Uroboros Glass Area-Wide

Soil Sampling Report

March 2016

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Northwest Region
Cleanup Program
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State of Oregon
Department of Environmental Quality

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Background

DEQ collected 27 soil samples and 2 mulch samples from 3 properties in North Portland (Lillis Albina Park, Grandma's Place Daycare and Albina Community Gardens) in the vicinity of North Kerby Avenue and 21st street (Figure1). DEQ performed the sampling in response to concerns related to particulate emission deposition, specifically metals, associated with the Uroboros Glass Company, located at 2181 North Kerby Ave in Portland Oregon. Soil sample sites were selected based on available sampling locations (available soil media) in the vicinity of the Uroboros Glass Company (Figure 1).

Soil sampling objectives, study design, data collection methodology, and data quality were implemented as described in the *Uroboros Area-Wide Soil Sampling and Analysis Plan (SAP), DEQ, February 18, 2016*. Soil samples were collected on February 19 and 23, 2016 and were transferred to Environmental Science Corp. (ESC) Lab Sciences along with chain of custody documentation for analysis of a suite of metals.

Soil samples were analyzed for the following metals that were thought to be potentially associated with the glass manufacturing process and subsequently emitted and deposited onto soil.

- Arsenic (As)
- Boron (B)
- Cadmium (Cd)
- Total Chromium (Cr) and Chromium +6 (Cr +6, hexavalent chromium)
- Lead (Pb)
- Manganese (Mn)
- Cobalt (Co)
- Nickel (Ni)
- Mercury (Hg)
- Selenium (Se)
- Iron (Fe)
- Aluminum (Al)

Iron and aluminum are commonly present in soil, and were added to assist with data interpretation.

Sampling Methods

Between February 19 and February 23, 2016, DEQ collected soil samples from the three properties nearby the Uroboros Glass Company property in accordance with DEQ's *Uroboros Area-Wide Soil Sampling and Analysis Plan, February 18, 2016.* Samples were placed in an iced cooler, and transported to and analyzed at ESC following standard analytical Quality Assurance/Quality Control (QA/QC) procedures. The laboratory is accredited under the National Environmental Laboratory Accreditation Program (NELAP).

The samples are generally representative of surface soil and were collected primarily at shallow depths up to six inches below ground surface (bgs). One sample was collected at a deeper interval at 8 inches bgs.

Soil sample location at Grandma's Place Daycare
February 19, 2016

Soil sample location at Albina Community Garden
February 23,, 2016

The SAP described preliminary soil screening using a portable X-Ray Florescence analyzer (XRF). The SAP was prepared with the intention that XRF analysis would be used to determine sample locations for laboratory analysis. However, due to interference from the moisture content of saturated soil from recent rain during the Bullseye sampling event, it was decided that the XRF would not be used during the Uroboros Glass area-wide soil sampling.

Analytical Results

DEQ staff collected a total of 27 soil samples and 2 mulch samples from Lillis Albina Park, Grandma's Place Daycare and Albina Community Garden properties with sampling locations shown on Figure 1. Of these 29 samples, 12, 6, and 11 samples were collected at Lillis Albina Park, Grandma's Place Daycare and Albina Community Garden properties, respectively. These sample locations and corresponding concentrations for select metals are presented and compared to risk-based screening criteria on Figures 2 through 6. Analytical data are presented and compared to screening criteria in Appendix A, Tables 1-4. Two samples represent mulch (i.e., bark chips) collected from the Lillis Albina Park playground and are presented in Table 4 and Figure 7. It is important to note that the risk-based soil screening criteria presented in Table 5 are appropriate for comparison to average (i.e., mean) concentrations, not individual sample results. Comparing the average soil concentration from an area to the screening criteria provides a better analysis of risk, as people move around and are unlikely to be exposed to potential contamination at one specific location from ingesting or inhaling the soil. Individual sample concentrations represent small volumes of soil taken from one specific location and are not directly relevant for long-term exposure for which the comparision criteria were developed.

Screening criteria used for comparison to analytical data are presented in Table 5, and referenced here:

1. Background Levels of Metals in Soils for Cleanups, Fact Sheet, Oregon DEQ, Land Quality Division, Environmental Cleanup Program, March 20, 2013. Available at:

   http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf

2. ATSDRs Environmental Guidelines, used nationally. Available at:

   http://www.atsdr.cdc.gov/hac/phamanual/appf.html

3. DEQ's Risk-Based Concentrations (RBCs), last updated November 2015. DEQ publishes RBCs for assessing sites within the state. Available at:

   www.deq.state.or.us/lq/pubs/docs/RBDMTable.pdf

Conclusions

At each of the three soil sampling locations, most metals analyzed were measured in a concentration range expected for naturally-occurring metals. These metals are arsenic, aluminum, boron, cobalt, iron, manganese, nickel, mercury, and selenium.
Exceptions at one or more locations are lead, cadmium, total chromium, and hexavalent chromium or chromium +6, each of which is discussed further here.

Lead levels were low and consistent with background at the Albina Community Garden location. At the Lillis Albina Park location, four of ten samples were above DEQ's estimate of background, but the overall average was within a range expected for background, and all lead concentrations at this location were below DEQ's screening value. Similarly, at the Grandma's Place Daycare location, two samples exceeded the background estimate, but the overall average was within a background range and below the DEQ screening level.

Cadmium levels at Lillas Albina Park and Albina Community Garden were below regional background levels. One of the six samples at Grandma's Place Daycare was above background, however the overall average for all samples at the daycare was below cadmium background levels.

Chromium +6 at the Albina Community Garden was mostly non-detect with one detection above the method reporting limit[1] and three estimated values below the method reporting limit. We did not determine an estimated average concentration due to the lack of reliable concentration data. At Grandma's Place Daycare, there were five non-detections and one estimated value slightly above the method detection limit[2] but below the method reporting limit. The sample with the estimated value had a duplicate sample, for which the result was non-detect. This difference between a non-detect and a low level estimate in a duplicate sample illustrates the imprecision in low level analysis near the method detection limit.

At Lillis Albina Park, there were two detections for chromium +6 above the method reporting limit, four estimated values below the reporting limit, and four non-detections. A mean value was estimated with these data at or just below one milligram per kilogram (mg/kg).

[1] The method reporting limit is the concentration above which the analyte concentration can be reliably quantified.
[2] A method detection limit is the minimum concentration of a substance that can be measured and reported with 99% confidence that the substance concentration is greater than zero.

Total chromium was within a concentration range expected for background at Lillis Albina Park and the Grandma's Place Daycare. At the Albina Community Garden, 10 of 11 samples were consistent with background. One duplicate sample had a result of 217 mg/kg, while the primary sample was within the background range at 16.1 mg/kg. The relative percent difference (RPD) between the primary and field duplicate is 172%, exceeding desired variation for differences between primary and duplicate samples as presented in the *EPA PA/SI Quality Assurance Project Plan,* dated August 14, 2012. The reason for the high RPD is unknown. However, one possible explanation could be the heterogeneity of the soil matrix. Soil has considerable variation in particle size, and the relatively small volume used in the analysis of a discrete grab sample does not capture this variation. Iron, manganese and aluminum were also unsually high in the same duplicate sample which could indicate a random particle of a metallic substance was included in the sample duplicate, but not in the primary sample analysis. Regardless of the source of the variation, an average was estimated at 88 mg/kg, which is well below screening levels for total chromium.

Based on a comparison of the soil data to health-based screening levels, there does not appear to be excess risk to human health from the metals deposition onto the soil in the vicinity of the Uroboros Glass Company Property.

References

Uroboros Area-Wide, Soil Sampling and Analysis Plan, Oregon Department of Environmental Quality, February 18, 2016.
www.deq.state.or.us/nwr/docs/metalsem/bullseyeSAP.pdf

Oregon Department of Environmental Quality, 2015. Oregon Administrative Rules, Division 41, http://www.deq.state.or.us/regulations/rules.htm.

Oregon Department of Environmental Quality, 2013.Background Levels of Metals in Soils for Cleanups. March 2013. http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf.

Oregon Department of Environmental Quality, 2015. Risk-Based Concentrations. November 2015. www.deq.state.or.us/lq/pubs/docs/RBDMTable.pdf.

Agency for Toxic Substances and Disease Registry (ATSDR), 2016. ATSDR values are environmental media evaluation guides (EMEGS). http://www.atsdr.cdc.gov/hac/phamanual/appf.html.

Environmental Science Corp (ESC) Laboratories. 12065 Lebanon Road, Mount Juliet, Tennessee, 37122, 615-773-9678, http://www.esclabsciences.com/

Appendix A – Analytical Results

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Table 1. Lillis Albina Park (mg/kg dry weight)

Sample ID	As	Cd	Cr	Cr+6 [a]	Co	Pb	Ni	Se	Hg	Fe	Mn	Al	B
LIP-SS-01-08	5.6	*0.27*	15.9	< 0.38	14.9	69.7	15.1	*0.42*	0.032	25300	576	8040	*4.5*
LIP-SS-03-01	8.4	*0.31*	13.8	*0.58*	13.2	36.5	15.7	*0.49*	*0.022*	22800	583	7820	*2.5*
LIP-SS-04-01	5.0	*0.50*	13.7	*0.98*	12.9	80.4	12.6	*0.48*	0.041	21800	633	7710	*4.2*
LIP-SS-05-01	5.0	*0.45*	13.5	*0.44*	12.3	77.0	13.2	*0.45*	0.053	24200	556	8780	*2.6*
LIP-SS-05-01 Dup	5.8	*0.43*	15.6	<0.44	14.0	88.0	15.8	*0.54*	0.057	28500	585	10100	*2.5*
LIP-SS-06-01	5.4	*0.47*	14.7	1.9	13.3	79.6	14.9	*0.55*	0.040	23200	644	8630	*3.8*
LIP-SS-07-01	2.6	<0.098	9.8	<0.31	12.0	4.7	23.3	*0.34*	<0.0034	17600	514	8110	*2.1*
LIP-SS-08-01	3.6	*0.17*	11.0	*0.55*	12.9	11.6	21.0	*0.40*	*0.0050*	19300	557	8900	*3.2*
LIP-SS-09-01	6.5	*0.43*	21.9	<0.36	15.9	101.0	17.6	*0.50*	0.054	29500	713	10100	*2.8*
LIP-SS-10-01	3.1	<0.098	10.7	1.5	13.7	5.2	24.8	*0.34*	<0.0034	20300	519	9650	*2.7*
Background Estimate	8.8	0.63	76	NA	33	79	47	0.71	0.23	36100	1800	52300	8 [2]
Background Range	2.4 - 9.5	0.15 - 0.82	20 - 84	NA	4.1 - 151	6.9 - 100	13 - 49	0.2 - 1.1	0.02 - 0.23	16350- 59850	150 - 1960	13750 - 54500	NA
DEQ Screening Value	0.43	78	120000	0.3	23	400	1500	390	23	55000	1800	77000	NA
ATSDR Screening Value	15	5	75000	45	500	NA	1000	250	15	NA	2500	50000	10000
90th UCL on Mean [1]	5.9	0.39	16	0.98	14	72	19	0.48	0.04	24914	615	9179	3.4
95th UCL on Mean	6.1	0.41	16	1.1	14	77	20	0.5	0.04	25445	623	9308	3.6

1- Averages estimated as upper confidence limits on mean using US EPA ProUCL software version 5.0.
2 - ATSDR Toxicological Profile for Boron, November 2010.
NA- Not Available - No Screening value from this source.

Estimated Data below the MRL (J Flag)

[a]Cr+6 analyzed by EPA 7199

Table 2. Grandma's Place Daycare (mg/kg dry weight)

Sample ID	As	Cd	Cr	Cr+6 [a]	Co	Pb	Ni	Se	Hg	Fe	Mn	Al	B
GMD-SS-01-01	2.8	*0.27*	12.2	*0.56*	8.0	13.0	12.3	*0.34*	*0.015*	15300	346	7050	*4.0*
GMD-SS-01-01 Dup	2.2	*0.21*	9.3	<0.37	6.0	10.9	8.1	<0.27	*0.017*	11900	281	5150	*3.9*
GMD-SS-02-01	2.6	*0.32*	10.3	<0.38	7.5	19.8	10.8	*0.38*	0.021	14800	348	6310	*5.6*
GMD-SS-03-01	4.8	1.07	15.7	<0.36	12.4	101.0	13.8	*0.60*	0.043	22100	559	8060	*2.9*
GMD-SS-04-01	*1.1*	*0.55*	4.9	<0.71	2.9	37.1	3.1	<0.53	*0.020*	4560	436	1570	*7.8*
GMD-SS-05-01	5.7	*0.72*	15.7	<0.37	14.1	105.0	14.8	*0.60*	0.041	26100	655	8400	*2.2*
Background Estimate	8.8	0.63	76	NA	33	79	47	0.71	0.23	36100	1800	52300	8 [2]
Background Range	2.4 - 9.5	0.15 - 0.82	20 - 84	NA	4.1 - 151	6.9 - 100	13 - 49	0.2 - 1.1	0.02 - 0.23	16350- 59850	150 - 1960	13750 - 54500	NA
DEQ Screening Value	0.43	78	120000	0.3	23	400	1500	390	23	55000	1800	77000	NA
ATSDR Screening Value	15	5	75000	45	500	NA	1000	250	15	NA	2500	50000	10000
90th UCL on Mean [1]	4.2	0.72	14	NC	11	74	13	NC	NC	20371	524	7602	5.6
95th UCL on Mean	4.6	0.79	15	NC	12	84	14	NC	NC	22043	555	8155	6.1

1- Averages estimated as upper confidence limits on mean using US EPA ProUCL software version 5.0.
2 - ATSDR Toxicological Profile for Boron, November 2010.
NA- Not Available - No Screening value from this source.
NC - Not Calculated- too few detections.

Estimated Data below the MRL (J Flag)

[a]Cr+6 analyzed by EPA 7199

Table 3. Albina Community Garden (mg/kg dry weight)

Sample ID	As	Cd	Cr	Cr+6 [a]	Co	Pb	Ni	Se	Hg	Fe	Mn	Al	B
LEG-SS-01-01	4.8	*0.34*	12.4	<0.38	12.4	55.2	12.7	*0.39*	0.053	22300	540	8310	*3.6*
LEG-SS-01-06	5.4	*0.29*	14.4	*1.3*	16.7	69.0	14.6	*0.41*	0.048	26600	743	12500	*1.4*
LEG-SS-02-01	4.3	*0.36*	16.2	<0.39	11.7	48.9	12.8	*0.38*	0.038	22500	592	8430	*4.8*
LEG-SS-03-01	3.9	*0.40*	16.1	*0.89*	11.0	42.2	11.4	<0.35	0.055	18800	578	7160	*5.3*
LEG-SS-03-01 Dup	5.2	*0.45*	217	<0.47	12.8	57.1	14.3	*0.43*	0.059	29100	1660	10300	*4.3*
LEG-SS-04-01	4.0	*0.30*	26.1	<0.37	11.2	35.5	12.5	*0.38*	*0.029*	19700	669	7870	*4.7*
LEG-SS-05-01	3.2	*0.19*	11.8	<0.38	15.1	10.0	19.4	*0.60*	*0.019*	19700	671	7710	*3.1*
LEG-SS-06-01	2.4	*0.12*	7.3	1.3	7.5	17.6	6.9	*0.25*	*0.018*	13200	284	4450	*0.93*
LEG-SS-07-01	2.8	*0.26*	12.3	<0.51	13.3	15.4	13.3	*0.42*	*0.038*	19100	649	7080	*5.3*
LEG-SS-07-06	2.8	*0.23*	9.2	<0.38	10.0	11.7	13.3	*0.37*	*0.026*	15600	490	6630	*4.9*
LEG-SS-07-06 Dup	2.5	*0.28*	8.0	*0.50*	11.5	13.7	11.2	*0.35*	*0.025*	13200	539	5380	*8.6*
Background Estimate	8.8	0.63	76	NA	33	79	47	0.71	0.23	36100	1800	52300	8 [2]
Background Range	2.4 - 9.5	0.15 - 0.82	20 - 84	NA	4.1 - 151	6.9 - 100	13 - 49	0.2 - 1.1	0.02 - 0.23	16350- 59850	150 - 1960	13750 - 54500	NA
DEQ Screening Value	0.43	78	120000	0.3	23	400	1500	390	23	55000	1800	77000	NA
ATSDR Screening Value	15	5	75000	45	500	NA	1000	250	15	NA	2500	50000	10000
90th UCL on Mean [1]	4.2	0.33	88	NC	13	43	14	0.42	0.04	22059	818	8712	5.1
95th UCL on Mean	4.3	0.34	113	NC	13.5	46	16	0.44	0.05	22726	865	9004	5.4

1- Averages estimated as upper confidence limits on mean using US EPA ProUCL software version 5.0.

2 - ATSDR Toxicological Profile for Boron, November 2010.

NA- Not Available - No Screening value from this source.

Estimated Data below the MRL (J Flag)

[a]Cr+6 analyzed by EPA 7199

Table 4. Lillis Albina Park Mulch (mg/kg wet weight)

Sample ID	As	Cd	Cr	Cr+6 [a]	Co	Pb	Ni	Se	Hg	Fe	Mn	Al	B
LIP-SS-01-01	*0.14*	*0.14*	0.67	< 0.255	*0.27*	1.5	1.7	<0.19	<0.0028	577	21.2	194	*4.5*
LIP-SS-02-01	*0.098*	<0.080	*0.44*	<0.255	*0.14*	1.1	*0.42*	<0.190	<0.0028	344	8.6	123	*1.9*
Background Estimate	8.8	0.63	76	NA	33	79	47	0.71	0.23	36100	1800	52300	NA
Background Range	2.4 - 9.5	0.15 - 0.82	20 - 84	NA	4.1 - 151	6.9 - 100	13 - 49	0.2 - 1.1	0.02 - 0.23	16350- 59850	150 - 1960	13750 - 54500	NA
DEQ Screening Value	0.43	78	120000	0.3	23	400	1500	390	23	55000	1800	77000	NA
ATSDR Screening Value	15	5	75000	45	500	NA	1000	250	15	NA	2500	50000	10000

Estimated Data below the MRL (J Flag)

[a]Cr+6 analyzed by EPA 7199

Reported Wet Weight

Table 5. Screening Table (mg/kg dry weight)

Metal	DEQ Background[1]	Residential [2]	ATSDR Values [3]
Aluminum [a]	52,300 [b]	77,000	50,000
Arsenic	8.8	0.43	15
Boron	8[f]	NA	10,000
Cadmium	0.63	78	5
Total Chromium [e]	76	120,000	75,000
Chromium +6	NA	0.3	45
Cobalt [a]	33 [c]	23	500
Iron [a]	36,100 [b]	55,000	NA
Lead	79	400	NA
Manganese	1,800	1,800	2,500
Mercury	0.23	23	15
Nickel	47	1,500	1,000
Selenium [a]	0.71	390	250

1- Source DEQ background metals fact sheet, http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf

2 - Residental values are DEQ soil screening values, where available, or EPA regional screening values (RSLs) when no DEQ residential value is published
DEQ Residential values assume the following:
· A person resides in the same residence 24 hours a day, 7 days a week, 350 days a year, for 26 years
· Adults incidentally ingest 100 mg of soil per day, children incidentally ingest 200 mg of soil per day

3 - Agency for Toxic Substances and Disease Registry (ATSDR) Screening Values. ATSDR values are environmental media evaluation guides (EMEGS), or reference dose media evaluation guides (RMEGs).

a - Residential values for these metals are the US EPA Regional Screening Values (RSLs) for residential use
b - Background values shown are from Washington Department of Ecology Pub. No. 94-115
c - No background estimate for cobalt has been published by DEQ. Value shown is average of Willamette Valley soil from DEQ database
d - Background estimate from Toxicological Profile for Uranium, US ATSDR, February 2013.
e - Background value is based on total chromium. Screening Values are based on trivalent chromium
f - ATSDR Toxicological Profile for Boron, November 2010.
NA - Not Available - No estimate of background soil concentration or screening values are available for these metals and agencies

Appendix B – Figures

Figure 1.

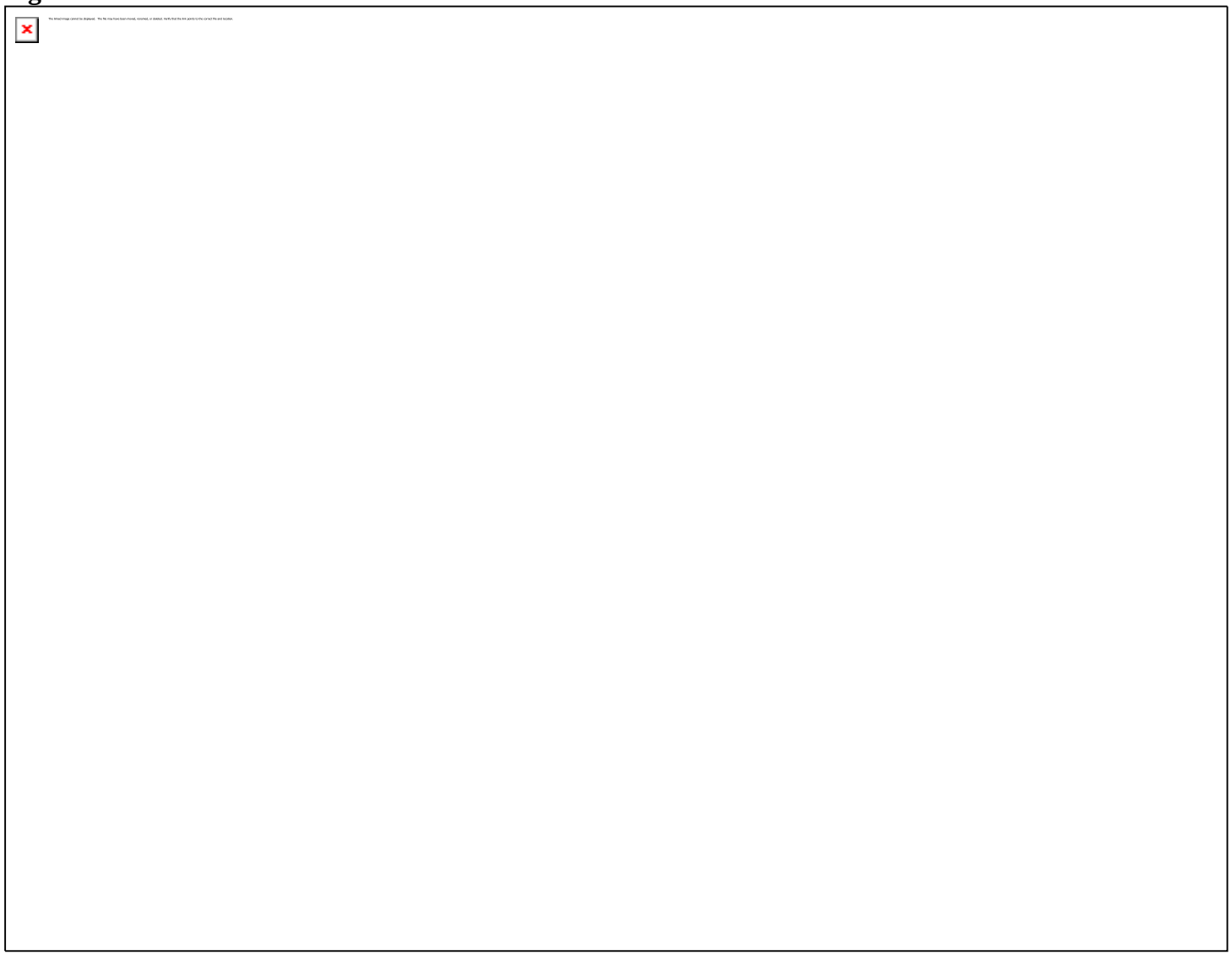
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Figure 2.

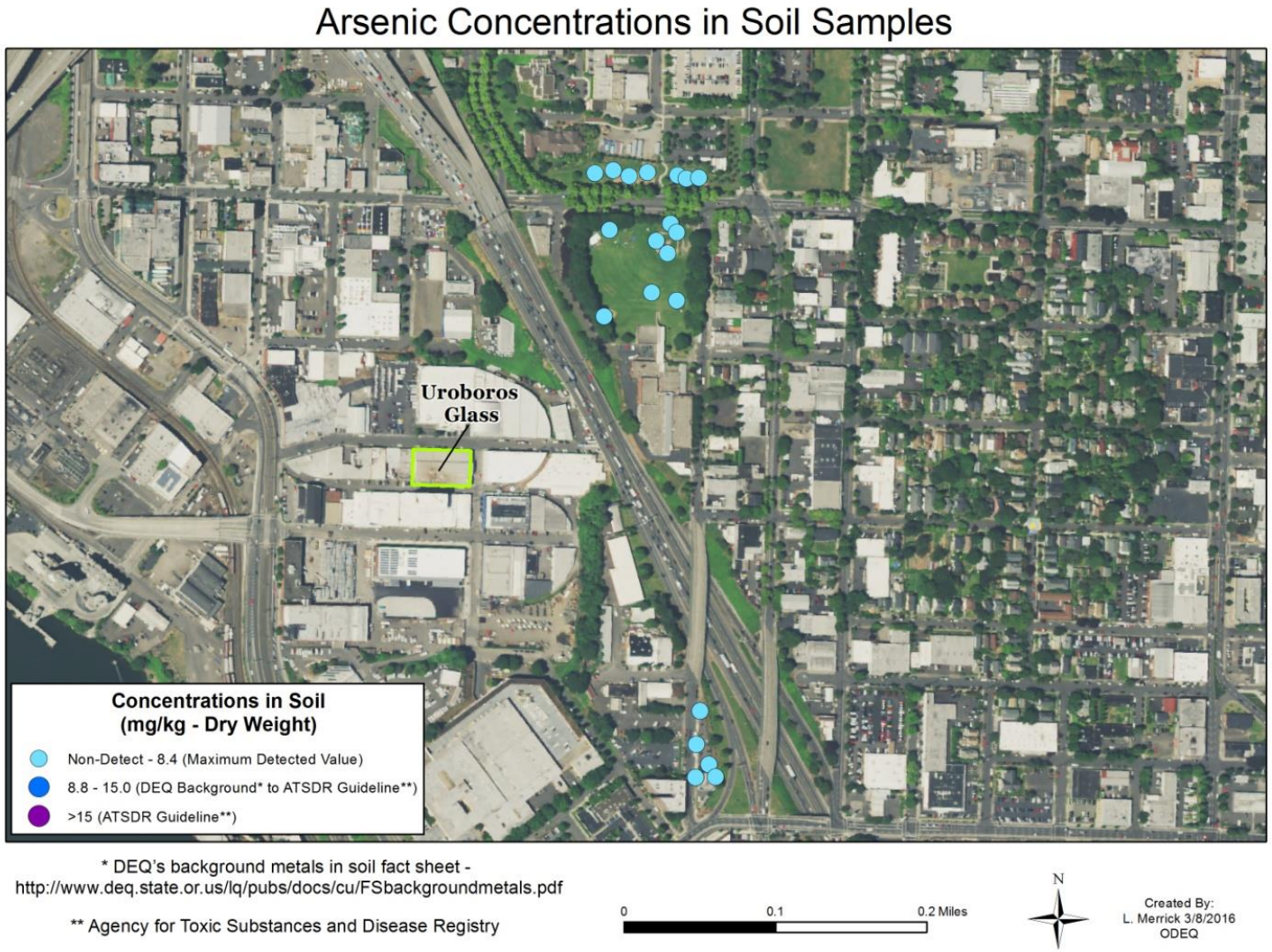
Arsenic Concentrations in Soil Samples
Uroboros Glass
Concentrations in Soil
(mg/kg - Dry Weight)
Non-Detect - 8.4 (Maximum Detected Value)
8.8 - 15.0 (DEQ Background* to ATSDR Guideline**)
>15 (ATSDR Guideline**)
* DEQ's background metals in soil fact sheet -
http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf
** Agency for Toxic Substances and Disease Registry
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Figure 3.

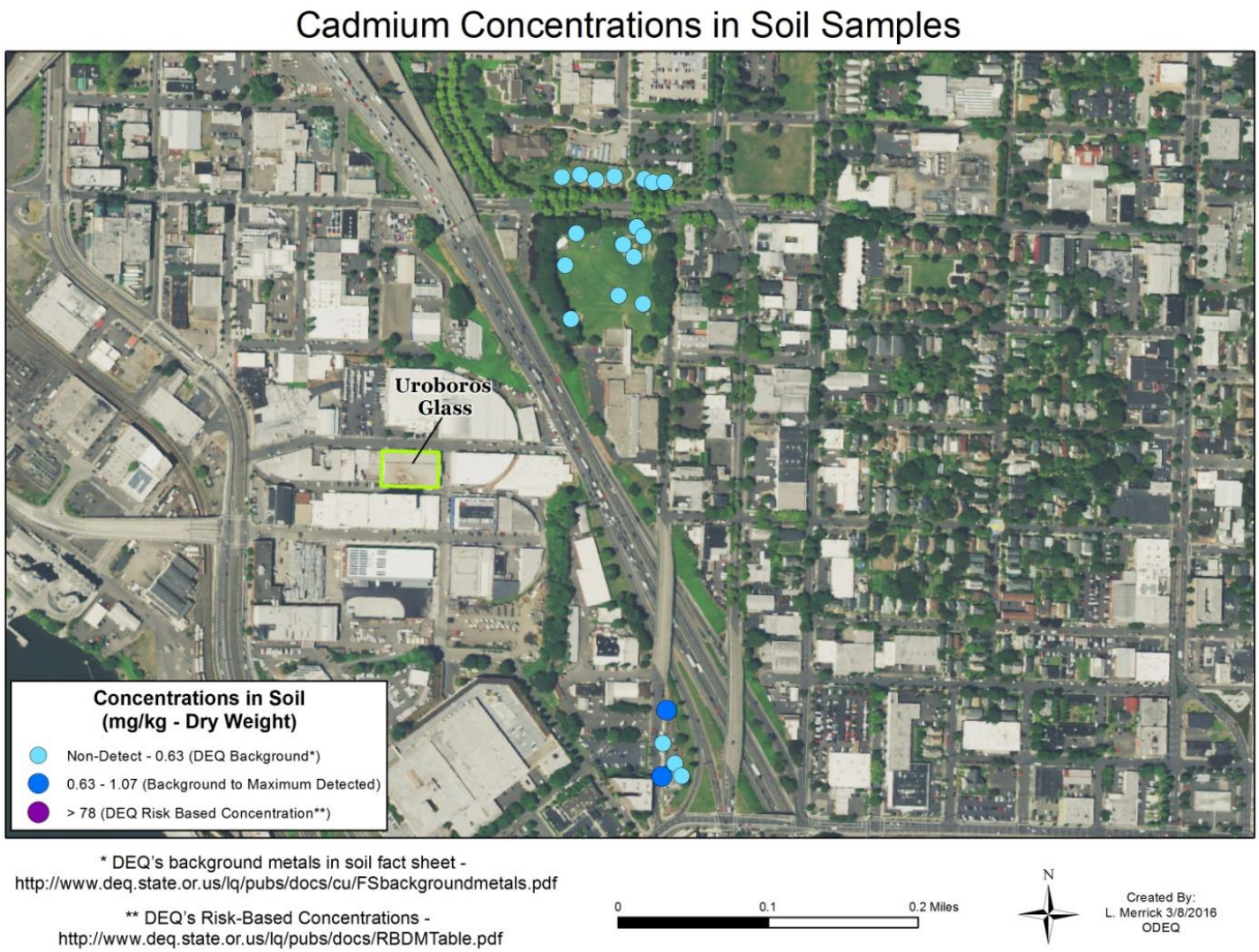
Cadmium Concentrations in Soil Samples
Uroboros Glass
Concentrations in Soil
(mg/kg - Dry Weight)
Non-Detect - 0.63 (DEQ Background*)
0.63 - 1.07 (Background to Maximum Detected)
> 78 (DEQ Risk Based Concentration**)
* DEQ's background metals in soil fact sheet -
http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf
** DEQ's Risk-Based Concentrations -
http://www.deq.state.or.us/lq/pubs/docs/RBDMTable.pdf
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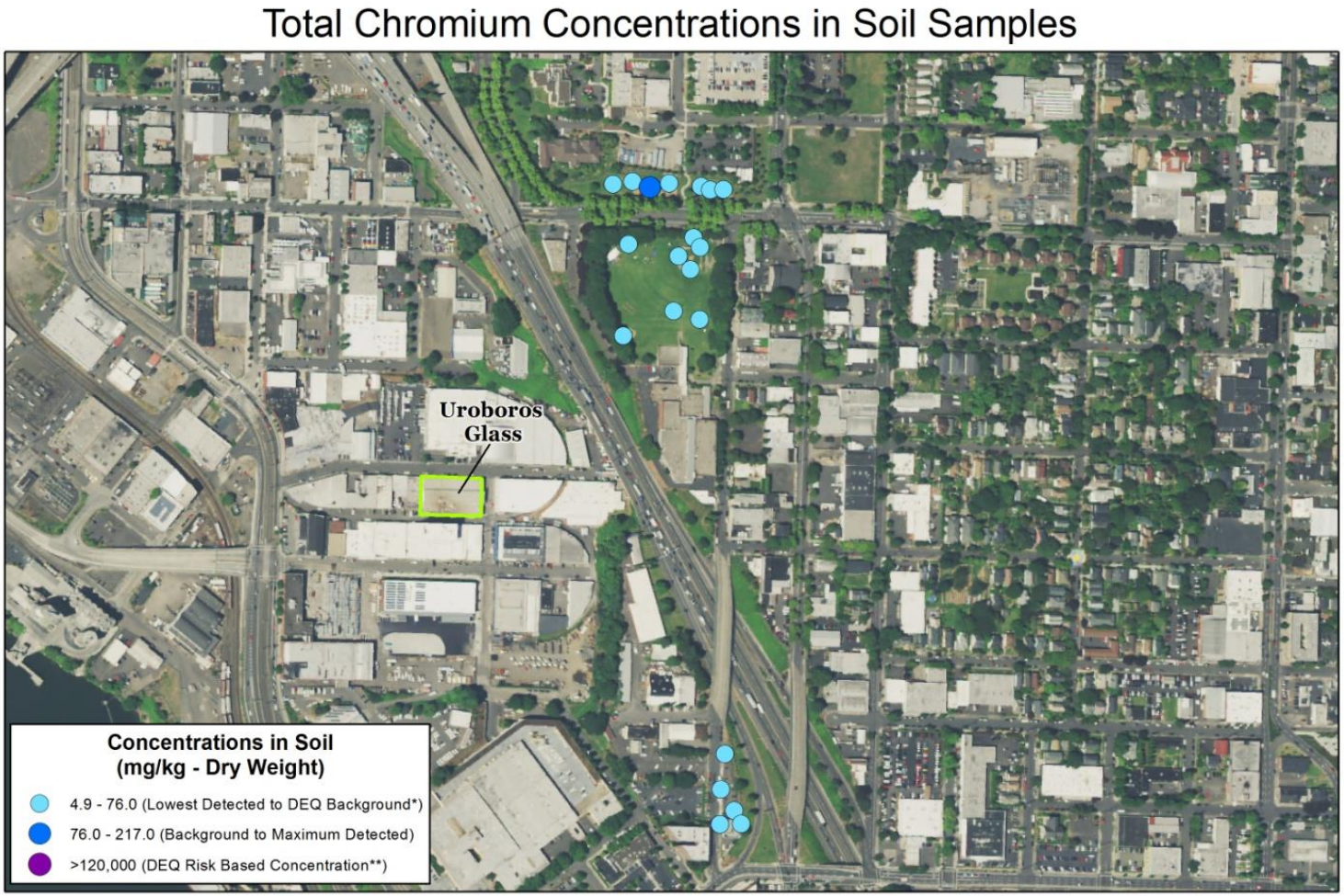
Figure 4.



* DEQ's background metals in soil fact sheet - http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf

** DEQ's Risk-Based Concentrations - http://www.deq.state.or.us/lq/pubs/docs/RBDMTable.pdf

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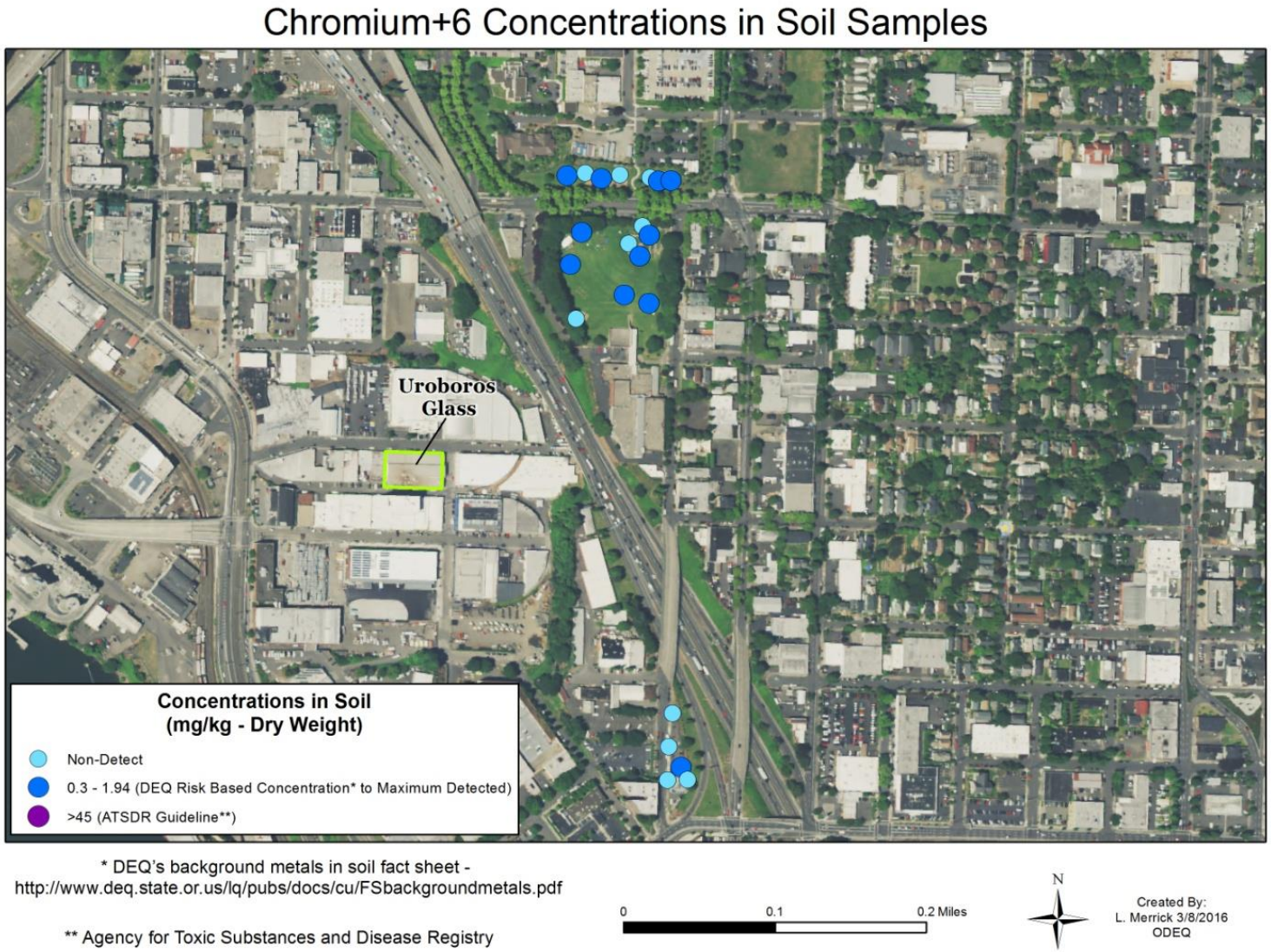
Figure 5.


Chromium+6 Concentrations in Soil Samples
Uroboros Glass
Concentrations in Soil
(mg/kg - Dry Weight)
Non-Detect
0.3 - 1.94 (DEQ Risk Based Concentration* to Maximum Detected)
>45 (ATSDR Guideline**)
* DEQ's background metals in soil fact sheet -
http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf
** Agency for Toxic Substances and Disease Registry
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0.1
0.2 Miles
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Figure 6.

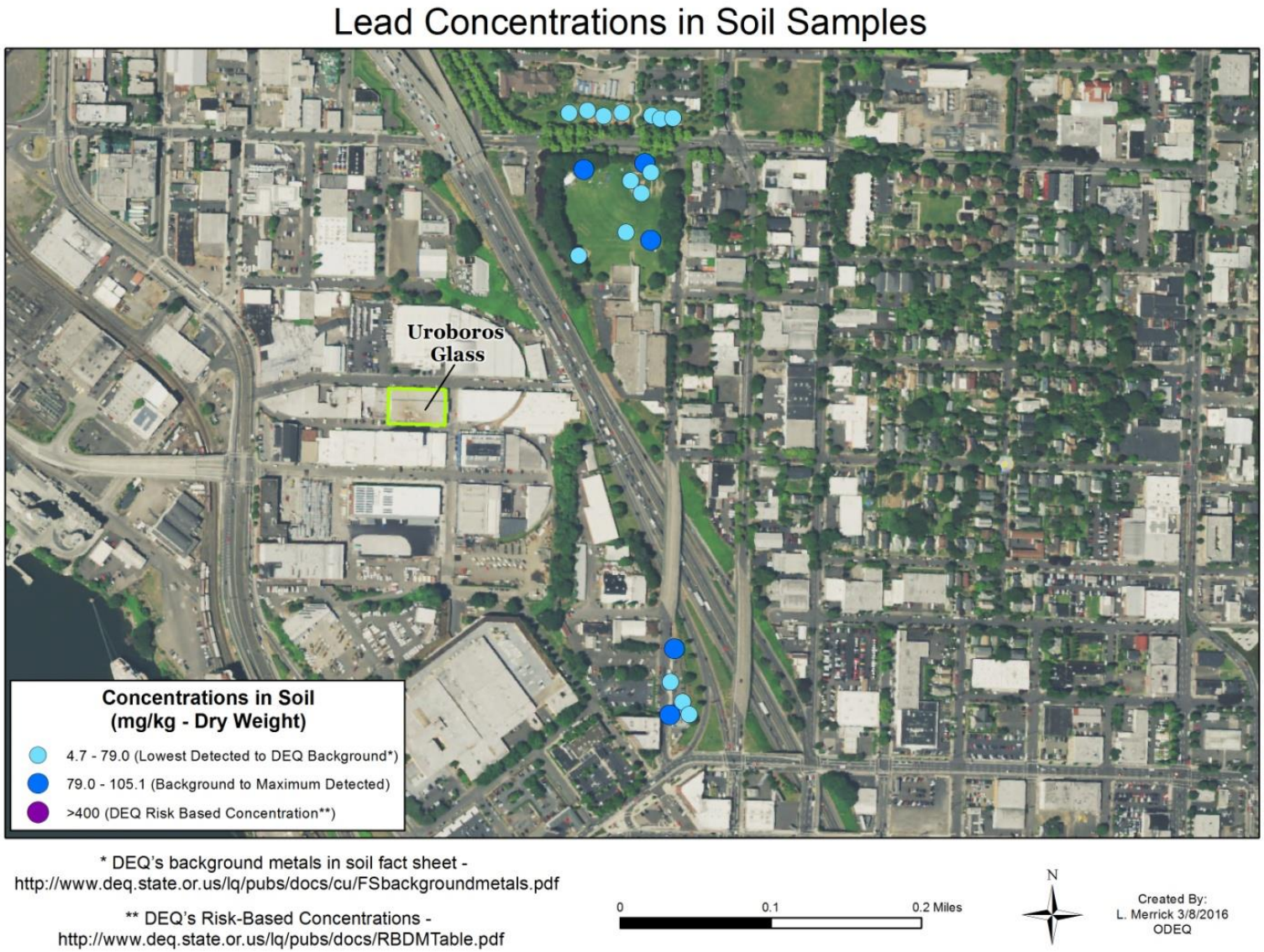
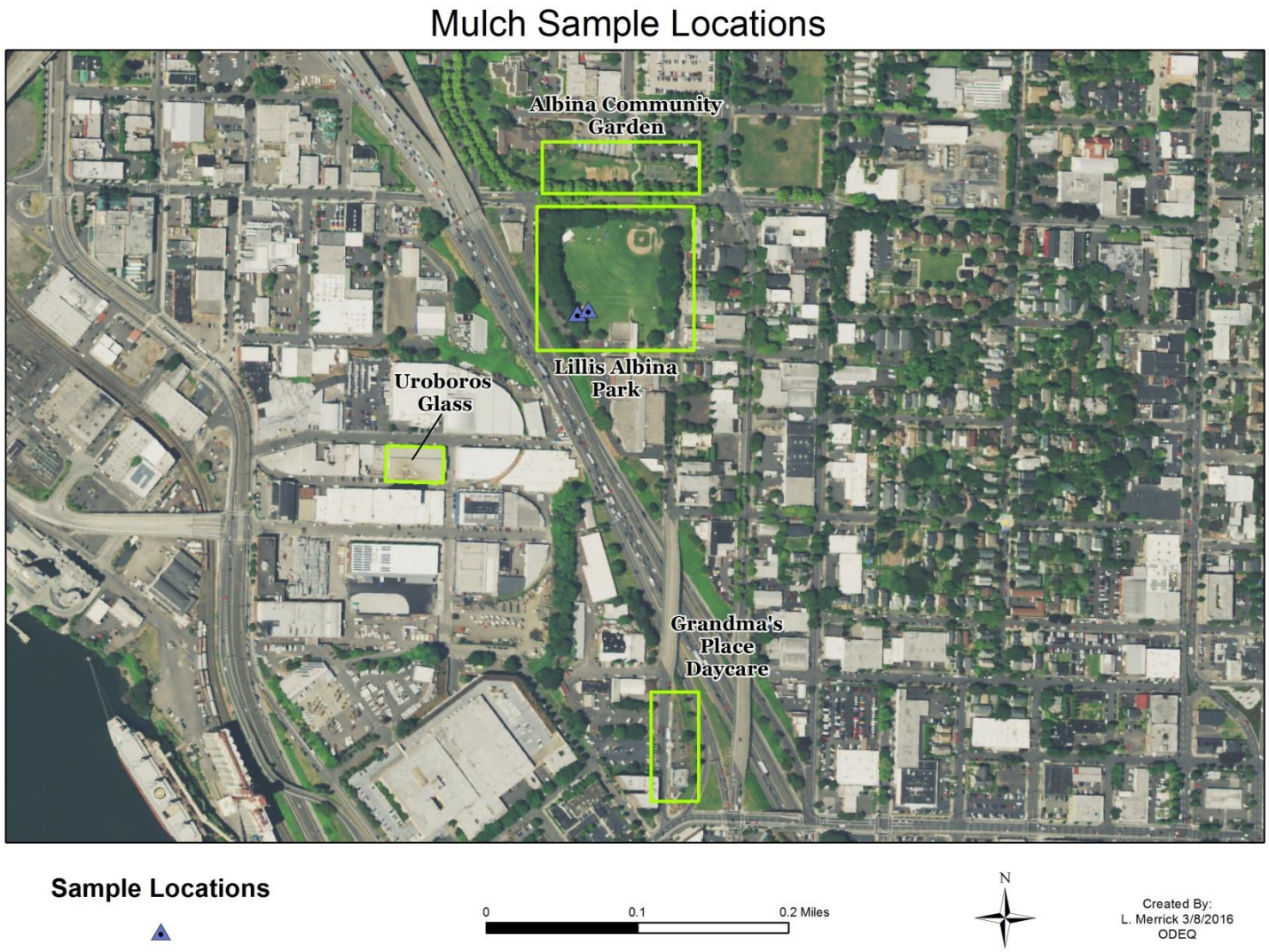

Lead Concentrations in Soil Samples
Uroboros Glass
Concentrations in Soil
(mg/kg - Dry Weight)
4.7 - 79.0 (Lowest Detected to DEQ Background*)
79.0 - 105.1 (Background to Maximum Detected)
>400 (DEQ Risk Based Concentration**)
* DEQ's background metals in soil fact sheet -
http://www.deq.state.or.us/lq/pubs/docs/cu/FSbackgroundmetals.pdf
** DEQ's Risk-Based Concentrations -
http://www.deq.state.or.us/lq/pubs/docs/RBDMTable.pdf
0
0.1
0.2 Miles
N
Created By:
L. Merrick 3/8/2016
ODEQ

Figure 7.


Mulch Sample Locations
Albina Community Garden
Lillis Albina Park
Uroboros Glass
Grandma's Place Daycare
Sample Locations
0
0.1
0.2 Miles
N
Created By:
L. Merrick 3/8/2016
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