Johnson Creek Sediment Sampling Data Report
PCC Structurals, Inc. Large Parts Campus
4600 Southeast Harney Drive
Portland, Oregon

August 21, 2018

Prepared for

PCC Structurals, Inc.
4600 Southeast Harney Drive
Portland, Oregon

LANDAU ASSOCIATES

1500 SW 1st Avenue, Suite 1015
Portland, OR 97201
(503) 542-1080

Johnson Creek Sediment Sampling Data Report
PCC Structurals, Inc. Large Parts Campus
4600 Southeast Harney Drive
Portland, Oregon

This document was prepared by, or under the direct supervision of, the technical professionals noted below.

Document prepared by: _____ Colette Gaona
Project Manager

Document reviewed by: _____ Jay Bower
Quality Reviewer

Date: August 21, 2018
Project No.: 0883002.040.044
File path: P:\883\002\FileRm\R\040\Johnson Creek\Johnson Creek ISM\Signature Page.docx
Project Coordinator: MCS

LANDAU ASSOCIATES

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

CSM ..... conceptual site model
DU ..... decision unit
EPA ..... U.S. Environmental Protection Agency
ft ..... foot/feet
GPS ..... global positioning system
HVOC ..... halogenated volatile organic compound
ISM ..... incremental sampling methodology
ITRC ..... Interstate Technology and Regulatory Council
LAI ..... Landau Associates, Inc.
LPC ..... Large Parts Campus
µg/kg ..... micrograms per kilogram
mg/kg ..... milligram per kilogram
ODEQ ..... Oregon Department of Environmental Quality
oz ..... ounce
PCB ..... polychlorinated biphenyl
PCC ..... PCC Structurals, Inc.
ppm ..... parts per million
RI ..... remedial investigation
RSM ..... representative sampling methodology
SAP ..... sampling and analysis plan
SLV ..... screening level value
SOP ..... standard operating procedure

This page intentionally left blank.

1.0 INTRODUCTION

This report documents the results of sediment sampling performed by Landau Associates, Inc. (LAI) in a portion of Johnson Creek near the PCC Structurals, Inc. (PCC) Large Parts Campus (LPC), located at 4600 Southeast Harney Drive in Portland, Oregon (site; Figure 1). LAI representatives used the incremental sampling methodology (ISM) techniques described in the September 20, 2017 Johnson Creek Sediment Sampling Work Plan (LAI 2017).

The site is the subject of an ongoing remedial investigation (RI), and sediment sampling was conducted to confirm creek conditions, as required by the Oregon Department of Environmental Quality (ODEQ). Sampling was performed in accordance with applicable methods and the quality assurance/quality control procedures outlined in the ODEQ-approved Phase I Remedial Investigation Work Plan (LAI 2009), the Phase II RI Work Plan (LAI 2010), and the associated sampling and analysis plans (SAPs) appended to the Phase I and II RI Work Plans. Specific methods and procedures employed during this sampling event are summarized in the following sections.

2.0 BACKGROUND

Information about the site, including its location and ownership history and a conceptual site model (CSM), was presented in the Agency Review Draft RI Report (LAI 2013). The CSM will be revised, based on the results of this sediment investigation and other ongoing RI activities. The following section summarizes the findings of previous sediment investigations conducted at Johnson Creek.

2.1 Previous Sediment Investigations

Previous investigations have consisted of collecting sediment samples in the vicinity of the Johnson Creek storm drainpipe outfall. On August 27, 2010, initial sediment samples were collected at locations 30 feet (ft) upstream and 30 ft downstream and at the storm drainpipe outfall.[1] The samples were analyzed for priority pollutant metals and halogenated volatile organic carbons (HVOCs).

Based on the August 2010 sediment sampling results, ODEQ requested additional sediment sampling of Johnson Creek (Manzano 2011). Additional samples were to be analyzed for priority pollutant metals and PCBs. On January 5, 2012, sediment samples were collected along five transects, located approximately 30, 60, 100, 150, and 300 ft downstream of the storm drain outfall. Three samples were collected from each transect. Ten sediment samples were collected 50 to 100 ft upstream of the outfall to establish background concentrations of constituents in sediment. Sediment sampling was conducted in general accordance with the SAP addendum included in the Phase II RI Work Plan (LAI 2010) and the Supplemental Sediment Sampling Work Plan (LAI 2011).

In August 2014, ODEQ required a resampling of sediments, with collection methodology consistent with that used in the January 2012 sampling (ODEQ 2014). In October 2014, samples were collected from the transects established during the January 2012 sampling event. Following review of analytical results, ODEQ requested that samples be collected from two additional downstream transects, located 200 and 250 ft from the outfall. In June 2015, four samples were collected from each of the additional transects.

The sampling described herein was performed to assess sediment quality in the Johnson Creek Oxbow, prior to initiation of improvements by the City of Portland (anticipated for summer 2018). At ODEQ's direction, PCC assessed the feasibility of using an ISM approach in lieu of sampling along the transects established during previous events. As part of the feasibility assessment, ODEQ, PCC, and LAI performed a site reconnaissance in the Johnson Creek Oxbow on July 18, 2017. During the reconnaissance, LAI completed a visual survey of creek bed materials and documented creek conditions. Observed creek bed conditions are presented on Figure 2. The results of the creek reconnaissance and proposed sampling methodology were summarized in an August 2, 2017 email to ODEQ (Gaona 2017).

[1] The City of Portland's storm drain outfall discharges stormwater collected from the PCC LPC and the surrounding area.

The visual survey confirmed that many areas in the creek contain washed cobbles with little to no accumulated sediment. Based on the findings of the survey, ODEQ and LAI modified the ISM approach to be used only in areas where sediment accumulated in the creek bed. The modified approach is detailed in the following section.

3.0 SCOPE AND APPROACH

ISM techniques were used to sample sediment in three decision unit (DU) areas within Johnson Creek. DUs are presented on Figure 3. The DU areas were developed in the 2017 Johnson Creek Sediment Sampling Work Plan (LAI 2017). The sampling approach, deviations from the work plan, and a general description of the sediment observed in each DU are presented in the following sections.

3.1 Decision Unit and Sample Location Selection

ISM is a sampling procedure wherein a large number of subsamples (typically 30 or more) are collected from a certain area (DU) and combined into a single sample for analysis, rather than being individually analyzed. ISM sediment sampling was performed in general accordance with the guidelines established by the Interstate Technology and Regulatory Council (ITRC 2012). Certain procedures were adapted to allow for the unique sampling environment and limited sampleable material.

The three DUs (DU1, DU2, and DU3) sampled as part of the ISM approach are shown on Figures 4 through 6. DUs were defined by areas of sampleable material (i.e., fines, gravel with fines, and cobbles with fines). DU1 is located upstream of the outfall, and DU2 and DU3 are located downstream of the outfall. Selected site photographs documenting the conditions of each DU are provided in Appendix A.

At ODEQ's request, LAI field staff visually assessed creek conditions downstream of DU3 to determine if other sampleable material could be found within a reasonable distance (i.e., within 200 ft of DU3). Based on the visual survey and concurrence with ODEQ, it was determined that no sampleable material was present within 200 ft downstream of DU3.

Within each DU, LAI field staff used a stake to randomly select and designate a sampling origination point. Origination points, shown as red triangles on Figure 3, were located in the field using a handheld global positioning system (GPS) unit. LAI field staff then measured a distance of 3 to 5 ft from the stake and collected a sample. In each DU, the distance from the stake varied based on the overall area of sampleable material, so that a spatially representative and randomly generated sediment sample was collected in each DU. LAI field staff then moved laterally and collected a second sample. This approach was repeated throughout the sample area until 30 incremental samples had been collected from each DU. Incremental samples were spaced as evenly as possible within areas of fines. The location of each of the incremental samples was marked on figures in the field.

3.2 Sediment Sampling Procedures

Thirty incremental samples were collected from DU2, and 90 incremental samples were collected from DU1 and DU3 for triplicate analysis. To provide the amount of material necessary for ISM laboratory analysis, each incremental sample consisted of approximately 4 ounces (oz) of sediment by

volume. Each incremental sample was collected into a 4-oz glass jar, or 4-oz stainless steel sieve with cap, then transferred to a 1-gallon ISM sample container supplied by the analytical laboratory, and composited with other incremental samples from the same DU. Samples were stored on ice and transported under chain of custody to PCC's contracted analytical laboratory, Apex Laboratories in Tigard, Oregon.

In all areas of the stream, sediment was removed from around the cobbles with a stainless steel spoon or stainless steel sieve with cap. The fine mesh (0.45 microns) on the stainless steel sieves allowed for some water to pass through the sieve and remove liquid from the sediment samples while retaining fine-grained sediment for sample collection. Field staff typically were able to collect approximately 4 oz of sediment from each incremental sample area. Sampling equipment was decontaminated following sample collection in each DU (but not between each incremental sample). Decontamination included removing large particulate matter with a brush or paper towel, and rinsing with Alconox® and distilled water.

Triplicate samples were collected for DU1 and DU3. Data from triplicate samples were used to calculate standard deviation to compare sample results from the DU upstream of the outfall (DU1) with sample results from the DUs downstream of the outfall. Triplicate samples were collected as independent random samples in DU1 and DU3, using the same ISM procedures discussed previously.

In addition to the ISM samples collected from each DU, three discrete subsurface samples were collected from DU2, per ODEQ's request. To evaluate sediment quality, discrete samples were collected in areas with fines or gravel with fines, 12 inches beneath the streambed surface. A stainless steel cylinder (12 to 18 inches in diameter) was placed into the streambed to isolate the sample location. Water was removed from the cylinder via a bilge pump, and sediment was removed from the cylinder with a stainless steel scoop or hand auger to reach the desired sample depth. Approximately 8 oz of sediment were removed from the isolated area with a stainless steel spoon or scoop and placed into laboratory-supplied containers.

3.2.1 Decision Unit 1

In DU1, areas of sediment accumulation were noted along the edges of the stream. Accumulation was most common behind stream obstructions, such as downed trees or large rocks. Four originating points were selected in DU1, and each point was staked and located with a GPS unit. The originating points were designated DU1-1, DU1-2, DU1-3, and DU1-4. Incremental samples were collected from each of these locations, as shown on Figure 4.

3.2.2 Decision Unit 2

In DU2, areas of sediment accumulation were noted along the edges of the stream. The stream oxbow cuts to the west in DU2, providing additional areas of sediment accumulation inside the convex bank. Three originating points were selected in DU2, and each point was staked and located with a GPS unit.

The originating points were designated DU2-1, DU2-2, and DU2-3, and the three discrete sample locations were designated DU2-01, DU2-02, and DU2-03, as shown on Figure 5.

3.2.3 Decision Unit 3

As in DU1 and DU2, sediment accumulation in DU3 was noted along the edges of the stream, though accumulation in DU3 was slightly thicker. Four originating points were selected in DU3, and each point was staked and located with a GPS unit. The originating points were designated DU3-1, DU3-2, DU3-3, and DU3-4, as shown on Figure 6.

3.2.4 Downgradient of Decision Unit 3

During the October 4, 2017 sampling, ODEQ requested additional reconnaissance of the section of Johnson Creek downstream of DU3, before the confluence of the oxbow and the main stream of Johnson Creek. The purpose of the reconnaissance was to determine the availability of sampleable material that could comprise a fourth decision unit.

The reconnaissance was conducted from the downstream boundary of DU3 (approximately 400 ft downstream of the outfall) to a point approximately 250 ft downstream of DU3 (approximately 650 ft downstream of the outfall). The reconnaissance terminated at 250 ft, due to a large blockage of debris in the creek. During the reconnaissance, the following streambed surface material was noted:

- 0 ft downstream – washed cobbles with gravel and trace fines.
- 50 ft downstream – cobbles with gravel and trace organics.
- 100 ft downstream – washed cobbles.
- 200 ft downstream – washed cobbles with gravel and trace fines.
- 250 ft downstream – washed cobbles with fines.

A small area, approximately 10 ft long and comprised of mostly fine-grained material, was observed about 250 ft downstream of the terminus of DU3. The area was located on the downstream side of a tree rootball protruding into Johnson Creek. LAI and ODEQ determined that the area was not of sufficient size to be sampled as a representative fourth decision unit, and the area was not sampled as part of this investigation.

3.3 ISM Processing and Sample Analysis

Apex Laboratories processed the ISM samples and performed the sample analyses. Upon receipt, the ISM samples were dried, sieved, ground, and processed in accordance with the ITRC sample preparation protocol (ITRC 2012), Apex Laboratories representative sampling methodology (RSM) standard operating procedure (SOP; Apex 2016), and the site-specific RSM SAP prepared by Apex Laboratories (Apex 2017). The RSM SOP and site-specific RSM SAP are provided in Appendix B.

Following ISM processing, all sediment samples were analyzed for PCB Aroclors by U.S. Environmental Protection Agency (EPA) Method 8082 and for priority pollutant metals (suite of 13 metals) plus cobalt by EPA Methods 6010B and 7471A. Unused sample material was archived.

3.4 Discrete Sample Analysis

Discrete sediment samples were analyzed for PCB Aroclors by EPA Method 8082 and priority pollutant metals plus cobalt by EPA Methods 6010B and 7471A. Unused sample material was archived.

4.0 DATA EVALUATION AND REPORTING

Laboratory analytical data were tabulated and validated in accordance with the ODEQ-approved Sampling and Analysis Plan (LAI 2009) and Sampling and Analysis Plan Addendum (LAI 2010). The analytical data package and data validation report is provided in Appendix C. Results for ISM samples are compared with ODEQ screening level values (SLVs) in Table 1, and results for discrete samples are compared with SLVs in Table 2. The mean concentration from DU1 and DU3 replicate samples was calculated and presented along with the single DU2 ISM result for detected PCB Aroclors (Figure 7) and for select metals (Figure 8).

4.1 Comparison of Downstream ISM Results to DU1

Data for the DUs downstream of the outfall (DU2 and DU3) were compared to data for the DU upstream of the outfall (DU1) to assess whether the outfall is a source of contamination to accumulated, downstream sediment. Analyte concentrations for DU1 are considered to be background levels relative to concentrations downstream of the outfall. At ODEQ's request, the standard deviation of the mean was calculated for replicate samples in DU1 for comparison to background levels. The standard deviation of the mean was also calculated for replicate samples in DU3 for comparison to DU1.

4.1.1 PCB Results

Aroclors consistently detected above the laboratory reporting limits included 1242 and 1254. Aroclor 1260 was also detected in one of the replicate samples from DU3. All detected Aroclor concentrations were summed to calculate total PCB concentrations. Total PCBs concentrations in DU1 and DU3 exceeded the applicable SLV, while DU2 remained below the SLV. Concentrations of Aroclor 1254 exceeded the applicable SLV in all ISM samples. Trends in PCB concentrations vary based on Aroclor, as shown on Figure 7.

Concentrations of Aroclor 1242 were detected in DU1, decreased in DU2, and then increased in DU3. The mean concentration of Aroclor 1242 in DU3 (57.5 micrograms per kilogram [µg/kg] ± 31.9 µg/kg) is slightly greater than background levels (37.2 ± 11 µg/kg), but within the range of standard deviation. Aroclor 1242 was not detected in the ISM sample from DU2 (directly downstream of the outfall), and has never been detected in media collected from the PCC LPC.

Concentrations of Aroclor 1254 were detected in DU1, and increased slightly with distance downstream of DU1. The mean background concentration is 17.4 ± 0.5 µg/kg, and downstream concentrations are 23.4 µg/kg at DU2 and 37.9 µg/kg ± 7.6 µg/kg at DU3.

Total PCB concentrations decrease from DU1 (54.6 ± 11 µg/kg) to DU2 (23.4 µg/kg) and then increase in DU3 (99.5 µg/kg ± 32.5 µg/kg); however, the lower standard deviation in DU3 (67.0 µg/kg) falls within a range similar to the upper standard deviation in DU1 (65.6 µg/kg). The largest fraction of total PCB concentration in DU3 is attributed to Aroclor 1242, as shown on Figure 7.

Based on a comparison of the data collected from DU1 and DU2, the outfall does not appear to be a significant source of PCB contamination in the streambed sediments. Total PCB concentrations are greater in DU3 than in DU1; however, the lower standard deviation in DU3 is comparable to the upper standard deviation in DU1. Based on the Aroclor 1242 results, there is likely another source of PCBs upstream of the outfall, not attributable to the PCC LPC, where Aroclor 1242 has never been detected.

4.1.2 Metals Results

Of the 14 metal analytes, eight were detected above laboratory reporting limits. Detected metals were arsenic, beryllium, chromium, cobalt, copper, lead, mercury, nickel, and zinc. Of these, nickel and zinc were the only metals with concentrations that exceed applicable SLVs. Nickel concentrations exceed the SLV in all DUs. Zinc concentrations exceed the SLV in DU1 and DU3 only.

Nickel concentrations increase with distance downstream of the background unit, DU1, as shown on Figure 8. However, there does not appear to be a significant correlation between concentrations of chromium, cobalt, copper, lead, and zinc and distance downstream of DU1. Concentrations of lead, chromium, and zinc decrease between DU1 and DU2, and then increase in DU3. Cobalt concentrations in DU2 fall within the background-level range (range of standard deviation of DU1 mean), meaning no change is observed between DU1 and DU2. A slight increase in cobalt concentrations is observed between DU1 (10.7 ± 0.3 milligrams per kilogram [mg/kg]) and DU3 (11.4 mg/kg). Copper concentrations decrease from DU1 to DU2, and fall within the background-level range in DU3. Based on these data, the outfall does not appear to contribute to sediment concentrations of cobalt and copper in DU2 and DU3. The outfall may contribute to nickel concentrations in sediment in DU2 and DU3. It is uncertain whether the outfall contributes to concentrations of lead, chromium, and zinc in DU3.

4.2 Discrete Sampling Results

Results from discrete samples collected in DU2 are presented in Table 2. Discrete samples were collected at the ODEQ's request to assess the quality of sediment 12 inches below the streambed surface. Results indicate that concentrations are similar to those found in ISM samples collected from the surface of the streambed.

PCBs detected above laboratory reporting limits include Aroclor 1242 and Aroclor 1254. Aroclor 1254 was detected at concentrations above the screening level. Concentrations ranged from 10.6 µg/kg to 30.2 µg/kg, which is consistent with the DU2 ISM results of 23.4 µg/kg. Aroclor 1242 was detected in only one discrete sample at a concentration of 15.0 µg/kg. The other two discrete samples did not contain concentrations above the reporting limit, similar to the DU2 ISM sample. Total PCB concentrations range from 10.6 µg/kg to 45.2 µg/kg, which is consistent with the DU-2 ISM result of 23.4 µg/kg.

Metals detected above laboratory reporting limits include the same eight detected in ISM samples: arsenic, beryllium, chromium, cobalt, copper, lead, nickel, and zinc. Nickel and zinc are the only two metals that exceed applicable SLVs. Concentrations of nickel range from 20.7 mg/kg to 36.9 mg/kg, which is consistent with the DU-2 ISM result of 30.8 mg/kg. Concentrations of zinc range from 92.8 mg/kg to 125 mg/kg, which is consistent with the DU-2 ISM result of 117 mg/kg.

Based on these results, there appears to be no significant difference in constituent concentrations within the top foot of accumulated sediment in DU2.

5.0 USE OF THIS REPORT

This Johnson Creek Sediment Sampling Data Report has been prepared for the exclusive use of PCC Structurals, Inc. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by Landau Associates, shall be at the user's sole risk. Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

6.0 REFERENCES

Apex. 2017. Site Specific RSM SAP for Landau Project #883002 (PCC LPC). Apex Laboratories. October 5.

Apex. 2016. Standard Operating Procedure: Representative Subsampling Methodology. SOP No. G105 RSM. Apex Laboratories. January 22.

Gaona, C. 2017. "Re: PCC LPC Johnson Creek ISM Approach for DEQ Concurrence." Colette Gaona, Landau Associates, Inc. August 2.

ITRC. 2012. Incremental Sampling Methodology: Executive Summary. http://www.itrcweb.org/ism-1/executive_summary.html. Interstate Technology and Regulatory Council.

LAI. 2017. Johnson Creek Sediment Sampling Work Plan, PCC Structurals, Inc., Large Parts Campus, Portland, Oregon. Landau Associates, Inc. September 20.

LAI. 2009. Phase I Remedial Investigation Work Plan, PCC Large Parts Campus, Portland, Oregon. Landau Associates, Inc. April 1.

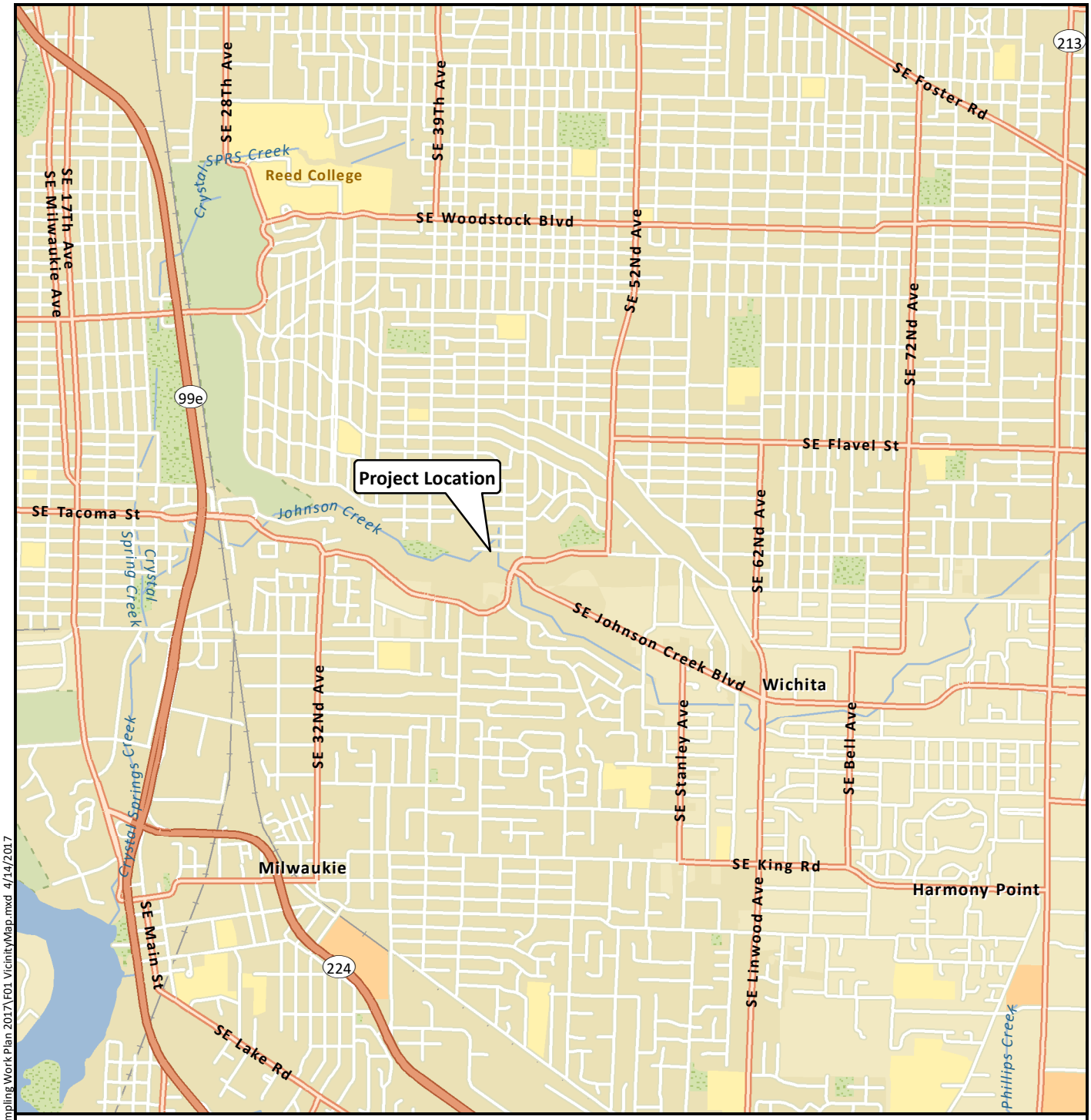
LAI. 2010. Phase II Remedial Investigation Work Plan, PCC Large Parts Campus, Portland, Oregon. Landau Associates, Inc. May 21.

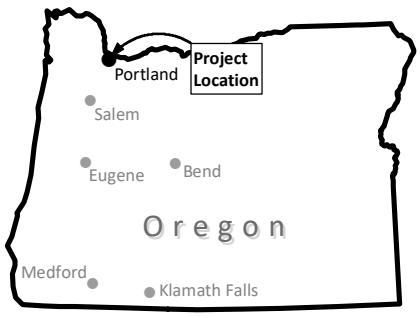
LAI. 2011. Phase II Remedial Investigation Supplemental Sediment Sampling. Landau Associates, Inc. November 16.

LAI. 2013. Remedial Investigation Report, PCC Structurals, Inc., Large Parts Campus, Portland, Oregon. Landau Associates, Inc. July 17.

Manzano, S. 2011. "Re: Comments for BWUD and Eco Screening." Scott Manzano, Oregon Department of Environmental Quality. November 10.

ODEQ. 2014. Letter: Results of Recent City of Portland Storm Investigation, PCC Structurals, Large Parts Campus, ECSI #274. From Cindy Ryals, Oregon Department of Environmental Quality, to Chris Meyers, PCC Structurals. August 5.



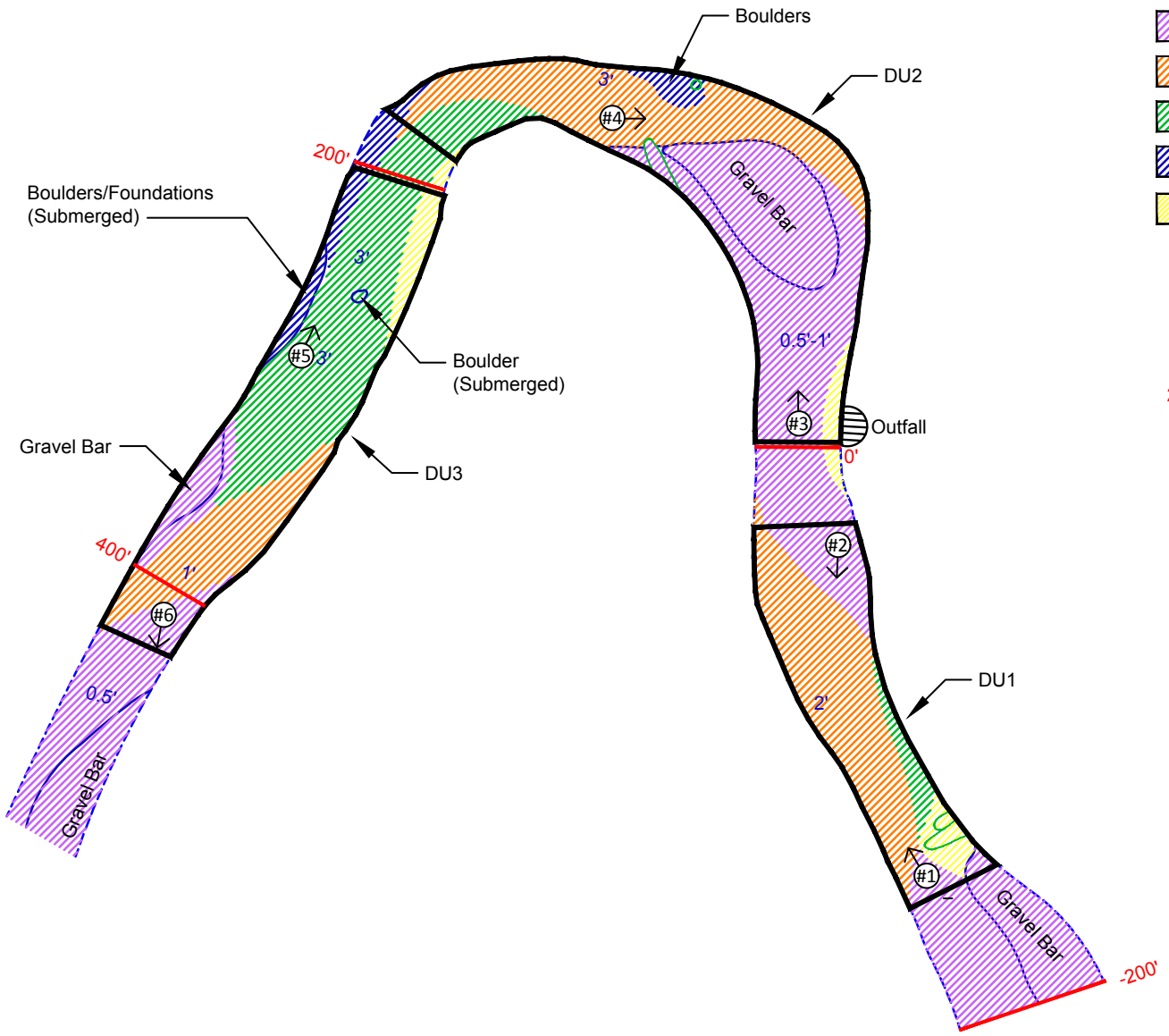


Data Source: Esri 2012

G:\Projects\883\002\040\044\Johnson Creek Sediment Sampling Work Plan 2017\F01 VicinityMap.mxd 4/14/2017

LANDAU ASSOCIATES

PCC Structurals, Inc. Large Parts Campus Portland, Oregon	**Vicinity Map**	Figure 1



Legend

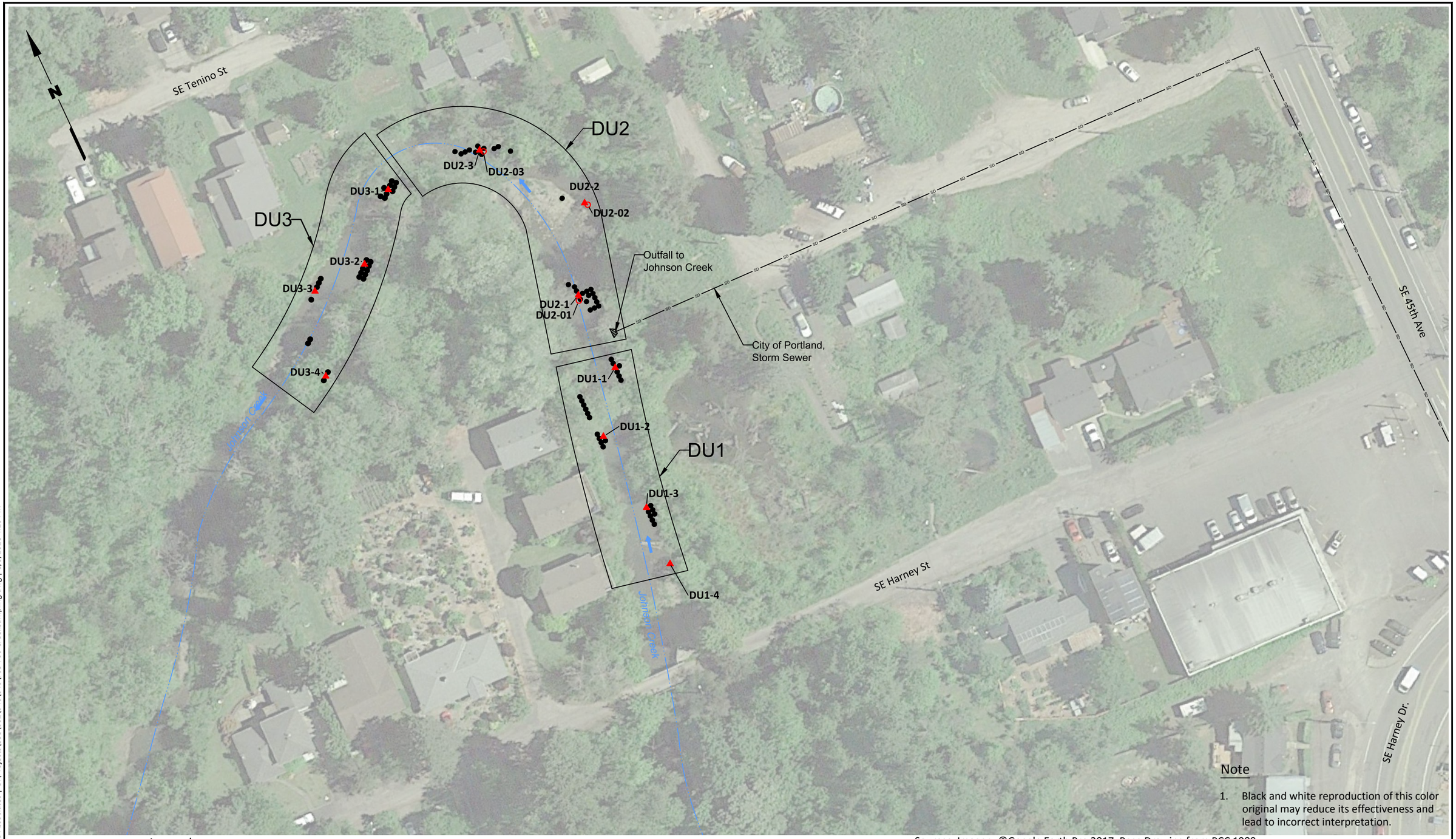
- Cobbles with gravel
- Cobbles with fines
- Gravel and fines
- Cobbles and boulders
- Fines with cobbles
- Tree/Logs
- #1 Photo Location & Direction (See Appendix A)
- 3' Approximate Depth
- 200' Feet from Outfall

Note

1. Conceptual model, not to scale.
2. DU = Decision Unit
3. ISM = Incremental sampling methodology
4. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

LANDAU ASSOCIATES

PCC Structurals, Inc. Large Parts Campus Portland, Oregon	**Johnson Creek Streambed Map and Decision Units for ISM Approach**	Figure 2



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Origination Point
- Incremental Sample Collection Location
- Creek Flow Direction
- Discrete Sample Location

0 60 120

Scale in Feet

Sources: Imagery ©Google Earth Pro 2017, Base Drawing from PCC 1989

LANDAU ASSOCIATES

PCC Structurals Inc.
Large Parts Campus
Portland, Oregon

Decision Units

Figure 3

Landau Associates | G:\Projects\883\002\040\046\F03-F06 CreekSampling.dwg | 8/9/2018 4:16 PM

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Origination Point
- Incremental Sample Collection Location
- Creek Flow Direction

0 30 60

Scale in Feet

Sources: Imagery ©Google Earth Pro 2017, Base Drawing from PCC 1989

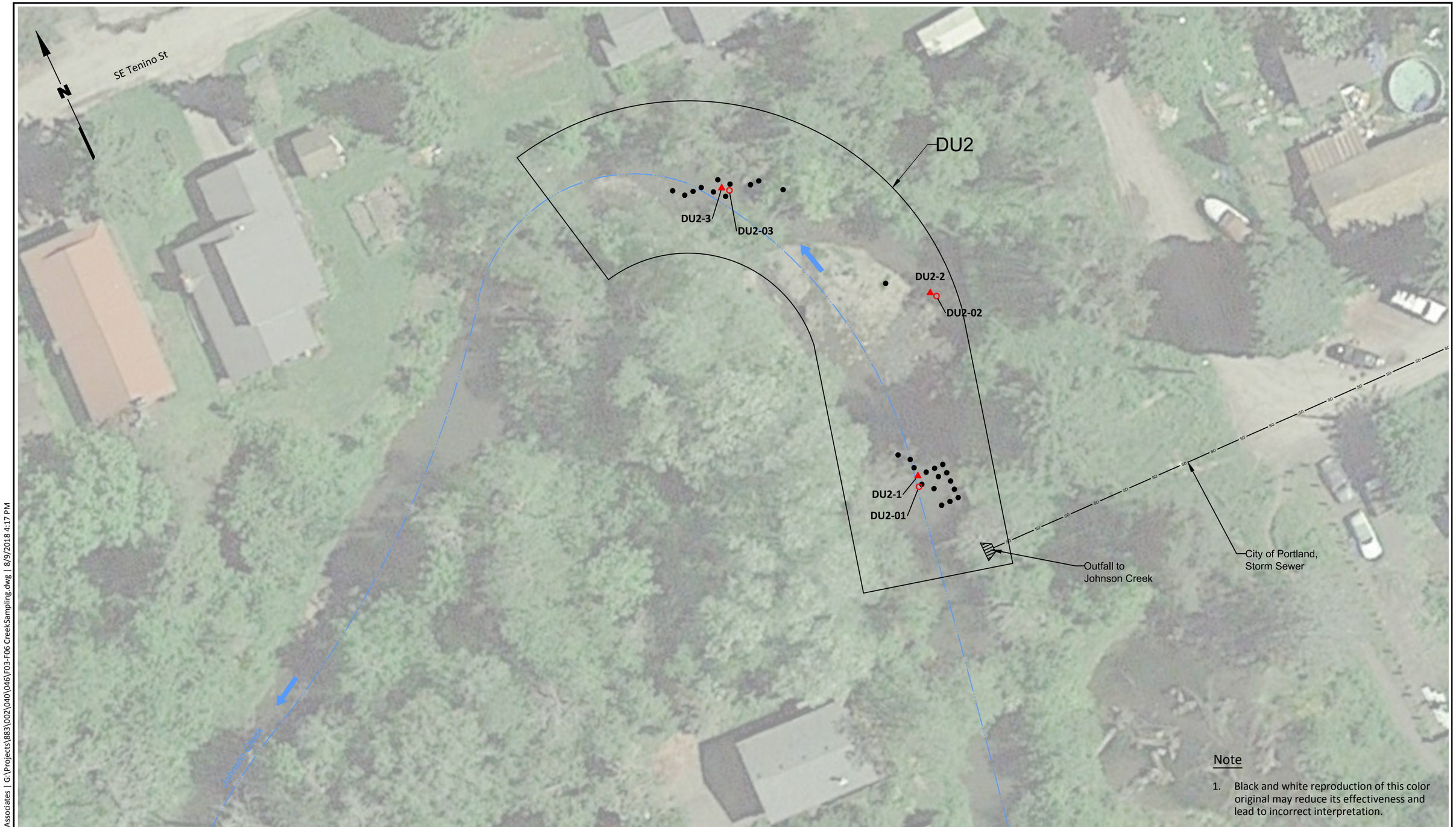
LANDAU ASSOCIATES

PCC Structurals Inc.
Large Parts Campus
Portland, Oregon

DU1 Sediment Sampling Locations

Figure 4

Landau Associates | G:\Projects\883\002\040\046\F03-F06 CreekSampling.dwg | 8/9/2018 4:16 PM



Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Origination Point
- Incremental Sample Collection Location
- Creek Flow Direction
- Discrete Sample Location

0 30 60
Scale in Feet

Sources: Imagery ©Google Earth Pro 2017, Base Drawing from PCC 1989

LANDAU ASSOCIATES

PCC Structurals Inc. Large Parts Campus Portland, Oregon	**DU2 Sediment Sampling Locations**	Figure 5

Landau Associates | G:\Projects\883\002\040\046\F03-F06 CreekSampling.dwg | 8/9/2018 4:17 PM

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Legend

- Origination Point
- Incremental Sample Collection Location
- Creek Flow Direction

0 60 120

Scale in Feet

Sources: Imagery ©Google Earth Pro 2017, Base Drawing from PCC 1989

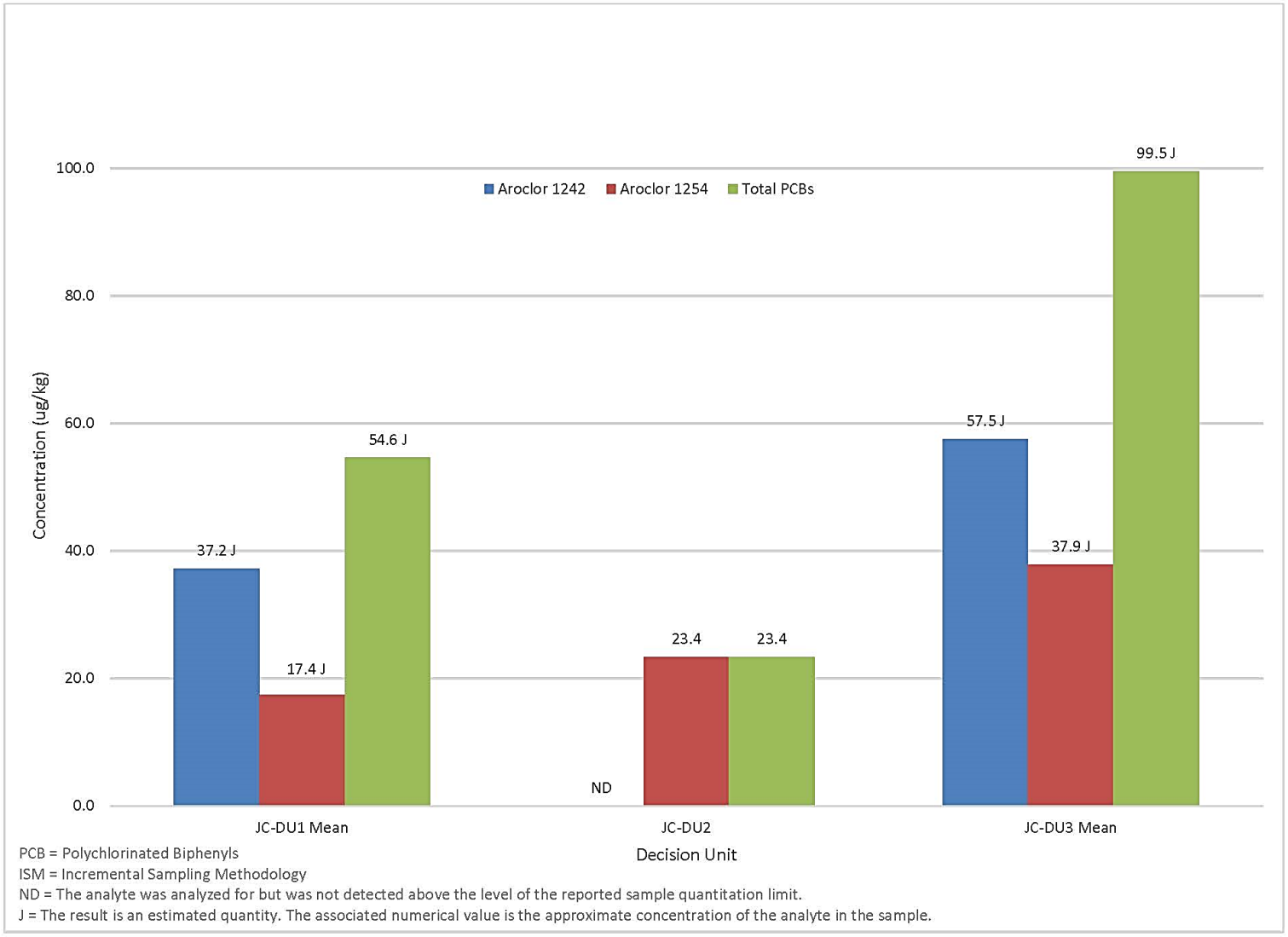
LANDAU ASSOCIATES

PCC Structurals Inc.
Large Parts Campus
Portland, Oregon

DU3 Sediment Sampling Locations

Figure 6

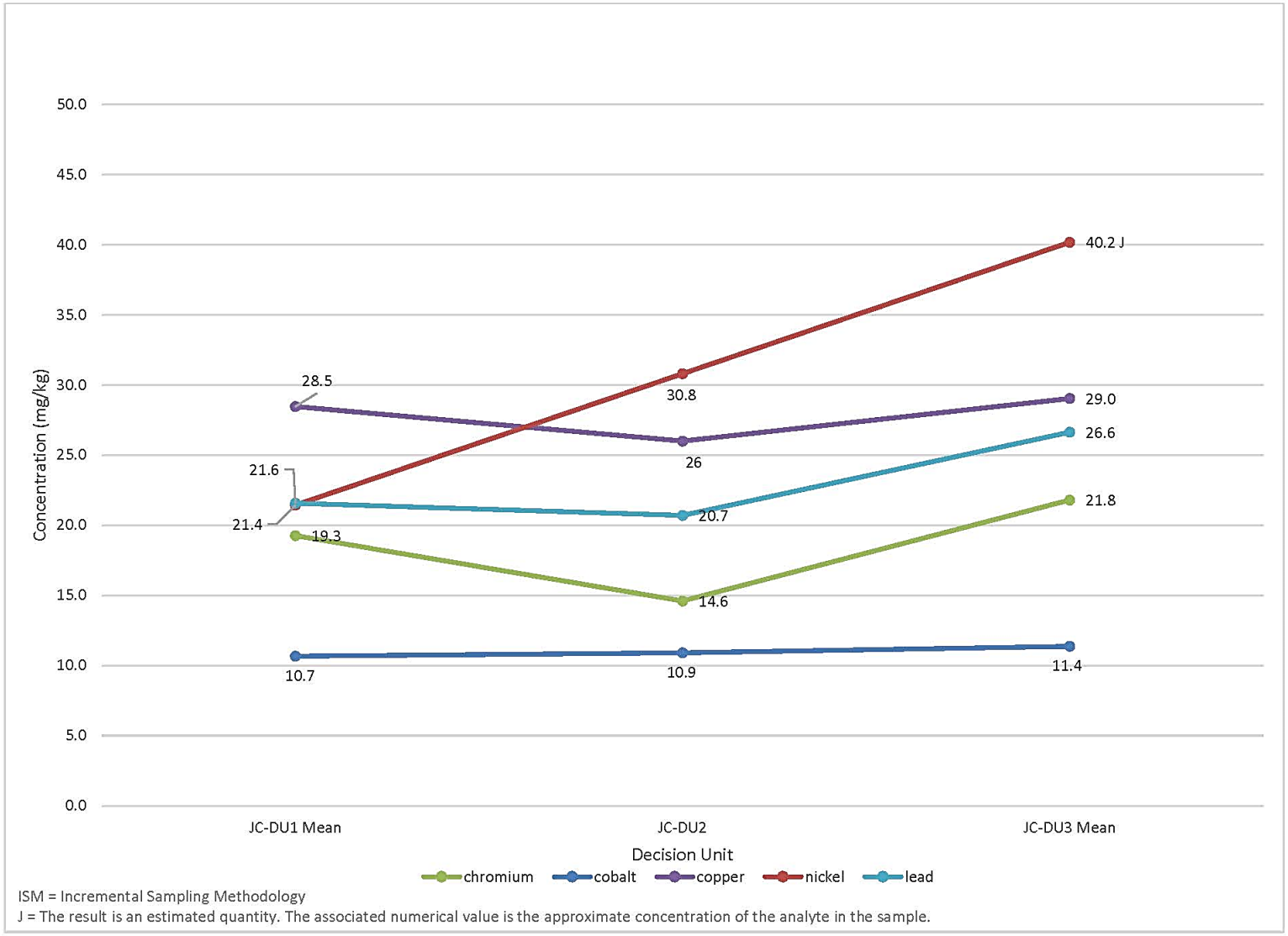
Landau Associates | G:\Projects\883\002\040\046\F03-F06 CreekSampling.dwg | 8/9/2018 4:17 PM



PCB = Polychlorinated Biphenyls
ISM = Incremental Sampling Methodology
ND = The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.
J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

LANDAU ASSOCIATES

PCC Structurals Inc. Large Parts Campus Portland, Oregon	**Sediment PCB Results Plot**	Figure 7



ISM = Incremental Sampling Methodology
J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

LANDAU ASSOCIATES

PCC Structurals Inc. Large Parts Campus Portland, Oregon	**Sediment Metals Results Plot**	Figure 8

Table 1.
Johnson Creek ISM
Sediment Sample Results
PCC Large Parts Campus
Portland, Oregon

Analyte	Screening Level (a)	Sample Location, Field Sample ID, Sample Date, Laboratory SDG, Sample Type						
		JC-DU1 JC-DU1-100317 10/3/2017 A7J0162 N	JC-DU1 JC-DU1-A-100317 10/3/2017 A7J0162 FT	JC-DU1 JC-DU1-B-100317 10/3/2017 A7J0162 FT	JC-DU2 JC-DU2-100317 10/3/2017 A7J0162 N	JC-DU3 JC-DU3-100417 10/4/2017 A7J0162 N	JC-DU3 JC-DU3-A-100417 10/4/2017 A7J0162 FT	JC-DU3 JC-DU3-B-100417 10/4/2017 A7J0162 FT
Metals (mg/kg; SW-846 6020A)								
Antimony	3	0.503 U	0.506 U	0.499 U	0.506 U	0.501 U	0.503 U	0.510 U
Arsenic	6	**2.26**	**2.29**	**2.20**	**1.75**	**2.36**	**2.49**	**2.57**
Beryllium	N/A	**0.478**	**0.466**	**0.464**	**0.283**	**0.401**	**0.412**	**0.439**
Cadmium	0.6	0.503 U	0.506 U	0.499 U	0.506 U	0.501 U	0.503 U	0.510 U
Chromium	37	**19.4**	**19.8**	**18.6**	**14.6**	**20.9**	**23.3**	**21.2**
Cobalt	N/A	**10.7**	**10.4**	**10.9**	**10.9**	**11.2**	**11.9**	**11.0**
Copper	36	**30.7**	**27.1**	**27.6 J**	**26.0**	**30.6**	**29.4**	**27.1**
Lead	35	**21.3**	**22.2**	**21.2**	**20.7**	**27.9**	**26.3**	**25.7**
Mercury	0.2	**0.0657 J**	**0.0451 J**	**0.0560 J**	0.0398 U	0.0398 UJ	**0.0476 J**	0.0406 UJ
Nickel	18	**21.2**	**23.8**	**19.3**	**30.8**	**34.8 J**	**49.8 J**	**35.9 J**
Selenium	N/A	1.01 U	1.01 U	0.998 U	1.01 U	1.00 U	1.01 U	1.02 U
Silver	4.5	0.503 U	0.506 U	0.499 U	0.506 U	0.501 U	0.503 U	0.510 U
Thallium	N/A	0.503 U	0.506 U	0.499 U	0.506 U	0.501 U	0.503 U	0.510 U
Zinc	123	**139**	**144**	**142**	**117**	**155**	**197**	**154**
PCBs (ug/kg; SW-846 8082A)								
Aroclor 1016	N/A	10.1 U	10.2 U	9.64 U	9.99 U	9.59 U	10.3 U	9.63 U
Aroclor 1221	N/A	10.1 U	10.2 U	9.64 U	9.99 U	9.59 U	10.3 U	9.63 U
Aroclor 1232	N/A	10.1 U	10.2 U	9.64 U	24.0 U	9.59 U	10.3 U	9.63 U
Aroclor 1242	N/A	**24.9 J**	**40.3 J**	**46.5 J**	9.99 U	**93.8 J**	**44.8 J**	**33.9 J**
Aroclor 1248	21	10.1 U	10.2 U	9.64 U	9.99 U	9.59 U	10.3 U	9.63 U
Aroclor 1254	7	**17.1 J**	**18.0 J**	**17.1 J**	**23.4**	**36.1 J**	**46.2 J**	**31.3 J**
Aroclor 1260	N/A	10.1 U	10.2 U	9.64 U	9.99 U	9.59 U	**12.4 J**	9.63 U
Total PCBs	34	**42 J**	**58.3 J**	**63.6 J**	**23.4**	**129.9 J**	**103.4 J**	**65.2 J**

Abbreviations and Acronyms

µg/kg = micrograms per kilogram
FT = field triplicate
ID = identification
mg/kg = milligrams per kilogram
N = primary sample
N/A = not applicable
PCBs = polychlorinated biphenyls

Notes:

(a) Screening levels are for freshwater and are from Oregon Department of Environmental Quality, Guidance for Ecological Risk Assessment, Level II Screening Level Values for Freshwater and Marine Sediment, Dec 2001.
Bold text indicates detected analyte
U = The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.
J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

Table 2.
Johnson Creek Discrete
Sediment Sample Results
PCC Large Parts Campus
Portland, Oregon

Analyte	Screening Level (a)	Sample Location, Field Sample ID, Sample Date, Laboratory SDG, Sample Type JC-DU2-01 JC-DU2-01-100317 10/3/2017 A7J0162 N	JC-DU2-02 JC-DU2-02-100317 10/3/2017 A7J0162 N	JC-DU2-03 JC-DU2-03-100317 10/4/2017 A7J0162 N
Metals (mg/kg; SW-846 6020A)				
Antimony	3	0.509 U	0.492 U	0.500 U
Arsenic	6	**2.33**	**1.99**	**2.46**
Beryllium	N/A	**0.377**	**0.285**	**0.390**
Cadmium	0.6	0.509 U	0.492 U	0.500 U
Chromium	37	**13.9**	**9.47**	**14.9**
Cobalt	N/A	**10.5**	**10.1**	**12.1**
Copper	36	**21.9**	**18.1**	**22.5**
Lead	35	**24.3 J**	**15.9**	**23.9**
Mercury	0.2	0.0403 U	0.0399 U	0.0405 U
Nickel	18	**22.5**	**20.7**	**36.9**
Selenium	N/A	1.02 U	0.984 U	1.00 U
Silver	4.5	0.509 U	0.492 U	0.500 U
Thallium	N/A	0.509 U	0.492 U	0.500 U
Zinc	123	**113**	**92.8**	**125**
PCBs (µg/kg; SW-846 8082A)				
Aroclor 1016	N/A	9.75 U	9.38 U	9.46 U
Aroclor 1221	N/A	9.75 U	9.38 U	9.46 U
Aroclor 1232	N/A	9.75 U	10.3 U	9.46 U
Aroclor 1242	N/A	9.75 U	9.38 U	**15.0 J**
Aroclor 1248	21	9.75 U	9.38 U	9.46 U
Aroclor 1254	7	**27.1 J**	**10.6**	**30.2 J**
Aroclor 1260	N/A	9.75 UJ	9.38 U	9.46 U
Total PCBs	34	**27.1 J**	**10.6**	**45.2 J**

Abbreviations and Acronyms

µg/kg = micrograms per kilogram
ID = Identification
mg/kg = milligrams per kilogram
N = primary sample
N/A = not applicable
PCBs = polychlorinated biphenyls

Notes:

(a) Screening levels are for freshwater and are from Oregon Department of Environmental Quality, Guidance for Ecological Risk Assessment, Level II Screening Level Values for Freshwater and Marine Sediment, Dec 2001
Bold text indicates detected analyte
U = The analyte was analyzed for but was not detected above the level of the reported sample quantitation limit.
J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
UJ = The analyte was analyzed for but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

APPENDIX A

Selected Site Photographs

Photo #1: DU1 – Looking downstream toward the outfall.

Photo #2: DU1 – Looking upstream toward the main stream of Johnson Creek.

LANDAU ASSOCIATES

PCC Structurals, Inc. Large Parts Campus Portland, Oregon	**Selected Site Photographs**	Figure A-1

Photo #3: DU2 – Looking downstream from the outfall toward the reinforced shore.

Photo #4: DU2 – Looking upstream toward the reinforced shore.

LANDAU ASSOCIATES	PCC Structurals, Inc. Large Parts Campus Portland, Oregon	**Selected Site Photographs**

Figure
A-2

Photo #5: DU3 – Looking upstream toward DU2.

Photo #6: DU3 – Looking downstream toward the main stream of Johnson Creek.

LANDAU ASSOCIATES

PCC Structurals, Inc.
Large Parts Campus
Portland, Oregon

Selected Site Photographs

Figure
A-3

APPENDIX B

Apex Laboratories Sample Processing Documentation

Apex Laboratories LLC Site Specific RSM SAP for Landau Project #883002 (PCC LPC) Apex WO# A7J0162. (10/05/17)

When processing, samples representing ISM DUs and discrete samples from the PCC LPC Site, Apex Laboratories LLC (Apex Labs) will follow procedures described in Representative Subsampling Methodology (RSM) SOP G-105. It is understood that due to differences between sites and project objectives a site specific RSM SAP should be developed for each project where representative sampling methodology is being used.

At the Site contaminants for concern include PCBs and priority pollutant 13 metals + cobalt. The sample handling and preservation requirements require specific field and laboratory actions to be taken to accurately determine the mean concentration of each contaminant of concern in the decision unit or discrete grab sample. For this project metallic and methyl mercury are not specific target elements. The most common form in sediments is mercuric sulfide or amalgam of mercury and other metal. Mercuric sulfide is insoluble and does not volatilize or sublime at temperatures below 400 degrees C.

Apex Laboratories SVOC/Metals RSM Sample Processing Outline

When processing the ISM samples or discrete samples for Landau PCC LPC Project, Apex Laboratories, LLC will use the entire sample volume from each DU or grab to create a well-mixed and representative sample. The ISM sample for each DU will be processed following the procedures of using Apex Laboratories SOP G-105 RSM. This SOP is consistent with the ITRC ISM February 2012 Final guidance. The process for this project is summarized below:

- Samples collected from below water line will contain entrained water. The free liquid along with fresh water organisms will be decanted and removed from the sediment samples. ISM sample volume is dependent on sampling conditions and the amount of free liquid entrained in the sample. ISM samples can be expected to consist of one or more 1 gallon glass RSM jar and associated 8 and 4 ounce jars. All containers associated with ISM sample are dried together. Multiple drying pans may be required to speed up drying process.
- The DU sample composite including interstitial water that was not decanted will be air-dried at room temperature. Samples will be dried on baking sheets covered with Teflon sheeting to protect the sample from both metals and phthalate contamination.
- Wet soil will be worked and turned following Apex SOP G-105 RSM during drying to prevent sediments from hardening into "bricks." This processing will also decrease the sample drying time. The conversion of inorganic mercury to organic mercury in sediments requires a moist environment. The drying of samples prevents loss of mercury due to interconversion and potential loss due to volatilization.
- Once air dried, all of the DU sample from the pans will be sieved. Under ITRC guidelines soil is defined as particles < 2mm. Two RSM sub samples of approximately 150 grams of <2mm particles of soil will be representatively sub-sampled using the Japanese 2-D Slab Cake method from the dried, sieved and well mixed ISM or discrete grab sample. Two aliquots are necessary since cobalt and mercury are best ground in stainless steel ring and puck mill and all other metals are best processed using tungsten rig and puck mill. The samples will be ground using a cool grinding technique until soil is a fine powder (50-60 micron diameter). Cool grinding is a process to preserve lower boiling components in samples.

Once grinding is complete the material will be transferred back to a clean Teflon lined baking tray.

- Ground sample is placed on the baking tray with the Teflon sheet and thoroughly remixed and placed in 4-8 oz jars for PCB and metals analyses. Due to the small uniform size of particles, the fundamental sampling error is significantly reduced while maintaining standard sample masses for all organic and inorganic extraction methods proposed. Note that a 2-millimeter diameter particle can be broken up into 64,000 fifty-micron particles. This comminution leads to the reduction of sampling error by eliminating discrete nuggets of contaminants that historically lead to non-representative sub samples and greater uncertainty of results.
- Solids Determination will be taken from dried and ground RSM sample to determine remaining moisture in the sample.
- Laboratory processing blanks will be analyzed for metals to monitor metals that could be transferred to samples during processing. The blank matrix is borosilicate 2 mm glass beads that are processed with samples from time of drying through grinding. Apex Laboratories uses Tungsten(W) bowl and stainless steel, ring and puck mills to prevent non- target metal alloy contamination.
- The remaining ground sample will be returned to an RSM container for frozen archiving. If additional material is needed for future testing, the entire archived sample will be thawed and additional aliquots will be taken. It is anticipated that PCB congener analyses may be requested on select representative samples.
- Sufficient sample volume will be representatively subsampled by the laboratory to create laboratory QA/QC samples.

Site-Specific Quality Control (QC)

Note that air drying and sample drying and processing can lead to a loss of volatile compounds. PCBs/Pesticides/Dioxin and HPAHs are not subject to loss due to high boiling point and low vapor pressure

For each batch of 20 RSM soil samples, Apex shall perform standard method and laboratory batch QC and the following site-specific QC:

For metals: Stainless Steel grinding bowl for cobalt and mercury. All other metals reported from Tungsten grind.

RSM SampleRSM Sample Duplicate

- RSM Sample Triplicate (optional)
- RSM Matrix Spike

For SVOCs: Stainless Steel for PCB and Congener testing

- RSM Sample
- RSM Sample Duplicate
- General Sample Matrix Spike
- General Sample Matrix Spike Duplicate

APEX LABORATORIES, LLC

STANDARD OPERATING PROCEDURE
APPROVAL SIGNATURE PAGE

SOP Title: **Representative Subsampling Methodology (RSM)**

SOP Number: **G-105 RSM**

Revision: **0**

Effective Date: **January 22, 2016**

Approval Signatures:

Director of Technical Services: Kent Patton — 01/16/16 (date)

Analytical Department: James Johnson — 02/16/16 (date)

QA Manager: Ken Yeomans — 2/16/16 (date)

1.0 INTRODUCTION

1.1. This SOP describes the policies and procedures of Apex Laboratories L.L.C., concerning the preparation of soil samples received from clients following representative subsampling methods. The most common procedures samplers use to attain the mean concentration for chemicals of concern for a particular site decision unit (DU) are Incremental Sampling Methodology (ISM) developed by the ITRC or Multi Increment Sampling (MIS) developed by Chuck Ramsey of EnviroStat, (both ISM and MIS are RSM procedures). This SOP is generic and outlines a procedure that can be applicable for wide spread use for all projects employing representative sampling methods (RSM). RSM is a sampling procedure that relies on a large number of subsamples (typically greater than 30) being collected in a certain area (DU) and combined into a single sample, rather than a smaller number of discrete samples that are analyzed individually. This procedure involves preparation of the combined sample and differs from normal lab compositing.

2.0 SCOPE AND APPLICATION

2.1. This procedure is typically applicable for analysis of metals and non-volatile organics. Preservation of samples for volatile organic analysis (VOA) is performed in the field. Compositing of preserved VOA samples is not covered by this version of this SOP, which will be revised as necessary. See ITRC guidance for further information on VOA sampling and compositing (ITRC ISM 5.4.2).

2.2. RSM is a very project specific procedure, and should be driven by the client's Sampling Analysis Plan. Contact with the client is essential prior to beginning processing; as the end use of the data may significantly change the procedure used to handle the samples. This SOP is intended as guidance for the steps common for most samples, and is not intended to supersede client instructions as to how their samples should be handled. Modifications will be documented on the RSM request form (example, Appendix A).

3.0 SUMMARY OF METHOD

3.1. There is no simple summary of the RSM procedure since there is no one “best option” to handle all types of samples. Generally the entire volume of each sample is used in this preparation. The samples are air dried (time is variable 1-3 days), then sieved through a #10 (2 mm mesh) sieve and the material that does not pass through is discarded. The < 2mm material is representatively subsampled for extraction, digestion or direct analyses.

4.0 SAFETY AND ENVIRONMENTAL

4.1. Personal protective equipment (P.P.E.) such as lab coats, nitrile gloves, and safety glasses must be worn while working with samples. Dust masks are optional, but recommended.

4.2. All secondary containers used to store samples or solutions beyond immediate use require proper labeling.

4.3. All waste, rinsate, expired solutions and/or solvents generated by this method should be handled in accordance with Apex's hazardous waste procedures. Care should be taken not to discharge

any potentially hazardous or unknown substances into the drains or sinks.

4.3.1. Any step that creates dust, such as sieving or grinding, should be performed on or near down draft fume hood.

5.0 APPARATUS AND MATERIALS

- #10, #20 or other sieves
- Stainless steel bowls and spoons
- Ceramic mortar and pestle, Automated or Manual
- Ring and Puck Mill (Tungsten & Stainless Steel)
- Aluminum baking sheets
- Teflon Sheeting
- Stainless steel and Teflon coated metal spatulas, spoons, square spoons
- Compressed air
- Lab grade acetone or methanol
- Reagent grade water

6.0 PREPARATION FOR SAMPLE PROCESSING

6.1. CLIENT CONTACT

6.1.1. A RSM coordinator will be designated for each project. This person will be the main client contact at Apex for the duration of the RSM event, and will supervise and review all steps of the process that occur at Apex and any portions of the processing that are subcontracted.

6.1.2. The RSM coordinator MUST contact the client regarding appropriate sample handling procedures and fill out an RSM Request Form. This should be done significantly prior to samples being received at the laboratory to allow for modifications of the method or apparatus as necessary.

6.1.3. The client's Sampling and Analysis Plan (SAP), however named, and DQOs must also be received by the laboratory prior to sample processing.

6.1.4. The RSM coordinator will also generate a project specific RSM Worksheet (example, Appendix B) to use as a template for the RSM process. This spreadsheet will act as a guide for sample login by designating the appropriate log in procedure and will outline the steps required by the client's SAP.

6.1.5. Effective communication between the lab, the samplers, and the project team is essential to a successful RSM project.

6.2. SAMPLE RECEIPT

6.2.1. Samples to be processed for RSM will be most often received in a single one gallon glass jar containing all increments taken in the field. Individual soil containers (i.e. 30

glass jars or plastic bags for metals only) pulled from a common decision unit (DU) can be used to house increments but are not recommended due to waste of time and materials. All material associated with a particular decision unit must be used for RSM processing. The containers will be entered into Element LIMs for tracking and reporting. The increments as received are not the sample that will be analyzed but will be used to create the representative sample. Therefore sample container IDs will be created for the sample that will be created during the RSM process. The sample referenced by Apex for all analyses will be created by this procedure. Log samples in for the Representative Sampling Methodology test code, and create empty sample jars with labels in accordance with the RSM worksheet.

6.2.2. Once the RSM procedure is complete, the jars will be returned to sample receiving and requested analysis can be set to available status in Element LIMS to the appropriate samples.

6.3. BLANK SAMPLE

6.3.1. A Blank sample consisting of borosilicate glass beads will be processed through the steps of the ISM procedure along with the samples IF metals analysis is requested. It will be analyzed for metals only unless otherwise specified by the RSM worksheet. All references to a sample in the following steps will also include the Blank sample.

6.3.2. Due to volume restrictions, some steps of the process are not applicable to the blank. Note any steps not performed on the RSM worksheet. 1-D Japanese Slab Cake Subsampling is performed by default, 2-D Slab Cake is not applicable for the small volume used for the blank.

6.3.3. The Blank sample should be logged in as the last two samples on each work order where RSM will be performed. The first of the two Blanks will be processed as a sample by RSM. It will be provided to Sample Receiving and held. The second will be analyzed as is in order to provide a baseline for metals analysis.

6.4. EQUIPMENT CLEANING

6.4.1. All equipment and work spaces must be cleaned before and after each sample is processed in order to minimize the potential for cross contamination. The fume hood used for sieving and grinding must have its work surface and inside walls be blown free of dust with compressed air. Sieves are dusted with compressed air or washed with soap and warm water and rinsed with methanol initially and between preparations of each sample. All equipment should be washed with warm water and soap before and in between each sample batch, followed by a rinse with methanol.

6.4.2. Trays used for air drying, subsampling, etc. may be lined with clean Teflon sheeting prior to use instead of the above cleaning procedure.

6.4.3. All references to cleaned equipment indicate that one of these procedures should be followed before use.

7.0 SAMPLE PROCESSING

7.1. In order to reduce potential sources of error, this procedure processes the entire sample received at the laboratory through as many steps as possible. Unless otherwise specified, references to sample in this document refer to the total amount of sample received, or what is still defined as sample after prior processing steps. See the Quality Control section for a further discussion on sources of error and Data Quality Objectives (DQOs).

Each sample will be different. The following steps are potential parts of any RSM processing, but may not be used for all samples. As such, the processing for each sample will be driven by the SAP and the steps below should not be considered sequential requirements for all RSM projects. Refer to the SAP and the RSM worksheet for which steps are necessary for each sample. Steps not included in this SOP may be necessary. Details of these steps should be included in the RSM worksheet or other documentation.

7.2. SAMPLE IDENTIFICATION

7.2.1. Samples may include material that is not considered part of the analytical sample. Vegetation, oversized material, and decantable water are examples of material that may be requested to be removed before sample processing begins. The SAP should include detailed instructions as to what defines the analytical sample, and what to do with materials that are removed. This may include documenting their removal photographically and potentially recording the weight of removed material.

7.3. PERCENT MOISTURE DETERMINATION

7.3.1. If as received percent moisture determination is requested on samples, it must be performed before samples are air dried. Samples will be mixed and a subsample aliquot taken using the 2-D Japanese Slab Cake method (7.13). This may be done with or without wet sieving.

7.3.2. This result will be reported as the percent moisture. Dry weight analysis and correction will be performed on the prepared samples, but this result does not reflect the percent moisture of the sample as received.

7.4. SAMPLE SPLITTING/MASS REDUCTION

7.4.1. Two simple sample splitting techniques are available for use at Apex:

7.4.2. Alternate Shoveling divides the sample into two subsamples by placing alternate subsample scoops of the original sample into two separate sample containers. (see SOP G-103 ISM current revision)

7.4.3. Fractional Shoveling is similar to alternate shoveling except the sample is divided into three or more subsamples. (see SOP G-103 ISM current revision)

7.5. SAMPLE CONDITIONING

7.5.1. Sample conditioning is usually necessary before processing or particle size reduction steps, in order to produce a flowable sample. Some sample conditioning steps may not be appropriate for some Chemicals of Concern (COCs), such as low boiling point SVOCs and Mercury. (See ITRC ISM Table 6.1.) The SAP should address acceptable sample conditioning steps and how to process samples if conditioning is not acceptable.

7.5.2. Air drying at room temperature is the default sample conditioning step used by Apex if particle size reduction steps such as sieving are required. Other conditioning steps include drying at elevated temperature, freeze drying, and water addition. If these methods are requested, their procedure should be carefully specified in the SAP.

7.6. AIR DRY

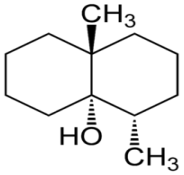
7.6.1. Air dry the entire volume of all the sample containers by emptying them out on flat aluminum baking sheets lined with Teflon sheeting and spread out to a depth of < 1 inch.

7.6.2. Place trays in bakery rack and allow drying at ambient temperature in a low traffic area with sufficient air flow to carry away evaporated moisture, such as in or near a fume hood. 1-2 days are normally needed. Turning samples regularly will be necessary to aid the drying process for wet samples, and layers of clay should be broken up by pressing sample between folds of Teflon sheeting periodically through the drying process to avoid formation of “bricks” that are difficult to break apart after samples are fully dried.

7.6.3. Record the air drying start and end times on the ISM worksheet.

7.6.4. After samples are dry, remove any visible sticks, rocks, vegetation, or other non-soil materials.

7.6.5. NOTE: If samples will be air dried, this will halt typical biodegradation in the soil. When samples are drying geosmin is often smelled. Geosmin is an organic compound with a distinct earthy flavor and aroma produced by a type of Actinobacteria, and is responsible for the earthy smell when soil is disturbed. When the bacteria die the cells breakdown and geosmin is released. The odor threshold is very low (5 ppt) and although it is not harmful it can cause concern for unfamiliar technicians. The odor will be of short duration and is a good indicator that soil was rich in bacteria and cells have been destroyed. The structure of geosmin below.



7.7. PARTICLE SIZE REDUCTION

7.7.1. For many projects, particle size reduction will be required in order to reduce the

Fundamental Error and uncertainty associated with the data. Most SAPs will require that the particle size is less than 2 mm before analysis. For analytical preparations that cannot use at least 10 - 30 grams of sample, (metals, cyanide, and other wet chem tests) grain size of less than 0.25mm is often required in SAP. Specific projects may require even finer grain sizes for these analyses. Sample grinding with puck mill is often the preferred method for processing samples since it produces sample of uniform shape and the size of particle is 50-60 micron diameter.

7.7.2. If the RSM worksheet specifies that the sample will be processed to reduce particle size, there are many techniques that may be used. Automated mortar and pestle or ring and puck mill are two processes that are available to Apex. The ring and puck mill is preferred due to the generation of smaller and more uniform particles. Depending on the contaminant of concern these techniques may not be appropriate, and SAP should specify which technique to use for mercury, VOCs etc.

7.7.3. If a particle size reduction step is required, the client and laboratory must determine the mass or the sample to be processed. This can range in size from the entire sample to approximately 100 grams. If representative subsample is to be taken sections 7.12 or 7.13 for Japanese 1-D or 2-D Slab Cake preparation must be followed. The material processed must be of sufficient mass to support the analyses of all follow-up tests and quality control. For all grinding methods other than ring and puck mill the sample should be ground so that it can pass through the sieve corresponding to the final grain size requested by the RSM worksheet. The fine 50-60 micron particles that result from the completion of ring and puck mill grinding can hold electrostatic charge and will not sieve well. Grind is completed after sample passes tactile test. If multiple analyses are to be performed, this may require multiple samples to be taken in the field, or the sample to be split prior to processing.

7.8. SAMPLE SIEVING

7.8.1. Soil clumps should be broken up to allow them to pass through the sieve, and anything remaining in the sieve (stones, metal, glass) should be discarded and noted. Clay, wet, and/or rocky samples pose significant difficulties during this process. Breaking up dried clumps of dirt/clay and separating them from the material to be removed may be facilitated by grinding, pounding, tumbling or shaking samples. Record procedure used on RSM worksheet.

7.8.2. A sieve stack consisting of a lid, #4 and #10 sieves and a sieve pan may be loaded with sample and placed in to a sieve shaker for 2 to 5 minutes to breakup clumps without changing particle sizes.

7.8.3. A single #10 twelve in sieve is often effective for samples and should be used when practical versus sieve stack.

7.8.4. A mortar and pestle may be used, though this method can cause more particle size reduction than other methods.

7.9. MILLING/GRINDING

7.9.1. This step is often done on the sample that has passed through the #10 sieve. (Everything larger than 2mm is not defined as sample.)

7.9.2. Ring and Puck Mill: This is the most universally accepted method of comminution of soil and sediment. Apex has both stainless steel and tungsten ring and puck mills. The stainless hold greater volume, approximately 100 grams per grind and are optimal for processing samples without metals as COCs. If metals are of concern the tungsten mill is to be used. Typical mass suitable for grind is 70-80 grams. See instrument manual or Apex operating procedure for details.

7.9.3. Automated Mortar and Pestle: This may be required in certain SAPs but is not preferred since size and shape of sample is not uniform. Heat generated in grinding is also not easy to control. Using a cleaned mortar and pestle, grind the entire sample until it is fine enough to pass through the required sieve, as noted on the RSM worksheet. See instrument manual or Apex operating procedure for details.

7.9.3.1. NOTE: Mortar and Pestle can also be done manually, which is a very laborious process and should only be done for small samples with few particles greater than the required size.

7.9.4. Enter details of the operation, operator initials and date on the RSM worksheet.

7.10. MIXING

7.10.1. The sample mixing step specified here assumes that the sample has been sieved so that all particles are less than 2mm. If this is not the case, simply stirring the sample will be more likely to increase sample representativeness than decrease it, due to particle size separation within the bowl. Tumbling the sample in a container with sufficient headspace to allow free movement is another option for mixing sample.

7.10.2. Place the entire sample (minus any portions removed during the air drying and sieving steps, if performed) into a stainless steel bowl. Stir the sieved sample well (approximately 3 minutes).

7.10.3. If it is necessary to complete the procedure at a later time, place the entire mixed sample into the 1 gallon glass jar or re-closeable plastic bag labeled for storage.

7.10.4. Enter operator initials and date on the RSM worksheet.

7.11. SUBSAMPLING

7.11.1. There are many methods available for subsampling, some of which produce less error than others. Apex has available two simple incremental sampling methods. If other methods are required, Apex will procure the appropriate technology or subcontract this

portion of the process.

7.11.2. If subsampling for an analytical aliquot, pay close attention to the RSM worksheet. The aliquots taken must be very close to the mass requirements, because the entire aliquot subsampled must be used for analysis.

7.11.3. If specified by the RSM worksheet, repeat this process as needed to provide sample volume for process duplicate or triplicate analyses.

7.12. 1-D JAPANESE SLAB CAKE PREPARATION

7.12.1. Pour the entire sample into a line, using 20 or more passes along the line to distribute the sample. For samples where small analytical masses are required (e.g. metals, cyanide) a long thin line should be created.

7.12.2. Using a square scoop, cut across the line to create an aliquot. Combine as many of these aliquots as needed to create the analytical sample or mass reduction required. Repeat until all analytical aliquots have been created.

7.12.3. Place the aliquots into their respective containers, according to the RSM worksheet.

7.12.4. Place the remainder of the sample into the container labeled for storage.

7.13. 2-D JAPANESE SLAB CAKE PREPARATION

7.13.1. Pour the entire sample into a cleaned aluminum tray lined with Teflon sheeting and spread evenly. Pull an equally sized aliquot of sample from 30 random locations distributed across the pan and combine into the appropriate container for analysis. Be sure to scrape along the bottom of the tray in order to include a representative portion of all grain sizes present in the sample.

7.13.2. Repeat the above process to create a representative portion for each container listed in the RSM container query for the project. Pull an aliquot of sample from each section of the pan to ensure that the final sample size is close to the mass requested for analyses, typically 1-30 grams. Place the aliquots into their respective containers according to the RSM worksheet.

7.13.3. Place the remainder of the sample into the container marked for storage.

7.14. DOCUMENTATION

7.14.1. Create a batch in Element for the RSM test code, add the samples processed as a batch, and print out the bench sheet. Set sample status to Needs Review, attach the completed ISM worksheet and submit for review and scanning.

7.14.2. Return jars to Sample Receiving for completion of log in.

7.15. LOG IN

7.15.1. After samples are returned from RSM processing, analysis test codes can be added to the samples.

7.15.2. Be sure to add comments indicating the use for each jar in accordance with the RSM worksheet. Because one jar will be created per analysis, duplicate, and MS/MSD, there will be a large number of containers for some samples. The container comments should match the RSM worksheet, and the work order should be reviewed carefully by the person coordinating the RSM project.

7.16. ANALYSIS

7.16.1. Each aliquot for analysis has been pulled during sample processing and placed into a separate container. Use the RSM worksheet and the analysis comments to find which container is designated for your analysis. **Be sure to use the entire amount of the aliquot provided**, and rinse the container into the extraction vessel. Check the sample comments for sample specific instructions (e.g. MS/MSD, etc.).

8.0 QUALITY CONTROL

8.1. CONVENTIONS

8.1.1. Samples by default will be reported on an air dry weight basis. The reported dry weight result will reflect the moisture left in the sample after air drying. If SAP request correction based on original wet weight or corrected air dried rate additional aliquots will need to be pulled for processing.

8.2. QUALITY CONTROL SAMPLES

8.2.1. Blank: A borosilicate glass blank is processed and analyzed along with samples tested for metals to verify that no contamination is being added by processing the samples. This will be done as requested for other classes of COCs.

8.2.2. The glass for blanks will have to be tested before and after processing to compare levels of metals present, as no known clean matrices for metals exist.

8.2.3. Process Replicates: Whether process replicates will be analyzed should be determined by the client on a project basis. They may request that one or two replicates be performed per project, per batch, or per sample. (ITRC ISM 4.2 notes that 3 replicates from a single decision unit provide a direct measure of variability of sample means so an upper control limit can be calculated. Process Replicates are not field collected replicates as described in ITRC ISM.)

8.2.4. Aliquots may be pulled and designated to be analyzed as batch duplicates in the same manner as sample aliquots. This should be specified on the RSM worksheet, as a separate container will have to be created for them.

8.2.5. Matrix Spikes: Apex will not evaluate spike samples through the entire RSM process unless requested. If required to do so by a client, the client should specify or provide a standard reference material suitable for RSM processing.

9.0 REFERENCES

- Hawai'i Department of Health*Technical Guidance Manual for the Implementation of the Hawai`i State Contingency Plan*, Section 4, November 12, 2008.
- Alaska Department of Environmental Conservation Division of Spill Prevention and Response Contaminated Sites Program *Draft Guidance on Multi-Increment Soil Sampling,* March 2009.
- EPA Method 8330B Appendix A Revision 2 October 2006.
- Interstate Technology Regulatory Council *Technical and Regulatory Guidance: Incremental Sampling Methodology*, February 2012 (Final)
- Element Laboratory Information System (LIMS)

  The Element LIMS system contains Apex's current version of all Method Performance information, including LOD/LOQ, Batch and Sequence DQOs. Please refer to the Analysis information in the QA Admin section of Element.

- Apex laboratories Quality Systems Manual (QSM)

  The QSM contains guidance information about the laboratory's Quality System, including: definitions; general calculations and data processing steps; basic corrective actions and contingencies for handling out-of-control data.

- Apex laboratories SOP G-103 ISM current revision

Appendix A – Example RSM Request Form

Client: _____

Project: _____

Client Contact: _____

# of Decision Units: _____

# of Increments / Unit: _____

Notes:

Analysis: Note any that require subcontracting or small sample size (e.g. Metals)

Which ISM guidance document is being used for this project?

Alaska Hawaii EPA 8330A Appendix A ITRC Draft ISM Guidance

When will the Sampling and Analysis Plan be completed? _____
A copy must be provided to Apex before the project begins.

Project Specific Data Quality Objectives and procedures.
Apex follows the ITRC Draft guidance where possible. The following categories are procedural steps that are likely to have project specific goals. Our standard procedure is listed under the Apex heading, followed by specific requirements from the guidance documents. Each sampling event is unique, and modifications from our default procedure are expected. These differences should be noted.

Sample Storage:

Apex: Store refrigerated until air drying, room temperature thereafter.

Client request?

Air Drying:

Apex/ITRC: Air dry samples to help with sieving and grinding. Consider potential effects on volatile Contaminates of Concern (COCs) such as SVOCs and Mercury.

AK: Air dry only if necessary to sieve to < 2mm. May not be appropriate for Pesticides and PAHs.

HI: Air dry for all non-volatile analytes.

Client request?

Dry Weight:

Apex/ITRC: Samples are air dried, sieved, and then subsampled. That subsample is tested for most analysis and for dry weight. Results are reported on a dry weight basis, corrected to the air dried sample. If field percent moisture is requested, then a separate aliquot must be made prior to air drying.

HI: Air dried = dry weight, no further correction needed.

Client request?

Appendix A – Example RSM Request Form

Laboratory Replicate Samples:

Apex:	Per client SAP.
ITRC:	Field and lab triplicates are recommended for most projects.
Client request?	

Blank:

Apex/ITRC:	We have a blank sand matrix go through all steps of the analysis to ensure that metals are not added by the ISM process. Other analysis can be performed on the blank at additional cost. Matrix spikes are performed on a batch basis, per analysis.

Matrix Spikes:

ITRC:	Suggests that processing standard reference materials may be appropriate for some projects and COCs.

Notes:

Appendix B – RSM Worksheet

Batch _____

Sample Log in

Each sample created by the ISM procedure will be logged in with the containers and comments specified below. If samples will be treated differently, multiple sections will need to be created.

Sample IDs:

	Container	Use/Analysis	Particle size	Weight Needed	Comments
Jar A	Plastic Bag	Composite	<2mm	NA	No analysis
Jar B	4 oz jar				
Jar C					
Jar D					
Jar E					
Jar F					
Jar G					

Air Dry

Sample ID	Analyst	# of Containers to Composite	Air Dry Start Time	Air Dry End Time	Comments (Note sticks, rocks, etc removed.)

#10 Sieve

Sample ID	Date	Analyst	Homogenized?	Comments

Appendix B – RSM Worksheet

Sample Splitting/Mass Reduction

This section may be needed multiple times for each sample. Modify worksheet to include this section for each step.

Method Used: 1-D Japanese Slabcake | 2-D Japanese Slabcake | Alternate Shoveling | Fractional Shoveling | Other:

Sample ID		Date	Analyst		Weight Obtained**	Comments

*Indicate use for Replicates (Dry Weight, Duplicate analysis, etc)

**Total weight minus tare. (8 oz jar tare weight is 215g, 4 oz jar tare weight is 130g)

Grinding

This section may be needed for only a portion of each sample. Ensure that the proper container is noted.

Method Used: Automated Mortar and Pestle | Manual Mortar and Pestle | Puck Mill SS or W

Sample ID	Jar	Date	Analyst	Sieve size	

Sieve Size Chart

#10	2 mm
#20	850 µm
#40	425 µm
#60	250 µm
#100	150 µm
#140	106 µm
#200	75 µm

Comments:

APPENDIX C

Analytical Data Package and Data Validation Report

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Wednesday, November 29, 2017

Colette Gaona
Landau Associates
1500 SW First Avenue Suite 1015
Portland, OR 97201

RE: PCC LPC-RSM / 883002

Enclosed are the results of analyses for work order A7J0162, which was received by the laboratory on 10/5/2017 at 12:19:00PM.

Thank you for using Apex Labs. We appreciate your business and strive to provide the highest quality services to the environmental industry.

If you have any questions concerning this report or the services we offer, please feel free to contact me by email at: ldomenighini@apex-labs.com, or by phone at 503-718-2323.

Apex Laboratories

Lisa Domenighini, Client Services Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL REPORT FOR SAMPLES

SAMPLE INFORMATION

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
JC-DU2-100317-As Received	A7J0162-01	Sediment	10/03/17 11:00	10/05/17 12:19
JC-DU2-100317-RSM-SS	A7J0162-02	Sediment	10/03/17 11:00	10/05/17 12:19
JC-DU2-100317-RSM-W	A7J0162-03	Sediment	10/03/17 11:00	10/05/17 12:19
JC-DU2-01-100317-As Received	A7J0162-04	Sediment	10/03/17 11:25	10/05/17 12:19
JC-DU2-01-100317-RSM-SS	A7J0162-05	Sediment	10/03/17 11:00	10/05/17 12:19
JC-DU2-02-100317-As Received	A7J0162-07	Sediment	10/03/17 11:45	10/05/17 12:19
JC-DU2-02-100317-RSM-SS	A7J0162-08	Sediment	10/03/17 11:45	10/05/17 12:19
JC-DU2-02-100317-RSM-W	A7J0162-09	Sediment	10/03/17 11:45	10/05/17 12:19
JC-DU2-03-100317-As Received	A7J0162-10	Sediment	10/03/17 12:05	10/05/17 12:19
JC-DU2-03-100317-RSM-SS	A7J0162-11	Sediment	10/03/17 12:05	10/05/17 12:19
JC-DU2-03-100317-RSM-W	A7J0162-12	Sediment	10/04/17 12:05	10/05/17 12:19
JC-DU1-100317-As Received	A7J0162-13	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-100317-RSM-SS	A7J0162-14	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-100317-RSM-W	A7J0162-15	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-A-100317-As Received	A7J0162-16	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-A-100317-RSM-SS	A7J0162-17	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-A-100317-RSM-W	A7J0162-18	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-B-100317-As Received	A7J0162-19	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-B-100317-RSM-SS	A7J0162-20	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-B-100317-RSM-W	A7J0162-21	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU3-100417-As Received	A7J0162-23	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-100417-RSM-SS	A7J0162-24	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-100417-RSM-W	A7J0162-25	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-A-100417-As Received	A7J0162-26	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-A-100417-RSM-SS	A7J0162-27	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-A-100417-RSM-W	A7J0162-28	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-B-100417-As Received	A7J0162-29	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-B-100417-RSM-SS	A7J0162-30	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU3-B-100417-RSM-W	A7J0162-31	Sediment	10/04/17 13:15	10/05/17 12:19
JC-DU2-01-100317-RSM-W	A7J0162-32	Sediment	10/03/17 11:00	10/05/17 12:19

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL CASE NARRATIVE

Work Order: A7J0162

Landau Associates
Project: PCC LPC-RSM
Apex Laboratories LLC Work Order: A7J0162
Case Narrative:

Sediment samples were received by Apex Laboratories in good condition (see Apex Labs Cooler Receipt Form attached to this report.)

All Decision Unit (DU) samples, both ISM and discrete samples were processed following Apex Lab SOP G-105 Representative Subsampling Methodology (RSM). The field samples are designated in the report "As Received". The "As Received" samples were air dried at standard temperature and atmospheric pressure. The drying process kills soil bacteria, halting the potential bio-degradation and chemical alteration that may occur in wet soils. The RSM process creates a sample of uniform particles of 50 to 60-micron diameter. Particle comminution significantly reduces fundamental sampling error. Grinding was completed on two separate fractions of the Decision Unit (DU) sample due to the suite of metals requested. The wear metals of associated with a tungsten ring and puck mill are cobalt and tungsten. These interfere with the analyses of trace levels of cobalt and mercury in samples. Cobalt and mercury results were obtained from samples ground with a stainless-steel (SS) ring and puck mill. PCBs were also analyzed from the stainless-steel grind. All other metals were reported from sample ground in a tungsten (W) ring and puck mill. The reporting convention for data processed by RSM, is to record field sample name followed by the extension -RSM-SS for stainless steel processing or -RSM-W for tungsten processing.

The report contains standard batch QC for PCBs and metals. The PCBs are reported as Aroclors. Those samples with hits for Aroclors often have mixtures of PCBs and the results are reported estimated due to the mixture. Standard reporting limits for both metals and PCBs were reported since samples were relatively free of non-target interferences.

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Polychlorinated Biphenyls by EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-100317-RSM-SS (A7J0162-02)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.99	ug/kg dry	1	10/23/17 10:39	EPA 8082A	
Aroclor 1221	ND	---	9.99	"	"	"	"	
Aroclor 1232	ND	---	24.0	"	"	"	"	R-02
Aroclor 1242	ND	---	9.99	"	"	"	"	
Aroclor 1248	ND	---	9.99	"	"	"	"	
Aroclor 1254	**23.4**	---	9.99	"	"	"	"	
Aroclor 1260	ND	---	9.99	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 91 %*	*Limits: 72-126 %*	"	"	"	
JC-DU2-01-100317-RSM-SS (A7J0162-05RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.75	ug/kg dry	1	10/23/17 16:02	EPA 8082A	
Aroclor 1221	ND	---	9.75	"	"	"	"	
Aroclor 1232	ND	---	9.75	"	"	"	"	
Aroclor 1242	ND	---	9.75	"	"	"	"	
Aroclor 1248	ND	---	9.75	"	"	"	"	
Aroclor 1254	**27.1**	---	9.75	"	"	"	"	P-10
Aroclor 1260	ND	---	9.75	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 88 %*	*Limits: 72-126 %*	"	"	"	
JC-DU2-02-100317-RSM-SS (A7J0162-08RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.38	ug/kg dry	1	10/23/17 17:52	EPA 8082A	
Aroclor 1221	ND	---	9.38	"	"	"	"	
Aroclor 1232	ND	---	10.3	"	"	"	"	R-02
Aroclor 1242	ND	---	9.38	"	"	"	"	
Aroclor 1248	ND	---	9.38	"	"	"	"	
Aroclor 1254	**10.6**	---	9.38	"	"	"	"	
Aroclor 1260	ND	---	9.38	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 79 %*	*Limits: 72-126 %*	"	"	"	
JC-DU2-03-100317-RSM-SS (A7J0162-11RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.46	ug/kg dry	1	10/23/17 18:46	EPA 8082A	
Aroclor 1221	ND	---	9.46	"	"	"	"	
Aroclor 1232	ND	---	9.46	"	"	"	"	
Aroclor 1242	**15.0**	---	9.46	"	"	"	"	P-10
Aroclor 1248	ND	---	9.46	"	"	"	"	
Aroclor 1254	**30.2**	---	9.46	"	"	"	"	P-10
Aroclor 1260	ND	---	9.46	"	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Polychlorinated Biphenyls by EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-03-100317-RSM-SS (A7J0162-11RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 78 %*	*Limits: 72-126 %*	1	"	EPA 8082A	
JC-DU1-100317-RSM-SS (A7J0162-14RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	10.1	ug/kg dry	1	10/23/17 16:02	EPA 8082A	
Aroclor 1221	ND	---	10.1	"	"	"	"	
Aroclor 1232	ND	---	10.1	"	"	"	"	
Aroclor 1242	**24.9**	---	10.1	"	"	"	"	P-10
Aroclor 1248	ND	---	10.1	"	"	"	"	
Aroclor 1254	**17.1**	---	10.1	"	"	"	"	P-10
Aroclor 1260	ND	---	10.1	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 76 %*	*Limits: 72-126 %*	"	"	"	
JC-DU1-A-100317-RSM-SS (A7J0162-17)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	10.2	ug/kg dry	1	10/23/17 13:42	EPA 8082A	
Aroclor 1221	ND	---	10.2	"	"	"	"	
Aroclor 1232	ND	---	10.2	"	"	"	"	
Aroclor 1242	**40.3**	---	10.2	"	"	"	"	P-10
Aroclor 1248	ND	---	10.2	"	"	"	"	
Aroclor 1254	**18.0**	---	10.2	"	"	"	"	P-10
Aroclor 1260	ND	---	10.2	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 77 %*	*Limits: 72-126 %*	"	"	"	
JC-DU1-B-100317-RSM-SS (A7J0162-20)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.64	ug/kg dry	1	10/23/17 14:18	EPA 8082A	
Aroclor 1221	ND	---	9.64	"	"	"	"	
Aroclor 1232	ND	---	9.64	"	"	"	"	
Aroclor 1242	**46.5**	---	9.64	"	"	"	"	P-10
Aroclor 1248	ND	---	9.64	"	"	"	"	
Aroclor 1254	**17.1**	---	9.64	"	"	"	"	P-10
Aroclor 1260	ND	---	9.64	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 94 %*	*Limits: 72-126 %*	"	"	"	
JC-DU3-100417-RSM-SS (A7J0162-24)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.59	ug/kg dry	1	10/23/17 14:55	EPA 8082A	
Aroclor 1221	ND	---	9.59	"	"	"	"	
Aroclor 1232	ND	---	9.59	"	"	"	"	
Aroclor 1242	**93.8**	---	9.59	"	"	"	"	P-10

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Polychlorinated Biphenyls by EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU3-100417-RSM-SS (A7J0162-24)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1248	ND	---	9.59	ug/kg dry	1	"	EPA 8082A	
Aroclor 1254	**36.1**	---	9.59	"	"	"	"	P-10
Aroclor 1260	ND	---	9.59	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 86 %*	*Limits: 72-126 %*	"	"	"	
JC-DU3-A-100417-RSM-SS (A7J0162-27RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	10.3	ug/kg dry	1	10/23/17 16:57	EPA 8082A	
Aroclor 1221	ND	---	10.3	"	"	"	"	
Aroclor 1232	ND	---	10.3	"	"	"	"	
Aroclor 1242	**44.8**	---	10.3	"	"	"	"	P-10
Aroclor 1248	ND	---	10.3	"	"	"	"	
Aroclor 1254	**46.2**	---	10.3	"	"	"	"	P-10
Aroclor 1260	**12.4**	---	10.3	"	"	"	"	P-10
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 81 %*	*Limits: 72-126 %*	"	"	"	
JC-DU3-B-100417-RSM-SS (A7J0162-30RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.63	ug/kg dry	1	10/23/17 17:52	EPA 8082A	
Aroclor 1221	ND	---	9.63	"	"	"	"	
Aroclor 1232	ND	---	9.63	"	"	"	"	
Aroclor 1242	**33.9**	---	9.63	"	"	"	"	P-10
Aroclor 1248	ND	---	9.63	"	"	"	"	
Aroclor 1254	**31.3**	---	9.63	"	"	"	"	P-10
Aroclor 1260	ND	---	9.63	"	"	"	"	
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 73 %*	*Limits: 72-126 %*	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-100317-RSM-SS (A7J0162-02)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**10.9**	---	0.497	mg/kg dry	5	10/23/17 18:47	EPA 6020A	
Mercury	ND	---	0.0398	"	"	"	"	
JC-DU2-100317-RSM-W (A7J0162-03)			**Matrix: Sediment**					
Batch: 7100999								
Antimony	ND	---	0.506	mg/kg dry	5	10/23/17 19:03	EPA 6020A	
Arsenic	**1.75**	---	1.01	"	"	"	"	
Beryllium	**0.283**	---	0.101	"	"	"	"	
Cadmium	ND	---	0.506	"	"	"	"	
Chromium	**14.6**	---	1.01	"	"	"	"	
Copper	**26.0**	---	1.01	"	"	"	"	
Lead	**20.7**	---	0.506	"	"	"	"	Q-42
Nickel	**30.8**	---	1.01	"	"	"	"	
Selenium	ND	---	1.01	"	"	"	"	
Silver	ND	---	0.506	"	"	"	"	
Thallium	ND	---	0.506	"	"	"	"	
Zinc	**117**	---	2.02	"	"	"	"	Q-42
JC-DU2-01-100317-RSM-SS (A7J0162-05)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**10.5**	---	0.504	mg/kg dry	5	10/23/17 19:28	EPA 6020A	
Mercury	ND	---	0.0403	"	"	"	"	
JC-DU2-02-100317-RSM-SS (A7J0162-08)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**10.1**	---	0.498	mg/kg dry	5	10/23/17 19:35	EPA 6020A	
Mercury	ND	---	0.0399	"	"	"	"	
JC-DU2-02-100317-RSM-W (A7J0162-09)			**Matrix: Sediment**					
Batch: 7100999								
Antimony	ND	---	0.492	mg/kg dry	5	10/23/17 19:38	EPA 6020A	
Arsenic	**1.99**	---	0.984	"	"	"	"	
Beryllium	**0.285**	---	0.0984	"	"	"	"	
Cadmium	ND	---	0.492	"	"	"	"	
Chromium	**9.47**	---	0.984	"	"	"	"	
Copper	**18.1**	---	0.984	"	"	"	"	
Lead	**15.9**	---	0.492	"	"	"	"	
Nickel	**20.7**	---	0.984	"	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-02-100317-RSM-W (A7J0162-09)			**Matrix: Sediment**					
Selenium	ND	---	0.984	mg/kg dry	5	"	EPA 6020A	
Silver	ND	---	0.492	"	"	"	"	
Thallium	ND	---	0.492	"	"	"	"	
Zinc	**92.8**	---	1.97	"	"	"	"	
JC-DU2-03-100317-RSM-SS (A7J0162-11)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**12.1**	---	0.506	mg/kg dry	5	10/23/17 19:41	EPA 6020A	
Mercury	ND	---	0.0405	"	"	"	"	
JC-DU2-03-100317-RSM-W (A7J0162-12)			**Matrix: Sediment**					
Batch: 7100999								
Antimony	ND	---	0.500	mg/kg dry	5	10/23/17 19:44	EPA 6020A	
Arsenic	**2.46**	---	1.00	"	"	"	"	
Beryllium	**0.390**	---	0.100	"	"	"	"	
Cadmium	ND	---	0.500	"	"	"	"	
Chromium	**14.9**	---	1.00	"	"	"	"	
Copper	**22.5**	---	1.00	"	"	"	"	
Lead	**23.9**	---	0.500	"	"	"	"	
Nickel	**36.9**	---	1.00	"	"	"	"	
Selenium	ND	---	1.00	"	"	"	"	
Silver	ND	---	0.500	"	"	"	"	
Thallium	ND	---	0.500	"	"	"	"	
Zinc	**125**	---	2.00	"	"	"	"	
JC-DU1-100317-RSM-SS (A7J0162-14)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**10.7**	---	0.504	mg/kg dry	5	10/23/17 19:47	EPA 6020A	
Mercury	**0.0657**	---	0.0403	"	"	"	"	
JC-DU1-100317-RSM-W (A7J0162-15)			**Matrix: Sediment**					
Batch: 7100999								
Antimony	ND	---	0.503	mg/kg dry	5	10/23/17 19:51	EPA 6020A	
Arsenic	**2.26**	---	1.01	"	"	"	"	
Beryllium	**0.478**	---	0.101	"	"	"	"	
Cadmium	ND	---	0.503	"	"	"	"	
Chromium	**19.4**	---	1.01	"	"	"	"	
Copper	**30.7**	---	1.01	"	"	"	"	
Lead	**21.3**	---	0.503	"	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU1-100317-RSM-W (A7J0162-15)			**Matrix: Sediment**					
Nickel	**21.2**	---	1.01	mg/kg dry	5	"	EPA 6020A	
Selenium	ND	---	1.01	"	"	"	"	
Silver	ND	---	0.503	"	"	"	"	
Thallium	ND	---	0.503	"	"	"	"	
Zinc	**139**	---	2.01	"	"	"	"	
JC-DU1-A-100317-RSM-SS (A7J0162-17)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**10.4**	---	0.497	mg/kg dry	5	10/23/17 19:54	EPA 6020A	
Mercury	**0.0451**	---	0.0397	"	"	"	"	
JC-DU1-A-100317-RSM-W (A7J0162-18)			**Matrix: Sediment**					
Batch: 7100999								
Antimony	ND	---	0.506	mg/kg dry	5	10/23/17 19:57	EPA 6020A	
Arsenic	**2.29**	---	1.01	"	"	"	"	
Beryllium	**0.466**	---	0.101	"	"	"	"	
Cadmium	ND	---	0.506	"	"	"	"	
Chromium	**19.8**	---	1.01	"	"	"	"	
Copper	**27.1**	---	1.01	"	"	"	"	
Lead	**22.2**	---	0.506	"	"	"	"	
Nickel	**23.8**	---	1.01	"	"	"	"	
Selenium	ND	---	1.01	"	"	"	"	
Silver	ND	---	0.506	"	"	"	"	
Thallium	ND	---	0.506	"	"	"	"	
Zinc	**144**	---	2.03	"	"	"	"	
JC-DU1-B-100317-RSM-SS (A7J0162-20)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**10.9**	---	0.511	mg/kg dry	5	10/23/17 20:10	EPA 6020A	
Mercury	**0.0560**	---	0.0409	"	"	"	"	
JC-DU1-B-100317-RSM-W (A7J0162-21)			**Matrix: Sediment**					
Batch: 7100999								
Antimony	ND	---	0.499	mg/kg dry	5	10/23/17 20:13	EPA 6020A	
Arsenic	**2.20**	---	0.998	"	"	"	"	
Beryllium	**0.464**	---	0.0998	"	"	"	"	
Cadmium	ND	---	0.499	"	"	"	"	
Chromium	**18.6**	---	0.998	"	"	"	"	
Copper	**27.6**	---	0.998	"	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU1-B-100317-RSM-W (A7J0162-21)			**Matrix: Sediment**					
Lead	**21.2**	---	0.499	mg/kg dry	5	"	EPA 6020A	
Nickel	**19.3**	---	0.998	"	"	"	"	
Selenium	ND	---	0.998	"	"	"	"	
Silver	ND	---	0.499	"	"	"	"	
Thallium	ND	---	0.499	"	"	"	"	
Zinc	**142**	---	2.00	"	"	"	"	
JC-DU3-100417-RSM-SS (A7J0162-24RE1)			**Matrix: Sediment**					
Batch: 7101088								
Cobalt	**11.2**	---	0.498	mg/kg dry	5	10/24/17 17:45	EPA 6020A	
Mercury	ND	---	0.0398	"	"	"	"	
JC-DU3-100417-RSM-W (A7J0162-25RE1)			**Matrix: Sediment**					
Batch: 7101088								
Antimony	ND	---	0.501	mg/kg dry	5	10/24/17 17:48	EPA 6020A	
Arsenic	**2.36**	---	1.00	"	"	"	"	
Beryllium	**0.401**	---	0.100	"	"	"	"	
Cadmium	ND	---	0.501	"	"	"	"	
Chromium	**20.9**	---	1.00	"	"	"	"	
Copper	**30.6**	---	2.00	"	"	"	"	
Lead	**27.9**	---	0.501	"	"	"	"	
Nickel	**34.8**	---	1.00	"	"	"	"	
Selenium	ND	---	1.00	"	"	"	"	
Silver	ND	---	0.501	"	"	"	"	
Thallium	ND	---	0.501	"	"	"	"	
Zinc	**155**	---	2.00	"	"	"	"	
JC-DU3-A-100417-RSM-SS (A7J0162-27RE1)			**Matrix: Sediment**					
Batch: 7101088								
Cobalt	**11.9**	---	0.494	mg/kg dry	5	10/24/17 18:01	EPA 6020A	
Mercury	**0.0476**	---	0.0396	"	"	"	"	
JC-DU3-A-100417-RSM-W (A7J0162-28RE1)			**Matrix: Sediment**					
Batch: 7101088								
Antimony	ND	---	0.503	mg/kg dry	5	10/24/17 18:04	EPA 6020A	
Arsenic	**2.49**	---	1.01	"	"	"	"	
Beryllium	**0.412**	---	0.101	"	"	"	"	
Cadmium	ND	---	0.503	"	"	"	"	
Chromium	**23.3**	---	1.01	"	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU3-A-100417-RSM-W (A7J0162-28RE1)			**Matrix: Sediment**					
Copper	**29.4**	---	2.01	mg/kg dry	5	"	EPA 6020A	
Lead	**26.3**	---	0.503	"	"	"	"	
Nickel	**49.8**	---	1.01	"	"	"	"	
Selenium	ND	---	1.01	"	"	"	"	
Silver	ND	---	0.503	"	"	"	"	
Thallium	ND	---	0.503	"	"	"	"	
Zinc	**197**	---	2.01	"	"	"	"	
JC-DU3-B-100417-RSM-SS (A7J0162-30RE1)			**Matrix: Sediment**					
Batch: 7101088								
Cobalt	**11.0**	---	0.508	mg/kg dry	5	10/24/17 18:17	EPA 6020A	
Mercury	ND	---	0.0406	"	"	"	"	
JC-DU3-B-100417-RSM-W (A7J0162-31RE1)			**Matrix: Sediment**					
Batch: 7101088								
Antimony	ND	---	0.510	mg/kg dry	5	10/24/17 18:20	EPA 6020A	
Arsenic	**2.57**	---	1.02	"	"	"	"	
Beryllium	**0.439**	---	0.102	"	"	"	"	
Cadmium	ND	---	0.510	"	"	"	"	
Chromium	**21.2**	---	1.02	"	"	"	"	
Copper	**27.1**	---	2.04	"	"	"	"	
Lead	**25.7**	---	0.510	"	"	"	"	
Nickel	**35.9**	---	1.02	"	"	"	"	
Silver	ND	---	0.510	"	"	"	"	
Thallium	ND	---	0.510	"	"	"	"	
Zinc	**154**	---	2.04	"	"	"	"	
JC-DU3-B-100417-RSM-W (A7J0162-31RE2)			**Matrix: Sediment**					
Batch: 7101088								
Selenium	ND	---	1.02	mg/kg dry	5	10/25/17 16:27	EPA 6020A	
JC-DU2-01-100317-RSM-W (A7J0162-32RE1)			**Matrix: Sediment**					
Batch: 7101088								
Antimony	ND	---	0.509	mg/kg dry	5	10/24/17 18:23	EPA 6020A	
Arsenic	**2.33**	---	1.02	"	"	"	"	
Beryllium	**0.377**	---	0.102	"	"	"	"	
Cadmium	ND	---	0.509	"	"	"	"	
Chromium	**13.9**	---	1.02	"	"	"	"	
Copper	**21.9**	---	2.04	"	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-01-100317-RSM-W (A7J0162-32RE1)			**Matrix: Sediment**					
Lead	**24.3**	---	0.509	mg/kg dry	5	"	EPA 6020A	
Nickel	**22.5**	---	1.02	"	"	"	"	
Selenium	ND	---	1.02	"	"	"	"	
Silver	ND	---	0.509	"	"	"	"	
Thallium	ND	---	0.509	"	"	"	"	
Zinc	**113**	---	2.04	"	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Percent Dry Weight

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-100317-RSM-SS (A7J0162-02)			**Matrix: Sediment**		**Batch: 7100904**			
% Solids	**98.3**	---	1.00	% by Weight	1	10/19/17 08:01	EPA 8000C	
JC-DU2-100317-RSM-W (A7J0162-03)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**98.4**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU2-01-100317-RSM-SS (A7J0162-05)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.7**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU2-02-100317-RSM-SS (A7J0162-08)			**Matrix: Sediment**		**Batch: 7111043**			
% Solids	**98.6**	---	1.00	% by Weight	1	11/28/17 08:41	EPA 8000C	
JC-DU2-02-100317-RSM-W (A7J0162-09)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**98.4**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU2-03-100317-RSM-SS (A7J0162-11)			**Matrix: Sediment**		**Batch: 7111043**			
% Solids	**97.4**	---	1.00	% by Weight	1	11/28/17 08:41	EPA 8000C	
JC-DU2-03-100317-RSM-W (A7J0162-12)			**Matrix: Sediment**		**Batch: 7111043**			
% Solids	**96.9**	---	1.00	% by Weight	1	11/28/17 08:41	EPA 8000C	
JC-DU1-100317-RSM-SS (A7J0162-14)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.2**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU1-100317-RSM-W (A7J0162-15)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.2**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU1-A-100317-RSM-SS (A7J0162-17)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.1**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU1-A-100317-RSM-W (A7J0162-18)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.2**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU1-B-100317-RSM-SS (A7J0162-20)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.3**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU1-B-100317-RSM-W (A7J0162-21)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.3**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU3-100417-RSM-SS (A7J0162-24)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.4**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU3-100417-RSM-W (A7J0162-25)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.3**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU3-A-100417-RSM-SS (A7J0162-27)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.2**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

ANALYTICAL SAMPLE RESULTS

Percent Dry Weight

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU3-A-100417-RSM-W (A7J0162-28)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.3**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU3-B-100417-RSM-SS (A7J0162-30)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.1**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU3-B-100417-RSM-W (A7J0162-31)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.2**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU2-01-100317-RSM-W (A7J0162-32)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**98.0**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Polychlorinated Biphenyls by EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7101020 - EPA 3546							**Sediment**					
Blank (7101020-BLK1)					Prepared: 10/20/17 15:51		Analyzed: 10/23/17 10:02					C-07
EPA 8082A												
Aroclor 1016	ND	---	9.09	ug/kg wet	1	---	---	---	---	---	---	
Aroclor 1221	ND	---	9.09	"	"	---	---	---	---	---	---	
Aroclor 1232	ND	---	9.09	"	"	---	---	---	---	---	---	
Aroclor 1242	ND	---	9.09	"	"	---	---	---	---	---	---	
Aroclor 1248	ND	---	9.09	"	"	---	---	---	---	---	---	
Aroclor 1254	ND	---	9.09	"	"	---	---	---	---	---	---	
Aroclor 1260	ND	---	9.09	"	"	---	---	---	---	---	---	
Surr: Decachlorobiphenyl (Surr)			*Recovery: 98 %*	*Limits: 72-126 %*			*Dilution: 1x*					
LCS (7101020-BS1)					Prepared: 10/20/17 15:51		Analyzed: 10/23/17 10:21					C-07
EPA 8082A												
Aroclor 1016	180	---	10.0	ug/kg wet	1	250	---	72	47-134%	---	---	
Aroclor 1260	221	---	10.0	"	"	"	---	88	53-140%	---	---	
Surr: Decachlorobiphenyl (Surr)			*Recovery: 100 %*	*Limits: 72-126 %*			*Dilution: 1x*					
Duplicate (7101020-DUP1)					Prepared: 10/20/17 15:51		Analyzed: 10/23/17 11:15					C-07
QC Source Sample: JC-DU2-100317-RSM-SS (A7J0162-02)												
EPA 8082A												
Aroclor 1016	ND	---	9.98	ug/kg dry	1	---	ND	---	---	---	30%	
Aroclor 1221	ND	---	9.98	"	"	---	ND	---	---	---	30%	
Aroclor 1232	ND	---	21.0	"	"	---	ND	---	---	---	30%	R-02
Aroclor 1242	ND	---	9.98	"	"	---	ND	---	---	---	30%	
Aroclor 1248	ND	---	9.98	"	"	---	ND	---	---	---	30%	
Aroclor 1254	**20.2**	---	9.98	"	"	---	23.4	---	---	15	30%	
Aroclor 1260	ND	---	9.98	"	"	---	ND	---	---	---	30%	
Surr: Decachlorobiphenyl (Surr)			*Recovery: 81 %*	*Limits: 72-126 %*			*Dilution: 1x*					
Matrix Spike (7101020-MS1)					Prepared: 10/20/17 15:51		Analyzed: 10/23/17 11:52					C-07
QC Source Sample: JC-DU2-100317-RSM-SS (A7J0162-02)												
EPA 8082A												
Aroclor 1016	133	---	10.0	ug/kg dry	1	250	ND	53	47-134%	---	---	
Aroclor 1260	170	---	10.0	"	"	"	ND	68	53-140%	---	---	
Surr: Decachlorobiphenyl (Surr)			*Recovery: 79 %*	*Limits: 72-126 %*			*Dilution: 1x*					
Matrix Spike Dup (7101020-MSD1)					Prepared: 10/20/17 15:51		Analyzed: 10/23/17 12:28					C-07

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Polychlorinated Biphenyls by EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7101020 - EPA 3546							**Sediment**					
Matrix Spike Dup (7101020-MSD1)					Prepared: 10/20/17 15:51		Analyzed: 10/23/17 12:28					C-07
QC Source Sample: JC-DU2-100317-RSM-SS (A7J0162-02)												
EPA 8082A												
Aroclor 1016	154	---	9.97	ug/kg dry	1	249	ND	62	47-134%	15	30%	
Aroclor 1260	198	---	9.97	"	"	"	ND	80	53-140%	15	30%	
Surr: Decachlorobiphenyl (Surr)				*Recovery: 91 %*	*Limits: 72-126 %*		*Dilution: 1x*					

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7100999 - EPA 3051A							**Sediment**					
Blank (7100999-BLK1)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 18:21							
EPA 6020A												
Antimony	ND	---	0.500	mg/kg wet	5	---	---	---	---	---	---	
Arsenic	ND	---	1.00	"	"	---	---	---	---	---	---	
Beryllium	ND	---	0.100	"	"	---	---	---	---	---	---	
Cadmium	ND	---	0.500	"	"	---	---	---	---	---	---	
Chromium	ND	---	1.00	"	"	---	---	---	---	---	---	
Cobalt	ND	---	0.500	"	"	---	---	---	---	---	---	
Copper	ND	---	1.00	"	"	---	---	---	---	---	---	
Lead	ND	---	0.500	"	"	---	---	---	---	---	---	
Mercury	ND	---	0.0400	"	"	---	---	---	---	---	---	
Nickel	ND	---	1.00	"	"	---	---	---	---	---	---	
Selenium	ND	---	1.00	"	"	---	---	---	---	---	---	
Silver	ND	---	0.500	"	"	---	---	---	---	---	---	
Thallium	ND	---	0.500	"	"	---	---	---	---	---	---	
Zinc	ND	---	2.00	"	"	---	---	---	---	---	---	
Blank (7100999-BLK2)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 18:24							
EPA 6020A												
Antimony	ND	---	0.488	mg/kg wet	5	---	---	---	---	---	---	A-01c
Arsenic	ND	---	0.977	"	"	---	---	---	---	---	---	A-01c
Beryllium	ND	---	0.0977	"	"	---	---	---	---	---	---	A-01c
Cadmium	ND	---	0.488	"	"	---	---	---	---	---	---	A-01c
Chromium	ND	---	0.977	"	"	---	---	---	---	---	---	A-01c
Copper	ND	---	0.977	"	"	---	---	---	---	---	---	A-01c
Lead	ND	---	0.488	"	"	---	---	---	---	---	---	A-01c
Nickel	ND	---	0.977	"	"	---	---	---	---	---	---	A-01c
Selenium	ND	---	0.977	"	"	---	---	---	---	---	---	A-01c
Silver	ND	---	0.488	"	"	---	---	---	---	---	---	A-01c
Thallium	ND	---	0.488	"	"	---	---	---	---	---	---	A-01c
Zinc	ND	---	1.95	"	"	---	---	---	---	---	---	A-01c
Blank (7100999-BLK3)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 18:37							
EPA 6020A												
Cobalt	ND	---	0.482	mg/kg wet	5	---	---	---	---	---	---	A-01b
Mercury	ND	---	0.0385	"	"	---	---	---	---	---	---	A-01b

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7100999 - EPA 3051A							**Sediment**					
LCS (7100999-BS1)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 18:40							
EPA 6020A												
Antimony	12.7	---	0.500	mg/kg wet	5	12.5	---	102	80-120%	---	---	
Arsenic	24.5	---	1.00	"	"	25.0	---	98	"	---	---	
Beryllium	12.7	---	0.100	"	"	12.5	---	102	"	---	---	
Cadmium	24.9	---	0.500	"	"	25.0	---	99	"	---	---	
Chromium	24.5	---	1.00	"	"	"	---	98	"	---	---	
Cobalt	25.2	---	0.500	"	"	"	---	101	"	---	---	
Copper	26.0	---	1.00	"	"	"	---	104	"	---	---	
Lead	26.0	---	0.500	"	"	"	---	104	"	---	---	
Mercury	0.540	---	0.0400	"	"	0.500	---	108	"	---	---	
Nickel	24.7	---	1.00	"	"	25.0	---	99	"	---	---	
Selenium	13.3	---	1.00	"	"	12.5	---	107	"	---	---	
Silver	12.8	---	0.500	"	"	"	---	103	"	---	---	
Thallium	12.9	---	0.500	"	"	"	---	103	"	---	---	
Zinc	25.2	---	2.00	"	"	25.0	---	101	"	---	---	
Duplicate (7100999-DUP1)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 18:50							
QC Source Sample: JC-DU2-100317-RSM-SS (A7J0162-02)												
EPA 6020A												
Antimony	ND	---	0.501	mg/kg dry	5	---	ND	---	---	---	40%	
Arsenic	**1.66**	---	1.00	"	"	---	1.90	---	---	14	40%	
Beryllium	**0.265**	---	0.100	"	"	---	0.278	---	---	5	40%	
Cadmium	ND	---	0.501	"	"	---	0.487	---	---	23	40%	
Chromium	**21.6**	---	1.00	"	"	---	27.2	---	---	23	40%	
Cobalt	**9.62**	---	0.501	"	"	---	10.9	---	---	12	40%	
Copper	**27.5**	---	1.00	"	"	---	29.9	---	---	8	40%	
Lead	**18.3**	---	0.501	"	"	---	20.8	---	---	13	40%	
Mercury	ND	---	0.0401	"	"	---	ND	---	---	---	40%	
Nickel	**28.1**	---	1.00	"	"	---	38.4	---	---	31	40%	
Selenium	ND	---	1.00	"	"	---	ND	---	---	---	40%	
Silver	ND	---	0.501	"	"	---	ND	---	---	---	40%	
Thallium	ND	---	0.501	"	"	---	ND	---	---	---	40%	
Zinc	**116**	---	2.00	"	"	---	120	---	---	4	40%	
Duplicate (7100999-DUP2)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 18:53							

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7100999 - EPA 3051A							**Sediment**					
Duplicate (7100999-DUP2)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 18:53							
QC Source Sample: JC-DU2-100317-RSM-SS (A7J0162-02)												
EPA 6020A												
Antimony	ND	---	0.498	mg/kg dry	5	---	ND	---	---	---	40%	
Arsenic	**1.65**	---	0.996	"	"	---	1.90	---	---	14	40%	
Beryllium	**0.284**	---	0.0996	"	"	---	0.278	---	---	2	40%	
Cadmium	ND	---	0.498	"	"	---	0.487	---	---	19	40%	
Chromium	**22.1**	---	0.996	"	"	---	27.2	---	---	20	40%	
Cobalt	**9.38**	---	0.498	"	"	---	10.9	---	---	15	40%	
Copper	**29.8**	---	0.996	"	"	---	29.9	---	---	0.2	40%	
Lead	**18.4**	---	0.498	"	"	---	20.8	---	---	12	40%	
Mercury	ND	---	0.0398	"	"	---	ND	---	---	---	40%	
Nickel	**27.5**	---	0.996	"	"	---	38.4	---	---	33	40%	
Selenium	ND	---	0.996	"	"	---	ND	---	---	---	40%	
Silver	ND	---	0.498	"	"	---	ND	---	---	---	40%	
Thallium	ND	---	0.498	"	"	---	ND	---	---	---	40%	
Zinc	**116**	---	1.99	"	"	---	120	---	---	4	40%	
Duplicate (7100999-DUP3)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 19:06							
QC Source Sample: JC-DU2-100317-RSM-W (A7J0162-03)												
EPA 6020A												
Antimony	ND	---	0.496	mg/kg dry	5	---	ND	---	---	---	40%	
Arsenic	**1.76**	---	0.992	"	"	---	1.75	---	---	0.3	40%	
Beryllium	**0.278**	---	0.0992	"	"	---	0.283	---	---	2	40%	
Cadmium	ND	---	0.496	"	"	---	0.385	---	---	0.6	40%	
Chromium	**13.3**	---	0.992	"	"	---	14.6	---	---	9	40%	
Cobalt	**63.8**	---	0.496	"	"	---	63.8	---	---	0.09	40%	
Copper	**26.5**	---	0.992	"	"	---	26.0	---	---	2	40%	
Lead	**19.5**	---	0.496	"	"	---	20.7	---	---	6	40%	
Nickel	**29.2**	---	0.992	"	"	---	30.8	---	---	6	40%	
Selenium	ND	---	0.992	"	"	---	ND	---	---	---	40%	
Silver	ND	---	0.496	"	"	---	ND	---	---	---	40%	
Thallium	ND	---	0.496	"	"	---	ND	---	---	---	40%	
Zinc	**109**	---	1.98	"	"	---	117	---	---	7	40%	
Duplicate (7100999-DUP4)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 19:09							

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7100999 - EPA 3051A							**Sediment**					
Duplicate (7100999-DUP4)					Prepared: 10/20/17 10:44		Analyzed: 10/23/17 19:09					
QC Source Sample: JC-DU2-100317-RSM-W (A7J0162-03)												
EPA 6020A												
Antimony	ND	---	0.494	mg/kg dry	5	---	ND	---	---	---	40%	
Arsenic	**1.86**	---	0.989	"	"	---	1.75	---	---	6	40%	
Beryllium	**0.267**	---	0.0989	"	"	---	0.283	---	---	6	40%	
Cadmium	ND	---	0.494	"	"	---	0.385	---	---	1	40%	
Chromium	**12.6**	---	0.989	"	"	---	14.6	---	---	15	40%	
Cobalt	**66.1**	---	0.494	"	"	---	63.8	---	---	4	40%	
Copper	**27.2**	---	0.989	"	"	---	26.0	---	---	5	40%	
Lead	**18.4**	---	0.494	"	"	---	20.7	---	---	12	40%	
Nickel	**30.3**	---	0.989	"	"	---	30.8	---	---	2	40%	
Selenium	ND	---	0.989	"	"	---	ND	---	---	---	40%	
Silver	ND	---	0.494	"	"	---	ND	---	---	---	40%	
Thallium	ND	---	0.494	"	"	---	ND	---	---	---	40%	
Zinc	**117**	---	1.98	"	"	---	117	---	---	0.04	40%	
Matrix Spike (7100999-MS1)					Prepared: 10/20/17 10:44		Analyzed: 10/23/17 18:56					
QC Source Sample: JC-DU2-100317-RSM-SS (A7J0162-02)												
EPA 6020A												
Antimony	10.3	---	0.496	mg/kg dry	5	12.4	0.248	81	75-125%	---	---	
Arsenic	24.3	---	0.992	"	"	24.8	1.90	90	"	---	---	
Beryllium	12.9	---	0.0992	"	"	12.4	0.278	102	"	---	---	
Cadmium	24.4	---	0.496	"	"	24.8	0.487	96	"	---	---	
Chromium	45.0	---	0.992	"	"	"	27.2	72	"	---	---	Q-03
Cobalt	32.6	---	0.496	"	"	"	10.9	88	"	---	---	
Copper	50.3	---	0.992	"	"	"	29.9	83	"	---	---	
Lead	40.7	---	0.496	"	"	"	20.8	80	"	---	---	
Mercury	0.495	---	0.0397	"	"	0.496	ND	100	"	---	---	
Nickel	51.4	---	0.992	"	"	24.8	38.4	52	"	---	---	Q-03
Selenium	12.2	---	0.992	"	"	12.4	ND	99	"	---	---	
Silver	12.2	---	0.496	"	"	"	ND	98	"	---	---	
Thallium	11.5	---	0.496	"	"	"	ND	93	"	---	---	
Zinc	129	---	1.98	"	"	24.8	120	35	"	---	---	Q-03
Matrix Spike (7100999-MS2)					Prepared: 10/20/17 10:44		Analyzed: 10/23/17 19:12					

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7100999 - EPA 3051A							**Sediment**					
Matrix Spike (7100999-MS2)					Prepared: 10/20/17 10:44 Analyzed: 10/23/17 19:12							
QC Source Sample: JC-DU2-100317-RSM-W (A7J0162-03)												
EPA 6020A												
Antimony	10.4	---	0.490	mg/kg dry	5	12.2	ND	85	75-125%	---	---	
Arsenic	24.2	---	0.981	"	"	24.5	1.75	91	"	---	---	
Beryllium	13.2	---	0.0981	"	"	12.2	0.283	106	"	---	---	
Cadmium	23.9	---	0.490	"	"	24.5	0.385	96	"	---	---	
Chromium	34.3	---	0.981	"	"	"	14.6	80	"	---	---	
Cobalt	82.1	---	0.490	"	"	"	63.8	74	"	---	---	Q-03
Copper	48.4	---	0.981	"	"	"	26.0	91	"	---	---	
Lead	38.8	---	0.490	"	"	"	20.7	74	"	---	---	Q-03
Nickel	51.3	---	0.981	"	"	"	30.8	83	"	---	---	
Selenium	12.6	---	0.981	"	"	12.2	ND	103	"	---	---	
Silver	12.0	---	0.490	"	"	"	ND	98	"	---	---	
Thallium	11.4	---	0.490	"	"	"	ND	93	"	---	---	
Zinc	127	---	1.96	"	"	24.5	117	44	"	---	---	Q-03

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7101088 - EPA 3051A							**Sediment**					
Blank (7101088-BLK1)					Prepared: 10/24/17 10:30 Analyzed: 10/24/17 17:23							
EPA 6020A												
Antimony	ND	---	0.481	mg/kg wet	5	---	---	---	---	---	---	
Arsenic	ND	---	0.962	"	"	---	---	---	---	---	---	
Beryllium	ND	---	0.0962	"	"	---	---	---	---	---	---	
Cadmium	ND	---	0.481	"	"	---	---	---	---	---	---	
Chromium	ND	---	0.962	"	"	---	---	---	---	---	---	
Cobalt	ND	---	0.481	"	"	---	---	---	---	---	---	
Copper	ND	---	1.92	"	"	---	---	---	---	---	---	
Lead	ND	---	0.481	"	"	---	---	---	---	---	---	
Mercury	ND	---	0.0385	"	"	---	---	---	---	---	---	
Nickel	ND	---	0.962	"	"	---	---	---	---	---	---	
Silver	ND	---	0.481	"	"	---	---	---	---	---	---	
Thallium	ND	---	0.481	"	"	---	---	---	---	---	---	
Zinc	ND	---	1.92	"	"	---	---	---	---	---	---	
Blank (7101088-BLK2)					Prepared: 10/24/17 10:30 Analyzed: 10/24/17 17:34							
EPA 6020A												
Antimony	ND	---	0.489	mg/kg wet	5	---	---	---	---	---	---	A-01a
Arsenic	ND	---	0.978	"	"	---	---	---	---	---	---	A-01a
Beryllium	ND	---	0.0978	"	"	---	---	---	---	---	---	A-01a
Cadmium	ND	---	0.489	"	"	---	---	---	---	---	---	A-01a
Chromium	ND	---	0.978	"	"	---	---	---	---	---	---	A-01a
Copper	ND	---	1.96	"	"	---	---	---	---	---	---	A-01a
Lead	ND	---	0.489	"	"	---	---	---	---	---	---	A-01a
Nickel	ND	---	0.978	"	"	---	---	---	---	---	---	A-01a, R-04
Selenium	ND	---	0.978	"	"	---	---	---	---	---	---	A-01a
Silver	ND	---	0.489	"	"	---	---	---	---	---	---	A-01a
Thallium	ND	---	0.489	"	"	---	---	---	---	---	---	A-01a
Zinc	ND	---	1.96	"	"	---	---	---	---	---	---	A-01a
Blank (7101088-BLK3)					Prepared: 10/24/17 10:30 Analyzed: 10/24/17 17:42							
EPA 6020A												
Cobalt	ND	---	0.486	mg/kg wet	5	---	---	---	---	---	---	A-01
Mercury	ND	---	0.0389	"	"	---	---	---	---	---	---	A-01
Blank (7101088-BLK4)					Prepared: 10/24/17 10:30 Analyzed: 10/25/17 16:24							

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7101088 - EPA 3051A							**Sediment**					
Blank (7101088-BLK4)					Prepared: 10/24/17 10:30		Analyzed: 10/25/17 16:24					
EPA 6020A												
Selenium	ND	---	0.962	mg/kg wet	5	---	---	---	---	---	---	B-02, Q-16
LCS (7101088-BS1)					Prepared: 10/24/17 10:30		Analyzed: 10/24/17 17:27					
EPA 6020A												
Antimony	12.1	---	0.500	mg/kg wet	5	12.5	---	97	80-120%	---	---	
Arsenic	24.8	---	1.00	"	"	25.0	---	99	"	---	---	
Beryllium	12.1	---	0.100	"	"	12.5	---	97	"	---	---	
Cadmium	25.1	---	0.500	"	"	25.0	---	101	"	---	---	
Chromium	24.8	---	1.00	"	"	"	---	99	"	---	---	
Cobalt	25.3	---	0.500	"	"	"	---	101	"	---	---	
Copper	26.0	---	2.00	"	"	"	---	104	"	---	---	
Lead	27.4	---	0.500	"	"	"	---	110	"	---	---	
Mercury	0.528	---	0.0400	"	"	0.500	---	106	"	---	---	
Nickel	24.9	---	1.00	"	"	25.0	---	100	"	---	---	
Silver	12.7	---	0.500	"	"	12.5	---	102	"	---	---	
Thallium	13.0	---	0.500	"	"	"	---	104	"	---	---	
Zinc	25.3	---	2.00	"	"	25.0	---	101	"	---	---	
Duplicate (7101088-DUP1)					Prepared: 10/24/17 10:30		Analyzed: 10/24/17 18:07					
QC Source Sample: JC-DU3-A-100417-RSM-W (A7J0162-28RE1)												
EPA 6020A												
Antimony	ND	---	0.497	mg/kg dry	5	---	0.407	---	---	4	40%	
Arsenic	**2.60**	---	0.994	"	"	---	2.49	---	---	4	40%	
Beryllium	**0.422**	---	0.0994	"	"	---	0.412	---	---	2	40%	
Cadmium	ND	---	0.497	"	"	---	0.463	---	---	5	40%	
Chromium	**25.7**	---	0.994	"	"	---	23.3	---	---	10	40%	
Cobalt	**71.3**	---	0.497	"	"	---	67.8	---	---	5	40%	
Copper	**30.6**	---	1.99	"	"	---	29.4	---	---	4	40%	
Lead	**29.5**	---	0.497	"	"	---	26.3	---	---	11	40%	
Nickel	**51.9**	---	0.994	"	"	---	49.8	---	---	4	40%	
Selenium	ND	---	0.994	"	"	---	ND	---	---	---	40%	
Silver	ND	---	0.497	"	"	---	ND	---	---	---	40%	
Thallium	ND	---	0.497	"	"	---	ND	---	---	---	40%	
Zinc	**169**	---	1.99	"	"	---	197	---	---	15	40%	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7101088 - EPA 3051A							**Sediment**					
Matrix Spike (7101088-MS1)					Prepared: 10/24/17 10:30 Analyzed: 10/24/17 18:10							
QC Source Sample: JC-DU3-A-100417-RSM-W (A7J0162-28RE1)												
EPA 6020A												
Antimony	10.2	---	0.501	mg/kg dry	5	12.5	0.407	78	75-125%	---	---	
Arsenic	26.6	---	1.00	"	"	25.1	2.49	96	"	---	---	
Beryllium	12.7	---	0.100	"	"	12.5	0.412	98	"	---	---	
Cadmium	25.5	---	0.501	"	"	25.1	0.463	100	"	---	---	
Chromium	49.1	---	1.00	"	"	"	23.3	103	"	---	---	
Cobalt	98.4	---	0.501	"	"	"	67.8	122	"	---	---	
Copper	56.2	---	2.00	"	"	"	29.4	107	"	---	---	
Lead	54.3	---	0.501	"	"	"	26.3	112	"	---	---	
Nickel	79.3	---	1.00	"	"	"	49.8	118	"	---	---	
Selenium	12.7	---	1.00	"	"	12.5	ND	101	"	---	---	B-02
Silver	12.5	---	0.501	"	"	"	ND	100	"	---	---	
Thallium	12.0	---	0.501	"	"	"	ND	96	"	---	---	
Zinc	199	---	2.00	"	"	25.1	197	11	"	---	---	Q-03

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

QUALITY CONTROL (QC) SAMPLE RESULTS

Percent Dry Weight

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7100904 - Total Solids (Dry Weight)											**Soil**	
Duplicate (7100904-DUP2)					Prepared: 10/18/17 12:06		Analyzed: 10/19/17 08:01					
QC Source Sample: JC-DU2-100317-RSM-SS (A7J0162-02)												
EPA 8000C												
% Solids	**98.2**	---	1.00	% by Weight	1	---	98.3	---	---	0.06	10%	

No Client related Batch QC samples analyzed for this batch. See notes page for more information.

Analyte	Result	MDL	Reporting Limit	Units	Dil.	Spike Amount	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 7100940 - Total Solids (Dry Weight)											**Soil**	
Duplicate (7100940-DUP1)					Prepared: 10/19/17 09:25		Analyzed: 10/20/17 08:22					
QC Source Sample: JC-DU2-100317-RSM-W (A7J0162-03)												
EPA 8000C												
% Solids	**98.3**	---	1.00	% by Weight	1	---	98.4	---	---	0.07	10%	

No Client related Batch QC samples analyzed for this batch. See notes page for more information.

Batch 7111043 - Total Solids (Dry Weight) **Soil**

No Client related Batch QC samples analyzed for this batch. See notes page for more information.

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

SAMPLE PREPARATION INFORMATION

Polychlorinated Biphenyls by EPA 8082A

Prep: EPA 3546

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 7101020							
A7J0162-02	Sediment	EPA 8082A	10/03/17 11:00	10/20/17 15:51	10.19g/5mL	10g/5mL	0.98
A7J0162-05RE1	Sediment	EPA 8082A	10/03/17 11:00	10/20/17 15:51	10.49g/5mL	10g/5mL	0.95
A7J0162-08RE1	Sediment	EPA 8082A	10/03/17 11:45	10/20/17 15:51	10.81g/5mL	10g/5mL	0.93
A7J0162-11RE1	Sediment	EPA 8082A	10/03/17 12:05	10/20/17 15:51	10.85g/5mL	10g/5mL	0.92
A7J0162-14RE1	Sediment	EPA 8082A	10/03/17 14:00	10/20/17 15:51	10.15g/5mL	10g/5mL	0.99
A7J0162-17	Sediment	EPA 8082A	10/03/17 14:00	10/20/17 15:51	10.08g/5mL	10g/5mL	0.99
A7J0162-20	Sediment	EPA 8082A	10/03/17 14:00	10/20/17 15:51	10.66g/5mL	10g/5mL	0.94
A7J0162-24	Sediment	EPA 8082A	10/04/17 13:15	10/20/17 15:51	10.71g/5mL	10g/5mL	0.93
A7J0162-27RE1	Sediment	EPA 8082A	10/04/17 13:15	10/20/17 15:51	10.03g/5mL	10g/5mL	1.00
A7J0162-30RE1	Sediment	EPA 8082A	10/04/17 13:15	10/20/17 15:51	10.69g/5mL	10g/5mL	0.94

Total Metals by EPA 6020 (ICPMS)

Prep: EPA 3051A

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 7100999							
A7J0162-02	Sediment	EPA 6020A	10/03/17 11:00	10/20/17 11:47	0.512g/50mL	0.5g/50mL	0.98
A7J0162-03	Sediment	EPA 6020A	10/03/17 11:00	10/20/17 11:47	0.502g/50mL	0.5g/50mL	1.00
A7J0162-05	Sediment	EPA 6020A	10/03/17 11:00	10/20/17 11:47	0.508g/50mL	0.5g/50mL	0.98
A7J0162-08	Sediment	EPA 6020A	10/03/17 11:45	10/20/17 11:47	0.509g/50mL	0.5g/50mL	0.98
A7J0162-09	Sediment	EPA 6020A	10/03/17 11:45	10/20/17 11:47	0.516g/50mL	0.5g/50mL	0.97
A7J0162-11	Sediment	EPA 6020A	10/03/17 12:05	10/20/17 11:47	0.507g/50mL	0.5g/50mL	0.99
A7J0162-12	Sediment	EPA 6020A	10/04/17 12:05	10/20/17 11:47	0.516g/50mL	0.5g/50mL	0.97
A7J0162-14	Sediment	EPA 6020A	10/03/17 14:00	10/20/17 11:47	0.51g/50mL	0.5g/50mL	0.98
A7J0162-15	Sediment	EPA 6020A	10/03/17 14:00	10/20/17 11:47	0.511g/50mL	0.5g/50mL	0.98
A7J0162-17	Sediment	EPA 6020A	10/03/17 14:00	10/20/17 11:47	0.518g/50mL	0.5g/50mL	0.97
A7J0162-18	Sediment	EPA 6020A	10/03/17 14:00	10/20/17 11:47	0.508g/50mL	0.5g/50mL	0.98
A7J0162-20	Sediment	EPA 6020A	10/03/17 14:00	10/20/17 11:47	0.503g/50mL	0.5g/50mL	0.99
A7J0162-21	Sediment	EPA 6020A	10/03/17 14:00	10/20/17 11:47	0.515g/50mL	0.5g/50mL	0.97
Batch: 7101088							
A7J0162-24RE1	Sediment	EPA 6020A	10/04/17 13:15	10/24/17 10:30	0.516g/50mL	0.5g/50mL	0.97
A7J0162-25RE1	Sediment	EPA 6020A	10/04/17 13:15	10/24/17 10:30	0.513g/50mL	0.5g/50mL	0.98
A7J0162-27RE1	Sediment	EPA 6020A	10/04/17 13:15	10/24/17 10:30	0.52g/50mL	0.5g/50mL	0.96
A7J0162-28RE1	Sediment	EPA 6020A	10/04/17 13:15	10/24/17 10:30	0.511g/50mL	0.5g/50mL	0.98

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

SAMPLE PREPARATION INFORMATION

Total Metals by EPA 6020 (ICPMS)

Prep: EPA 3051A

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
A7J0162-30RE1	Sediment	EPA 6020A	10/04/17 13:15	10/24/17 10:30	0.507g/50mL	0.5g/50mL	0.99
A7J0162-31RE1	Sediment	EPA 6020A	10/04/17 13:15	10/24/17 10:30	0.504g/50mL	0.5g/50mL	0.99
A7J0162-31RE2	Sediment	EPA 6020A	10/04/17 13:15	10/24/17 10:30	0.504g/50mL	0.5g/50mL	0.99
A7J0162-32RE1	Sediment	EPA 6020A	10/03/17 11:00	10/24/17 10:30	0.501g/50mL	0.5g/50mL	1.00

Percent Dry Weight

Prep: Total Solids (Dry Weight)

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 7100904							
A7J0162-02	Sediment	EPA 8000C	10/03/17 11:00	10/18/17 12:06	1N/A/1N/A	1N/A/1N/A	NA
Batch: 7100940							
A7J0162-03	Sediment	EPA 8000C	10/03/17 11:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-05	Sediment	EPA 8000C	10/03/17 11:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-09	Sediment	EPA 8000C	10/03/17 11:45	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-14	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-15	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-17	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-18	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-20	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-21	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-24	Sediment	EPA 8000C	10/04/17 13:15	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-25	Sediment	EPA 8000C	10/04/17 13:15	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-27	Sediment	EPA 8000C	10/04/17 13:15	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-28	Sediment	EPA 8000C	10/04/17 13:15	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-30	Sediment	EPA 8000C	10/04/17 13:15	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-31	Sediment	EPA 8000C	10/04/17 13:15	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-32	Sediment	EPA 8000C	10/03/17 11:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
Batch: 7111043							
A7J0162-08	Sediment	EPA 8000C	10/03/17 11:45	11/27/17 18:58	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-11	Sediment	EPA 8000C	10/03/17 12:05	11/27/17 18:58	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-12	Sediment	EPA 8000C	10/04/17 12:05	11/27/17 18:58	1N/A/1N/A	1N/A/1N/A	NA

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

Notes and Definitions

Qualifiers:

A-01	RSM Grind Blank #2, RSM batch 7100844
A-01a	RSM Grind Blank, RSM batch 7100844
A-01b	Sample is grind blank #2, RSM batch 7100844.
A-01c	Sample is grind blank, RSM batch 7100844.
B-02	Analyte detected in an associated blank at a level between one-half the MRL and the MRL. (See Notes and Conventions below.)
C-07	Extract has undergone Sulfuric Acid Cleanup by EPA 3665A, Sulfur Cleanup by EPA 3660B, and Florisil Cleanup by EPA 3620B in order to minimize matrix interference.
P-10	Result estimated due to the presence of multiple PCB Aroclors and/or matrix interference.
Q-03	Spike recovery and/or RPD is outside control limits due to the high concentration of analyte present in the sample.
Q-16	Reanalysis of an original Batch QC sample.
Q-42	Matrix Spike and/or Duplicate analysis was performed on this sample. % Recovery or RPD for this analyte is outside laboratory control limits. (Refer to the QC Section of Analytical Report.)
R-02	The Reporting Limit for this analyte has been raised to account for interference from coeluting organic compounds present in the sample.
R-04	Reporting levels elevated due to dilution necessary for analysis.

Notes and Conventions:

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis. Results listed as 'wet' or without 'dry'designation are not dry weight corrected.
RPD	Relative Percent Difference
MDL	If MDL is not listed, data has been evaluated to the Method Reporting Limit only.
WMSC	Water Miscible Solvent Correction has been applied to Results and MRLs for volatiles soil samples per EPA 8000C.
Batch QC	Unless specifically requested, this report contains only results for Batch QC derived from client samples included in this report. All analyses were performed with the appropriate Batch QC (including Sample Duplicates, Matrix Spikes and/or Matrix Spike Duplicates) in order to meet or exceed method and regulatory requirements. Any exceptions to this will be qualified in this report. Complete Batch QC results are available upon request. In cases where there is insufficient sample provided for Sample Duplicates and/or Matrix Spikes, a Lab Control Sample Duplicate (LCS Dup) is analyzed to demonstrate accuracy and precision of the extraction and analysis.
Blank Policy	Apex assesses blank data for potential high bias down to a level equal to ½ the method reporting limit (MRL), except for conventional chemistry and HCID analyses which are assessed only to the MRL. Sample results flagged with a B or B-02 qualifier are potentially biased high if they are less than ten times the level found in the blank for inorganic analyses or less than five times the level found in the blank for organic analyses. For accurate comparison of volatile results to the level found in the blank; water sample results should be divided by the dilution factor, and soil sample results should be divided by 1/50 of the sample dilution to account for the sample prep factor.

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

Results qualified as reported below the MRL may include a potential high bias if associated with a B or B-02 qualified blank. B and B-02 qualifications are not applied to J qualified results reported below the MRL.

--- QC results are not applicable. For example, % Recoveries for Blanks and Duplicates, % RPD for Blanks, Blank Spikes and Matrix Spikes, etc.

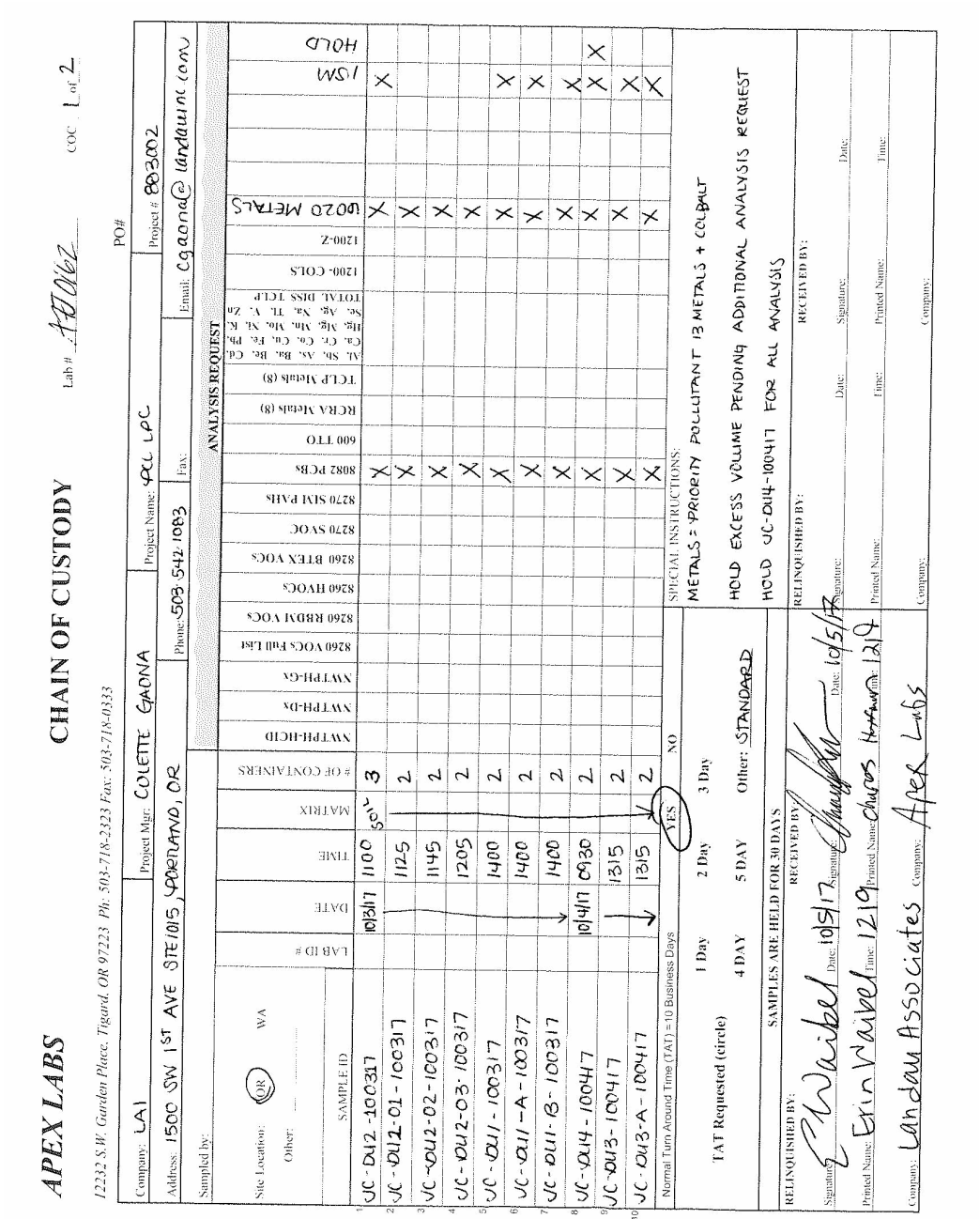
*** Used to indicate a possible discrepancy with the Sample and Sample Duplicate results when the %RPD is not available. In this case, either the Sample or the Sample Duplicate has a reportable result for this analyte, while the other is Non Detect (ND).

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11



APEX LABS
12232 S.W. Garden Place, Tigard, OR 97223 PH: 503-718-2323 FAX: 503-718-0333

CHAIN OF CUSTODY

Lab # _____ COC 1 of 2

PO#

Company: LAI | Project Mgr: COLETTE GAONA | Project Name: PCC LPC | Project # 883002

Address: 1500 SW 1ST AVE STE 1015, PORTLAND, OR | Phone: 503-542-1083 | Fax: | Email: cgaona@landauinc.com

Sampled by:

Site Location: OR / WA
Other: _____

ANALYSIS REQUEST

	SAMPLE ID	LAB ID #	DATE	TIME	MATRIX	# OF CONTAINERS	NWTPH-HCID	NWTPH-Dx	NWTPH-Gx	8260 VOCs Full List	8260 RBDM VOCs	8260 HVOCs	8260 BTEX VOCs	8270 SVOC	8270 SIM PAHs	8082 PCBs	600 TTO	RCRA Metals (8)	TCLP Metals (8)	Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Hg, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Tl, V, Zn TOTAL DISS TCLP	1200-COLS	1200-Z	8020 METALS	LSM	HOLD
1	JC-DU2-100317		10/3/17	1100	soil	3										X						X		
2	JC-DU2-01-100317			1125		2										X								
3	JC-DU2-02-100317			1145		2										X						X		
4	JC-DU2-03-100317			1205		2										X						X		
5	JC-DU1-100317			1400		2										X						X		
6	JC-DU1-A-100317			1400		2										X						X		
7	JC-DU1-B-100317			1400		2										X						X		
8	JC-DU4-100417		10/4/17	0930		2										X						X	X	
9	JC-DU3-100417			1315		2										X						X		
10	JC-DU3-A-100417		↓	1315	↓	2										X						X		

Normal Turn Around Time (TAT) = 10 Business Days — YES / NO

TAT Requested (circle): 1 Day | 2 Day | 3 Day | 4 DAY | 5 DAY | Other: STANDARD

SPECIAL INSTRUCTIONS:
METALS = PRIORITY POLLUTANT 13 METALS + COBALT
HOLD EXCESS VOLUME PENDING ADDITIONAL ANALYSIS REQUEST
HOLD JC-DU4-100417 FOR ALL ANALYSIS

SAMPLES ARE HELD FOR 30 DAYS

RELINQUISHED BY: Erin Waived Date: 10/5/17 Signature: _____ Printed Name: Erin Waived Time: 1210 Company: Landau Associates

RECEIVED BY: _____ Date: _____ Signature: _____ Printed Name: _____ Time: _____ Company: _____

RELINQUISHED BY: _____ Date: _____ Signature: _____ Printed Name: _____ Time: _____ Company: _____

RECEIVED BY: Chuck Hayward Date: 10/5/17 Signature: _____ Printed Name: Chuck Hayward Time: 1217 Company: Apex Labs

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

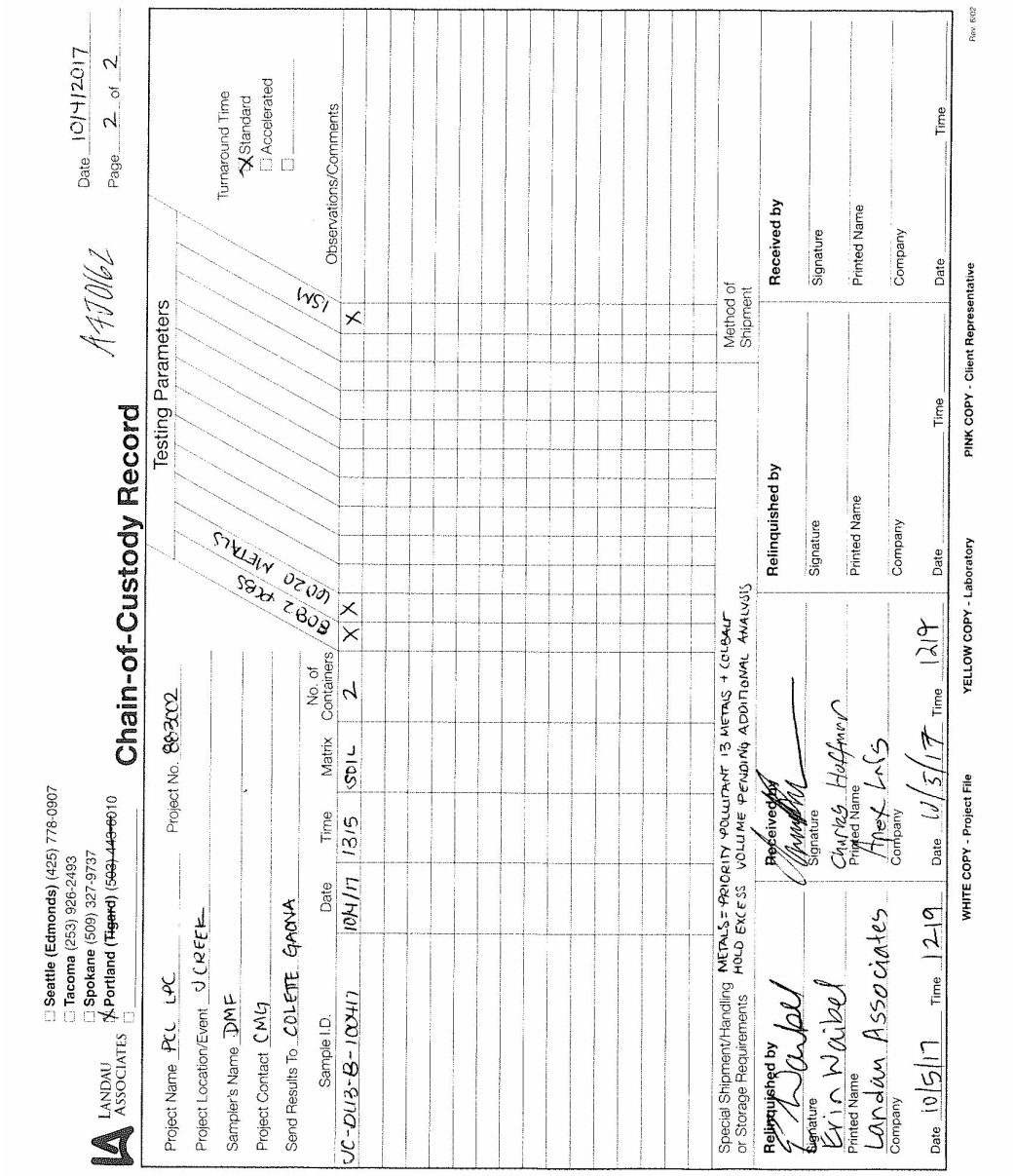
Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11



LANDAU ASSOCIATES

☐ Seattle (Edmonds) (425) 778-0907
☐ Tacoma (253) 926-2493
☐ Spokane (509) 327-9737
☒ Portland (Tigard) (503) 448-0010
☐ _____

Chain-of-Custody Record

Date 10/4/2017
Page 2 of 2

Project Name PCC LPC
Project No. 883002
Project Location/Event UCREEK
Sampler's Name DMF
Project Contact CMG
Send Results To COLETTE GAONA

Testing Parameters

Sample I.D.	Date	Time	Matrix	No. of Containers	8082 PCBs	6020 METALS	TSM	Observations/Comments
UC-DU3-B-100417	10/4/17	1315	SOIL	2	X	X	X	

Turnaround Time
☒ Standard
☐ Accelerated
☐ _____

Special Shipment/Handling or Storage Requirements: METALS = PRIORITY POLLUTANT 13 METALS + COBALT; HOLD EXCESS VOLUME PENDING ADDITIONAL ANALYSIS

Method of Shipment

Relinquished by
Signature: Erin Waibel
Printed Name: Erin Waibel
Company: Landau Associates
Date 10/5/17 Time 1219

Received by
Signature: Charles Hoffmann
Printed Name: Charles Hoffmann
Company: Apex Labs
Date 10/5/17 Time 1219

Relinquished by
Signature
Printed Name
Company
Date _____ Time _____

Received by
Signature
Printed Name
Company
Date _____ Time _____

WHITE COPY - Project File YELLOW COPY - Laboratory PINK COPY - Client Representative

Rev. 6/02

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 10:11

APEX LABS COOLER RECEIPT FORM

Client: Landau Element WO#: A7 J0162

Project/Project #: PCC LPC 883002

Delivery info:

Date/Time Received: 10/4/17 @ 1219 By: CFH

Delivered by: Apex X Client ___ ESS ___ FedEx ___ UPS ___ Swift ___ Senvoy ___ SDS ___ Other ___

Cooler Inspection Inspected by: CFH : 10/4/17 @ 1305

Chain of Custody Included? Yes ___ No ___ Custody Seals? Yes ___ No ___

Signed/Dated by Client? Yes ___ No ___

Signed/Dated by Apex? Yes ___ No ___

	Cooler #1	Cooler #2	Cooler #3	Cooler #4	Cooler #5	Cooler #6	Cooler #7
Temperature (deg. C)	2.7		1.5				
Received on Ice? (Y/N)							
Temp. Blanks? (Y/N)		4.5		1.3			
Ice Type: (Gel/Real/Other)							
Condition:	Good						

Cooler out of temp? (Y/N) Possible reason why:

If some coolers are in temp and some out, were green dot applied to out of temperature samples? Yes/No (NA)

Samples Inspection: Inspected by: MM : 10/6/17 @ 11:32

All Samples Intact? Yes X No ___ Comments:

Bottle Labels/COCs agree? Yes ___ No X Comments: D on JC-DU2-01-100317, JC-DU2-02-100317, JC-DU2-03-100317 labels read 10/2/17,

Containers/Volumes Received Appropriate for Analysis? Yes X No ___ Comments:

Do VOA Vials have Visible Headspace? Yes ___ No ___ NA X

Comments

Water Samples: pH Checked and Appropriate (except VOAs): Yes ___ No ___ NA X

Comments:

Additional Information: 3 MM 10/6 LOC reads 10/3/17, D on JC-DU6-A-100417; read JC-DU3-B-100417 labels read 10/3/17, LOC read 10/4/17

Labeled by: Witness: Cooler Inspected by: See Project Contact Form: Y

MM (8) JS

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

ANALYTICAL REPORT FOR SAMPLES

SAMPLE INFORMATION

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
JC-DU2-01-100317-RSM-SS-DUP	A7J0162-06	Sediment	10/03/17 11:25	10/05/17 12:19
JC-DU2-01-100317-RSM-W-DUP	A7J0162-33	Sediment	10/03/17 11:25	10/05/17 12:19
JC-DU1-B-100317-RSM-SS-DUP	A7J0162-34	Sediment	10/03/17 14:00	10/05/17 12:19
JC-DU1-B-100317-RSM-W-DUP	A7J0162-35	Sediment	10/03/17 14:00	10/05/17 12:19

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

ANALYTICAL CASE NARRATIVE

Work Order: A7J0162

Landau Associates
Project: PCC LPC-RSM
Apex Laboratories LLC Work Order: A7J0162 – RSM Process QC Duplicates
Case Narrative:

This report contains the results for additional Quality Control duplicate samples that were prepared to test the precision of sediment processing following Apex Lab SOP G-105 Representative Subsampling Method (RSM). Historic digestion/extraction of methods simply remove a discrete 1 gram for metals and 10 grams for organics from the container to test. This has led to high variability in sample results, often due to sample sorting, segregation and random nuggets of contamination. The RSM uses a significantly larger subsample that is processed to reduce these fundamental sampling errors.

All samples were prepared as follows for the production of primary result:

All Decision Unit (DU) samples, both ISM and discrete samples, were processed following the RSM. The field samples are designated in the report "As Received". The "As Received" samples were air dried at standard temperature and atmospheric pressure. The drying process kills soil bacteria, halting the potential bio-degradation and chemical alteration that may occur in wet soils. The RSM process creates a sample of uniform particles of 50 to 60-micron diameter. Particle comminution significantly reduces fundamental sampling error. Grinding was completed on two separate fractions of the DU sample due to the suite of metals requested and interfering alloys present in either stainless steel or tungsten mills. The wear metals associated with a tungsten ring and puck mill are cobalt and tungsten. These interfere with the analyses of trace levels of cobalt and mercury in samples. Cobalt and mercury results were obtained from samples ground with a stainless-steel (SS) ring and puck mill. PCBs were also analyzed from the stainless-steel grind. All other metals were reported from sample ground in a tungsten (W) ring and puck mill. The reporting convention for data processed by RSM is to record field sample name followed by the extension -RSM-SS for stainless steel processing or -RSM-W for tungsten processing.

Additional Laboratory QC Duplicate preparation:

The SOP does not require that the entire DU sample is ground, but a representative subsample is processed. This subsample is generated following the Japanese 2-Dimensional Slab Cake technique using 50+ increments. The subsample size is approximately 250-300 grams. This is approach allows labs to conduct multiple grinds to ensure the grinder material is compatible for all elements and compounds being analyzed. Standard laboratory QC is performed on replicates of the primary grind.

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

ANALYTICAL CASE NARRATIVE

Work Order: A7J0162

This report contains the results from two additional Japanese 2-Dimensional Slab Cake subsamples prepared from JC-DU2-01 and JC-DU1-B bulk dried and mixed sample. Samples were selected at random. These QC subsamples were generated to test the relative percent difference between 250-300-gram aliquots of dried and mixed sediment. This testing is not required by the SW-846 methods 8082 or 6020. The batch QC required by the method are included in the full analytical report. These processing duplicates, can be used to estimate precision of laboratory sample processing and the variability of the specific sample.

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

ANALYTICAL SAMPLE RESULTS

Polychlorinated Biphenyls by EPA 8082A

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-01-100317-RSM-SS-DUP (A7J0162-06RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.39	ug/kg dry	1	10/23/17 16:57	EPA 8082A	
Aroclor 1221	ND	---	9.39	"	"	"	"	
Aroclor 1232	ND	---	19.7	"	"	"	"	R-02
Aroclor 1242	ND	---	9.39	"	"	"	"	
Aroclor 1248	ND	---	9.39	"	"	"	"	
Aroclor 1254	**32.5**	---	9.39	"	"	"	"	P-10
Aroclor 1260	**88.3**	---	9.39	"	"	"	"	P-10
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 96 %*	*Limits: 72-126 %*	"	"	"	
JC-DU1-B-100317-RSM-SS-DUP (A7J0162-34RE1)			**Matrix: Sediment**		**Batch: 7101020**			**C-07**
Aroclor 1016	ND	---	9.88	ug/kg dry	1	10/23/17 18:46	EPA 8082A	
Aroclor 1221	ND	---	9.88	"	"	"	"	
Aroclor 1232	ND	---	9.88	"	"	"	"	
Aroclor 1242	**58.4**	---	9.88	"	"	"	"	P-10
Aroclor 1248	ND	---	9.88	"	"	"	"	
Aroclor 1254	**67.3**	---	9.88	"	"	"	"	P-10
Aroclor 1260	**15.0**	---	9.88	"	"	"	"	P-10
Surrogate: Decachlorobiphenyl (Surr)			*Recovery: 76 %*	*Limits: 72-126 %*	"	"	"	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-01-100317-RSM-SS-DUP (A7J0162-06)			**Matrix: Sediment**					
Batch: 7100999								
Cobalt	**9.29**	---	0.490	mg/kg dry	5	10/24/17 14:26	EPA 6020A	
Mercury	ND	---	0.0392	"	"	"	"	
JC-DU2-01-100317-RSM-W-DUP (A7J0162-33RE1)			**Matrix: Sediment**					
Batch: 7101088								
Antimony	ND	---	0.502	mg/kg dry	5	10/24/17 18:26	EPA 6020A	
Arsenic	**1.60**	---	1.00	"	"	"	"	
Beryllium	**0.236**	---	0.100	"	"	"	"	
Cadmium	ND	---	0.502	"	"	"	"	
Chromium	**10.2**	---	1.00	"	"	"	"	
Copper	**27.7**	---	2.01	"	"	"	"	
Lead	**12.9**	---	0.502	"	"	"	"	
Nickel	**23.3**	---	1.00	"	"	"	"	
Selenium	ND	---	1.00	"	"	"	"	
Silver	ND	---	0.502	"	"	"	"	
Thallium	ND	---	0.502	"	"	"	"	
Zinc	**101**	---	2.01	"	"	"	"	
JC-DU1-B-100317-RSM-SS-DUP (A7J0162-34RE1)			**Matrix: Sediment**					
Batch: 7101088								
Cobalt	**9.85**	---	0.500	mg/kg dry	5	10/24/17 18:29	EPA 6020A	
Mercury	**0.0480**	---	0.0400	"	"	"	"	
JC-DU1-B-100317-RSM-W-DUP (A7J0162-35RE1)			**Matrix: Sediment**					
Batch: 7101088								
Antimony	ND	---	0.495	mg/kg dry	5	10/24/17 18:33	EPA 6020A	
Arsenic	**2.13**	---	0.989	"	"	"	"	
Beryllium	**0.430**	---	0.0989	"	"	"	"	
Cadmium	ND	---	0.495	"	"	"	"	
Chromium	**19.0**	---	0.989	"	"	"	"	
Copper	**48.7**	---	1.98	"	"	"	"	
Lead	**24.4**	---	0.495	"	"	"	"	
Nickel	**19.8**	---	0.989	"	"	"	"	
Silver	ND	---	0.495	"	"	"	"	
Thallium	ND	---	0.495	"	"	"	"	
Zinc	**149**	---	1.98	"	"	"	"	
JC-DU1-B-100317-RSM-W-DUP (A7J0162-35RE2)			**Matrix: Sediment**					

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa A Domenighini

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

ANALYTICAL SAMPLE RESULTS

Total Metals by EPA 6020 (ICPMS)

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU1-B-100317-RSM-W-DUP (A7J0162-35RE2)			**Matrix: Sediment**					
Batch: 7101088								
Selenium	ND	---	0.989	mg/kg dry	5	10/25/17 16:06	EPA 6020A	B-02

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

ANALYTICAL SAMPLE RESULTS

Percent Dry Weight

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
JC-DU2-01-100317-RSM-SS-DUP (A7J0162-06)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**99.0**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU2-01-100317-RSM-W-DUP (A7J0162-33)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**99.1**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU1-B-100317-RSM-SS-DUP (A7J0162-34)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.7**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	
JC-DU1-B-100317-RSM-W-DUP (A7J0162-35)			**Matrix: Sediment**		**Batch: 7100940**			
% Solids	**97.8**	---	1.00	% by Weight	1	10/20/17 08:22	EPA 8000C	

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

SAMPLE PREPARATION INFORMATION

Polychlorinated Biphenyls by EPA 8082A

Prep: EPA 3546

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 7101020							
A7J0162-06RE1	Sediment	EPA 8082A	10/03/17 11:25	10/20/17 15:51	10.75g/5mL	10g/5mL	0.93
A7J0162-34RE1	Sediment	EPA 8082A	10/03/17 14:00	10/20/17 15:51	10.36g/5mL	10g/5mL	0.97

Total Metals by EPA 6020 (ICPMS)

Prep: EPA 3051A

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 7100999							
A7J0162-06	Sediment	EPA 6020A	10/03/17 11:25	10/20/17 11:47	0.515g/50mL	0.5g/50mL	0.97
Batch: 7101088							
A7J0162-33RE1	Sediment	EPA 6020A	10/03/17 11:25	10/24/17 10:30	0.502g/50mL	0.5g/50mL	1.00
A7J0162-34RE1	Sediment	EPA 6020A	10/03/17 14:00	10/24/17 10:30	0.512g/50mL	0.5g/50mL	0.98
A7J0162-35RE1	Sediment	EPA 6020A	10/03/17 14:00	10/24/17 10:30	0.517g/50mL	0.5g/50mL	0.97
A7J0162-35RE2	Sediment	EPA 6020A	10/03/17 14:00	10/24/17 10:30	0.517g/50mL	0.5g/50mL	0.97

Percent Dry Weight

Prep: Total Solids (Dry Weight)

Lab Number	Matrix	Method	Sampled	Prepared	Sample Initial/Final	Default Initial/Final	RL Prep Factor
Batch: 7100940							
A7J0162-06	Sediment	EPA 8000C	10/03/17 11:25	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-33	Sediment	EPA 8000C	10/03/17 11:25	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-34	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA
A7J0162-35	Sediment	EPA 8000C	10/03/17 14:00	10/19/17 09:25	1N/A/1N/A	1N/A/1N/A	NA

Apex Laboratories

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lisa Domenighini, Client Services Manager

Apex Labs

AMENDED REPORT

12232 S.W. Garden Place
Tigard, OR 97223
503-718-2323 Phone
503-718-0333 Fax

Landau Associates	Project: **PCC LPC-RSM**	
1500 SW First Avenue Suite 1015	Project Number: 883002	**Reported:**
Portland, OR 97201	Project Manager: Colette Gaona	11/29/17 08:26

Notes and Definitions

Qualifiers:

B-02	Analyte detected in an associated blank at a level between one-half the MRL and the MRL. (See Notes and Conventions below.)
C-07	Extract has undergone Sulfuric Acid Cleanup by EPA 3665A, Sulfur Cleanup by EPA 3660B, and Florisil Cleanup by EPA 3620B in order to minimize matrix interference.
P-10	Result estimated due to the presence of multiple PCB Aroclors and/or matrix interference.
R-02	The Reporting Limit for this analyte has been raised to account for interference from coeluting organic compounds present in the sample.

Notes and Conventions:

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis. Results listed as 'wet' or without 'dry'designation are not dry weight corrected.
RPD	Relative Percent Difference
MDL	If MDL is not listed, data has been evaluated to the Method Reporting Limit only.
WMSC	Water Miscible Solvent Correction has been applied to Results and MRLs for volatiles soil samples per EPA 8000C.
Batch QC	Unless specifically requested, this report contains only results for Batch QC derived from client samples included in this report. All analyses were performed with the appropriate Batch QC (including Sample Duplicates, Matrix Spikes and/or Matrix Spike Duplicates) in order to meet or exceed method and regulatory requirements. Any exceptions to this will be qualified in this report. Complete Batch QC results are available upon request. In cases where there is insufficient sample provided for Sample Duplicates and/or Matrix Spikes, a Lab Control Sample Duplicate (LCS Dup) is analyzed to demonstrate accuracy and precision of the extraction and analysis.
Blank Policy	Apex assesses blank data for potential high bias down to a level equal to ½ the method reporting limit (MRL), except for conventional chemistry and HCID analyses which are assessed only to the MRL. Sample results flagged with a B or B-02 qualifier are potentially biased high if they are less than ten times the level found in the blank for inorganic analyses or less than five times the level found in the blank for organic analyses. For accurate comparison of volatile results to the level found in the blank; water sample results should be divided by the dilution factor, and soil sample results should be divided by 1/50 of the sample dilution to account for the sample prep factor. Results qualified as reported below the MRL may include a potential high bias if associated with a B or B-02 qualified blank. B and B-02 qualifications are not applied to J qualified results reported below the MRL.
---	QC results are not applicable. For example, % Recoveries for Blanks and Duplicates, % RPD for Blanks, Blank Spikes and Matrix Spikes, etc.
***	Used to indicate a possible discrepancy with the Sample and Sample Duplicate results when the %RPD is not available. In this case, either the Sample or the Sample Duplicate has a reportable result for this analyte, while the other is Non Detect (ND).

Technical Memorandum

TO: Colette Gaona, Project Manager

FROM: Kristi Schultz and Danielle Jorgensen

DATE: January 19, 2018

RE: **PCC Structurals, Inc. Large Parts Campus**
2017 Sediment Incremental and Discrete Sampling
Laboratory Data Quality Evaluation

This technical memorandum provides the results of a focused data validation associated with 10 sediment samples collected on October 3-4, 2017 at the PCC Structurals (PCC) Large Parts Campus (LPC) in Portland, Oregon. Samples were analyzed by Apex Laboratories (Apex), located in Tigard, Oregon. This data quality evaluation covers Apex data package A7J0162. Samples submitted to Apex were analyzed for polychlorinated biphenyls ([PCBs], U.S. Environmental Protection Agency [EPA] Method SW-846 8082), total metals (EPA Method SW-846 6020A), and percent dry weight (EPA 8000C). A summary of field sample identification (ID), sample collection date, laboratory sample ID, and requested analyses is provided in Table 1.

The verification and validation check was conducted with guidance from applicable portions of EPA's *National Functional Guidelines for Organic Data Review* (EPA 2016a) and the *National Functional Guidelines for Inorganic Data Review* (EPA 2016b). Landau Associates, Inc. (LAI) performed an EPA-equivalent Level IIA verification and validation check on each laboratory data package, which included the following:

- Verification that the laboratory data package contained all necessary documentation (including chain-of-custody (COC) records; identification of samples received by the laboratory; date and time of receipt of the samples at the laboratory; sample conditions upon receipt at the laboratory; date and time of sample analysis; explanation of any significant corrective actions taken by the laboratory during the analytical process; and, if applicable, date of extraction, definition of laboratory data qualifiers, all sample-related quality control data, and quality control acceptance criteria).
- Verification that all requested analyses, special cleanups, and special handling methods were performed.
- Evaluation of sample holding times.
- Evaluation of quality control data compared to acceptance criteria, including method blanks, surrogate recoveries, matrix spike results, laboratory duplicate and/or replicate results, and laboratory control sample results.
- Evaluation of overall data quality and completeness of analytical data.

Data validation qualifiers are added to the sample results, as appropriate, based on the verification and validation check. The absence of a data qualifier indicates that the reported result

is acceptable without qualification. The data quality evaluation is summarized below. Data qualifiers are summarized in Table 2.

Laboratory Analytical Process Background

Per the lab data package case narrative, samples were processed following laboratory standard operating procedure for Representative Subsampling Methodology (RSM). Field samples were designated "As Received."

Following the drying of the samples (which created samples with uniform sized particles), samples were ground in two separate fractions due to the requested analytical suite of metals. The metals associated with a tungsten ring and puck mill are cobalt and tungsten, which interfere with analysis for cobalt and mercury (two of the requested metals). To account for the possible interference, a second grind was completed using a stainless-steel ring and puck mill, and was subsequently used for the cobalt, mercury, and PCB analyses. Ground samples were differentiated by the lab with an appended suffix of "RSM-SS" for stainless steel processing or "RSM-W" for tungsten processing.

The laboratory also provided additional quality control replicate sample results that tested the precision of the RSM preparation method. The RSM SOP does not require an entire sample to be ground, but rather to process a representative subsample. The additional quality control replicate samples were processed by grinding a larger sample volume and subsequently subsampling the required sample size for analysis. The replicate results were provided as an accompaniment to the method-required quality control sample results, and provide additional information on the precision of the laboratory sample processing and the matrix variability of the collected samples.

Data qualifier reason codes, when determined necessary, also provided information on whether or not replicates were prepared using the same preparation methodology or differing methodology.

Chain-of-Custody Records

A signed COC record was attached to the data packages. The laboratory received all samples in good condition, and all analyses were performed as requested. No special cleanups or handling methods were requested, except as noted above. Upon receipt by Apex, the sample container information was compared to the associated COC and the cooler temperatures were recorded. The coolers were received with temperatures within the EPA-recommended limit of ≤6°C. No qualification of the data was necessary.

Holding Times

For all analyses and all samples, the time between sample collection, extraction (if applicable), and analysis was determined to be within EPA- and project-specified holding times. No qualification of the data was necessary.

Blank Results

Laboratory Method Blanks

At least one method blank was analyzed with each batch of samples for analysis as required by the analytical method. Target analytes were not detected at concentrations greater than the reporting limits in the associated method blanks. No qualification of the data was necessary.

Laboratory Grind Blanks

Two laboratory grind blanks were prepared by the laboratory for total metals analysis with the sample batches. Target analytes were not detected at concentrations greater than the reporting limits in the associated grind blanks. No qualification of the data was necessary.

Surrogate Recoveries

Appropriate compounds were used as surrogate spikes for the organics analyses. Recovery values for the surrogate spikes were within the current laboratory-specified control limits for all project samples. No qualification of the data was necessary.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Replicate/Triplicate Results

At least one MS and/or laboratory replicate and/or triplicate sample were analyzed with the PCB, total metals, and dry weight analyses. The recovery values for each required spiking compound and/or the relative percent differences (RPDs) between the laboratory replicate results were within the current project-specified and/or laboratory-specified control limits for all project samples, with the following exceptions:

- The laboratory replicate RPD for Aroclor 1260 associated with the PCB analysis of sample JC-DU2-01-100317-RSM-SS exceeded the laboratory-specified control limit. The associated sample result was qualified as estimated (UJ), as indicated in Table 2. The laboratory replicate was prepared using the non-method-prescribed methodology described above.
- The laboratory replicate RPD for Aroclor 1254 associated with the PCB analysis of sample JC-DU1-B-100317-RSM-SS exceeded the laboratory-specified control limit. The associated sample result was qualified as estimated (J), as indicated in Table 2. The laboratory replicate was prepared using the non-method-prescribed methodology described above.

- The MS recoveries for chromium, nickel, and zinc associated with the total metals analysis of sample JC-DU2-100317-RSM-SS were less than the laboratory-specified control limit. Results for these metals were not reported from this specific sample (they were reported from the sample processed with the tungsten mill); therefore, no qualification of the data was necessary.
- The MS recovery for cobalt associated with the total metals analysis of sample JC-DU2-100317-RSM-W was less than the laboratory-specified control limit. Results for cobalt were not reported from this specific sample (it was reported from the sample processed with the stainless-steel mill); therefore, no qualification of the data is necessary.
- The MS recovery for lead associated with the total metals analysis of sample JC-DU2-100317-RSM-W was less than the laboratory-specified control limit. The associated sample result was qualified as estimated (J, UJ), as indicated in Table 2.
- The MS recovery for zinc associated with the total metals analysis of sample JC-DU2-100317-RSM-W was less than the laboratory-specified control limit. The original sample concentration was greater than four times the spike concentration; therefore, no qualification of the data was necessary.
- The MS recovery for zinc associated with the total metals analysis of sample JC-DU3-A-100417-RSM-W was less than the laboratory-specified control limit. The original sample concentration was greater than four times the spike concentration; therefore, no qualification of the data was necessary.
- The laboratory replicate RPD for lead associated with the total metals analysis of sample JC-DU2-01-100317-RSM-W exceeded the laboratory-specified control limit. The associated sample result was qualified as estimated (J), as indicated in Table 2. The laboratory replicate was prepared using the non-method-prescribed methodology described above.
- The laboratory replicate RPD for copper associated with the total metals analysis of sample JC-DU1-B-100317-RSM-W exceeded the laboratory-specified control limit. The associated sample result was qualified as estimated (J), as indicated in Table 2. The laboratory replicate was prepared using the non-method-prescribed methodology described above.

Laboratory Control Sample and Laboratory Control Sample Duplicate (LCS/LCSD) Results

At least one laboratory control sample and/or laboratory control sample duplicate (LCS/LCSD) was analyzed with each batch of samples as required by the analytical method. Recoveries and RPDs for the laboratory control samples and associated duplicates were within the current laboratory-specified control limits. No qualification of the data was necessary.

Field Triplicate Results

Two pairs of field triplicate samples (JC-DU1-100317/JC-DU1-A-100317/JC-DU1-B-100317 and JC-DU3-100417/JC-DU3-A-100417/JC-DU3-B-100417) were submitted for analysis with data package A7J0162.

A project-specified control limit of 20 percent was used to evaluate the relative standard deviations (RSDs) between the triplicate samples except when the sample results were within five times the reporting limit. In these cases, a project-specified control limit of plus or minus two times the reporting limit was used. RSDs for the triplicate sample pairs submitted for analysis were within the project-specified control limits, with the following exceptions:

- The RSD for Aroclor 1242 associated with the PCB analysis of field triplicate samples JC-DU1-100317/JC-DU1-A-100317/JC-DU1-B-100317 exceeded the project-specified control limit. The associated sample results were qualified as estimated (J), as indicated in Table 2. The triplicates were prepared using the method-prescribed methodology described above.
- The RSDs for Aroclors 1242 and 1254 associated with the PCB analysis of field triplicate samples JC-DU3-100417/JC-DU3-A-100417/JC-DU3-B-100417 exceeded the project-specified control limit. The associated sample results were qualified as estimated (J), as indicated in Table 2. The triplicates were prepared using the method-prescribed methodology described above.
- The RSD for mercury associated with the total metals analysis of field triplicate samples JC-DU1-100317/JC-DU1-A-100317/JC-DU1-B-100317 exceeded the project-specified control limit. The associated sample results were qualified as estimated (J), as indicated in Table 2. The triplicates were prepared using the method-prescribed methodology described above.
- The RSDs for mercury and nickel associated with the total metals analysis of field triplicate samples JC-DU3-100417/JC-DU3-A-100417/JC-DU3-B-100417 exceeded the project-specified control limit. The associated sample results were qualified as estimated (J), as indicated in Table 2. The triplicates were prepared using the method-prescribed methodology described above.

Quantitation Limits

Project-specified quantitation limits were met for all samples except for instances where dilution was performed due to the presence of high level target species or sample matrix interference. The laboratory noted reporting limits for Aroclor 1232 were raised to account for co-elution.

Audit/Corrective Action Records

No audits were performed or required. No corrective action records were generated for these sample batches. Based on the laboratory's case narratives, continuing calibration verification (CCV) recovery results were within laboratory-specified control limits, with the following exceptions:

- The laboratory flagged several sample detections of Aroclors 1242, 1254, and 1260 as estimated due to the presence of multiple Aroclors or possible matrix interference. The associated sample results were qualified as estimated (J), as indicated in Table 2.

Completeness and Overall Data Quality

The completeness for this data set is 100 percent, which meets the project-specified goal of 90 percent minimum.

Data precision was evaluated through laboratory duplicates and triplicates, and field triplicates. Data accuracy was evaluated through laboratory control samples, matrix spikes, and surrogate spikes. No data were rejected.

LANDAU ASSOCIATES, INC.

Kristi Schultz
Data Specialist

Danille Jorgensen
Environmental Data Manager

DRJ/kes
[P:\883\002\FILERM\T\040\DATA\DATA VALIDATION REPORTS\ISM 2017 SEDIMENT\PCC LPC ISM 2017 SEDIMENT TM.DOCX]

References

EPA. 2016a. National Functional Guidelines for Inorganic Superfund Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

EPA. 2016b. National Functional Guidelines for Organic Superfund Methods Data Review. edited by Office of Superfund Remediation and Technology Innovation (OSRTI). Washington, DC: US Environmental Protection Agency.

Table 1
Sample Summary and Requested Analyses
PCC Structurals Large Parts Campus

Sample Location	Sample ID	Sample Date	Lab Sample ID	Total Metals by EPA 6020A	Percent Dry Weight by EPA 8000C	PCBs by EPA 8082A
JC-DU1	JC-DU1-100317-RSM-SS	10/3/2017	A7J0162-14	X	X	X
JC-DU1	JC-DU1-100317-RSM-W	10/3/2017	A7J0162-15	X	X	
JC-DU2	JC-DU2-100317-RSM-SS	10/3/2017	A7J0162-02	X	X	X
JC-DU2	JC-DU2-100317-RSM-W	10/3/2017	A7J0162-03	X	X	
JC-DU2-01	JC-DU2-01-100317-RSM-SS	10/3/2017	A7J0162-05	X	X	X
JC-DU2-01	JC-DU2-01-100317-RSM-W	10/3/2017	A7J0162-32	X	X	
JC-DU2-02	JC-DU2-02-100317-RSM-SS	10/3/2017	A7J0162-08	X	X	X
JC-DU2-02	JC-DU2-02-100317-RSM-W	10/3/2017	A7J0162-09	X	X	
JC-DU2-03	JC-DU2-03-100317-RSM-SS	10/3/2017	A7J0162-11	X	X	X
JC-DU2-03	JC-DU2-03-100317-RSM-W	10/4/2017	A7J0162-12	X	X	
JC-DU3	JC-DU3-100417-RSM-SS	10/4/2017	A7J0162-24	X	X	X
JC-DU3	JC-DU3-100417-RSM-W	10/4/2017	A7J0162-25	X	X	

Table 2
Summary of Data Qualifiers
PCC Structurals Large Parts Campus

Data Package	Analyte	Result	Qualifier	Sample Number	Reason
A7J0162	Aroclor 1254	27.1	J	JC-DU2-01-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference.
A7J0162	Aroclor 1242	14.6	J	JC-DU2-03-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference.
A7J0162	Aroclor 1254	29.4	J	JC-DU2-03-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference.
A7J0162	Aroclor 1242	24.9	J	JC-DU1-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1254	17.1	J	JC-DU1-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference.
A7J0162	Aroclor 1242	40.3	J	JC-DU1-A-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1254	18	J	JC-DU1-A-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference.
A7J0162	Aroclor 1242	46.5	J	JC-DU1-B-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1254	17.1	J	JC-DU1-B-100317-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, RPD between parent and laboratory duplicate exceeds control limit, High RPD/RSD among duplicate/triplicate samples prepared by different lab preparation processes.
A7J0162	Aroclor 1242	93.8	J	JC-DU3-100417-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1254	36.1	J	JC-DU3-100417-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1242	44.8	J	JC-DU3-A-100417-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.

Table 2
Summary of Data Qualifiers
PCC Structurals Large Parts Campus

Data Package	Analyte	Result	Qualifier	Sample Number	Reason
A7J0162	Aroclor 1254	46.2	J	JC-DU3-A-100417-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1260	12.4	J	JC-DU3-A-100417-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference.
A7J0162	Aroclor 1242	33.9	J	JC-DU3-B-100417-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1254	31.3	J	JC-DU3-B-100417-RSM-SS	Laboratory indicates concentration is considered estimated due to possible matrix interference, High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Aroclor 1260	9.75 U	UJ	JC-DU2-01-100317-RSM-SS	RPD between parent and laboratory duplicate exceeds control limit, High RPD/RSD among duplicate/triplicate samples prepared by different lab preparation processes.
A7J0162	Mercury	0.0657	J	JC-DU1-100317-RSM-SS	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Mercury	0.0451	J	JC-DU1-A-100317-RSM-SS	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Mercury	0.056	J	JC-DU1-B-100317-RSM-SS	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Nickel	34.8	J	JC-DU3-100417-RSM-W	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Nickel	49.8	J	JC-DU3-A-100417-RSM-W	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Nickel	35.9	J	JC-DU3-B-100417-RSM-W	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Mercury	0.0398 U	UJ	JC-DU3-100417-RSM-SS	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.

Table 2
Summary of Data Qualifiers
PCC Structurals Large Parts Campus

Data Package	Analyte	Result	Qualifier	Sample Number	Reason
A7J0162	Mercury	0.0476	J	JC-DU3-A-100417-RSM-SS	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Mercury	0.0406 U	UJ	JC-DU3-B-100417-RSM-SS	High relative standard deviation among incremental field triplicate samples, High RPD/RSD among duplicate/triplicate samples prepared by the same lab preparation processes.
A7J0162	Lead	24.3	J	JC-DU2-01-100317-RSM-W	RPD between parent and laboratory duplicate exceeds control limit, High RPD/RSD among duplicate/triplicate samples prepared by different lab preparation processes.
A7J0162	Copper	27.6	J	JC-DU1-B-100317-RSM-W	RPD between parent and laboratory duplicate exceeds control limit, High RPD/RSD among duplicate/triplicate samples prepared by different lab preparation processes.
A7J0162	Lead	20.7	J	JC-DU2-100317-RSM-W	Low matrix spike recovery

U = The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.
UJ = The analyte was not detected in the sample; the reported sample reporting limit is an estimate.