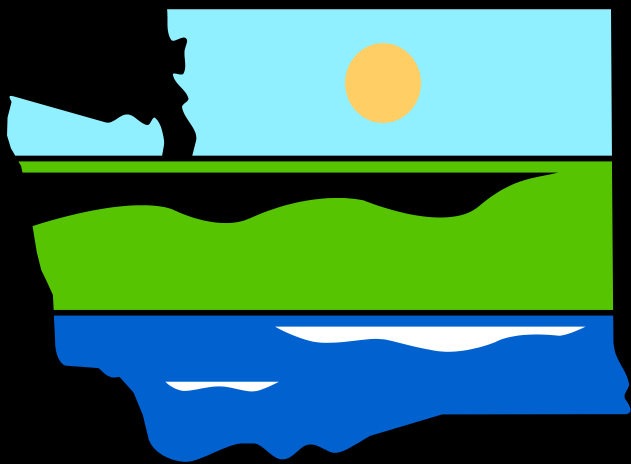


Update on the Lora Lake Apartments Cleanup Site

July 2012

David L. South, Site Manager



DEPARTMENT OF
ECOLOGY
State of Washington

Major points:

- Dioxin is widespread in the environment and comes from many different sources.
- The Lora Lake Apartments Site does not appear to contribute significant amounts of dioxin to Miller Creek.
- Lora Lake Apartments contamination will be cleaned up by a combination of excavation and capping.

Project Process

- A draft report on site conditions and cleanup approaches is currently in review. This report is called the **draft Remedial Investigation/Feasibility Study**.
- The purpose of the draft RI/FS is to provide sufficient information for Ecology to select a cleanup action for the site. **The draft RI/FS is not a decision document.**
- The Cleanup Action Plan will describe the selected cleanup actions. **The Cleanup Action Plan will be Ecology's decision document.**
- The draft RI/FS and the Cleanup Action Plan will be issued for a **30-day public comment period** before they are finalized.

SR 518

LLA

DMCA

LL

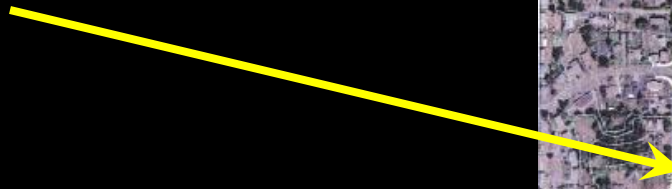
Des Moines Mem. Dr.

Miller Creek

The Lora Lake Apartment parcel is at the intersection of SR 518 and Des Moines Memorial Drive.

Two other areas of interest are Lora Lake and an area where sediment dredged from Lora Lake in 1982 was disposed of, the Dredged Material Containment Area.

The Northeast Redevelopment Area Boundary

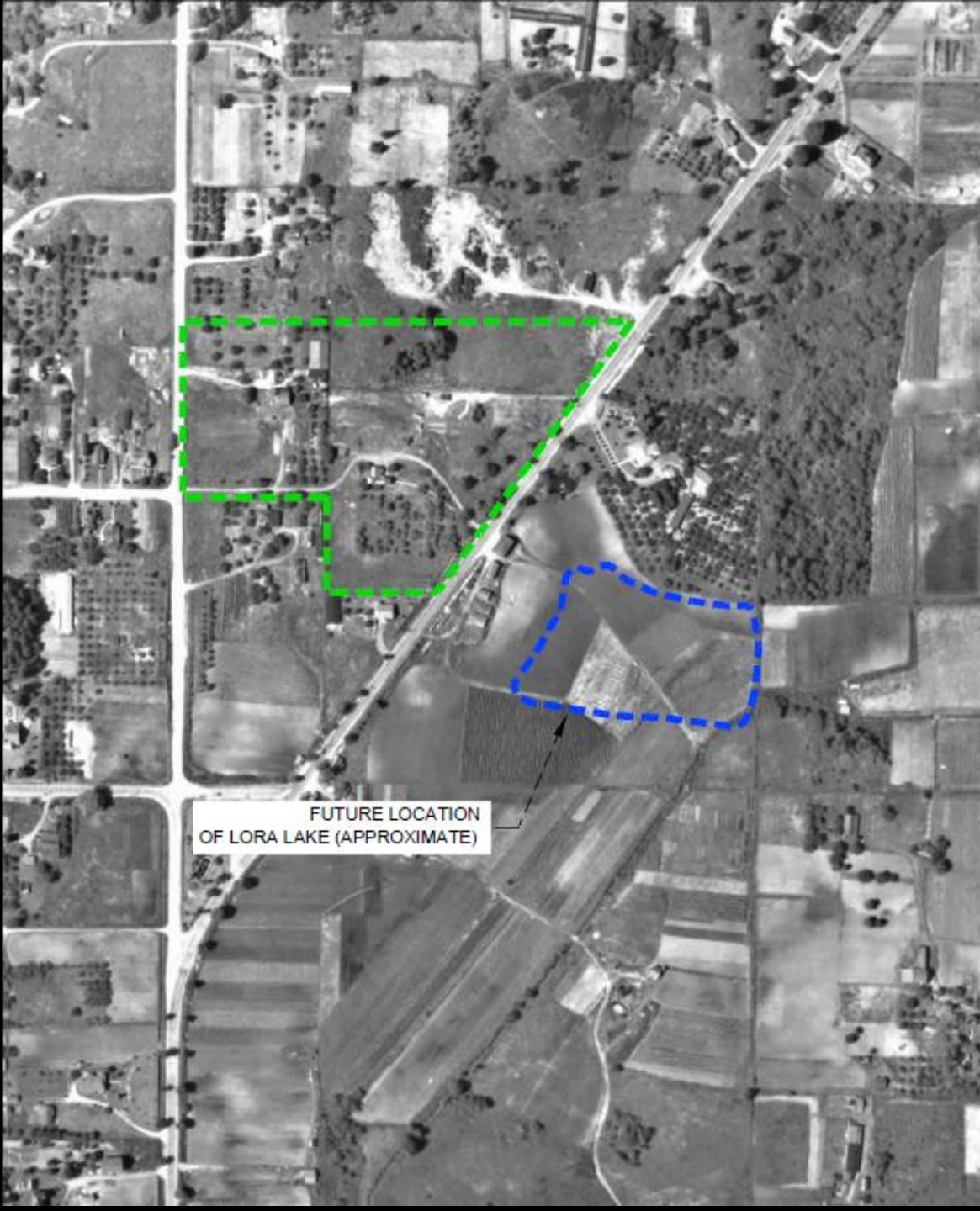


Legend		Aviation Constraints	
NEMA Boundary	Miller Creek	Approach Transition Zone (ATZ) - Airport compatible uses	RDP/Adopted Funds - Developable - to compatible uses
Buffer Parcels	Miller Creek 50 Feet Buffer	Controlled Activity Area (CAA) - Passes maximum taxi belt extension	RDP/Adopted Funds - Developable - Purchased with funds to develop into compatible uses
10' Elevation Contour	Miller Creek Wetland	Double-Ended Object Free Area (DEOFA) (located north of JOFA)	Non-Developable Land - Part as impervious or use for parking
	Miller Creek Wetland Buffer	Non-Developable Land - Part as impervious or use for parking	Extended Object Free Area (EOFA) - to Structures
		Decision Level Contour	

1936

The Apartment site had residences and trees.

Excavation of the peat mine that would become Lora Lake had not begun.



FUTURE LOCATION
OF LORA LAKE (APPROXIMATE)

A barrel-washing operation was located on the Apartment site. Lora Lake had been created by peat mining.

1946

POTENTIAL DRUM
CLEANOUT POND



1980

Burien Auto Wrecking occupied the site from the 1950s to the 1980s.

Lora Lake was surrounded by homes.



APPROXIMATE LOCATION OF
LLA PROPERTY BOUNDARY

1985

In the 1980s a developer bought the site and cleared it to construct the Lora Lake Apartments.

In 1982 King County dredged the lake because residents were complaining of siltation. The dredge material was placed on airport land to the north of the lake, now called the DMCA.



2004



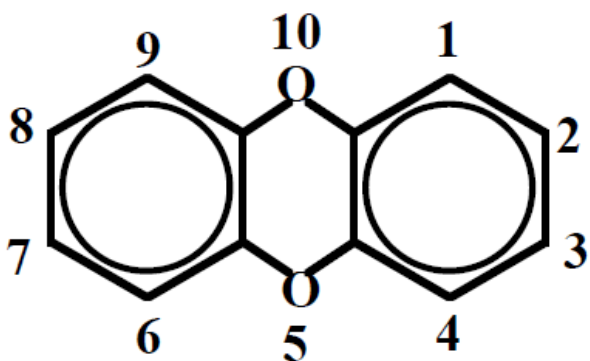
The Port acquired the Lora Lake Apartments property in the late 1990s as part of their planning for construction of the Third Runway.

Part of the Apartment property is within the area needed for the Runway Protection Zone.

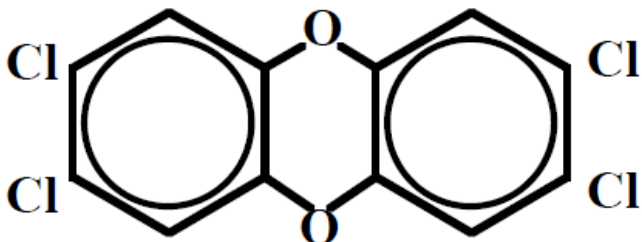
What are dioxins and furans?

- Dioxins and furans are double benzene rings with chlorine atoms attached at various points. They are not just one chemical composition.

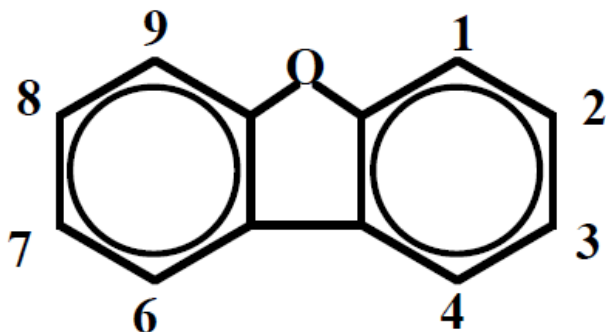
DIOXIN AND FURAN STRUCTURE



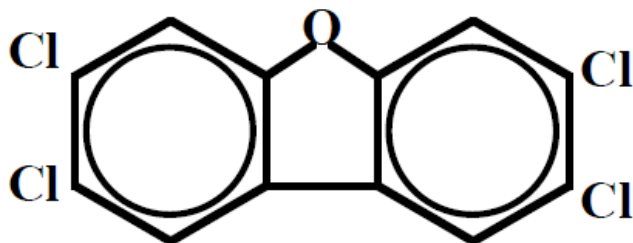
Dioxin



2,3,7,8 — Tetrachlorodibenzo(p)dioxin



Furan



2,3,7,8 — Tetrachlorodibenzofuran

Different congeners have different toxicities. 2,3,7,8 TCDD is the most toxic.

Dioxin/furan concentrations are reported as Toxicity Equivalent Quotients (TEQ).

Environmental studies normally look at 17 congeners.

□ There are 210 different congener configurations.

Dioxins form when organic matter is burned in the presence of chlorine.

Natural Sources

- Forest Fires



- Volcanos

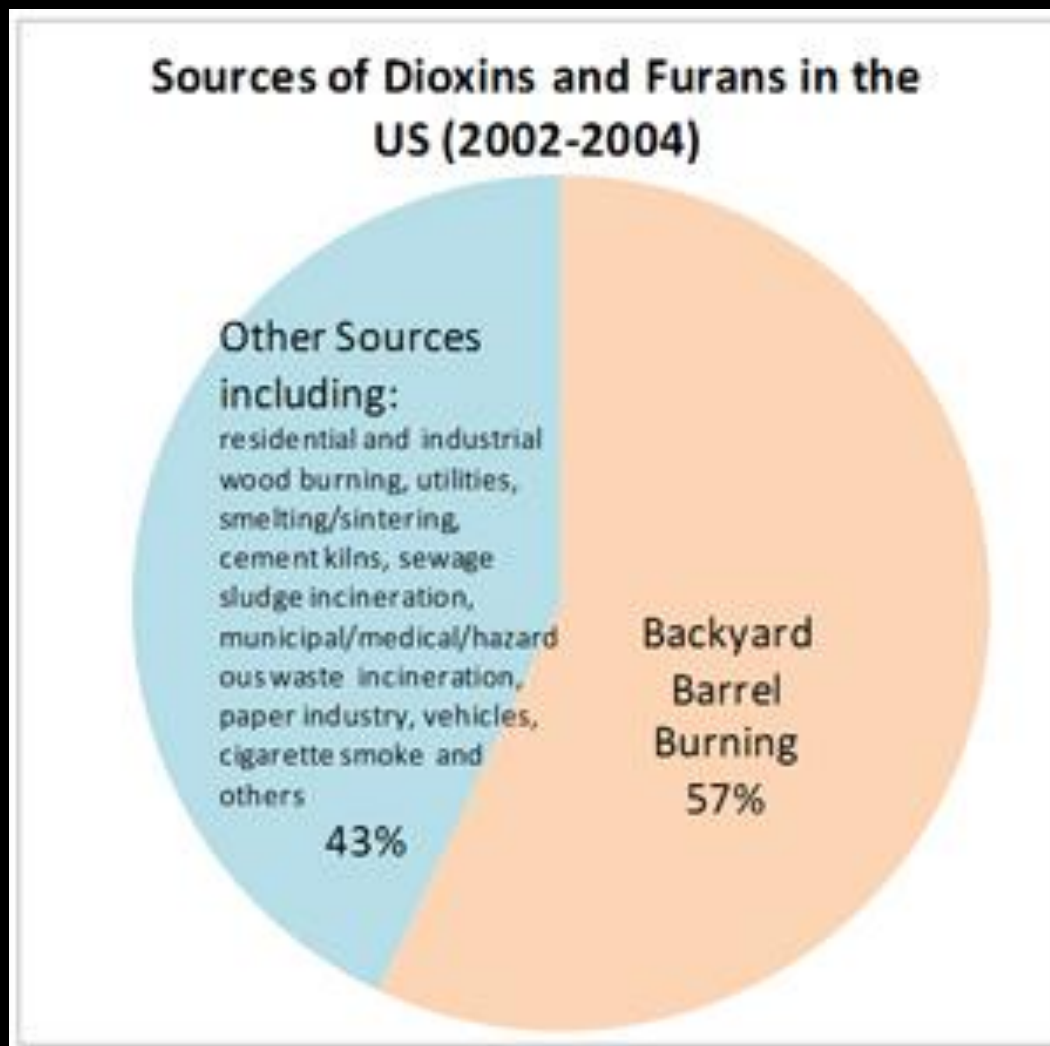


Some Man-Made Sources

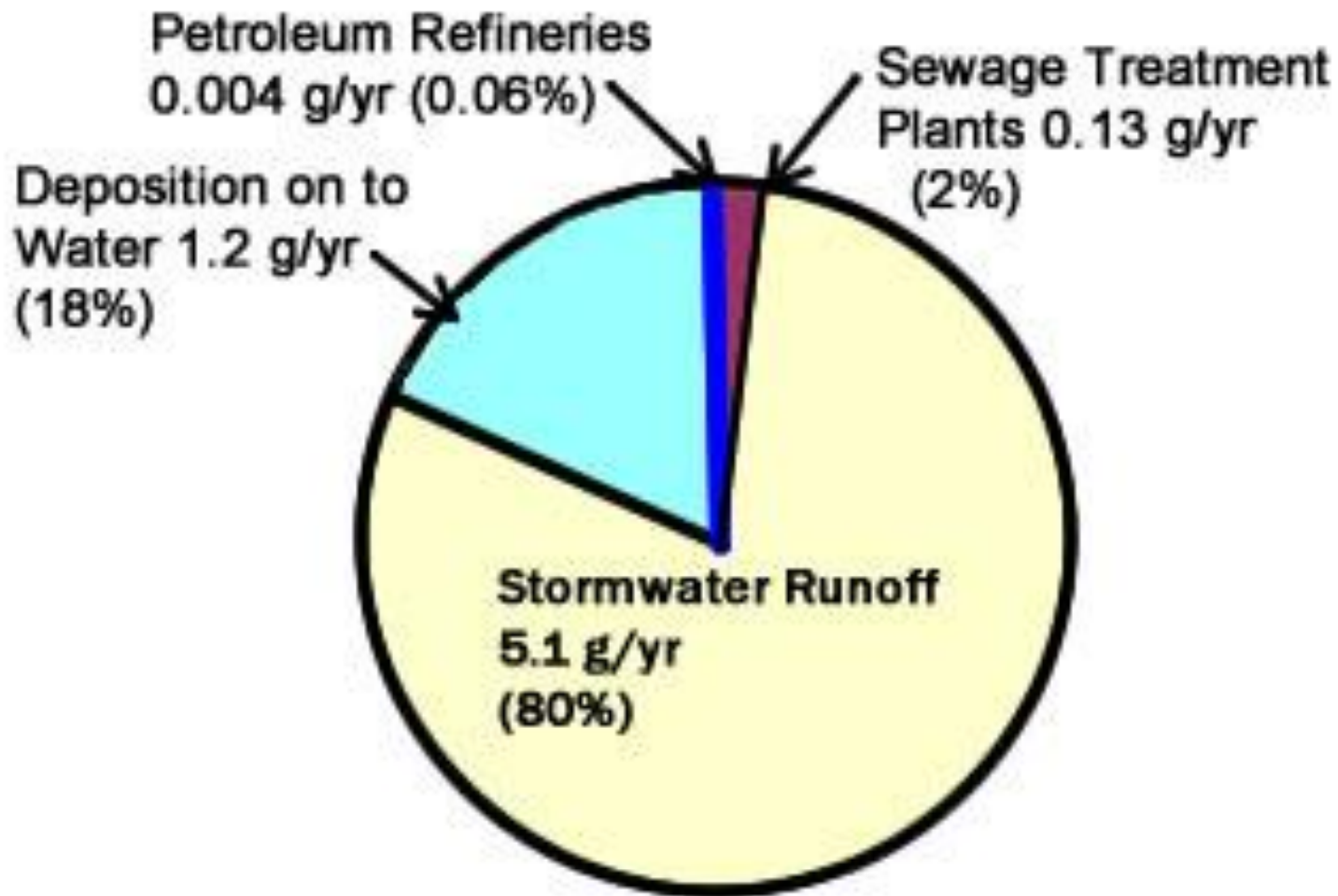
- Residential wood burning
- Backyard burn barrels
- Chlorinated chemical production
- Diesel exhaust
- Chlorine bleaching of pulp
- Burning salt-laden wood in hog-fuel boilers
- Waste incineration
- Cement kilns
- Crematoriums



Example: Backyard Burn Barrels



Example: Sources of dioxin to San Francisco Bay



Point 1:

- Dioxin is widespread in the environment and comes from many different sources.

How do dioxins behave in the environment?

- Dioxins are **PERSISTENT**: They last a long time when released to the environment.
- Dioxins have **LOW VOLATILITY**.
- Dioxins have **VERY LOW SOLUBILITY** in water.
- Dioxins have **VERY LOW MOBILITY**. They tend to attach to soil particles.
- Dioxins are **BIOACCUMULATIVE**. When ingested (say by a big fish that eats a small fish that has fed on small critters living in contaminated sediment), they will dissolve in the lipids (fats) and accumulate in the food chain.

Note:

- This cleanup is addressing dioxin and related contamination from historic industrial operations at the Lora Lake Apartments Site that ended long ago.
- This dioxin contamination is likely from dioxin impurities in the chlorinated chemicals that were washed out of the barrels during cleaning, particularly pentachlorophenol.

Data have been collected in several environmental media



Soil



Storm water and storm drain solids

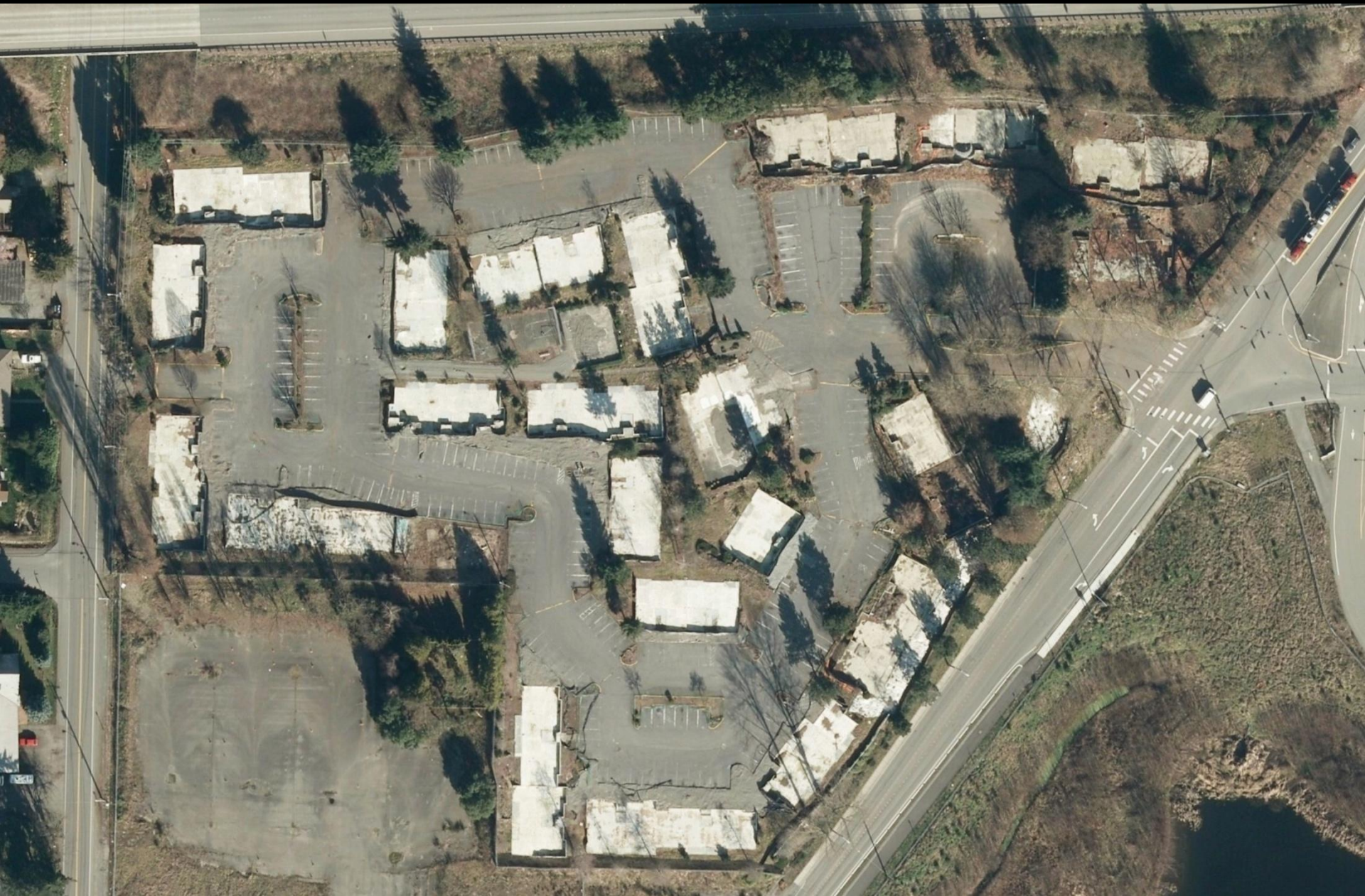


Ground water

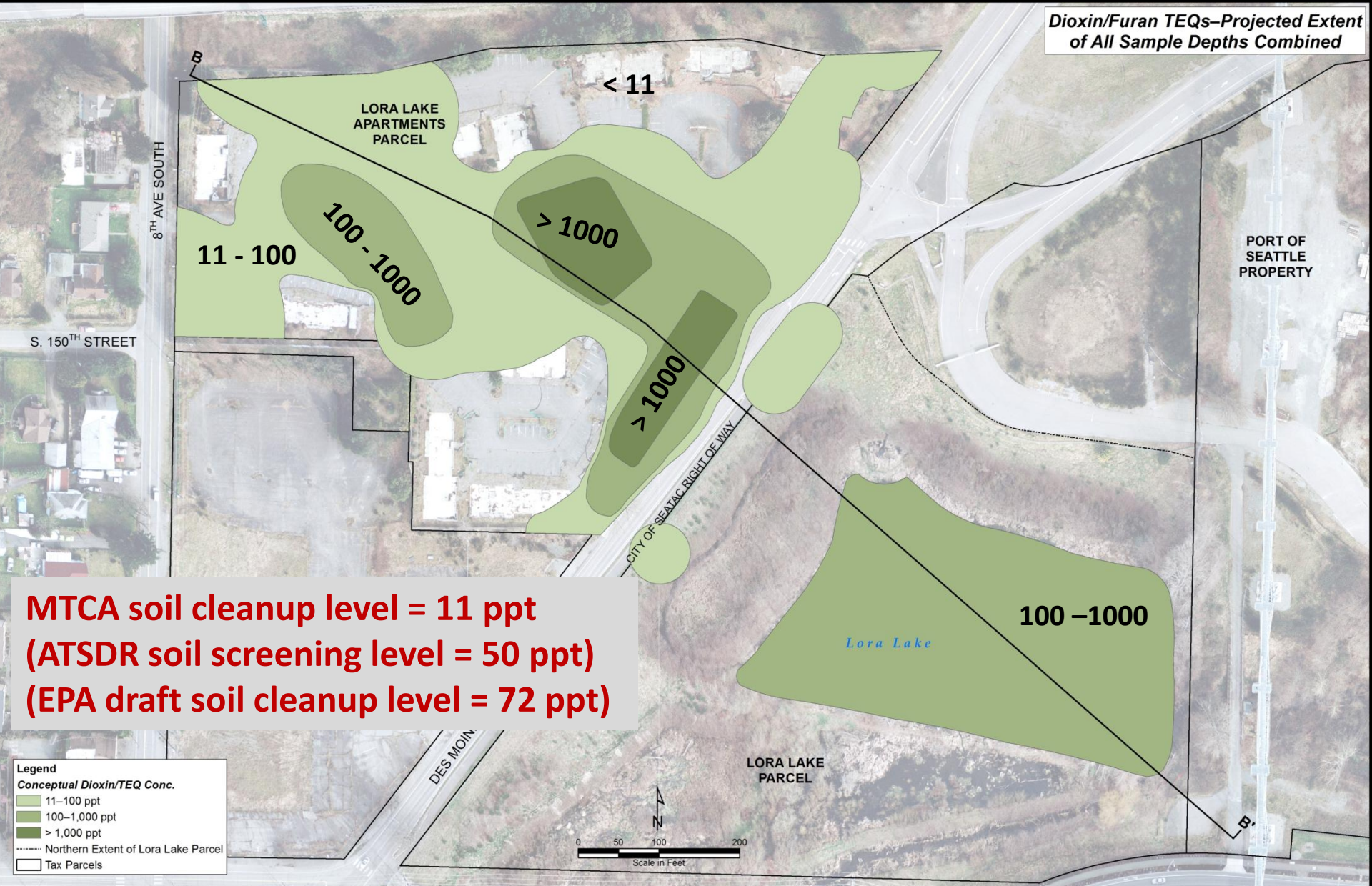


Lora Lake sediment

The apartment parcel is mostly paved or covered by foundations.

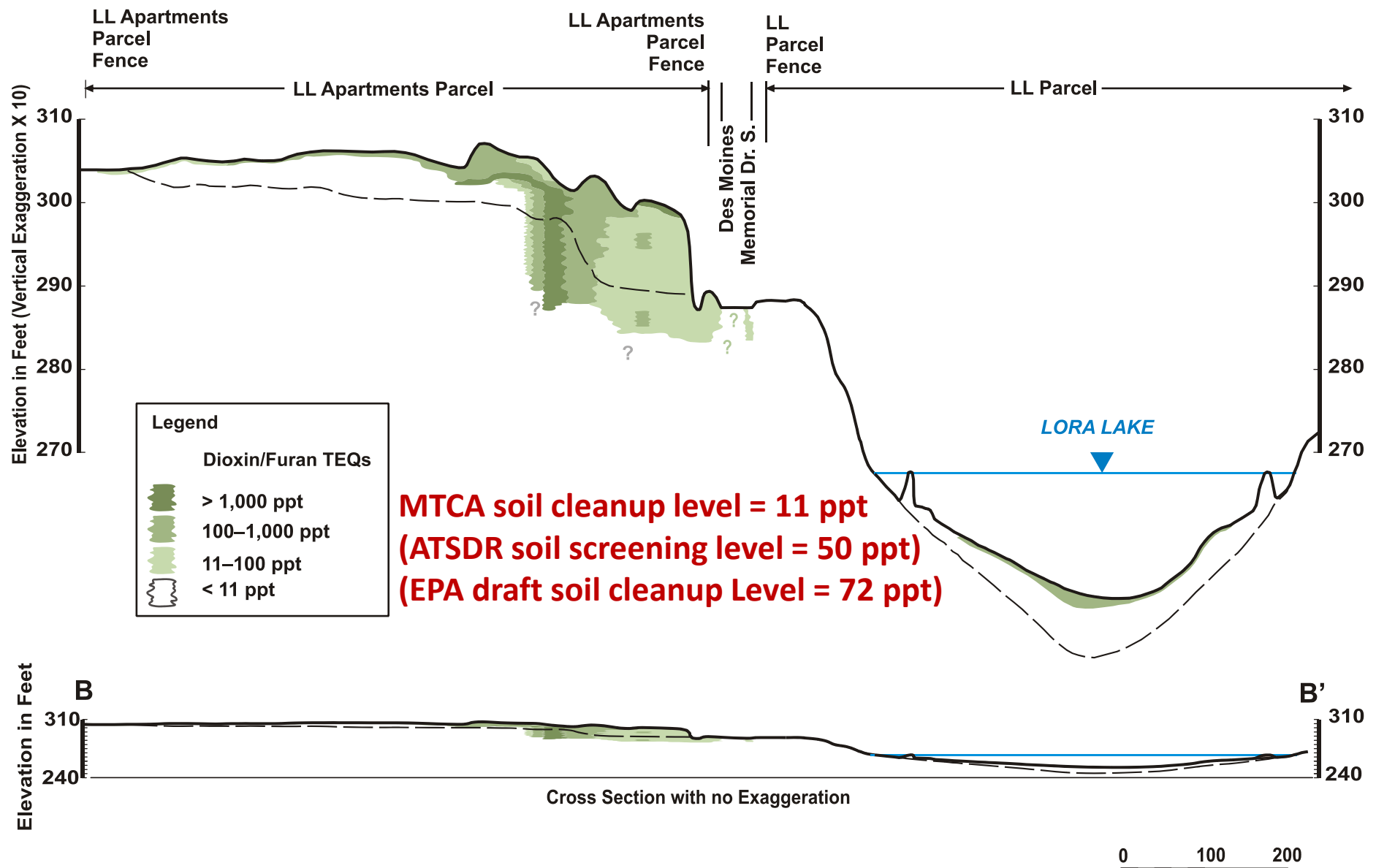


Within the Lora Lake Apartments Parcel dioxin soil contamination is highest at and downhill from the old barrel cleanout area. Over much of the western part of the property dioxin concentrations are < 100 ppt.

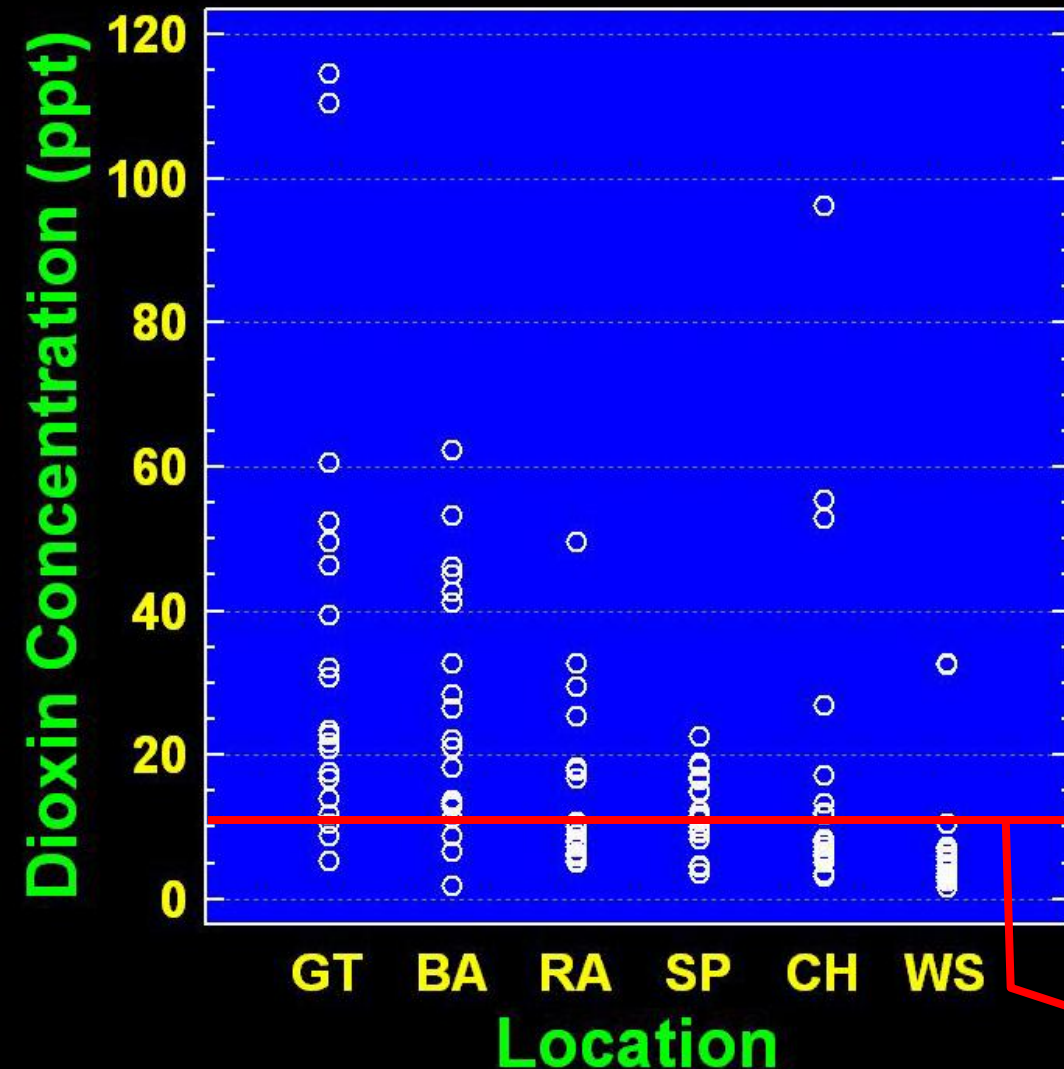


MTCA soil cleanup level = 11 ppt
(ATSDR soil screening level = 50 ppt)
(EPA draft soil cleanup level = 72 ppt)

Cross-section view.



What is the occurrence of dioxin in urban Seattle soils?

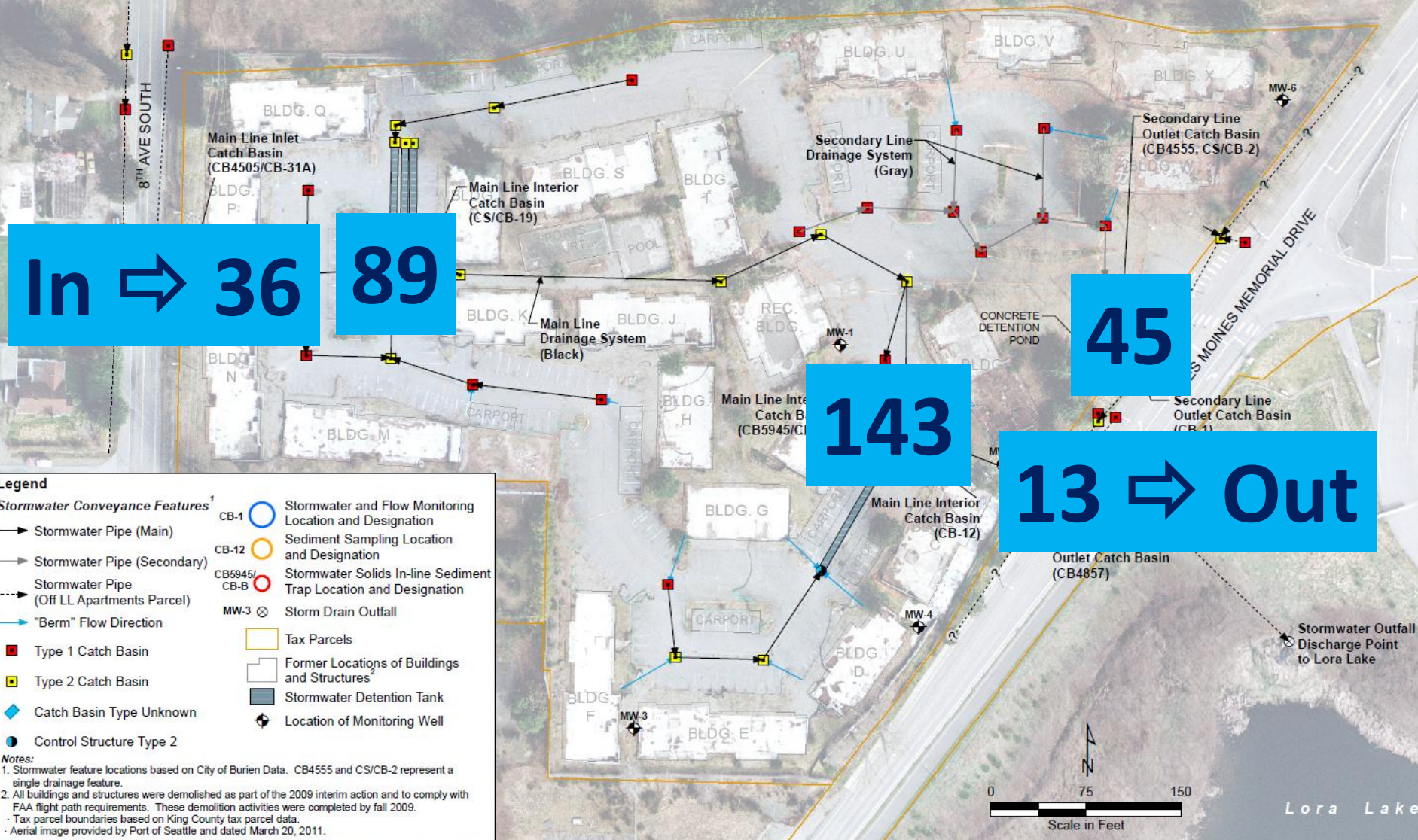


- Ecology recently completed a study of dioxin concentrations in Seattle neighborhoods. Concentrations ranged from 2 to 114 ppt.
- One of the challenges at Lora Lake is to know when to stop.

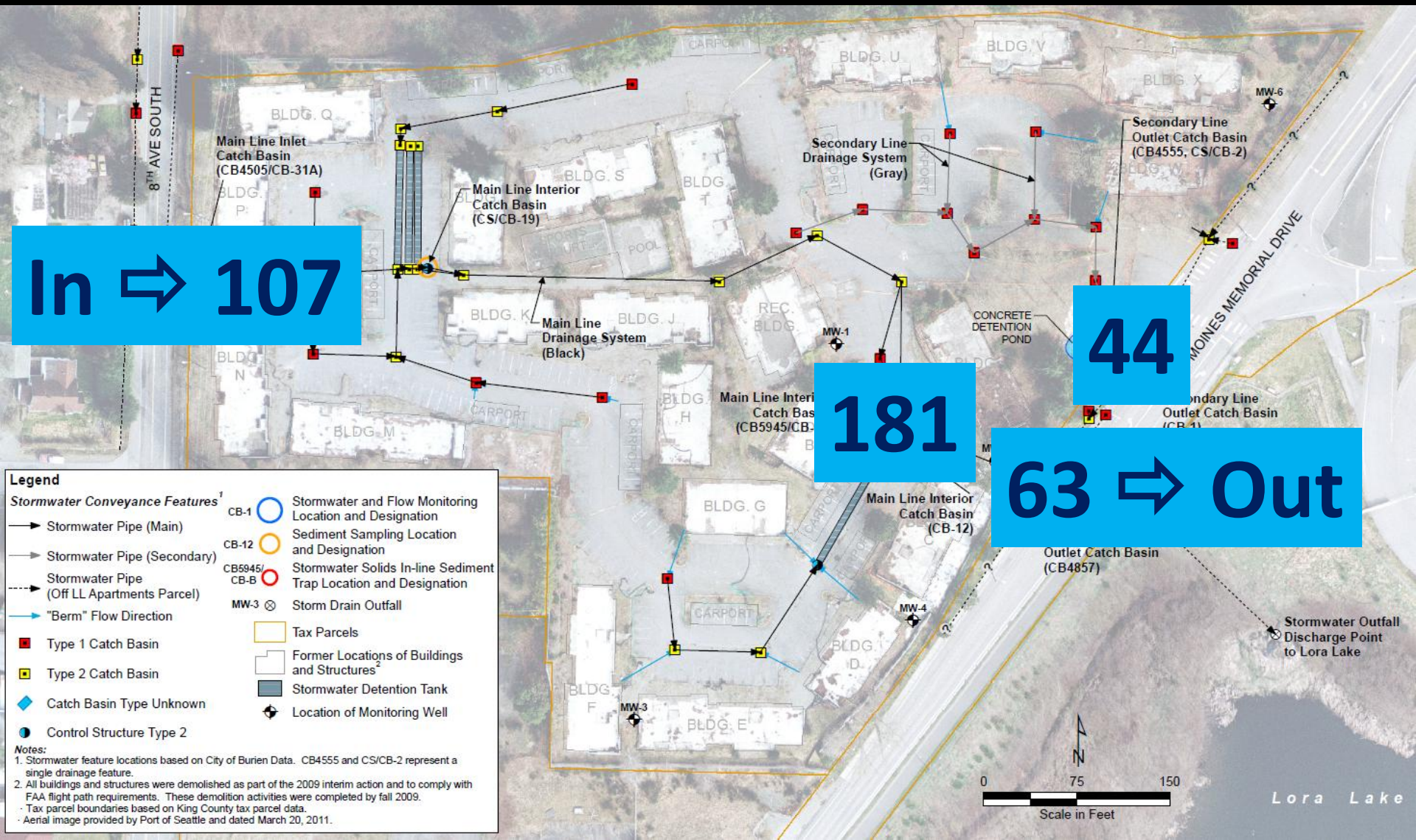
Cleanup Level = 11 ppt

Dioxin in catch-basin solids (ppt)

The catch basin solids were removed in 2010



Dioxin in in-line solids traps (ppt)



In => 107

181

44

63 => Out

Legend

Stormwater Conveyance Features¹

- Stormwater Pipe (Main)
- Stormwater Pipe (Secondary)
- Stormwater Pipe (Off LL Apartments Parcel)
- "Berm" Flow Direction
- Type 1 Catch Basin
- Type 2 Catch Basin
- ◆ Catch Basin Type Unknown
- Control Structure Type 2

Stormwater and Flow Monitoring Location and Designation

- CB-1
- CB-12
- CB5945/CB-B
- ⊗ MW-3

Sediment Sampling Location and Designation

-

Stormwater Solids In-line Sediment Trap Location and Designation

-

Storm Drain Outfall

- ⊗

Tax Parcels

-

Former Locations of Buildings and Structures²

-

Stormwater Detention Tank

-

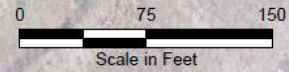
Location of Monitoring Well

- ⊗

Notes:

1. Stormwater feature locations based on City of Burien Data. CB4555 and CS/CB-2 represent a single drainage feature.
2. All buildings and structures were demolished as part of the 2009 interim action and to comply with FAA flight path requirements. These demolition activities were completed by fall 2009.

• Tax parcel boundaries based on King County tax parcel data.
• Aerial image provided by Port of Seattle and dated March 20, 2011.



Lora Lake

Dioxin in Storm Water

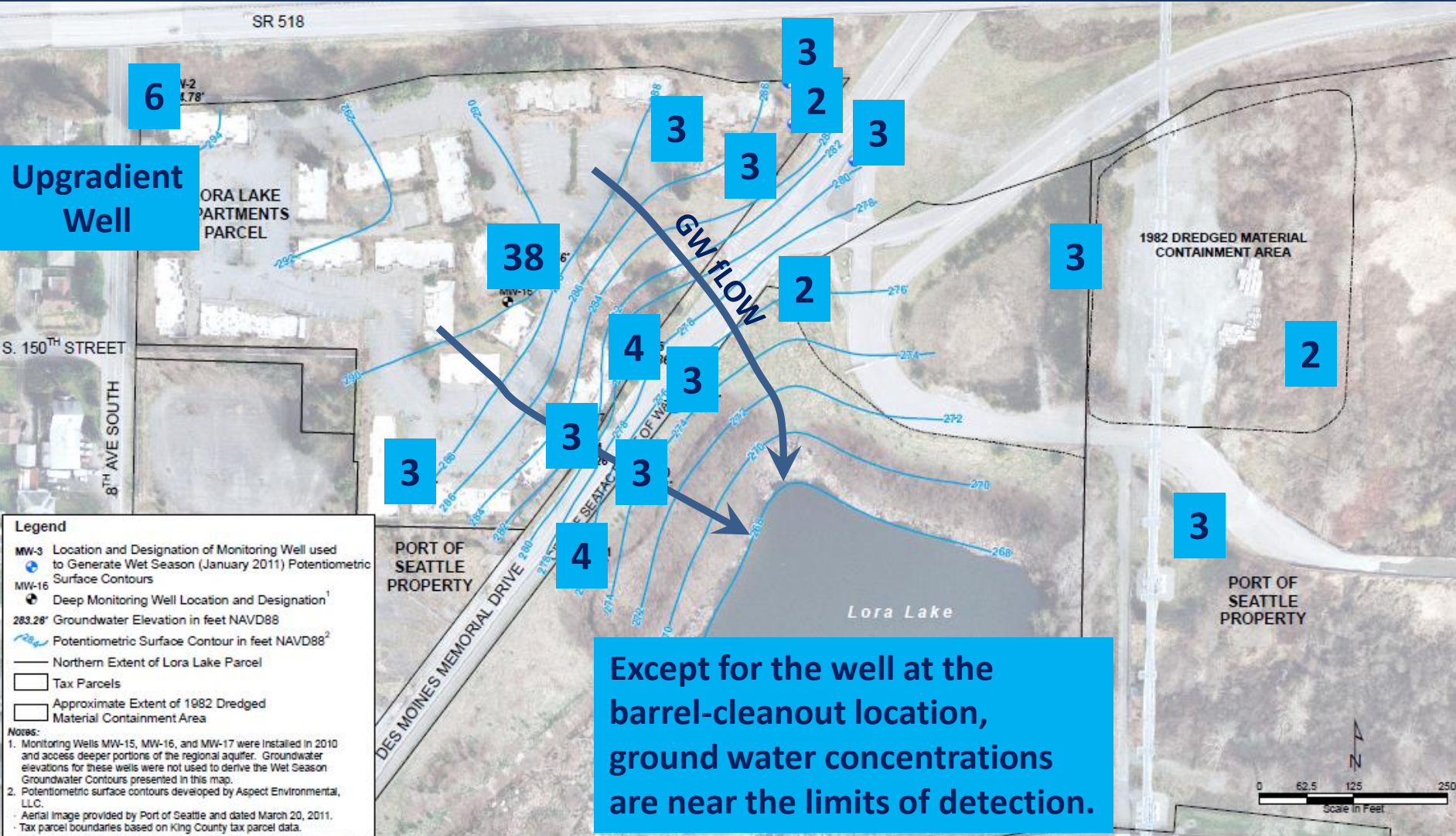
Upstream and downstream stations were statistically the same



Water cleanup levels

- 30 ppq – Safe Drinking Water Act (Federal)
- 5.83 ppq – MTCA Drinking water standard (State)
- 1 – 6 ppq – limits of detectability; depends upon what else is in the water.
- 0.005 ppq – Protective for fish consumption combined with drinking the water the fish are in.

Maximum dioxin concentrations detected in ground water (ppq). Blue lines are ground water elevation contours, wet season. Flow is toward Lora Lake.



Upgradient Well

Except for the well at the barrel-cleanout location, ground water concentrations are near the limits of detection.

Legend

- Location and Designation of Monitoring Well used to Generate Wet Season (January 2011) Potentiometric Surface Contours
- Deep Monitoring Well Location and Designation¹
- 283.28' Groundwater Elevation in feet NAVD88
- Potentiometric Surface Contour in feet NAVD88²
- Northern Extent of Lora Lake Parcel
- Tax Parcels
- Approximate Extent of 1982 Dredged Material Containment Area

Notes:

1. Monitoring Wells MW-15, MW-16, and MW-17 were installed in 2010 and access deeper portions of the regional aquifer. Groundwater elevations for these wells were not used to derive the Wet Season Groundwater Contours presented in this map.
2. Potentiometric surface contours developed by Aspect Environmental, LLC.

- Aerial image provided by Port of Seattle and dated March 20, 2011.
- Tax parcel boundaries based on King County tax parcel data.

**Lora Lake, looking southwest
(Size ~ 3 acres)**



Culvert inlet where Lora Lake drains to Miller Creek.



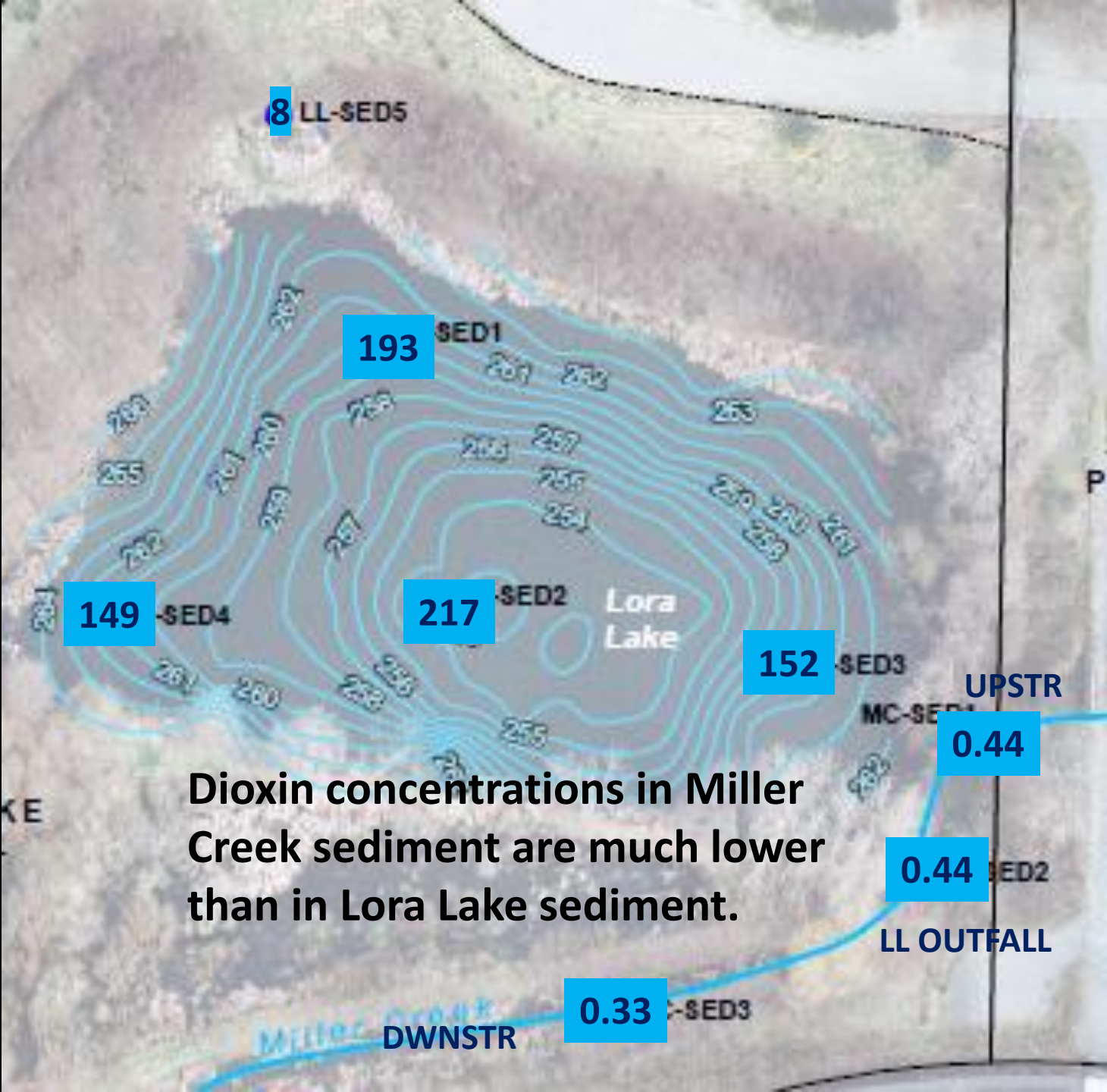
**Culvert outlet
to Miller Creek.**



Lora Lake Sediment

Dioxin concentrations in the biologically active zone (ppt)

There are no freshwater chemistry standards.



Dioxin concentrations in Miller Creek sediment are much lower than in Lora Lake sediment.

What about dioxin in sediment at deeper depths?

Station	Depth	Upper_Depth_ft	Lower_Depth_ft	Dioxin_ppt
LL-SED1	Surface	0.0	0.5	193
LL-SED2	Surface	0.0	0.5	217
LL-SED3	Surface	0.0	0.5	152
LL-SED4	Surface	0.0	0.5	149
LL-SED5	Surface	0.0	0.5	8
MC-SED1	Surface	0.0	0.3	0.4
MC-SED2	Surface	0.0	0.3	0.4
MC-SED3	Surface	0.0	0.3	0.3
LL-SED1	Mid	0.0	1.8	23
LL-SED2	Mid	0.0	1.8	154
LL-SED3	Mid	0.0	1.2	202
LL-SED2	Deeper	1.8	3.7	1
LL-SED3	Deeper	1.2	4.6	1
LL-SED2	Deepest	3.7	5.5	1
LL-SED3	Deepest	4.6	5.5	2

Lora Lake Bioassay Results

- Scuds and midge larvae were exposed to sediment from the biologically active zones in Lora Lake and Miller Creek.
- The effect on their growth and mortality was measured.



Scud
(*Hyalla azteca*)



Midge larvae
(*Chironomus dilutus*)



Midge – adult stage

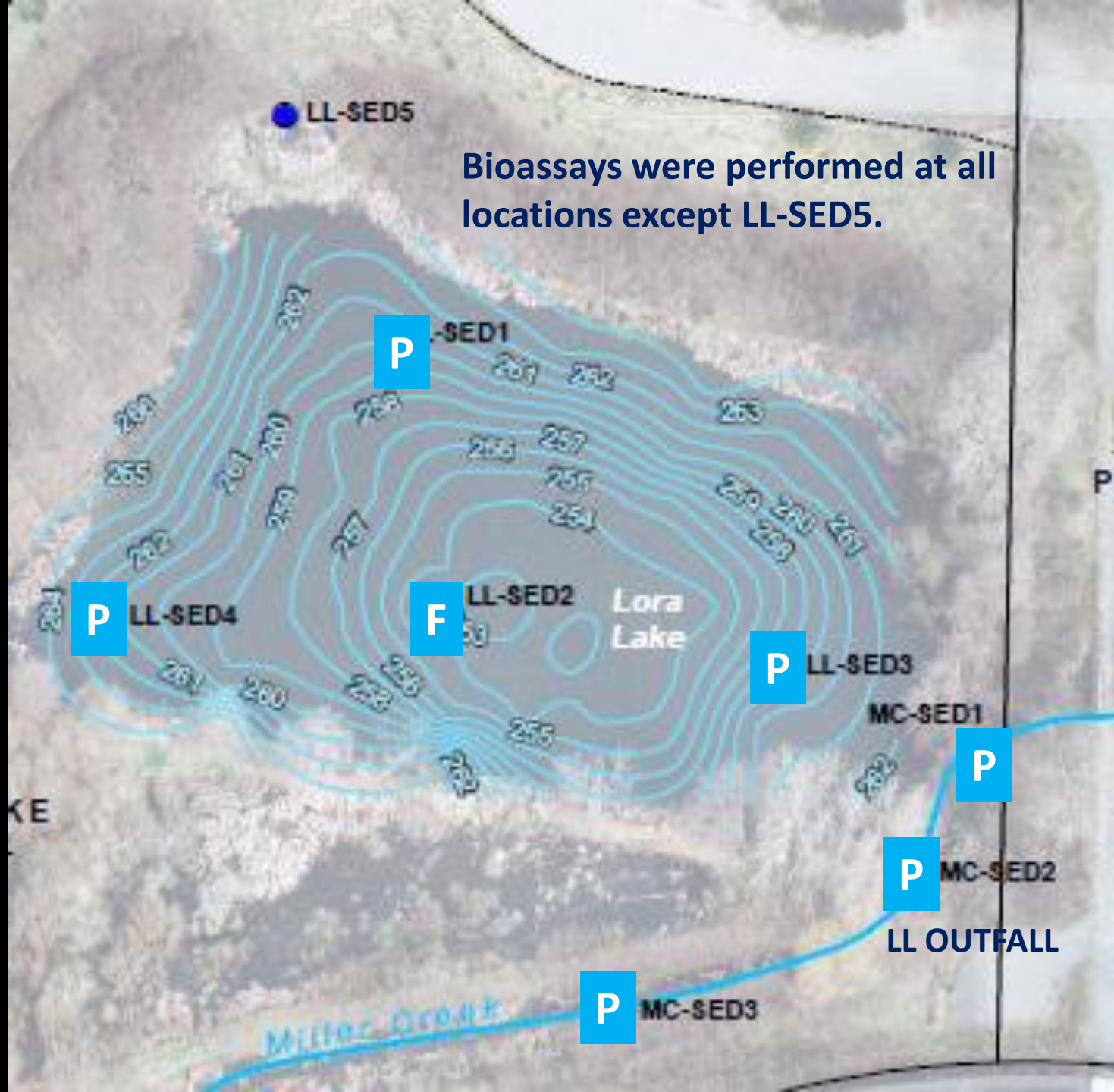
Bioassay results:

Surface sediments are unlikely to cause adverse effects on biological receptors except in the deepest part of the lake (LL-SED2).

The adverse effect is thought to be due to high sulfides.

P = Pass

F = Fail



Bioassays were performed at all locations except LL-SED5.

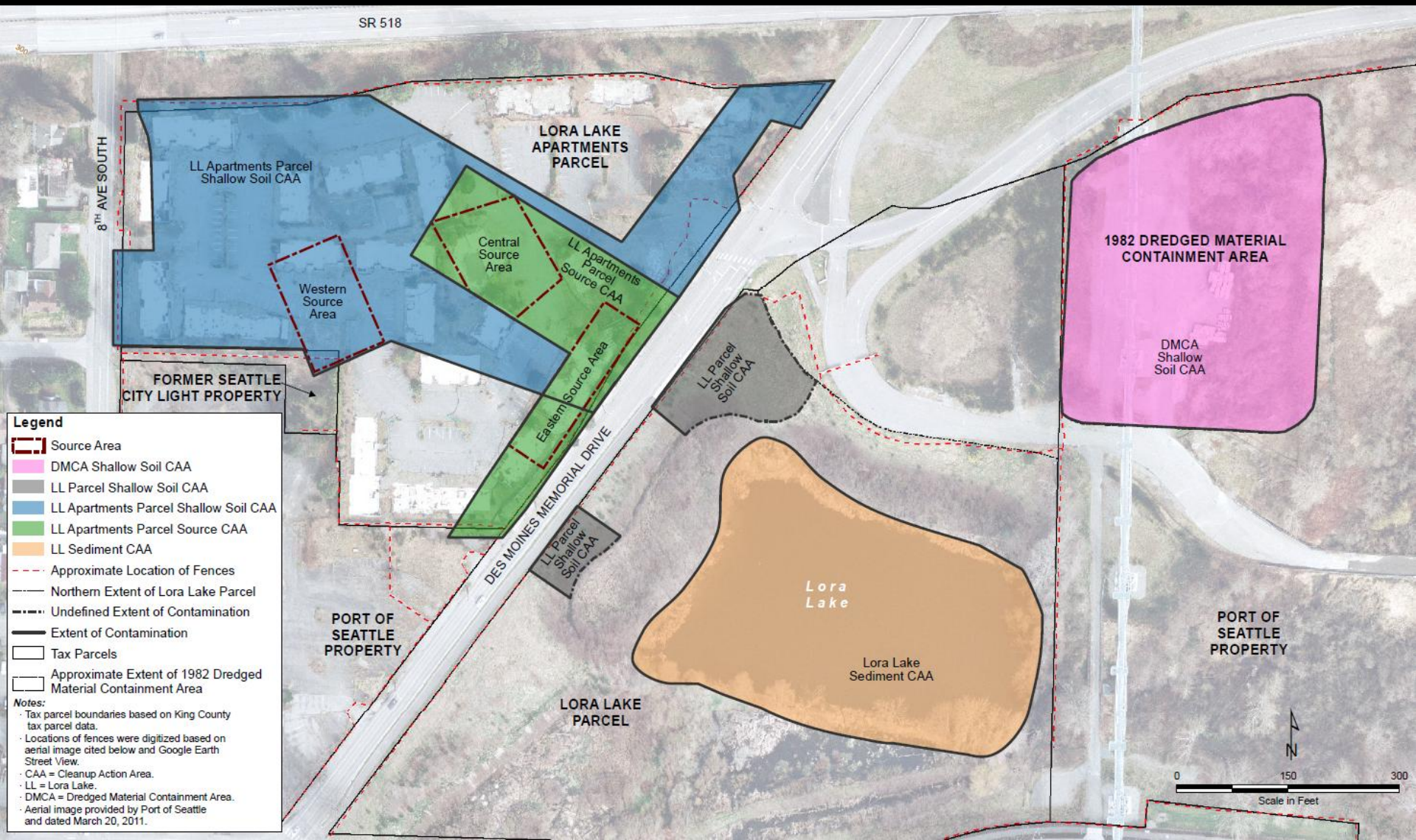
Point 2:

- The Lora Lake Apartments Site does not appear to contribute significant amounts of dioxin to Miller Creek.

Remediation Goals

- Protect people from exposure
- Keep contamination contained on site out of the storm drain system.
- Prevent migration of contaminants from the Site.
- Make the Lora Lake Apartments parcel suitable for development.

The RI/FS divides the site into several cleanup areas and evaluates various Soil CAA combinations of soil capping, soil excavation, and sediment capping or sediment dredging.



The FS evaluated 5 cleanup alternatives that spanned the range from no action to complete removal.

- Alternative 1 – No Action.
- Alternative 2 – Capping, long-term monitoring, and deed covenants restricting property use.
- The Port found that Alternatives 1 and 2 did not meet all of the remediation goals.

Alternative 3 Excavation Extent – Excavates soil with dioxin over **1,000** ppt. Cap other areas, storm drain system improvements, deed covenants, long-term monitoring. **\$7.9 million.**

Legend

Max Dioxin/Furan TEQ Conc. in Soil in pg/g

- 0-11
- 11-100
- 100-1,000
- 1,000-10,000
- > 10,000

Source Area
 Lora Lake Apartments Source Cleanup Action Area
 Alternative 3 Proposed Excavation Extent
 Tax Parcels
 Northern Extent of Lora Lake Parcel

Notes:

- Dioxin/furan cleanup level = 11 pg/g (MTC A Method B - Standard, Non-carcinogen). Concentrations that exceed this cleanup level are indicated in Bold.
- TEQ = Toxic equivalency quotient.
- CAA = Cleanup action area.
- MTC A = Model Toxics Control Act.
- J = Contaminant of concern was detected but the result is qualified.
- JN = Contaminant of concern was analyzed for and tentatively identified but the associated numerical value is an estimated quantity.
- Tax parcel boundaries based on King County tax parcel data.
- Aerial image provided by Port of Seattle and dated March 20, 2011.



8TH AVE SOUTH

DES MOINES MEMORIAL DRIVE

Lora Lake

Scale in Feet

0 100 200

Alternative 4 Excavation Extent – Excavates soil with dioxin over 100 ppt. Cap other areas, storm drain system improvements, deed covenants, long-term monitoring.

\$8.1 million

Legend

Max Dioxin/Furan TEQ Conc. in Soil in pg/g

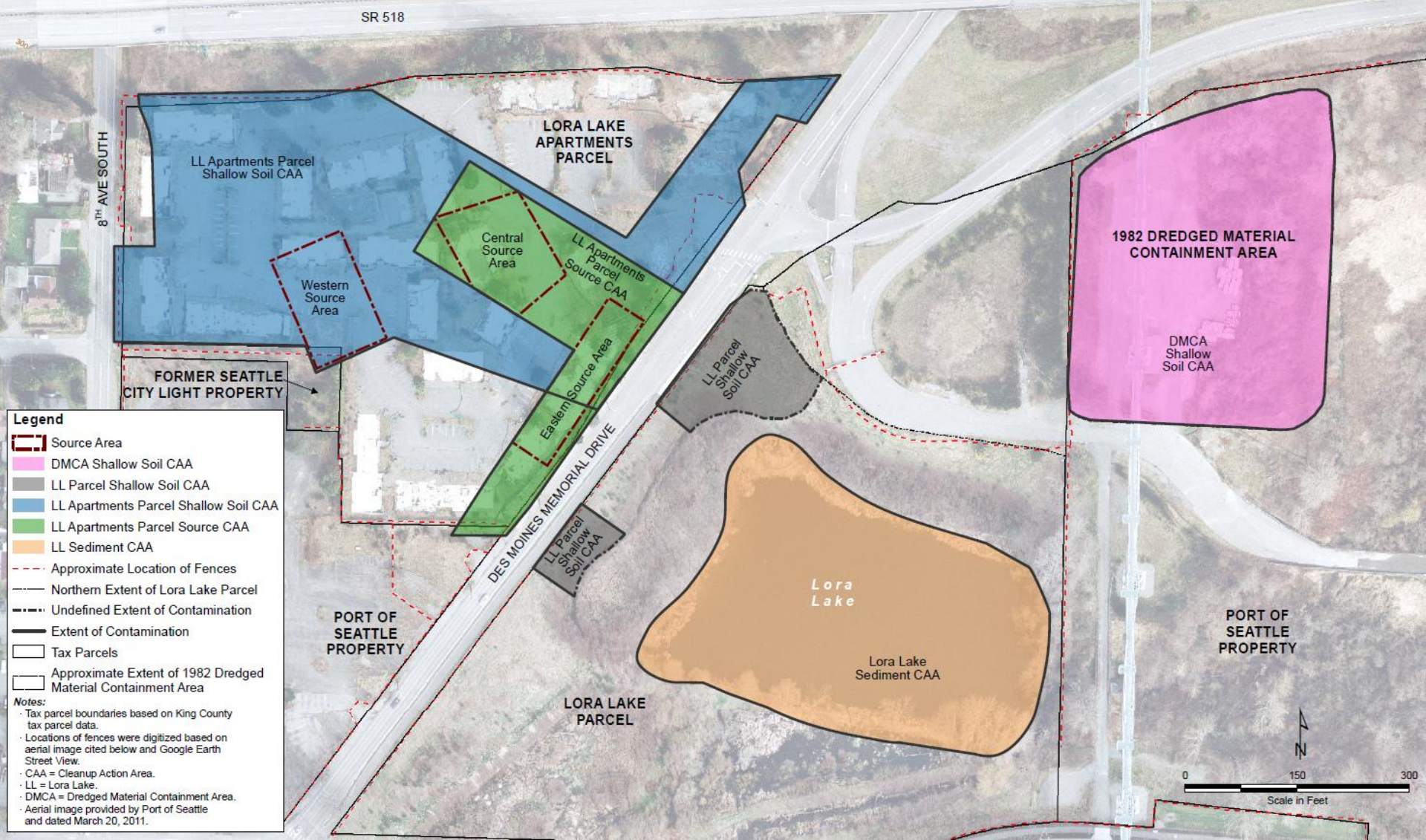
- 0-11
- 11-100
- 100-1,000
- 1,000-10,000
- > 10,000

Source Area
 Lora Lake Apartments Source Cleanup Action Area
 Alternative 4 Proposed Excavation Extent
 Tax Parcels
 Northern Extent of Lora Lake Parcel

Notes:
 Dioxin/furan cleanup level = 11 pg/g (MTC A Method B - Standard, Non-carcinogen). Concentrations that exceed this cleanup level are indicated in Bold.
 TEQ = Toxic equivalency quotient.
 CAA = Cleanup action area.
 MTC A = Model Toxics Control Act.
 J = Contaminant of concern was detected but the result is qualified.
 JN = Contaminant of concern was analyzed for and tentatively identified but the associated numerical value is an estimated quantity.
 Tax parcel boundaries based on King County tax parcel data.
 Aerial image provided by Port of Seattle and dated March 20, 2011.



Alternative 5 – All soil with dioxin exceeding **11** ppt is excavated. Lora Lake is dredged. **\$14 million,**



Ecology has asked the Port to evaluate two alternatives intermediate between Alternatives 4 and 5.

Alternative 4+

- This is Alternative 4 except that Lora Lake is dredged instead of having a sand cap placed over the dioxin-contaminated sediment.

Alternative 5-

- This is Alternative 5 except that the DMCA is capped with asphalt or an engineered gravel cap instead of excavated.

UPDATE: The revised draft RI/FS will evaluate each parcel separately instead of combining approaches for the three parcels. This approach makes more sense as cleanup of each parcel is not dependent on what happens on the others.

Point 3:

- Lora Lake Apartments Cleanup Site contamination will be cleaned up by a combination of excavation and capping.

When Will Actual Cleanup Start?

Lora Lake Apts and Dredged Material Containment Area

- By the time we get through developing all the plans and legal documents,
- Holding the public comment period,
- Preparing all the design documents, and
- And the Port bids the job,
- Construction is anticipated to start in the **2014 construction season.**

Lora Lake

- Cleanup of Lora Lake must be coordinated with the Natural Resource Mitigation Area trustees and is on a separate track.
- The Port and Ecology will proceed with a sense of urgency, but **the timing depends upon discussions with the trustees.**

Major points:

- Dioxin is widespread in the environment and comes from many different sources.
- The Lora Lake Apartments Site does not appear to contribute significant amounts of dioxin to Miller Creek.
- Lora Lake Apartments contamination will be cleaned up by a combination of excavation and capping.

What's next?

- The Port will submit a revised draft RI/FS July 11th. This 2nd draft is available by public request.
- It will cover the Lora Lake Apartments and DMCA parcels.
- The draft RI/FS for the Lora Lake portion of the site will be submitted by the end of the year. The extra time is needed for increased coordination with other resource agencies, the complexities associated with remediation of the lake sediment, and work within a wetland mitigation area.
- The Port's and Ecology's goal is to bring everything together for the 2014 construction season, but there is not yet sufficient information to firm up the Lora Lake parcel schedule.

The project is dynamic and ongoing.

Lora Lake Apartments Web Site

<https://fortress.wa.gov/ecy/gsp/Sitepage.aspx?csid=2008>

Or search on

Lora Lake Apartments | Cleanup Sites | Washington Department of Ecology

Or contact me:

David L. South

david.south@ecy.wa.gov

425-649-7200



Questions?