Cleanup Report
Lake Chelan School District Ball Fields
Chelan, Washington

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Prepared for

Lake Chelan School District
Chelan, Washington

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1.0 INTRODUCTION

This report documents the final cleanup of soil contamination at the Lake Chelan School District (school district) Ball Fields site in Chelan, Washington. Site characterization and soil cleanup conducted was consistent with the Model Toxics Control Act (MTCA) Washington Administrative Code (WAC) 173-340 in consultation with staff at the Washington Department of Ecology (Ecology) Central Regional Office. The occurrence of arsenic and lead at the project area is assumed to be associated with the project area's historical use as orchards that existed prior to the late 1940s when lead arsenate was used extensively to control pests. Guidance from Ecology's Area-Wide Lead and Arsenic Soil Contamination Project Task Force was used in evaluating and choosing a cleanup remedy for the project area as outlined in the *Revised Cleanup Action Plan, Lake Chelan School District Ball Fields* (Landau Associates 2010). The location of the project area is shown on Figure 1.

1.1 PROJECT BACKGROUND

The project area is located north of the State Route (SR) 97 and SR 150 interchange in Section 18, Township 27 N, Range 23 East. The school district constructed ball fields on three parcels that total approximately 30.64 acres as part of the Apple Blossom Center development. Parcel 1 (#272318627022) is 3.25 acres; parcel 2 (#272318627027) is 15.09 acres; parcel 3 (#272318627020) is 12.3 acres. The total project area is estimated to be 29.6 acres. This total includes the area of all three parcels excluding a small eastern portion of parcel 2, where Apple Blossom Road bisects the project area. The project area can be subdivided into two areas; the North Fields and the South Fields. The North Fields area is located north of Apple Blossom Drive in a higher elevation portion of the project area. The South Fields area is located south of Apple Blossom Drive in a lower elevation area. The project area with the remedial actions and site improvements is shown on Figure 2.

Prior to the site improvements, the project area consisted of vacant land in an area historically used for orchards. Lead arsenate was a commonly used pesticide on apple and pear orchards to control the codling moth between 1905 and 1947 (Landau Associates 2005). This pesticide is the primary source of lead and arsenic soil contamination found in former orchards throughout central and eastern Washington.

1.2 SITE CHARACTERIZATION

Landau Associates performed a site investigation in 2009 to evaluate the extent of lead and arsenic contamination within the project area. Characterization sampling was performed in general accordance with the *Lake Chelan School District #129 Ball Fields Site Characterization* draft work plan

(Landau Associates 2009) and results were summarized in the *Revised Cleanup Action Plan, Lake Chelan School District Ball Fields* (Landau Associates 2010).

Initial soil sampling was completed at the project area on November 10 and 11, 2009 and supplemental depth-profile sampling was completed on March 29, 2010 at the request of Ecology. A total of 139 soil samples were collected during these two sampling events from 67 locations to characterize the distribution lead and arsenic contamination. A near-surface sample [0 to 1 foot (ft) below ground surface (BGS)] was collected from each of the 67 sample locations to evaluate the horizontal distribution of lead and arsenic contamination. Eighteen locations were selected for depth-profile sampling where the most extensive soil cuts were planned to support site development. A total of 72 depth-profile samples were collected at 1-ft intervals ranging from ground surface to 7 ft BGS from these locations.

The majority of arsenic and lead concentrations in near-surface soil exceeded MTCA Method A cleanup levels throughout the site. Concentrations ranged from below detection levels (non-detect) to 296 milligrams per kilogram (mg/kg) for arsenic and non-detect to 1,540 mg/kg for lead. Groupings of higher or lower concentrations were not observed in any specific area of the site. Depth-profile results identified lead concentrations exceeding cleanup levels only to a depth of 1 ft BGS; however, arsenic exceedances consistently extended to 2 ft BGS. Arsenic concentrations exceeding the Method A cleanup level are intermittent below 2 ft BGS and continue to decline with depth.

Soil remedial actions were conducted as part of site improvements in the summer of 2010. Site improvements included the construction of five new ball fields and two parking lots in the project area. Remedial actions included a combination of contaminated soil removal, capping, institutional controls, and educational programs. This report provides documentation of those remedial actions.

2.0 CLEANUP ACTION FRAMEWORK

This section presents the cleanup levels, sampling approach, and analytical methods and quality control. Sampling approach and analytical methods and quality control were performed in accordance with the methods described in the sampling analysis plan (Ecology 2010) developed for the project area, which is provided in Appendix A for reference.

2.1 CLEANUP LEVELS

Ecology administers the MTCA regulation that establishes cleanup levels for metals in soil. MTCA Method A soil cleanup levels for unrestricted land uses (WAC 173-340-740) have been established for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. The project area meets the criteria for use of Method A cleanup levels. The MTCA Method A soil cleanup levels for unrestricted land uses for arsenic and lead are 20 mg/kg and 250 mg/kg, respectively.

Under the Toxics Cleanup Program, Ecology developed an Area-Wide Soil Contamination Task Force that identified steps to reduce exposure to soil contamination that is dispersed over large geographic areas, primarily lead and arsenic contamination, from historical sources such as metal smelters and arsenical pesticides. For land uses such as schools, childcare facilities, and residential areas, the Area-Wide Task Force identified contaminant concentration ranges that represent low, medium, and high levels of contamination. Concentrations less than 20 mg/kg for arsenic and 250 mg/kg for lead are considered low. The medium concentration range is 20 to 100 mg/kg for arsenic and 250 to 700 mg/kg for lead; high ranges are arsenic concentrations greater than 100 mg/kg and lead concentrations greater than 700 mg/kg (Area-Wide Task Force 2003).

2.2 SAMPLING APPROACH

Soil sampling consisted of field screening and confirmation sampling. Field screening was conducted during grading activities in the South Fields to identify areas where additional soil removal was needed to reach the low concentration range for lead and arsenic. Confirmation sampling was performed after the final grading activities were completed in the North and South Fields areas. Confirmation sampling for the South Fields area was conducted on June 29 and July 2, 2010 and on July 14, 2010 for the North Fields area.

2.2.1 SAMPLE LOCATIONS

A 100-ft sampling grid was defined to provide geographic coverage of the project area. There were a total of 86 sample locations: 30 in the North Field area and 56 in the South Field area. Sample locations were identified in the field using a hand-held Trimble® global positioning system (GPS) unit. Field screening was conducted in each of the 56 sampling locations during soil removal activities in the South Fields to identify areas where additional soil removal was needed to reach acceptable lead and arsenic concentrations. Additional field screening was conducted on all imported topsoil and fill material for use on the North Fields. Final confirmation samples for MTCA compliance were then collected from each sample location in the South Fields area when all grading activities were complete. These final confirmation results are presented on Table 1 and shown on Figures 3 and 4. Final confirmation sampling was conducted in the North Fields area after filling and grading activities were completed to identify areas where capping would be required. These confirmation results are presented on Table 2 and shown on Figures 3 and 4. Field screening results for the imported fill material are presented on Table 3.

All field screening and confirmation sampling were performed by the Okanogan County Public Health Department (Health Department) under supervision by Ecology. Both the field screening and confirmation sampling used the same sampling procedure to determine lead and arsenic concentrations in soil as described below.

2.2.2 SAMPLE COLLECTION METHODOLOGY

The top 1 inch of soil was scraped from the sample location to prevent contamination from wind-blown fines or site equipment. The sample location was excavated to a depth of 2 to 6 inches with a steel shovel. Soil samples were collected using a stainless-steel trowel and placed in a stainless-steel bowl. Care was taken to prevent fines from blowing away. Large rocks and organic debris can reduce the accuracy of the soil analysis; therefore, this material was removed using clean nitrile gloves. The sample from the entire depth interval was homogenized and excess soil was discarded back into the hole. Samples were then placed in Ziploc® bags or laboratory-supplied containers. The shovel, trowel and bowl were thoroughly decontaminated before each use by an Alconox® wash and scrub followed by a deionized water rinse. Sample locations were recorded in the field using a hand-held Trimble GPS unit.

Sample information was recorded in a field notebook by the Health Department for each sampling location: site and sample identification, sampling team members, weather conditions, date, soil description, and other pertinent site observations. Information regarding sample interval, sampling utensils and decontamination procedures, and sample containers were also recorded.

2.2.3 SAMPLING NOMENCLATURE

Unique sampling codes were assigned to identify all soil samples. The sampling code format consists of the following elements:

- Sample type: CS = confirmation sample
- Sample location: N = North Fields area, S = South Fields area
- Sample number: sequential numbers corresponding to the relative sample grid location
- Sample number appendage: at locations where more than one sample was collected from a grid point (e.g., sequential depths), the additional samples were identified with a letter in alphabetical order.
- An example sample number is CSS129B (confirmation sample from the South Fields area, grid number 129, second confirmation sample at this location).

Fill material sample identification codes were assigned to identify the source of the material. This consisted of a location designator and a sample identification number:

- Sample location: BRW = borrow pit
- Sample number: Each sample was numbered sequentially
- An example sample number is BRW01 (confirmation sample from the borrow pit).

2.2.4 SAMPLE HANDLING PROCEDURES

Transportation and handling of the samples were conducted in a manner to protect the integrity of the sample. Samples were packaged carefully and placed in coolers containing ice. All samples to be sent for laboratory analysis were inventoried and logged on a chain-of-custody (COC) form which accompanied the samples. The COCs were placed inside the sample coolers and custody seals were placed on the coolers. The COCs were signed and dated by all appropriate persons.

2.3 ANALYTICAL METHODS AND DATA QUALITY

All field screening and confirmation samples were analyzed for lead and arsenic by X-ray fluorescence (XRF). Quality assurance and quality control were conducted to verify the accuracy and reliability of the of the confirmation sample results. XRF analytical methods and data quality procedures are described below.

2.3.1 ANALYTICAL METHODS

X-ray fluorescence was conducted using a hand held XRF device, Innov-X Systems model α-4000S, by Health Department staff at a designated location near the project area. Soil samples to be

analyzed by the XRF device were placed in a labeled Ziploc bag and stored in a cooler containing double-bagged ice until ready for analysis.

Reporting limits for XRF vary based on soil moisture content, sample homogeneity, and particle size. Actual detection levels determined during soil analysis varied for each sample and ranged from 7 to 12 mg/kg. These detection levels are below the MTCA Method A cleanup levels for unrestricted land uses, which are 20 mg/kg and 250 mg/kg for arsenic and lead, respectively. Prior to the soil analysis, the XRF was standardized and calibrated. Additional standardization was conducted after each batch of approximately 20 samples was analyzed.

Quality Assurance Quality Control samples of approximately 10 percent of the total soil samples collected were submitted for laboratory analysis at Cascade Analytical, Inc. of Wenatchee, Washington. Soil samples to be analyzed by the laboratory were placed in laboratory supplied container (paper bag with plastic liner) and shipped in a cooler with double-bagged ice under proper COC procedures. Samples were analyzed for lead and arsenic using Environmental Protection Agency Method 6010. Maximum laboratory reporting limits for soil are 2.5 mg/kg for arsenic and 2.5 mg/kg for lead.

2.3.2 QUALITY ASSURANCE/QUALITY CONTROL SAMPLE RESULTS

The laboratory duplicate results were compared to the XRF results to evaluate the accuracy of the XRF confirmation samples, and whether or not this accuracy would impact the cleanup evaluation. Ten duplicate samples were collected for the South Fields area and three duplicate samples were collected for the North Fields area, approximately 10 percent of the total samples collected for each area. Laboratory duplicate results for the South Fields area are provided in Table 4 and in Table 5 for the North Fields area. Original laboratory data is presented in Appendix B.

For the South Fields area, all arsenic laboratory duplicate results were lower than the XRF results (difference ranging from 1 to 10 mg/kg). This indicates that the actual arsenic levels in the South Fields area may be slightly lower than what was reported through XRF sampling. Lead confirmation samples in the South Fields area were consistently below the MTCA Method A cleanup level for both the XRF and laboratory duplicates. The difference between results obtained by XRF analysis and laboratory methods is not considered substantial enough to affect the cleanup evaluation.

For the North Fields area, both the laboratory results and the XRF results placed the three arsenic samples in the high range and the same three lead results into the high, medium, and low range. The differences between the XRF and laboratory results were greater (ranging from 8 to 55 mg/kg for arsenic and 14 to 158 mg/kg for lead) than those observed in the South Fields results. However, due to the high concentrations present for both contaminants in the North Fields area, the variability in concentrations reported by the two methods is not substantial enough to affect the cleanup evaluation.

3.0 CLEANUP ACTIONS

This section presents the cleanup actions taken to address lead and arsenic soil contamination in the project area. The cleanup action evaluation and the cleanup plan for the project area is discussed in the *Revised Cleanup Action Plan, Lake Chelan School District Ball Fields* (Landau Associates 2010).

3.1 MODEL TOXICS CONTROL ACT COMPLIANCE

MTCA allows various approaches to comply with cleanup standards and provides a hierarchy for selecting cleanup technologies [WAC 173-340-360(4)]. More permanent technologies (such as soil removal) are preferred over less permanent technologies (such as capping). However, either approach may result in an acceptable cleanup action, provided the risk posed by the site is reduced to an acceptable level. The Area-Wide Soil Contamination Task Force (2003) identified six categories of protective measures or cleanup actions applicable to area-wide contamination: contamination reduction, physical barriers, education programs, land use and institutional controls, and individual protective measures.

The cleanup approach used at the site included a combination of these protective measures (Landau Associates 2010). Different actions were taken for those areas of the site to which public access was unrestricted (such as the ball fields and parking areas) and those portions of the site that were not considered public access areas (such as areas with no land improvements and exposed contaminated soils). Remedial actions completed for the project area during the construction phase of the ball fields during the summer/fall of 2010 are described in the following sections.

3.2 UNRESTRITED SITE ACCESS AREAS

Site areas with unrestricted public access include the ball fields and parking areas. The contaminated soil from the South Fields area was excavated and used as fill in the North Fields area and capped to prevent exposure to the contamination. This process consolidated the contamination into one area (North Fields) for easier capping procedures and ongoing site maintenance.

3.2.1 SOUTH FIELDS AREA CONSTRUCTION

A baseball field, utility field, softball field, parking lot, and stormwater pond were construction in the South Fields area. A paved road connects Apple Blossom Drive to the parking lot area. Figure 2 shows the location of the South Fields area and constructed site features.

Grading plans for the South Fields area required soils on the site to be cut (with excess cut material to be removed from the South Fields area) to meet the desired grade for the parking lot, ball fields, and stormwater pond. Based on the results from the depth profiling conducted during the site

characterization (summarized in Section 1.2) it was decided to remove contaminated soils (i.e., excess cut soils) from the South Fields area to a depth at which lead and arsenic concentrations were within the low concentration range. The removal of contaminated soils allows full use of the South Fields area without additional land use restrictions or safety measures.

3.2.1.1 South Fields Area Cleanup

During construction activities, all excess cut material generated from the South Fields was placed on the North Field area to be used as fill material. The amount of soil to be removed was determined by field screening conducted by the Health Department as described in Section 2.2 of this report. Soil removal continued in the South Fields area until the field screening results within the identified sample locations were within the low concentration range for lead and arsenic. This required nearly 6 feet of soil removal in some areas (Torrence Engineering 2010). The final grading was completed using the native soils remaining in the South Fields after the contaminated soils were removed from the site. The elevation of the South Fields ball fields was adjusted to accommodate the larger than anticipated volume of soil removed. Once grading activities were completed in the South Fields, confirmation samples were collected from the exposed native soils at the 56 sampling locations in the South Fields area by the Health Department. Final confirmation results are presented on Table 1 and sampling locations with sample results are shown on Figures 3 and 4 for lead and arsenic, respectively.

3.2.1.2 South Fields Area Model Toxics Control Act Compliance

WAC 173-340-740(7) outlines the compliance requirements for unrestricted land use soil cleanup standards. It requires that data analysis methods use the true mean soil concentration to evaluate compliance when the cleanup levels are based on chronic or carcinogenic threats (as is the case with lead and arsenic).

All data used for the determination of compliance must meet specific requirements. No single sample concentration shall be greater than two times the soil cleanup level and less than 10 percent of the sample concentrations shall exceed the soil cleanup level. All of the 56 confirmation samples for lead were below the 250 mg/kg MTCA Method A cleanup level. Five of the 56 samples (8.9 percent) exceeded the 20 mg/kg MTCA cleanup level for arsenic. None of the sample results were greater than two times the soil cleanup level for arsenic (40 mg/kg) or for lead (500 mg/kg). Therefore, the confirmation data for lead and arsenic meet MTCA data analysis requirements.

The statistical methods outlined in WAC 173-340-740(7) include estimating an upper 95 percent confidence limit (UCL95) for the mean value of the chemicals of concern and comparing the UCL95 to the soil cleanup for each chemical. Due to the high occurrence of non-detect (censored) values, an

alternative approach was used to calculate the UCL95 based on an estimated percentile that corresponds to the sample mean. This method is outlined in a memorandum prepared by Landau Associates (1996). The calculated arsenic UCL95 is 13 mg/kg (Appendix C), which demonstrates statistical compliance with the 20 mg/kg cleanup level for arsenic in the South Fields area. The UCL 95 was not calculated for lead as the maximum detection concentration for lead (136 mg/kg) is below the cleanup level of 250 mg/kg which demonstrates compliance. Table 6 provides a summary of the statistics for the South Fields area.

3.2.2 NORTH FIELDS AREA CONSTRUCTION

The North Fields area is located to the north of Apple Blossom Drive. A soccer field, practice field, and gravel parking lot were constructed in the North Fields area. A gravel road connects Apple Blossom Drive to the gravel parking lot. Figure 2 shows the location of the North Fields area and constructed site features.

Grading plans for the North Fields area required the use of fill material to meet the desired grade for the parking lot and ball fields. All of the contaminated soil was removed from the South Fields area and used as fill for the North Fields area, effectively consolidating contamination in one part of the site. There was no removal of contaminated soils from the North Fields area, and all of the native contaminated soils were left in place or graded on the North Fields area as part of construction. The final grade of the North Fields area was adjusted to accommodate all of the contaminated soils from the South Fields area. Thirty confirmation samples were collected from the North Fields area after all grading activities were completed. These confirmation samples indicated that most of the North Fields area still contained arsenic concentrations within the high range. Based on these results, Ecology and representatives of the Chelan School District determined that the entire North Fields unrestricted access area would be capped to form a physical barrier. Final confirmation results are presented on Table 2 and sampling locations with sample results are shown on Figures 3 and 4 for lead and arsenic, respectively.

3.2.2.1 North Fields Area Capping

Due to the anticipation of high rates of use as play fields, geotextile fabric and 8 inches of clean soil were used to cap the contaminated soils, rather than using easily erodible grass cover. The geotextile fabric also acts as a marker for maintenance personnel, providing a clear distinction between clean and contaminated soils. Capping operations were monitored and documented by Larry Hibbard, of Hibbard Architecture & Planning, and supervised by Ecology site manager, Laura Klasner.

After reaching final grade in the unrestricted access area, geotextile fabric was placed in strips directly over the contaminated soil. Edges of the geotextile fabric strips were laid with a minimum 12-inch overlap by at least 12 inches and secured with metal staples 6 to 8 inches apart. After securing

several geotextile fabric strips, they were covered with 8 inches of clean fill material. Grade stakes were used throughout the North Fields area to ensure that the required depth of clean fill was met. All geotextile fabric and clean fill was brought on site through the areas already capped to prevent the cross-contamination of clean soils by heavy equipment moving through contaminated soils. The irrigation system was installed over the contaminated soils but under the geotextile fabric and clean soil. The irrigation risers were extended through the geotextile fabric. Photographs of the capping operations in the North Fields area are provided in Appendix D.

Clean fill material for the cap came from Tunnel Hill Gravel borrow pit. Six soil samples collected from the Tunnel Hill Gravel fill material were tested for lead and arsenic using the sampling field method described in Section 2.2.2. All sample results were below instrumentation detection level for lead and arsenic with the exception of one sample that contained lead concentrations of 13 mg/kg, which is well below the 250 mg/kg MTCA Method A cleanup level for lead. Sample results for the fill material are presented in Table 5.

The parking lot and road was constructed along the eastern edge of the geotextile fabric and clean soil cap on the North Fields area. The road and parking lot were constructed by placing 12 inches of crushed gravel over the contaminated soils. The geotextile fabric crosses over beneath the gravel in a 12-inch swath along the border between the two different cap types.

3.2.2.2 North Fields Area Model Toxics Control Act Compliance

Compliance sampling indicated that the concentrations of arsenic were in the high range and lead was in the low to high range throughout the North Fields public access area. The Area-Wide Soil Contamination Task Force identifies the installation of physical barriers as a protective measure to limit exposure to contaminated soils. The caps within the project area were constructed in a manner consistent with the recommendations made by the Area-Wide Soil Contamination Task Force as an effective action to protect human health.

3.3 NON-PUBLIC AREAS

The non-public area consists of the slope along the northern and eastern boundary of the North Fields area. Concentrations of lead and arsenic were detected in the moderate to high ranges in the exposed surface soils in the non-public area (Landau Associates 2010). No land improvements, soil disposal, grading activities, or cleanup were conducted within the non-public area, therefore, these exposed contaminated soils remain *in situ*.

The Area-Wide Soil Contamination Task Force identifies fencing as a physical barrier method to prevent or limit unauthorized access to a property containing contaminated soils. This method was

proposed in the cleanup action plan for the project area to restrict the public from entering the non-public area while using the ball fields (Landau Associates 2010).

A 6-ft chain-link fence was positioned between the unrestricted site access area and the non-public access area, as this area has steep topography and general unsuitability as the exposed soils still contain lead and arsenic concentrations in the high range. Additionally, warning signs will be placed along the chain-link fence to inform the public of the presence of lead and arsenic contamination and to not enter the fenced-off areas. An example of the warning signs is provided in Appendix E.

3.4 INSTITUTIONAL CONTROLS

Institutional controls have been implemented at the site due to remaining lead and arsenic contamination with concentrations above MTCA Method A cleanup levels. These controls include an environmental covenant (covenant) to restrict subsurface excavation and the incorporation of safety information into the Chelan School District's Facility and Grounds Maintenance Plans for the ball fields.

The covenant identifies the contamination on the project area, and places land use restrictions (for the school district and future successors) on activities which may interfere with the integrity of the remedial actions (e.g., digging activities, which may damage the cap). The covenant also states that no conveyance of title, easement, lease, or other interest in the project area may occur without adequate and complete provision for continued monitoring, operation, and maintenance of the remedial actions. The covenant was not finalized at the time of this draft cleanup report, but a draft copy of the covenant is provided in Appendix F.

The Chelan School District's Facility and Grounds Maintenance Plans will be updated to include operation and maintenance for the remedial actions (such as the cap and gravel road and parking lot) and health and safety measures to protect workers conducting maintenance on the ball fields in the North Fields area. Operation and maintenance procedures will include contaminated soil handling for utility and irrigation system repair below the cap, lawn aeration procedures, and sign installation notifying the public that digging is not permitted (Appendix E). Health and safety measures will include personal protective measures for workers directly handling soils contaminated with lead and arsenic. The updates to the Chelan School District's Facility and Grounds Maintenance Plans were not completed at the time of this draft cleanup report.

3.5 REMAINING CLEANUP ACTIVITIES

Remaining activities to complete the cleanup action (as outlined in the Revised Cleanup Action Plan) include:

- Placing signs along the fencing within the North Fields area as an educational program to inform users of the ball fields of the presence of contamination and methods to reduce exposure to the contamination
- Placing institutional controls on the project area in the form of an environmental covenant to place land use restrictions on the site and provide for ongoing maintenance of cleanup measures
- Incorporate health and safety measures into the Chelan School District's Facility and Grounds Maintenance Plans for the ball fields to limit or reduce exposure of contaminants by maintenance personnel.

4.0 FINDINGS AND CONCLUSIONS

A combination of protective measures was used at the project area to remediate lead and arsenic in the soil at concentrations exceeding MTCA Method A cleanup levels for unrestricted land use. The remedial actions conducted at the project area during construction of the ball fields in 2010 include the removal of contaminated soil from the South Fields area, consolidation and capping of contaminated soils in the North Fields area, and placing fencing to restrict access between the unrestricted site access area and non-public areas with exposed contaminated soils in the North Fields area. Remedial actions to be completed prior to public use of the ball fields include placing signage to educate the public of contamination remaining on site, formalizing an environmental covenant to place land use restrictions and require ongoing maintenance on the project area, and incorporating health and safety measures into the Chelan School District's Facility and Grounds Maintenance Plans for the ball fields. The results of the completed cleanup activities are as follows:

- Contaminated soil was removed from the South Fields area until soil testing indicated that lead and arsenic concentrations were within the low range (below MTCA Method A cleanup levels for unrestricted land use). Soil confirmation samples collected at the South Fields after the soil removal and grading activities were completed demonstrate that the soil removal was effective in achieving compliance with the MTCA Method A cleanup level (250 mg/kg).
- All contaminated soil removed from the South Fields area was consolidated in the North Fields area. Confirmation samples collected after filling and grading operations were completed in the North Fields indicated that the surface soils still contained arsenic concentrations within the high range (greater than 40 mg/kg). All of the North Fields unrestricted site access area was capped to create an effective physical barrier between the contaminated soils and the public.
- No cleanup or construction activities were conducted on the slope along the northern and eastern boundary of the North Fields. This area is considered to be a non-public area as the steep topography and general unsuitability of the exposed soils still contain lead and arsenic concentrations in the high range. A 6-ft high chain-link fence was placed between the unrestricted access areas on the North Fields and the non-public area to restrict the public from entering this non-public area while using the ball fields. Warning signs will be placed along the chain-link fence as an educational measure to inform the public of the remaining presence of lead and arsenic contamination and identify this as a restricted area. These measures serve to restrict public access to this non-public area containing contaminated soils.
- Chelan School District's Facility and Grounds Maintenance Plans will be updated to include operation and maintenance for the remedial actions and health and safety measures to protect workers conducting maintenance on the ball fields located on the North Fields area.
- A covenant was prepared for the project area to put in place, land use restrictions applicable to current and future owners. The covenant restricts activities that may interfere with the integrity of the remedial actions and states that no conveyance of title, easement, lease, or other interest in the project area may occur without adequate and complete provision for continued monitoring, operation, and maintenance of the remedial actions.

Based on the confirmation sampling data collected, the physical barriers installed, and institutional controls implemented to maintain the integrity of the physical barriers, the remedial action is considered complete.

5.0 USE OF THIS REPORT

This report has been prepared for the exclusive use of the Lake Chelan School District. No other parties are 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.

This document has been prepared under the supervision and direction of the following key staff.

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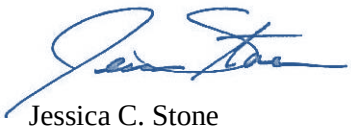

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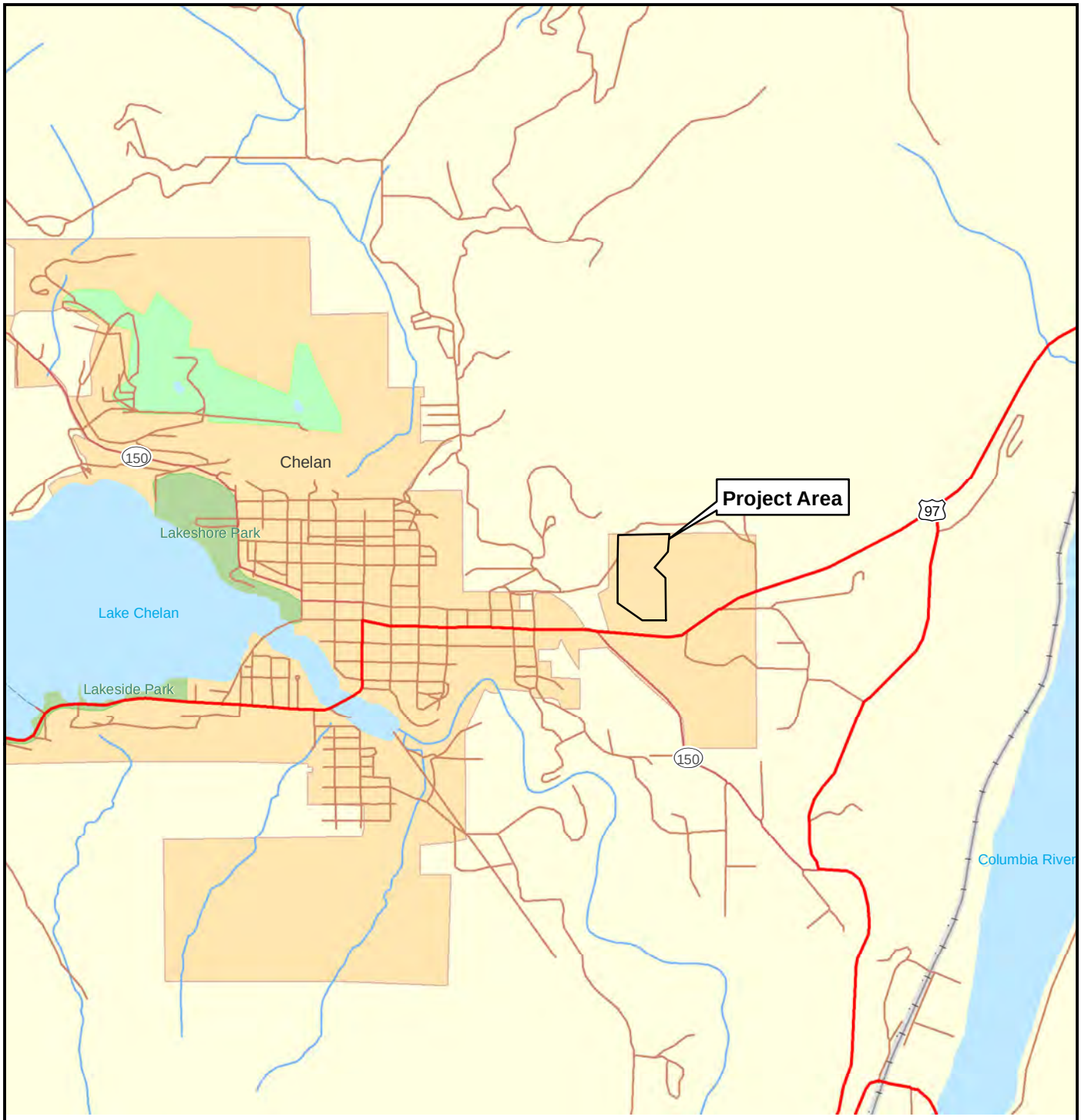
Torrence Engineering, LLC. 2010. Memorandum to: Deanne Reynolds and Dan Baker, City of Chelan Public Works. From: John Torrence. Re: Chelan School District Ballfields – Site Grading and Lighting. June 21.



N

0 0.5 1

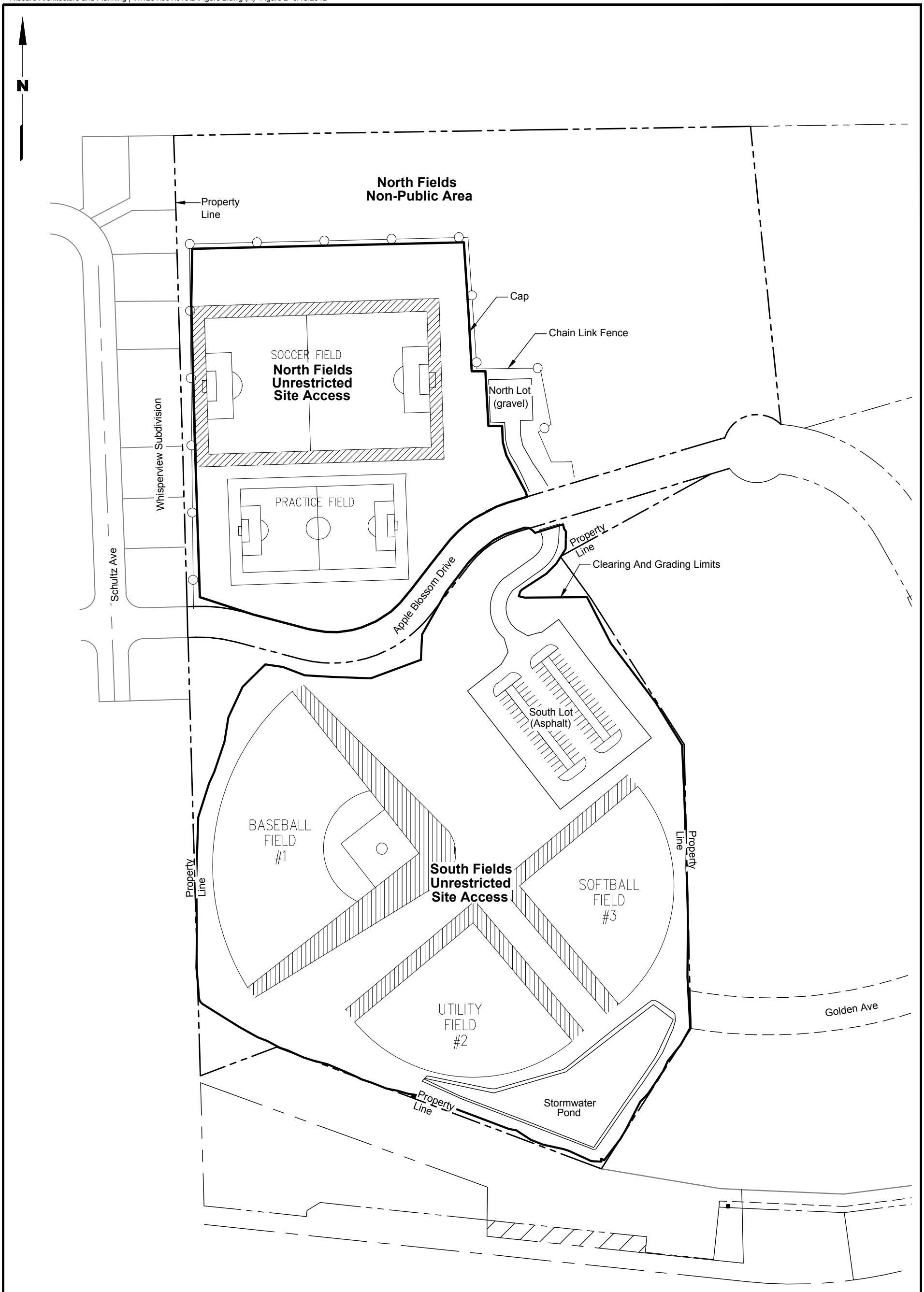
Miles

Data Source: ESRI 2008

Y:\Projects\1201001\MapDocs\Fig1.mxd 5/2/2012

LANDAU ASSOCIATES

Lake Chelan School District Ball Fields Chelan, Washington	**Vicinity Map**	Figure 1



Note

The cap boundary has not been surveyed.
The cap boundary shown in this figure is an approximation based on site features.

Base map source: Hibbard Architecture and Planning, 2009

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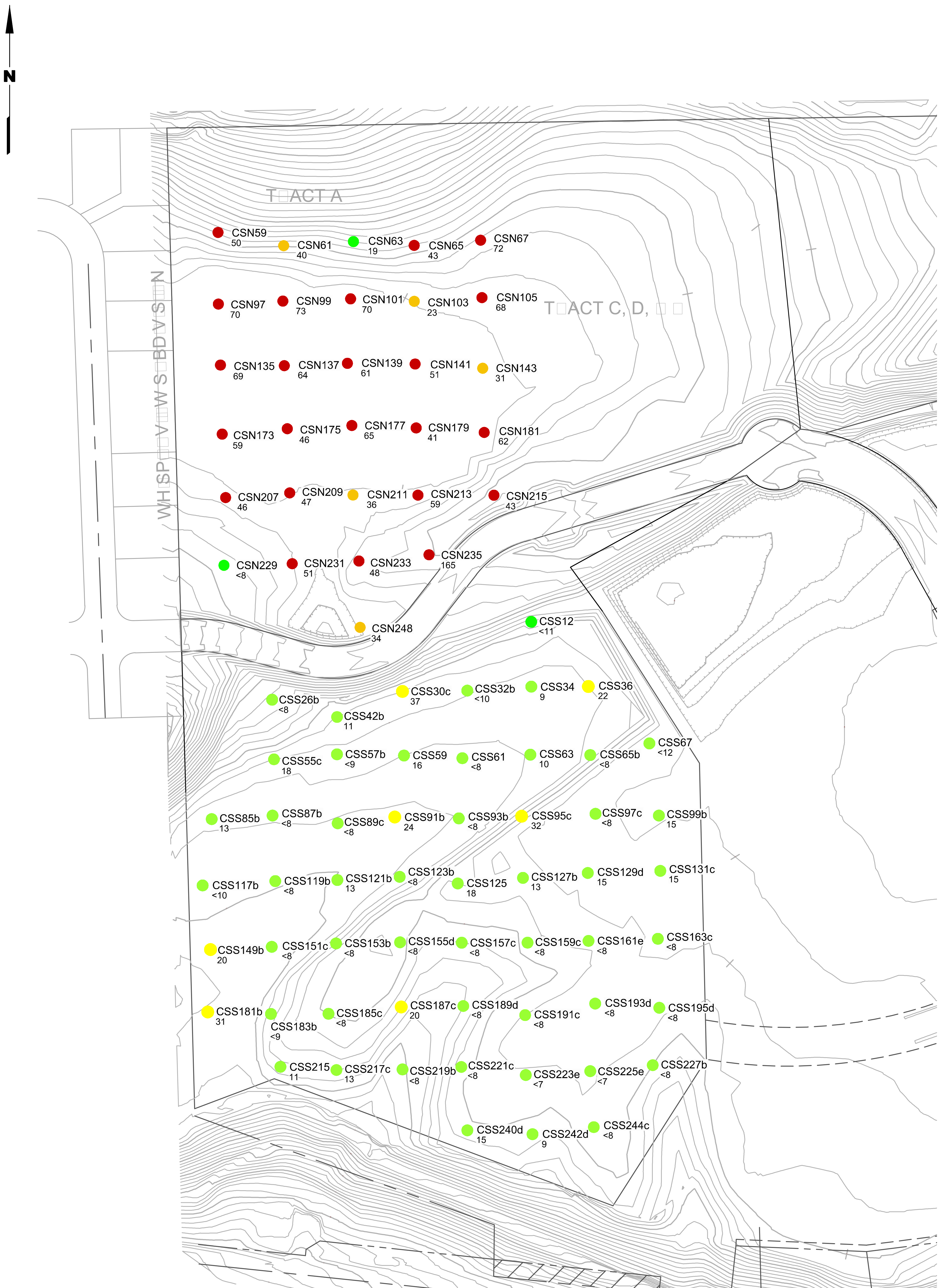
0 150 300
Scale in Feet

Lake Chelan School District
Ball Fields
Chelan, Washington

Site Plan

Figure
2



Legend

CSS215 Confirmation Sample Location and Designation
11 Arsenic Concentration (mg/kg)

Arsenic Concentration Less Than 20 mg/kg

Arsenic Concentration Between 20 and □0 mg/kg

Arsenic Concentration Greater than □0 mg/kg

Base map source: Hibbard Architecture and Planning, 2009

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0 150 300
Scale in Feet

Lake Chelan School District
Ball Fields
Chelan, Washington

Confirmation Soil Sampling Results (Arsenic; 0-1 Ft BGS)

Figure 3

Legend

- CSS215 23 — Confirmation Sample Location and Designation; Lead Concentration (mg/kg)
- Lead Concentration Less Than 250 mg/kg
- Lead Concentration Between 250 and 500 mg/kg
- Lead Concentration Greater than 500 mg/kg

0 150 300
Scale in Feet

Base map source: Hibbard Architecture and Planning, 2009

LANDAU ASSOCIATES

Lake Chelan School District Ball Fields Chelan, Washington	**Confirmation Soil Sampling Results (Lead; 0-1 ft BGS)**	Figure 4

TABLE 1
SOUTH FIELD CONFIRMATION SAMPLE RESULTS
LAKE CHELAN SCHOOL DISTRICT BALL FIELDS
LAKE CHELAN, WASHINGTON

Sample ID	Date	Depth (Inches)	XRF Results	
			As (mg/kg)	Pb (mg/kg)
CSS12	7/2/2010	4	<11	45
CSS26b	7/2/2010	4	<8	15
CSS30c	7/2/2010	4	37	136
CSS32b	7/2/2010	4	<10	24
CSS34	7/2/2010	2	9	<10
CSS36	7/2/2010	4	22	38
CSS42b	7/2/2010	6	11	17
CSS55c	7/2/2010	4	18	12
CSS57b	7/2/2010	4	<9	<11
CSS59	7/2/2010	4	16	<11
CSS61	7/2/2010	2	<8	<11
CSS63	7/2/2010	4	10	<11
CSS65b	7/2/2010	2	<8	<10
CSS67	7/2/2010	4	<12	51
CSS85b	7/2/2010	4	13	20
CSS87b	7/2/2010	4	<8	<10
CSS89c	7/2/2010	2	<8	<10
CSS91b	7/2/2010	2	24	13
CSS93b	7/2/2010	4	<8	<10
CSS95c	7/2/2010	4	32	84
CSS97c	7/2/2010	4	<8	<10
CSS99b	7/2/2010	6	15	51
CSS117b	6/29/2010	4	<10	20
CSS119b	6/29/2010	2	<8	<10
CSS121b	6/29/2010	4	13	36
CSS123b	6/29/2010	4	<8	<11
CSS125	6/29/2010	4	18	17
CSS127b	6/29/2010	4	13	15
CSS129d	6/29/2010	4	15	17
CSS131c	6/29/2010	4	15	37
CSS149b	6/29/2010	4	20	43
CSS151c	6/29/2010	6	<8	<10
CSS153b	6/29/2010	4	<8	11
CSS155d	6/29/2010	4	<8	<10
CSS157c	6/29/2010	4	<8	<10
CSS159c	6/29/2010	6	<8	<10
CSS161e	6/29/2010	4	<8	<10
CSS163c	6/29/2010	4	<8	<9
CSS181b	6/29/2010	4	31	59
CSS183b	6/29/2010	2	<9	12
CSS185c	6/29/2010	4	<8	<10
CSS187c	6/29/2010	4	20	<10
CSS189d	6/29/2010	4	<8	<10
CSS191c	6/29/2010	6	<8	<10
CSS193d	6/29/2010	2	<8	12
CSS195d	6/29/2010	6	<8	<10

TABLE 1
SOUTH FIELD CONFIRMATION SAMPLE RESULTS
LAKE CHELAN SCHOOL DISTRICT BALL FIELDS
LAKE CHELAN, WASHINGTON

Sample ID	Date	Depth (Inches)	XRF Results As (mg/kg)	XRF Results Pb (mg/kg)
CSS215	6/29/2010	4	11	23
CSS217c	6/29/2010	4	13	17
CSS219b	6/29/2010	4	<8	<10
CSS221c	6/29/2010	4	<8	<10
CSS223e	6/29/2010	4	<7	<10
CSS225e	6/29/2010	2	<7	<9
CSS227b	6/29/2010	4	<8	<10
CSS240d	6/29/2010	4	15	15
CSS242d	6/29/2010	2	9	<10
CSS244C	6/29/2010	6	<8	14

XRF = X-ray fluorescence
As = arsenic
Pb = lead
mg/kg = milligrams per kilogram

TABLE 2
NORTH FIELD CONFIRMATION SAMPLE RESULTS
LAKE CHELAN SCHOOL DISTRICT BALL FIELDS
LAKE CHELAN, WASHINGTON

Sample ID	Date	Depth (Inches)	XRF Results As (mg/kg)	XRF Results Pb (mg/kg)
CSN59	7/14/2010	4	50	47
CSN61	7/14/2010	4	40	54
CSN63	7/14/2010	4	19	82
CSN65	7/14/2010	6	43	99
CSN67	7/14/2010	4	72	423
CSN105	7/14/2010	4	68	309
CSN103	7/14/2010	4	23	75
CSN101	7/14/2010	4	70	261
CSN99	7/14/2010	4	73	181
CSN97	7/14/2010	4	70	301
CSN135	7/14/2010	4	69	212
CSN137	7/14/2010	4	64	152
CSN139	7/14/2010	4	61	182
CSN141	7/14/2010	3	51	129
CSN143	7/14/2010	2	31	22
CSN181	7/14/2010	2	62	222
CSN179	7/14/2010	6	41	62
CSN177	7/14/2010	4	65	197
CSN175	7/14/2010	6	46	31
CSN173	7/14/2010	2	59	237
CSN207	7/14/2010	3	46	225
CSN209	7/14/2010	3	47	52
CSN211	7/14/2010	3	36	29
CSN213	7/14/2010	4	59	118
CSN233	7/14/2010	2	48	133
CSN231	7/14/2010	2	51	143
CSN229	7/14/2010	2	<8	<10
CSN215	7/14/2010	4	43	36
CSN235	7/14/2010	6	165	1248
CSN248	7/14/2010	4	34	125

XRF = X-ray fluorescence
As = arsenic
Pb = lead
mg/kg = milligrams per kilogram

TABLE 3
FILL MATERIAL SAMPLE RESULTS
LAKE CHELAN SCHOOL DISTRICT BALL FIELDS
LAKE CHELAN, WASHINGTON

Sample ID	Date	Depth (Inches)	XRF Results As (mg/kg)	XRF Results Pb (mg/kg)
BRW001	6/3/2010	6	<7	<10
BRW002	6/3/2010	6	<7	<10
BRW003	6/3/2010	6	<7	<10
BRW004	6/3/2010	6	<7	<10
BRW005	6/3/2010	6	<7	<10
BRW006	6/3/2010	6	<8	13

XRF = X-ray fluorescence
As = arsenic
Pb = lead
mg/kg = milligrams per kilogram

TABLE 4
SOUTH FIELD CONFIRMATION SAMPLES LABORATORY DUPLICATES
LAKE CHELAN SCHOOL DISTRICT BALL FIELDS
LAKE CHELAN, WASHINGTON

Field Samples	CSS181b Field Sample 6/29/2010	CSS240d Field Sample 6/29/2010	CSS149b Field Sample 6/29/2010	CSS131c Field Sample 6/29/2010	CSS36 Field Sample 7/2/2010	CSS30c Field Sample 7/2/2010
TOTAL METALS (mg/Kg)						
Aresenic (XRF)	31	15	20	15	22	37
Lead (XRF)	59	15	43	37	38	136

Laboratory Duplicate	CSS181d 10-E012711 6/29/2010	CSS240e 10-E012712 6/29/2010	CSS149d 10-E012713 6/29/2010	CSS131d 10-E012714 6/29/2010	CSS36c 10-E012715 7/2/2010	CSS30d 10-E012716 7/2/2010
TOTAL METALS (mg/Kg)						
Aresenic (Method SW846 6010)	30.35	11.55	13.65	11.90	12.45	28.05
Lead (Method SW846 6010)	65.0	17.0	31.4	24.2	30.4	128.0

XRF = X-ray fluorescence
mg/kg = milligrams per kilogram

TABLE 5
NORTH FIELD CONFIRMATION SAMPLES LABORATORY DUPLICATES
LAKE CHELAN SCHOOL DISTRICT BALL FIELDS
LAKE CHELAN, WASHINGTON

Field Samples	CSN235 Field Sample 7/14/2010	CSN135 Field Sample 7/14/2010	CSN97 Field Sample 7/14/2010
TOTAL METALS (mg/Kg)			
Aresenic (XRF)	165	69	70
Lead (XRF)	1248	212	301

Laboratory Duplicate	CSN235B 10-E014170 7/14/2010	CSN135B 10-E014169 7/14/2010	CSN97B 10-E014168 7/14/2010
TOTAL METALS (mg/Kg)			
Aresenic (Method SW846 6010)	109.5	61	81
Lead (Method SW846 6010)	1090	198	382

XRF = X-ray fluorescence
mg/kg = milligrams per kilogram

TABLE 6
SOUTH FIELDS SUMMARY STATISTICS
LAKE CHELAN SCHOOL DISTRICT BALL FIELDS
LAKE CHELAN, WASHINGTON

Chemical of Concern	Number of Samples	Frequency of Detection (mg/kg)	Maximum Detection (mg/kg)	UCL 95 (mg/kg)	CUL[a] (mg/kg)	Number of Samples Exceeding CUL	Frequency Exceeding CUL
Arsenic	56	41.0%	37	13	20	5	8.9%
Lead	56	48.2%	136	N/A [b]	250	0	0.0%

UCL = Upper 95 Percent ConfidenceLimit on the Arithmetic Mean
CUL = Clean-Up Level

Notes:
[a] MTCA Method A soil cleanup levels
[b] The UCL95 was not calculated because the maximum detected concentration is less thean the CUL

APPENDIX A

Ecology Confirmation Sampling Plan

Sampling and Analysis Plan (SAP)

Lake Chelan School District Ball Fields Development
Apple Blossom Drive
Chelan, Washington
Prepared by Laura Klasner, Dept. of Ecology, TCP-CRO
May 24, 2010

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DRAFT

1.0 INTRODUCTION

This sampling and analysis plan describes sampling design, sample collection procedures, analytical methods, and quality assurance measures for soil sampling at the Lake Chelan School District ball fields development.

Recent soil sampling by the Landau and Associates (Landau 2010) has indicated the presence of elevated levels of arsenic and lead in shallow soil at the Lake Chelan School District ball fields. The project is located on the east side of Chelan to the north of the intersection of Highways 97 and 150, on Apple Blossom Drive (Section 18, Township 27 N, Range 23 East). Figure 1 shows the location of the ball fields in relation to nearby features.

1.1 BACKGROUND

The ball fields are being constructed in an area historically used for orchards. Lead arsenate was commonly used a pesticide on apple and pear orchards to control the codling moth between the early 1900s and the late 1940s.

Currently the project area is vacant land. A section of a newly installed paved road, Apple Blossom Drive, runs east to west through the center of the project area. Fill for the road construction was obtained from the project area. All trees from an apparent former orchard have been removed, and the site consists of weedy herbaceous vegetation, a few shrubs, and sprouts growing from the remaining orchard root stock. The northern end of the project area is on a steep hillside with boulder outcrops at an elevation of 1,350 ft. The hillside flattens out through the North Fields area and then descends down to 1,280 ft in elevation in the South Fields area.

The proposed project will install ball fields for the Lake Chelan School District (LCSD) as part of the Apple Blossom Center development. The North Fields will include a soccer field, soccer practice field, and one stormwater pond. The South Fields will include a baseball field, utility field, softball field, parking lot and three stormwater ponds (see Figure 2 for the site plan). Contaminated soils will be kept on site and consolidated underneath the parking lot or covered with an engineered cap to prevent exposure to human health and the environment.

The improvements will require grading and fill throughout the project area. All fill material used to bring areas up to final grade will be obtained from the project area. The North Fields area is estimated to require a minimum of 18,235 cubic yards of fill for the soccer fields. Most of this will come from the 12,030 cubic yards of cut from the North Fields area; the remaining 6,205 cubic yards of fill will come from the South Fields area. Additional fill will be placed on the North Fields area as necessary to accommodate capping of contaminated soil. There will be no construction activities along the steep hillside at the far northern and northeastern end of the project area.

The South Fields area will be graded and will have an estimated total cut volume of 51,217 cubic yards and will require 33,980 cubic yards of fill. 6,205 cubic yards of the excess cut volume will be used for fill on the North Fields area to meet the minimum fill requirements of the grading plan. The remaining 11,032 cubic yards of excess cut material will be also be placed in the North Fields area. Additional cut volumes may be required to accommodate capping of contaminated soil. Cut and fill activities will be coordinated so that all excess fill will be placed on site, mainly in the North Fields area.

1.2 OBJECTIVES

The objective of soil sampling is to characterize arsenic and lead soil concentrations. Characterization results will be used to guide the cleanup and construction activities. The cleanup is being conducted address soil concentrations above the Model Toxics Cleanup Act (MTCA) risk-based cleanup levels.

2.0 SOIL SAMPLING DESIGN

Soil sampling will be divided into two phases: incoming fill sampling and graded ballfields confirmation sampling. The sampling design and rationale for each of these events is described below.

2.1 INCOMING TOPSOIL SAMPLING APPROACH

Once the clean topsoil source area(s) is identified, LCSD will submit laboratory analytical results to Ecology and Landau Associates. Additional sampling of the topsoil source area(s) should be conducted using the XRF to confirm that they are clean. The sampling approach for the source area(s) will be determined once more is known about the location, setting, and analytical results.

2.2 CONFIRMATION SAMPLING APPROACH

Confirmation sampling is designed to demonstrate clean soil conditions upon completion of grading within each area. Confirmation sampling will be conducted to determine if soils are in compliance with the cleanup levels. Additional or repeat sampling may be conducted on an as needed basis (ex. if areas are regraded, high organic/silty soil conditions, based on field observations, etc.). Ten percent of all samples should be submitted for laboratory analysis.

Initial sample locations are based on an approximately 100 ft grid. If sample results indicate that soil lead and/or arsenate concentrations are near the cleanup levels then sampling should be conducted on an approximately 50 ft grid in those areas. Figure 2 provides a sample 50 ft grid overlay. Additional or repeat sampling may be conducted on an as needed basis (ex. if areas are regraded, high organic/silty soil conditions, based on field observations, etc.). Sample locations will be measured and recorded in the field using a hand held global positioning system unit (GPS). Sample locations may be adjusted in the field to avoid sampling in steep slopes, ravines, or other areas that are inaccessible, unsafe, or where ground conditions are not conducive to sampling or are not representative of potentially mpacted soil. Care should be taken to prevent fines from blowing away; large rocks and organic debris were removed with

clean nitrile gloves as this material may reduce the accuracy of soil analysis. The sample from the entire depth interval should be homogenized and unwanted soil discarded back into the hole.

The sample numbering scheme for confirmation samples consists of the following:

- Sample type: CS = confirmation sample
- Sample number: sample number should correspond with grid number (Figure 3)
- If more than one sample is collected from each grid, indicate this with a letter (ex. the second sample from the same grid location would include the letter B in the sample name).
- An example sample number is CS01(B) (confirmation sample from grid cell number 01, second confirmation sample at this location).

3.0 SOIL SAMPLE COLLECTION PROCEDURES

Soil sampling methods are described in this section. Sample handling and documentation procedures are also described. Table 1 describes required sample containers.

3.1 FIELD PROCEDURES

Field sample collection forms should be used to record information for each sampling location. In addition to site location and sample identification information, the sampling team members, weather conditions, date, time, soil description, moisture content, and other pertinent site observations should be recorded. Information regarding sample interval, sampling utensils and decontamination procedures, and sample containers should also be recorded.

Soil samples will be collected using a core sampler or a shovel and stainless steel spoons. The equipment will be thoroughly decontaminated before each use by an Alconox wash and scrub followed by a deionized water rinse.

Samples will be placed in laboratory-supplied jars for analysis. Each sample collected will be properly labeled, identifying each sample by name/location, depth, date and time, and sampler's initials.

The soil sampling procedure for 1 to 6 inch samples is as follows:

1) Note location in field book and current site conditions; wash and decontaminate shovel as described above.
2) Scrape a minimum of the top 1 inch of soil from the sampling area to avoid tire ruts, etc. Use the core sampler or shovel to excavate to a depth of 6 inches. Use a ruler to estimate depth.
3) Place soil sample into sampling container until full, label as described above, and record necessary information on the sample collection log.
4) Decontaminate shovel as described above.
5) Restore sampling area with available hand tools. All soil will be placed back in the hole with no residual material being generated.

3.2 SAMPLE DOCUMENTATION AND HANDLING

This section describes sample transportation, documentation, and handling. Sample labeling and matrix coding is also described.

3.2.1 SAMPLE TRANSPORTATION AND HANDLING

The transportation and handling of samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of the soil samples. Samples will be placed on sealed, reusable ice packs or double-bagged ice in coolers following collection. At the end of each day, samples to be sent to the analytical laboratory will be inventoried.

A cooler will be used as a transport container. Samples will be packaged carefully using sufficient packing material to avoid breakage or contamination. The sample jars will be placed in the coolers containing ice and stored and transported at the proper temperature. Samples will be logged on a chain-of-custody (COC) form. A COC form will accompany all samples to the laboratory and will be signed and dated by all appropriate persons. The coolers will be shipped by laboratory contracted courier service.

3.2.2 SAMPLE CUSTODY AND DOCUMENTATION

The primary objective of sample custody is to create an accurate, written record that can be used to document the possession and handling of samples so that their quality and integrity can be maintained from collection until completion of all required analyses. Adequate sample custody will be achieved by means of approved field and analytical documentation. Such documentation consists of the chain-ofcustody record, which is initially completed by the sampler and is thereafter signed by those individuals who accept custody of the sample. A sample is in custody if at least one of the following is true:

- It is in someone's physical possession
- It is secured in a locked container or otherwise sealed so that tampering will be evident
- It is kept in a secured area, restricted to authorized personnel only.

Sample control and chain-of-custody in the field and during transportation to the laboratory will be conducted in general conformance with the procedures described below:

- As few persons as possible will handle samples.
- New or pre-cleaned sample bottles will be obtained from the laboratory performing the analyses.
- The sample collector will be personally responsible for the completion of the chain-of custody record and the care and custody of samples collected until they are transferred to another person or dispatched properly under chain-of-custody rules.

The coolers in which the samples are shipped will be accompanied by the chain-of-custody record identifying their contents. The original record and laboratory copy will accompany the shipment. The other copy will be kept for quality assurance purposes.

When samples are transferred, the individuals relinquishing and receiving the samples will sign the chain-of-custody form and record the date and time of transfer. A designated sample custodian at the laboratory will accept custody of the shipped samples, verify the integrity of the samples, and certify that the sample identification numbers match those on the chain-of-custody record. If containers arrive in a damaged condition or appear to have been tampered with, the laboratory will note this on the chain-of-custody record and will immediately notify Ecology's site manager, Laura Klasner.

Documentation necessary to meet the quality assurance (QA) objectives for this project includes the following:

- Field notebooks (logbooks), in which general field observations and activities are recorded
- Field sampling forms specific to sampling, chain-of-custody, etc.
- Handwritten field notes and GPS entries

4.0 ANALYTICAL METHODS

All samples will be analyzed using X-ray fluorescence (XRF) methodology. In addition, ten percent of all samples should be submitted for laboratory analysis.

4.1 Field XRF Analysis

All samples will be analyzed for lead and arsenic by XRF using a hand held XRF devise, Innov-X Systems model α-4000S, by Ecology Central Region, Yakima, Washington (Innov-X Systems 2006). Reporting limits for XRF vary based on soil moisture content, sample homogeneity, and particle size and tend to range from 7 to 13 ppm. These detection levels are below the MTCA Method A cleanup levels for unrestricted land uses which are 20 mg/kg and 250 mg/kg for arsenic and lead respectively. Prior to the soil analysis, the XRF should be standardized. Standard reference materials should be run on the XRF at the beginning and end of each sampling event. In addition, one SRM should after every 15-20 XRF sample runs. Duplicate samples of approximately 10% of the total XRF samples should be collected and submitted to the laboratory for analysis.

4.2 Laboratory Analysis

All samples will be analyzed for arsenic and lead by inductively coupled plasma-atomic emissions spectroscopy (ICP) [U.S. Environmental Protection Agency (EPA) Method 6010B]. Laboratory chemical analyses for arsenic and lead in soil will be conducted by Cascade Analytical, Inc. of Wenatchee, WA.

Maximum reporting limits for soil are 2.5 mg/kg for arsenic and 2.5 mg/kg for lead. The reporting limits listed are only goals because instances may arise where high sample

concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the desired reporting limits and associated quality control (QC) criteria. If this occurs, the laboratory will report the reason(s) for deviations from these reporting limits or noncompliance with QC criteria. Analytical methods, holding times, and reporting limits are listed below.

Analyses	Sample Container	Preservation	Holding Time
Soil Samples			
Lead	Lab supplied paper bag with plastic liner, or glass container	Cool, 4°C	6 months
Arsenic	Lab supplied paper bag with plastic liner, or glass container	Cool, 4°C	6 months

5.0 REPORTING

At the completion of daily activities described in this work plan, results will be provided to the Lake Chelan School District on a quick turnaround schedule. Results provided to the LCSD contractor and architect will be in the form of a shaded grid map. Shaded cells will indicate sample grid locations where soil concentrations exceed cleanup levels (20 mg/kg Arsenic and 250 mg/kg Lead). Numerical and grid map results will also be compiled sent to Ecology's site manager on a regular basis (ex. minimum of once per week). Landau Associates of Tacoma, WA, are expected to compile results into a cleanup summary report for arsenic and lead contaminated soil at the site.

6.0 REFERENCES

Landau Associates. 2010. *Revised Cleanup Action Plan Lake Chelan School District Ball Fields, Chelan, Washington*. May 6th.

Figure 1 – Vicinity Map

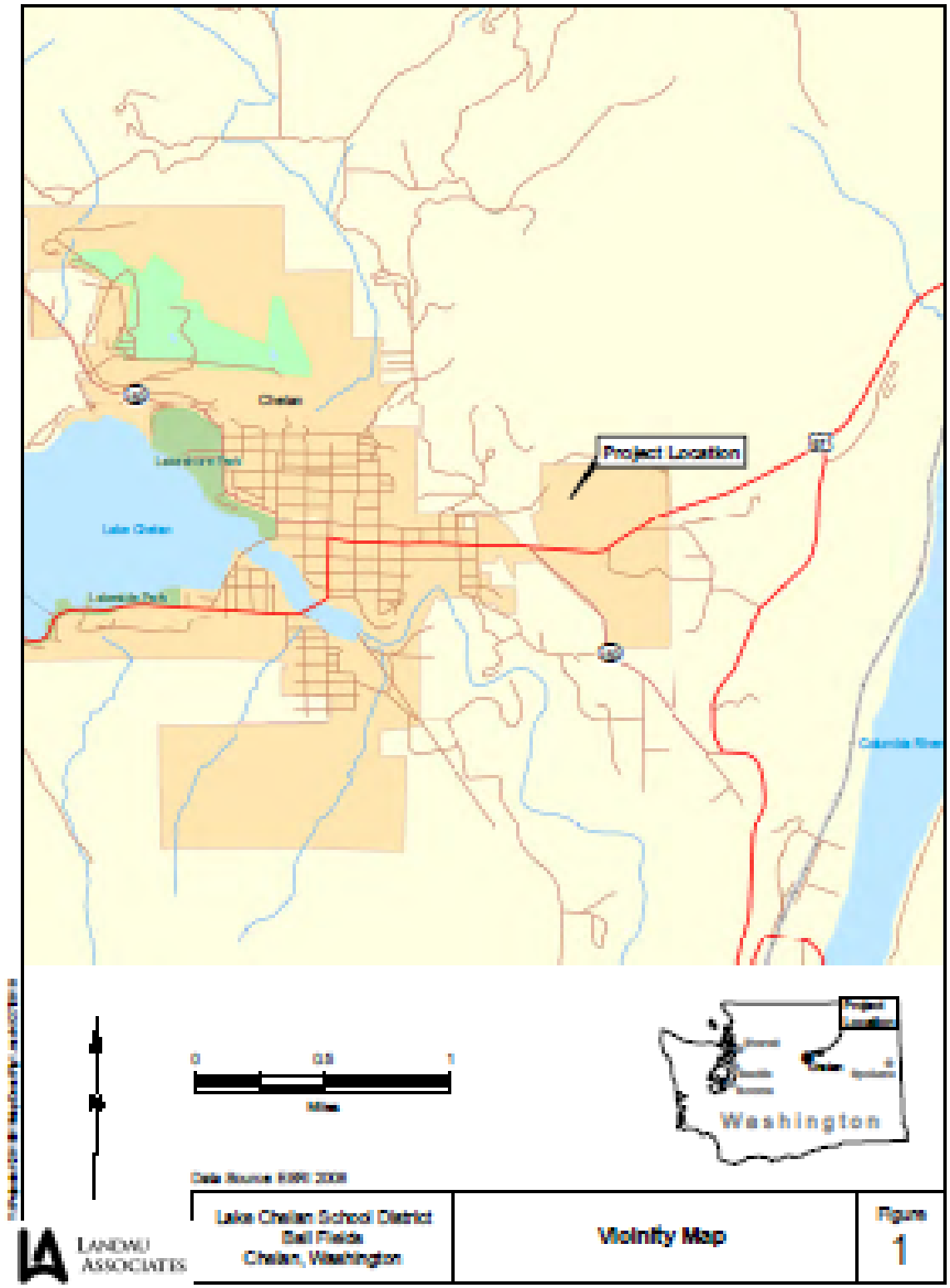


Figure 2 – Site Development Plan

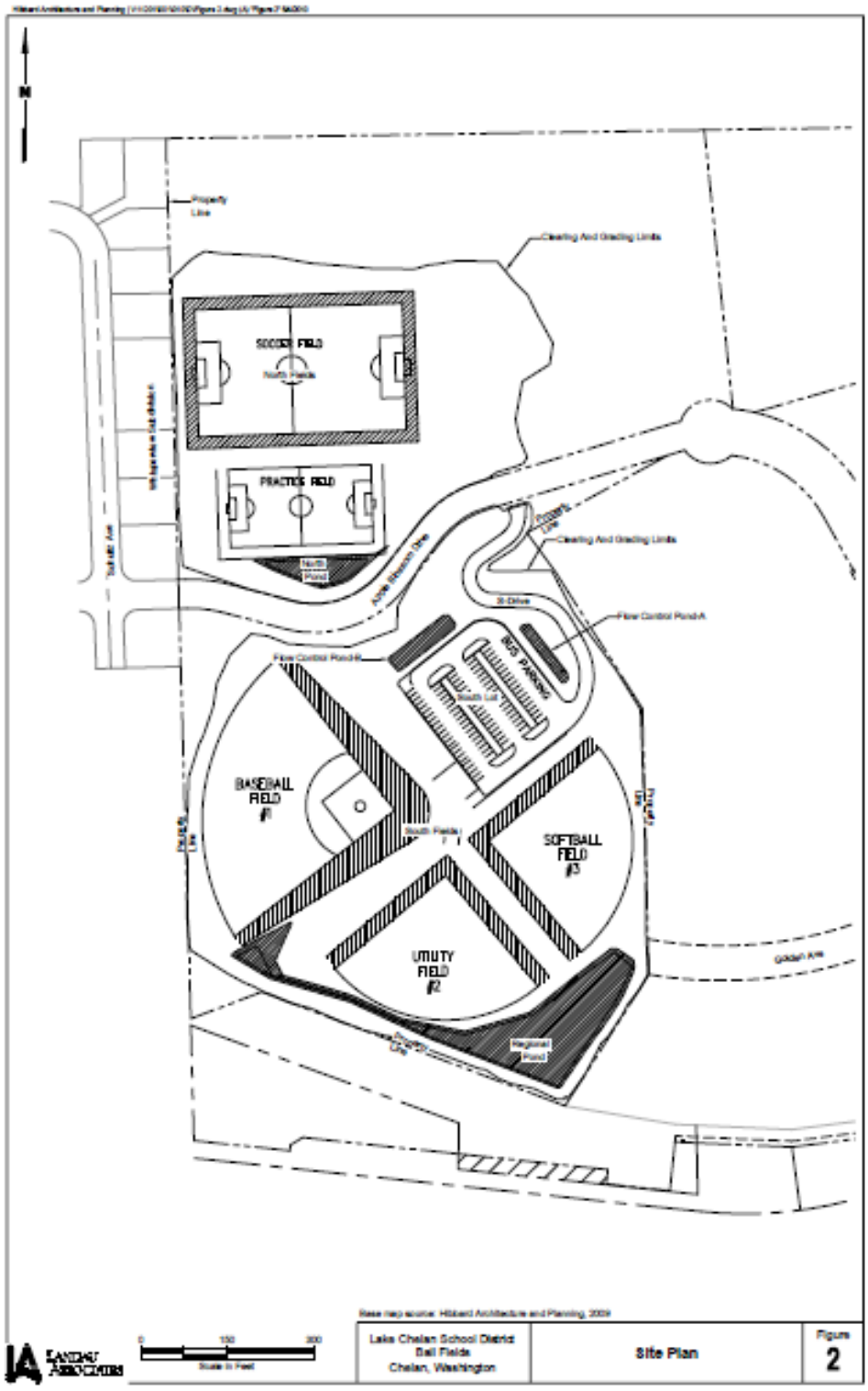
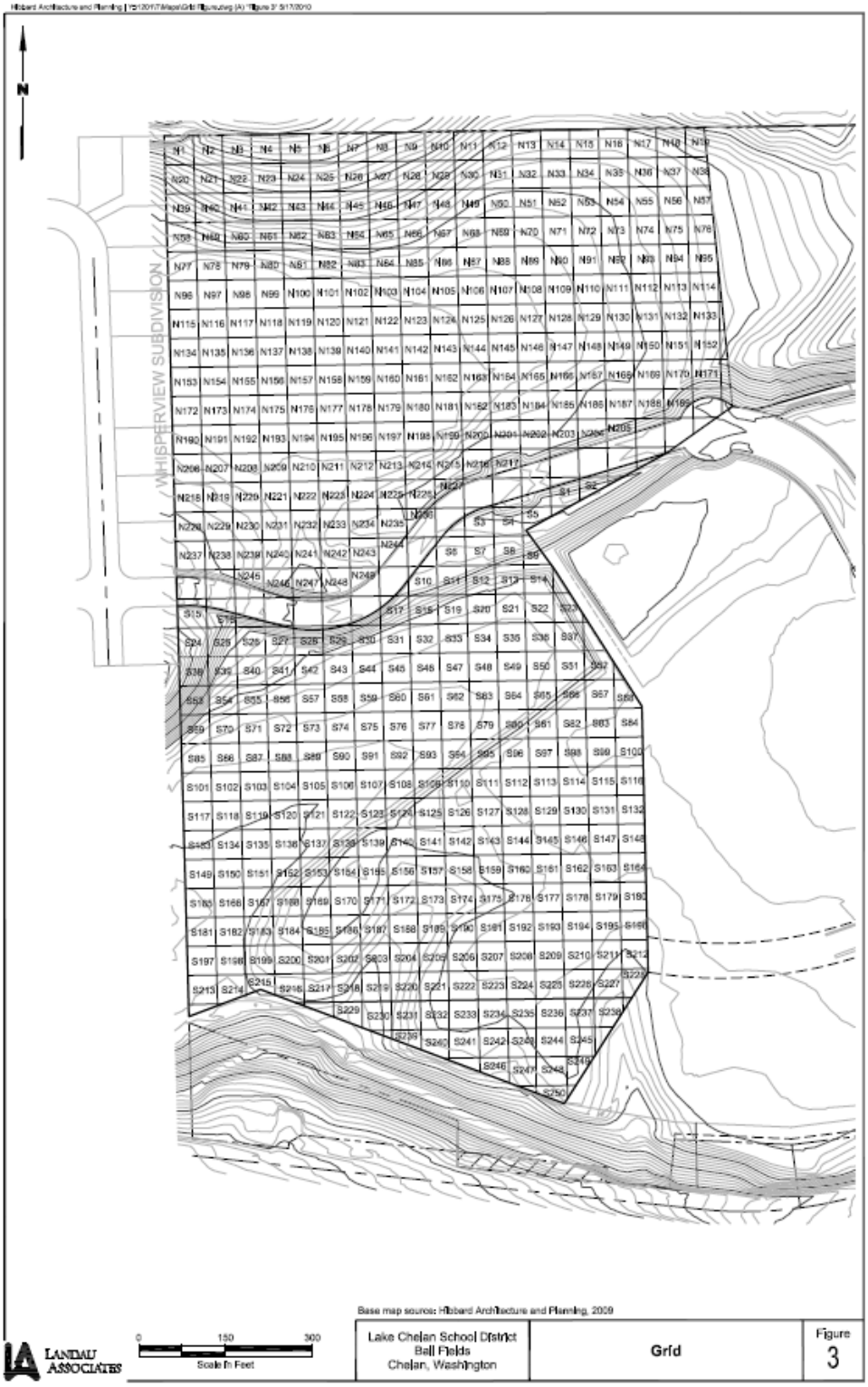


Figure 3 – Sample Grid



APPENDIX B

Laboratory Results

CASCADE ANALYTICAL, INC.
1-800-545-4206

(509) 662-1888
Fax: (509) 662-8183
3019 G.S. Center Road
Wenatchee, WA 98801

(509) 452-7707
Fax: (509) 452-7773
1008 W. Ahtanum Rd.
Union Gap, WA 98903

Batch: 043532
Client: Okanogan Co. Health Dist
Account: 05265
Sampler: Doug Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/30/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E014170
Sample Identification: CSN235B

Date Received: 7/26/10
Date Sampled: 7/14/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	109.5	mg/Kg	2.5	SW846 6010	7/30/10	
Lead Solid	1090	mg/Kg	2.5	SW846 6010	7/30/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/30/10	

Approved By: Dwight Brown

CASCADE ANALYTICAL, INC.
1-800-545-4206

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3019 G.S. Center Road
Wenatchee, WA 98801

(509) 452-7707
Fax: (509) 452-7773
1008 W. Ahtanum Rd.
Union Gap, WA 98903

Batch: 043532
Client: Okanogan Co. Health Dist
Account: 05265
Sampler: Doug Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/30/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E014169
Sample Identification: CSN135B

Date Received: 7/26/10
Date Sampled: 7/14/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	61.00	mg/Kg	2.5	SW846 6010	7/30/10	
Lead Solid	198.	mg/Kg	2.5	SW846 6010	7/30/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/30/10	

Approved By:

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Union Gap, WA 98903

Batch: 043532
Client: Okanogan Co. Health Dist
Account: 05265
Sampler: Doug Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/30/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E014168
Sample Identification: CSN97B

Date Received: 7/26/10
Date Sampled: 7/14/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	81.00	mg/Kg	2.5	SW846 6010	7/30/10	
Lead Solid	382.	mg/Kg	2.5	SW846 6010	7/30/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/30/10	

RECEIVED
AUG 02 2010
HEALTH DISTRICT
OKANOGAN COUNTY

Approved By:

CASCADE ANALYTICAL, INC.

AGRICULTURAL & ENVIRONMENTAL ANALYSIS

3019 G.S. Center Rd.
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00930
05265

SPECIAL SERVICE ORDER FORM

SAMPLE #	1	2	3	4
SEND RESULTS TO 1) Client 2) Billing 3) Both	3	3	3	
SAMPLE REPRESENTS 1) Food 2) Water 3) Soil 4) Plant Tissue 5) Other	3	3	3	
SAMPLE BY 1) Client 2) Field Rep. 3) Quality Control 4) Cascade 5) Other	1	1	1	

CLIENT NAME/ADDRESS
OKANOGAN PUBLIC HEALTH
P. O. BOX 231
OKANOGAN, WA 98840

BILLING NAME/ADDRESS
DEPT OF ECOLOGY
LAURA KLASNER

PHONE NO. 509-454-7833

SAMPLER'S NAME: DOUG HALE

FORM MUST BE COMPLETED BEFORE ANALYSIS WILL BE PERFORMED.

RELINQUISHED BY: (Signature) 1	DATE	RELINQUISHED BY: (Signature) 2	DATE	RELINQUISHED BY: (Signature) 3	DATE
	7-26-10				
(Printed) DOUGLAS HALE	TIME 1:25	(Printed)	TIME	(Printed)	TIME
RECEIVED BY: (Signature)	DATE 7-26-10	RECEIVED BY: (Signature)	DATE	RECEIVED BY: (Signature)	DATE
(Printed) Ken Haugh	TIME 1:25	(Printed) Brianna Buschbach	TIME 4:00pm	(Printed) Baten # 043537	TIME

1	SAMPLE I.D. CSN97B	Sample Date 7-14-10	Sample Time 1:10 PM
05-14168	ANALYSIS REQUESTED Pb/As		
	COMMENT		
2	SAMPLE I.D. CSN 135 B	Sample Date 7-14-10	Sample Time 1:13 PM
10-14169	ANALYSIS REQUESTED Pb/As		
	COMMENT		
3	SAMPLE I.D. CSN 235 B	Sample Date 7-14-10	Sample Time 2:42 PM
10-14170	ANALYSIS REQUESTED Pb/As		
	COMMENT		
4	SAMPLE I.D.	Sample Date	Sample Time
	ANALYSIS REQUESTED		
	COMMENT		

Sample container received by client was sealed Yes _____ No _____

Sample container received by laboratory was sealed Yes _____ No _____

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Customer Signature _____ Date 7-26-10

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Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012708
Sample Identification: CSS 43C

Date Received: 7/ 9/10
Date Sampled: 6/16/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	13.75	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	12.8	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012709
Sample Identification: CSS 35B

Date Received: 7/ 9/10
Date Sampled: 6/16/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	95.00	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	382.	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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Union Gap, WA 98903

Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012710
Sample Identification: CSS 66B

Date Received: 7/ 9/10
Date Sampled: 6/16/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	31.05	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	74.0	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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Fax: (509) 452-7773
1008 W. Ahtanum Rd.
Union Gap, WA 98903

Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012711
Sample Identification: CSS 181D

Date Received: 7/ 9/10
Date Sampled: 6/29/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	30.35	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	65.0	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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Union Gap, WA 98903

Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012712
Sample Identification: CSS 240E

Date Received: 7/ 9/10
Date Sampled: 6/29/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	11.55	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	17.0	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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Union Gap, WA 98903

Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012713
Sample Identification: CSS 149D

Date Received: 7/ 9/10
Date Sampled: 6/29/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	13.65	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	31.4	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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Union Gap, WA 98903

Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012714
Sample Identification: CSS 131D

Date Received: 7/ 9/10
Date Sampled: 6/29/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	11.90	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	24.2	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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1008 W. Ahtanum Rd.
Union Gap, WA 98903

Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012715
Sample Identification: CSS 36C

Date Received: 7/ 9/10
Date Sampled: 7/ 2/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	12.45	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	30.4	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

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Fax: (509) 452-7773
1008 W. Ahtanum Rd.
Union Gap, WA 98903

Batch: 042837
Client: Okanogan Co. Health Dist
Account: 00930
Sampler: Douglas Hale
PO Number:

--- Analytical Services Report ---

Report Date: 7/14/10

Okanogan Co. Health Dist
P.O. Box 231
Okanogan, Wa 98840

Laboratory Number: 10-E012716
Sample Identification: CSS 30D

Date Received: 7/ 9/10
Date Sampled: 7/ 2/10

Test Requested	Results	Units	MDL	Method	Date Analyzed	Flags
Arsenic Solid	28.05	mg/Kg	2.5	SW846 6010	7/14/10	
Lead Solid	128.	mg/Kg	2.5	SW846 6010	7/14/10	
Total Metals Digest Solid	Metals Digest			SW846 3050	7/14/10	

Approved By:

CASCADE ANALYTICAL, INC.

AGRICULTURAL & ENVIRONMENTAL ANALYSIS

3019 G.S. Center Rd.
Wenatchee, WA 98801

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SPECIAL SERVICE ORDER FORM

SAMPLE #	1	2	3	4
SEND RESULTS TO 1) Client 2) Billing 3) Both	3	3	3	3
SAMPLE REPRESENTS 1) Food! 2) Water! 3) Soil 4) Plant Tissue 5) Other	3	3	3	3
SAMPLE BY 1) Client 2) Field Rep. 3) Quality Control 4) Cascade 5) Other	1	1	1	1

CLIENT NAME/ADDRESS
OKANOGAN COUNTY PUBLIC HEALTH
P.O. BOX 231
OKANOGAN, WA 98840

BILLING NAME/ADDRESS
DEPT. OF ECOLOGY

PHONE NO.
509-454-7833 LAURA KLASNER

SAMPLER'S NAME: DOUG HANE

FORM MUST BE COMPLETED BEFORE ANALYSIS WILL BE PERFORMED.

RELINQUISHED BY: (Signature) 1	DATE	RELINQUISHED BY: (Signature) 2	DATE	RELINQUISHED BY: (Signature) 3	DATE
	7-9-10				
(Printed) DOUGLAS HANE	TIME 12:140	(Printed)	TIME	(Printed)	TIME
RECEIVED BY: (Signature)	DATE 7/9	RECEIVED BY: (Signature)	DATE	RECEIVED BY: (Signature) 7/9/10	DATE
(Printed) Josh Trevino	TIME 12:40	(Printed) Batch 042837	TIME	(Printed)	TIME

1 (12768)	SAMPLE I.D. CSS 43C	Sample Date 6-16-10	Sample Time 11:43 AM
	ANALYSIS REQUESTED Pb/As		
	COMMENT		
2 (12769)	SAMPLE I.D. CSS 35B	Sample Date 6-16-10	Sample Time 3:21 PM
	ANALYSIS REQUESTED Pb/As		
	COMMENT		
3 (12770)	SAMPLE I.D. CSS 66B	Sample Date 6-16-10	Sample Time 3:40 PM
	ANALYSIS REQUESTED Pb/As		
	COMMENT		
4 (12771)	SAMPLE I.D. CSS 181D	Sample Date 6-29-10	Sample Time 11:32 AM
	ANALYSIS REQUESTED Pb/As		
	COMMENT		

Sample container received by client was sealed Yes _____ No _____

Sample container received by laboratory was sealed Yes _____ No _____

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Customer Signature _____ Date 7-8-10

SPECIAL SERVICE ORDER FORM

CASCADE ANALYTICAL, INC.

AGRICULTURAL & ENVIRONMENTAL ANALYSIS

3019 G.S. Center Rd.
Wenatchee, WA 98801

(509) 662-1888
Fax: (509) 662-8183
1-800-545-4206

SAMPLE #	1	2	3	4
SEND RESULTS TO 1) Client 2) Billing 3) Both	3	3	3	3
SAMPLE REPRESENTS 1) Food! 2) Water! 3) Soil 4) Plant Tissue 5) Other	3	3	3	3
SAMPLE BY 1) Client 2) Field Rep. 3) Quality Control 4) Cascade 5) Other	1	1	1	1

CLIENT NAME/ADDRESS	BILLING NAME/ADDRESS
Okanogan Public Health	Dept. of Ecology
P.O. Box 231	
Okanogan, WA 98840	
	PHONE NO. 509-454-7833 Laura Kuasner

SAMPLER'S NAME: Doug Hare

FORM MUST BE COMPLETED BEFORE ANALYSIS WILL BE PERFORMED.

RELINQUISHED BY: (Signature) 1	DATE	RELINQUISHED BY: (Signature) 2	DATE	RELINQUISHED BY: (Signature) 3	DATE
	7-9-10				
(Printed) Doug Hare	TIME 12:40	(Printed)	TIME	(Printed)	TIME
RECEIVED BY: (Signature)	DATE 7/9	RECEIVED BY: (Signature)	DATE	RECEIVED BY: (Signature)	DATE 7/9/10
(Printed) Josh Trevino	TIME 12:40	(Printed) Batch 042837	TIME	(Printed)	TIME

1	SAMPLE I.D. CSS 240 E	Sample Date 6-29-10	Sample Time 10:45 AM	12/12
	ANALYSIS REQUESTED Pb/As			
	COMMENT			
2	SAMPLE I.D. CSS 149 D	Sample Date 6-29-10	Sample Time 2:02 PM	12/13
	ANALYSIS REQUESTED Pb/As			
	COMMENT			
3	SAMPLE I.D. CSS 131 D	Sample Date 6-29-10	Sample Time 3:51 PM	12/14
	ANALYSIS REQUESTED Pb/As			
	COMMENT			
4	SAMPLE I.D. CSS 36C	Sample Date 7-2-10	Sample Time 2:39 PM	12/15
	ANALYSIS REQUESTED Pb/As			
	COMMENT			

Sample container received by client was sealed Yes _____ No _____

Sample container received by laboratory was sealed Yes _____ No _____

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Customer Signature _____ Date 7-8-10

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Wenatchee, WA 98801

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Fax: (509) 662-8183
1-800-545-4206

SAMPLE #	1	2	3	4
SEND RESULTS TO 1) Client 2) Billing 3) Both	3			
SAMPLE REPRESENTS 1) Food! 2) Water! 3) Soil 4) Plant Tissue 5) Other	3			
SAMPLE BY 1) Client 2) Field Rep. 3) Quality Control 4) Cascade 5) Other	1			

CLIENT NAME/ADDRESS	BILLING NAME/ADDRESS
Okanogan Public Health	Dept. of Ecology
P.O. Box 231	
Okanogan, WA 98840	
	PHONE NO. 509-454-7833 Laura Klasner

SAMPLER'S NAME: Doug Hale

FORM MUST BE COMPLETED BEFORE ANALYSIS WILL BE PERFORMED.

RELINQUISHED BY: (Signature) 1	DATE	RELINQUISHED BY: (Signature) 2	DATE	RELINQUISHED BY: (Signature) 3	DATE
	7-9-10				
(Printed) Doug Hale	TIME 12:40	(Printed)	TIME	(Printed)	TIME
RECEIVED BY: (Signature)	DATE 7/9	RECEIVED BY: (Signature)	DATE	RECEIVED BY: (Signature)	DATE 7/9/10
(Printed) Josh Trevino	TIME 1290	(Printed) Batch 042857	TIME	(Printed)	TIME

1	SAMPLE I.D. CSS 30D	Sample Date 7-2-10	Sample Time 2:25PM
	ANALYSIS REQUESTED Pb/As		
	COMMENT		
2	SAMPLE I.D.	Sample Date	Sample Time
	ANALYSIS REQUESTED		
	COMMENT		
3	SAMPLE I.D.	Sample Date	Sample Time
	ANALYSIS REQUESTED		
	COMMENT		
4	SAMPLE I.D.	Sample Date	Sample Time
	ANALYSIS REQUESTED		
	COMMENT		

Sample container received by client was sealed Yes _____ No _____

Sample container received by laboratory was sealed Yes _____ No _____

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Customer Signature _____ Date 7-8-10

APPENDIX C

South Fields Arsenic Compliance Statistics

LANDAU ASSOCIATES

By JCS Date 8/26/10 Project LAKE CHELAN BALL FIELDS Project No. 1201001.010

Checked By CPH Date 8/26/10 Subject SOUTH FIELDS AS COMPLIANCE STATISTICS Sheet 1 of 2

CALCULATION OF THE MEAN AND STANDARD DEVIATION FROM A PROBABILTY PLOT

1) PERCENTILE OF THE DATA ESTAMATE FROM THE PROBABILITY PLOT

$X_{0.50} = \frac{8.19 + 8.45}{2} = 8.32$

$X_{0.16} = \frac{4.04 + 4.25}{2} = 4.15$

$X_{0.84} = \frac{16.30 + 17.16}{2} = 16.73$

FROM TABLE 1, SINCE THERE ARE AN EVEN NUMBER OF DATA POINTS THE VALUES WERE INTERPOLATED BETWEEN THEM.

2) MEAN OF THE LOG-TRANSFORMED DISTRIBUTION

$X_y = Ln\ X_{0.50}$
$= Ln\ (8.32)$
$= 2.12$

3) VARIANCE OF THE LOG-TRANSFORMED DISTRIBUTION

$S_y^2 = \left\{ Ln \left[\frac{1}{2} \left(\frac{X_{0.50}}{X_{0.16}} + \frac{X_{0.84}}{X_{0.50}} \right) \right] \right\}^2$

$= \left\{ Ln \left[\frac{1}{2} \left(\frac{8.32}{4.15} + \frac{16.73}{8.32} \right) \right] \right\}^2$

$= 0.486$

NOTE: THE STANDARD DEVIATION OF THE LOG-TRANSFORMED DISTRIBUTION IS $S_y = 0.697$

4) MEAN OF THE UNTRANSFORMED DISTRIBUTION

$X = \exp\left(X_y + \frac{S_y^2}{2} \right)$

$= \exp\left(2.12 + \frac{0.486}{2} \right)$

$= 10.62\ mg/kg$

5) PERCENTILE CORRESPONDING TO THE ESTIMATED MEAN OF THE UNTRANSFORMED DISTRIBUTION

$P_{10.62} = 0.63$

FROM TABLE 1, THE CLOSEST EST AS VALUE IS 10.59 mg/kg WHICH IS THE 0.63 PERCENTILE

6) 95TH PERCENTILE OF THE CUMULATIVE NORMAL DISTRIBUTION

$Z_{95} = 1.645$

FROM TABLE A-6, CUMULATIVE NORMAL DISTRIBUTION, ECOLOGY 1992

7) H STATISTIC FOR A 95TH PERCENT CONFIDENCE LEVEL (INTERPOLATION) USING TABLE A12 (GILBERT 1987) $S_y = 0.697$ $= 0.70$

$\frac{(56-51)}{(101-51)} = \frac{(H_{95} - 2.025)}{(1.960 - 2.025)}$

$H_{95} = 2.019$

LANDAU ASSOCIATES

By JCS Date 8/26/10 Project LAKE CHELAN BALL FIELDS Project No. 1201001.01D

Checked By CPH Date 8/26/10 Subject SOUTH FIELDS AS COMPLIANCE STATISTICS Sheet 2 of 2

8) RANK OF THE SAMPLE THAT REPRESENTS THE UPPER 95TH PERCENT CONFIDENCE LIMIT OF THE P TH PERCENTILE (ATTACHMENT 2, LANDAU ASSOCIATES 1996)

$$UNCL_p = p(n+1) + Z_{95}\left[np(1-p)\right]^{1/2}$$

$$= 0.63(56+1) + (1.645)\left[(56)(0.63)(1-0.63)\right]^{1/2}$$

$$= 41.85$$

UCL_{95} = 13 mg/kg — FROM TABLE 1, 41ST RANKED SAMPLE = 12.63 mg/kg AND 42nd RANKED SAMPLE = 13.12 mg/kg

9) CALCULATION OF THE UPPER 95TH PERCENT CONFIDENCE LIMIT (ATTACHMENT 3, LANDAU ASSOCIATES 1996)

$$UCL_{95} = \exp\left\{x_y + (0.5)(S_y^2) + \left[\frac{(S_y)(H_{95})}{(n-1)^{1/2}}\right]\right\}$$

$$= \exp\left\{2.12 + (0.5)(0.486) + \left[\frac{(0.697)(2.019)}{(56-1)^{1/2}}\right]\right\}$$

$$= 12.8 \text{ mg/kg}$$

THE UPPER 95TH PERCENT CONFIDENCE LIMIT ON THE MEAN CONCENTRATION IS ESTIMATED AT 13 mg/kg (AS SHOWN USING THE CALCULATION OF THE UPPER 95TH PERCENT CONFIDENCE LIMIT AND THE RANK OF THE SAMPLE THAT REPRESENTS THE UPPER 95TH PERCENT CONFIDENCE LIMIT), WHICH DEMONSTRATES STATISTICAL COMPLIANCE WITH THE 20 mg/kg CLEANUP LEVEL FOR AS.

LANDAU ASSOCIATES, INC.

Environmental and Geotechnical Services

MEMORANDUM

TO: Nigel Blakely, Washington State Department of Ecology

FROM: David Pischer and Eric Weber, Landau Associates, Inc.

DATE: April 9, 1996

RE: COMPLIANCE DECISION ON SITE SOIL CONFIRMATION DATA WITH GREATER THAN 50 PERCENT NONDETECTED (CENSORED) VALUES

INTRODUCTION

This memorandum has been prepared by Landau Associates for the purpose of clarifying the use of various statistical methods available for determining compliance with MTCA cleanup levels when post-excavation confirmation soil sample data sets consist of greater than 50 percent nondetected (censored) values. The methods evaluated include only those recommended by Ecology in the *Statistical Guidance for Ecology Site Managers* (Ecology 1992) and the *Supplement to Statistical Guidance for Ecology Site Managers* (Ecology 1993a). Because the guidance and the supplement state that use of some of these methods requires consultation with Ecology, we request that Ecology review the evaluations presented in this memorandum and respond with any comments that should be considered when selecting the method for determining statistical compliance with MTCA soil cleanup levels.

BACKGROUND

Soil remediation is being completed on a 3-acre site in western Washington as part of a MTCA independent cleanup action. After removal/disposal of soil contaminated with certain metals, TPH (diesel and heavy oil ranges), PAHs, and PCBs, 53 soil samples were collected on a grid-based system to evaluate compliance with MTCA Method A soil cleanup levels. Compliance is being evaluated using the statistical methods outlined in WAC 173-340-740(7)(e). These statistical methods include estimating an upper 95th percent confidence limit (UCL95) for the mean value of the indicator hazardous substances (IHS) and comparing the estimated UCL95 to the soil cleanup for each IHS.

For most constituents, calculation of the UCL95 is being accomplished using the MTCAStat computer package (Ecology 1993b); however, some chemical constituents, such as TPH, were not

detected in more than 50 percent of the samples, and a UCL95 could not be calculated using this computer package. For these constituents, the data is considered heavily censored, and standard statistical approaches for developing sample statistics are less reliable. The supplement discusses three alternative approaches for calculating a statistic equivalent to the UCL95 when greater than 50 percent of the data is below the detection limit. One of these alternative approaches specifies using the maximum value of the data set as the UCL95. We understand that Ecology considers this the conservative default approach. For some of the confirmation sample data sets associated with the subject site, the maximum value is greater than the Method A soil cleanup level and thus statistical compliance is not indicated using this default method; however, because of the large number of confirmation samples collected at this site (i.e., at least 53 samples), this default approach tends to be very conservative. For this reason, the other two alternative statistical approaches described in the supplement were used to evaluate statistical compliance for data sets with greater than 50 percent nondetected values. In one of these alternative approaches, we used a nonparametric upper confidence limit on a sample percentile corresponding to an estimate of the sample mean. In the other alternative approach, we used a parametric upper confidence limit based on best estimates of the mean and standard deviation. Both of these approaches require an estimate of sample statistics based on a best fit statistical distribution to the data.

A more detailed evaluation of the three approaches for calculating a statistic equivalent to the UCL95 for heavily censored data sets is presented below. Example calculations are performed using site-specific data for heavy oil range petroleum hydrocarbons (heavy oil). The heavy oil data set consists of 53 soil samples each collected from a random location within a separate 2500 ft^2 sampling grid. Eighty-five percent of the samples (45 samples) were reported below the method detection limit (MDL) of 25 mg/kg. Fifteen percent of the samples (8 samples) were reported above the MDL. The maximum heavy oil concentration is 250 mg/kg. The MTCA Method A soil cleanup level for TPH (other) is 200 mg/kg. The heavy oil data set is presented in Table 1.

Approach 1 (Ecology's Default Approach): Use of the Maximum Value as the UCL95

For the heavy oil data set, use of the maximum value as the UCL95 results in a compliance statistic (250 mg/kg) that is greater than the MTCA Method A cleanup level for heavy oil (200 mg/kg); however, as discussed below, because of the large size of this data set this approach tends to be very conservative.

The maximum value of a data set corresponds to an upper nonparametric interval estimate on a percentile of the data set. As shown in the following example, the confidence level (i.e., 90 percent, 95 percent, etc.) associated with that upper interval estimate is a function of the data set (e.g., the maximum value of a large data set is more likely to contain the true population mean than a small data set).

Example:

> Using the equation in Section 5.2.2.4 of the guidance (Ecology 1992), if a data set consisted of 30 samples, the confidence level associated with the maximum value corresponding to an upper nonparametric interval estimate on the 90th percentile would be 90 percent. In contrast, if a data set consisted of 50 samples, the confidence level would be 97 percent (see Ecology 1993a, page 13).

This example demonstrates how using the maximum value of the heavy oil data set (which consists of 53 samples) as the UCL95 corresponds to a very high confidence level (i.e., greater than 97 percent) on the 90th percentile. The maximum value of the heavy oil data set also corresponds to a greater than 99 percent confidence level on the median (i.e., the 50th percentile).

A high confidence level associated with an upper nonparametric interval estimate on a percentile results in a statistical test with a relatively lower false positive rate (i.e., a low probability that the test will indicate the site is clean when it is not); however, tests with very low false positive rates also have lower statistical power. For MTCA compliance evaluations, statistical power is equivalent to the probability that the test will identify a clean site when the site is actually clean. A goal in many regulatory statistical programs is to strike a balance between false positive rates and statistical power (e.g., EPA 1992, page 64). For a sample size of 53, using the maximum value as the UCL95 is likely to have relatively low statistical power to determine that the site is clean.

Based on the considerations discussed above, use of the maximum value as the UCL95 for determining statistical compliance with MTCA cleanup levels is considered to be overly conservative for this site.

Alternative Approach 2: Use of a Nonparametric Confidence Limit on a Percentile Corresponding to the Mean

In this alternative, a nonparametric approach is used to estimate a UCL95 for the heavy oil data set; however, because nonparametric confidence limits are calculated based on sample percentiles and not on the sample mean, the UCL95 is calculated based on an estimated percentile that corresponds to the sample mean. To calculate the percentile that corresponds to the sample

mean for a heavily censored data set (such as the heavy oil data set with greater than 50 percent nondetects), a mean must first be determined based on the best fit distribution of the data set. If the best fit distribution is normal, the mean can be estimated from the median. If the best fit distribution is lognormal, the mean will be greater than the median and must be estimated from the parameters of the best fit distribution.

The procedure for estimating the best fit distribution is discussed in the supplement (pages 2 and 3). In this procedure, a probability plot analysis is used that requires calculating a normal score (percentile of the standard normal distribution) that corresponds to each sample percentile. The sample percentile and normal score for each of the 53 data points in the heavy oil data set is presented in Table 1. If the detected values of the data set are normally distributed, a plot of the normal score versus heavy oil data should closely approximate a straight line. If the data are lognormally distributed, a plot of the normal score versus the log-transformed data should closely approximate a straight line. The best fit distribution can be evaluated quantitatively by performing a least squares regression analysis (based only on sample detections and corresponding normal scores) and comparing the regression statistics, as discussed below. Assuming a reasonable fit, we can use the equation of the best fit regression line as the best fit distribution to the data.

The supplement (page 3) lists two decision criteria for evaluating best fit distribution lines for heavily censored data. These criteria are based on the square of the linear regression correlation coefficient (r^2) and the ANOVA F statistic. For a good regression model, the r^2 should be close to 1 (perfect correlation) and the F statistic p-value should be less than 0.05. The regression statistics for the untransformed and log-transformed values in the heavy oil data set are presented in Tables 2 and 3, respectively. A comparison between these regression statistics indicates the data more closely approximate a lognormal distribution (r^2 = 0.95, F p-value = 0.00003) than a normal distribution (r^2 = 0.91, F p-value = 0.0002). Based on these results, we can assume the heavy oil data set follows a lognormal distribution defined by a line with the slope and intercept as presented in Table 3. The equation of the line corresponding to the best fit distribution is:

$$Ln(y) = 1.01 + (2.07)(x)$$

where:

y = heavy oil concentration (mg/kg)

x = normal score

Ln = the natural logarithm operator.

The best fit distribution line for the heavy oil data set is presented on Figure 1. The actual heavy oil data are also plotted on Figure 1 (values below the MDL were assigned a value equal to the MDL of 25 mg/kg).

From the best fit distribution line, it is possible to estimate the mean (x_y) and standard deviation (s_y) of the log-transformed data distribution. From this line it is also possible to estimate sample values below the detection limit (as presented in Table 1). Using these parameters, it is then possible to estimate the mean (x) of the untransformed data distribution, the percentile corresponding to the untransformed mean, and a confidence level on the untransformed mean. Procedures for estimating the x_y, s_y, and x values from a normal probability plot are discussed by Gilbert (1987). These procedures are also referenced in the *Supplement* (page 8). The following parameter estimates for the heavy oil data set were calculated using the equations shown on Attachment 1:

Log-transformed parameters:

$x_y = 1.01$

$s_y = 2.03$

Untransformed parameter:

$x = 21.8$ mg/kg

Accordingly, the mean (average) concentration of the heavy oil data set is estimated to be 21.8 mg/kg. From Table 1, the sample percentile corresponding to this mean concentration can be determined as follows:

> A concentration of 21.8 mg/kg falls between the 45th (21.12 mg/kg) and 46th (24.91 mg/kg) ranked samples within the heavy oil data set. The 45th and 46th rankings correspond to the 84th and 86th percentiles of the heavy oil data set, respectively. Therefore, the percentile corresponding to the mean concentration of the heavy oil data set is between 84 and 86.

An estimated UCL95 for the heavy oil data set can now be determined based on the estimated percentile corresponding to the mean. Using the approach described in Section 5.2.2.4 of the guidance and the equations shown on Attachment 2, the upper 95th percent nonparametric confidence limit on the 84th percentile is 67 mg/kg. The upper 95th percent nonparametric confidence limit on the 86th percentile is 76 mg/kg. Therefore, the UCL95 on the mean

concentration of the heavy oil data set is estimated to be between 67 and 76 mg/kg, which demonstrates statistical compliance with the 200 mg/kg cleanup level for TPH.

Alternative Approach 3: Use of a Parametric Confidence Limit Based on the Estimated Best Fit Distribution

The third approach discussed in the supplement calculates the UCL95 using the estimates of the log-transformed mean (x_y) and standard deviation (s_y) calculated on Attachment 1 and discussed in the previous section. The appropriate method for calculating the UCL95 when the underlying data distribution is lognormal is the method of Land. This method is described in Section 5.2.1.2 of the guidance. Using this parametric confidence limit approach and the equations presented on Attachment 3, the UCL95 is estimated to be 72 mg/kg, which demonstrates compliance with the 200 mg/kg cleanup level for TPH.

Summary

Three alternative approaches discussed in the supplement were used to estimate the UCL95 for the heavy oil data set with more than 50 percent nondetected values. The first approach, using the maximum value of 250 mg/kg as the UCL95, does not demonstrate compliance with the 200 mg/kg cleanup level for TPH. The second and third alternative approaches, which are based on a best fit distribution of the data set, resulted in estimates of the UCL95 appreciably below the 200 mg/kg cleanup level (i.e., in the nonparametric confidence limit approach, a UCL95 between 67 and 76 mg/kg was estimated, and in the parametric confidence limit approach, a UCL95 of 72 mg/kg was estimated).

All three alternative approaches are considered valid methods for determining statistical compliance with MTCA cleanup levels; however, Ecology's recommended default approach (Approach 1) is considered to be overly conservative for this site for the following reasons:

- The large number of confirmation soil samples collected at the site results in a maximum value that corresponds to a relatively high confidence level on a given percentile.
- The relatively high confidence level associated with the maximum value results in relatively lower statistical power to determine the site is clean when it actually is clean.
- The regression statistics used in the second and third alternative approaches indicate that a lognormal distribution is appropriate for characterizing the heavy oil data set

and, therefore, using either of these alternative approaches should result in a reliable estimate of the UCL95.

Based on our evaluation of the various statistical methods available for determining compliance with MTCA cleanup levels, statistical compliance at this site should be evaluated using alternative approaches 2 and/or 3 when: 1) the data set consists of greater than 50 percent nondetects, 2) the maximum value exceeds the site cleanup level, and 3) the detected values are consistent with a normal or lognormal distribution. The supplemental criteria that no single sample concentration be greater than two times the cleanup level and that less than 10 percent of the sample concentrations exceed the cleanup level would, of course, be applicable.

****

We would be pleased to discuss the statistical approaches presented in this memorandum with Ecology. Please call us if you have any questions and respond with any comments that you believe should be considered for our statistical demonstration that the heavy oil data set complies with the MTCA cleanup level.

DAP/EFW/SJP
No. 236005.24

Attachments

REFERENCES

Ecology. 1992. *Statistical Guidance for Ecology Site Managers.*

Ecology. 1993a. *Supplement to Statistical Guidance for Ecology Site Managers.*

Ecology. 1993b. *MTCA STAT - A Statistical Package for Statistical Guidance for Ecology Site Managers.* July.

EPA. 1992. *Statistical Analysis of Groundwater Monitoring at RCRA Facilities Addendum to Interim Final Guidance.* June.

Gilbert. 1987. *Statistical Methods for Environmental Pollution Monitoring*

Table 1

Total Petroleum Hydrocarbons: Heavy Oil								
Rank	H Oil (mk/kg)	Ln(HOil)	Percentile	Normal Score	Est HOil			
1	25	3.22	0.01	-2.27	0.03			
2	25	3.22	0.03	-1.87	0.06			
3	25	3.22	0.05	-1.65	0.09			
4	25	3.22	0.07	-1.49	0.13			
5	25	3.22	0.09	-1.36	0.16			
6	25	3.22	0.11	-1.25	0.21			
7	25	3.22	0.12	-1.15	0.25			
8	25	3.22	0.14	-1.07	0.30			
9	25	3.22	0.16	-0.99	0.36			
10	25	3.22	0.18	-0.91	0.42			
11	25	3.22	0.20	-0.84	0.48			
12	25	3.22	0.22	-0.78	0.55			
13	25	3.22	0.24	-0.72	0.62			
14	25	3.22	0.26	-0.66	0.71			
15	25	3.22	0.27	-0.60	0.79			
16	25	3.22	0.29	-0.54	0.89			
17	25	3.22	0.31	-0.49	1.00			
18	25	3.22	0.33	-0.44	1.11			
19	25	3.22	0.35	-0.39	1.23			
20	25	3.22	0.37	-0.34	1.37			
21	25	3.22	0.39	-0.29	1.52			
22	25	3.22	0.41	-0.24	1.68			
23	25	3.22	0.42	-0.19	1.85			
24	25	3.22	0.44	-0.14	2.05			
25	25	3.22	0.46	-0.09	2.26			
26	25	3.22	0.48	-0.05	2.49			
27	25	3.22	0.50	0.00	2.74			
28	25	3.22	0.52	0.05	3.02			
29	25	3.22	0.54	0.09	3.34			
30	25	3.22	0.56	0.14	3.68			
31	25	3.22	0.58	0.19	4.06			
32	25	3.22	0.59	0.24	4.49			
33	25	3.22	0.61	0.29	4.96			
34	25	3.22	0.63	0.34	5.50			
35	25	3.22	0.65	0.39	6.10			
36	25	3.22	0.67	0.44	6.78			
37	25	3.22	0.69	0.49	7.56			
38	25	3.22	0.71	0.54	8.45			
39	25	3.22	0.73	0.60	9.47			
40	25	3.22	0.74	0.66	10.67			
41	25	3.22	0.76	0.72	12.06			
42	25	3.22	0.78	0.78	13.72			
43	25	3.22	0.80	0.84	15.71			
44	25	3.22	0.82	0.91	18.13			
45	25	3.22	0.84	0.99	21.12			
46	26	3.26	0.86	1.07	24.91			
47	31	3.43	0.88	1.15	29.83			
48	34	3.53	0.89	1.25	36.45			
49	37	3.61	0.91	1.36	45.79			
50	67	4.20	0.93	1.49	59.92			
51	76	4.33	0.95	1.65	83.68			
52	190	5.25	0.97	1.87	132.34			
53	250	5.52	0.99	2.27	298.03			

Key:

Rank: The sample number ranked from lowest to highest value.

H Oil: The concentration of the heavy oil fraction of TPH in mg/kg.

Ln(HOil): The natural log of the heavy oil concentration.

Percentile: The Blom plotting position of each value calculated from its rank.

Normal Score: Critical value of a standard normal distribution corresponding to each percentile.

Est HOil: Estimated value (mg/kg) of heavy oil based on the best fit data distribution.

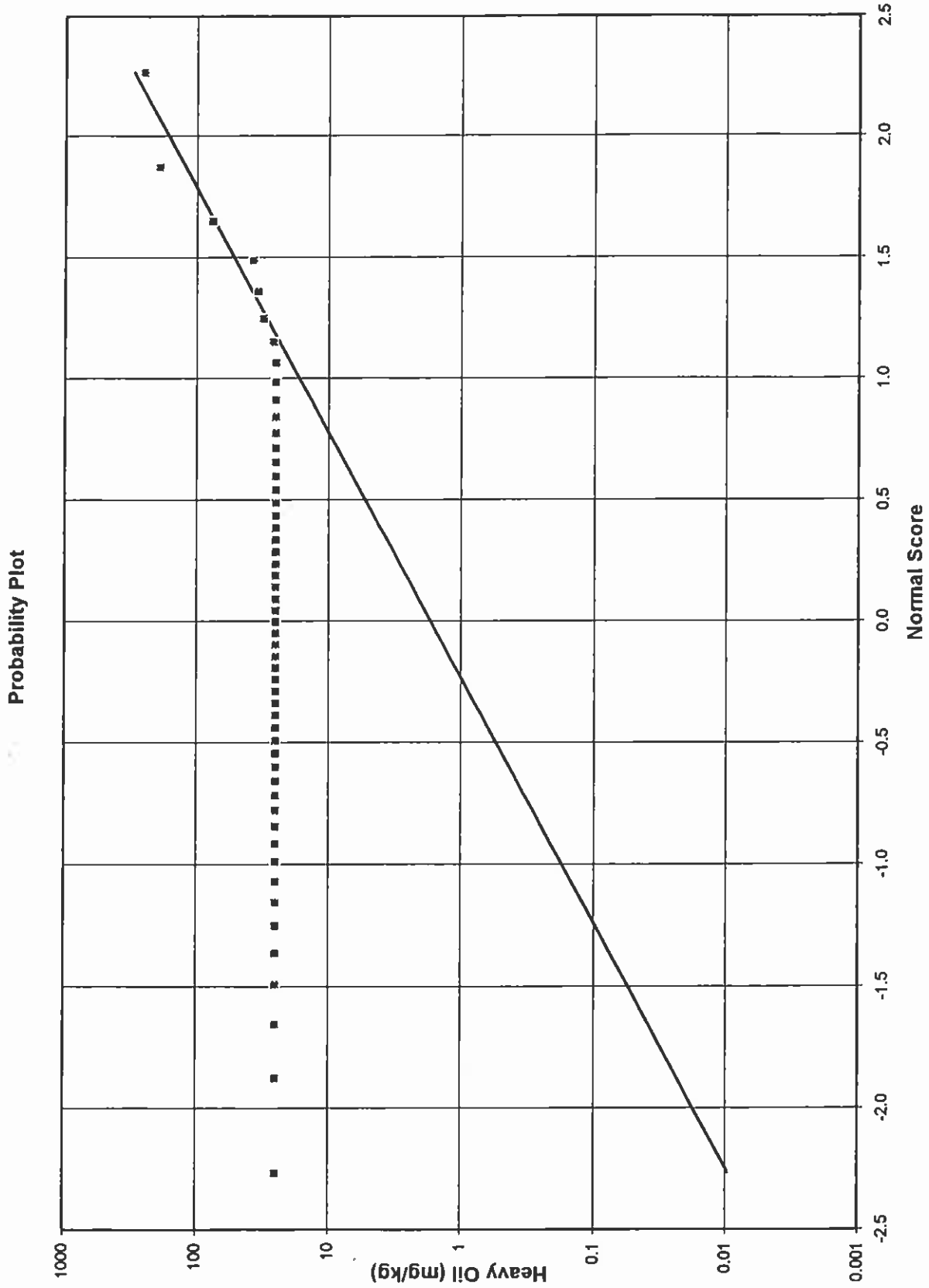
Table 2

SUMMARY OUTPUT: Normal Score vs Heavy Oil						
Regression Statistics						
Multiple R	0.96					
R Square	0.91					
Adjusted R Square	0.90					
Standard Error	26.7					
Observations	8					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	45567	45567	64.0	0.00020	
Residual	6	4270	712			
Total	7	49837				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-214	39	-5.5	0.00153	-310	-119
Slope	200	25	8.0	0.00020	139	261

Table 3

SUMMARY OUTPUT: Normal Score vs. Ln(Heavy Oil)							
Regression Statistics							
Multiple R	0.98						
R Square	0.95						
Adjusted R Square	0.95						
Standard Error	0.20						
Observations	8						
ANOVA							
	df	*SS*	*MS*	*F*	*Significance F*		
Regression	1	4.9	4.9	123.3	3.2E-05		
Residual	6	0.237	0.040				
Total	7	5.1					
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	
Intercept	1.01	0.29	3.47	0.013	0.30	1.72	
Slope	2.07	0.19	11.10	3E-05	1.61	2.53	

Figure 1


Probability Plot
Heavy Oil (mg/kg)
1000
100
10
1
0.1
0.01
0.001
-2.5
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
2.5
Normal Score

ATTACHMENT 1

CALCULATION OF THE MEAN AND STANDARD DEVIATION FROM A PROBABILITY PLOT (AFTER GILBERT 1987)

BASE EQUATIONS

$$x_y = \text{Ln}(x_{0.50})$$

$$s_y^2 = \left[Ln \left(\tfrac{1}{2} \left(\frac{x_{0.50}}{x_{0.16}} + \frac{x_{0.84}}{x_{0.50}} \right) \right) \right]^2$$

$$x = \exp \left(x_y + \frac{s_y^2}{2} \right)$$

where:

x_y	=	mean of the log-transformed distribution
s_y^2	=	variance of the log-transformed distribution
x	=	mean of the untransformed distribution
$x_{0.50}$	=	50th percentile of the data estimated from the probability plot.

CALCULATION 1: MEAN OF THE LOG-TRANSFORMED DATA

$$x_y = \text{Ln}(x_{0.50}) = \text{Ln}(2.74) = 1.01$$

CALCULATION 2: VARIANCE OF THE LOG-TRANSFORMED DATA

$$s_y^2 = \left[Ln \left(\tfrac{1}{2} \left(\frac{x_{0.50}}{x_{0.16}} + \frac{x_{0.84}}{x_{0.50}} \right) \right) \right]^2$$

$$= \left[Ln \left(\tfrac{1}{2} \left(\frac{2.74}{0.36} + \frac{21.12}{2.74} \right) \right) \right]^2$$

$$= [\text{Ln}(7.66)]^2$$

$$= 4.14$$

CALCULATION 3: MEAN OF THE UNTRANSFORMED DATA

$$x = \exp \left(x_y + \frac{s_y^2}{2} \right)$$

$$= \exp (1.01 + 2.07)$$

$$= 21.8 \text{ mg/kg}$$

ATTACHMENT 2

CALCULATION OF THE UPPER 95TH PERCENT NONPARAMETRIC CONFIDENCE LIMIT ON p^{th} PERCENTILE CORRESPONDING TO THE MEAN

BASE EQUATION

$UNCL_p = p(n+1) + Z_{95}\,[np(1-p)]^{½}$ (after Ecology 1992)

where:

p	=	percentile corresponding to the estimated mean of the untransformed distribution
n	=	number of samples
$UNCL_p$	=	upper 95th percent confidence limit of the p^{th} percentile
Z_{95}	=	95th percentile of the cumulative normal distribution (from Ecology 1992, Table A-6)

CALCULATION 1:

$UNCL_{84} = (0.84)(53+1) + 1.645[(53)(0.84)(1-0.84)]^{½}$
$= 45.3 + 4.39$
$= 49.8^{th}$ ranked sample (round up to 50)
$\approx$ 67 mg/kg (50^{th} ranked sample)

CALCULATION 2:

$UNCL_{86} = p(n+1) + Z_{95}[np(1-p)]^{½}$
$= (0.86)(53+1) + 1.645[(53)(0.86)(1-0.86)]^{½}$
$= 46.44 + 4.16$
$= 50.6^{th}$ ranked sample (round up to 51)
$\approx$ 76 mg/kg (51^{st} ranked sample)

ATTACHMENT 3

CALCULATION OF THE UCL_{95} OF A LOGNORMALLY DISTRIBUTED DATA SET

BASE EQUATION

$$UCL_{95} = \exp\left[x_y + (0.5)(s_y^2) + \left(\frac{(s_y)(H_{95})}{(n-1)^{1/2}}\right)\right]$$

where:

x_y	=	mean of the log-transformed distribution (Attachment 1)
s_y^2	=	variance of the log-transformed distribution (Attachment 2)
s_y	=	standard deviation of the log-transformed distribution
n	=	number of samples
H_{95}	=	H statistic for a 95th percent confidence level (from Gilbert 1987, Table A-12)

$$= \exp\left[1.01 + (0.5)(4.14) + \left(\frac{(2.03)(4.228)}{(53-1)^{1/2}}\right)\right]$$

$$= \exp(1.01 + 2.07 + 1.19)$$

$$= \exp(4.27)$$

$$= 72 \text{ mg/kg}$$

APPENDIX D

Site Photographs

1. Installing the geotextile fabric over contaminated soils in the North Fields area.

2. Placing the clean fill soil over the geotextile fabric in the North Fields area.

LANDAU ASSOCIATES

Lake Chelan School District
Ball Fields Site Improvements
Chelan, Washington

Selected Site Photographs

Figure
D-1

3. Overlapping geotextile fabric.

4. Placing clean fill material on the North Fields area.

LANDAU ASSOCIATES

Lake Chelan School District Ball Fields Site Improvements Chelan, Washington	**Selected Site Photographs**	Figure D-2

5. Completed remediation and site improvements in the South Fields area.

6. Completed remediation and site improvements in the North Fields area.

LANDAU ASSOCIATES

Lake Chelan School District Ball Fields Site Improvements Chelan, Washington	**Selected Site Photographs**	Figure D-3

APPENDIX E

Public Signage

Remediated Soil: NO DIGGING ALLOWED

Apple Blossom Center Park

In 2011, the Apple Blossom Center Park was developed as a cooperative effort between the Chelan School District and the Washington State Department of Ecology. The old orchard land had arsenic and lead above safe levels for a child play area.

Early orchardists, circa 1920's, used dry arsenate of lead to control insects like coddling moth. The insecticide left behind unhealthy levels of lead and arsenic in the orchard soils that could possibly harm young children.

The park's design was based on providing children a safe place to play. Soil with arsenic and lead from throughout the park was consolidated under the soccer fields and capped with a protective barrier, clean soil, and a grass cover. Now, at least 1' of clean soil covers the whole park providing our children a safe place to play.

We need your help to maintain the park. No digging is allowed in the park and children should not play in the soil in the undeveloped areas behind the fence. Please help keep the park a beautiful place to rest, play, and enjoy.

Worker's placing the protective black fabric barrier and clean soil during summer 2011.

The Chelan School District is committed to keeping the park safe and will be regularly maintaining and inspecting the clean soil and grass cover.

Remediated Soil: NO DIGGING, PLEASE.

For further information, contact: Chelan School District

APPENDIX F

Draft Environmental Covenant

~~Model Restrictive (Environmental) Covenant~~

After Recording Return to:
Norman Hepner
Department of Ecology
Central Regional Office
15 W. Yakima Avenue, Suite 200
Yakima, WA 98902

Environmental Covenant

Grantor: Chelan School District No. 129
Grantee: State of Washington, Department of Ecology
Legal: [fill in brief legal description]
Tax Parcel Nos.: 272318627022, 272318627027, 272318627020 ~~[check parcel #s please]~~

Grantor, Chelan School District No. 129, hereby binds Grantor, its successors and assigns to the land use restrictions identified herein and grants such other rights under this environmental covenant (~~-~~hereafter "Covenant"~~-~~) made this day, the ~~16th of August~~September, ~~2011,~~DATE in favor of the State of Washington Department of Ecology (Ecology). Ecology shall have full right of enforcement of the rights conveyed under this Covenant pursuant to the Model Toxics Control Act, RCW 70.105D.030(1)(g), and the Uniform Environmental Covenants Act, 2007 Wash. Laws ch. 104, sec. 12.

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This Declaration of Covenant is made pursuant to RCW 70.105D.030(1)(f) and (g) and WAC 173-340-440 by ~~[NAME OF PROPERTY OWNER],~~Chelan School District No. 129, its successors and assigns, and the State of Washington Department of Ecology, its successors and assigns (hereafter "Ecology").

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A remedial action (hereafter "Remedial Action") occurred at the property that is the subject of this Covenant. The Remedial Action conducted at the property is described in the following document~~[s]~~:

[INSERT THE DATE AND TITLE FOR CLEANUP ACTION [cite final report (to be issued by Landau)]and other documents as applicable]. .

Thisese document is[s] are on file at Ecology's [Insert Office Location]Central Regional Office. Office.

+++++++Select the appropriate scenario for the property+++++++

SCENARIO 1:

This Covenant is required because the Remedial Action resulted in residual concentrations of [SPECIFICALLY LIST SUBSTANCE(S)] lead and arsenic which exceed the Model Toxics Control Act Method [LIST APPLICABLE METHOD] A Cleanup Level(s) for [SOIL, GROUNDWATER, ETC.]soil established under WAC 173-340-700.

++++and/or++++

SCENARIO 2:

This Restrictive Covenant is also required because a conditional point of compliance has been established for soil. [SOIL, GROUNDWATER, ETC.].

SCENARIO 3:

If the Remedial Action does not fit within Scenarios 1 and/or 2 and you believe that the property still needs a Restrictive Covenant, contact the AG's office.

++

The undersigned, [NAME OF PROPERTY OWNER],Chelan School District No. 129, is the fee owner of real property (hereafter "Property") in the County of [NAME OF COUNTY], Chelan, State of Washington, that is subject to this Covenant. The Property is legally described [AS FOLLOWS: (insert legal description language)] or [INin ATTACHMENT Attachment A OF THISof this covenant and made a part hereof by reference. COVENANT AND MADE A PART HEREOF BY REFERENCE (attach document containing legal description)].

[NAME OF PROPERTY OWNER]Chelan School District No. makes129 makes the following declaration as to limitations, restrictions, and uses to which the Property may be put

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and specifies that such declarations shall constitute covenants to run with the land, as provided by law and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property (hereafter "Owner").

Section 1. ~~(This Section must describe with particularity the restrictions Restrictions to be placed on the property.)~~

~~1. If the property was remediated to industrial soil cleanup standards, then use the following sentence: "The Property shall be used only for traditional industrial uses, as described in RCW 70.105D.020(23) and defined in and allowed under the [CITY or COUNTY] of [_____'s] zoning regulations codified in the [OFFICIAL NAME OF ZONING REGULATION] as of the date of this Restrictive Covenant."~~

~~2. If the groundwater contains hazardous substances above cleanup levels, then use the following sentence: "No groundwater may be taken for [LIST THE PROHIBITED USES, E.G., DOMESTIC, AGRICULTURAL, OR ANY USE] from the Property."~~

~~3. If the s~~Because soil remains on the property that contains hazardous substances above cleanup levels and is contained under a clean soil cap, ~~then describe prohibited activities as follows:~~

~~a. For contaminated soil under a structure use the following sentence: "A portion of the Property contains [SPECIFICALLY LIST SUBSTANCE(S)] contaminated soil located [SPECIFICALLY DESCRIBE WHERE THE SOIL IS LOCATED, I.E., UNDER THE SOUTHEAST PORTION OF BUILDING 10]. The Owner shall not alter, modify, or remove the existing structure[s] in any manner that may result in the release or exposure to the environment of that contaminated soil or create a new exposure pathway without prior written approval from Ecology."~~

~~b. Example language for contaminated soil under a cap: "Any~~ any activity on the Property that may result in the release or exposure to the environment of the contaminated soil that was contained as part of the Remedial Action, or create a new exposure pathway, is prohibited. Maintenance and repairs under the clean soil cap are allowable provided they are conducted in accordance with the approved plan of operations and all contaminated soils are returned to below the fabric demarcation layer and/or properly disposed. ~~Some examples of~~

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~~activities that are prohibited in the capped areas include: drilling, digging, placement of any objects or use of any equipment which deforms or stresses the surface beyond its load bearing capability, piercing the surface with a rod, spike or similar item, bulldozing or earthwork.~~ A p~~P~~roperty d~~D~~iagram indicating location of contaminated soil is included in Attachment B of this covenant and made a part hereof by reference.

"

Section 2. Any activity on the Property that may interfere with the integrity of the Remedial Action and continued protection of human health and the environment is prohibited.

Section 3. Any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or create a new exposure pathway, is prohibited without prior written approval from Ecology.

Section 4. The Owner of the property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Remedial Action.

Section 5. The Owner must restrict leases to uses and activities consistent with the Covenant and notify all lessees of the restrictions on the use of the Property.

Section 6. The Owner must notify and obtain approval from Ecology prior to any use of the Property that is inconsistent with the terms of this Covenant. Ecology may approve any inconsistent use only after public notice and comment.

Section 7. The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times for the purpose of evaluating the Remedial Action; to take

samples, to inspect remedial actions conducted at the property, to determine compliance with this Covenant, and to inspect records that are related to the Remedial Action.

Section 8. The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and opportunity for comment, concurs.

Chelan School District No. 129	**State of Washington Department of Ecology**
[Name of Signatory]	**~~[Name of Person Acknowledging Receipt]~~Valerie Bound**
[Title]	TCP Section Manager, CRO
Dated:	**[Title]**
	Dated:

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~~[NAME OF GRANTOR]~~Chelan School District No. 129

_____

~~[Name of Signatory]~~
~~[Title]~~

~~Dated:~~ _____

~~STATE OF WASHINGTON~~
~~DEPARTMENT OF ECOLOGY~~

_____

~~[Name of Person Acknowledging Receipt]~~
~~[Title]~~

~~Dated:~~ _____

[INDIVIDUAL ACKNOWLEDGMENT]

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, and acknowledged that **he/she** is the individual described herein and who executed the within and foregoing instrument and signed the same at **his/her** free and voluntary act and deed for the uses and purposes therein mentioned.

_____
Notary Public in and for the State of Washington, residing at _____.
My appointment expires_____.

[CORPORATE ACKNOWLEDGMENT]

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ personally appeared before me, acknowledged that **he/she** is the _____ of the corporation that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said corporation.

_____
Notary Public in and for the State of Washington, residing at
_____.
My appointment expires_____.

[REPRESENTATIVE ACKNOWLEDGEMENT]

STATE OF _____
COUNTY OF _____

On this _____ day of _____, 20__, I certify that _____ _____ personally appeared before me, acknowledged that **he/she** signed this instrument, on oath stated that **he/she** was authorized to execute this instrument, and acknowledged it as the _____ [type of authority] of _____ [name of party being represented] to be the free and voluntary act and deed of such party for the uses and purposes mentioned in the instrument.

_____
Notary Public in and for the State of Washington, residing at _____.
My appointment expires _____.

Exhibit A
Legal Description

[Insert legal description]

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Exhibit B
Property Diagram and Contamination Locations

[Insert a property diagram, also indicating location of contamination. In addition to the aerial extent of contamination, this diagram should also indicate the vertical depth intervals of contamination. For example, in the north soccer fields contamination extends from 1' to a maximum of ?' below ground surface. South baseball fields…. This will be taken from the as-builts and ~~can probably be copied from the Landau~~final remediation report~~, once it is finalized~~.]

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