AOC B - Sulfuric Acid Tank

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5.5.29 AOC B – Sulfuric Acid Tank

Area of Concern (AOC) B at the Rhodia Silver Bow Site is the Sulfuric Acid Tank Area. Sulfuric acid was stored in an above ground tank located at the north end of the elemental phosphorus production area and was used to adjust the pH of process streams during production. The sulfuric acid tank was removed during Plant demolition activities in the late 1990s and the area was covered with several feet of coarse slag to bring the area up to grade.

5.5.29.1 RFI Investigation

The area near the former sulfuric acid tank was investigated by excavating test pits to view the soil profile and collect soil samples for field screening and laboratory analyses. Coarse slag, which had been placed as fill, was removed as necessary with a rubber tire backhoe to expose native soil prior to sampling. Four test pits (AOC-B-1 through AOC-B-4) were installed at the locations shown on Figure 5.5.29-1. Five soil samples (AOC-B-1 through AOC-B-5) from four test pits were collected from an interval of 0-to-1 feet in the native soil. The top of the native soil was encountered at depths ranging from approximately 3- to 5-feet below ground surface (bgs). Because field screening indicated soil impacts were present at depth, a sixth sample was collected from the bottom of test pit AOC B-3 which was excavated to a depth of approximately 18.5 feet bgs (maximum reach of backhoe). The soil samples were collected for field measurement of pH and laboratory analysis of metals.

The former sulfuric acid tank is located within SWMU 7 (Elemental Phosphorus Production Area). The soil boring program for SWMU 7 included an evaluation of soil pH in the samples collected from 4 borings installed along the north end of the SWMU 7 (i.e., EPP-1, EPP-2, EPP-3 and EPP-14). pH measurements were conducted on soil from each split-spoon sample collected from the 4 borings around the northern part of the area, near the former acid plant.

5.5.29.2 RFI Results

The objective of the RFI work for AOC B was to evaluate possible soil pH influences from the former Sulfuric Acid Tank defined as AOC B. The test pit and soil boring locations are shown on Figure 5.5.29-1. A cross section location map is presented on Figure 5.5.29-2. RFI analytical results are presented on Figures 5.5.29-3 through 5.5.29-7 for metals parameters. Figures 5.5.29-8 and 5.5.29-9 present a conceptual cross section prepared from soil boring and test trench data and present pH field screening results.

5.5.29.2.1 Soil pH

The soil pH readings ranged from 10.98 standard units from the 3-4 foot sample collected from test pit AOC B-4 to 2.97 standard units for the 18-18.5 foot interval collected from the bottom of test pit AOC B-3. The soil pH field data is summarized in Table 5.5.29-1.

A total of five pH field samples were collected from test pit AOC B-3 starting with the 3-4 foot interval, which had a pH of 4.87 standard units. The pH decreases with depth (Table 5.5.29-1 and Figure 5.5.29-9) to the base of excavation interval of 18-18.5 foot interval, which had a pH of 2.97 standard units. The cross section location map is provided in Figure 5.5.29-2 and the soil pH diagram showing the vertical distribution of pH measurements from the test pits is provided as Figure 5.5.29-9.

Soil pH was also measured in soil samples from borings (EPP-1, EPP-2, EPP-3 and EPP-14) installed at the perimeter of the SWMU 7. These locations are further away from the sulfuric acid tank area and soil pH values were essentially at neutral pH, ranging from 6.32 to 8.17.

The soil pH indicates that acid was released to the soils in AOC B. The acid migrated at least to a depth of 18.5 feet near the tank based on the low pH readings for the soil samples collected at AOC B-3. The low pH soils do not extend to the boundary defined by SWMU 7 since the pH for soil samples collected from these locations were near neutral. The soils do not represent a characteristic hazardous waste since the pH is greater than 2.0.

5.5.29.2.2 Metals

This section discusses the identification of metals constituents above background based on the data set of samples from AOC B. Six soil samples were collected from four test pits for analysis of metals. Five of the samples were collected from the 0- to 1-foot interval of native soil, which was generally encountered at depths ranging from 3- to 5-feet bgs, and one was collected from the bottom of test pit AOC B-3.

The AOC B metals sample data and background values (i.e., mean, maximum and 95% upper confidence limit of the mean) are summarized in Tables 5.5.29-2. The sample locations are shown on Figure 5.5.29-1. The data presentation on Figures 5.5.29-3 through 5.5.29-7 show the locations, concentrations, and depth intervals for the metals data.

Soil data from AOC B were compared to the background/reference area concentrations. Concentrations above the 95% upper confidence limit of the mean background/reference area

concentrations are highlighted on the constituent delineation figures presented in this section. Where a 95% upper confidence limit of the mean could not be calculated, the maximum detected concentration or the maximum detection limit was selected.

Constituent concentrations are described in this report as above background/reference area concentrations if the mean and maximum concentrations of the SWMU data exceed both of the mean and maximum background/reference area values. All data will be retained for evaluation in the human health and ecological risk assessments. The definitive background comparison will be conducted in the risk assessment using a statistical approach consistent with EPA guidance (U.S. EPA 2002).

As detailed below, certain metals are identified at concentrations above the background/reference area values. The risk assessment will identify which parameters, if any, are present at concentrations that warrant corrective measures. The dataset would be reviewed at that time and additional sampling may be necessary to inform the corrective measures study or later during the corrective measures design phase.

5.5.29.2.1.1 Metals - Group A

The metals included in Group A are arsenic, cadmium, chromium and copper. The distribution of these metal constituents in the 0-1 foot interval of native soil and the samples collected from AOC B-5 and the base of test pit AOC B-3, are shown on Figure 5.5.29-3.

Arsenic, cadmium, and copper concentrations are consistent with the background/reference area concentrations. The maximum chromium concentration (AOC B-4, 3-4 feet) was above the maximum background concentration (*see* Table 5.5.29-2). The maximum chromium concentration causes the mean concentration to be above the mean background concentration so chromium is above background concentrations.

5.5.29.2.1.2 Metals - Group B

The metals included in Group B are iron, manganese, nickel and lead. The distribution of these metal constituents in the 0-1 foot interval of native soil and the samples collected from AOC B-5 and the base of test pit AOC B-3, are shown on Figure 5.5.29-4. The concentrations for these metals are consistent with the background/reference area concentrations (*see* Table 5.5.29-2).

5.5.10.2.1.3 Metals - Group C

The metals included in Group C are selenium, silver, uranium, vanadium and zinc. The distribution of these metal constituents in the 0-1 foot interval of native soil and the samples collected from AOC B-5 and the base of test pit AOC B-3, are shown on Figure 5.5.29-5.

Silver, vanadium and zinc concentrations are consistent with the background/reference area concentrations. Selenium and uranium are present at concentrations above the maximum background concentrations (*see* Table 5.5.29-2).

5.5.29.2.1.3 Metals - Group D

The metals included in Group D are barium, beryllium, cobalt, mercury and thallium. The distribution of these metal constituents in the 0-1 foot interval of native soil and the samples collected from AOC B-5 and the base of test pit AOC B-3, are shown on Figure 5.5.29-6.

Beryllium, cobalt and thallium concentrations are consistent with the background/reference area concentrations. Barium and mercury are present at concentrations above the maximum background concentrations (*see* Table 5.5.29-2).

5.5.29.2.1.4 Metals - Group E

The metals included in Group E are antimony, calcium, magnesium, potassium and sodium. The distribution of these metal constituents in the 0-1 foot interval of native soil and the samples collected from AOC B-5 and the base of test pit AOC B-3, are shown on Figure 5.5.29-7.

Magnesium, potassium and antimony concentrations are consistent with the background/reference area concentrations. Calcium and sodium are present at concentrations above the maximum background concentrations, but these parameters are not hazardous constituents.

5.5.29.3 Conclusions

The following conclusions were developed based on review of the information presented in this section:

- Soil samples collected from the test pits installed to evaluate soil quality were generally below the neutral soil pH range of approximately 6 to 8 standard units. The pH of samples collected from test pit AOC B-3 decrease with depth with the lowest pH found at the deepest interval. As such, the vertical impacts have not been defined. Split spoon samples collected as part of the SWMU 7 investigation from soil borings (EPP-1, EPP-2, EPP-3 and EPP-14)

were essentially at neutral pH (ranging from 6.32 to 8.17) and provide a measure of horizontal extent.

- The following metals are considered above background because the mean and maximum concentrations are above the mean and maximum of the background/reference area concentrations: barium, calcium, chromium, mercury, selenium, sodium and uranium. The highest concentration for most of these metals was found in sample AOC B-4. The metals concentrations would be consistent with background if this sample were removed from the data set with the exception of mercury. The highest concentration for mercury was found in sample AOC B-2.

There is sufficient information to conduct the risk assessment for this AOC. The risk assessment will identify which parameters, if any, are present at concentrations that may warrant corrective measures. The dataset would be reviewed at that time and additional sampling may be necessary to inform the corrective measures study or later during the corrective measures design phase.

5.5.29.4 References

U.S. EPA. 2002. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. U.S. Environmental Protection Agency. EPA 540-R-01-003. OSWER 9285.7-41. September 2002

Tables

Table 5.5.29-1
Soil Data - pH
AOC-B
Rhodia Silver Bow Plant
[concentrations in pH units]

			Chemical Name	pH
Location ID	Sample Date	Depth	Sample Type	
AOC-B-1	05/20/2009	4.3 - 5.3 ft	N	**5.71**
AOC-B-2	05/20/2009	5 - 6 ft	N	**4.99**
AOC-B-3	05/20/2009	3 - 4 ft	N	**4.87**
AOC-B-3	05/20/2009	7 - 8 ft	N	**4.20**
AOC-B-3	05/20/2009	14.5 - 14.5 ft	N	**3.70**
AOC-B-3	05/20/2009	17 - 18 ft	N	**3.16**
AOC-B-3	05/20/2009	18 - 18.5 ft	N	**2.97**
AOC-B-4	05/20/2009	3 - 4 ft	N	**10.98**
AOC-B-5	05/20/2009	4 - 6 ft	N	**5.74**
EPP-1	05/27/2009	2 - 4 ft	N	**6.98**
EPP-1	05/27/2009	4.5 - 6.5 ft	N	**6.87**
EPP-1	05/27/2009	7 - 9 ft	N	**6.32**
EPP-1	05/27/2009	9.5 - 11.5 ft	N	**5.95**
EPP-2	05/27/2009	2 - 4 ft	N	**7.04**
EPP-2	05/27/2009	4.5 - 6.5 ft	N	**7.84**
EPP-2	05/27/2009	7 - 9 ft	N	**7.70**
EPP-2	05/27/2009	9.5 - 11.5 ft	N	**7.80**
EPP-3	05/27/2009	3 - 4 ft	N	**7.40**
EPP-3	05/27/2009	5 - 7 ft	N	**7.50**
EPP-3	05/27/2009	8 - 10 ft	N	**8.17**
EPP-3	05/27/2009	10.5 - 12.5 ft	N	**7.83**
EPP-14	05/27/2009	2 - 4 ft	N	**8.00**
EPP-14	05/27/2009	4.5 - 6.5 ft	N	**7.88**
EPP-14	05/27/2009	7 - 9 ft	N	**7.87**
EPP-14	05/27/2009	9.5 - 11.5 ft	N	**7.72**

Table 5.5.29-2
Soil Data - Metals
AOC-B
Rhodia Silver Bow Plant
[concentration in mg/kg]

Chemical Name / Analysis Location				Antimony Lab	Arsenic Lab	Barium Lab	Beryllium Lab	Cadmium Lab	Calcium Lab	Chromium Lab	Cobalt Lab	Copper Lab	Iron Lab	Lead Lab	Magnesium Lab	Manganese Lab	Mercury Lab	Nickel Lab	Potassium Lab	Selenium Lab	Silver Lab	Sodium Lab	Thallium Lab	Uranium Lab	Vanadium Lab	Zinc Lab
Background Mean, Exceedances **Bold**				**0.50**	23	**150**	**0.51**	**1.6**	**3900**	**11**	5.9	35	**19600**	17	**3500**	540	**0.021**	**5.3**	**3000**	**0.41**	**0.73 (1)**	**140**	**0.35**	**1.8**	**41**	**59**
Background Maximum, Exceedances Underline				3.9	120	290	1.3	8.9	14000	48	9.5	301	35300	190	5700	1100	0.20	21	5300	0.70	1.7 (1)	620	1.0	4.1	83	380
Background 95% UPL, Exceedances *Italic*				1.0	40	*170*	*0.55*	*1.1*	*4500*	*12*	6.1	64	*20600*	35	*3700*	570	*0.038*	*6.0*	*3200*	*0.47*	*0.35 (1)*	*220*	0.46	*2.0*	*43*	98
Location ID	**Sample Date**	**Depth**	**Sample Type**																							
AOC-B-1	05/20/2009	4.3 - 5.3 ft	N	0.45	4.8	**168**	0.34 J	< 0.2	2700	5.6	4.5	23.3	***21600***	5.6 J	***4150***	171	0.011 J	4.5	***3870***	< 0.8	< 0.4	**161**	0.337	0.693	40.5	**61.4**
AOC-B-2	05/20/2009	5 - 6 ft	N	**0.67**	< 0.3	32.8	0.02 J	< 0.2	1720	0.5 J	< 0.3	0.8 J	43.7	6.2 J	8.49	0.52 J	***5.550***	< 0.6	707	***0.8 J***	***1.5 J***	***377***	0.042	0.081	< 0.44	< 0.3
AOC-B-3	05/20/2009	3 - 4 ft	N	0.47	< 0.3	15.0	< 0.01	< 0.2	875	< 0.4	< 0.3	< 0.7	63.5	< 3.3	16.0	0.50 J	***0.200***	< 0.6	240	***1.3***	*0.6 J*	***320***	0.022 J	0.031	< 0.44	< 0.3
AOC-B-3	05/20/2009	18 - 18.5 ft	N	0.24	5.4	***382***	0.21 J	0.30 J	***13000***	6.9	0.4 J	10.6	11400	8.4 J	964	50.80	***0.151***	0.9 J	2970	< 0.7	< 0.4	***823***	**0.380**	**1.810**	17.6	24.9
AOC-B-4	05/20/2009	3 - 4 ft	N	0.17	< 0.3	***202***	***1.83***	***5.4***	***238000***	***84.1***	< 0.3	4.2	765	< 3.2	***4740***	93.70	**0.025**	1.2 J	***5730***	***1.7***	< 0.4	***2500***	0.094	***139***	***68.0***	**67.9**
AOC-B-5	05/20/2009	4 - 6 ft	N	0.42	7.7	***210***	***0.60 J***	0.4 J	***5870***	6.6	5.3	21.6	17700	8.6 J	**3560**	458	**0.026**	***13.6***	***3630***	< 0.9	< 0.5	***258***	0.282	**1.950**	34.8	57.3

12/17/2012
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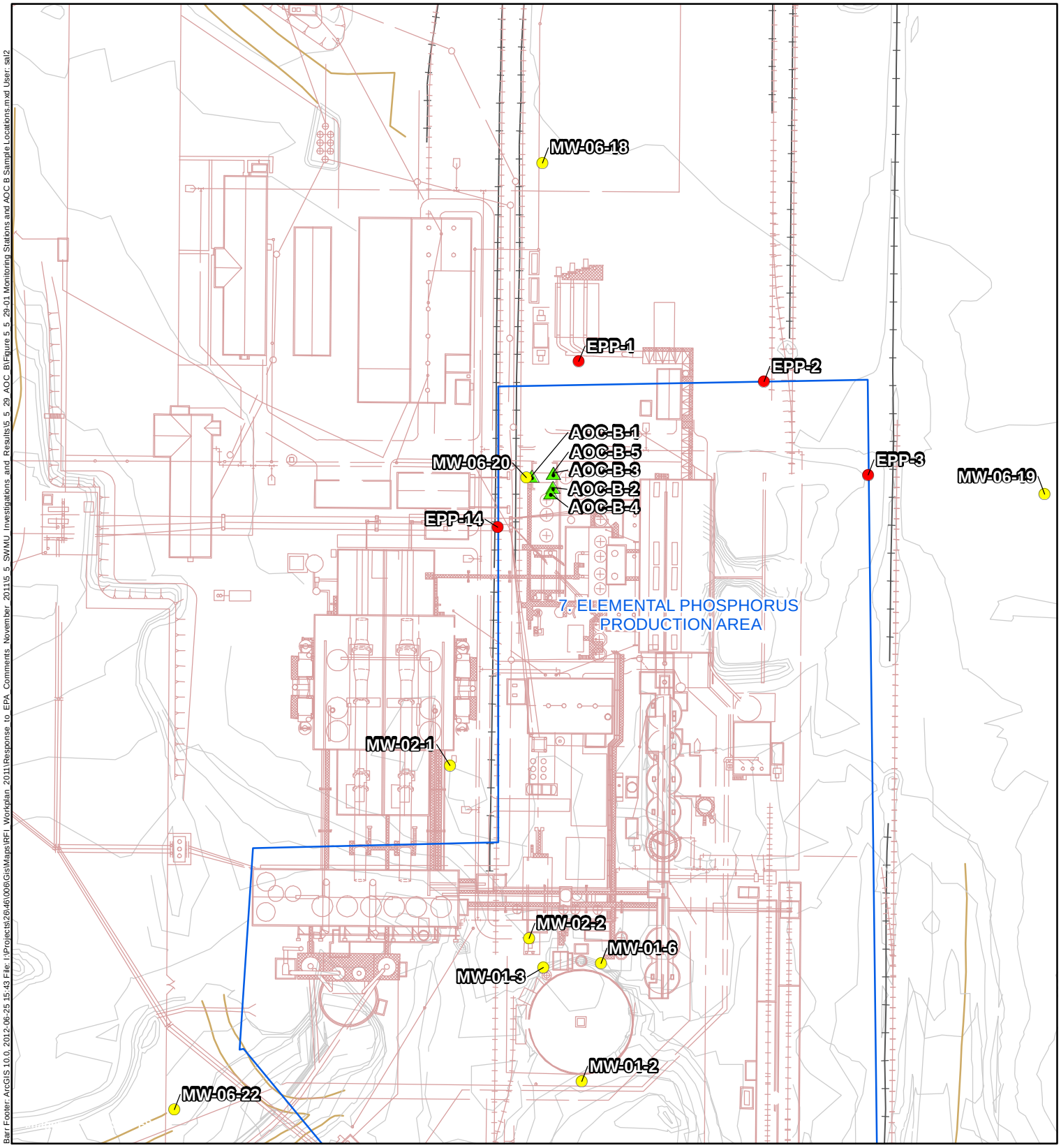
Figures



Barr Footer: ArcGIS 10.0, 2012-06-25 15:43 File: \\Projects\26\46\006\Gis\Maps\RFI Workplan 2011\Response to EPA Comments November 2011\5 5 SWMU Investigations and Results\5 5 29 AOC B\Figure 5 5 29-01 Monitoring Stations and AOC B Sample Locations.mxd User: sal2

Figure 5.5.29-1

MONITORING STATIONS AND AOC B SAMPLE LOCATIONS
Rhodia Silver Bow Plant
Montana

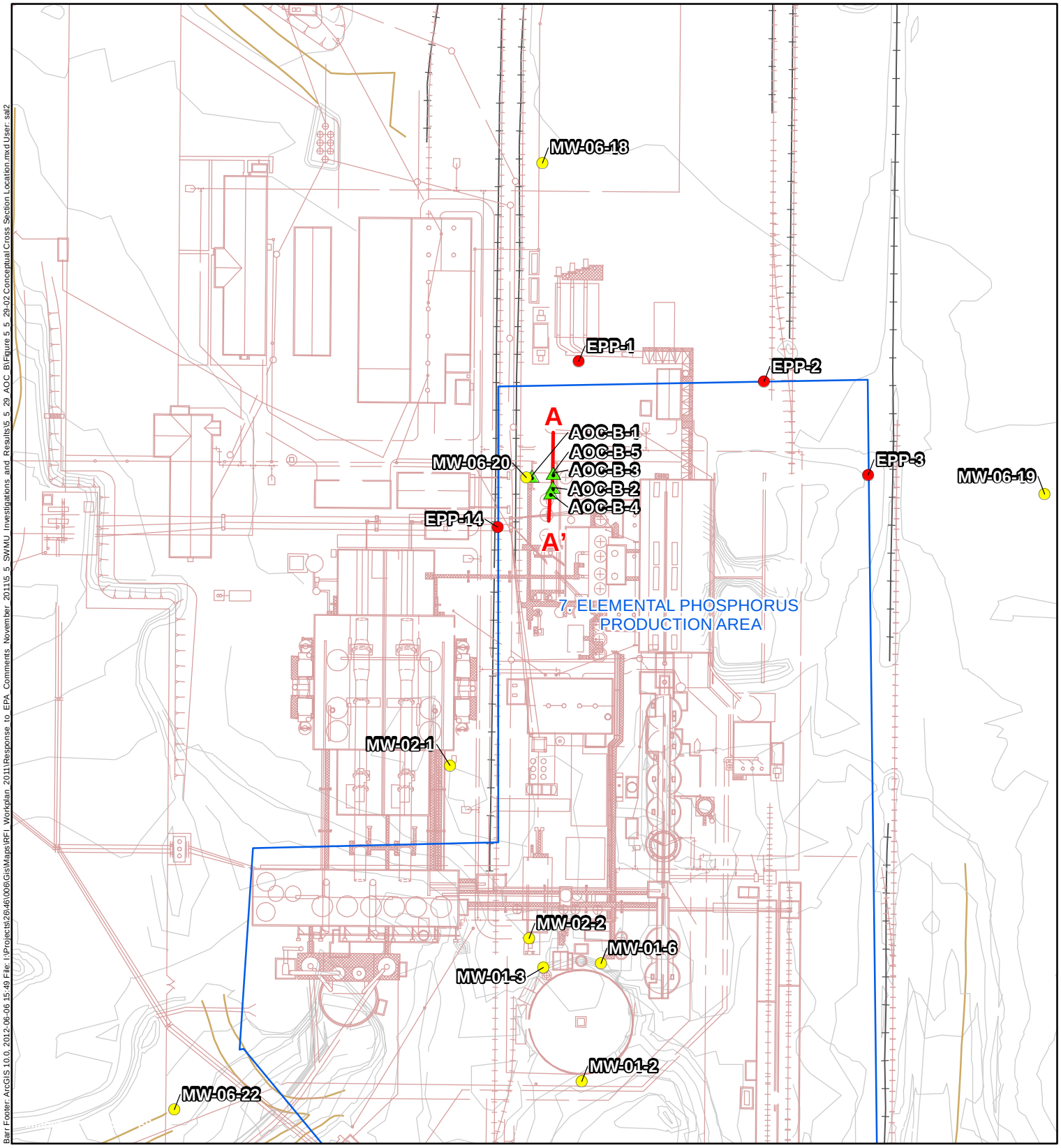
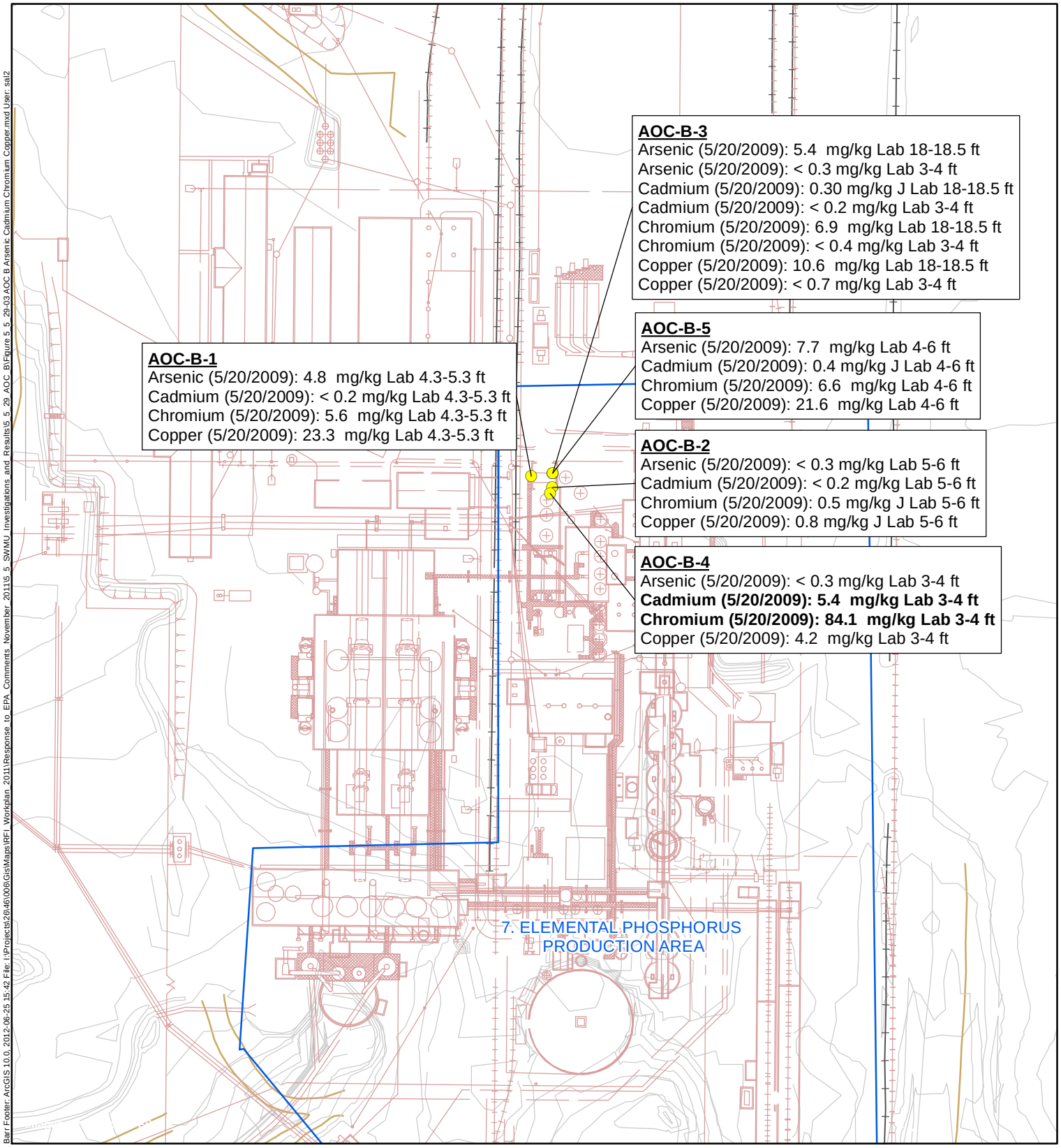


Figure 5.5.29-2

AOC B
CONCEPTUAL CROSS SECTION LOCATION
Rhodia Silver Bow Plant
Montana



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Sample Location

Solid Waste Management Units and Areas Of Concern

Elevation Contour

Drainage

Railroad

Road

Former Plant Structures

N

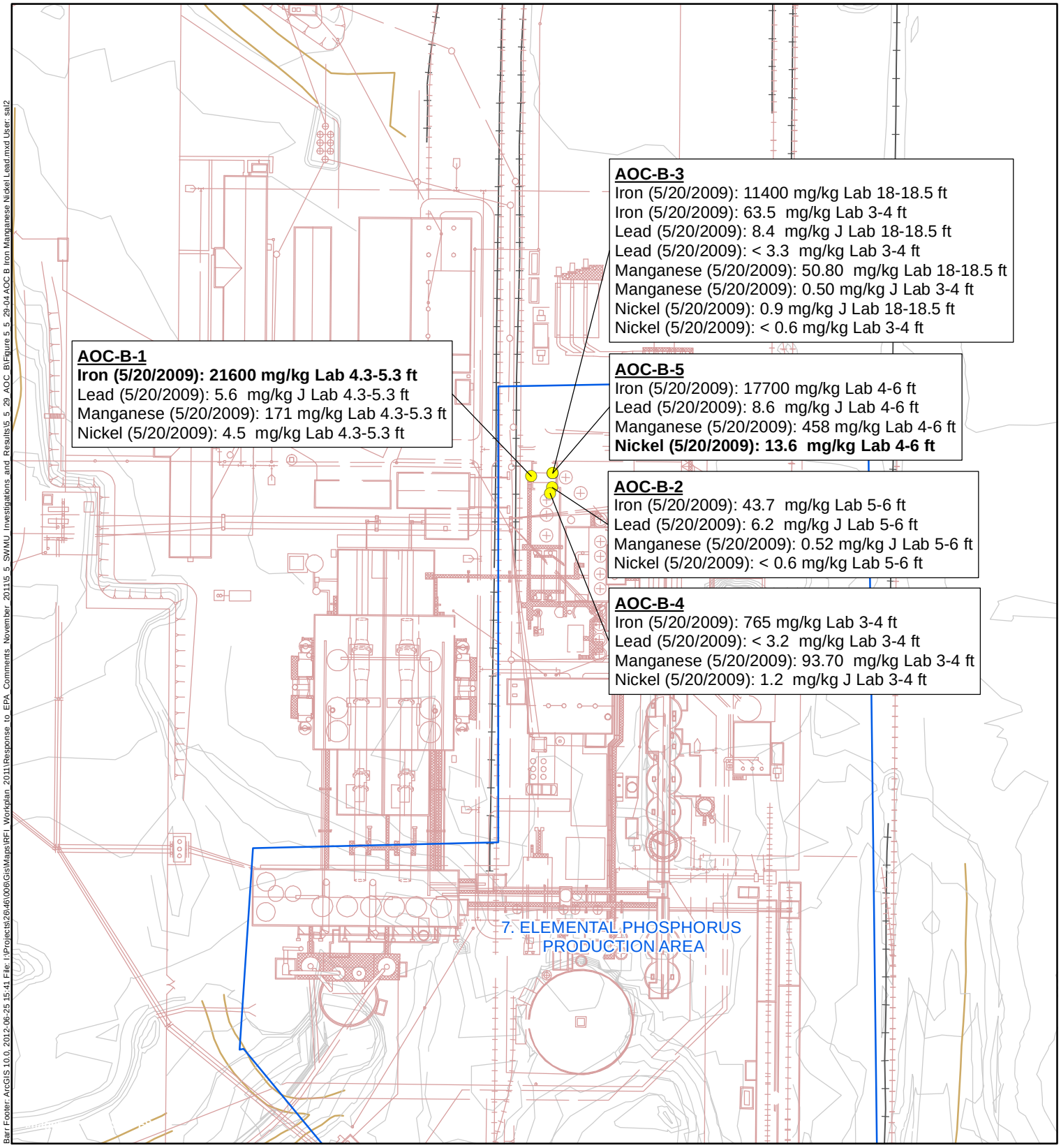
Feet

100 0 100

Bold font indicates that sample concentration is greater than the 95% UPL Reference Area Concentration.

Figure 5.5.29-3

AOC B
ARSENIC, CADMIUM, CHROMIUM, AND COPPER
Rhodia Silver Bow Plant
Montana



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Sample Location

Solid Waste Management Units and Areas Of Concern

Elevation Contour

Drainage

Railroad

Road

Former Plant Structures

N

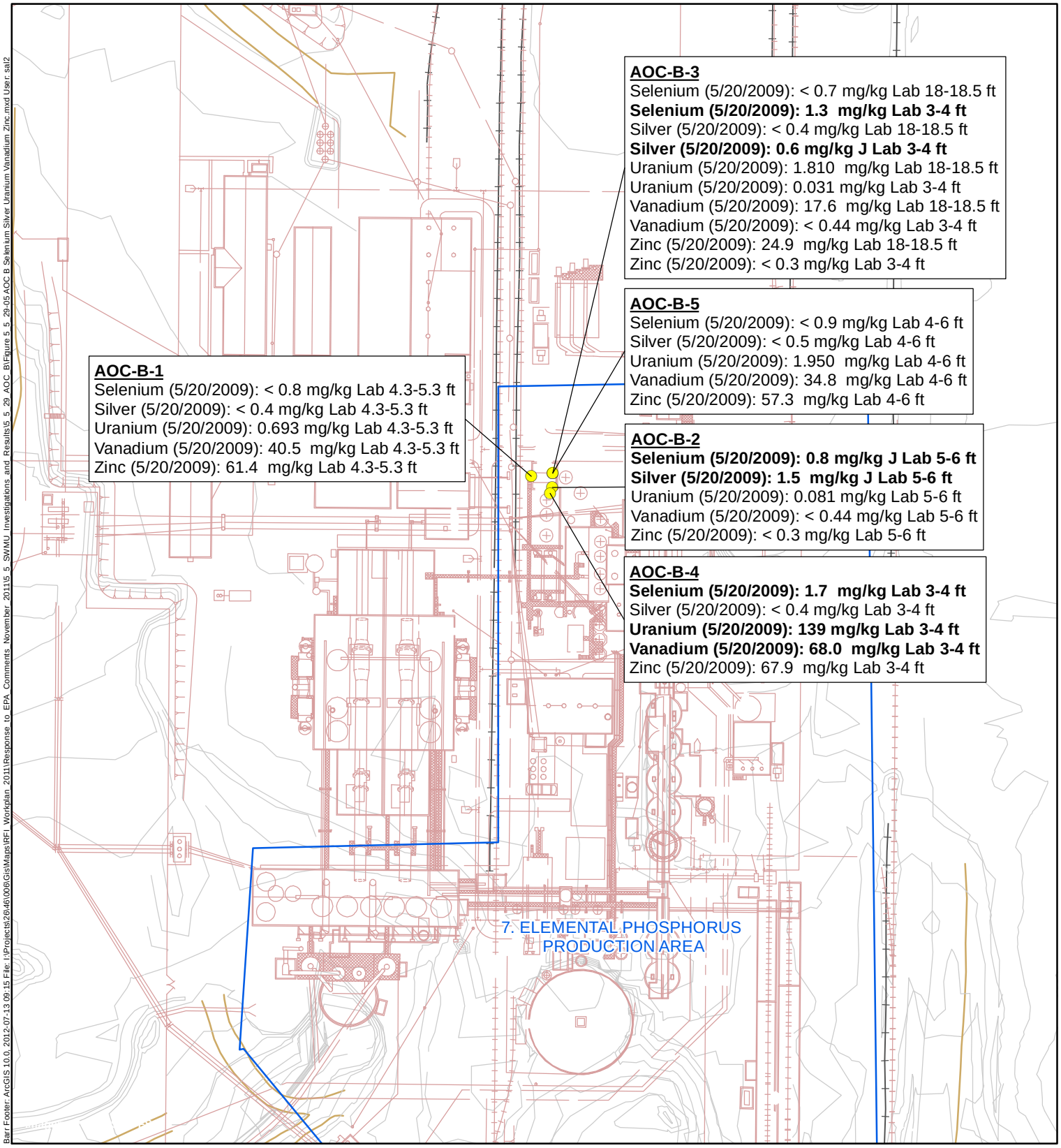
Feet

100 0 100

Bold font indicates that sample concentration is greater than the 95% UPL Reference Area Concentration.

Figure 5.5.29-4

AOC B
IRON, MANGANESE, NICKEL, AND LEAD
Rhodia Silver Bow Plant
Montana



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Sample Location

Solid Waste Management Units and Areas Of Concern

Elevation Contour

Drainage

Railroad

Road

Former Plant Structures

N

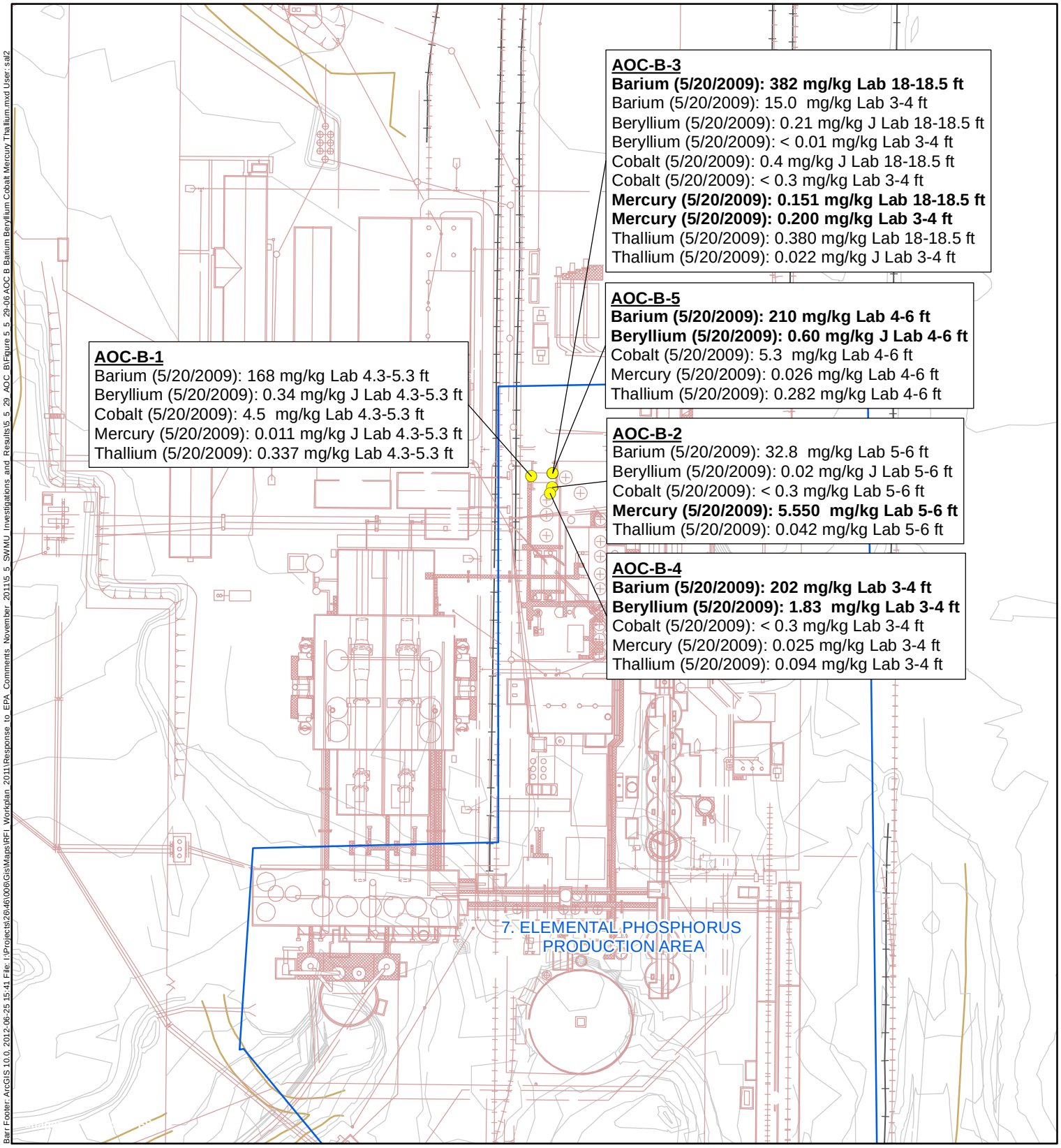
Feet

100 0 100

Bold font indicates that sample concentration is greater than the 95% UPL Reference Area Concentration.

Figure 5.5.29-5

AOC B
SELENIUM, SILVER, URANIUM, VANADIUM, AND ZINC
Rhodia Silver Bow Plant
Montana



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Sample Location

Solid Waste Management Units and Areas Of Concern

Elevation Contour

Drainage

Railroad

Road

Former Plant Structures

N

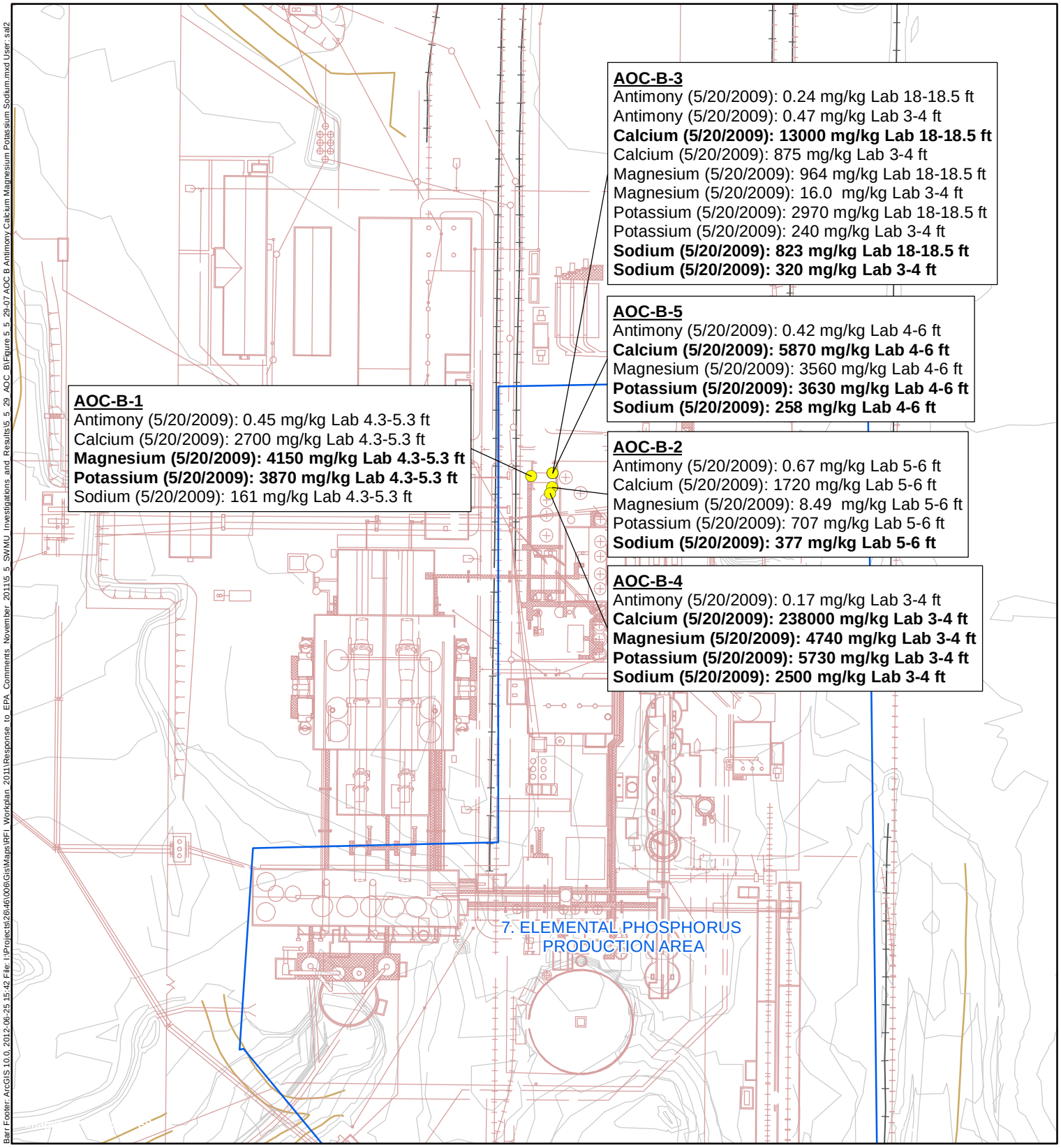
Feet

100 0 100

Bold font indicates that sample concentration is greater than the 95% UPL Reference Area Concentration.

Figure 5.5.29-6

AOC B
BARIUM, BERYLLIUM, COBALT, MERCURY, AND THALLIUM
Rhodia Silver Bow Plant
Montana



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Sample Location

Solid Waste Management Units and Areas Of Concern

Elevation Contour

Drainage

Railroad

Road

Former Plant Structures

N

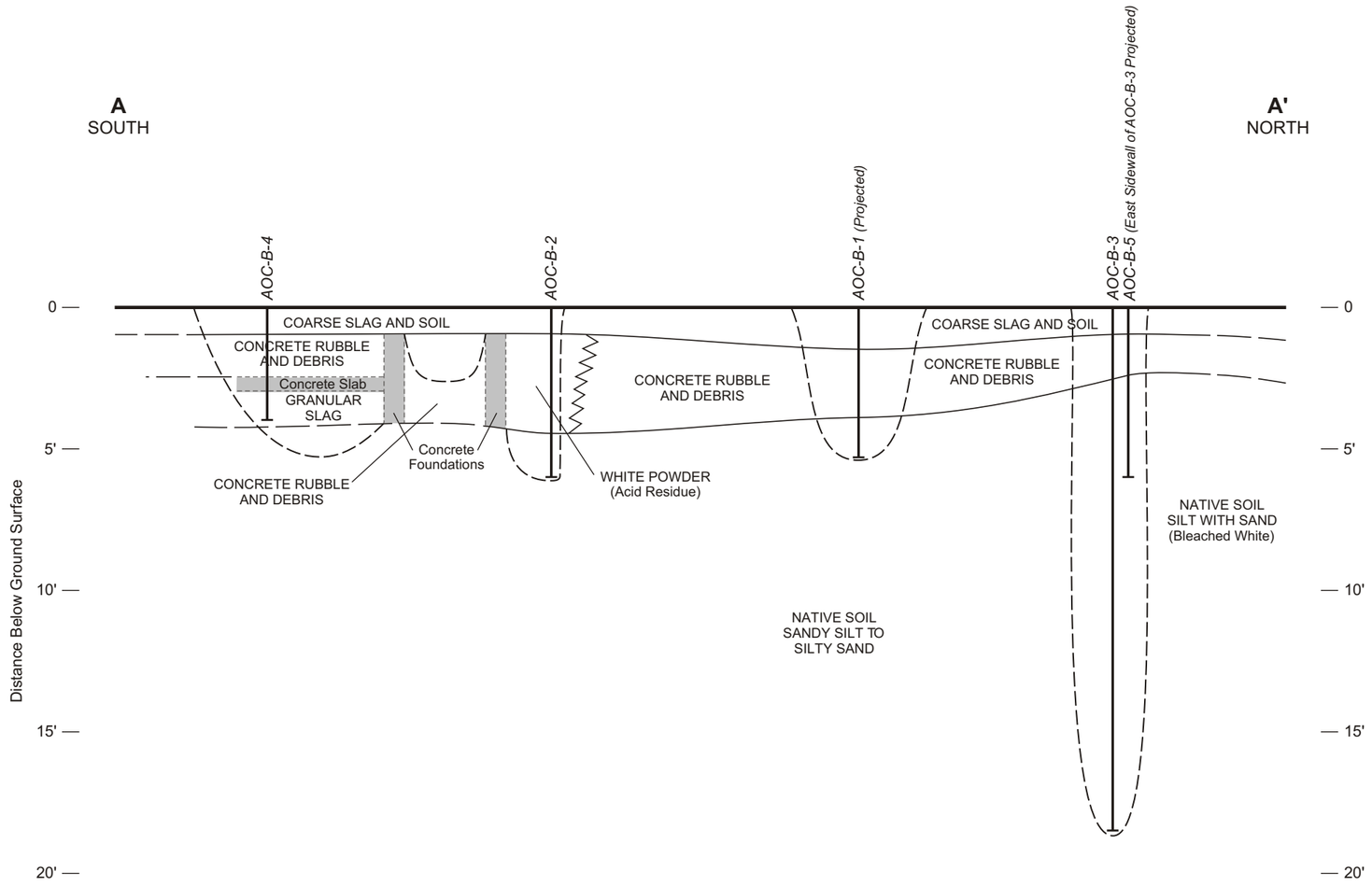
Feet

100 0 100

Bold font indicates that sample concentration is greater than the 95% UPL Reference Area Concentration.

Figure 5.5.29-7

AOC B
ANTIMONY, CALCIUM, MAGNESIUM, POTASSIUM, AND SODIUM
Rhodia Silver Bow Plant
Montana



No Horizontal Scale

Figure 5.5.29-8

CONCEPTUAL CROSS SECTION A-A'
ACROSS AOC-B
Rhodia Silver Bow Plant
Montana

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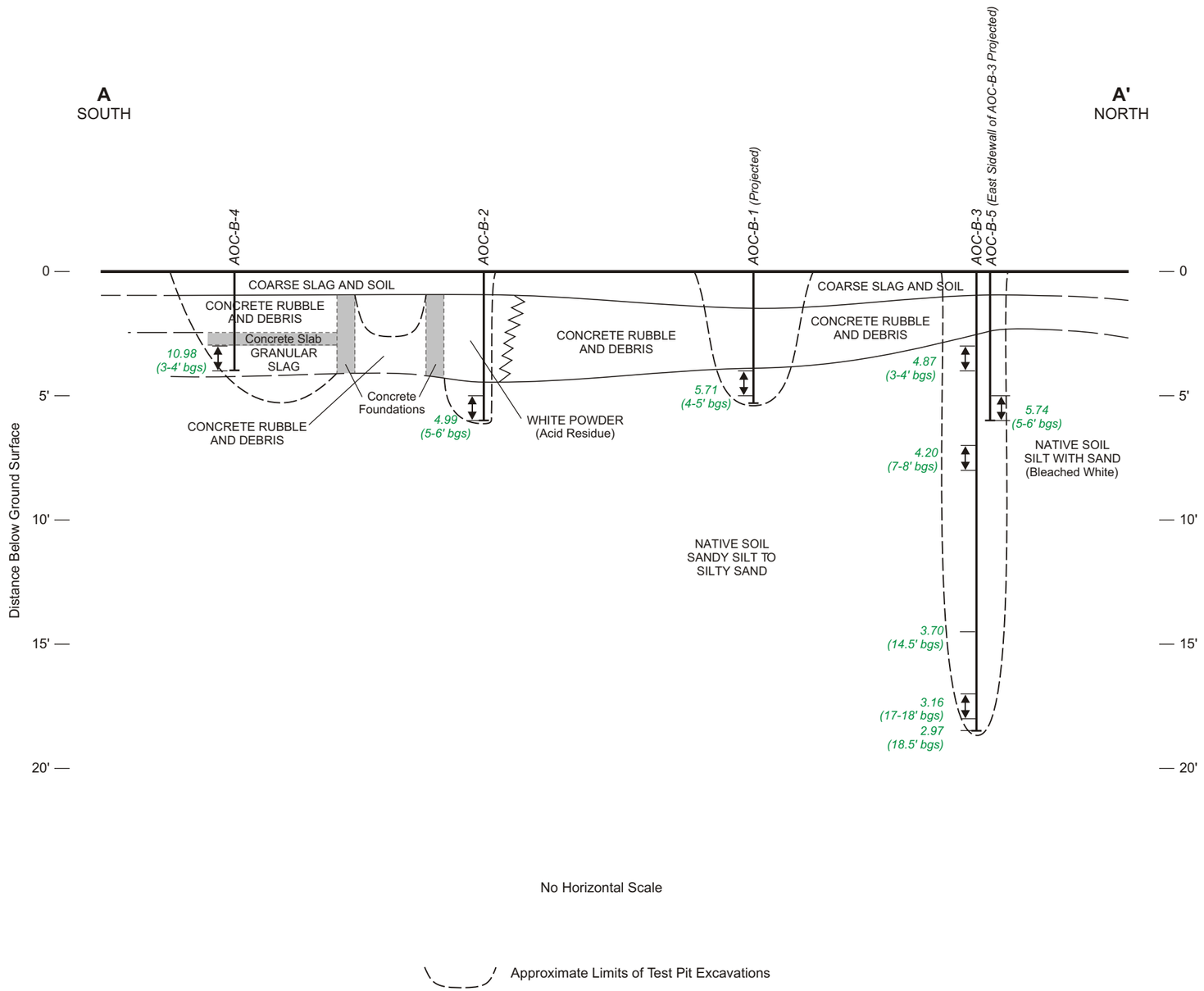


P:\Mpls\26 MT\46\2646006\WorkFiles\Figures_Graphics\2012 Cross Sections\Conceptual Cross Section A-A' Soil pH Measurements.CDR RLG 12-17-12

Figure 5.5.29-9

CONCEPTUAL CROSS SECTION A-A'
SOIL pH MEASUREMENTS
Rhodia Silver Bow Plant
Montana

Appendices

Appendix 5.5.29-A

Test Trench Field Notes

Location Rhodia Date 5/20/09

Project / Client 26/46-0006.13

2009 Soil Investigation SKW

AOC B-2 sample location

-located in ~~SW~~ SE corner of Sulfuric Acid Tank Area.

Cam ~~KA~~ said the transfer pump was located in this area.

Depth	Description
0-1'	Slag - angular gy to bl-gy
1'-4.5'	White powder (sulfuric acid-product) some dk sk staining near 4'-4.5' base
4.5'-6'	Lt gy to Pinkish gy Sandy silt - appears to be Native material that is imported

12:30 - collected sample at 5'-6' bgs for Metals & pH - 2-8 oz jars

Sample name = AOC-B-2 (5-6')

-SKW spoke with Chris Frerich & Tom Matthias about impacts seen in AOC-B-2 test pit. Plan is to collect sample at top of native and try to dig down to where impacts stop or at

Location Rhodia Date 5/20/09

Project / Client 26/46-0006.13

2009 Soil Investigation SKW

the maximum depth the backhoe can reach. Screen soil by visual impacts & checking pH.

12:45 - SKW calibrating YSI 60
pH 7 = 7.0
pH 10 = 10.0

AOC B-3 sample location

Depth	Description
0-1'	gy slag (angular)
1'-2.5'	Rubble gy-brn

> See next pg for P.I. description

-SKW takes pH measurement of sand from AOC-B-1 (4-5')
pH = 3.70

~~Unable to~~ Spl pH measurement of DI was around 4.8 which seems low. YSI possibly malfunctioning due to low pH ~~reading~~ Sup reading at AOC-B-1 soil. Will later take pH measurement with litmus paper later SKW

Location Rhodia Date 5/20/09

Project / Client 26/46-0006.13

2009 Soil Investigation MMB/SKN

AOC-B-3

Depth	Description
0-1.0	coarse slag, gray.
1.0-2.5	Rubble, brown-gray.
2.5-18.5'	whitish (bleached) native soil (silt w/ fg sand) Hardened ~~15-17'~~ 14.5-16' MMB.

Hardened areas have some yellowish staining and moderate odor (rotten egg).

Bottom ~~East~~ SKW of trench - backhoe can no longer reach.

Impacts on eastern side of trench seem to be minimal. Soil in east sidewall is yellow-tan rather than the whitish color of the acid impacted soils.

Collected sample from 18-18.5' at base of ~~excava~~ trench at 15:30.
- sample name SKW = AOC-B-3 (18-18.5')
- collected 2-8oz jars for Metals + pH

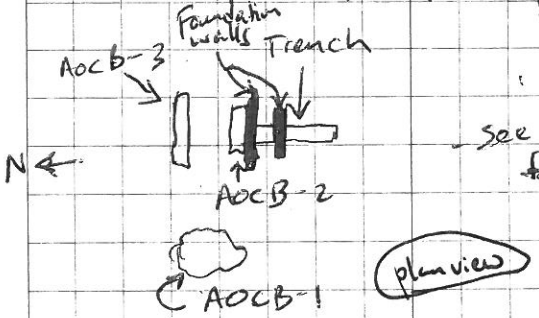
- collected sample from east sidewall at ~~east~~ SKW 4-6' bgs for Metals + pH at 15:40
sample name = AOC-B-5 (4-6')

Location Rhodia Date 5/20/09

Project / Client 26/46-0006.13

2009 Soil Investigation MMB/SKN

1545 Gary setting up to trench to south of AOCB-2 pit.



- see test pit log for details

Foundation walls are 4' apart (on center) ~1.5' thick. At-grade cement floor on building to the south - cement floor built on compacted granular slag (light gray).
- not sure what material is below floor. Material is very hard + backhoe is have difficult time to SKW digging through it. Decided to collect sample at 3 to 4' to see if acid inputs extend to south of the foundation walls.
- see sheet next pg for sample locations.

Location Rhodia Date 5/20/09

Project / Client 26146-0006.13

2009 SOIL INVESTIGATION SKW

Sample Summary Table

Sample ID	# 8oz Jars	Parameters	Location Description
① AOC-B-1 (4.3-5.3')	2	Metals + pH	0.4' below top of Native Soils
② AOC-B-2 (5-6')	2	Metals + pH	0.5' below bottom of white powder (acid)
③ AOC-B-3 (3-4')	2	Metals + pH	0.5' below top of Native soils impacted by acid
④ AOC-B-3 (18-18.5)	2	Metals + pH	bottom of Test Pit in Native Soils impacted by acids
④ AOC-B-4 (3-4')	2	Metals + pH	Lt. grey material south of foundation wall + below 4" thick concrete slab
⑤ AOC-B-5 (4-6')	1	Metals + pH	East sidewall of AOC-B-3 test pit. No visual impacts from acid

-will check pH of samples in with litmus paper. SKW

Sample locations - see sketch →

17:00 - Gary backfilling last AOC AOC-B-Test Pit (AOC-B-4)

Covered surface with slick rock to prevent acid impacted soils from migrating away from AOC-B.

Location Date 5/20/09

Project / Client

SKW

AOC-B sketch

Time

12:00

~~12:30~~ SKW

~~13:45~~ 12:30

13:45

15:30

16:30

15:40