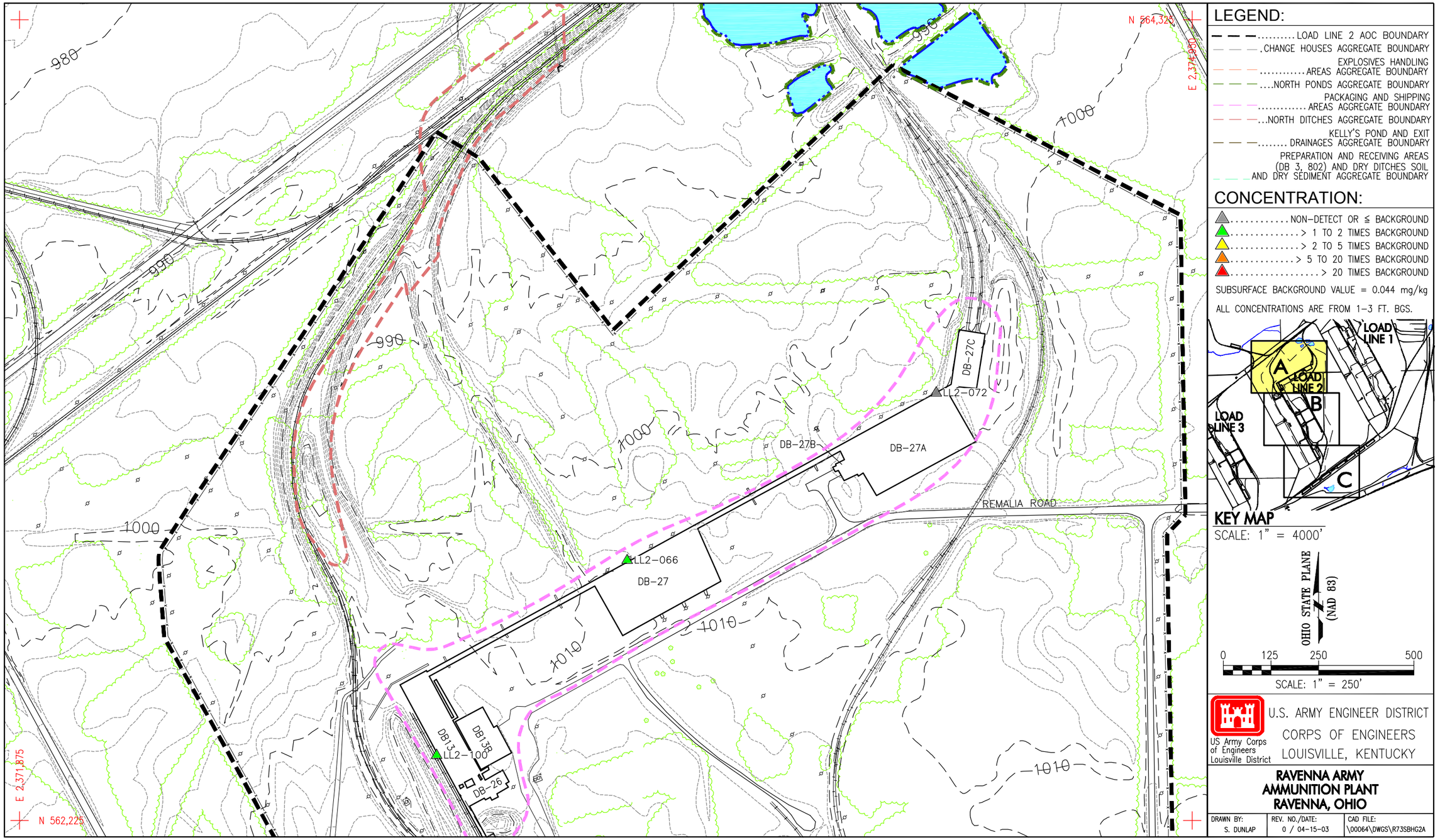


Figure 4-27. Distribution and Relative Concentration of Mercury in Suburface Soil at Load Line 2 - Northern Section

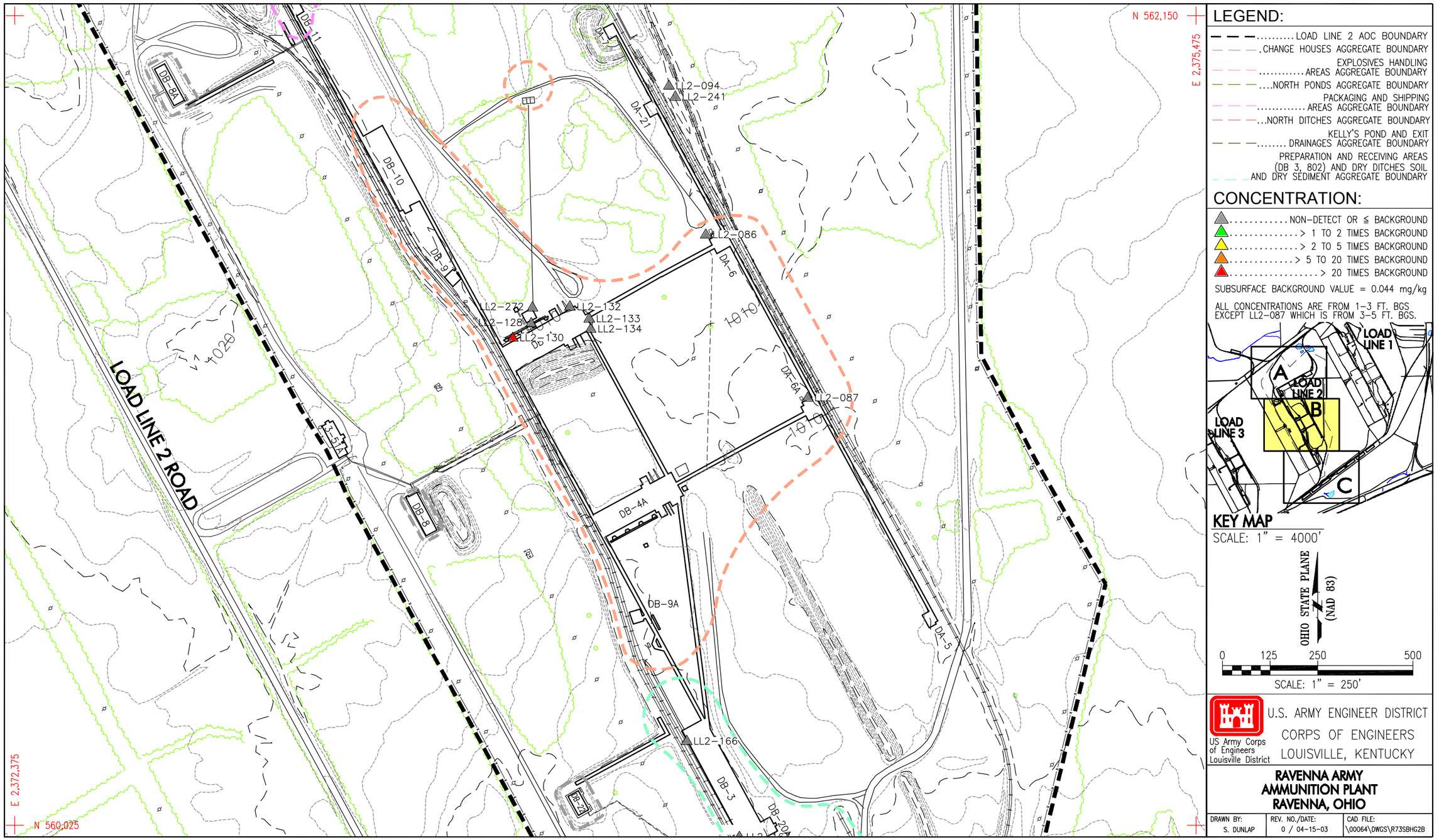


Figure 4-28. Distribution and Relative Concentration of Mercury in Subsurface Soil at Load Line 2 - Central Section

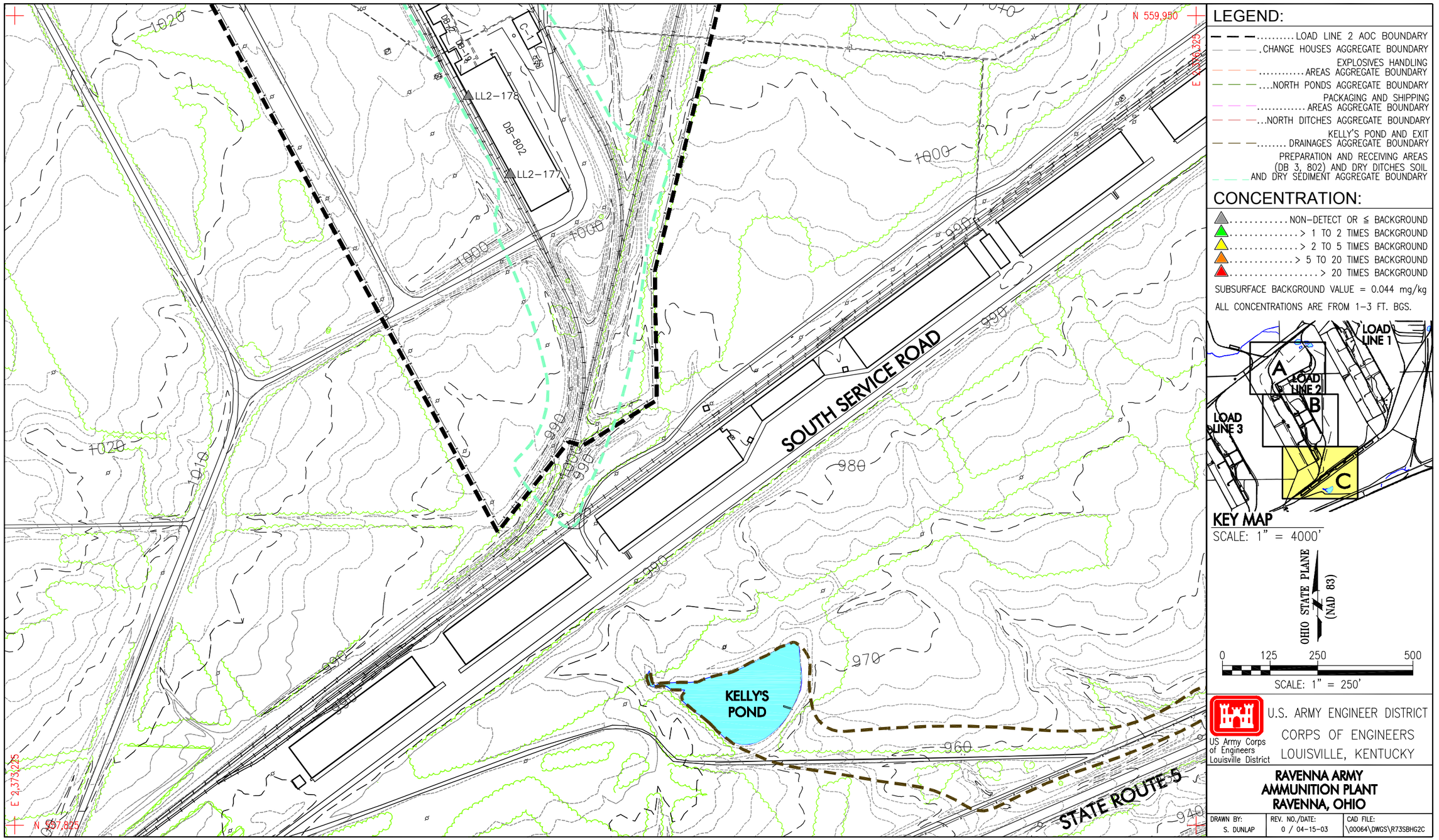


Figure 4-29. Distribution and Relative Concentration of Mercury in Subsurface Soil at Load Line 2 - Southern Section

all SRCs, except arsenic, occurred in the sample from station LL2-130. The maximum arsenic concentration occurred at station LL2-086. The field duplicate sample from station LL2-132 showed a detected concentration of 449 mg/kg for zinc (Table 4-36). Maximum concentrations of aluminum, arsenic, and zinc were less than twice the site-related background criteria in subsurface soils. Maximum concentrations of barium, beryllium, and chromium were between 2 and 10 times the background criteria, and lead and mercury were considerably greater than the background criteria – 40 times greater for lead, and 160 times greater for mercury. With the exception of stations LL2-130, LL2-132 (field duplicate sample), and LL2-086, all detected concentrations were less than 2 times the background value for those chemicals having site background values.

Preparation and Receiving Areas

Five inorganic constituents were considered to be SRCs in subsurface soils (1 to 3 ft bgs) from the Preparation and Receiving Areas Aggregate (Table 4-4). Antimony, copper, lead, and zinc were detected above the site background criteria in at least 1 of 4 subsurface soil samples. Background for cadmium was set to zero and, thus, it is considered to be an SRC. As shown in Table 4-37, copper, lead, and zinc exceeded the background criteria at station LL2-177. Maximum concentrations of these metals were all less than twice the background criteria. This was also the only sample in which cadmium was detected. The maximum concentration of antimony was at station LL2-167, and was approximately 3 times the background criteria. Both LL2-177 and LL2-167 were collected between the railroad tracks and the buildings immediately to the east (Figures 4-21 through 4-29).

Table 4-37. Load Line 2 Subsurface Soil Preparation and Receiving Areas Aggregate – Inorganics – Site-Related Contaminants

Functional Area		Preparation and Receiving Areas Aggregate	Preparation and Receiving Areas Aggregate	Preparation and Receiving Areas Aggregate	Preparation and Receiving Areas Aggregate
Station ID		**LL2-166**	**LL2-167**	**LL2-177**	**LL2-178**
Sample ID		**LL20957**	**LL20960**	**LL20984**	**LL20987**
Date		**07/29/2001**	**07/29/2001**	**07/29/2001**	**07/29/2001**
Depth (ft)		**1 - 3**	**1 - 3**	**1 - 3**	**1 - 3**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**				
Inorganics					
Antimony	mg/kg	1.9 J *	2.6 J *	1.2 UJ	1.2 UJ
Cadmium	mg/kg	0.57 U	0.57 U	0.082 J *	0.6 U
Copper	mg/kg	4.2 =	16.5 =	45.7 J *	20.1 =
Lead	mg/kg	7.4 J	11.4 J	39.3 J *	13 =
Zinc	mg/kg	20.5 J	35.6 J	99.1 = *	58.1 =

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Packaging and Shipping Areas Aggregate

A total of 11 inorganic SRCs were detected in subsurface soils in the Packaging and Shipping Areas Aggregate (Table 4-4). Antimony, arsenic, barium, beryllium, chromium, copper, lead, mercury, and zinc were each detected above the site background value in at least one sample. Cadmium and silver

were detected above the background criteria of zero (since they were not detected in the background dataset) and, thus, are considered to be SRCs. Table 4-38 shows the detected concentrations of the SRCs in subsurface soil from this aggregate. The maximum concentration of 10 of the 11 SRCs occurred in the 1- to 3-ft bgs sample from station LL2-100. This station is located between the railroad tracks and Building BD-13. MDCs ranged from less than twice the background criteria for arsenic, barium, and beryllium, to between 2 and 10 times background (chromium, copper, and zinc), to many times above the background criteria. The maximum concentration of antimony was 23 times background, mercury was 34 times above background, and lead exceeded the background criteria by 80 times (Figures 4-21 through 4-29). The maximum detection of arsenic was from the 3- to 5-ft bgs sample at station LL2-072, located on the northern corner of Building DB-27A.

Table 4-38. Load Line 2 Subsurface Soil Packaging and Shipping Areas Aggregate – Inorganics – Site-Related Contaminants

Functional Area		Packaging and Shipping Areas Aggregate	Packaging and Shipping Areas Aggregate	Packaging and Shipping Areas Aggregate	Packaging and Shipping Areas Aggregate
Station ID		**LL2-066**	**LL2-072**	**LL2-072**	**LL2-100**
Sample ID		**LL20691**	**LL20707**	**LL20708**	**LL20779**
Date		**08/01/2001**	**07/26/2001**	**07/29/2001**	**07/29/2001**
Depth (ft)		**1 - 3**	**1 - 3**	**3 - 5**	**1 - 3**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**				
Inorganics					
Antimony	mg/kg	1.2 UJ	1.3 UJ	1.2 UJ	22 J *
Arsenic	mg/kg	11.6 =	10 =	23.3 = *	13.5 =
Barium	mg/kg	74.9 =	73.3 =	64.8 =	227 = *
Beryllium	mg/kg	0.52 J	0.71 =	0.74 =	1.4 = *
Cadmium	mg/kg	0.26 J *	0.63 U	0.6 U	8.5 = *
Chromium	mg/kg	16.1 =	12.8 =	17.3 =	168 = *
Copper	mg/kg	18 =	11.4 =	26.5 =	123 = *
Lead	mg/kg	15.3 J	15.8 =	15.2 J	1530 J *
Mercury	mg/kg	0.048 J *	0.026 J	0.024 J	0.079 J *
Silver	mg/kg	0.61 U	0.63 U	0.6 U	1.5 = *
Zinc	mg/kg	50.8 J	64 =	70.3 J	639 J *

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Perimeter Area Aggregate

Two inorganic SRCs were detected in subsurface soils (1 to 3 ft bgs) from the Perimeter Area Aggregate (Table 4-4). Lead occurred above the site-related background criteria, and cadmium was detected in the sample from station LL2-094 (Table 4-39 and Figures 4-24 through 4-26). The maximum concentration of lead was less than twice the background criteria. This station is located between the two sets of railroad tracks just northeast of Building DA-21, and also contained the only explosive detections from subsurface soils in the Perimeter Area Aggregate. Both cadmium and lead concentrations are relatively low, with lead only slightly above the site-related background criteria.

Table 4-39. Load Line 2 Subsurface Soil Perimeter Area Aggregate – Inorganics – Site-Related Contaminants

Functional Area		Perimeter Area Aggregate	Perimeter Area Aggregate
Station ID		**LL2-094**	**LL2-241**
Sample ID		**LL20761**	**LL20955**
Date		**07/30/2001**	**08/21/2001**
Depth (ft)		**1 - 3**	**1 - 3**
Sample Type		**Grab**	**Grab**
Analyte	**Units**		
Inorganics			
Cadmium	mg/kg	0.29 J *	0.14 U
Lead	mg/kg	24.9 = *	12 =

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

4.3.5 SVOCs, VOCs, and PCBs

Explosives Handling Areas Aggregate

Organic compounds, other than explosives (discussed in Section 4.3.3), were not detected in subsurface soils from the Explosive Handling Areas Aggregate.

Preparation and Receiving Areas Aggregate

A total of 6 organic compounds (5 SVOCs and 1 VOC) were detected in subsurface soil (1 to 3 ft bgs) from the Preparation and Receiving Areas Aggregate. All occurred at station LL2-177 (Table 4-40 and Figure 4-30). Concentrations were all estimated and low (less than 0.1 mg/kg with the exception of phenanthrene, which was detected at 0.11 J mg/kg). Station LL2-177 is located between Building DB-802 and the railroad tracks.

Packaging and Shipping Areas Aggregate

Three organic compounds, all VOCs, were detected in subsurface soil (1 to 3 ft bgs) from station LL2-071 in the Packaging and Shipping Areas Aggregate (Table 4-41 and Figure 4-30). All concentrations are estimated and low (less than 0.1 mg/kg). Acetone and toluene are common laboratory solvents, and may not be related to site operations.

Perimeter Area Aggregate

The organic compound PCB-1260 was detected in one subsurface soil (1 to 3 ft bgs) sample (LL2-094) at an estimated concentration of 0.64 J mg/kg (Table 4-41). This station is located between the two sets of railroad tracks just northeast of Building DA-21 (Figure 4-30). Explosives and inorganic compounds were also detected in this sample.

Table 4-40. Load Line 2 Subsurface Soil Preparation and Receiving Areas Aggregate – Organics – Site-Related Contaminants

Functional Area		**Preparation and Receiving Areas Aggregate**
Station ID		**LL2-177**
Sample ID		**LL20984**
Date		**07/29/2001**
Depth (ft)		**1 - 3**
Sample Type		**Grab**
Analyte	**Units**	
Semivolatile Organics		
Benzo(*b*)fluoranthene	mg/kg	0.069 J
Chrysene	mg/kg	0.062 J
Fluoranthene	mg/kg	0.11 J
Phenanthrene	mg/kg	0.078 J
Pyrene	mg/kg	0.083 J
Volatile Organics		
Toluene	mg/kg	0.0012 J

ID = Identification.
= - Detected result.
J - Estimated result.
U - Not detected.

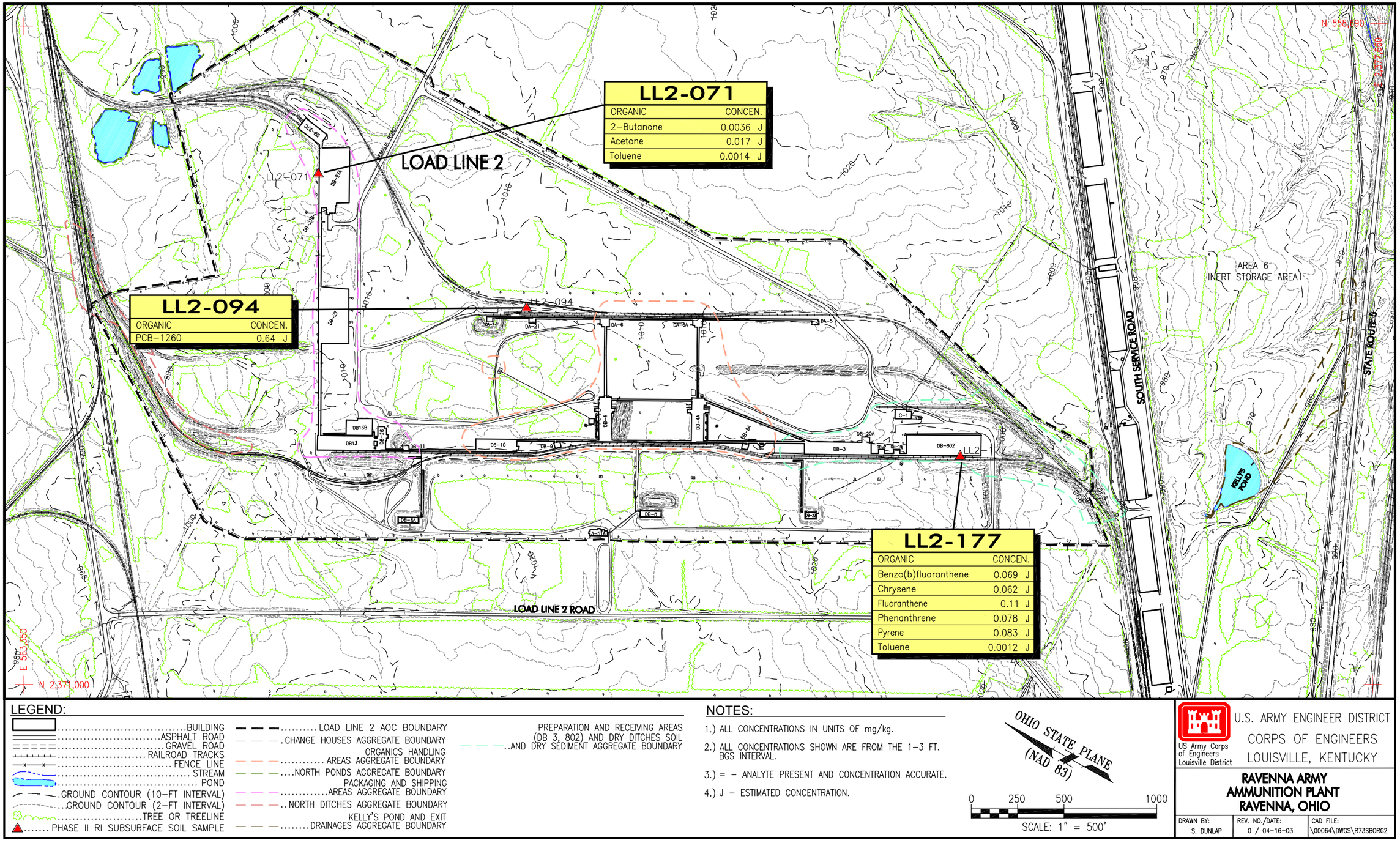


Figure 4-30. Distribution of Organics in Subsurface Soil at Load Line 2

Table 4-41. Load Line 2 Subsurface Soil Packaging and Shipping Areas Aggregate – Organics – Site-Related Contaminants

Functional Area		Packaging and Shipping Areas Aggregate
Station ID		**LL2-071**
Sample ID		**LL20704**
Date		**07/30/2001**
Depth (ft)		**1 - 3**
Sample Type		**Grab**
Analyte	**Units**	
Volatile Organics		
2-Butanone	mg/kg	0.0036 J
Acetone	mg/kg	0.017 J
Toluene	mg/kg	0.0014 J

ID = Identification.
J - Estimated result.

4.3.6 Summary

Contamination in the subsurface soil at Load Line 2 varied considerably by aggregate. Subsurface samples from the Change Houses Aggregate were not collected due to the absence of explosives or propellants in surface soil and extremely shallow bedrock. Subsurface samples were also not collected at the North Ditches Aggregate, which had only one low estimated detection of 2,4,6-TNT (0.051 mg/kg) in surface soil. Explosives were confined to the Explosives Handling Areas and Perimeter Areas Aggregates, and were not detected in the subsurface in other aggregates. Organic compounds were detected in one sample each in the Preparation and Receiving Areas, Packaging and Shipping Areas, and Perimeter Areas Aggregates. Inorganic SRCs were slightly more widespread in the subsurface, occurring in all four of the subsurface soil aggregates sampled. The most commonly detected metals were antimony, arsenic, cadmium, lead, and zinc. These metals were detected at concentrations near or only slightly above the background criteria for the most part; however, several samples had exceedances 80 or more times above the background criteria.

Based on the evaluation of the occurrence and distribution of contaminants in subsurface soil at Load Line 2, the following observations can be made.

- Explosives are present in the subsurface soil in the vicinity of buildings and railroad tracks in the Explosives Handling Areas Aggregate. The sample from the Perimeter Area Aggregate with explosives detections is located adjacent to the railroad tracks in the near vicinity of the Explosives Handling Areas Aggregate. 2,4,6-TNT is the most common explosive, with the highest concentrations detected adjacent to Building DA-6. This station also had the maximum 2,4,6-TNT concentration in surface soil.

- Propellants were not detected in any subsurface soil sample at Load Line 2.

- The metals detected at concentrations exceeding their respective site background concentrations most frequently include antimony, lead, and zinc. More samples in the Explosives Handling Areas Aggregate contained inorganic SRCs than in other aggregates, but in any aggregate containing inorganic SRCs, there were generally one or two samples with the majority of the contamination. These samples tended to be located between process buildings and adjacent railroad tracks.

- SVOC contamination in the subsurface soil was limited to one sample in the Preparation and Receiving Areas Aggregate, and consisted of a low estimated detection of five SVOC compounds. Only phenanthrene was present at a concentration above 0.1 mg/kg.

- VOC contamination in the subsurface soil at Load Line 2 was found in two samples, one in the Packaging and Shipping Areas Aggregate, and the other in the Preparation and Receiving Areas Aggregate. Acetone, toluene, and 2-butanone were detected at low, estimated concentrations less than 0.1 mg/kg.

- There was a single detection of the PCB-1260 in the Perimeter Area Aggregate. No pesticides were detected.

4.4 SEDIMENT

Stream and pond sediment samples were collected from seven locations during the Phase II RI to determine the nature and extent of contamination (Figure 3-7). Sampling occurred within the North Ponds and the Kelly's Pond and Exit Drainages Aggregates. Three sediment samples from the North Drainage Ditches Aggregate [LL2-046(p2), LL2-233, and LL2-234] and several miscellaneous sediment locations along the eastern-most drainage ditch leading to Kelly's Pond were collected from dry ditch conveyances and, therefore, were discussed in the surface soil section of this report. Sediment samples collected from the sewer system are discussed in Section 4.7.

All sample collection and analyses for the Phase II RI were conducted in accordance with the SAP (USACE 2001a) and as described in Chapter 3.0 of this report. Sediment samples were analyzed for field explosives, explosives, propellants, TAL metals, VOCs, SVOCs, PCBs/Pesticides, cyanide, TOC, and grain size distribution.

The complete analytical results for sediment samples collected at Load Line 2 are presented by aggregate, station, and analyte group in Appendix I. Table 4-5 presents the summary statistics and determination of SRCs for each aggregate in sediment. The following sections describe major findings from the Phase I RI, as well as the distribution of explosives propellants and inorganic and organic constituents in the two ditch and pond aggregate areas, as determined in the Phase II RI.

4.4.1 Summary of Phase I Remedial Investigation Data

In the Phase I RI, 11 ditch and pond sediment samples were collected and analyzed for the following parameters:

- eleven samples were analyzed for explosives and 11 site-related metals; and
- three samples were analyzed for TAL metals, cyanide, VOCs, SVOCs, and pesticides/PCBs.

Two ditch samples showed explosives contamination: LL2sd-028, near Building DB-9A, and LL2sd-049, in the ditch that exits the load line and discharges to Kelly's Pond. Samples from the pond also contained TNT. The source of this contamination was thought to be pink wastewater effluent discharged directly from the load line, rather than migration of surface soil contamination. However, storm drains, drainage ditches on the north and west sides of the load line, and the outfall from Kelly's Pond did not contain explosives contamination at the locations sampled during the Phase I RI.

Metals were most abundant and most concentrated in sediments from Kelly's Pond and in the eastern-most ditch that discharges to the pond. Calcium, chromium, copper, and lead were found in these sediments. A drainage ditch near Building DB-9A also contained a number of metals. PAHs and one PCB were found in one sample from Kelly's Pond. Other SVOCs and VOCs were observed at station LL2sd-030, which is located south of Building DB-3A.

4.4.2 Geotechnical Results

Geotechnical samples were collected from all stations and submitted for grain size distribution and TOC. All of the sediment samples were disturbed or grab samples. Table 4-42 presents summary results of the grain size distribution.

Table 4-42. Summary of Geotechnical Analysis of Sediment

Sample I.D.	Station No.	Depth (ft)	Grain Size Distribution (%)			
			Gravel	Sand	Silt	Clay
LL21131	LL2sd-054(p)	0 to 0.5	6.4	17.4	36.4	39.8
LL21096	LL2-233	0 to 0.5	1.4	24.9	44.1	29.6
LL21113	LL2-245	0 to 0.5	5.9	76.0	12.2	5.9
LL21118	LL2-249	0 to 0.5	3.1	21.2	47.0	28.7
LL21125	LL2-252	0 to 0.5	2.8	36.6	41.5	19.1
LL21133	LL2sd-055(p)	0 to 0.5	42.7	51.2	3.9	2.2
LL21129	LL2-053	0 to 0.5	3.3	22.3	39.5	34.9

Appendix K provides the complete geotechnical laboratory results.

4.4.3 Explosives and Propellants

North Ponds Aggregate

One pond sediment sample was collected from the North Ponds Aggregate. Explosives were not detected in the field explosives screening, and no explosives were analyzed for the laboratory. The propellant nitrocellulose was detected at a low, estimated concentration of 0.43J mg/kg, as shown in Table 4-43.

Kelly's Pond and Exit Drainages Aggregate

All sediment samples from the Kelly's Pond and Exit Drainages Aggregate were screened for field explosives and none were detected. Two sediment samples were sent for laboratory analysis of explosives and propellants. Propellants were not detected in either sample, and sample LL2sd/sw-054(p) had no detections of explosive compounds. Sample LL2-182, located in the drainage ditch leading immediately off-AOC to the south, contained three low (less than 1 mg/kg) detections of explosive compounds: 2,4,6-TNT, 2,4-DNT, and 4-amino-2,6-DNT. Explosive results for these two samples are presented in Table 4-44.

4.4.4 Inorganic Constituents

North Ponds Aggregate

A total of three inorganic SRCs were detected in the sample from the North Ponds Aggregate (Table 4-5). Lead and nickel concentrations exceed the site-related background criteria. The background value for cadmium was set to zero and, thus, it is considered to be an SRC whenever detected. The summary data for SRCs for sample LL2-271 in the North Ponds Aggregate is given in Table 4-45. All detected concentrations were low (only 1 to 2 mg/kg above the background criteria for lead and nickel, and less than 1 mg/kg for cadmium) and estimated values. At the detected concentrations it is difficult to say if the metals are due to site operations at Load Line 2 or just slight variations above the average background for those metals at the installation.

Table 4-43. Summary Data for Site-Related Explosives and Propellants in the North Ponds Aggregate Sediment

Functional Area		North Ponds Aggregate
Station ID		**LL2-271**
Sample ID		**LL21076**
Date		**07/31/2001**
Depth (ft)		**0 - 1**
Sample Type		**Grab**
Analyte	**Units**	
Explosives		
Nitrocellulose	mg/kg	0.43 J

ID = Identification.
J - Estimated result.

Table 4-44. Summary Data for Site-Related Explosives and Propellants in the Kelly's Pond and Exit Drainages Aggregate[a]

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2-182**	**LL2sd/sw-054(p)**
Sample ID		**LL20998**	**LL2SD-054(P)-0149-SD**
Date		**07/31/2001**	**08/12/1996**
Depth (ft)		**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab Composite**
Analyte	**Units**		
Explosives			
2,4,6-Trinitrotoluene	mg/kg	0.27 =	0.25 U
2,4-Dinitrotoluene	mg/kg	0.19 J	0.25 UJ
4-Amino-2,6-dinitrotoluene	mg/kg	0.13 J	NA

[a]Table presents both Phase I (1996) and Phase II (2001) data.
ID = Identification.
NA = Not analyzed.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-45. Summary Data for Site-Related Inorganics in the North Ponds Aggregate

Functional Area		North Ponds Aggregate
Station ID		**LL2-271**
Sample ID		**LL21076**
Date		**07/31/2001**
Depth (ft)		**0 - 1**
Sample Type		**Grab**
Analyte	**Units**	
Inorganics		
Cadmium	mg/kg	0.25 J *
Lead	mg/kg	28.5 J *
Nickel	mg/kg	20.7 J *

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Kelly's Pond and Exit Drainages Aggregate

A total of nine inorganic SRCs were identified for sediment in the Kelly's Pond and Exit Drainages Aggregate (Table 4-5). Beryllium, chromium, cobalt, copper, lead, and nickel each exceeded the respective site-background value in one sample. The background criteria for antimony, cadmium, and silver were set to zero since they were not detected in the background dataset and, thus, were considered to be SRCs if they were detected. Table 4-46 shows the detected analytical concentrations by station for all the SRCs in the Kelly's Pond and Exit Drainages Aggregate.

Metal SRCs were detected in nearly all samples (Table 4-46); however, in almost all cases, detected concentrations were less than twice the background criteria for those constituents having background criteria. One exception was a detected concentration of 0.97 mg/kg for beryllium in the field duplicate sample of LL2-182, which was slightly more than twice the background criteria of 0.38 mg/kg. Of the inorganics with no site-background criteria, antimony was detected in two of five samples, cadmium was detected in two of six samples, and silver was detected in one of six samples. The number of SRCs detected and the concentrations of each is fairly consistent for all six samples. The sediment sample located closest to the outfall of Kelly's Pond, LL2sd/sw-053(p), does have the greatest number of SRCs (Table 4-46), but they do not occur at higher concentrations, as a whole, than other sediment stations within this aggregate.

4.4.5 SVOCs, VOCs, and PCBs

North Ponds Aggregate

Organic constituents, other than explosives discussed in Section 4.4.3, were not detected in the North Pond sediment sample.

Table 4-46. Load Line 2 Sediment from Kelly's Pond and Exit Drainages Aggregate – Inorganics – Site-Related Contaminants[a]

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2-054(p2)**	**LL2-182**	**LL2-182**	**LL2sd/sw-052(p)**
Sample ID		**LL21131**	**LL20998**	**LL21175**	**LL21127**
Date		**07/30/2001**	**07/31/2001**	**07/31/2001**	**07/30/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Field Duplicate**	**Grab**
Analyte	**Units**				
Inorganics					
Antimony	mg/kg	1.1 UJ	1.8 J *	2.6 J *	1.3 UJ
Beryllium	mg/kg	0.52 J *	0.63 = *	0.97 = *	0.64 J *
Cadmium	mg/kg	0.56 U	0.21 J *	0.28 J *	0.67 U
Chromium	mg/kg	12.7 =	19.7 = *	25.5 = *	15.7 =
Cobalt	mg/kg	9.4 J *	9 J	9 J	8.3 J
Copper	mg/kg	18.9 =	23.6 =	27.6 =	17.2 =
Lead	mg/kg	12.2 =	31.2 = *	39.7 = *	19 =
Nickel	mg/kg	21.9 = *	15.2 =	16 =	17.7 =
Silver	mg/kg	0.56 U	0.55 U	0.56 U	0.67 U

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2sd/sw-053(p)**	**LL2sd/sw-054(p)**	**LL2sd/sw-055(p)**
Sample ID		**LL21129**	**LL2SD-054(P)-0149-SD**	**LL21133**
Date		**07/30/2001**	**08/12/1996**	**07/31/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab Composite**	**Grab**
Analyte	**Units**			
Inorganics				
Antimony	mg/kg	0.85 J *	NA	1.3 UJ
Beryllium	mg/kg	0.63 J *	NA	0.57 J *
Cadmium	mg/kg	0.73 U	0.26 J *	0.63 U
Chromium	mg/kg	23.6 = *	17.5 =	9.4 =
Cobalt	mg/kg	9.1 J	NA	11 J *
Copper	mg/kg	28.8 = *	NA	12.1 =
Lead	mg/kg	32.1 = *	45.8 = *	19.6 =
Nickel	mg/kg	18.3 = *	NA	19.1 = *
Silver	mg/kg	0.73 U	0.25 U	4.1 = *

[a]Table presents both Phase I (1996) and Phase II (2001) data.
ID = Identification.
NA = Not analyzed.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Kelly's Pond and Exit Drainages Aggregate

A total of five sediment samples were analyzed for organic constituents (Table 4-5). Sample LL2sd/sw-054(p), collected during the Phase I RI, was not analyzed for organics. Five pesticides and 13 SVOCs were detected in at least 1 sample from pond and ditch samples within this aggregate. PCBs and VOCs were not detected in any sample.

The most commonly detected pesticides were 4,4'-DDE and Beta-BHC, each detected in three samples (Table 4-5). The remaining pesticides were detected one time each. Table 4-47 gives the data summary by station and analyte group for the Kelly's Pond and Exit Drainages aggregate. As seen in this table, the sample from station LL2-182 contained all five pesticides, although most were detected at low (less than 0.1 mg/kg) estimated concentrations. 4,4'-DDE and Beta-BHC were also detected in LL2-054(p2) and LL2sd/sw-053(p). Station LL2-182 is located south of Kelly's Pond, in a drainage running away from the load line towards State Route 5.

Table 4-47. Load Line 2 Sediment from Kelly's Pond and Exit Drainages Aggregate – Organics – Site-Related Contaminants[a]

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2-054(p2)**	**LL2-182**	**LL2sd/sw-052(p)**
Sample ID		**LL21131**	**LL20998**	**LL21127**
Date		**07/30/2001**	**07/31/2001**	**07/30/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Pesticides and PCBs				
4,4'-DDD	mg/kg	0.0038 U	0.0038 J	0.0023 U
4,4'-DDE	mg/kg	0.0056 J	0.021 J	0.0026 J
4,4'-DDT	mg/kg	0.0038 U	0.0037 =	0.0023 U
Endrin Ketone	mg/kg	0.0038 U	0.01 J	0.0023 U
beta-BHC	mg/kg	0.0092 J	0.079 J	0.004 J
Semivolatile Organics				
2,4-Dinitrotoluene	mg/kg	0.37 U	0.36 U	0.44 U
Anthracene	mg/kg	0.37 U	0.12 J	0.44 U
Benz(*a*)anthracene	mg/kg	0.37 U	0.6 =	0.44 U
Benzo(*a*)pyrene	mg/kg	0.37 U	0.55 =	0.44 U
Benzo(*b*)fluoranthene	mg/kg	0.37 U	0.71 =	0.44 U
Benzo(*g,h,i*)perylene	mg/kg	0.37 U	0.2 J	0.44 U
Benzo(*k*)fluoranthene	mg/kg	0.37 U	0.36 =	0.44 U
Bis(2-ethylhexyl)phthalate	mg/kg	0.37 U	0.12 J	0.44 U
Chrysene	mg/kg	0.37 U	0.69 =	0.44 U
Dibenz(*a,h*)anthracene	mg/kg	0.37 U	0.082 J	0.44 U
Fluoranthene	mg/kg	0.072 J	0.94 J	0.085 J
Indeno(1,2,3-*cd*)pyrene	mg/kg	0.37 U	0.22 J	0.44 U
Phenanthrene	mg/kg	0.37 U	0.5 J	0.44 U
Pyrene	mg/kg	0.06 J	0.84 J	0.071 J

Table 4-47. Load Line 2 Sediment from Kelly's Pond and Exit Drainages Aggregate – Organics – Site-Related Contaminants[a] (continued)

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2sd/sw-053(p)**	**LL2sd/sw-054(p)**	**LL2sd/sw-055(p)**
Sample ID		**LL21129**	**LL2SD-054(P)-0149-SD**	**LL21133**
Date		**07/30/2001**	**08/12/1996**	**07/31/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab Composite**	**Grab**
Analyte	**Units**			
Pesticides and PCBs				
4,4'-DDD	mg/kg	0.0025 U	NA	0.0021 U
4,4'-DDE	mg/kg	0.0025 U	NA	0.0021 U
4,4'-DDT	mg/kg	0.0025 U	NA	0.0021 U
Endrin Ketone	mg/kg	0.0025 U	NA	0.0021 U
beta-BHC	mg/kg	0.0025 U	NA	0.0021 U
Semivolatile Organics				
2,4-Dinitrotoluene	mg/kg	0.48 U	NA	0.42 U
Anthracene	mg/kg	0.48 U	NA	0.42 U
Benz(*a*)anthracene	mg/kg	0.15 J	NA	0.42 U
Benzo(*a*)pyrene	mg/kg	0.18 J	NA	0.42 U
Benzo(*b*)fluoranthene	mg/kg	0.25 J	NA	0.074 J
Benzo(*g,h,i*)perylene	mg/kg	0.11 J	NA	0.42 U
Benzo(*k*)fluoranthene	mg/kg	0.14 J	NA	0.42 U
Bis(2-ethylhexyl)phthalate	mg/kg	0.48 U	NA	0.42 U
Chrysene	mg/kg	0.24 J	NA	0.061 J
Dibenz(*a,h*)anthracene	mg/kg	0.48 U	NA	0.42 U
Fluoranthene	mg/kg	0.41 J	NA	0.096 J
Indeno(1,2,3-*cd*)pyrene	mg/kg	0.11 J	NA	0.42 U
Phenanthrene	mg/kg	0.18 J	NA	0.42 U
Pyrene	mg/kg	0.34 J	NA	0.083 J

[a]Table presents both Phase I (1996) and Phase II (2001) data.
ID = Identification.
NA = Not available.
PCB = Polychlorinated biphenyl.
= - Detected result.
J - Estimated result.
U - Not detected.

The most commonly detected SVOCs were fluoranthene and pyrene, with five detections each (Table 4-5). Benzo(*b*)fluoranthene and chrysene were each detected in three samples, the other SVOCs were detected in one or two samples. Table 4-47 presents the data by station for comparison. The maximum concentration for most SVOCs occurred in station LL2-182. Station LL2sd/sw-053 also had a large number of SVOC detections (10 of the 13 SVOC SRCs were detected in this station, although all at relatively low estimated concentrations). Both these stations occur in the drainage ditch leaving Kelly's Pond and exiting to the south.

Summary

- Three explosive compounds (2,4,6-TNT, 2,4-DNT, and 4-amino-2,6-DNT) were detected in sediments from the Kelly's Pond and Exit Drainages Aggregate. The explosive compounds exhibited relatively low concentrations and were detected in only one sediment sample, one of the most downgradient locations. As explosives were not identified in the upgradient sediment locations, the detections may be attributed to sediments mobilizing during rain events with no continuing source to feed the upgradient locations. No explosives were identified in the sediment sample from the North Ponds Area Aggregate.

- The propellant nitrocellulose was detected once, in sediment from the North Ponds Aggregate. It was detected at a low, estimated concentration.

- Inorganics are distributed throughout sediments from the Kelly's Pond and Exit Drainages Aggregate, and were also detected above background in the sample from the North Pond Aggregate. Concentrations are typically low (at or only slightly above the background criteria for those elements with background values).

- Pesticides and VOCs were not detected in Load Line 2 ditch and pond sediment samples. Pesticides and SVOCs were detected in most samples, but especially in samples LLs-182 and LL2sd/sw-053(p). All organic constituents were detected at concentrations less than 1 mg/kg.

4.5 SURFACE WATER

Surface water samples were collected from three stations in the Kelly's Pond and Exit Drainages Aggregate and two miscellaneous locations in drainages leading from the load line to Kelly's Pond in order to determine the nature and extent of contamination in surface water at Load Line 2 (Figure 3-7). All Kelly's Pond and Exit Pathway surface water samples were co-located with sediment samples (see Section 4.4). Two additional surface water samples were collected from drainage conveyances leading from the load line to Kelly's Pond; the solid media portion of these samples is included in the surface soils discussion (Section 4.2).

4.5.1 Summary of Phase I Remedial Investigation Data

Surface water was not investigated during the Phase I RI.

4.5.2 Explosives and Propellants

Kelly's Pond and Exit Drainages Aggregate

Four explosive compounds were detected in one of three samples from the Kelly's Pond and Exit Drainages aggregate (Table 4-6). Propellants were not detected. Table 4-48 shows the detailed summary of data by station. 2-Amino-4,6-DNT; 4-amino-2,6-DNT; HMX; and RDX were all detected in station LL2sd/sw-055(p), with all concentrations less than 0.01 mg/L. Station LL2sd/sw-055(p) is the most distantly located station to Kelly's Pond (Figure 3-7), and lies in a drainage pathway separate from Kelly's Pond.

Table 4-48. Summary Data for Site-Related Explosives and Propellants in the Kelly's Pond and Exit Drainages Aggregate

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2sd/sw-052(p)**	**LL2sd/sw-053(p)**	**LL2sd/sw-055(p)**
Sample ID		**LL21128**	**LL21130**	**LL21134**
Date		**07/30/2001**	**07/30/2001**	**07/30/2001**
Filtered		**Total**	**Total**	**Total**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Explosives				
2-Amino-4,6-dinitrotoluene	mg/L	0.0002 U	0.0002 U	0.001 =
4-Amino-2,6-dinitrotoluene	mg/L	0.0002 U	0.0002 U	0.0013 =
HMX	mg/L	0.0005 U	0.0005 U	0.0007 =
RDX	mg/L	0.0005 U	0.0005 U	0.0024 =

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
ID = Identification.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
= - Detected result.
J - Estimated result.
U - Not detected.

Miscellaneous Water Samples Aggregate

Explosives or propellants were not detected in surface water samples from either of the miscellaneous water samples (Table 4-7).

4.5.3 Inorganic Constituents

Kelly's Pond and Exit Drainages Aggregate

Three inorganic SRCs were identified for surface water for the Kelly's Pond and Exit Drainages Aggregate (Table 4-6). Antimony and vanadium were each detected in two samples, and cadmium was detected in one surface water sample. Table 4-49 presents the data summary of SRCs by station. All three of the metals were identified as SRCs on the basis that the background criteria for these metals were set to zero. Concentrations were all very low (less than 0.01 mg/L). The number of detected SRCs does decrease with increasing distance from Kelly's Pond.

Miscellaneous Water Samples Aggregate

Eleven inorganic constituents were determined to be SRCs in surface water from the Miscellaneous Water Samples aggregate (Table 4-7). Arsenic, barium, manganese, and zinc were each detected above their respective background criteria in at least one of the two samples. Concentrations were more than twice the background criteria for arsenic, barium, and manganese in LL2-249, and more than twice the background criteria for manganese in LL2-048(p2). Table 4-50 presents the surface water SRC data summary by station for this aggregate.

Table 4-49. Summary Data for Site-Related Inorganics in the Kelly's Pond and Exit Drainages Aggregate

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2sd/sw-052(p)**	**LL2sd/sw-053(p)**	**LL2sd/sw-055(p)**
Sample ID		**LL21128**	**LL21130**	**LL21134**
Date		**07/30/2001**	**07/30/2001**	**07/30/2001**
Filtered		**Total**	**Total**	**Total**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Inorganics				
Antimony	mg/L	0.014 = *	0.015 = *	0.01 U
Cadmium	mg/L	0.00028 J *	0.005 U	0.005 U
Vanadium	mg/L	0.0024 J *	0.0017 J *	0.007 U

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-50. Summary Data for Site-Related Inorganics in the Miscellaneous Water Samples Aggregate

Functional Area		Miscellaneous Water Samples Aggregate	Miscellaneous Water Samples Aggregate
Station ID		**LL2-048(p2)**	**LL2-249**
Sample ID		**LL21124**	**LL21119**
Date		**07/27/2001**	**07/30/2001**
Filtered		**Total**	**Total**
Sample Type		**Grab**	**Grab**
Analyte	**Units**		
Inorganics			
Arsenic	mg/L	0.0062 J *	0.0092 J *
Barium	mg/L	0.1 = *	0.24 = *
Chromium	mg/L	0.005 U	0.0025 J *
Cobalt	mg/L	0.0018 U	0.0026 J *
Lead	mg/L	0.01 U	0.0086 J *
Manganese	mg/L	4.9 = *	3 = *
Mercury	mg/L	0.0002 U	0.000071 J *
Nickel	mg/L	0.0041 J *	0.0062 J *
Thallium	mg/L	0.4 = *	0.002 UJ
Vanadium	mg/L	0.007 U	0.0042 J *
Zinc	mg/L	0.016 J	0.066 = *

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

4.5.4 SVOCs, VOCs, and PCBs

Kelly's Pond and Exit Drainages Aggregate

Three samples from the Kelly's Pond and Exit Drainages Aggregate were submitted for organics analyses (two for SVOCs and two for VOC analyses) (Table 4-6). A single detection of the SVOC bis(2ethylhexyl)phthalate occurred at station LL2sd/sw-052(p), and a single detection of the VOC carbon disulfide occurred at station LL2sd/sw-053(p). As seen in Table 4-51, both detections were low (less than 0.01 mg/L). No organic compounds were detected at the most distal location, LL2sd/sw-055(p).

Table 4-51. Summary Data for Site-Related Organics in the Kelly's Pond and Exit Drainages Aggregate

Functional Area		Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate	Kelly's Pond and Exit Drainages Aggregate
Station ID		**LL2sd/sw-052(p)**	**LL2sd/sw-053(p)**	**LL2sd/sw-055(p)**
Sample ID		**LL21128**	**LL21130**	**LL21134**
Date		**07/30/2001**	**07/30/2001**	**07/30/2001**
Filtered		**Total**	**Total**	**Total**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Semivolatile Organics				
Bis(2-ethylhexyl)phthalate	mg/L	0.0028 J	NA	0.01 U
Volatile Organics				
Carbon Disulfide	mg/L	NA	0.0023 =	0.001 U

ID = Identification.
NA = Not analyzed.
= - Detected result.
J - Estimated result.
U - Not detected.

Miscellaneous Water Samples Aggregate

Organic compounds were not detected in the two samples from the Miscellaneous Water Samples Aggregate (Table 4-7).

4.5.5 Summary

- Four explosive compounds were detected in one surface water sample associated with the Kelly's Pond and Exit Drainages Aggregate. Detected concentrations were relatively low, with the detected concentrations occurring in the station located farthest from Kelly's Pond. Explosives were not detected in the two miscellaneous water samples collected.

- Three metals were identified as SRCs in the Kelly's Pond and Exit Drainages Aggregate surface water samples. Antimony, cadmium, and vanadium were not detected in the background dataset and, therefore, were retained as SRCs. Eleven metals were identified as SRCs in the Miscellaneous Water Samples Aggregate; however, seven of these also do not have site-related background values and thus were retained as SRCs. Concentrations were more than 2 times the background criteria for several constituents (arsenic, barium, and manganese).

- Isolated detections of organic compounds occurred, but the detected concentrations were relatively low and these compounds were not detected in other media during the Phase II RI.

4.6 GROUNDWATER

Groundwater samples were collected from 12 wells during the Phase II RI (Figure 3-6). Two of these wells (LL2mw-059 and LL2mw-060) were installed during the Phase I field effort, the remaining 10 wells (LL2mw-261 to LL2mw-270) were installed during the Phase II field effort. Well LL2mw-265 is located on the southern end of the AOC, between the two previously existing monitoring wells (LL2mw-059 and LL2mw-060). The remaining nine wells are located within the main process area, mostly near former building sites. Groundwater flow patterns have been inferred from static water level data, as described in Section 2.4.2. In general, a radial groundwater flow pattern exists around a potentiometric high in the center of the load line. Water table elevations drop steeply on the south side of the AOC, consistent with topography.

Unfiltered groundwater samples from each well were analyzed for explosives, propellants, VOCs, SVOCs, PCB/pesticides and cyanide. Additionally, groundwater from four wells was analyzed for hexavalent chromium. Filtered groundwater samples were analyzed for metals. Table 4-8 provides the summary statistics and determination of SRCs for groundwater at Load Line 2. Nature and extent of contamination in groundwater is considered on an AOC-wide basis; therefore, no spatial aggregates have been assigned. Table 4-52 presents concentrations of the constituents considered SRCs in groundwater (only detected concentrations are shown). The full analytical results are provided by analyte and station in Appendix I.

The two existing monitoring wells, LL2mw-059 and LL2mw-060, have each been sampled four times between 1996 and 2001. Table 4-53 shows the detected concentrations of organic compounds, including explosives, over the four sampling events. Table 4-54 shows the detected concentrations of inorganic constituents from these four sampling events over time.

4.6.1 Explosives and Propellants

Six explosives compounds were each detected one time in groundwater samples from 2 of the 12 monitoring wells during the Phase II RI (Table 4-52). No propellant compounds were detected. RDX was detected in LL2mw-262 at an estimated concentration of 0.18 µg/L. This well is located between the Explosives Handling Areas Soil Aggregate and the Packing and Shipping Areas Soil Aggregate, and is not associated with any particular process building. Monitoring well LL2mw-059 showed detected concentrations of five explosive compounds: 1,3,5-TNB; 2,4-DNT; 2-amino-4,6-DNT; 4-amino-2,6-DNT; and HMX (Table 4-52 and Figure 4-31). This well is one of the existing monitoring wells located at the southern exit pathway end of the load line. As seen in Table 4-53, explosives have been detected in this well fairly consistently since 1996. Explosives were also detected in well LL2mw-060 in the 1999 and 2000 sampling events, but none were detected in this well in the 2001 Phase II RI sampling event. All explosives concentrations were below EPA Region 9 Tap Water PRGs.

4.6.2 TAL Metals, Cyanide, and Hexavalent Chromium

All groundwater samples were analyzed for TAL metals and cyanide. In addition, samples from four wells were analyzed for hexavalent chromium. Cyanide and hexavalent chromium samples were unfiltered, the remaining TAL metal analyses were performed on filtered groundwater samples. Facility-wide background criteria for metals were established prior to the Phase II efforts and only detections above background are discussed below. Exceptions to this are antimony, arsenic, and cobalt, which were not detected in the background dataset and for which background criteria were set to zero and are, therefore, automatically considered SRCs if detected at a frequency greater than 5%.

Table 4-52. Detected Concentrations of Groundwater Site-Related Contaminants at Load Line 2

Functional Area		Load Line 2	Load Line 2	Load Line 2	Load Line 2	Load Line 2	Load Line 2	Load Line 2
Station ID		LL2mw-059	LL2mw-060	LL2mw-261	LL2mw-262	LL2mw-263	LL2mw-264	LL2mw-265
Sample ID		LL21155	LL21156	LL21145	LL21146	LL21147	LL21148	LL21149
Date		09/20/2001	09/19/2001	09/10/2001	09/07/2001	09/07/2001	09/10/2001	09/19/2001
Filtered		Total	Total	Total	Total	Total	Total	Total
Sample Type		Grab	Grab	Grab	Grab	Grab	Grab	Grab
Analyte	Units							
Explosives								
1,3,5-Trinitrobenzene	mg/L	0.0048 =	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U
2,4-Dinitrotoluene	mg/L	0.00033 =	0.00013 U	0.00013 UJ	0.00013 UJ	0.00013 UJ	0.00013 UJ	0.00013 U
2-Amino-4,6-dinitrotoluene	mg/L	0.0011 =	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U
4-Amino-2,6-dinitrotoluene	mg/L	0.00087 =	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U
HMX	mg/L	0.00033 J	0.0005 U	0.0005 UJ	0.0005 UJ	0.0005 UJ	0.0005 UJ	0.0005 U
RDX	mg/L	0.0005 U	0.0005 U	0.0005 UJ	0.00018 J	0.0005 UJ	0.0005 UJ	0.0005 U
Inorganics								
Antimony	mg/L	0.01 U	0.01 U	0.0022 J *	0.01 U	0.01 U	0.01 U	0.01 U
Arsenic	mg/L	0.015 U	0.015 U	0.016 = *	0.029 = *	0.02 = *	0.016 = *	0.1 = *
Cobalt	mg/L	0.005 U	0.005 U	0.005 U	0.0092 = *	0.0034 U	0.0039 U	0.073 = *
Manganese	mg/L	0.13 J	0.0042 J	0.34 =	0.76 =	0.75 =	0.44 =	1.9 J *
Nickel	mg/L	0.0039 J	0.025 U	0.01 J	0.031 =	0.011 J	0.011 J	0.3 = *
Pesticides and PCBs								
Heptachlor Epoxide	mg/L	0.00034 =	0.00022 =	0.00005 U	0.00005 U	0.00005 U	0.00005 U	0.00005 U
PCB-1242	mg/L	0.00085 =	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.00072 =
Volatile Organics								
2-Butanone	mg/L	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Benzene	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Carbon Disulfide	mg/L	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.00026 J
Chloromethane	mg/L	0.001 U	0.001 U	0.00016 J	0.001 U	0.001 U	0.001 U	0.001 U

Table 4-52. Detected Concentrations of Groundwater Site-Related Contaminants at Load Line 2 (continued)

Functional Area		Load Line 2	Load Line 2	Load Line 2	Load Line 2	Load Line 2	Load Line 2
Station ID		LL2mw-265	LL2mw-266	LL2mw-267	LL2mw-268	LL2mw-269	LL2mw-270
Sample ID		LL21187	LL21150	LL21151	LL21152	LL21153	LL21154
Date		09/19/2001	09/11/2001	09/10/2001	09/07/2001	09/20/2001	09/07/2001
Filtered		Total	Total	Total	Total	Total	Total
Sample Type		Field Duplicate	Grab	Grab	Grab	Grab	Grab
Analyte	Units						
Explosives							
1,3,5-Trinitrobenzene	mg/L	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 UJ
2,4-Dinitrotoluene	mg/L	0.00013 U	0.00013 UJ	0.00013 UJ	0.00013 UJ	0.00013 U	0.00013 UJ
2-Amino-4,6-dinitrotoluene	mg/L	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 UJ
4-Amino-2,6-dinitrotoluene	mg/L	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 U	0.0002 UJ
HMX	mg/L	0.0005 U	0.0005 UJ	0.0005 UJ	0.0005 UJ	0.0005 U	0.0005 UJ
RDX	mg/L	0.0005 U	0.0005 UJ	0.0005 UJ	0.0005 UJ	0.0005 U	0.0005 UJ
Inorganics							
Antimony	mg/L	0.01 U	0.008 J *	0.01 U	0.01 U	0.0047 J *	0.01 U
Arsenic	mg/L	0.094 = *	0.0061 J *	0.0062 J *	0.0047 J *	0.015 U	0.015 U
Cobalt	mg/L	0.07 = *	0.0098 = *	0.0046 U	0.0015 U	0.0092 = *	0.0019 U
Manganese	mg/L	1.9 J *	0.98 =	1.5 = *	0.29 =	1.5 J *	0.058 =
Nickel	mg/L	0.29 = *	0.01 J	0.025 U	0.0035 J	0.024 J	0.0035 J
Pesticides and PCBs							
Heptachlor Epoxide	mg/L	0.00005 U	0.00005 U	0.00005 U	0.00005 U	0.00005 U	0.00005 U
PCB-1242	mg/L	0.0005 U	0.0005 U	0.0005 UJ	0.0005 U	0.0005 U	0.0005 U
Volatile Organics							
2-Butanone	mg/L	0.01 U	0.0012 J	0.01 U	0.01 U	0.01 U	0.01 U
Benzene	mg/L	0.001 U	0.00049 J	0.00022 J	0.001 U	0.001 U	0.001 U
Carbon Disulfide	mg/L	0.001 U	0.00031 J	0.001 U	0.001 U	0.001 U	0.001 U
Chloromethane	mg/L	0.001 U	0.00037 J	0.001 U	0.001 U	0.001 U	0.001 U

ID = Identification.
PCB = Polychlorinated biphenyl.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-53. Load Line 2 Historical Groundwater Summary, Explosives and Organic Compounds

Media		Groundwater	Groundwater	Groundwater	Groundwater
Location		Load Line 2	Load Line 2	Load Line 2	Load Line 2
Station		LL2mw-059	LL2mw-059	LL2mw-059	LL2mw-059
Sample ID		LL2MW-059-0667-GW	LL0686	LL11078	LL21155
Customer ID			LL2mw-059-0686-GW	LL2mw-059-1078-GW	LL2mw-059-1155-GW
Date		08/19/1996	09/03/1999	10/01/2000	09/20/2001
Depth (ft)		0 - 0	0 - 0	0 - 0	0 - 0
Filtered		Total	Total	Total	Total
Field Type		Grab	Grab	Grab	Grab
Analyte	Units				
1,3,5-Trinitrobenzene	µg/L	2 U	3.1 =	3.1 =	4.8 =
1,3-Dinitrobenzene	µg/L	3 U	0.092 J	0.068 J	0.2 U
2,4,6-Trinitrotoluene	µg/L	3 U	0.12 J	0.099 J	0.2 U
2,4-Dinitrotoluene	µg/L	0.34 =	0.24 U	0.24 U	0.33 =
2-Amino-4,6-dinitrotoluene	µg/L	NA	NA	1.3 =	1.1 =
4-Amino-2,6-dinitrotoluene	µg/L	NA	NA	1.2 =	0.87 =
HMX	µg/L	20 U	0.5 U	0.5 U	0.33 J
RDX	µg/L	20 U	0.15 J	0.2 J	0.5 U
Tetryl	µg/L	50 U	0.17 J	0.2 U	0.2 U
Heptachlor Epoxide	µg/L	0.04 U	NA	0.05 U	0.34 =
PCB-1242	µg/L	1 U	NA	1 U	0.85 =
Bis(2-ethylhexyl)phthalate	µg/L	5 U	NA	10 U	10 U
Methylene Chloride	µg/L	7 UJ	NA	2.3 J	1 U
Toluene	µg/L	5 U	NA	5 U	1 U

Table 4-53. Load Line 2 Historical Groundwater Summary, Explosives and Organic Compounds (continued)

Media		Groundwater	Groundwater	Groundwater	Groundwater
Location		Load Line 2	Load Line 2	Load Line 2	Load Line 2
Station		LL2mw-060	LL2mw-060	LL2mw-060	LL2mw-060
Sample ID		LL2MW-060-0668-GW	LL0688	LL11079	LL21156
Customer ID			LL2mw-060-0688-GW	LL2mw-060-1079-GW	LL2mw-060-1156-GW
Date		08/19/1996	09/06/1999	10/01/2000	09/19/2001
Depth (ft)		0 - 0	0 - 0	0 - 0	0 - 0
Filtered		Total	Total	Total	Total
Field Type		Grab	Grab	Grab	Grab
Analyte	Units				
1,3,5-Trinitrobenzene	µg/L	2 U	0.3 =	0.2 U	0.2 U
1,3-Dinitrobenzene	µg/L	3 U	0.2 U	0.2 U	0.2 U
2,4,6-Trinitrotoluene	µg/L	3 U	0.1 J	0.2 U	0.2 U
2,4-Dinitrotoluene	µg/L	0.1 U	0.096 J	0.22 =	0.13 U
2-Amino-4,6-dinitrotoluene	µg/L	NA	NA	0.81 =	0.2 U
4-Amino-2,6-dinitrotoluene	µg/L	NA	NA	0.75 =	0.2 U
HMX	µg/L	20 U	0.5 U	0.5 U	0.5 U
RDX	µg/L	20 U	0.5 U	0.5 U	0.5 U
Tetryl	µg/L	50 U	0.2 U	0.2 U	0.2 U
Heptachlor Epoxide	µg/L	0.04 U	NA	0.05 U	0.22 =
PCB-1242	µg/L	1 U	NA	1 U	0.5 U
Bis(2-ethylhexyl)phthalate	µg/L	2 J	NA	10 U	10 U
Methylene Chloride	µg/L	7 UJ	NA	2.5 J	1 U
Toluene	µg/L	5 U	NA	1 J	1 U

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
ID = Identification.
NA = Not analyzed.
ND = Constituent was not detected.
PCB = Polychlorinated biphenyl.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
J = Constituent was detected but concentrations was estimated.
U = Not detected.
* = Constituent exceeds background criteria (inorganics only).

Table 4-54. Load Line 2 Historical Groundwater Summary, Inorganic Constituents

Media		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Location		Load Line 2	Load Line 2	Load Line 2	Load Line 2	Load Line 2
Station		LL2mw-059	LL2mw-059	LL2mw-059	LL2mw-059	LL2mw-059
Sample ID		LL2MW-059-0667-GW	LL0686	LL0687	LL11078	LL11078
Customer ID			LL2mw-059-0686-GW	LL2mw-059-0687-GW	LL2mw-059-1078-GW	LL2mw-059-1078-GW
Date		08/19/1996	09/03/1999	09/03/1999	10/01/2000	10/01/2000
Depth (ft)		0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Filtered		Total	Total	Dissolved	Dissolved	Total
Field Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
Cyanide	µg/L	2 U	10 R	NA	NA	10 U
Aluminum	µg/L	18 U	450 = *	200 U	200 U	NA
Arsenic	µg/L	2.6 J *	5 U	10 U	5 U	NA
Barium	µg/L	13.3 =	12 J	9.4 J	6.2 J	NA
Calcium	µg/L	28,800 =	20,500 =	20,600 =	16,600 =	NA
Cobalt	µg/L	14.7 J *	50 U	50 U	50 U	NA
Iron	µg/L	32 U	470 =	100 U	100 U	NA
Magnesium	µg/L	7,510 =	6,900 =	6,800 =	5,900 =	NA
Manganese	µg/L	642 =	100 =	83 =	67 =	NA
Nickel	µg/L	17.9 J	40 U	40 U	3.3 J	NA
Potassium	µg/L	1,470 J	1,000 J	860 J	720 J	NA
Sodium	µg/L	6,200 =	6,200 J	6,200 J	5,900 =	NA
Zinc	µg/L	7.8 J	120 J *	90 J *	230 = *	NA

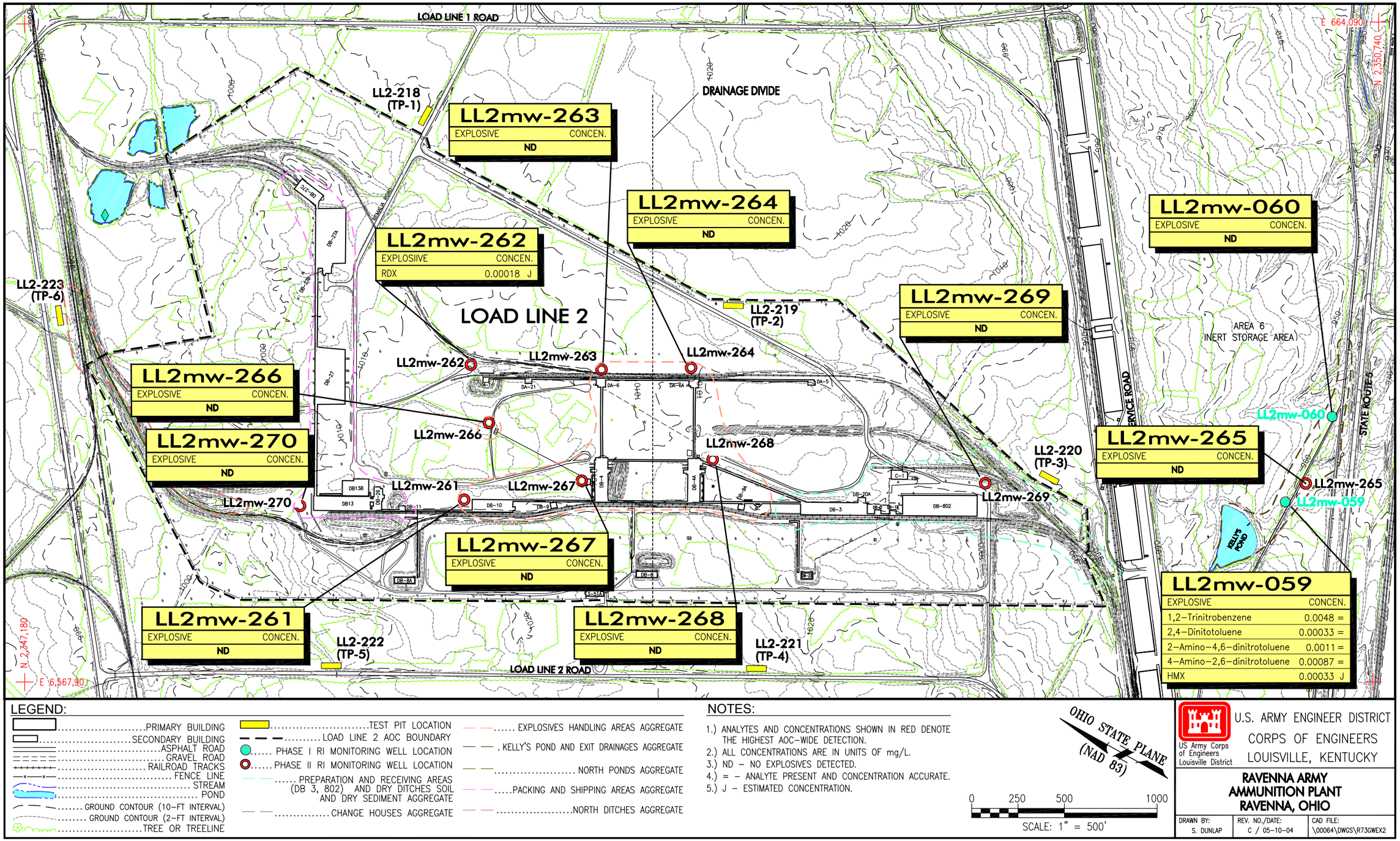
Table 4-54. Load Line 2 Historical Groundwater Summary, Inorganic Constituents (continued)

Media		Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
Location		Load Line 2	Load Line 2	Load Line 2	Load Line 2	Load Line 2
Station		LL2mw-059	LL2mw-059	LL2mw-060	LL2mw-060	LL2mw-060
Sample ID		LL21155	LL21155	LL2MW-060-0668-GW	LL0688	LL0689
Customer ID		LL2mw-059-1155-GW	LL2mw-059-1155-GW		LL2mw-060-0688-GW	LL2mw-060-0689-GW
Date		09/20/2001	09/20/2001	08/19/1996	09/06/1999	09/06/1999
Depth (ft)		0 - 0	0 - 0	0 - 0	0 - 0	0 - 0
Filtered		Dissolved	Total	Total	Total	Dissolved
Field Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
Cyanide	µg/L	NA	10 U	8.7 J	10 U	NA
Aluminum	µg/L	150 U	NA	27.4 J *	200 R	360 J *
Arsenic	µg/L	15 U	NA	3.3 U	5 U	10 U
Barium	µg/L	5.7 J	NA	18.7 =	21 J	22 J
Calcium	µg/L	17,900 =	NA	34,600 =	35,500 =	36,900 =
Cobalt	µg/L	5 U	NA	0.87 J *	50 U	50 U
Iron	µg/L	300 U	NA	26.4 J	100 U	100 U
Magnesium	µg/L	7,000 =	NA	9,900 =	9,700 =	9,600 =
Manganese	µg/L	130 J	NA	106 =	33 =	12 J
Nickel	µg/L	3.9 J	NA	3.8 J	40 U	40 U
Potassium	µg/L	910 J	NA	831 J	480 J	480 J
Sodium	µg/L	6,300 =	NA	3,050 =	2,700 J	2,800 J
Zinc	µg/L	40 U	NA	8.4 J	17 U	16 U

Table 4-54. Load Line 2 Historical Groundwater Summary, Inorganic Constituents (continued)

Media		Groundwater	Groundwater	Groundwater	Groundwater
Location		Load Line 2	Load Line 2	Load Line 2	Load Line 2
Station		LL2mw-060	LL2mw-060	LL2mw-060	LL2mw-060
Sample ID		LL11079	LL11079	LL21156	LL21156
Customer ID		LL2mw-060-1079-GW	LL2mw-060-1079-GW	LL2mw-060-1156-GW	LL2mw-060-1156-GW
Date		10/01/2000	10/01/2000	09/19/2001	09/19/2001
Depth (ft)		0 - 0	0 - 0	0 - 0	0 - 0
Filtered		Dissolved	Total	Dissolved	Total
Field Type		Grab	Grab	Grab	Grab
Analyte	**Units**				
Cyanide	µg/L	NA	10 U	NA	10 U
Aluminum	µg/L	200 U	NA	100 U	NA
Arsenic	µg/L	5 U	NA	15 U	NA
Barium	µg/L	21 J	NA	21 =	NA
Calcium	µg/L	31,800 =	NA	35,600 =	NA
Cobalt	µg/L	50 U	NA	5 U	NA
Iron	µg/L	100 =	NA	300 U	NA
Magnesium	µg/L	8,000 =	NA	10,400 =	NA
Manganese	µg/L	48 =	NA	4.2 J	NA
Nickel	µg/L	40 U	NA	25 U	NA
Potassium	µg/L	490 J	NA	610 U	NA
Sodium	µg/L	2,400 =	NA	2,700 J	NA
Zinc	µg/L	710 = *	NA	40 U	NA

ID = Identification.
NA = Not analyzed.
ND = Constituent was not detected in a specific groundwater sample.
U = Not detected.
* = Constituent exceeds background criteria.



LEGEND:

- PRIMARY BUILDING
- SECONDARY BUILDING
- ASPHALT ROAD
- GRAVEL ROAD
- RAILROAD TRACKS
- FENCE LINE
- STREAM
- POND
- GROUND CONTOUR (10-FT INTERVAL)
- GROUND CONTOUR (2-FT INTERVAL)
- TREE OR TREELINE
- TEST PIT LOCATION
- LOAD LINE 2 AOC BOUNDARY
- PHASE I RI MONITORING WELL LOCATION
- PHASE II RI MONITORING WELL LOCATION
- PREPARATION AND RECEIVING AREAS (DB 3, 802) AND DRY DITCHES SOIL AND DRY SEDIMENT AGGREGATE
- CHANGE HOUSES AGGREGATE
- EXPLOSIVES HANDLING AREAS AGGREGATE
- KELLY'S POND AND EXIT DRAINAGES AGGREGATE
- NORTH PONDS AGGREGATE
- PACKING AND SHIPPING AREAS AGGREGATE
- NORTH DITCHES AGGREGATE

NOTES:

1.) ANALYTES AND CONCENTRATIONS SHOWN IN RED DENOTE THE HIGHEST AOC-WIDE DETECTION.
2.) ALL CONCENTRATIONS ARE IN UNITS OF mg/L.
3.) ND - NO EXPLOSIVES DETECTED.
4.) = - ANALYTE PRESENT AND CONCENTRATION ACCURATE.
5.) J - ESTIMATED CONCENTRATION.

OHIO STATE PLANE (NAD 83)

0 250 500 1000
SCALE: 1" = 500'

US Army Corps of Engineers Louisville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

DRAWN BY:	REV. NO./DATE:	CAD FILE:
S. DUNLAP	C / 05-10-04	\00064\DWGS\R73GWEX2

Figure 4-31. Distribution and Concentration of Explosives in Groundwater at Load Line 2

Table 4-52 presents Phase II RI concentrations of the five inorganics that were considered SRCs in groundwater. Arsenic, manganese, and nickel were detected most frequently, while antimony and cobalt were detected in 4 or fewer of the 12 wells. Nickel was detected at a concentration exceeding background in only one well (LL2mw-265) and manganese was detected above the background concentration in three wells (LL2mw-267, LL2mw-268, and LL2mw-265). The distribution and relative concentration of antimony, arsenic, and manganese are shown on Figure 4-32. The two previously existing wells on the southern exit pathway end of the load line did not have any detections of inorganic SRCs, while the Phase II well LL2mw-265, also located on the southern end of the load line, had the MDCs of arsenic, cobalt, manganese, and nickel (Table 4-52). The maximum concentration of antimony (8 µg/L) was detected in LL2mw-266, which is associated with the Explosives Handling Areas Soil Aggregate. Between one and three of the SRCs were detected in the remaining wells.

Historically, analysis of groundwater from the two existing wells at the southern end of the load line has shown detected concentrations of aluminum, arsenic, cobalt, and zinc at concentrations above the site background (Table 4-54).

4.6.3 SVOCs, VOC, and PCBs

No SVOCs were detected in groundwater samples from monitoring wells samples during the Phase II RI. Historically, bis(-ethylhexyl)phthalate was detected 1 time in monitoring well LL2mw-060, with an estimated concentration of 2 µg/L (Table 4-53).

A total of 4 VOCs were detected in the 12 wells sampled during the Phase II RI. These are 2-butanone, benzene, carbon disulfide, and chloromethane. VOCs were detected in four wells, including LL2mw-261, LL2mw-266, and LL2mw-267, all of which are located in the central process area in the Explosives Handling Areas Soil Aggregate; and LL2mw-265, which is located in the southern exit pathway portion of the load line. Well LL2mw-267 contained detections of all four VOC SRCs, while the remaining wells had concentrations of only one SRC (Table 4-52 and Figure 4-33). A review of the historical data for the two previously existing wells indicates that none of the VOC compounds detected during the Phase II RI have been detected previously (Table 4-53). One of the two VOC compounds detected in previous sampling events (methylene chloride) is a common laboratory contaminant, so it may not have been significant in earlier sampling results.

One pesticide (heptachlor expoxide) and one PCB (PCB-1242) were each detected twice during the Phase II RI investigation of groundwater. All detections were from wells LL2mw-059, LL2mw-060, and LL2-mw-065, which are all located in the southern exit pathway end of the load line some distance from the process buildings (Figure 4-33). Heptachlor epoxide was detected in the two pre-existing wells (LL2mw-059 and -060) at concentrations of 0.34 µg/L and 0.22 µg/L, respectively. PCB-1242 was detected in LL2mw-065 at a concentration of 0.72 µg/L and in LL2mw-059 at a concentration of 0.85 µg/L (Table 4-52). These compounds have not been detected in the two pre-existing wells in previous sampling events (Table 4-53).

4.6.4 Summary

Groundwater from 2 of the 12 monitoring wells is contaminated with low levels of explosives, and primarily the contamination is found in well LL2mw-059 located in the southern exit pathway portion of the load line. All explosives concentrations were below EPA Region 9 Tap Water PRGs.

Groundwater in all monitoring wells contains site-related metals. The maximum concentrations of five of the inorganic SRCs were detected in well LL2mw-265, located in the southern exit pathway area of the load line. The other two wells in this area did not contain detectable levels of inorganic SRCs.

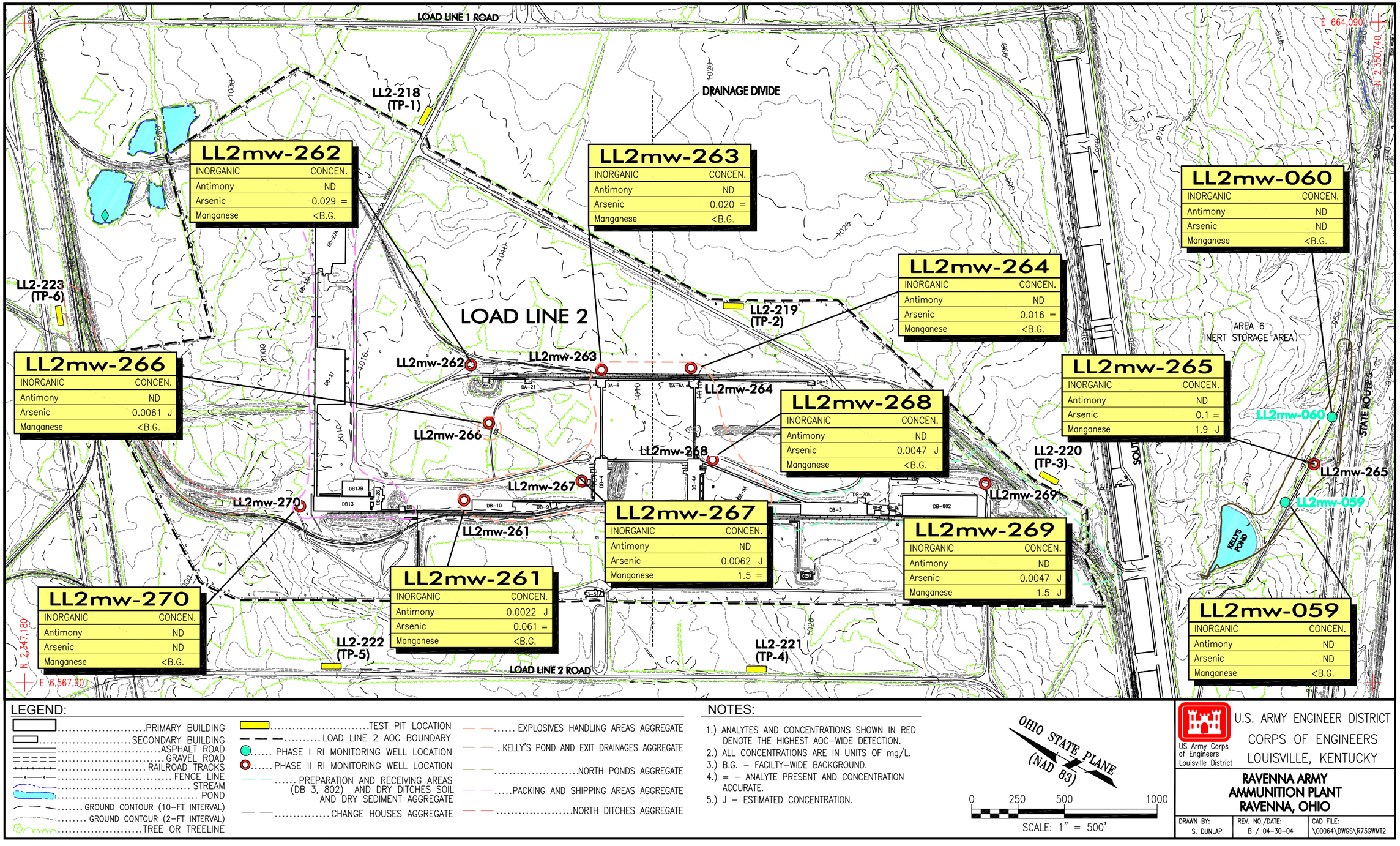


Figure 4-32. Distribution and Concentration of Inorganic SRCs in Groundwater at Load Line 2

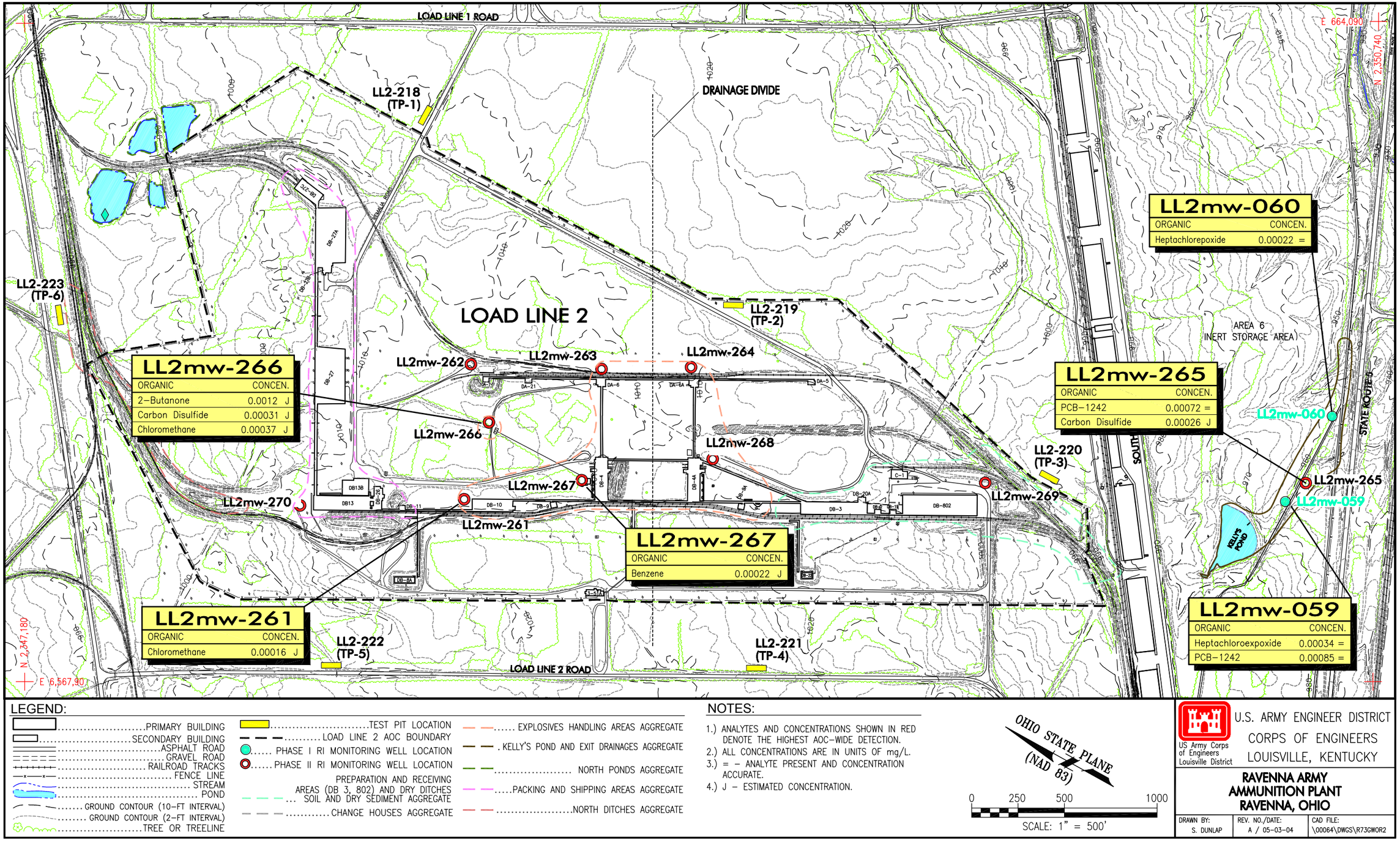


Figure 4-33. Distribution and Concentration of Organic Compounds in Groundwater at Load Line 2

Pesticides/PCBs and VOCs are minor contaminants in Load Line 2 groundwater. Occurrence of these compounds in groundwater does not correspond to hot spots for similar compounds in surface or subsurface soil. Therefore, a direct relationship between soil areas containing these constituents and groundwater was not observed.

4.7 STORM/SANITARY SEWER SYSTEM CHARACTERIZATION

4.7.1 Storm/Sanitary Sewer Line Video Survey Results

As discussed in Chapter 3.0, a video survey of the storm and sanitary sewers was conducted at Load Line 2. Approximately 1,500 ft of a total of 26,500 ft of sewer line was surveyed. The sanitary and storm sewer system was found to be largely intact, but exhibiting frequent cracks, mineral deposits indicating infiltrating water, and debris deposits (sediment, sand, and gravel, leaves, and sticks). Some portions of the system were flooded. The inspection records of the survey are found Appendix N and are summarized in Table 4-55.

4.7.2 Storm/Sanitary Sewer Sediment Samples

Sediment samples were collected from 12 sewer system manholes during the Phase II RI to characterize the nature and extent of contamination. Three sediment samples were co-located with storm/sanitary sewer water samples; MH-304 contained insufficient sediment to obtain a sample. All of the sediment samples were analyzed for TAL metals, field explosives, and PCBs. Based on the results of the field explosives data, 6 of the 12 sediment samples were sent for off-site explosives analysis. One sample at the Ejector Station, (LL2-259) was analyzed for the full suite of parameters. Table 4-9 presents summary statistics and determination of SRCs in storm/sanitary sewer system sediment. Tables 4-56 through 4-59 present summary results for SRCs detected in storm and sanitary sewer sediment. The analytical results are presented in their entirety in Appendix I. Figure 4-34 presents the distribution of selected prevalent metal SRCs in storm/sanitary sewer sediment, and Figure 4-35 presents the distribution of detected pesticides and PCBs in storm/sanitary sewer sediment.

4.7.2.1 Explosives

Eight explosives compounds were detected in sediment in the storm/sanitary sewer (Table 4-56). The most compounds were detected at MH-B2; the highest concentration (25 mg/kg of HMX) also occurred at MH-B-2. DB-11 had the next highest concentration (10 mg/kg of 2,4,6-TNT). MH-B2 and DB-11 are near the melt-pour building DB-4 (Figure 4-36). No explosives or propellants compounds were detected at C-4, DB-6, DB-8, DA-12, DA-18, DB-20, and DB-21.

4.7.2.2 Inorganic constituents

Sixteen TAL metals and hexavalent chromium were detected above background criteria at least once in sediment among the 12 storm/sanitary sewer samples collected (Table 4-57). Eleven of these metals were detected at every station.

With a few exceptions, the most and highest concentrations above background occurred at Inlet DB-20, adjacent to Building DB-2. At Inlet DB-20, chromium was detected at a high concentration of 3,710 mg/kg, over 200 times background, mercury was detected at a maximum concentration of 4.9 mg/kg (83 times background), and antimony was detected at the highest concentration of 8,910 mg/kg. Manganese was detected only once above background at Inlet DB-6 at 1.3 times background. The maximum concentration of copper and nickel were found at Inlet C-4. Figure 4-34 shows the distribution of lead, nickel, copper, and zinc in the sampling sewer system sediments at Load Line 2.

Table 4-55. Summary of Sewer Line Video Survey Results

Manhole	Direction	Condition of Pipe
DB-21	South	Cracks throughout
	North	Under water, heavy debris, cracks
DB-20	South	Heavy debris
	North	Heavy debris
	East	Cracks, debris
DB-14	South	Cracks throughout
	North	Heavy debris
DB-12	South	Crack
	North	Cracks throughout
	East	Crack
DB-11	East	Cracks throughout
C4	West	Heavy debris
	South	Heavy debris
DA-12	North	Good
	South	Cracks throughout with fracture
	West	Metal in mouth of pipe, debris, light roots
DA-20	North	Camera under water
	South	Under water, heavy debris
DA-12	To B3	Survey ended because of large rocks
DB-12	To B3	Cracks throughout, fracture, heavy debris blocked
MH-310	North	Scale/mineral deposits
	South	Scale/mineral deposits
MH-307	North	Scale/mineral deposits
	South	Scale/mineral deposits; infiltration dripping
MH-305	North	Scale/mineral deposits; infiltration dripping
	South	Scale/mineral deposits, crack
MH-302	North	Heavy debris
	South	Crack, heavy debris
MH-337	North	Separated joint
	West	Debris
Ejector Station	East	Too murky to see

Table 4-56. Load Line 2 Sediment from Storm/Sanitary Sewers Sediment Samples Aggregate – Organics Explosives – Site-Related Contaminants

Functional Area		Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate
Station ID		**LL2-238**	**LL2-239**	**LL2-240**
Sample ID		**LL21103**	**LL21104**	**LL21106**
Date		**07/29/2001**	**08/06/2001**	**08/06/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Explosives				
1,3,5-Trinitrobenzene	mg/kg	0.25 U	0.25 U	0.25 U
2,4,6-Trinitrotoluene	mg/kg	0.74 =	0.78 =	21 J
2,4-Dinitrotoluene	mg/kg	0.25 U	0.25 U	0.47 U
2,6-Dinitrotoluene	mg/kg	0.25 U	0.25 UJ	2 UJ
2-Amino-4,6-dinitrotoluene	mg/kg	0.23 J	0.62 J	8.9 J
4-Amino-2,6-dinitrotoluene	mg/kg	0.59 =	0.94 =	22 J
HMX	mg/kg	0.5 U	0.5 U	25 J
RDX	mg/kg	0.17 J	0.5 U	13 J

Functional Area		Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate
Station ID		**LL2-242**	**LL2-250**	**LL2-259**
Sample ID		**LL21110**	**LL21121**	**LL21141**
Date		**07/28/2001**	**07/28/2001**	**07/31/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Explosives				
1,3,5-Trinitrobenzene	mg/kg	0.37 =	0.25 U	0.25 U
2,4,6-Trinitrotoluene	mg/kg	10 =	0.25 U	0.25 U
2,4-Dinitrotoluene	mg/kg	0.13 J	0.25 U	0.27 =
2,6-Dinitrotoluene	mg/kg	0.78 U	0.25 U	0.12 J
2-Amino-4,6-dinitrotoluene	mg/kg	5.5 =	0.25 U	0.1 J
4-Amino-2,6-dinitrotoluene	mg/kg	7.8 =	0.25 U	0.11 J
HMX	mg/kg	0.5 U	0.5 U	0.5 U
RDX	mg/kg	0.5 U	0.5 U	0.5 U

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
ID = Identification.
NA = Not analyzed.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
= - Detected result.
J - Estimated result
U - Not detected.

Table 4-57. Load Line 2 Sediment Storm/Sanitary Sewers Sediment Samples Aggregate – Inorganics – Site-Related Contaminants

Functional Area		Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate
Station ID		**LL2-235**	**LL2-236**	**LL2-237**	**LL2-238**	**LL2-239**	**LL2-240**
Sample ID		**LL21100**	**LL21101**	**LL21102**	**LL21103**	**LL21104**	**LL21106**
Date		**07/29/2001**	**07/28/2001**	**07/28/2001**	**07/29/2001**	**08/06/2001**	**08/06/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**						
General Chemistry							
Chromium, hexavalent	mg/kg	1.4 J	NA	NA	NA	NA	NA
Inorganics							
Antimony	mg/kg	5.3 J *	1.3 UJ	2.6 J *	4 J *	3.6 J *	14.9 J *
Arsenic	mg/kg	17.6 =	6.7 =	7.3 =	7.6 =	14 =	11.5 =
Barium	mg/kg	80.3 =	163 = *	149 = *	56.9 =	79 =	122 =
Beryllium	mg/kg	0.61 J *	0.34 J	1.5 = *	0.83 = *	1.1 = *	1.3 = *
Cadmium	mg/kg	0.98 J *	4.5 = *	3.6 = *	2.5 = *	3 = *	5 = *
Chromium	mg/kg	420 = *	14 =	30.1 = *	20 = *	43 = *	74.5 = *
Cobalt	mg/kg	8.2 =	14.1 = *	4.6 =	4.1 =	13.4 = *	8.6 =
Copper	mg/kg	2,540 = *	47.7 = *	260 = *	161 = *	92.2 = *	271 = *
Lead	mg/kg	1,670 J *	148 = *	185 = *	166 J *	111 = *	475 = *
Manganese	mg/kg	786 J	2,620 = *	1,780 =	448 J	210 =	203 =
Mercury	mg/kg	0.96 J *	0.057 J	0.061 J *	0.016 J	0.11 J *	0.2 J *
Nickel	mg/kg	82 J *	17 =	19.1 = *	29.1 J *	63.4 = *	62.1 = *
Selenium	mg/kg	2.7 J *	1.6 U	1.3 U	2.4 U	2.1 = *	1.6 =
Silver	mg/kg	0.41 J *	0.23 U	0.36 U	0.24 J *	0.51 J *	3.3 = *
Vanadium	mg/kg	15.8 =	11.5 =	16.6 =	9.8 =	26.6 = *	23.4 =
Zinc	mg/kg	332 J	1,110 = *	494 =	462 J	334 =	588 = *

Table 4-57. Load Line 2 Sediment Storm/Sanitary Sewers Sediment Samples Aggregate Inorganics Site-Related Contaminants (continued)

Functional Area		Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate
Station ID		**LL2-242**	**LL2-246**	**LL2-247**	**LL2-250**	**LL2-250**	**LL2-251**
Sample ID		**LL21110**	**LL21115**	**LL21116**	**LL21121**	**LL21174**	**LL21122**
Date		**07/28/2001**	**07/29/2001**	**07/28/2001**	**07/28/2001**	**07/28/2001**	**07/28/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Field Duplicate**	**Grab**
Analyte	**Units**						
General Chemistry							
Chromium, hexavalent	mg/kg	NA	NA	NA	NA	NA	NA
Inorganics							
Antimony	mg/kg	1.7 UJ	1.4 J *	1.3 UJ	7,150 J *	8,910 J *	845 J *
Arsenic	mg/kg	7.4 =	11.8 =	5.8 =	29.4 = *	36.2 = *	8.7 =
Barium	mg/kg	284 = *	71.2 =	33.7 =	2,030 = *	2,020 = *	245 = *
Beryllium	mg/kg	0.92 = *	0.81 U	0.32 J	0.56 J *	0.52 J *	0.41 J *
Cadmium	mg/kg	6.8 = *	0.99 = *	0.33 J *	11.2 = *	10.8 = *	3.7 = *
Chromium	mg/kg	40.2 = *	8.5 =	7.9 =	2,380 = *	3,710 = *	467 = *
Cobalt	mg/kg	8.5 =	7.6 =	5.4 =	58.5 = *	93.1 = *	20.9 = *
Copper	mg/kg	57 = *	28.3 = *	17.4 =	674 = *	1,350 = *	428 = *
Lead	mg/kg	1,530 = *	29.5 = *	26.6 =	14,600 = *	23,700 = *	5,280 = *
Manganese	mg/kg	1130 J	924 J	447 J	568 J	548 J	374 J
Mercury	mg/kg	0.13 J *	0.14 U	0.019 J	2.3 = *	4.9 = *	1.4 = *
Nickel	mg/kg	44.6 = *	12 =	29.4 = *	41.5 = *	65.3 = *	13.7 =
Selenium	mg/kg	1.4 U	1 J	2.5 U	3.5 J *	2.8 J *	1.4 J
Silver	mg/kg	0.84 U	0.69 U	0.63 U	0.48 J *	0.57 J *	0.77 U
Vanadium	mg/kg	13.3 =	13.3 =	7.7 =	11 =	18.9 =	10.4 =
Zinc	mg/kg	459 =	112 =	117 =	1,010 = *	1,960 = *	836 = *

ID = Identification.
NA = Not analyzed.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-58. Load Line 2 Sediment from Storm/Sanitary Sewers Sediment Samples Aggregate – Organics Semivolatile – Site-Related Contaminants

Functional Area		**Storm/Sanitary Sewers Sediment Samples Aggregate**
Station ID		**LL2-259**
Sample ID		**LL21141**
Date		**07/31/2001**
Depth (ft)		**0 - 1**
Sample Type		**Grab**
Analyte	**Units**	
Semivolatile Organics		
1,2-Dichlorobenzene	mg/kg	0.73 =
2,4-Dinitrotoluene	mg/kg	0.45 U
2,6-Dinitrotoluene	mg/kg	0.45 U
Benz(*a*)anthracene	mg/kg	0.19 J
Benzo(*a*)pyrene	mg/kg	0.26 J
Benzo(*b*)fluoranthene	mg/kg	0.34 J
Benzo(*g,h,i*)perylene	mg/kg	0.19 J
Benzo(*k*)fluoranthene	mg/kg	0.16 J
Chrysene	mg/kg	0.26 J
Fluoranthene	mg/kg	0.23 J
Indeno(1,2,3-*cd*)pyrene	mg/kg	0.19 J
Phenanthrene	mg/kg	0.15 J
Pyrene	mg/kg	0.2 J

ID = Identification.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-59. Load Line 2 Sediment from Storm/Sanitary Sewers Sediment Samples Aggregate – Organics Pesticides – Site-Related Contaminants

Functional Area		Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate
Station ID		**LL2-235**	**LL2-236**	**LL2-237**	**LL2-238**	**LL2-239**
Sample ID		**LL21100**	**LL21101**	**LL21102**	**LL21103**	**LL21104**
Date		**07/29/2001**	**07/28/2001**	**07/28/2001**	**07/29/2001**	**08/06/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**					
Pesticides and PCBs						
4,4'-DDE	mg/kg	NA	NA	NA	NA	NA
4,4'-DDT	mg/kg	NA	NA	NA	NA	NA
PCB-1254	mg/kg	0.45 =	3.7 =	4.4 =	6.9 =	0.099 UJ
PCB-1260	mg/kg	0.044 UJ	0.44 U	0.48 U	0.79 U	0.099 UJ

Functional Area		Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate
Station ID		**LL2-240**	**LL2-242**	**LL2-246**	**LL2-247**	**LL2-250**
Sample ID		**LL21106**	**LL21110**	**LL21115**	**LL21116**	**LL21121**
Date		**08/06/2001**	**07/28/2001**	**07/29/2001**	**07/28/2001**	**07/28/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**					
Pesticides and PCBs						
4,4'-DDE	mg/kg	NA	NA	NA	NA	NA
4,4'-DDT	mg/kg	NA	NA	NA	NA	NA
PCB-1254	mg/kg	5.3 =	31 =	1.5 =	0.042 U	10 =
PCB-1260	mg/kg	1.1 U	2.8 U	0.23 U	0.16 J	2 U

Table 4-59. Load Line 2 Sediment from Storm/Sanitary Sewers Sediment Samples Aggregate Organics Pesticides Site-Related Contaminants (continued)

Functional Area		Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate	Storm/Sanitary Sewers Sediment Samples Aggregate
Station ID		**LL2-250**	**LL2-251**	**LL2-259**
Sample ID		**LL21174**	**LL21122**	**LL21141**
Date		**07/28/2001**	**07/28/2001**	**07/31/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Field Duplicate**	**Grab**	**Grab**
Analyte	**Units**			
Pesticides and PCBs				
4,4'-DDE	mg/kg	NA	NA	0.0078 J
4,4'-DDT	mg/kg	NA	NA	0.01 J
PCB-1254	mg/kg	7.5 =	4.3 =	0.11 =
PCB-1260	mg/kg	1 U	0.51 U	0.045 U

ID = Identification.
NA = Not analyzed.
PCB = Polychlorinated biphenyl.
= - Detected result.
J - Estimated result.
U - Not detected.

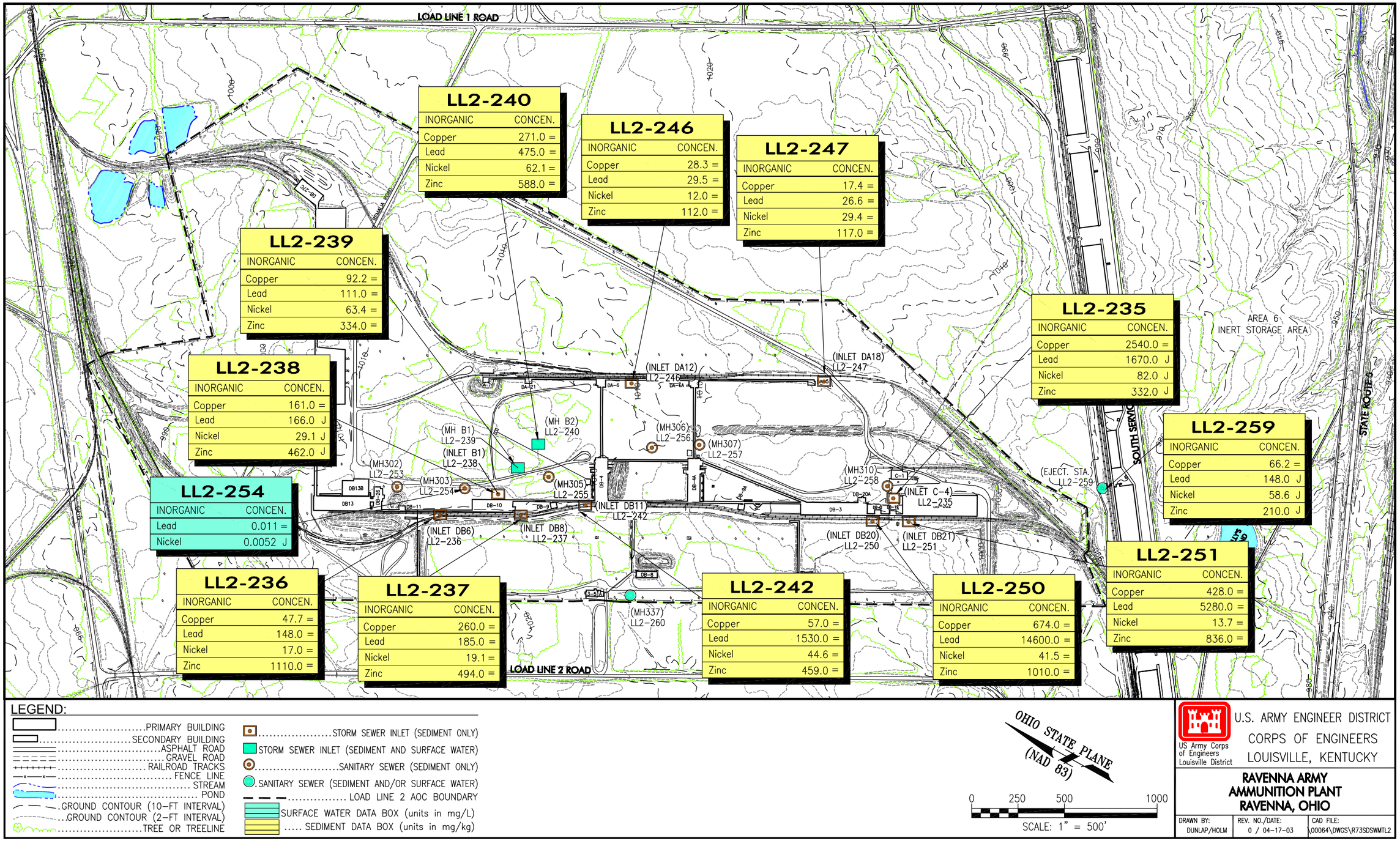


Figure 4-34. Distribution of Lead, Nickel, Copper, and Zinc in the Sewer System at Load Line 2

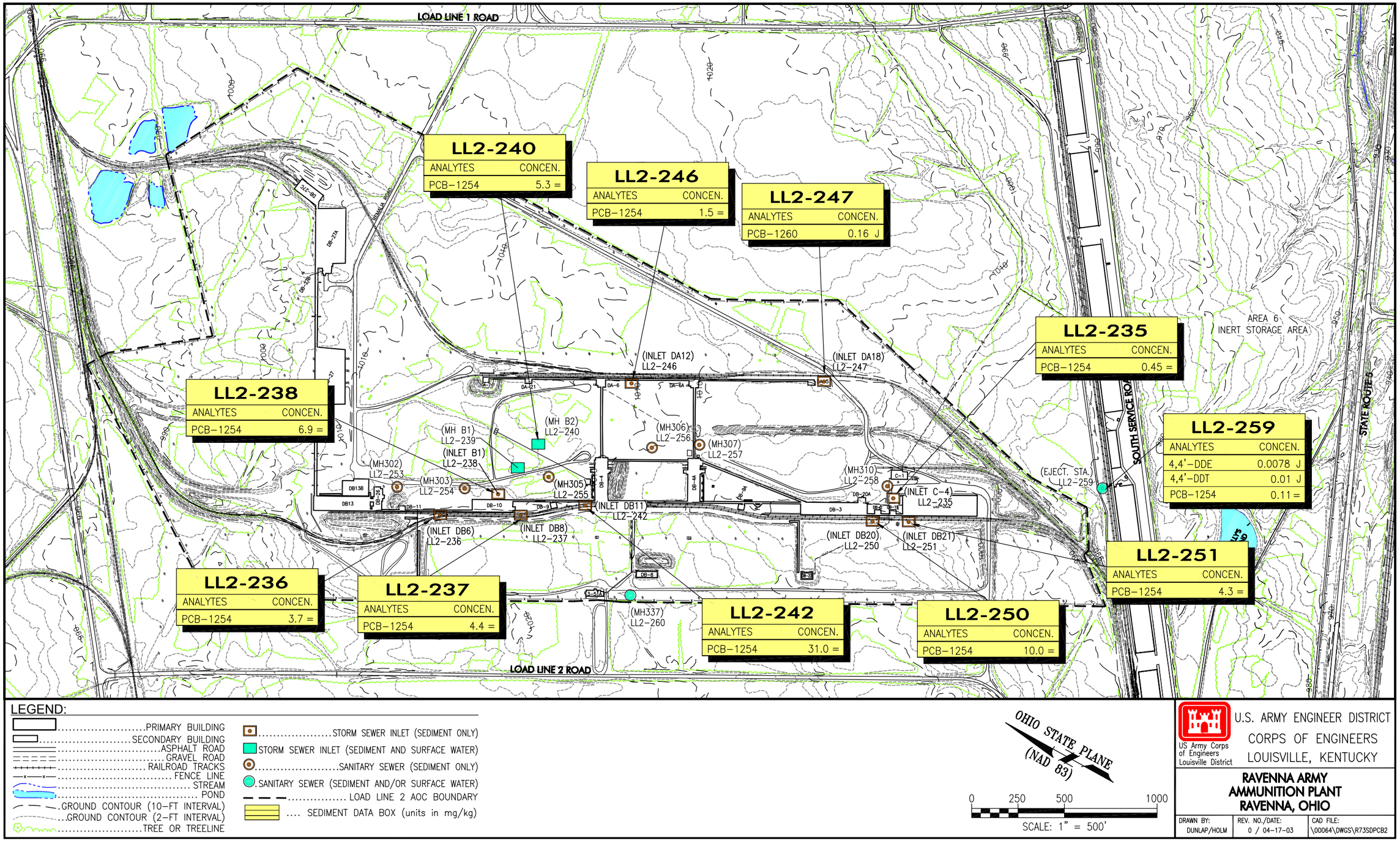


Figure 4-35. Distribution of Detected Pesticides and PCBs in the Sewer System Sediment at Load Line 2

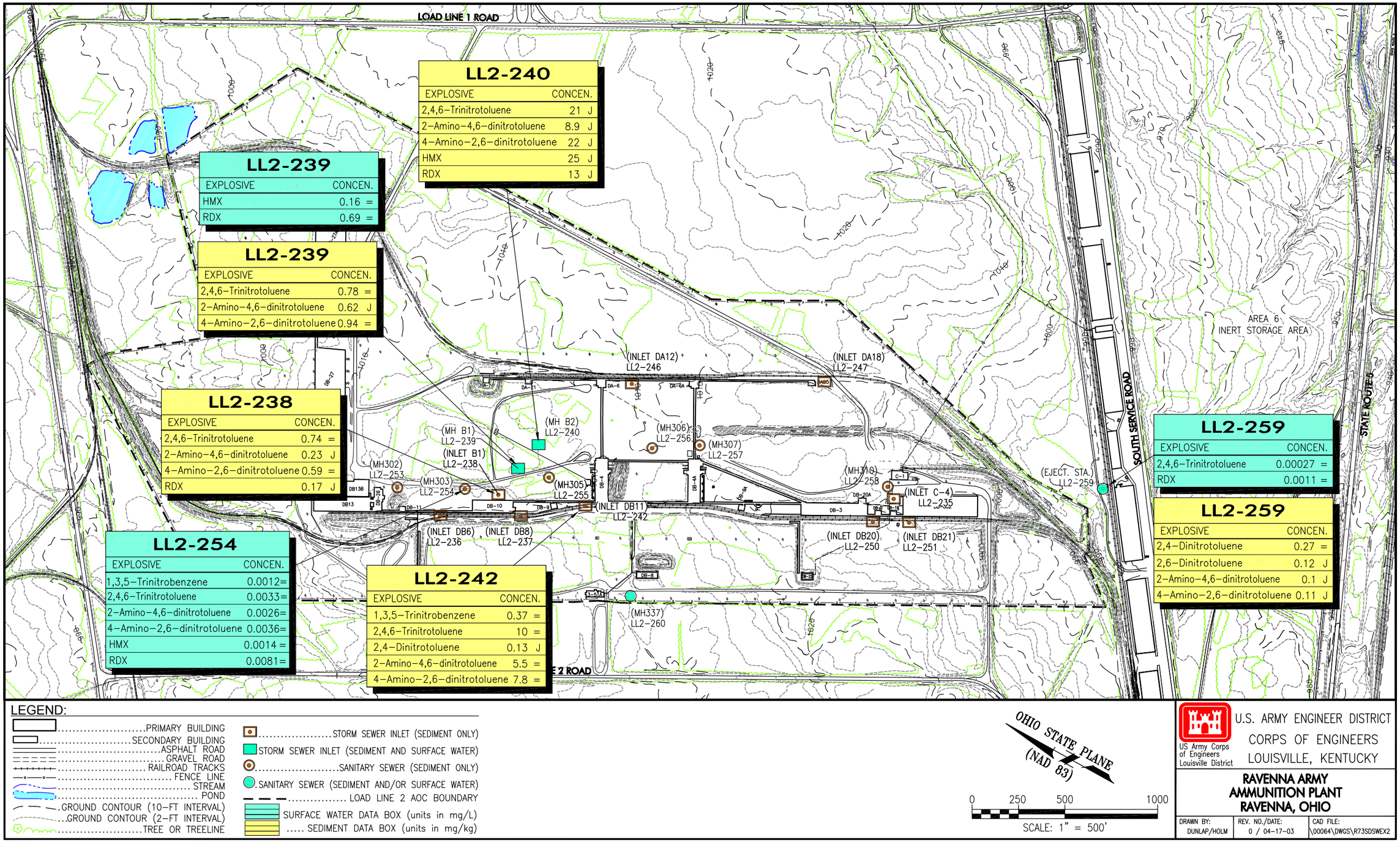


Figure 4-36. Distribution of Detected Explosives in the Sewer System at Load Line 2

Hexavalent chromium was detected at Inlet C-4 at a concentration of 1.4 mg/kg.

4.7.2.3 SVOCs, VOCs, and PCBs/pesticides

Only one sediment sample was submitted for full suite analysis collected, the Ejector Station (LL2-259). Eleven SVOCs were detected in this sample (Table 4-58). Benzoic acid (2.2 mg/kg) was the highest detected SVOC. No VOCs were detected. Two pesticides [4,4-DDE and 4,4- dichlorodiphenyltrichloroethane (DDT)] were detected. PCBs were collected at all 12 sediment stations (Table 4-59). PCB-1254 was detected in 10 of the 12 sediment samples at a high concentration of 31 mg/kg at DB-11 (Figure 4-34). PCB-1260 was detected in 1 sediment sample at a concentration of 0.016 mg/kg at DA-18.

4.7.3 Storm/Sanitary Sewer Water Samples

Water samples were collected from four storm/sanitary sewer system manholes during the Phase II RI to determine whether residual contamination exists within the system and whether the pipelines may be functioning as a preferential migration pathway or source of contaminants to groundwater. Table 4-10 presents summary statistics and determination of SRCs in sanitary and storm sewer system water. Tables 4-60 and 4-61 contain summary data for water samples collected from the sanitary sewer system. Background values for surface water were used conservatively to screen for SRCs. The water samples were analyzed for explosives, propellants, TAL metals, cyanide, VOCs, SVOCs, and PCBs/pesticides. The analytical results are presented in their entirety in Appendix I. Figures 4-34 and 4-36 present the distributions of selected pervasive explosives and metals SRCs in sanitary sewer system water.

4.7.3.1 Explosives

Six explosives were detected in water from the four sampling locations (Table 4-60). Most frequently detected compounds were RDX (four detections), 2,4,6-TNT (four detections), 2-amino-4,6-DNT (four detections), 4-amino-2,6-DNT (four detections), and HMX (three detections) (Figure 4-36). The highest concentrations of all explosives detected occurred at MH-B1 (0.69 mg/L of RDX). Explosives compounds decreased from MH-B1 to MH-B2 to MH-304. The number and concentration of explosives compounds were lowest at the Ejector Station (Table 4-60).

4.7.3.2 Inorganic constituents

Surface water collected from MH-B1, the station furthest upgradient, contained the most and generally highest concentration of TAL metals within the sewer system. Lead and nickel were the most frequently detected above background at three of the four stations sampled and are shown in Figure 4-34 to represent inorganic SRCs. Lead was detected at a high concentration of 0.12 mg/L at MH-B1. Nickel was also detected at its highest concentration at MH-B1 at 0.0061 mg/L.

Antimony, lead, nickel, and silver were detected above background at MH-304 (Table 4-61). MH-B2 only had two metals exceeding background (lead and nickel). No metals above background were detected in the Ejector Station.

4.7.3.3 SVOCs, VOCs, and PCBs/pesticides

No pesticides, PCBs, or SVOCs were detected in the storm/sanitary sewer water samples. One VOC trichloroethene was detected at the Ejector Station at a concentration of 0.0021 mg/L (Table 4-60).

Table 4-60. Load Line 2 Surface Water Storm/Sanitary Sewers Water Samples Aggregate – Organics – Site-Related Contaminants

Functional Area		Storm/Sanitary Sewers Water Samples Aggregate	Storm/Sanitary Sewers Water Samples Aggregate	Storm/Sanitary Sewers Water Samples Aggregate	Storm/Sanitary Sewers Water Samples Aggregate
Station ID		**LL2-239**	**LL2-240**	**LL2-254**	**LL2-259**
Sample ID		**LL21111**	**LL21107**	**LL21105**	**LL21142**
Date		**08/06/2001**	**08/01/2001**	**08/01/2001**	**07/31/2001**
Depth (ft)		**0 - 0**	**0 - 0**	**0 - 0**	**0 - 0**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**				
Explosives					
1,3,5-Trinitrobenzene	mg/L	0.002 U	0.0002 U	0.0012 =	0.0002 U
2,4,6-Trinitrotoluene	mg/L	0.37 =	0.15 =	0.0033 =	0.00027 =
2-Amino-4,6-dinitrotoluene	mg/L	0.19 =	0.075 =	0.0026 =	0.00074 =
4-Amino-2,6-dinitrotoluene	mg/L	0.26 =	0.12 =	0.0036 =	0.00069 =
HMX	mg/L	0.16 =	0.069 =	0.0014 =	0.0005 U
RDX	mg/L	0.69 =	0.34 =	0.0081 =	0.0011 =
Volatile Organics					
Trichloroethene	mg/L	NA	NA	NA	0.0021 =

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
NA = Not analyzed.
ID = Identification.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-61. Load Line 2 Surface Water Storm/Sanitary Sewers Water Samples Aggregate – Inorganics – Site-Related Contaminants

Functional Area		Storm/Sanitary Sewers Water Samples Aggregate	Storm/Sanitary Sewers Water Samples Aggregate	Storm/Sanitary Sewers Water Samples Aggregate	Storm/Sanitary Sewers Water Samples Aggregate
Station ID		**LL2-239**	**LL2-240**	**LL2-254**	LL2-259
Sample ID		**LL21111**	**LL21107**	**LL21105**	LL21142
Date		**08/06/2001**	**08/01/2001**	**08/01/2001**	07/31/2001
Depth (ft)		**0 - 0**	**0 - 0**	**0 - 0**	0 - 0
Sample Type		**Grab**	**Grab**	**Grab**	Grab
Analyte	**Units**				
Inorganics					
Antimony	mg/L	0.0053 = *	0.01 U	0.0048 J *	0.01 U
Cadmium	mg/L	0.0023 = *	0.005 U	0.005 U	0.005 U
Chromium	mg/L	0.005 = *	0.0015 U	0.005 U	0.005 U
Copper	mg/L	0.039 = *	0.0049 J	0.015 U	0.015 U
Lead	mg/L	0.12 = *	0.012 = *	0.011 = *	0.01 U
Nickel	mg/L	0.0061 J *	0.0046 J *	0.0052 J *	0.025 U
Silver	mg/L	0.005 U	0.005 U	0.03 = *	0.005 U
Vanadium	mg/L	0.0028 J *	0.007 U	0.007 U	0.007 U
Zinc	mg/L	0.13 = *	0.023 U	0.036 U	0.024 U

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

4.8 BUILDINGS AND STRUCTURES

As described in Section 4.1, samples collected from various buildings and structures included soil beneath building floor slabs, sediment/sludges and accumulated water from sedimentation and washout basins, and floor sweep samples from several former production buildings. Table 4-62 summarizes samples collected from buildings and structures; locations of these samples are shown on Figures 3-1 through 3-3 and Figure 3-7. The evaluation of these data is limited in that summary statistics and screening to identify SRCs are not conducted for this data aggregate. Comparisons of floor sweep sample TCLP results to their respective hazardous waste criteria are presented in Section 4.8.3.

4.8.1 Building Sub-floor Samples

As noted in Table 4-62, 17 samples of soil beneath building floor slabs were collected and analyzed for field explosives, TAL metals, and PCBs. In addition, sample station LL2-077 beneath the Building DB-27B boiler plant floor slab was analyzed for cyanide, SVOCs, VOCs, and pesticides. Stations LL2-173 and LL2-174 (powerhouse) also included SVOC analyses, and station LL2-136 included cyanide analysis.

Table 4-63 presents results for inorganics detected at least once in the sub-floor soil aggregate. Table 4-64 presents results for detected organic constituents. All field results for TNT and RDX were less than 1 mg/kg; thus, no sub-floor soil samples were submitted for fixed-base laboratory analysis of explosives. TAL metals concentrations in all samples generally reflect an absence of inorganic contamination that may be attributed to facility operations. No SVOCs were detected in the samples submitted for these analyses. A few detections of low concentrations of PCB-1254 were observed and trace levels of three VOCs were detected in the sample collected at station LL2-077.

4.8.2 Washout Annexes and Sedimentation Basins

Four sediment and water samples were collected from washout sumps located inside of Buildings DB-4 and DB-4A. The washout sumps were in generally sound physical condition. The sludge or sediment in these sumps was approximately 0.1 ft thick, and described as black muck with paint chips, rust flakes, decayed leaves, and other debris from the buildings (see Appendix B). It was noted that the sample from LL2-229 “smells bad.” Inorganic constituents, in particular cadmium, chromium, copper, lead, and zinc, were detected at high concentrations in all samples, with station LL2-227 exhibiting the highest concentrations and number of constituents (Table 4-65). Sediment samples collected from these washout annexes contained detectable quantities of several explosive and propellant compounds (Table 4-66). The north washout annexes in both DB-4 (LL2-227) and DB-4A (LL2-229) contained the highest concentrations of this class of contaminants, with 2,4,6-TNT, RDX, and HMX as the major constituents present. Lead concentrations were the highest observed among any media at the load line. Detectable mercury and silver were present in each sample collected from the annexes. A number of pesticides was detected at low concentrations. PCB-1254 was prevalent in all four basins at concentrations ranging from 170 to 3,200 mg/kg. Multiple SVOCs, primarily PAHs, were detected in the sample collected at LL2-230 (DB-4A south annex).

Table 4-62. Load Line 2 Phase II RI Summary of Samples Collected from Buildings and Structures

Location	Station ID	Sample Type
Building Sub-floor Samples		
DB-27 Cyclic Heat Building	LL2-070	Sub-floor Soil
DB-27A Cyclic Heat Building	LL2-075	Sub-floor Soil
DB27B Boiler Plant (HVAC)	LL2-077	Sub-floor Soil
DA 6 Explosives Preparation	LL2-084	Sub-floor Soil
	LL2-085	Sub-floor Soil
DA-6A Explosives Preparation	LL2-091	Sub-floor Soil
	LL2-092	Sub-floor Soil
DB-10 Drilling and Assembly	LL2-123	Sub-floor Soil
	LL2-124	Sub-floor Soil
DB-4 Melt-Load Building/SPCC	LL2-135	Sub-floor Soil
	LL2-136	Sub-floor Soil
	LL2-137	Sub-floor Soil
DB-4A Melt-Load Building/SPCC	LL2-151	Sub-floor Soil
	LL2-152	Sub-floor Soil
	LL2-153	Sub-floor Soil
DC-1 Powerhouse 2	LL2-173	Sub-floor Soil
	LL2-174	Sub-floor Soil
Washout Annexes and Sedimentation/Filter Basins		
Covered Sedimentation Basin	LL2-226	Sediment and water samples
DB-4 Melt-Pour Building - North Washout Annex	LL2-227	Sediment and water samples
DB-4 Melt-Pour Building - South Washout Annex	LL2-228	Sediment and water samples
DB-4A Melt-Pour Building - North Washout Annex	LL2-229	Sediment and water samples
DB-4A Melt-Pour Building - South Washout Annex	LL2-230	Sediment and water samples
Floor Sweep Samples		
DB-10 Drilling and Assembly	LL2-125	Floor sweep sample; As^{+3}, TCLP also collected
DB-4 Melt-Load Building/SPCC	LL2-138	Floor sweep; As^{+3} and TCLP collected
DB-3	LL2-168	Floor sweep sample; As^{+3}, TCLP also collected
Ballast and Slag Samples		
	LL2-177	Ballast sample
Railroad Track DH	LL2-214	Ballast sample
	LL2-216	Ballast sample

HVAC = Heating, ventilation, and air conditioning.
ID = Identification.
TCLP = Toxicity characteristic leaching procedure.

Table 4-63. Buildings and Structures Soil Beneath Building Floor Slabs – Inorganics

Functional Area		Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate
Station ID		**LL2-070**	**LL2-075**	**LL2-077**	**LL2-084**	**LL2-085**	**LL2-091**
Sample ID		**LL2ss-070-0702-SO**	**LL2ss-075-0715-SO**	**LL2ss-077-0719-SO**	**LL2ss-084-0738-SO**	**LL2ss-085-0739-SO**	**LL2ss-091-0755-SO**
Date		**07/25/2001**	**07/25/2001**	**07/25/2001**	**07/25/2001**	**07/25/2001**	**07/26/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**						
Aluminum	mg/kg	5,780 =	5,720 =	7,370 =	6,610 =	5,680 =	6,330 =
Antimony	mg/kg	1.1 R	1.1 R	1.2 R	1.1 UJ	1.1 UJ	1.1 R
Arsenic	mg/kg	13.1 =	10.3 =	11.9 =	11.5 =	11.7 =	25.7 =
Barium	mg/kg	33.7 =	24 =	39.3 =	30.3 =	27.8 =	30.5 =
Beryllium	mg/kg	0.33 U	0.34 U	0.41 U	0.3 U	0.27 U	0.32 U
Cadmium	mg/kg	0.53 U	0.55 U	0.58 U	0.54 U	0.53 U	0.13 J
Calcium	mg/kg	4,740 =	960 =	723 =	13,200 =	2,730 =	3,660 =
Chromium	mg/kg	7.7 =	7.1 =	8.7 =	7.2 =	6.9 =	7.6 =
Cobalt	mg/kg	8.9 J	6 J	8.6 J	5.3 =	8.5 =	6.9 J
Copper	mg/kg	18.7 =	13.9 =	11.2 =	19.4 =	20.4 =	25.9 =
Iron	mg/kg	17,300 =	16,000 =	17,800 =	15,200 =	15,500 =	21,500 =
Lead	mg/kg	27.2 =	9.2 =	12.1 =	12.1 =	12.2 =	15 =
Magnesium	mg/kg	2,160 =	1,270 =	1,280 =	1,890 =	2,040 =	2,030 =
Manganese	mg/kg	394 J	211 J	541 J	274 =	339 =	459 J
Mercury	mg/kg	0.11 U	0.11 U	0.015 J	0.11 U	0.0092 J	0.11 U
Nickel	mg/kg	14.7 =	10 =	10.5 =	11.9 =	14.2 =	17.3 =
Potassium	mg/kg	492 J	506 J	670 =	759 =	853 =	810 =
Selenium	mg/kg	2.1 U	0.5 J	2.3 U	2.2 U	2.1 U	2.2 U
Sodium	mg/kg	532 U	549 U	583 U	542 U	532 U	560 U
Thallium	mg/kg	0.65 =	0.68 =	0.68 =	0.39 =	0.38 =	0.58 =
Vanadium	mg/kg	9 =	10.8 =	16.2 =	10.5 =	8.8 =	10.7 =
Zinc	mg/kg	46.8 =	44.9 =	40.4 =	56.1 =	64.3 =	113 =

Table 4-63. Buildings and Structures Soil Beneath Building Floor Slabs Inorganics (continued)

Functional Area		Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate
Station ID		**LL2-092**	**LL2-123**	**LL2-124**	**LL2-135**	**LL2-136**	**LL2-137**
Sample ID		**LL2ss-092-0756-SO**	**LL2ss-123-0847-SO**	**LL2ss-124-0848-SO**	**LL2ss-135-0877-SO**	**LL2ss-136-0878-SO**	**LL2ss-137-0879-SO**
Date		**07/26/2001**	**07/25/2001**	**07/25/2001**	**07/28/2001**	**07/28/2001**	**07/28/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**						
Aluminum	mg/kg	5,930 =	7,090 =	7,750 =	6,020 =	1,900 =	7,590 =
Antimony	mg/kg	1.1 R	1.1 UJ	1.1 UJ	1.1 UJ	1 UJ	1.3 J
Arsenic	mg/kg	8.8 =	22 =	12.2 =	11.2 =	7.5 =	12.6 =
Barium	mg/kg	28.8 =	45.2 =	33.5 =	27.3 =	14.4 =	38.9 =
Beryllium	mg/kg	0.29 U	0.35 U	0.35 U	0.28 J	0.14 U	0.32 J
Cadmium	mg/kg	0.55 U	0.54 U	0.55 U	0.15 J	0.1 J	0.18 J
Calcium	mg/kg	1,660 =	2,630 =	1,360 =	8,980 =	16,900 =	1,750 =
Chromium	mg/kg	7.1 =	8.3 =	8.4 J	7.2 =	3 =	8.9 =
Cobalt	mg/kg	5.8 J	15.1 J	8.9 J	6.3 =	4.1 =	7.4 =
Copper	mg/kg	17 =	18.8 =	20.5 =	18.2 =	10.7 =	22.5 =
Iron	mg/kg	13,700 =	18,600 =	18,900 J	16,400 =	8,800 =	19,500 =
Lead	mg/kg	10.8 =	17.7 =	15.4 =	12.1 =	9.4 =	17.8 =
Magnesium	mg/kg	1,740 =	1,790 =	1,960 =	1,720 =	2,240 =	2,120 =
Manganese	mg/kg	294 J	484 J	464 =	273 J	311 =	414 J
Mercury	mg/kg	0.11 U	0.016 J	0.025 J	0.024 J	0.012 J	0.011 J
Nickel	mg/kg	12.6 =	14.9 =	15 =	13.4 =	6.7 =	15.1 =
Potassium	mg/kg	938 =	816 =	777 =	544 =	283 J	659 =
Selenium	mg/kg	2.2 U	2.2 U	0.38 J	0.58 U	2.1 U	0.44 U
Sodium	mg/kg	64.8 J	60.6 J	552 U	532 U	517 U	551 U
Thallium	mg/kg	0.67 =	0.48 =	0.43 =	0.33 =	0.13 J	0.43 =
Vanadium	mg/kg	9 =	11.2 =	12.7 =	10.7 =	3.8 =	13.4 =
Zinc	mg/kg	48.7 =	67.1 =	59.9 =	54.6 =	33.9 =	65.9 =

Table 4-63. Buildings and Structures Soil Beneath Building Floor Slabs Inorganics (continued)

Functional Area		Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate
Station ID		**LL2-151**	**LL2-152**	**LL2-153**	**LL2-173**	**LL2-174**
Sample ID		**LL2ss-151-0917-SO**	**LL2ss-152-0918-SO**	**LL2ss-153-0919-SO**	**LL2ss-173-0975-SO**	**LL2ss-174-0976-SO**
Date		**07/27/2001**	**07/27/2001**	**07/27/2001**	**07/26/2001**	**07/26/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**					
Aluminum	mg/kg	11,600 =	8,840 =	7,400 =	7,050 =	5,090 =
Antimony	mg/kg	1.1 UJ	1.1 UJ	1.1 UJ	1.2 UJ	1.1 UJ
Arsenic	mg/kg	11.8 =	10.6 =	9.2 =	13.1 =	10 =
Barium	mg/kg	148 =	45.6 =	42.1 =	38.6 =	22.6 =
Beryllium	mg/kg	1.1 =	0.43 U	0.37 U	0.39 U	0.25 U
Cadmium	mg/kg	0.56 U	0.25 J	0.072 U	0.58 U	0.54 U
Calcium	mg/kg	1,400 J	18,700 J	3230 J	6,300 =	3,020 =
Chromium	mg/kg	14.6 =	11.1 =	8.4 =	9.2 =	5.9 =
Cobalt	mg/kg	23.4 =	7.2 =	10.3 =	7 =	4.9 =
Copper	mg/kg	17.5 =	21.5 =	17.6 =	16.1 =	17.7 =
Iron	mg/kg	22,500 =	19,800 =	15,400 =	17,000 =	13,000 =
Lead	mg/kg	9.9 =	13.1 =	11 =	15.2 =	10.9 =
Magnesium	mg/kg	3,500 =	3,480 =	2,310 =	2,390 =	1,890 =
Manganese	mg/kg	352 =	321 =	426 =	303 =	265 =
Mercury	mg/kg	0.11 U	0.011 J	0.11 U	0.012 J	0.018 J
Nickel	mg/kg	27 =	16.9 =	14.3 =	15.6 =	11.1 =
Potassium	mg/kg	1,780 J	1,430 J	1,320 J	976 =	525 J
Selenium	mg/kg	2.2 U	2.3 U	2.2 U	2.3 U	2.2 U
Sodium	mg/kg	87.3 U	566 U	561 U	582 U	543 U
Thallium	mg/kg	0.48 =	0.93 =	0.72 J	0.49 =	0.42 =
Vanadium	mg/kg	15.5 =	13.7 =	11.2 =	11 =	7.7 =
Zinc	mg/kg	61.6 =	256 =	52 =	68.2 =	54.1 =

ID = Identification.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-64. Buildings and Structures Soil Beneath Buildings Floor Slabs – Organics

Functional Area		Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate
Station ID		**LL2-070**	**LL2-075**	**LL2-077**	**LL2-084**	**LL2-085**	**LL2-091**
Sample ID		**LL2ss-070-0702-SO**	**LL2ss-075-0715-SO**	**LL2ss-077-0719-SO**	**LL2ss-084-0738-SO**	**LL2ss-085-0739-SO**	**LL2ss-091-0755-SO**
Date		**07/25/2001**	**07/25/2001**	**07/25/2001**	**07/25/2001**	**07/25/2001**	**07/26/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**						
PCB-1254	mg/kg	0.035 U	0.036 U	0.038 U	0.036 U	0.035 U	0.037 U
2-Butanone	mg/kg	NA	NA	0.0084 J	NA	NA	NA
Acetone	mg/kg	NA	NA	0.073 =	NA	NA	NA
Toluene	mg/kg	NA	NA	0.00074 J	NA	NA	NA

Functional Area		Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate
Station ID		**LL2-092**	**LL2-123**	**LL2-124**	**LL2-135**	**LL2-136**	**LL2-137**
Sample ID		**LL2ss-092-0756-SO**	**LL2ss-123-0847-SO**	**LL2ss-124-0848-SO**	**LL2ss-135-0877-SO**	**LL2ss-136-0878-SO**	**LL2ss-137-0879-SO**
Date		**07/26/2001**	**07/25/2001**	**07/25/2001**	**07/28/2001**	**07/28/2001**	**07/28/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**						
PCB-1254	mg/kg	0.036 U	0.036 U	0.63 =	0.052 =	0.034 U	0.036 U
2-Butanone	mg/kg	NA	NA	NA	NA	NA	NA
Acetone	mg/kg	NA	NA	NA	NA	NA	NA
Toluene	mg/kg	NA	NA	NA	NA	NA	NA

Table 4-64. Buildings and Structures Soil Beneath Buildings Floor Slabs Organics (continued)

Functional Area		Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate	Soil Beneath Building Floor Slabs Aggregate
Station ID		**LL2-151**	**LL2-152**	**LL2-153**	**LL2-173**	**LL2-174**
Sample ID		**LL2ss-151-0917-SO**	**LL2ss-152-0918-SO**	**LL2ss-153-0919-SO**	**LL2ss-173-0975-SO**	**LL2ss-174-0976-SO**
Date		**07/27/2001**	**07/27/2001**	**07/27/2001**	**07/26/2001**	**07/26/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**					
PCB-1254	mg/kg	0.037 U	0.037 U	0.037 U	0.038 U	0.036 U
2-Butanone	mg/kg	NA	NA	NA	NA	NA
Acetone	mg/kg	NA	NA	NA	NA	NA
Toluene	mg/kg	NA	NA	NA	NA	NA

ID = Identification.
NA = Not analyzed.
PCB = Polychlorinated biphenyl.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-65. Buildings and Structures Sediment from Process Effluent Sumps Inside of Buildings – Inorganics

Functional Area		Pink Water and Washdown Sedimentation Sumps Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate
Station ID		**LL2-226**	**LL2-227**	**LL2-228**	**LL2-229**	**LL2-230**
Sample ID		**LL2sd-226-1082-SD**	**LL2sd-227-1084-SD**	**LL2sd-228-1086-SD**	**LL2sd-229-1088-SD**	**LL2sd-230-1090-SD**
Date		**07/30/2001**	**07/30/2001**	**07/30/2001**	**07/30/2001**	**07/30/2001**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**					
Cyanide	mg/kg	3.9 U	23.9 =	0.84 U	3.3 =	2.5 =
Aluminum	mg/kg	8,960 =	19,700 =	7,800 =	5,460 J	30,200 J
Antimony	mg/kg	7.4 J	34.1 J	4.8 J	13.9 J	22.4 J
Arsenic	mg/kg	24.8 J	60.8 =	16.1 J	14.1 =	37.1 =
Barium	mg/kg	1,010 J	17,500 =	1,100 J	232 =	376 =
Beryllium	mg/kg	0.88 U	2.3 J	0.59 J	0.43 U	0.65 U
Cadmium	mg/kg	23.9 J	187 =	10.2 J	29.3 =	36.7 =
Calcium	mg/kg	24,000 =	139,000 =	122,000 =	59,400 =	127,000 =
Chromium	mg/kg	78.1 J	2,760 =	125 J	263 =	403 =
Cobalt	mg/kg	11.4 J	227 =	40.5 J	37.1 J	59.6 J
Copper	mg/kg	344 J	2,550 =	330 J	745 =	1,010 =
Iron	mg/kg	64,600 J	251,000 =	126,000 J	77,700 =	317,000 =
Lead	mg/kg	1,270 J	23,300 =	852 J	2,240 =	3,080 =
Magnesium	mg/kg	2,510 J	16,900 J	3,910 =	2,320 =	5,150 =
Manganese	mg/kg	477 J	1,870 =	909 J	561 =	2,010 =
Mercury	mg/kg	0.52 J	1 =	0.39 J	0.22 J	0.96 =
Nickel	mg/kg	92.7 J	179 =	55.6 J	46.4 =	264 =
Potassium	mg/kg	1,450 J	3,090 J	1,710 =	1,080 J	2,170 =
Selenium	mg/kg	5.6 J	7.8 J	0.96 J	0.76 J	4.2 J
Silver	mg/kg	16 =	9.9 =	0.58 J	3 =	1.9 =
Sodium	mg/kg	3,950 U	1,280 J	210 J	284 J	282 J
Thallium	mg/kg	1.3 J	1.5 J	0.23 J	0.28 UJ	0.61 UJ
Vanadium	mg/kg	23.1 J	69.4 =	11.3 J	12.8 =	22 =
Zinc	mg/kg	5,370 =	13,400 =	912 =	1,940 =	1,480 =

ID = Identification.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-66. Building and Structures Sediment from Process Effluent Sumps Inside of Buildings – Organics

Functional Area		Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate
Station ID		**LL2-227**	**LL2-228**	**LL2-229**	**LL2-230**
Sample ID		**LL2sd-227-1084-SD**	**LL2sd-228-1086-SD**	**LL2sd-229-1088-SD**	**LL2sd-230-1090-SD**
Date		**07/30/2001**	**07/30/2001**	**07/30/2001**	**07/30/2001**
Depth (ft)		**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**				
1,3,5-Trinitrobenzene	mg/kg	0.87 J	1.2 J	5 U	0.42 =
2,4,6-Trinitrotoluene	mg/kg	130 J	39 J	45 =	45 =
2-Amino-4,6-dinitrotoluene	mg/kg	10 =	6.9 J	5 U	2.7 =
4-Amino-2,6-dinitrotoluene	mg/kg	28 U	22 J	11 U	8.8 U
HMX	mg/kg	270 =	11 J	1,100 =	30 =
Nitrocellulose	mg/kg	124 J	36.5 J	926 =	20.3 =
Nitroguanidine	mg/kg	0.11 J	0.073 J	0.079 J	0.18 J
RDX	mg/kg	14 =	18 J	320 =	25 =
4,4'-DDE	mg/kg	230 J	6.8 =	47 J	10 J
Dieldrin	mg/kg	39 U	0.57 U	4.1 J	1 U
Endrin	mg/kg	39 U	0.57 U	2.8 =	1 U
Endrin Aldehyde	mg/kg	200 J	3.1 J	52 J	9.3 J
PCB-1254	mg/kg	3,200 =	170 J	1,500 =	570 =
alpha-Chlordane	mg/kg	39 U	0.57 U	2.9 J	1 U
gamma-Chlordane	mg/kg	320 J	4.1 J	27 J	5.5 J
2,6-Dinitrotoluene	mg/kg	31 U	2.2 UJ	0.43 J	10 U
2-Methylnaphthalene	mg/kg	31 U	2.2 UJ	0.77 UJ	2.1 J
Acenaphthene	mg/kg	31 U	2.2 UJ	0.77 UJ	6.5 J
Anthracene	mg/kg	31 U	2.2 UJ	0.77 UJ	12 =
Benz(*a*)anthracene	mg/kg	31 U	2.2 UJ	0.77 UJ	25 =
Benzo(*a*)pyrene	mg/kg	31 U	2.2 UJ	0.77 UJ	23 =
Benzo(*b*)fluoranthene	mg/kg	31 U	2.2 UJ	0.27 J	29 =
Benzo(*g,h,i*)perylene	mg/kg	31 U	2.2 UJ	0.77 UJ	9.9 J
Benzo(*k*)fluoranthene	mg/kg	31 U	2.2 UJ	0.77 UJ	12 =
Benzoic Acid	mg/kg	150 U	11 UJ	1.2 J	48 U
Bis(2-ethylhexyl)phthalate	mg/kg	31 U	2.2 UJ	1 J	10 U
Carbazole	mg/kg	31 U	2.2 UJ	0.77 UJ	6.2 J
Chrysene	mg/kg	31 U	2.2 UJ	0.77 UJ	31 =
Dibenz*(a,h)*anthracene	mg/kg	31 U	2.2 UJ	0.77 UJ	2.9 J
Dibenzofuran	mg/kg	31 U	2.2 UJ	0.77 UJ	3.7 J
Fluoranthene	mg/kg	6.9 J	2.2 UJ	0.65 J	58 J
Fluorene	mg/kg	31 U	2.2 UJ	0.77 UJ	7 J
Indeno(1,2,3-*cd*)pyrene	mg/kg	31 U	2.2 UJ	0.77 UJ	8.8 J
Naphthalene	mg/kg	31 U	2.2 UJ	0.77 UJ	10 =
Pentachlorophenol	mg/kg	31 U	2.2 UJ	0.83 J	10 U
Phenanthrene	mg/kg	31 U	2.2 UJ	0.17 J	60 J
Pyrene	mg/kg	7.2 J	2.2 UJ	0.48 J	63 J
2-Butanone	mg/kg	0.19 U	0.017 J	0.047 U	0.061 U
Acetone	mg/kg	0.092 J	0.062 J	0.048 UJ	0.061 UJ
Toluene	mg/kg	0.009 J	0.0099 U	0.012 U	0.015 U

= - Detected result.
J - Estimated result.
U - Not detected.

Water samples from the washout annex basins showed detectable concentrations of metals and explosives corresponding to those observed at high concentrations in sediment (Tables 4-67 and 4-68).

Sediment and water samples were also collected from the covered sedimentation basin located north of Building DB-4 (station LL2-226). The sedimentation basin structure was in generally poor condition and was full of water. The sediment was approximately 0.3 ft thick, and was described as dark black to very dark grey muck with decaying pin oak leaves (Appendix B). Sediment contained elevated levels of numerous metals, notably cadmium, chromium, copper, lead, silver, and zinc. Lead (1,270 mg/kg) and silver (16 mg/kg) concentrations in this sample were also among the highest observed in any media within the load line (Table 4-65). Low levels of nitroguanidine and nitrocellulose; 4,4'-DDE; and two PCBs were also detected in sediment (Table 4-69). SVOCs were absent in this sample, with exception of trace levels of butyl benzyl phthalate. Trace levels of three VOCs were also detected.

Water samples from the covered sedimentation basin showed detectable concentrations of metals and explosives corresponding to those observed at high concentrations in sediment (Tables 4-70 and 4-71).

4.8.3 Floor Sweep Samples

Samples of fine debris material (dirt, dust, paint chips, etc.) were collected from the floor areas inside of Buildings DB-10 (Station LL2-125), DB-4 (Station LL2-138), and DB-3 (Station LL2-168). Sample locations are illustrated on Figures 3-1 through 3-3. These samples were analyzed for explosives, inorganics (including cyanide, Cr^{+6}, and As^{+3}), VOCs, SVOCs, and pesticides/PCBs. Tables 4-72 and 4-73 present results for inorganic and organic constituents, respectively, that were detected in at least one sample.

Inorganics

Results of inorganic analyses of floor sweep samples show high concentrations of multiple metals. Of particular note, cadmium, chromium, and lead all were present at high concentrations in all three buildings. Comparatively high concentrations of beryllium and copper were observed in the sample collected from Building DB-4 as compared to the other two buildings. Cyanide and As^{+3} were detected in the samples collected from all three buildings, although concentrations were low and relatively consistent.

Organics

Explosive compounds were detected in each of the floor sweep samples. The Building DB-3 sample contained the highest concentrations (2,4,6-TNT at 160 mg/kg) and greatest number of explosives (5 specific compounds). Comparatively low explosives concentrations were detected in the samples from Buildings DB-4 and DB-10. Low, estimated concentrations of a number of SVOCs and pesticides were detected in all of the floor sweep samples. Trace levels of benzene and/or toluene were also detected in every sample. Notably, PCB-1254 was detected in all three floor sweep samples at similarly elevated concentrations (690 to 790 mg/kg).

TCLP Analyses

In addition to direct analyses of floor sweepings, aliquots were collected for TCLP analyses (Table 4-74). Cadmium and lead were the only analytes detected in TCLP extracts. Cadmium and lead concentrations in the samples collected at stations LL2-125 (Building DB-10) and LL2-168 (Building DB-3) exceed maximum concentrations for the toxicity characteristic (1.0 and 5.0 mg/L, respectively) as specified in 40 *Code of Federal Regulations* 261.24.

Table 4-67. Buildings and Structures Surface Water from Process Effluent Sumps Inside Buildings Aggregate – Inorganics Detects

Functional Area		Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate
Station ID		**LL2-227**	**LL2-228**	**LL2-229**	**LL2-230**
Sample ID		**LL2sw-227-1085-SW**	**LL2sw-228-1087-SW**	**LL2sw-229-1089-SW**	**LL2sw-230-1091-SW**
Date		**07/30/2001**	**07/30/2001**	**07/30/2001**	**07/30/2001**
Depth (ft)		**0 - 0**	**0 - 0**	**0 - 0**	**0 - 0**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**				
Inorganics					
Aluminum	mg/L	0.18 U	0.12 U	0.21 U	0.13 J
Antimony	mg/L	0.01 U	0.01 U	0.21 =	0.18 =
Barium	mg/L	0.027 =	0.038 =	0.016 =	0.012 =
Cadmium	mg/L	0.0018 J	0.0017 J	0.0029 J	0.006 =
Calcium	mg/L	21.7 =	32.7 =	22.9 =	24.1 J
Chromium	mg/L	0.0014 J	0.0015 J	0.0072 =	0.005 U
Copper	mg/L	0.014 J	0.02 =	0.022 =	0.022 =
Iron	mg/L	0.3 U	0.3 U	0.11 J	0.26 J
Lead	mg/L	0.033 =	0.022 =	0.031 =	0.15 =
Magnesium	mg/L	0.78 J	1.7 J	1.2 J	0.7 J
Manganese	mg/L	0.0046 U	0.0091 J	0.0054 J	0.021 =
Nickel	mg/L	0.025 U	0.0036 J	0.025 U	0.025 U
Potassium	mg/L	21 =	43 =	26.4 =	13.2 J
Sodium	mg/L	9.7 =	21.2 =	11.6 =	5.2 =
Zinc	mg/L	0.059 =	0.099 =	0.077 =	0.13 J

ID = Identification.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-68. Buildings and Structures Surface Water from Process Effluent Slumps Inside Buildings Aggregate – Organics Detects

Functional Area		Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate	Process Effluent Sumps Inside Buildings Aggregate
Station ID		**LL2-227**	**LL2-228**	**LL2-229**	**LL2-230**
Sample ID		**LL2sw-227-1085-SW**	**LL2sw-228-1087-SW**	**LL2sw-229-1089-SW**	**LL2sw-230-1091-SW**
Date		**07/30/2001**	**07/30/2001**	**07/30/2001**	**07/30/2001**
Depth (ft)		**0 - 0**	**0 - 0**	**0 - 0**	**0 - 0**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**				
Explosives					
1,3,5-Trinitrobenzene	mg/L	0.0013 =	0.0002 U	0.0002 U	0.0002 U
2,4,6-Trinitrotoluene	mg/L	0.12 =	0.014 =	0.0025 =	0.0014 =
2,4-Dinitrotoluene	mg/L	0.00046 U	0.00025 =	0.0002 =	0.00013 U
2-Amino-4,6-dinitrotoluene	mg/L	0.065 =	0.013 =	0.005 =	0.0056 =
4-Amino-2,6-dinitrotoluene	mg/L	0.093 =	0.036 =	0.011 =	0.018 =
HMX	mg/L	0.05 =	0.18 =	0.02 =	0.074 =
RDX	mg/L	0.11 =	0.25 =	0.076 =	0.32 =
Pesticides and PCBs					
Endosulfan Sulfate	mg/L	0.00025 U	0.00005 U	0.00005 U	0.000071 J
PCB-1254	mg/L	0.0005 U	0.0005 U	0.00057 =	0.0011 =
beta-BHC	mg/L	0.00025 U	0.00005 U	0.00005 U	0.000066 J

ID = Identification.
* - Exceed Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-69. Buildings and Structures Sediment from Pink Water and Washdown Sedimentation Sumps – Organics

Functional Area		**Pink Water and Washdown Sedimentation Sumps Aggregate**
Station ID		**LL2-226**
Sample ID		**LL2sd-226-1082-SD**
Date		**07/30/2001**
Depth (ft)		**0 - 1**
Sample Type		**Grab**
Analyte	**Units**	
Nitrocellulose	mg/kg	12.5 J
Nitroguanidine	mg/kg	0.16 J
4,4'-DDE	mg/kg	0.3 =
PCB-1248	mg/kg	2 =
PCB-1260	mg/kg	2.4 =
Butyl benzyl phthalate	mg/kg	0.5 J
2-Butanone	mg/kg	0.26 J
Acetone	mg/kg	0.8 J
Carbon Disulfide	mg/kg	0.013 J
Toluene	mg/kg	0.0046 J

ID = Identification.
= - Detected result.
J - Estimated result.

Table 4-70. Buildings and Structures Surface Water from Pink Water and Washdown Sedimentation Sumps – Inorganics Detects

Functional Area		Pink Water and Washdown Sedimentation Sumps Aggregate	Pink Water and Washdown Sedimentation Sumps Aggregate
Station ID		**LL2-226**	**LL2-226**
Sample ID		**LL2sw-226-1083-SW**	**LL2sw-226-1188-SW**
Date		**07/29/2001**	**07/29/2001**
Depth (ft)		**0 - 0**	**0 - 0**
Sample Type		**Grab**	**Field Duplicate**
Analyte	**Units**		
Inorganics			
Barium	mg/L	0.1 =	0.11 =
Cadmium	mg/L	0.0029 J	0.0025 J
Calcium	mg/L	35.7 =	36.6 =
Iron	mg/L	4.3 =	4 =
Lead	mg/L	0.038 =	0.034 =
Magnesium	mg/L	1.9 J	1.9 J
Manganese	mg/L	0.33 =	0.33 =
Nickel	mg/L	0.025 U	0.0037 J
Potassium	mg/L	17.8 =	18.3 =
Sodium	mg/L	7 =	7.2 =
Zinc	mg/L	0.1 =	0.093 =

ID = Identification.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-71. Buildings and Structures Surface Water from Pink Water and Washdown Sedimentation Sumps – Organics Detects

Functional Area		Pink Water and Washdown Sedimentation Sumps Aggregate	Pink Water and Washdown Sedimentation Sumps Aggregate
Station ID		**LL2-226**	**LL2-226**
Sample ID		**LL2sw-226-1083-SW**	**LL2sw-226-1188-SW**
Date		**07/29/2001**	**07/29/2001**
Depth (ft)		**0 - 0**	**0 - 0**
Sample Type		**Grab**	**Field Duplicate**
Analyte	**Units**		
Explosives			
2-Amino-4,6-dinitrotoluene	mg/L	0.0002 U	0.00013 J
4-Amino-2,6-dinitrotoluene	mg/L	0.00035 =	0.00034 =
HMX	mg/L	0.0017 =	0.0031 U
RDX	mg/L	0.0035 =	0.0039 =
Semivolatile Organics			
Benzoic Acid	mg/L	0.0038 J	0.035 U
Di-n-butyl phthalate	mg/L	0.0012 J	0.01 U

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
ID = Identification.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
* - Exceed Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-72. Load Line 2. Floor Sweep Samples – Inorganics Detected

Functional Area		Floor Sweep Samples Aggregate	Floor Sweep Samples Aggregate	Floor Sweep Samples Aggregate
Station ID		**LL2-125**	**LL2-138**	**LL2-168**
Sample ID		**LL2fs-125d-0849-FS**	**LL2fs-138d-0880-FS**	**LL2fs-168d-0962-FS**
Date		**08/20/2001**	**08/20/2001**	**08/20/2001**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Cyanide	mg/kg	3.8 =	1.1 =	2.4 =
Arsenic +3	µg/g	0.18 =	0.065 =	0.0311 =
Aluminum	mg/kg	4,910 =	2,380 =	4,930 =
Antimony	mg/kg	3.5 J	10.5 UJ	48.2 J
Arsenic	mg/kg	21.3 =	49.8 =	39.2 =
Barium	mg/kg	2,720 =	1,050 =	1,740 =
Beryllium	mg/kg	0.91 =	5.2 =	0.64 J
Cadmium	mg/kg	280 =	124 =	255 =
Calcium	mg/kg	52,100 =	15,900 =	18,500 =
Chromium	mg/kg	215 =	304 =	329 =
Cobalt	mg/kg	63.2 =	41.5 =	42 =
Copper	mg/kg	300 =	2,300 =	392 =
Iron	mg/kg	106,000 =	384,000 =	254,000 =
Lead	mg/kg	10,200 =	6,080 =	26,400 =
Magnesium	mg/kg	5,510 =	1,910 J	3,660 =
Manganese	mg/kg	804 =	2,490 =	1,990 =
Mercury	mg/kg	0.078 U	0.11 =	0.19 =
Nickel	mg/kg	62.7 =	157 =	112 =
Potassium	mg/kg	1,140 =	1,650 =	907 =
Selenium	mg/kg	4.1 J	10.6 J	8.5 J
Silver	mg/kg	2.2 =	5.2 U	0.71 J
Sodium	mg/kg	535 =	510 J	870 =
Vanadium	mg/kg	22.2 =	20.7 =	38.7 =
Zinc	mg/kg	7,330 =	3,180 =	11,100 =

ID = Identification.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-73. Buildings and Structures Floor Sweep Samples – Organics

Functional Area		Floor Sweep Samples Aggregate	Floor Sweep Samples Aggregate	Floor Sweep Samples Aggregate
Station ID		**LL2-125**	**LL2-138**	**LL2-168**
Sample ID		**LL2fs-125d-0849-FS**	**LL2fs-138d-0880-FS**	**LL2fs-168d-0962-FS**
Date		**08/20/2001**	**08/20/2001**	**08/20/2001**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Explosives				
2,4-Dinitrotoluene	mg/kg	1.7 U	1.3 =	0.75 U
2,4,6-Trinitrotoluene	mg/kg	15 =	3.2 =	160 =
1,3,5-Trinitrobenzene	mg/kg	0.25 U	0.25 U	1.3 =
HMX	mg/kg	3 =	0.53 U	24 =
2-Amino-4,6-dinitrotoluene	mg/kg	0.89 =	0.31 U	12 =
RDX		4.9 =	0.88 U	88 =
Pesticides/PCBs				
4,4'-DDE	mg/kg	12 J	13 J	8.5 J
Dieldrin	mg/kg	1.1 U	9.5 J	1.3 U
Endosulfan Sulfate	mg/kg	1.1 U	12 J	1.3 U
Endrin Aldehyde	mg/kg	8.5 J	11 J	8.3 J
PCB-1254	mg/kg	690 =	730 =	790 =
gamma-Chlordane	mg/kg	4.1 J	5.7 J	4.4 J
Semivolatile Organics				
2,4-Dinitrotoluene	mg/kg	2.2 UJ	0.14 J	1.3 UJ
Benz(*a*)anthracene	mg/kg	0.89 J	0.33 J	2 J
Benzo(*a*)pyrene	mg/kg	1.1 J	0.24 J	2.4 J
Benzo(*b*)fluoranthene	mg/kg	3.8 J	0.88 J	4.6 J
Benzo(*g,h,i*)perylene	mg/kg	0.82 J	0.26 J	1.6 J
Benzo(*k*)fluoranthene	mg/kg	1.6 J	0.37 J	2.9 J
Bis(2-ethylhexyl)phthalate	mg/kg	1.4 J	0.72 J	0.47 J
Butyl benzyl phthalate	mg/kg	2.2 UJ	6.1 J	1.3 UJ
Carbazole	mg/kg	0.44 J	0.87 UJ	0.45 J
Chrysene	mg/kg	4.5 J	0.83 J	5.2 J
Di-n-butyl phthalate	mg/kg	1.3 J	0.87 UJ	5.2 J
Dibenz(*a,h*)anthracene	mg/kg	2.2 UJ	0.87 UJ	0.5 J
Dibenzofuran	mg/kg	0.5 J	0.87 UJ	1.3 UJ
Fluoranthene	mg/kg	13 J	2.1 J	9.6 J
Indeno(1,2,3-*cd*)pyrene	mg/kg	0.86 J	0.23 J	1.4 J
Pentachlorophenol	mg/kg	2.2 UJ	0.87 UJ	3.4 J
Phenanthrene	mg/kg	8.4 J	0.64 J	4.8 J
Volatile Organics				
Pyrene	mg/kg	10 J	1.4 J	7.4 J
Benzene	mg/kg	0.0012 J	0.0014 J	0.0076 U
Toluene	mg/kg	0.014 =	0.011 =	0.0079 =

ID = Identification.
PCB = Polychlorinated biphenyl.
= - Detected result.
J - Estimated result.
U - Not detected.

Table 4-74. Load Line 2 Phase II RI TCLP Constituents Detected in Floor Sweep Samples

Functional Area		Floor Sweep Samples Aggregate	Floor Sweep Samples Aggregate	Floor Sweep Samples Aggregate
Station ID		**LL2-125**	**LL2-138**	**LL2-168**
Sample ID		**LL2fs-125d-0849-FS**	**LL2fs-138d-0880-FS**	**LL2fs-168d-0962-FS**
Date		**08/20/2001**	**08/20/2001**	**08/20/2001**
Sample Type		**Grab**	**Grab**	**Grab**
Analyte	**Units**			
Cadmium	mg/L	2.3 =	0.72 =	1.7 =
Lead	mg/L	42 =	0.57 =	26.8 =

ID = Identification.
= - Undetected result.

4.8.4 Ballast and Slag

Three samples of rail ballast material (mixed slag and stone aggregate) were collected along Track DH and analyzed for TAL metals for characterization purposes and to determine if these materials might represent a source of metals to underlying soil (Table 4-75). Sample locations are shown of Figures 3-1 through 3-3. At each station, ballast material was removed following sampling and the upper 0.3 m (1 ft) of soil immediately underlying the ballast was sampled for comparison of TAL metals in both media. An additional subsurface soil 0.3 to 0.6m (1 to 3 ft) was collected at station LL2-177 based on results of field TNT analysis of the surface sample.

Although matrix materials are different, ballast sample results were compared generally to RVAAP facility-wide surface soil background values to provide a comparative point of reference for evaluation of results. Generally, ballast samples contained elevated levels of major geochemical constituents (aluminum, calcium, magnesium, potassium, and sodium) as compared to soil background levels. Barium and manganese were elevated in samples collected from all three locations. The sample collected at station LL2-177 contained substantially higher concentrations of cadmium, copper, lead, nickel, and zinc as compared to the other two ballast samples indicating potentially anomalous contamination at this station.

Underlying soil samples at station LL2-177 exhibited elevated concentrations of several metals corresponding to those observed in the overlying ballast sample, specifically copper, cadmium, lead, and zinc (Table 4-75). However, concentrations were overall lower in the soil interval than in the ballast layer. The subsurface soil sample collected at station LL2-177 also showed elevated, but decreasing concentrations, of copper, lead, and zinc. Elevated metals observed in ballast at stations LL2-214 and LL2-216 were also present in the underlying soil interval; however, concentrations were generally much lower, with the exception of iron, which increased in the underlying soil. The observed data suggest that ballast materials may contribute to some contamination of underlying soil, but the effect rapidly diminishes with depth.

4.9 ORDNANCE AND EXPLOSIVES AVOIDANCE SURVEY SUMMARY

UXO technicians provided OE avoidance training and support during all field operations. The OE avoidance crew cleared all soil, surface water/sediment, and drilling locations within the former operations areas. In addition, they provided clearance for all test pit locations and supported the video survey of sanitary and storm sewer lines. In accordance with technical direction from USACE, OE technicians performed physical water and sediment sampling activities for process effluent collection

Table 4-75. Ballast and Slag Samples – Inorganics

Functional Area		Ballast and Slag Samples	Preparation and Receiving Areas Aggregate	Preparation and Receiving Areas Aggregate	Ballast and Slag Samples	Explosives Handling Areas Aggregate	Ballast and Slag Samples	Explosives Handling Areas Aggregate
Station ID		**LL2-177**	**LL2-177**	**LL2-177**	**LL2-214**	**LL2-214**	**LL2-216**	**LL2-216**
Sample ID		**LL2ss-177-1004-SO**	**LL2ss-177-0983-SO**	**LL2ss-177-0984-SO**	**LL2ss-214b-1158-SO**	**LL2ss-214-1054-SO**	**LL2ss-216b-1159-SO**	**LL2-216-1056-SO**
Date		**07/27/2001**	**07/27/2001**	**07/29/2001**	**07/27/2001**	**07/27/2001**	**07/27/2001**	**07/27/2001**
Depth (ft)		**0 - 0**	**0 - 1**	**1 - 3**	**0 - 0**	**0 - 1**	**0 - 0**	**0 - 1**
Sample Type		**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**	**Grab**
Analyte	**Units**							
Aluminum	mg/kg	12,900 =	10,300 =	10,200 =	28,000 =	11,600 =	35,200 =	2,510 =
Antimony	mg/kg	3.1 J	1.8 J *	1.2 UJ	1 UJ	1.1 UJ	1 UJ	1.1 UJ
Arsenic	mg/kg	11.3 =	12.1 =	9.3 =	0.55 J	20.7 = *	1 J	2.1 =
Barium	mg/kg	170 =	115 = *	71.2 =	313 =	76.5 =	254 =	17.8 =
Beryllium	mg/kg	1.4 =	0.84 J	0.65 =	2.9 J	0.8 J	4.7 J	0.2 U
Cadmium	mg/kg	4 =	1.2 = *	0.082 J *	2.5 U	0.57 U	0.13 U	0.54 =
Calcium	mg/kg	32,900 =	10,400 =	8,630 =	144,000 =	17,300 =	192,000 =	613 =
Chromium	mg/kg	65.5 =	33.1 = *	15.3 =	4.8 =	16.9 =	5.2 =	5.6 =
Cobalt	mg/kg	9.4 =	9.4 =	10.5 =	0.96 =	10.6 = *	0.56 U	3.1 =
Copper	mg/kg	839 =	382 = *	45.7 J *	0.64 U	19 = *	3.1 =	5.1 =
Iron	mg/kg	39,700 J	35,400 =	20,900 =	2790 J	24,400 =	6,890 J	12,500 =
Lead	mg/kg	597 =	229 = *	39.3 J *	1.4 J	14.7 J	9.9 J	4.2 J
Magnesium	mg/kg	5,000 =	3,210 =	2,620 =	22,800 =	4,520 =	22,600 =	548 =
Manganese	mg/kg	1,310 =	678 =	470 =	7,500 =	581 =	5,370 =	313 =
Mercury	mg/kg	0.12 =	0.12 = *	0.039 J	0.1 U	0.11 U	0.1 U	0.11 U
Nickel	mg/kg	30.4 =	26.3 = *	22.3 =	2.5 U	26.4 = *	0.61 J	7.6 =
Potassium	mg/kg	829 =	920 =	1,130 =	1,750 =	1,380 =	1,420 =	343 =
Selenium	mg/kg	0.85 J	2.5 U	ND	10.1 U	2.3 U	1.3 J	2.2 U
Silver	mg/kg	0.96 =	0.26 J *	ND	2.5 U	0.57 U	2.5 U	0.54 U
Sodium	mg/kg	241 J	ND	ND	706 =	65.8 =	632 =	ND
Thallium	mg/kg	0.4 =	0.46 =	0.33 =	0.11 UJ	0.42 = *	0.091 UJ	0.27 U
Vanadium	mg/kg	15.9 =	ND	ND	13.8 J	15.3 =	5.5 J	5.7 J
Zinc	mg/kg	908 =	392 = *	99.1 = *	20.2 U	57.3 =	5.3 =	13.5 =

ID = Identification.
* - Exceeds Ravenna Army Ammunition Plant background criteria.
= - Detected result.
J - Estimated result.
U - Not detected

sumps within the melt-pour buildings in order to ensure worker safety. The OE technicians received training from SAIC staff on the proper sampling protocols prior to these sampling activities; SAIC personnel completed all chain-of-custody and packaging and shipping. No OE was discovered during field reconnaissance and magnetometer surveys of access routes and proposed sampling, drilling, or test pit points. Various debris and metal scrap were encountered throughout Load Line 2 during visual and magnetometer surveys including, metal, rail ties, vitrified clay pipe fragments, rail spikes, and iron pipe. In several instances, subsurface magnetic anomalies resulted in the decision to move pre-planned sample locations short distances to points where no anomalies were observed. Appendix O contains the full OE avoidance report and supporting field logs for the Load Line 2 Phase II RI.

4.10 RADIOLOGICAL SURVEY RESULTS

Radiological surveys of Load Lines 2, 3, and 4 were conducted by USACE, Buffalo District staff to demonstrate that no residual radioactive contamination attributable to RVAAP activities remains within radiography buildings. The surveys were conducted using accepted survey methods for decommissioning. These surveys demonstrate that radiological activity from residual radioactive contamination is below the release criteria for each area surveyed. (The Release Criteria are found in U.S. Nuclear Regulatory Commission Guidance 1.86 as indicated in Section 5.4.2.2 of Appendix S.) In addition, records were reviewed to determine if documentation existed to support the proper disposal of the radioactive sources (e.g., cobalt-60 sealed sources) used in the load lines at RVAAP. Radiological survey results indicate that there is no detectable cobalt-60 contamination in the load lines. In addition, records exist that indicate that two of the three sealed cobalt-60 sources used at Load Lines 2, 3, and 4 (500-curie and 1,000-curie sources) were shipped off-site in 1971 and 1972 and returned to their licensed owner. A later memorandum indicated all three sources were returned to their licensed owner. Efforts are being taken by the U.S. Army to locate any additional pertinent information regarding the fate of the third cobalt-60 source (1,000-curie). A complete report containing methods and discussion of radiological survey results was prepared by the USACE, Buffalo District and is contained in Appendix S.

4.11 FIELD TNT AND RDX SCREENING ANALYSIS

This section presents a comparison of the TNT and RDX field screening analysis to values determined by the off-site analytical laboratory.

4.11.1 Field Sampling and Analysis Protocol

Samples were collected from surface, subsurface, and sediment locations in and around Load Line 2. All surface soil (0 to 1 ft depth) samples were composite samples from three individual sampling locations positioned in a 3-ft equilateral triangle pattern in the sampling area. Subsurface samples were collected at discrete locations, but were composited over the associated depth interval.

Field determinations of 2,4,6-TNT and RDX in soil and sediment samples were performed through implementation of colorimetric analyses developed by the USACE Cold Regions Research & Engineering Laboratory (CRREL).

The procedure for measuring TNT concentrations in soils involves a liquid extraction of the explosives from the soil matrix with acetone and formation of a color complex with sodium sulfite and potassium hydroxide. Absorbance is measured at a wavelength of 540 nm. For RDX, all nitrate must be removed from the extract, then glacial acetic acid and zinc powder are added. A complexing agent (NitriVer3) is

added to the sample, and absorbance is measured at 507 nm. In both methods, percent absorbance is correlated to concentration.

Off-site laboratory determinations for TNT and RDX were performed by solvent extraction and analysis by liquid chromatographic techniques (SW846-8330).

All surface soil and sediment samples were field analyzed with colorimetric methods for TNT and RDX. The purpose of the analysis was to define the extent of surface soil contamination with respect to these explosive compounds. Field colorimetry was also used as a screening method to reduce the number of samples that required fixed-base laboratory analysis for explosives. The strategy can be summarized as follows:

- If the field method indicated TNT was present at >/= 1 parts per million (ppm), the sample was sent to the off-site laboratory for analysis of explosives and propellants;
- If the concentration of TNT was < 1 ppm, the analysis for RDX was performed;
- If RDX was present at a concentration >/= 1 ppm, the sample was sent to the off-site laboratory for analysis of explosives and propellants;
- In addition, 15% of the samples showing non-detects of TNT or RDX were sent to the off-site laboratory for analysis of explosives; and
- All samples collected, regardless of field colorimetry results, were submitted for TAL metals analysis.

4.11.2 TNT Comparison

TNT field screening and laboratory results are presented in Table 4-76. Starting with the premise that the laboratory results are accurate relative to the presence or absence of TNT in the sample, the field screening values provide 2.5% false negative information and 11% false positive information. Consideration of values less than 2 ppm as equivalent reduces the false positive occurrences to a 5% rate. Comparison of positive TNT data where both laboratory and field screening values were greater than 2 ppm provided a slope of 0.56 and a correlation coefficient of 0.867 (Figure 4-37). Due to the exhibited heterogeneity of sample LL2-0740 and its laboratory duplicate LL2-1168, it has been eliminated from this comparison.

Review of laboratory results for associated explosive compounds (i.e., TNB, DNTs, nitrotoluenes, nitrocellulose, etc.) indicates there were not any impacts on the field screening determinations from these compounds. Elevated levels of nitrocellulose did not appear to influence the TNT screening value. The low levels of other nitro-compounds observed in these samples did not exhibit any impact on the TNT screening levels.

Figure 4-37 plots field screening data versus laboratory data. The limited data available for comparison provides a correlation coefficient of 0.867. It is believed the field screening has provided a valid representation of the presence or absence of TNT above 1 to 2 ppm and a reasonable correlation for those positive values greater than 2 ppm.

4.11.3 RDX Comparison

RDX field screening and laboratory results are presented in Table 4-77. Starting with the premise that the laboratory results are accurate relative to the presence or absence of RDX in the sample, the field screening values provide 3% false negative information and 3% false positive information. Ninety-one

Table 4-76. Load Line 2 Laboratory/Field TNT Comparison

Station	Sample No.	Lab Result		Lab Dup Result		Field Result		Units
LL2-066	LL20690	0.053	J			1.06		mg/kg
LL2-072	LL20706	0.18	J			1.9		mg/kg
LL2-072	LL20707	0.25	U			1.18		mg/kg
LL2-078	LL20720	0.047	J	0.25	U	1	U	mg/kg
LL2-082	LL20732	1,100				114		mg/kg
LL2-086	LL20740	17,000		5,900		2,400		mg/kg
LL2-086	LL20741	1,600	J			1,350		mg/kg
LL2-086	LL20742	61				67		mg/kg
LL2-086	LL21005	91	J			53		mg/kg
LL2-087	LL20743	240				9.6		mg/kg
LL2-087	LL20744	21				18.9		mg/kg
LL2-087	LL20745	57	J			59		mg/kg
LL2-094	LL20760	3,600				1,980		mg/kg
LL2-094	LL20761	450				691		mg/kg
LL2-096	LL20766	0.055	J	0.06	J	1	U	mg/kg
LL2-097	LL20769	0.19	J			1	U	mg/kg
LL2-098	LL20772	0.11	J	0.095	J	1	U	mg/kg
LL2-100	LL20778	0.21	J			2.2		mg/kg
LL2-104	LL20790	0.77				1	U	mg/kg
LL2-107	LL20799	0.065	J			1	U	mg/kg
LL2-111	LL20811	0.25	U			1	U	mg/kg
LL2-112	LL20814	2.6	J			1.41		mg/kg
LL2-115	LL20823	0.12	J			4.9		mg/kg
LL2-117	LL20829	0.25	U			1	U	mg/kg
LL2-118	LL20832	0.43				1.6		mg/kg
LL2-120	LL20838	0.27				2.4		mg/kg
LL2-121	LL20841	0.25	U			1.01		mg/kg
LL2-122	LL20844	1.9				5.2		mg/kg
LL2-126	LL20850	0.25	U	0.064	J	1	U	mg/kg
LL2-128	LL20856	13				17.4		mg/kg
LL2-129	LL20859	0.072	J	0.17	J	1	U	mg/kg
LL2-130	LL20862	23	J			17.2		mg/kg
LL2-130	LL20863	46				24		mg/kg
LL2-131	LL20865	4.9				7.2		mg/kg
LL2-132	LL20868	270				39		mg/kg
LL2-133	LL20871	29	J			152		mg/kg
LL2-133	LL20872	53				48		mg/kg
LL2-133	LL20873	5.8	J			1.25		mg/kg
LL2-134	LL20874	7.7				5.3		mg/kg
LL2-141	LL20887	0.25	U	0.25	U	1	U	mg/kg
LL2-144	LL20896	4.3	J			1	U	mg/kg
LL2-146	LL20902	1.3				3.6		mg/kg
LL2-149	LL20911	1.1	J			2.2		mg/kg
LL2-150	LL20914	0.67	J			3.5		mg/kg
LL2-158	LL20932	610	J			234		mg/kg

Table 4-76. Load Line 2 Lab/Field TNT Comparison (continued)

Station	Sample No.	Lab Result		Lab Dup Result		Field Result		Units
LL2-162	LL20944	9.2	J			6.6		mg/kg
LL2-164	LL20950	0.25	U	0.25	U	1	U	mg/kg
LL2-165	LL20953	0.16	J			2.19		mg/kg
LL2-166	LL20956	1.2				134		mg/kg
LL2-167	LL20959	0.49				19.6		mg/kg
LL2-169	LL20963	0.25	U			1	U	mg/kg
LL2-170	LL20966	0.25	U			1	U	mg/kg
LL2-175	LL20977	0.28	U			1	U	mg/kg
LL2-176	LL20980	0.58	J			1	U	mg/kg
LL2-177	LL20983	0.25	U			1.65		mg/kg
LL2-178	LL20986	0.25	U			2.7		mg/kg
LL2-182	LL20998	0.27	U			1	U	mg/kg
LL2-183	LL21001	0.25	U			1	U	mg/kg
LL2-183	LL21002	0.25	U			1	U	mg/kg
LL2-187	LL21013	0.25	U			1	U	mg/kg
LL2-188	LL21016	0.69	J			1.95		mg/kg
LL2-204	LL21044	0.25	U			1	U	mg/kg
LL2-205	LL21045	0.073	J			1	U	mg/kg
LL2-227	LL21084	130	J			32		mg/kg
LL20228	LL21086	39	J			21		mg/kg
LL2-229	LL21088	45				46		mg/kg
LL2-230	LL21090	45				44		mg/kg
LL2-231	LL21092	0.25	U			1	U	mg/kg
LL2-232	LL21094	0.059	J			11.1		mg/kg
LL2-234	LL21097	0.051	J			1	U	mg/kg
LL2-238	LL21103	0.74				4.6		mg/kg
LL2-239	LL21104	0.78				1	U	mg/kg
LL2-240	LL21106	21				1	U	mg/kg
LL2-242	LL21110	10				13.6		mg/kg
LL2-241	LL20839	15	J			7.4		mg/kg
LL2-243	LL20834	0.25	U			1	U	mg/kg
LL2-249	LL21118	0.25	U	0.25	U	1	U	mg/kg
LL2-250	LL21121	0.25	U			1.7		mg/kg
LL2-259	LL21141	0.25	U			1	U	mg/kg
LL2-272	LL20688	27				19.8		mg/kg
LL2-273	LL20692	0.25	U			1	U	mg/kg
LL2-274	LL20686	0.079	J			1	U	mg/kg

TNT= Trinitoluene.

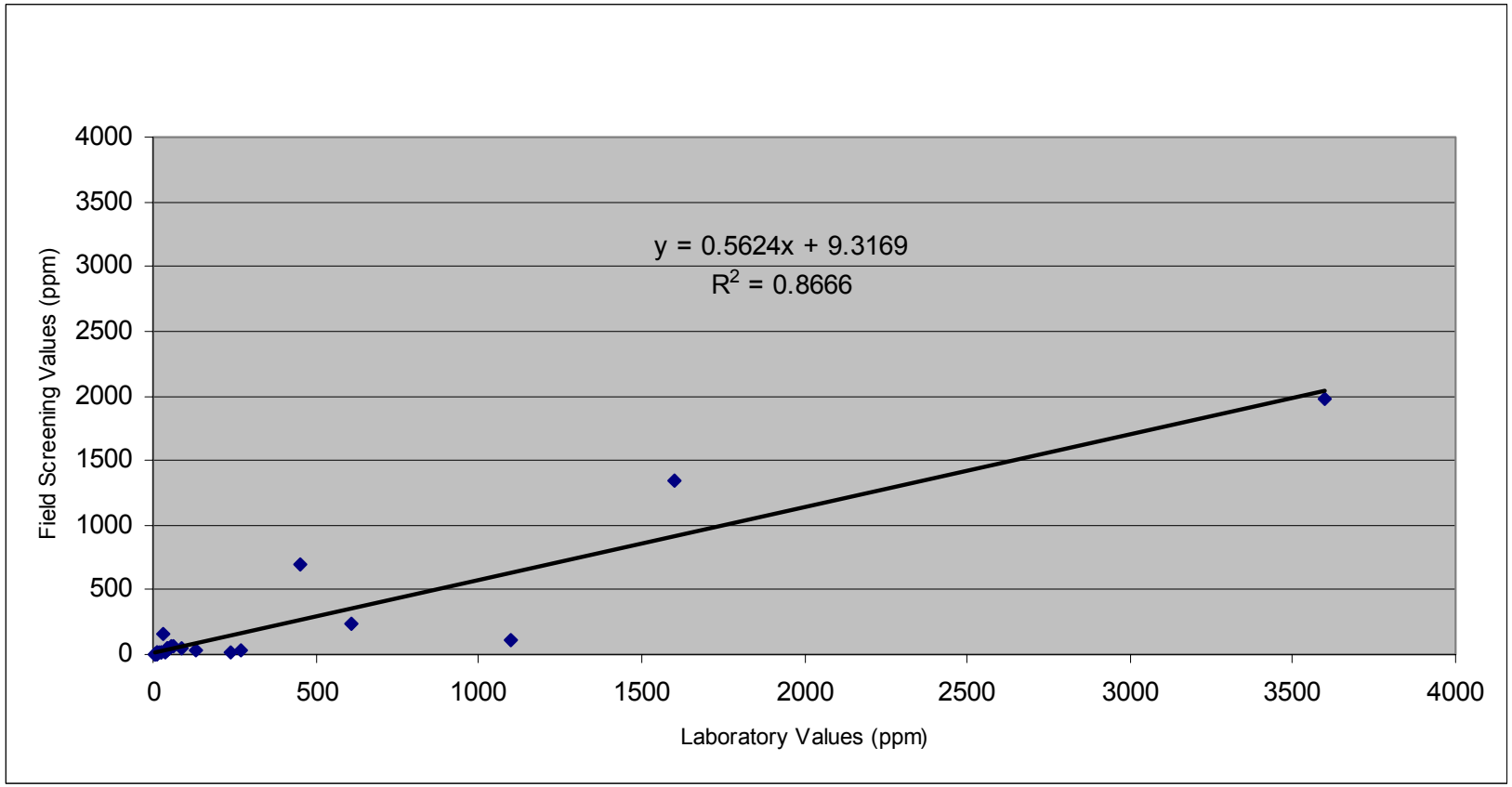


Figure 4-37. Comparison of Field Screening and Laboratory Results for Explosives (TNT)

Table 4-77. Load Line 2 Laboratory/Field RDX Comparison

Station	Sample No.	Lab Result		Lab Dup Result		Field Result		Units
LL2-078	LL20720	0.5	U	0.5	U	1	U	mg/kg
LL2-096	LL20766	0.5	U	0.5	U	1	U	mg/kg
LL2-097	LL20769	0.5	U			1	U	mg/kg
LL2-098	LL20772	0.5	U	0.5	U	1	U	mg/kg
LL2-104	LL20790	0.28	J			1	U	mg/kg
LL2-107	LL20799	0.5	U			1	U	mg/kg
LL2-111	LL20811	0.5	U			1	U	mg/kg
LL2-117	LL20829	0.5	U			1	U	mg/kg
LL2-126	LL20850	0.5	U	0.5	U	1	U	mg/kg
LL2-129	LL20859	0.18	J	0.5	U	1	U	mg/kg
LL2-141	LL20887	0.5	U	0.5	U	1	U	mg/kg
LL2-144	LL20896	0.5	U			1	U	mg/kg
LL2-164	LL20950	0.5	U	0.5	U	1	U	mg/kg
LL2-169	LL20963	0.5	U			1	U	mg/kg
LL2-170	LL20966	0.5	U			1	U	mg/kg
LL2-175	LL20977	0.5	U			1	U	mg/kg
LL2-176	LL20980	0.5	U			1	U	mg/kg
LL2-182	LL20998	0.5	U			1	U	mg/kg
LL2-183	LL21001	0.5	U			1	U	mg/kg
LL2-183	LL21002	0.5	U			1	U	mg/kg
LL2-187	LL21013	0.5	U			1	U	mg/kg
LL2-204	LL21044	0.5	U			1	U	mg/kg
LL2-205	LL21045	0.5	U			1	U	mg/kg
LL2-231	LL21092	0.64	=			3.4		mg/kg
LL20239	LL21104	0.5	U			3.9		mg/kg
LL20240	LL21106	13	J			1	U	mg/kg
LL2-243	LL20834	0.5	U			1	U	mg/kg
LL2-249	LL21118	0.5	U	0.5	U	1	U	mg/kg
LL2-250	LL21121	0.5	U			1	U	mg/kg
LL2-259	LL21141	0.5	U			1	U	mg/kg
LL2-273	LL20692	0.5	U			1	U	mg/kg
LL2-274	LL20686	0.5	U			1	U	mg/kg

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

percent of the RDX values were confirmed to be below 1 ppm and 3% were confirmed to be greater than 1 ppm. Due to the limited positive RDX data available, correlation coefficient information was not feasible. It is believed the field screening has provided a valid representation of the presence or absence of RDX above 1 ppm; however, statistical correlations were low due to the low population of positive detections of RDX above 1 ppm.

Review of laboratory results for associated explosive compounds (i.e., HMX, nitrocellulose, nitroquanidine, etc.) does not indicate any obvious impacts on the field screening determinations from these compounds. Elevated levels of nitrocellulose did not appear to influence the RDX screening value. Low levels of HMX and nitroquanidine observed in these samples did not exhibit an impact on the RDX screening levels.

4.12 SUMMARY OF CONTAMINANT NATURE AND EXTENT

Evaluation of data collected during the Phase I and II RIs shows that historical operations have resulted in contamination of surface and subsurface soil, primarily in the vicinity of former operations buildings, and in some drainage ditches near source areas. Contaminant occurrences in surface water, sediment, and groundwater are limited in terms of extent and magnitude; however, low levels of SRCs (explosives and metals) were observed in Kelly's Pond and in groundwater south of the AOC near the pond. The storm sewer system contained detectable explosives, SVOCs, PCBs, and VOCs; however, overall concentrations were low. Elevated concentrations of metals were observed in the some portions of the storm sewer network, primarily within the box inlets. The sanitary sewer system contained substantially lower levels of SRCs than the storm sewer network. A brief summary of nature and extent of contamination within each of the environmental media characterized, including buildings and structures, is outlined below.

4.12.1 Surface Soil

Aggregates containing the former process buildings (Explosives Handling Areas, Preparation and Receiving Areas, and Packaging and Shipping Areas) exhibited the greater number and concentrations of SRCs than the outlying aggregates (Change Houses, North Ditches, and Perimeter Area). The observed distributions of contaminants indicate relatively low mobility with the bulk of contamination adjacent to former process buildings. Explosives were detected in all aggregates except the Change Houses. 2,4,6-TNT was the most frequently detected explosive and it occurred at the highest concentrations. The most commonly detected inorganics above background include arsenic, lead, and manganese. SVOC compounds, primarily PAHs, were widespread at low, estimated concentrations; only sporadic samples contained this class of compounds at concentrations greater than 1 mg/kg. Arochlor-1254 was the most commonly detected PCB compound. Low levels of VOCs (primarily acetone and toluene) were detected. Almost all stations with higher concentrations and/or a number of SVOCs, PCBs/pesticides, and VOCs occurred in the immediate vicinity of the process buildings, or along the railroad tracks connecting the process areas to one another.

Based on the evaluation of the occurrence and distribution of contaminants in surface soil at Load Line 2, the following observations can be made.

Explosive Handling Areas Aggregate

- Explosive and propellant compounds are common in surface soil in this aggregate at concentrations up to 17,000 mg/kg (2,4,6-TNT) and 93.5 mg/kg (nitrocellulose), respectively. The highest overall

concentrations occur in the near vicinity of the melt-pour buildings (DB-4 and 4A) and the explosive preparations buildings (DB-6 and DB-6A).

- Pervasive inorganic SRCs in the Explosives Handling Area Aggregate include aluminum, arsenic, barium, chromium, lead, and zinc. Although a large number of SRCs were identified, over 70% of the detected values were less than 2 times background values. Maximum observed inorganic SRCs include antimony (187 times background), lead (33 times background), mercury (27 times background), and zinc (14 times background) representing the highest values. The highest concentrations and largest numbers of SRCs were clustered in the vicinity of the former production buildings, similar to the distribution observed for explosive compounds.

- SVOCs, primarily PAHs, were frequently detected although almost all concentrations were less than 1 mg/kg.

- Low levels of two VOCs, chloroform and toluene, were detected in surface soil in the Explosives Handling Areas Aggregate. The maximum value was 3.7 mg/kg for toluene at station LL2-232, a dry sediment sample collected adjacent to the sedimentation basin.

- PCB-1254 was commonly detected, along with PCBs-1256 and -1260 at lower frequencies of detection. The highest values were observed in the vicinity of Buildings DB-4 and DB-10. Low levels of pesticides (primarily 4,4'DDE) were also consistently detected adjacent to former process buildings.

Preparation and Receiving Areas Aggregate

- Low concentrations of explosive compounds and nitrocellulose were detected in surface soils. Detectable quantities of these contaminants were clustered in the vicinity of DB-3 and DB-802. Maximum values were substantially lower than in the Explosives Handling Areas Aggregate; the maximum detected explosive and propellant concentrations were 1.2 mg/kg (2,4,6-TNT) and 7.2 mg/kg (nitrocellulose).

- Elevated concentrations of multiple inorganic SRCs were detected in this aggregate. Elevated concentrations tended to be clustered in the vicinity of Buildings DB-3 and DB-802. The overall concentrations tended to be higher than in the Explosives Handling Area Aggregate. Those SRCs occurring at the highest concentrations include antimony (688 times background), chromium (109 times background), copper (186 times background), lead (264 times background), mercury (66 times background), and zinc (118 times background). Other pervasive SRCs include arsenic, barium, beryllium, cobalt, nickel, and selenium, which ranged from 2.5 to 10 times background criteria. Hexavalent chromium was detected in 1 of 13 samples at an estimated concentration of 81.9J mg/kg.

- PAH and other SVOC compounds were detected in surface soils from this aggregate, although at generally low concentrations. The highest concentrations of SVOCs occur in the immediate vicinity of Buildings DB-3, C-1, and DB-803.

- Four VOCs were sporadically detected at low, estimated concentrations.

- Low concentrations of PCBs (primarily PCB-1254) and pesticides were detected in approximately 30% of the samples collected from this aggregate. The highest concentrations of these classes of compounds occur on the eastern side of Building DB-3.

Packaging and Shipping Areas Aggregate

- Low concentrations of explosives were detected in surface soils, primarily along Track DH and near Building DB-13B. Detected values of explosives rarely exceeded 1 mg/kg, with exception of 2,4,6-TNT (maximum detected value of 2.6J mg/kg). Propellants were not detected in surface soil samples from this aggregate.

- Numerous inorganic SRCs were detected at a 100% frequency in the Packaging and Shipping Areas Aggregate; however, over 60% of the detected values were less than 2 times background values. A large percentage of maximum values for inorganic SRCs were clustered at four sampling stations located adjacent to Buildings DB-13, DB-13B, and DB-26 and at one station on the north side of Building DB-27A. Maximum observed inorganic SRCs include antimony (62 times background), lead (47 times background), and zinc (11 times background).

- PAHs were detected in multiple samples; however, only one station (LL2-071) located on the north side Building DB-27A, had concentrations exceeding 1 mg/kg.

- PCBs-1254 and -1260 were commonly detected in surface soil although concentrations greater than 1 mg/kg were limited to the vicinity of Buildings DB-13 and DB-13B.

- Low estimated concentrations of toluene were detected infrequently in surface soil.

Change Houses Aggregate

- Explosives and propellants were not detected in surface soils in the Change Houses Aggregate.

- Antimony, chromium, cobalt, copper, lead, nickel, and zinc exceeded their respective site-background values in at least one sample. All maximum SRC concentrations were less than 2 times the background criteria, with the exception of lead and zinc, which were between 3 and 4 times background. The maximum concentration for all SRCs, except copper, occurred at Building DB22-02.

- SVOCs, VOCs, and PCBs/pesticides were not detected in surface soil samples from the Change Houses Aggregate.

Perimeter Area Aggregate

- Explosives and nitrocellulose were detected in surface soil samples from the Perimeter Area Aggregate (Table 4-3). The maximum number and concentrations of detected explosive and propellant compounds occur along the railroad tracks immediately east of Building DA-21 and at a random grid sample location (LL2-204) located about 250 ft east of Building DB-3. Low concentrations of 2,4,6-TNT were detected in samples collected from several other stations.

- A total of 16 inorganic SRCs were identified in this aggregate; the distribution of values above background criteria is highly sporadic. Maximum values of most SRCs were less than 2 times background criteria. However, at specific locations, very high metals concentrations were observed for antimony (8,458 times background), chromium (230 times background), copper (40 times background), lead (950 times background), and mercury (77 times background). Maximum concentrations of the 12 of the 16 SRCs for this aggregate occurred at station LL2-248, which was a dry sediment sample collected from a drainage swale south of Building DA-5. Elevated inorganics were also observed adjacent to Building DA-7 (station LL2-078) and east of Building DA-21 (station LL2-094).

- Two SVOC compounds, benzoic acid and fluoranthene, were detected once at low estimated concentrations.

- Low concentrations of pesticides were sporadically detected in the Perimeter Area Aggregate. Arochlor-1254 was detected in four samples collected near Buildings DA-7 and DA-21 and at station LL2-248, located in a drainage swale south of Building DA-5.

- VOCs were not detected in surface soils from the Perimeter Area Aggregate.

North Ditches Aggregate

- 2,4,6-TNT was detected once in dry sediment at an estimated concentration of 0.051J mg/kg. Propellants were not detected in surface soil samples from this aggregate.

- Six inorganic SRCs were identified, but usually at concentrations at or only slightly above the site-related background level.

- No SVOCs or PCBs/pesticides were detected in dry sediments collected from this aggregate. Acetone was detected at low (less than 0.1 mg/kg) estimated concentrations in two samples.

4.12.2 Subsurface Soil

Contamination in the subsurface soil at Load Line 2 varied considerably by aggregate. Explosives were confined to the Explosives Handling Areas and Perimeter Areas Aggregates, and were not detected in the subsurface in other aggregates. Inorganic SRCs were slightly more widespread in the subsurface, occurring in four of the six subsurface soil aggregates. The most commonly detected metals were antimony, arsenic, cadmium, lead, and zinc. Most results for metals were near or only slightly above the background criteria. The extent and magnitude of SRCs in subsurface soil corresponded with elevated levels observed in samples collected from the overlying surface soil interval. Propellants and pesticides were not detected in any subsurface soil sample at Load Line 2.

Based on the evaluation of the occurrence and distribution of contaminants in subsurface soil at Load Line 2, the following observations can be made.

Explosive Handling Areas Aggregate

- Eight explosive compounds were detected in at least one of the eight subsurface soil sample from the Explosives Handling Areas Aggregate; no propellants were detected. 2,4,6-TNT was the most commonly detected explosive (all eight subsurface samples) with a MDC of 240 mg/kg. The highest concentrations of explosives in subsurface soil corresponded to high concentrations observed in overlying soils (e.g., Explosive Handling Areas).

- Barium, beryllium, chromium, lead, and mercury were identified as SRCs in subsurface soil. Lead (40 times background) and mercury (160 times background) were the most prevalent inorganic SRCs. Maximum concentrations were clustered at Building DB-4 and DA-6 (stations LL2-130, LL2-132, and LL2-086).

- Organic compounds, other than explosives (discussed in Section 4.3.3), were not detected in subsurface soils from the Explosive Handling Areas Aggregate.

Preparation and Receiving Areas Aggregate

- Explosives were not detected in subsurface soils in the Preparation and Receiving Areas Aggregate.

- Antimony, cadmium, copper, lead, and zinc were identified as SRCs in subsurface soil in this aggregate. Maximum concentrations of these metals were all less than 3 times background criteria and were clustered at stations LL2-177 and LL2-167 located along the railroad tracks west of Buildings DB-802 and DB-3.

- Low, estimated concentrations of five SVOCs were detected in one sample in the Preparation and Receiving Areas Aggregate; only phenanthrene was present at a concentration above 0.1 mg/kg.

- Acetone, toluene, and 2-butanone were detected at low, estimated concentrations less than 0.1 mg/kg.

Packaging and Shipping Areas Aggregate

- Explosives were not detected in subsurface soils in the Packaging and Shipping Areas Aggregate.

- Eleven inorganic SRCs were identified in this aggregate. Distributions were sporadic and the maximum detected values for 10 of the 11 SRCs occurred in the 1- to 3-ft bgs sample from station LL2-100 along the railroad tracks west of Building BD-13. Antimony, arsenic, barium, beryllium, chromium, copper, lead, mercury, and zinc were the most persistent SRCs in subsurface soil. Of these persistent SRCs, antimony (23 times background), mercury (34 times above background), and lead (80 times background) had the greatest magnitude. The maximum arsenic value was at station LL2-072 (3 to 5 ft bgs), located on the northern corner of Building DB-27A.

- SVOCs and PCBs/pesticides were not detected in subsurface soil in this aggregate.

- Acetone, toluene, and 2-butanone were detected at low estimated concentrations less than 0.1 mg/kg.

Change Houses Aggregate

- Subsurface soil samples were not collected in this aggregate.

Perimeter Area Aggregate

- Three explosive compounds were detected in the subsurface soil sample collected at station LL2-094 located between two sets of railroad tracks northeast of Building DA-21. The maximum detected value was 450 mg/kg (2,4,6-TNT). No propellants were detected.

- Lead and cadmium were identified as SRCs in subsurface soils (1 to 3 ft bgs) in the Perimeter Area Aggregate. The maximum concentration of lead was less than twice the background criteria. This station is located between the two sets of railroad tracks just northeast of Building DA-21, and also contained the only explosive detections from subsurface soils in the Perimeter Area Aggregate.

- PCB-1260 was detected once at a low concentration (0.64J mg/kg).

North Ditches Aggregate

- Subsurface soil samples were not collected in this aggregate.

4.12.3 Sediment and Surface Water

Kelly's Pond and Exit Drainages Aggregate

- Three explosive compounds (2,4,6-TNT, 2,4-DNT, and 4-amino-2,6-DNT) were detected at low concentrations in sediments from the Kelly's Pond and Exit Drainages Aggregate. Four explosive compounds (2-amino-4,6-DNT , 4-amino-2,6-DNT, HMX, and RDX) were detected in surface water only at station LL2sd/sw-055(p); all concentrations were less than 0.01 mg/L.

- Inorganic SRCs occur in sediments from the Kelly's Pond and Exit Drainages Aggregate. Concentrations are typically low occurring at or slightly above the background criteria. Antimony, cadmium, and vanadium were detected at concentrations <0.01 mg/L in surface water and were considered as SRCs because they were not detected in background samples.

- Two pesticides and numerous SVOCs (primarily PAHs) were detected in sediment samples from the Kelly's Pond and Exit Drainages Aggregate. Most detected values were clustered at stations LLs-182 and LL2sd/sw-053(p), at concentrations less than 1 mg/kg.

- PCBs and VOCs were not detected in sediment in the Kelly's Pond and Exit Drainages Aggregate. Trace quantities of carbon disulfide were detected in one surface water sample.

North Ponds Aggregate

- No explosives were identified in the sediment sample from the North Ponds Aggregate; nitrocellulose was detected at a low, estimated concentration.

- Inorganic SRCs occurring in sediment in the North Ponds Aggregate include lead, nickel, and cadmium. All detected concentrations were low (1 to 2 mg/kg for lead and nickel, and less than 1 mg/kg for cadmium) and were estimated values.

- Organic constituents, other than nitrocellulose, were not detected in sediment.

Miscellaneous Water Samples

- Explosives, SVOCs, and PCBs/pesticides were not detected in the two miscellaneous water samples collected.

- Eleven metals were identified as SRCs in the Miscellaneous Water Samples Aggregate; however, seven of these also do not have site-related background values and were retained as SRCs in the absence of background criteria. Concentrations exceeding 2 times the background criteria were observed for arsenic, barium, manganese, and zinc.

4.12.4 Groundwater

- Explosives were detected only in well LL2mw-262 (RDX at 0.18J mg/L) and in well LL2mw-059 in the southern portion of the AOC. Five different explosive compounds were detected in LL2mw-059, with a maximum value of 0.0048 mg/L for 1,3,5-TNB. Concentrations of explosives measured over

four sampling events since 1996 are variable depending on the constituent; clearly increasing or decreasing trends are not evident.

- Inorganic SRCs detected above RVAAP background values includes antimony, arsenic, cobalt, manganese, and nickel. The maximum concentrations of all inorganic SRCs, except antimony, were detected in well LL2mw-265, located in the southern exit pathway area of the load line. The other two wells in this area did not contain inorganic SRCs above background criteria. The maximum concentration of antimony (0.008 mg/L) was detected in LL2mw-266, located in the Explosives Handling Areas Soil Aggregate.

- No SVOCs were detected in groundwater samples collected during the Phase II RI.

- Trace levels of heptachlor epoxide and Arochlor-1242 were sporadically detected; the highest concentrations for both compounds were observed in well LL2mw-059.

- Low levels of four VOCs were sporadically detected; all four constituents and maximum detected values occurred in well LL2mw-266 installed north of the sedimentation basin.

4.12.5 Storm and Sanitary Sewer System

- Analyses of sanitary sewer system sediment collected from the Ejector Station showed trace quantities (0.1J mg/kg) of two explosives. A number of inorganic SRCs were detected well above RVAAP background values for sediment, in particular silver (393 mg/kg) and lead (148 mg/kg). Low levels of SVOCs were detected with a maximum concentration of 2.2 mg/kg for benzoic acid. No VOCs were detected. Two pesticides (4,4-DDE and 4,4-DDT) were detected at trace concentrations.

- Analysis of water from the sanitary sewer Ejector Station showed very low concentrations (<0.001 mg/L) of four explosive compounds. Inorganics did not exceed RVAAP surface water background values. Pesticides, PCBs, or SVOCs were not detected. A trace concentration of trichloroethene was detected.

- Eight explosives compounds were detected in sediment collected from the storm sewer system. Stations MH-B2 and Inlet DB-11 contained the highest number and concentrations of explosives (up to 25 mg/kg for HMX and 10 mg/kg for 2,4,6-TNT, respectively). Both stations are near melt-pour building DB-4. No explosives or propellants compounds were detected in seven of the inlets and manholes sampled.

- High concentrations of inorganic SRCs were observed in storm sewer sediment samples collected at several locations. In particular, Inlet DB-20, adjacent to Building DB-2, contains very high levels of chromium (3,710 mg/kg), lead (23,700 mg/kg), mercury (4.9 mg/kg), antimony (8,910 mg/kg), and other metals. Hexavalent chromium was detected at Inlet C-4 at a concentration of 1.4 mg/kg.

- PCB-1254 was detected in 10 of the 12 storm sewer sediment samples with a maximum concentration of 31 mg/kg at DB-11. PCB-1260 was detected in sediment at Inlet DA-18 at a concentration of 0.016 mg/kg. Sediment samples collected from the storm sewer system were not analyzed for SVOCs, VOCs, or pesticides.

- Three water samples collected from the storm sewer system (MH-B1, MH-B2, and MH-304) contained low concentrations of six explosive compounds; the maximum detected value (RDX at 0.69 mg/L) occurred at MH-B1. Lead (maximum detect of 012 mg/L) and nickel (maximum detect of 0.0061 mg/L) were the most frequently detected inorganics above background. Antimony and

silver were also detected above background at MH-304. No pesticides, PCBs, or SVOCs were detected in the storm sewer water samples.

4.12.6 Buildings and Structures

- Soil beneath building sub-floors is generally uncontaminated, based on a limited number of samples collected from beneath the building floor slabs.

- Sediment collected from washout sumps located inside of Buildings DB-4 and DB-4A contained high concentrations of metals related to historical operations (cadmium, chromium, copper, lead), detectable quantities of several explosive and propellant compounds, PCB-1254 (up to 3,200 mg/kg), and PAHs. Corresponding water samples from the washout annex basins showed detectable concentrations of metals and explosives corresponding to those observed at high concentrations in sediment.

- Sediment samples collected from the covered sedimentation basin located north of Building DB-4 contained elevated levels of numerous metals related to historical operations (cadmium, chromium, copper, lead, silver, and zinc). Low levels of nitroguanidine and nitrocellulose; 4,4'-DDE; and PCBs were also detected. Trace levels of one SVOC and three VOCs were also detected. Water samples from the sedimentation basin contained detectable concentrations of metals and explosives corresponding to those observed at high concentrations in sediment.

- Floor sweepings samples contained very high concentrations of multiple metals, including cadmium, chromium, and lead. Cyanide and As^{+3} were detected in the samples collected from all three buildings, although concentrations were low and relatively consistent. Explosive compounds were detected in each of the floor sweep samples, with maximum levels (2,4,6-TNT at 160 mg/kg) observed in Building DB-3. Low, estimated concentrations of SVOCs, pesticides, and VOCs were detected in all of the floor sweep samples. PCB-1254 was detected in all floor sweep samples at similarly elevated concentrations (690 to 790 mg/kg). Cadmium and lead concentrations in floor sweep TCLP samples collected from Building DB-10 and Building DB-3 exceeded criteria for the toxicity characteristic.

- Ballast and slag samples contained elevated concentrations of major geochemical elements; one sample (LL2-177) contained high anomalously high concentrations of cadmium, copper, lead, nickel, and zinc as compared to other ballast samples. Vertical profiles for inorganics in soil beneath the ballast samples suggest that these materials may contribute to some contamination of underlying soil, but the effect rapidly diminishes with depth.