Preliminary Assessments
West Salem
Salem, Oregon

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Prepared for:
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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List of Abbreviations and Acronyms

Acronym	Definition
%R	Percent Recovery
µg/L	Micrograms per Liter
bgs	Below Ground Surface
BS	Blank Spike
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CRQL	Contract Required Quantitation Limit
CWE	Century West Engineering
DQO	Data Quality Objectives
E & E	Ecology and Environment, Inc.
EPA	United States Environmental Protection Agency
FE	Foundation Engineering
GIS	Geographic Information System
GPS	Global Positioning System
IDW	Investigation-Derived Waste
MCL	Maximum Contaminant Level
MEL	Manchester Environmental Laboratory
mrem	Millirem
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAREL	National Analytical Radiation Environmental Laboratory
NPL	National Priorities List
ODEQ	Oregon Department of Environmental Quality
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl

List of Abbreviations and Acronyms (cont.)

pCi/g	Picocuries per Gram
pCi/L	Picocuries per Liter
QA	Quality Assurance
QAP	Quality Assurance Plan
QC	Quality Control
RBC	Risk-Based Concentration
RPD	Relative Percent Difference
RSL	Regional Screening Level
Shealy	Shealy Environmental
SPAF	Sample Plan Alteration Form
START	Superfund Technical Assessment and Response Team
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TDD	Technical Direction Document
TDL	Target Distance Limit
TWCA	Teledyne Wah Chang Albany
UST	Underground Storage Tank
VOC	Volatile Organic Compound

1 Introduction

Ecology and Environment, Inc., (E & E) was tasked by the United States Environmental Protection Agency (EPA) to provide technical support for completion of Preliminary Assessments (PAs) at several properties in West Salem in Salem, Oregon. E & E completed PA activities under Technical Direction Document (TDD) Number 13-04-0002, issued under EPA, Region 10, Superfund Technical Assessment and Response Team (START) Contract Number EP-S7-06-02 and TDD 13-09-0016, issued under EPA, Region 10, START-IV Contract Number EP-S7-13-07.

The specific goals for the West Salem PAs, identified by the EPA, are to:

- Determine the potential threat to public health or the environment posed by the sites;
- Determine the potential for a release of hazardous constituents into the environment; and
- Determine the potential for placement of the site on the National Priorities List (NPL).

Completion of the PAs included reviewing existing site information, collecting receptor information within the range of site influence, determining regional characteristics, and conducting a site visit and a limited sampling event. To help contextualize the facilities under study during this effort, the introductory sections of this report describe the general/common development and land use in the area of and surrounding the sites. The following subsections provide details regarding site-specific features, use history, and similar data for each individual site.

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2 Site Background

2.1 Site Location

Site Name:	West Salem Preliminary Assessments
CERCLIS ID Number:	Various
Site Address:	Various
Latitude:	44.9521876 (Approximate center of site)
Longitude:	-123.066836 (Approximate center of site)
Legal Description:	Various
County:	Polk County
Congressional District:	5th Congressional District
Site Owner(s):	Various
Site Operator(s):	Various

2.2 Site Description

The West Salem PAs site (Figure 2-1) includes several locations that are being investigated in response to petitions submitted by local residents concerned about multiple occurrences of osteosarcoma (a rare form of bone cancer) in the West Salem area of Oregon.

This assessment focused on five different properties in the area: Walker Middle School, West Salem High School, Wallace Marine Park, Orchard Heights Park, and the 7th and Patterson Ballfields, and included sampling at a Minto-Brown Island Park to represent background conditions (Figure 2-2). These properties were selected for inclusion in the West Salem PAs study during discussions that took place between the EPA, parents of the children who contracted osteosarcoma, and other interested parties. Locations selected for this assessment were identified as places where the children had frequented.

These sites are all located within an approximately 1.75-square-mile area on the west side of the Willamette River. Three of the properties (Walker Middle School, Wallace Marine Park, and 7th and Patterson Ballfields) are located at a lower relative elevation, within the ancestral alluvial flood plain of the Willamette River. The two remaining sites (West Salem High School and Orchard Heights Park) are located in upland areas of West Salem. Land use in the vicinity of all of these sites is a mix of light industrial/commercial and residential, with the light-industrial/commercial usage typically located in the lower elevation alluvial plain area.

The Willamette River is the predominant surface water feature within the study area, running through Salem and eventually discharging to the Columbia River approximately 80 miles downstream. Glenn Creek, a small tributary of the Willamette River, has head waters in the vicinity of West Salem High School, and from that source runs through various residential neighborhoods, transects Orchard Heights Park, and discharges to the Willamette River approximately 2.7 miles north of Orchard Heights Park, at a location approximately 3.2 river miles north of Wallace Marine Park.

2.3 Ownership and Development History

In all but one case, sites included in this project are owned and operated by public agencies. These include two sites owned by the Salem-Keizer School District (Walker Middle School and West Salem High School) and two sites owned by the City of Salem Parks Department (Wallace Marine Park and Orchard Heights Park). The fifth site is currently owned by KFP Investment LLC (7th and Patterson Ballfields) (PCA 2012a, 2012b, 2012c, 2013a, 2013b).

2.4 Operations and Waste Characteristics

As discussed above, the sites targeted by this assessment include two public parks (Wallace Marine and Orchard Heights Parks), two public schools (Walker Middle and West Salem High Schools), and community used baseball fields located on privately owned land (7th and Patterson Ballfields). With the exception of the 7th and Patterson Ballfields property, none of the sites are currently or historically associated with industrial or commercial operations or ownership. The 7th and Patterson Ballfields are located on a portion of a parcel that is currently used by a precision machining business (Hanard Machine) and was historically used by a textile/manufacturing businesses(Asten-Hill) (EDR 2012, 2013a, 2013b, 2013c, 2013d; Carter 2013; PCA 2012a, 2012b, 2012c, 2013a, 2013b). No industrial/commercial use of the ballfields has been documented.

Based on historic aerial photographs, the park and school properties generally appear to have been used as agricultural land and/or were residentially occupied prior to their current uses (EDR 2012, 2013a, 2013b, 2013c, 2013d). Prior to construction of Walker Middle School, that property appears to have been developed with athletic fields (SKPS 1959). Aerial photographs depict baseball fields at their present location on the 7th and Patterson site through at least 1950; no industrial use, disposal, or storage activities were observed on the ballfields in these photographs (EDR 2013a).

2.4.1 Geology/Hydrogeology

The Willamette Valley is a structural depression with hills of moderate relief separating broad alluvial flats. The valley lies between the Cascade Range and the Coast Range and extends from the Portland Basin southward to a point near the city of Cottage Grove. The Willamette Valley consists of numerous terraces and reworked floodplains, primarily of Pleistocene and more recent age. Regional geology within the alluvial flats consists of a stratigraphic sequence of largely Quaternary sediments and flow deposits associated with the Willamette

River and its tributaries. These deposits overlie older parent materials, including Cascade volcanic rocks and Columbia River Basalts (TechLaw 2011).

Regarding the specific sites included in this assessment, the Walker Middle School, Wallace Marine Park, 7th and Patterson Ballfields, and background sampling location (Minto-Brown Island Park, shown on Figure 2-2) are all situated within the alluvial flats of the Willamette River basin. The remaining sites (Orchard Heights Park and West Salem High School) are located on uplifted areas of local basement rock formations (Cascade volcanic rocks and Columbia River Basalts) (Beja 1981). In general, the sites in the alluvial flats are located at approximately 120- to 140-feet above sea level, in a topographic regime that slopes down towards the Willamette River. The Orchard Heights Park and West Salem High School sites are located approximately 160- to 200-, and 380- to 450-feet above sea level, respectively (USGS 2011).

In the Willamette Valley, surficial basin deposits include alluvium and flood deposits often grouped together and commonly referred to as the "over-bank deposits." Ground water is typically encountered in the "over-bank" units as an unconfined aquifer (TechLaw 2011). The over-bank deposits consist of approximately 15 to 20 feet of silt/clayey silt overlying sands, gravels, and some cemented gravels (Troutdale Formation) to a depth of greater than 100 feet. Columbia River basalts underlie the Troutdale Formation, and are generally encountered at 300 to 400 feet below ground surface (bgs) in this area (TechLaw 2011).

2.4.2 Drinking Water Sources

The Oregon Water Resource Department well logs for wells in the area indicate that the main water-bearing zone for domestic use is from 30 feet to 60 feet bgs, and the main water-bearing zone for industrial and municipal supply is from 100 feet to greater depths bgs. While non-continuous lenses of silts and clays are likely present within the sands and gravels and may locally affect the vertical hydrologic gradient, no significant aquitard or low permeability zone separates the shallow sands and gravels from the deeper, higher yield gravel zones (TechLaw 2011).

While some legacy wells are expected to provide drinking water to select residences in West Salem, the City of Salem provides the vast majority of the residential drinking water supply. This water is obtained from intakes on the Santiam River, approximately 19 miles southeast of the site, a location that would not be influenced by environmental conditions in the West Salem area (Salem 2012).

In accordance with the Safe Drinking Water Act, the City of Salem conducts ongoing monitoring of drinking water quality. Parameters tested include inorganic, microbiological, radioactive, and other disinfection (i.e., chlorination) related constituents. During this testing, the water district collects samples from the Geren Island Treatment Facility, the water distribution network, and from end user locations (i.e., taps). According to the 2012 water quality report, none of the parameters tested for were present at concentrations in excess of the EPA's published Maximum Contaminant Levels (MCLs) (Salem 2012).

With respect to testing for radioactive constituents, one sample was collected by the water district from the "backup" drinking water supply well located in the West Salem area and analyzed for the presence of total radium. Radium levels in this well were 0.26 picocuries per liter (pCi/L), well below the EPA's MCL of 5 pCi/L. In addition, although this well is a part of the City of Salem's system, the well is not used since the surface water source provides ample supply (Salem 2012).

2.5 Previous Investigations

In cooperation with the Oregon Health Authority, Dr. Scott Burns at the Geology Department of Portland State University has lead efforts to compile data on radon testing conducted in the State of Oregon. This work grouped available radon testing results by zip code. The potential radon hazard in the zip codes was evaluated using the maximum test result, average test result, and the percentage of tests that exceeded 4 pCi/L; these data points were then evaluated by rank sum distribution analysis which was used to assign radon exposure risk in a given zip code as a low, moderate, or high potential rating (Burns 2013b). Based on these evaluations, the short-term test results (i.e., less than 90 days) characterize the West Salem zip code as having a "high" radon hazard, though the long-term test results (i.e., 91 days to 1 year) characterize the area as having a moderate radon hazard (Burns 2013a). A summary of radon test results for zip codes in the vicinity of the study area is included as Table 2-1.

During a telephone conversation between the START and Dr. Burns seeking clarification on the methodology used in evaluating the relative radon exposure risk, Dr. Burns theorized that the higher levels may relate to exposed areas of sedimentary rock derived landslide deposits encountered in the West Salem area (Burns 2013b). Such deposits are located on the south-southwest side of the West Salem hills (Beja 1981), within unincorporated areas of Polk County zoned for farm use or low-density (one residence per 5 acre) development (Polk 2008). No further study of this theory was readily apparent in the literature.

Given the history of these sites, the properties included in this assessment have not been the target of significant environmental investigatory review in the past. In preparing this report, the property owners provided available background documentation on individual sites. To supplement this information, an environmental database report was generated for each facility. These database reports included searches of the same databases and target radii as would be used in an All Appropriate Inquiries/ASTM-1527-05 compliant Phase I Environmental Site Assessment. In addition, historic aerial photographs and Sanborn Fire Insurance Maps (as available) were obtained from the database provider. Printed copies of the historic aerial photographs and maps are included in Appendix B of this report. Electronic copies of the database reports have been provided on a CD included with this report.

More specific information on the environmental databases reports generated and a review of reports available for each site are included in site-specific sections presented as Sections 7 through 11 of this report.

2.6 START Site Visit and Community Meetings

Between February 25, 2013 and February 27, 2013, the START and EPA staff conducted site visits at the Walker Middle School, West Salem High School, Orchard Heights Park, and 7th and Patterson Ballfields sites included in this PA. (Note: Wallace Marine Park was later added to the list of PAs based on input provided by community members at public meetings.) EPA/START staff was accompanied by property owners/representatives at all but the Orchard Heights Park site. For information relating to site visits and observations, please refer to Sections 7 through 11 that follow within this report.

In addition, on the afternoon and evening of February 26, 2013 city, county, state, and federal governmental parties held two community meetings. These meetings were meant to provide an opportunity for community members to learn about the preliminary assessments to provide feedback on the proposed work. Governmental agency representatives included:

- Anthony Barber, EPA, Director, Oregon Operations Office;
- Joanne LaBaw, EPA, Site Assessment Manager;
- Jae Douglas, Oregon Health Authority, Administrator, Center for Prevention and Health Promotion;
- Katrina Hedberg, Oregon Health Authority, State Epidemiologist;
- Randy Phillips, Polk County Public Health, Public Health Manager;
- Mike Gotterba, City of Salem, Public Information Officer; and
- Mike Wolf, Salem-Keizer School District, Chief Operations Officer,

Members of the audience included the parents of several children that had developed osteosarcoma, state and local elected officials, reporters from Salem/Portland area print and broadcast media, local business owners and representatives, and concerned citizens.

EPA provided a brief description of the approach to be taken during the EPA's PAs. In addition, representatives from Oregon Health Authority discussed how cancer occurrences are tracked by the State of Oregon, and how these data are used by the State to identify areas where additional epidemiological study may be warranted. Oregon Public Health officials also answered questions from community members concerning radon gas levels in the community.

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3 Field Activities and Analytical Protocol

A Quality Assurance Plan (QAP) for the West Salem PAs was developed by the START prior to field sampling (E & E 2013). The QAP described the sampling strategy, sampling methodology, and analytical program to be used to investigate potential hazardous substance sources and potential targets in the area.

In general, PA field activities were conducted in accordance with the approved QAP; however, there were several deviations, including: a reduction in the number of samples collected from the Walker Middle School property; adding sample collection at the West Salem High School property; and adding more analytes to the project analytical scope. These deviations are documented in the Sample Plan Alteration Forms (SPAFs) provided in Appendix C. All deviations to the SQAP were pre-approved by the EPA Site Assessment Manager during the field sampling event. The site-specific deviations are explained in the individual property sections that describe site work.

In addition, based upon comments provided by an environmental advocate interested in this project, the EPA elected to submit certain samples for analysis of select total recoverable rare/exotic metals. These constituents included titanium, zirconium, niobium, tantalum, hafnium, and tungsten. As these analytes are not typically considered in standard toxicological/risk based assessments, the EPA's Manchester Environmental Lab (MEL) developed specific methods to test for their presence and concentration.

The field sampling event for the PAs was conducted from June 10, 2013 through June 14, 2013. A total of 45 samples, including background samples, were collected for the PAs. Sample types and methods of collection are described below. A list of all samples collected for laboratory analysis for the West Salem PAs is contained in Table 3-1. Chain-of-custody forms, laboratory data sheets of analytical results, and data validation memoranda for all samples are provided in Appendix D.

Alphanumeric identification numbers applied by the START to each sample location (e.g., OH01SS) are used in this report as the sample location identifiers. Table 3-2 summarizes the sample coding system used for formulating sample numbers. For example, the sample number OH01SS indicates the following:

- OH for the source code (in this case, Orchard Heights Park);

- 01 for the sequential number of samples from a given source area by matrix (in this case, the first soil sample from Orchard Heights Park); and
- SS for the sample matrix (in this case, surface soil).

This section describes sampling methodology, analytical protocol, global positioning system (GPS) coordinates, and investigation-derived waste (IDW).

3.1 Sampling Methodology

All PA samples were stored on ice in coolers continuously maintained under the custody of START personnel. Sampling methods used for each sample type are described below.

3.1.1 Gamma Field Screening

Field screening was performed at all target properties included in this sampling event. This screening utilized a Ludlum™ Model 44-2 probe and a Ludlum™ Model 2241-2 rate meter set to relay gamma activity data in kilo-counts per minute to a Viper data logging system. The Viper system receives simultaneous inputs from the Ludlum™ meter and a co-located GPS data logger. These collocated data are then wirelessly transmitted to a field computer that records, compiles, and uploads the data to project-specific website for data presentation and visualization (EPA 2013).

The Viper unit, Ludlum™, and GPS link set-up used a wheeled cart for field screening activities. Screening was performed by walking this cart across select areas of each site at predetermined transect intervals, ranging from approximately 25 to 50 feet. Prior to performing transects, operational checks were performed on the Ludlum™ using a Cesium-137 check source. Photographs of a typical gamma-screening transect and the associated equipment set-up are included in Appendix A, Sampling Photos 34 and 35.

3.1.2 Soil and Sediment Sampling

Surface soil and sediment were collected from 0 to 6 inches deep using dedicated stainless steel spoons. Due to the density of the ground surface, several soil samples required the use of a non-dedicated hand pick to break up the ground surface prior to sample collection. The hand pick was decontaminated prior to use and between all subsequent sample locations using distilled de-ionized water and Alconox. One or more soil samples from each property were collected from soils underlying the gamma screening transects.

Collected material was placed in a dedicated stainless steel bowl. Grass, leaves, and other vegetative material, as well as rocks and other debris unsuitable for analysis, were removed from samples; sediment and other samples with high-moisture content were decanted, as necessary, then thoroughly homogenized, and placed into pre-labeled sample containers.

3.2 Analytical Protocol

Analytical protocols applied to the PA samples included the following off-site fixed laboratory analysis (see Table 3-1 for a detailed summary of analyses applied to individual samples):

- **Pesticides/Polychlorinated Biphenyls (PCBs):** Thirty-nine samples were submitted for pesticide and PCB analysis using EPA Method SOM01.2, which includes analysis by SW-846 8082. The samples were submitted to Shealy Environmental (Shealy), an EPA Contract Laboratory Program (CLP) laboratory located in West Columbus, South Carolina.
- **Semivolatile Organic Compounds (SVOCs):** Thirty-nine samples were submitted for SVOCs analysis using EPA Method SOM01.2 SIM or SW-846 8270 methodology. All of the samples were submitted to Shealy.
- **Target Analyte List (TAL) Metals plus Mercury and Molybdenum:** Thirty-nine samples were submitted for TAL metals analysis using EPA Method ISM01.2 or SW-846 6000 methodology. All of the samples were submitted to A4 Scientific, an EPA CLP laboratory, located in The Woodlands, Texas.
- **Gamma Spectrometry with 21-day Ingrowth:** Twenty-six samples were submitted for gamma spectrometry analysis by NAREL-GAM-01 methodology (similar to EPA 901.0). The 21-day ingrowth part of the method involves sealing the samples tightly for a 21-day period to allow any natural radon gas to collect and decay through several half-lives (radon-222 gas has a half-life of 3.8 days), thereby reaching equilibrium with daughter radionuclides lead-214 and bismuth-214, which can be used to approximate the radium-226 content of the sample. The method also allows for ingrowth of actinium-228 from radium-228 so that the actinium-228 activity can be used to approximate the radium-228 content of the sample. All samples were submitted to the National Analytical Radiation Environmental Laboratory (NAREL), located in Montgomery, Alabama.
- **Gross Alpha and Beta:** Twenty-six samples were submitted to be analyzed for gross alpha and beta using method NAREL-GR03. All samples were submitted to NAREL.
- **Select Radionuclides (Plutonium, Uranium, Americium, Thorium, and Strontium):** Twenty-six samples were submitted to be analyzed for individual radionuclides by extraction chromatography. All samples were submitted to NAREL.
- **Rare/Exotic Metals (Tungsten, Titanium, Hafnium, Tantalum, Zirconium, and Niobium):** Twenty-two samples were submitted for analysis by EPA Method 3050B/200.8/6020 for total recoverable rare/exotic metals. These samples were sent to the EPA's Manchester Environmental Laboratory (MEL) located Manchester, Washington. It should be noted that due to the relatively inert nature of these metals, this data is for recoverable rather than total metals, and many/most sample results include a low-bias.

3.3 Global Positioning System

GPS coordinates for individual sample points were collected using a Trimble™ Geo XH handheld unit. Recorded GPS coordinates by sample point are listed in Appendix E. The GPS coordinates obtained in the field for four samples (WM01SD, OH01SD, OH03SD, and OH05SS) were not sufficiently accurate to use in mapping. The positions of these samples were estimated from field knowledge of their locations relative to site features, and the coordinates for these positions were obtained from GoogleEarth™.

Sample locations for gamma field screening efforts were recorded using the GPS link of the Viper system. Given the large number of screening locations for which this screening/Viper data were collected, these locations are not provided in this report, but rather are graphically displayed on figures included with this report.

3.4 Investigation-Derived Waste

IDW generated during the sampling effort for the PAs included disposable personal protective clothing and dedicated sampling equipment. IDW generated during field activities was rendered unusable by tearing (when appropriate), bagged in opaque plastic garbage bags, and disposed of at a municipal landfill. Recyclable field supplies (cardboard, stainless steel bowls, and stainless steel spoons) were separately bagged and recycled at the EPA’s warehouse in Seattle, Washington.

4 Quality Assurance/ Quality Control

Quality assurance (QA)/quality control (QC) data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of sampling equipment, glassware, and reagents. Specific QC requirements for laboratory analyses are incorporated in the *Contract Laboratory Program Statement of Work for Organic Analyses* (EPA 2007) and the *Contract Laboratory Program Statement of Work for Inorganic Analyses* (EPA 2011b). These QC requirements or equivalent requirements found in the analytical methods were followed for analytical work on the project. This section describes the QA/QC measures taken for the project and provides an evaluation of the usability of data presented in this report.

Data from the CLP laboratories were reviewed and validated by EPA chemists. Data from the EPA radiation laboratory were reviewed by EPA personnel at the laboratory. Data qualifiers and labels were applied, as necessary, according to the following guidance:

- EPA (2008) USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review;
- EPA (2009) Guidance for Labeling Externally Validated Laboratory Data for Superfund Use; and
- EPA (2010) USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review.

In the absence of other QC guidance, method- and/or SOP-specific QC limits were also utilized to apply qualifiers to the data.

4.1 Satisfaction of Data Quality Objectives

The following EPA (EPA 2000) guidance document was used to establish data quality objectives (DQOs) for this project:

- *Guidance for the Data Quality Objectives Process* (EPA QA/G-4), EPA/600/R-96/055.

The EPA Site Assessment Manager determined that definitive data without error and bias determination would be used for the sampling and analyses conducted during the field activities. The data quality achieved during the field work produced sufficient data that met the DQOs stated in the QAP (E & E 2013a). A detailed discussion of accomplished project objectives is presented in the following sections.

4.2 QA/QC Samples

Trip blank QA samples are only required for volatile organic compound (VOC) analyses and were not collected for this project. Rinsate blank QA samples were collected for each of the 20 samples using non-dedicated sampling equipment. QC samples included matrix spike/matrix spike duplicate (MS/MSD) and/or blank spike (BS) samples at a rate of one MS/MSD and/or BS per 20 samples per matrix.

4.3 Project-Specific Data Quality Objectives

The laboratory data were reviewed to ensure that DQOs for the project were met. The following sections describe the laboratories' and/or field team's abilities to meet project DQOs for precision, accuracy, and completeness, and the field team's ability to meet project DQOs for representativeness and comparability. The laboratories and the field team were able to meet DQOs for the project.

4.3.1 Precision

Precision measures the reproducibility of the sampling and analytical methodology. Laboratory and field precision is defined as the relative percent difference (RPD) between duplicate sample analyses. The laboratory duplicate samples or MS/MSD samples measure the precision of the analytical method. The RPD values were reviewed for all commercial laboratory samples. No sample results were qualified based on precision outliers; therefore, the project DQO for precision was met.

4.3.2 Accuracy

Accuracy indicates the conformity of the measurements to fact. Laboratory accuracy is defined as the surrogate spike percent recovery (%R) or the MS/MSD/BS %Rs for all laboratory analyses. The surrogate %R values were reviewed for all appropriate sample analyses. A total of five sample results (approximately 0.1% of the data) were qualified as estimated quantities (J) based on surrogate outliers.

The %R values were reviewed for all MS/MSD/BS analyses. A total of 76 sample results (approximately 1.3% of the data) were qualified as estimated quantities (J) based on MS/MSD/BS outliers; therefore, the project DQO for accuracy of 90% was met.

4.3.3 Completeness

Data completeness is defined as the percentage of usable data (usable data divided by the total possible data). All laboratory data were reviewed for data validation and usability. No sample results were rejected (R); therefore, the project DQO for completeness of 90% was met.

4.3.4 Representativeness

Data representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point or environmental condition. The number and selection of samples were determined in the field to accurately account for site variations and sample matrices. The DQO for representativeness was met.

4.3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Data produced for this site followed applicable field sampling techniques and specific analytical methodology. The DQO for comparability was met.

4.4 Laboratory QA/QC Parameters

The laboratory data also were reviewed for holding times/temperatures/sample containers, laboratory blank samples, serial dilution analyses, and rinsate blanks. These QA/QC parameters are summarized below.

4.4.1 Holding Times/Temperatures/Sample Containers

All holding times, sample temperatures, and containers were acceptable.

4.4.2 Laboratory Blanks

All laboratory blanks met the frequency criteria. The following potential contaminants of concern were detected in the laboratory blanks:

- **Inorganics**: Aluminum, antimony, arsenic, beryllium, cadmium, chromium, lead, molybdenum, mercury, selenium, silver, sodium, thallium, and vanadium.

See the data validation memoranda for results qualified based on blank contamination (Appendix D).

4.4.3 Serial Dilution Analyses

Serial dilution analyses met the frequency criteria. A total of 389 sample results (approximately 6.5% of the data) were qualified based on serial dilution outliers.

4.4.4 Rinsate Blanks

Rinsate blank analyses were performed at a frequency of one per 20 samples collected using non-dedicated sampling equipment (surface soil samples). There were no detections in the rinsate blank radiochemical analyses that exceeded the minimum detectable concentration; therefore, no qualifications were applied to the associated radiochemical results. Beta-BHC (0.0072 JQ micrograms per liter [µg/L]), chromium (0.11 JQ µg/L), and magnesium (0.1 JQ µg/L) were detected in the rinsate blank. None of these analytes were detected at elevated concentrations in the surface soil samples; therefore, no qualifications were applied to these associated sample results.

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5 Analytical Results Reporting

This section describes the reporting methods applied to analytical results presented in this report.

5.1 Analytical Results Evaluation Criteria

Analytical results presented in the summary tables included at the end of this report show all analytes detected above laboratory detection limits in bold type. Analytical results indicating elevated concentrations of contaminants in source samples and target samples (i.e., surface soil and sediment) with respect to background concentrations are shown underlined/bold type.

Background concentrations are based on the analysis of samples collected at Minto-Brown Island Park. Based on its location upriver from both Wallace Marine Park and current and former industrial facilities, and the absence of reported industrial use of the park, Minto-Brown Island Park was interpreted to have a low probability of being influenced or impacted by contaminants that may be present in the study area. For the purposes of this investigation, elevated concentrations of inorganic and organic constituents are those concentrations that are:

- Equal to or greater than the sample's Contract Required Quantitation Limit (CRQL) or the Sample Quantitation Limit when a non-CLP laboratory was used; and
- Equal to or greater than the background sample's CRQL or Sample Quantitation Limit when the background concentration was below detection limits; or
- At least three times greater than the background concentration when the background concentration equals or exceeds the detection limits.

For the purposes of this investigation, elevated concentrations of naturally occurring or otherwise environmentally ubiquitous radionuclides are those concentrations that are:

- Equal to or greater than the sample's CRQL or, in this case, the laboratory's Minimum Detectable Concentration; and
- At least two standard deviations above the project-specific mean background level. To allow for the calculation of mean background levels, four sediment and soil samples were collected from the background site for radiological analysis. The mean background activity levels and associated standard

deviation calculations for each radionuclide are included in Tables 6-3 and 6-6.

The radionuclides detected in samples collected for this report are naturally occurring, with the exception of cesium-137. Cesium-137 is ubiquitous in the environment at low levels primarily from man-made sources. It should also be noted that gross alpha and gross beta are tests that measure general alpha and beta radiation from any source, both natural and man-made.

It is recognized that the above criteria for determining elevated concentrations of radionuclides is very conservative. In response to this concern, EPA and START corresponded with a Health Physicist at the Oregon Health Authority regarding radiation exposure and dosage risk. This is further discussed in Section 5.2. This report will focus discussions on the sampling results, with regard to health-based criteria.

Finally, gamma screening results at each target site were compared to gamma data obtained during field screening at the background site (Minto-Brown Island Park). For the purposes of this report, individual screening results (i.e., each gamma activity count reading) were compared to the mean background gamma activity level measured in gamma screening transects at Minto-Brown Island Park. Any single reading at a target location that was greater than two times the mean background gamma level would have been elevated. It should be noted that the gamma screening data generated during this assessment is considered provisional, and was generated with the expressed intent to provide broad level comparison of the properties under study, rather than form the basis for decisions regarding site conditions.

The analytical results summary tables provided in this report are a condensed version of the laboratory data. Data validation memoranda and laboratory data sheets will be included as Appendix D. The presentation of data in the analytical summary tables are as follows:

- Analytes that were not present in any sample above their CRQL or minimum detectable concentration were omitted from their respective tables;
- All detected concentrations are shown in bold type; a non-detect concentration is shown as the detection limit reported by the laboratory (e.g., 0.66 U);
- The background concentrations and regulatory cleanup levels are provided in the first columns of the tables;
- Concentrations meeting the elevated definition are underlined.

Based on EPA Region 10 policy, evaluation of aluminum, calcium, iron, magnesium, potassium, and sodium (i.e., common earth crust metals) is generally used in mass tracing, which is beyond the scope of this report. Furthermore, these analytes are not associated with toxicity to humans under normal circumstances (EPA 1996). For these reasons, these analytes are not included in the evaluation, but are provided in the analytical summary tables if they were detected above the instrument detection limit.

5.2 Regulatory Standards

Although not typically part of a PA investigation, soil and sediment sample results for organic and inorganic constituents in this investigation will be compared to the Risk Based Concentrations (RBCs) promulgated by the Oregon Department of Environmental Quality (ODEQ) as a cleanup value for the surface soil direct contact pathway in a residential scenario. The values presented in ODEQ's RBC tables have been developed based on contaminated media, exposure pathway, and receptor scenario.

In the event that an analyte has no available RBC, the sample result was compared to the EPA Regional Screening Level (RSL) (EPA 2011a). These screening levels are risk-based concentrations derived from equations combining exposure information assumptions with EPA toxicity data. They are developed in accordance with the EPA soil screening guidance and are based on future residential land use assumptions and related exposure scenarios (EPA 1996).

As ODEQ has not developed RBCs for sediments, the residential soil values were conservatively applied to these samples for comparison.

Metals and other inorganic elements occur naturally in soil and other matrices, such as ground water and sediment. The ODEQ has determined that default background concentrations for inorganic contaminants can be used, at the discretion of the ODEQ, for sites where site-specific background metals concentrations are not known. Therefore, the default background concentrations of certain metals have also been included in summary tables.

Similar to radionuclides, discussion of organic and inorganic constituents within this report will also be based on a comparison to these RBC or RSL values.

Finally, as no RBCs or RSLs have been developed for radionuclides the START corresponded with a Health Physicist at the Oregon Health Authority regarding radiation exposure and dosage risk. Oregon maintains a whole body radiation dose limit equivalent to 25 millirem (mrem) above background levels (OAR 333-117-0120).

Additionally, 40 Code of Federal Regulations (CFR) 192 includes soil cleanup guidance for several radionuclides (radium-226, radium-228, etc.) that specifies a residual activity from a combination of radium-226 and radium-228 of less than 5 picocuries per gram (pCi/g) for surface soils. That said, the guidance provided in 40 CFR 192 is not an enforceable statute and was developed to address a very specific exposure route (i.e., exposure from inhalation of radon decay products and/or exposure to gamma radiation in houses built on land covered with radionuclide contaminated tailings from uranium mining sites). For this reason, this value does not have direct applicability for this PAs evaluation, but may provide a broad point of comparison for radionuclide results.

Regulatory standards to be applied to soil samples collected for this project are presented in Table 5-1, as well as included in the first columns of the analytical summary tables.

6 Minto-Brown Island Park (Background Location)

6.1 Site Location

Site Name:	Minto-Brown Island Park
CERCLIS ID Number:	N/A
Site Address:	2200 Minto Island Road SW, Salem, Oregon
Latitude:	44.924535 (Approximate center of farm field)
Longitude:	-123.072214 (Approximate center of farm field)
Legal Description:	Township 7S, Range 3W, Section 32, Marion County Tax Lot Numbers 073W3200100, 073W33A00200, 073W3200600 (Approximate area of farm field)
County:	Marion County
Congressional District:	5th Congressional District
Site Owner(s):	City of Salem
Site Operator(s):	Salem Parks Department
Site Contact(s):	Kacey Duncan, Deputy City Manager, City of Salem, Oregon 555 Liberty Street SE/Room 220 Salem, Oregon 97301

6.2 Site Description

Minto-Brown Island Park includes approximately 889 acres of land situated along the Willamette River at a location that is upstream of the downtown core of Salem, Oregon and Wallace Marine Park (Figure 2-2). The park includes wooded and cleared areas transected by paved and unpaved recreational paths, play equipment, a dog park area, and picnic tables and benches (Figure 6-1). Prior to its use as a park, the site had been owned by Isaac Brown and John Minto who raised livestock, farmed, and/or lived on the parkland (Salem 2013a). (Figure 2-2).

Minto-Brown Island Park was selected as a location that would be representative of background conditions due to its location upriver from current and former industrial facilities and Wallace Marine Park, the absence of reported industrial use of the park, and the low probability of being influenced or impacted by contaminants that may be present in the study area. Selection of this location as the representative “background” location had not occurred at the time of the preliminary site reconnaissance work; therefore, the START did not conduct a site visit at this property prior to sampling activities.

6.3 Geologic Features

Surficial geology beneath Minto-Brown Island Park site is comprised of recently deposited river alluvium. The alluvium includes unconsolidated cobbles, coarse gravel, sand, and some silt and clay. The alluvium is generally 15 to 45 feet thick and consists of stratified sands and well-rounded pebbles, gravels, and cobbles (Beja 1981).

6.4 PA Sampling

Soil and sediment samples were collected from two principal locations at the Minto-Brown Island Park property:

- Soil samples were collected from an upland “farm field” area of the property; and
- Sediment samples were collected along the Willamette River.

The farm field area was also field screened for gamma radiation using the Viper system. Figure 6-2 depicts soil and sediment sample locations across the PA study area. Figure 6-3 depicts soil and sediment sample locations specific to Minto-Brown Island Park. Figure 6-4 depicts the approximate alignment of transects with the Viper unit and range of gamma detections. All field work at the Minto-Brown Island Park site occurred on June 10, 2013.

At the suggestion of NAREL representatives, all four soil and sediment samples were analyzed for radiological constituent classes (gross alpha, gross beta, gamma spectrometry, and individual radionuclides). One soil and sediment sample from Minto-Brown Island Park was submitted for organic and inorganic constituents analysis (i.e., metals, pesticides, PCBs, SVOCs).

6.4.1 Gamma Radiation Field Screening

Gamma radiation field screening was conducted in a 100-foot by 200-foot area within a farm field on the property. Screening in this area proceeded on 25-foot transect intervals with alignment roughly northeast to southwest. Figure 6-4 depicts the transect alignments and corresponding screening results. A summary of gamma screening readings is included in Table 6-1.

6.4.2 Surface Soil Samples

Four soil samples (BG01SS through BG04SS) were collected from the Minto-Brown Island Park property to characterize “background” conditions in the PAs study area (Appendix A, Sampling Photos 1 to 4). These samples were all collected from within the area of the Viper transects. All four samples were submitted for analysis of radiological constituents. Sample BG02SS was submitted for organic and inorganic constituents. The background sample results are included in the first column(s) of Tables 6-2, 6-3, and 6-4.

6.4.3 Sediment Samples

Four sediment samples (BG01SD through BG04SD) were also collected from the Minto-Brown Island Park property to characterize "background" conditions in the PAs study area (Appendix A, Sampling Photos 5 to 8). These samples were collected at various locations along the Willamette River shoreline. Similar to the background soil samples, all four samples were submitted for analysis of radiological constituents. Only sample BG03SD was submitted for organic and inorganic constituents. The background sample results are included in the first column(s) of Tables 6-5, 6-6, and 6-7.

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7 Walker Middle School

7.1 Site Location

Site Name:	West Salem Area, Walker Middle School
CERCLIS ID Number:	ORN001003086
Site Address:	1075 8th Street NW, Salem, Oregon
Latitude:	44.947646 (Approximate center of site)
Longitude:	-123.059948 (Approximate center of site)
Legal Description:	Township 7S, Range 3W, Section 2, Polk County Tax Lots 7321AC1700, 7321DB100, 7321DB18200, 7321BD1801, 7321BD1902, and 7321AC802
County:	Polk County
Congressional District:	5th Congressional District
Site Owner(s):	Salem-Keizer School District
Site Operator(s):	Salem-Keizer School District
Site Contact(s):	Michael D. Wolfe, Chief Operations Officer Salem-Keizer Public Schools 2450 Lancaster Drive NE Salem, Oregon 97305

7.2 Site Description

The Walker Middle School site includes six tax lots and approximately 15.3 acres of land that are developed with the middle school buildings, an assortment of athletic playfields, and vehicular infrastructure including driveways and parking lots (Figure 7-1). A city-operated swimming pool is also located on the property; however, the pool has been closed in the recent past as a result of city budget shortfalls.

Surrounding property is predominantly residential, with single- and multi-family dwellings constructed north, south, and west of the site. Industrial/commercial development is located to the east-southeast. The nearest businesses include a boat storage/repair company, a transmission repair shop, and Hanard Machine which provides precision machining work (Figure 7-2). An additional machine shop and a steel sales and processing business are located further to the southeast. Until the mid- to late-1990s, Gould Battery had been located on the south side of the steel business (Figure 7-2) (EDR 2012). The Willamette River is located approximately 0.45 mile south-southeast of the Walker Middle School site (Figure 7-2).

7.3 Geologic Features

Surficial geology beneath the Walker Middle School site is characterized as high-terrace deposits that include semi-consolidated light-brown sand, silt, and clay ranging from 3 to 15 feet thick. These deposits are typical for many terraced areas adjacent to sedimentary bedrock foothills in the study area. Such bedrock foothills are present on the northern margin of the site and form much of the upland area within the West Salem study area. In general, the high-terrace deposits are mantled by moderately well-drained and well-drained silt loam soils (Beja 1981).

In 1993, geotechnical investigation work at the site by Foundation Engineering (FE) included four exploratory boreholes advanced to a maximum depth of 46.5 feet bgs. These boreholes revealed a similar material profile as described above, with 2 to 4 feet of brown gravelly or rocky silt (interpreted as fill), followed by approximately 14 feet of grey, very moist, soft silt, with lenses of fine sand. Below 19 feet bgs, the silt became a saturated, low-density sandy material. Fractured basaltic bedrock was encountered at between 25 and 29 feet bgs, and extended to the lowest depths of exploration (FE 1993).

During drilling activities, FE encountered ground water at approximately 15 feet bgs. As drilling occurred during the dry season, and given observed rust staining noted at shallower depths, FE anticipated ground water may reach to within several feet of the ground surfaces during wetter seasons (FE 1993).

7.4 Soil Exposure Pathway

The soil exposure pathway is evaluated based on the threat to residents, nearby residents, students, and workers from soil contamination within the first 2 feet of the ground surface and within one mile of the source of contamination. Approximately 10,972 people reside within one mile of Walker Middle School, with an additional 951 students attending Walker Middle School or Myers Elementary School, which are both within the one-mile distance ring. Populations by distance ring within one mile of Walker Middle School are as follows.

Distance Ring	Population	Students	Total Population
0 to ¼ mile	1,211	Walker Middle School: 530	1,741
¼ to ½ mile	2,774	0	2,774
½ to 1 mile	6,987	Myers Elementary School: 421	7,408
		Total Population within One Mile	**11,923**

Sources: Zawistoski 2013b; ODOE 2013

Walker Middle School is not used for commercial agriculture or silviculture, livestock production, or livestock grazing. Further, no terrestrial sensitive environments occur at the school. The school is accessible and used for recreation during school hours and during after school programs.

7.5 Surface Water Migration Pathway

As discussed in the previous geologic section, the site is located on a generally flat alluvial plain; a steep embankment abuts the northern margin of the site, and is interpreted to locally coincide with the northern limits of the Willamette River's historic meanders. Surface water runoff on the school grounds is handled by storm sewer catchments in the paved areas across the site. A small fence-enclosed, and apparently man-made, wetland is located on the north side of the property (Figure 7-1). The Willamette River is located approximately 0.5 mile to the south-southeast.

Surface water runoff is anticipated to be captured by the storm sewer catchments. For the purposes of this report, runoff from the Walker Middle School site is not anticipated to provide an overland migratory route from the school to the Willamette River. The site is located in a Zone X flood area, which is within the 500-year floodplain (FEMA 2003).

The surface water migration pathway target distance limit (TDL) begins at the probable points of entry of surface water runoff from a site to a surface water body and extends downstream for 15 miles. As surface water is not anticipated to reach the Willamette River from the Walker Middle School grounds, no probable point of entry has been established for this river. With respect to the on-site wetland, while this may be defined characteristically as a wetland (i.e., saturated soils, presence of surface water, moisture tolerant vegetation), this wetland is not included in the National Wetland Inventory. Given the above, targets such as fisheries and sensitive environmental receptors within the surface water pathway were not assessed for this property.

7.6 Ownership and Development History

The Walker Middle School property is currently owned by the Salem-Keizer School District. Other than an appraisal report prepared in 1961 listing Gerald and Inez Perry as owners of one of the lots that now comprise the Walker Middle School property, previous ownership information was not available (Geiser 1961). Based on a review of historic aerial photos, assessor records, and discussions with site-knowledgeable individuals, the school was first constructed in the late 1950s/early 1960s and underwent a major expansion in the mid-1990s (EDR 2012).

A ground-level photo in a newspaper clipping contained in school district files depicts the property as vacant land used as a playground, and provides 1961 as the projected opening time frame for the school (SKPS 1959). Prior to construction of the school, a 1955 dated aerial photo depicts the school site as a cleared and predominantly grass covered lot, with an east-west oriented running track visible on the west side of the property, several smaller access drives on the central and northwest corner of the site, and several smaller buildings constructed on the site (EDR 2012). Details regarding construction or use of those smaller structures were not readily available. An earlier plat map of the site drawn prior to construction depicted a drainage ditch crossing the site from east to west (Boatwright 1948).

7.7 Previous Reports

In addition to the environmental database report generated for this facility, the school district provided limited documentation on the subsurface and environmental conditions at the property. This information is summarized in the following sections.

7.7.1 Environmental Database Report

A search of environmental database listings for the site and vicinity revealed numerous listings, the majority of which are located in the industrial/commercial area east-southeast of the site. Releases and contamination issues documented in this area are not considered to represent conditions significantly different than what may be encountered in most any industrially developed area, generally consisting of release of various petroleum hydrocarbons, solvents, and heavy metals. While both Walker Middle School and Hanard Machine were listed in these database reports, these listings were related to releases discovered during removal of underground storage tanks (USTs) that had stored petroleum products (EDR 2012). Further discussion of UST removal activities at the Walker Middle School property follow within Section 7.7.3 of this report.

As a result of chlorine cylinder leaks at the on-site pool, Walker Middle School was listed as a “HAZMAT” site. Several properties in nearby residential areas were also listed, generally in connection with heating oil tank removals (EDR 2012).

Gould Battery/GNB was also listed in the database report in relation to a petroleum release and a spill of lead oxide. After participating in the Oregon’s Voluntary Cleanup Program and filing an environmental covenant that limits that site to industrial use, the Gould Battery/GNB site was granted a No Further Action status by ODEQ (EDR 2012).

7.7.2 Geotechnical Investigation (1993)

In October of 1993, FE presented the Salem-Keizer Public Schools with a Geotechnical Investigation for the Walker Middle School additions. No environmental sampling and/or testing occurred in conjunction with this work, which is discussed in further detail in Section 7.3 (FE 1993).

7.7.3 UST Removal Report (2000)

In December of 2000, Century West Engineering (CWE) oversaw decommissioning of one 8,000-gallon UST from the Walker Middle School property that had stored heating oil for use in the school’s boiler. Approximately

100 gallons of product and sludge were removed from the tank prior to removal. While some pitting and rusting was noted, the removed tank was observed to be free of holes. Following tank removal, approximately 107 tons of petroleum stained soil were excavated and stockpiled for characterization. An additional 5 tons of soil were removed from beneath the decommissioned remote fill port. Remote fill lines were drained, capped, and abandoned in place (CWE 2000).

A total of eight samples were collected during tank decommissioning work. Confirmation sampling revealed soil conditions at the end of excavation work to be compliant with ODEQ cleanup standards. The decommissioned tank was cleaned and sent to Cherry City Metals for recycling; the associated contaminated soil was transported to United Soil Recycling for thermal desorption treatment, and the excavation was backfilled with imported clean gravel. Ground water was not encountered during decommissioning or remedial activities (CWE 2000).

Following decommissioning work, CWE returned to the site to advance five borings along the abandoned filling line and port alignment to a depth of 8 feet bgs. Samples were collected from 5 feet bgs in all borings and sent for laboratory analysis. No petroleum hydrocarbons were detected in any of the samples (CWE 2000).

7.7.4 Radon Sampling

Beginning in 2001, the Salem School District implemented a district-wide radon screening protocol. This screening involved placing a radon test kit in each school in the district at locations thought to have the greatest likelihood for the presence of radon. Following that screening, entire school buildings were then sampled, focusing first on those structures where radon was detected, and then on other schools closest to those locations (SKPS 2012). In January of 2013, radon levels in the Walker Middle School were tested. Testing involved placing a total of 44 radon test kits in school rooms that were in contact with or below the ground surface. Radon concentrations were below the detection levels in 30 of these test kits (i.e., <0.3 pCi/L). The average radon level in 14 kits where detections occurred was 0.79 pCi/L, with the highest radon level detected in the school being 1.5 pCi/L. All detected concentrations were below the 4 pCi/L action level established by the EPA (Ellis 2013a).

7.8 Site Visit Observations

Prior to sampling activities, a site visit was conducted to review conditions at and surrounding the Walker Middle School property. Participants included:

- Joanne LaBaw, EPA, Site Assessment Manager;
- Derek Pulvino, E & E, Project Manager;
- Jim Jenney, Salem Keizer School District, Interim Director-Facilities and Planning; and
- David Fridenmaker, Salem Keizer School District, Manager, Planning and Property Services.

Property conditions noted during the field reconnaissance were considered typical for public school buildings; concrete block bearing and exterior walls define the majority of the structure, with a slab-on-grade foundation, a central boiler supplies hot-water/steam for convective heat, and interior finishes consist of gypsum board, cellulose ceiling panels, vinyl floor tiles, and carpet. The school has wood shop and science classrooms. The two laboratory science classrooms include a front desk/table with running water, natural gas, and non-reactive countertops. Chemicals are stored in a room located between the two classrooms. As classes were in session during the original screening review at the site, this room was not accessed (E & E 2013b).

Exterior areas at the school were primarily grass-covered, with asphalt drives and parking areas, and landscaping at near-building locations. Select portions of the property observed during this site visit are included in Appendix A, Site Visit Photos 1 through 12.

7.9 PA Sampling

Soil and sediment samples were collected from locations distributed across the Walker Middle School property. Sampling locations were selected to target areas where it appeared more likely that students or site users would spend time, focusing on locations where overlying vegetation was either not present or thinned by occupancy/usage (i.e., baseball infields, walking paths, near benches, in play areas, etc.). One sediment sample was collected from a fence-enclosed wetland area on the north-central portion of the property. The athletic fields on the east and west sides of the school, as well as a small grass covered area north of the west side of the school building, were field screened for gamma activity levels using the Viper system. Figure 7-3 depicts soil and sediment sample locations. Figure 7-4 depicts the approximate alignment of transects with the Viper unit and range of gamma detections. All field work at the Walker Middle School site occurred on June 12, 2013.

7.9.1 Gamma Radiation Field Screening

Gamma radiation field screening was conducted at three principal areas on the Walker Middle School property: the east athletic field; the west athletic field, and the grass covered area north of the west end of the school building. Screening in all three areas proceeded on 25 foot transect intervals. Figure 7-4 depicts the transect alignments and corresponding screening results. A summary of Viper screening readings from this site is included in Table 6-1.

7.9.2 Surface Soil Samples

Soil samples collected from the Walker Middle School property included five samples from baseball diamond infield areas (WM01SS, WM02SS, WM03SS, WM04SS, WM05SS) (Appendix A, Sampling Photos 9 to 13). WM06SS was collected from the grass area north of the western margin of the school building (Appendix A, Sampling Photo 15), while WM07SS was collected from an area of exposed soil near the southern main entrance to the school building.

The QAP called for the collection of up to nine soil samples from this property. Sample locations were to be selected based on field observations to target areas with relatively elevated potential for human use that may result in direct contact. During the field review, exterior areas of the property were observed to be predominantly grass covered or paved, with broad areas of exposed soils limited to the baseball diamond infields. Since few other areas of exposed soils were observed, additional sample collection did not appear warranted.

Sample results are presented in Tables 6-2, 6-3, and 6-4. The detected analytes were present at concentrations below the RBCs promulgated by ODEQ as a cleanup value for the surface soil direct contact pathway in a residential scenario or the applicable naturally occurring concentration.

7.9.3 Sediment Samples

One sediment sample (WM01SD) was collected from the fence-enclosed wetland area on the north-central portion of the property (Figure 7-3 and Appendix A, Sampling Photo 14). This sample was collected from the interpreted southwest margin of the wetland area.

Sample results are presented in Tables 6-5, 6-6, and 6-7. As no human direct contact RBC has been developed for sediments, the START has conservatively compared the contaminant concentrations to the ODEQ direct contact RBCs for surface soil or the applicable naturally occurring concentration. Using this comparison, the detected analytes were present at concentrations well below the ODEQ surface soil RBCs for the direct contact pathway in a residential scenario or the applicable naturally occurring concentration.

8 West Salem High School

8.1 Site Location

Site Name:	West Salem Area, West Salem High School
CERCLIS ID Number:	ORN001003085
Site Address:	1776 Titan Drive NW, Salem, Oregon
Latitude:	44.958521 (Approximate center of site)
Longitude:	-123.082882 (Approximate center of site)
Legal Description:	Township 7S, Range 3W, Section 17, Polk County Tax Lot 7317D001000
County:	Polk County
Congressional District:	5^{th} Congressional District
Site Owner(s):	Salem-Keizer School District
Site Operator(s):	Salem-Keizer School District
Site Contact(s):	Michael D. Wolfe, Chief Operations Officer Salem-Keizer Public Schools 2450 Lancaster Drive NE Salem, Oregon 97305

8.2 Site Description

The West Salem High School site occupies a single parcel that includes approximately 54 acres of land. This parcel is developed with the school building, athletic fields, and other parking- and school-related infrastructure. The athletic fields extend from the school parcel onto two adjacent lots owned by the City of Salem Parks Department (PCA 2012c); use of these athletic fields is shared by the parks department and school district. The school, itself, includes one interconnected, multi-story building (Figure 8-1).

Surrounding property is residential, predominated by single-family dwellings. The nearest industrial/commercial land use is approximately 1.25 miles southeast of the site, in the vicinity of the Walker Middle School and 7th and Patterson Ballfields sites. At its closest point, the Willamette River is located approximately 1.6 miles southeast of the West Salem High School site (Figure 2-2).

8.3 Geologic Features

Surficial geology beneath the West Salem High School site is characterized as Columbia River Basalt. Basalt in the area can range from 400 to 600 feet deep.

Local areas of reddish brown weathered basalt, and can weather into red clay (laterite) to depths of up to 30 feet (Beja 1981).

In 2000, geotechnical investigation work was performed on the site for design purposes, included advancing 19 exploratory test pits to between 8 and 20 feet bgs, and six exploratory borings to between 27 and 41.5 feet bgs. These explorations revealed a similar material profile as described above, with 2 to over 15 feet of fine-grained, residual soil underlain by highly weathered to decomposed basalt. Residual soil consists of very stiff to hard, dry to damp silt or clay, with some scattered fragments of basalt. The bedrock consists of closely jointed, highly weathered to decomposed extremely weak to weak flood basalt. Most of the basalt was decomposed to the consistency of medium stiff to hard soil. Some core-stones were noted and, based on test explorations, appeared to be discontinuous bodies of strong rock floating in a matrix of decomposed basalt (FE 2000).

No springs, seepage, or ground water were observed within test pits to a maximum depth of 20 feet. No ground water was detected in piezometers installed in test borings. Local well logs indicate ground water in the area of West Salem High School is encountered at approximately 150 to 300 feet of bgs (FE 2000).

8.4 Soil Exposure Pathway

The soil exposure pathway is evaluated based on the threat to residents, nearby residents, students, and workers from soil contamination within the first 2 feet of the ground surface and within one mile of the source of contamination. Approximately 9,743 people reside within one mile of West Salem High School, and 2,606 students attend West Salem High School, Chapman Hill Elementary, and Myers Elementary Schools, which are all are present within the one-mile distance ring. Populations by distance ring within one mile of West Salem High School are as follows.

Distance Ring	Population	Students	Total Population
0 to ¼ mile	388	West Salem High School: 1,735	2,123
¼ to ½ mile	1,469	Chapman Hill Elementary School: 450	1,919
½ to 1 mile	7,886	Myers Elementary School: 421	8,307
		Total Population within One Mile	**12,349**

Sources: Zawistoski 2013c; ODOE 2013

West Salem High School is not used for commercial agriculture or silviculture, livestock production, or livestock grazing. Further, no terrestrial sensitive environments occur at the school. The school is accessible and used for recreation during school hours and during after school programs.

8.5 Ownership and Development History

Similar to the Walker Middle School property, the West Salem High School site is owned by the Salem-Keizer School District. Prior to construction of the school in 2000, aerial photos depict the property as undeveloped. Fruit orchards were visible on the site through at least 1954 (EDR 2013b). Assessor records list the prior usage of the school property as a cherry orchard and for grain cultivation (PCA 2013c). Prior to school development, other structures noted on the site were limited to several small buildings located near the east-central margin and northwest corner of the school/ballfields property. Between 1954 and school development, the number of fruit trees on the property decreased, with those areas cleared of fruit trees being grass covered and/or vegetated (EDR 2013b). Sanborn Fire Insurance Maps did not include coverage of West Salem High School and/or the property immediately surrounding it.

Appraisal reports covering three of the parcels that were later purchased by the school district and/or city provide further confirmation of the site's residential history. These reports list previous owners as follows:

- (b) (6) **Orchard Heights Road**: This was a 23-acre area of land developed with a 1947 vintage, wood-framed residence that was served by an on-site septic system and drinking water well. Prior owners included (b) (6) (b) (6) (husband and wife), who purchased the property from (b) (6) (b) (6) in May of 1996. Pre-1993 ownership information was not available (CSP 1999a). By comparing map, text description, and address information contained in the appraisal report to grading plans provided by the school district, this property appears to comprise the western side of the school property. Additionally, the location of some or all of these former buildings appears to have been in what is now the Titan Drive NW right-of-way.
- **Portion of** (b) (6) **Doakes Ferry Road NW:** While the parcel associated with this address included 1.5 acres of residentially developed land, this appraisal report only covered the rear 0.5 acre undeveloped portion of the parcel and did not include information about the residential development on the other portion of the parcel. Prior owners were limited to members of the (b) (6) family. Pre-1993 ownership information was not available (CSP 1999b). This property is situated along the east side of site and is a part of the property currently owned by the City Parks Department.
- **SWC (Southwest Corner) of Orchard Heights & Doakes Ferry Roads NW:** This property included approximately 34.6 acres of undeveloped land. While properties situated on the east side of this lot were reported to utilize private septic systems and wells, no such improvements were listed for this property. Previous owners of this site were detailed to only include (b) (6) (b) (6) Review of assessor records list the (b) (6) family to have owned the property as long ago as 1984 (PCA 2013c). This property makes up most of the east half of the high school site.

8.6 Previous Reports

With the exception of a geotechnical investigation performed for design purposes, data on subsurface sampling and testing were not available for this property. Available information on this property is summarized in the following sections. Applicable details from the geotechnical investigation are included in Section 8.3, above.

8.6.1 Environmental Database Report

A search of environmental database listings for the site and vicinity revealed that those listings located within approximately one-half of a mile of the site were associated with heating oil tank removals. Listings beyond a half-mile are discussed in further detail in the sections of this report pertaining to Walker Middle School (see Section 7) and Wallace Marine Park (see Section 9).

8.6.2 Radon Sampling

Beginning in 2001, the Salem School District implemented a radon screening protocol. This screening involved placing a radon test kit in each school in the district at a location thought to have the greatest likelihood for the presence of radon. Following on from that screening, entire school buildings were then sampled, focusing first on those structures were radon was detected, and then other schools located nearby (SKPS 2012). In January of 2013, radon levels in the West Salem High School were tested. Testing involved placing a total of 92 radon test kits in school rooms that were in contact with or below the ground surface. With two exceptions, radon levels measured in all of the test kits were less than 2.0 pCi/L; the two exceptions were two lower-level classrooms (Room B105B at 5.8 pCi/L, and Room B117 at 4.9 pCi/L) (Ellis 2013b).

In response to these results, school maintenance personnel worked to better seal cracks and trench plates in the floors and adjust the air supply to increase air circulation in the rooms such that Rooms B105B and B117 are under "positive pressure." Monitoring data collected immediately after the mitigation efforts were implemented revealed that radon levels remained above the EPA recommended 4 pCi/L action level (SKPS 2013a).

Additional steps were then taken to address the continued high levels of radon. These included additional sealing of the cracks in the floor at one location; after these additional steps were taken, follow-on testing revealed radon levels of 3.7 pCi/L. At the other location, a sub-slab depressurization mitigation system was installed; after these additional steps were taken, follow-on testing revealed radon levels of 0.8 to 1.0 pCi/L. Long-term monitoring of radon levels continues at these locations (SKPS 2013b).

8.7 Site Visit Observations

Prior to sampling activities, a site visit was conducted to review conditions at and surrounding the property. Participants included:

- Joanne LaBaw, EPA, Site Assessment Manager;

- Derek Pulvino, E & E, Project Manager;
- Jim Jenney, Salem Keizer School District, Interim Director-Facilities and Planning; and
- David Fridenmaker, Salem Keizer School District, Manager, Planning and Property Services.

Property conditions noted during the preliminary field reconnaissance were considered typical for public school buildings: concrete block bearing and exterior walls supported with metal columns and trussing define the majority of the structure, with a slab-on-grade foundation, a central boiler that supplies hot water/steam for convective and/or forced-air heat, and interior finishes consisting of gypsum board, cellulose ceiling panels, vinyl floor tiles, and carpet. As per the current understanding, the school does not include automotive or metal working spaces. Four laboratory science classrooms were noted, with two on the ground-floor and two on the second story. These classrooms include lab benches with running water and natural gas. A utility trench runs through the floor of the two ground-level laboratory classrooms. Chemicals used in each pair of laboratory classrooms are stored in a room located between the two classrooms. The chemicals are segregated on shelving dependent on chemical type (i.e., inorganic, organic, sulfates, acetates, etc.). The storage rooms also have flammable material and acid storage cabinets. Evidence of spills or releases was not observed on the floors in these storage areas.

Exterior areas at the school were primarily grass-covered, with asphalt drives and parking areas, and landscaping at near-building locations. The site is near the crest of a hilltop within an area with a locally undulating topography, and the gradient generally sloping away from the site in all directions. Surface water drainage in parking areas is predominantly managed by storm water catchment basins observed in paved areas across the site. A surface water drainage trench/swale was also observed at the eastern edge of the eastern parking lot, separating the parking area from the softball/baseball/soccer field complex on the eastern portion of the site. The trench/swale drains to the south and, apart from localized area of standing water, was dry at the time of the site reconnaissance (Figure 8-1). Otherwise, surface water runoff in the area would appear to be collected by either Glenn Creek, which is located approximately 0.33 mile to the south, or an unnamed drainage channel mapped to the north of the site that empties into Glenn Creek. From the confluence of that drainage channel and Glenn Creek, surface water flows into the Willamette River, which is located approximately 2.5 miles downstream from the site. As West Salem High School is located at the crest of a hillside, runoff from this property would only be expected to reach those drainage channels during heavy rainfall events. A selection of features observed during the preliminary reconnaissance is included in Appendix A, Site Visit Photos 13 to 29.

8.8 PA Sampling

Soil samples were collected from locations distributed across the West Salem High School property. Sampling locations were selected based on the presence of either exposed soils, and/or target locations where increased exposure risk may be present from students spending time at a given location. Viper gamma screening was performed at four principal locations. Figure 8-2 depicts soil sample locations. Figure 8-3 depicts the approximate alignment of transects with the Viper unit and range of gamma detections. All field work at the West Salem High School property occurred on June 14, 2013.

8.8.1 Gamma Radiation Field Screening

Gamma radiation field screening was conducted at four principal areas on the West Salem High School property: the east athletic field; the south athletic field; the gravel parking area at the northwest corner of the property; and the small grass covered area outside the main eastern entrance to the school building. Screening in all but the grass covered areas proceeded on 50-foot transect intervals aligned roughly north to south. Transects on the grass covered area east of the school entrance were spaced approximately 25 feet apart (Figure 8-3).

With respect to the east athletic area, an equipment malfunction prevented the ability of the Viper system to record data during the first transects. As such, a second set of transects was conducted in this area. One of the ballfields in this complex was being used for practice at the time the second set of screening passes was performed; the START was unable to collect data from this area. Figure 8-3 depicts the transect alignments and corresponding screening results. A summary of Viper gamma screening results from this site is included in Table 6-1.

8.8.2 Surface Soil Samples

Although the QAP did not include collecting samples from the West Salem High School property, during the course of the field event, and to help generate comparable and consistent data for all of the facilities included in the PA, the START collected three soil samples from this property

The three soil samples collected from the West Salem High School property included one sample from a landscape planter in the eastern parking lot (WH01SS), one sample from the grass covered slope leading to the outdoor assembly area on the west side of the school (WH02SS), and one sample from the dirt path that leads to the northwest parking lot (WH03SS) (Appendix A, Sampling Photos 17 to 19).

Sample results are presented in Tables 6-2, 6-3, and 6-4. The detected analytes were present at concentrations well below the surface soil ODEQ RBCs for the direct contact pathway in a residential scenario or the applicable naturally occurring concentration.

9 Wallace Marine Park

9.1 Site Location

Site Name:	West Salem Area, Wallace Marine Park
CERCLIS ID Number:	ORN001003103
Site Address:	200 Glen Creek Road NW, Salem, Oregon
Latitude:	44.950773 (Approximate center of site)
Longitude:	-123.043845 (Approximate center of site)
Legal Description:	Township 7S, Range 3W, Section 21, Polk County Tax Lots 73150000301, 73150001701, 73150001700, 73150001901, 73150002001, 7322B000201, 7322B000100, 7322C000100, 7322C000200, 7322C001800
County:	Polk County
Congressional District:	5th Congressional District
Site Owner(s):	City of Salem
Site Operator(s):	Salem Parks Department
Site Contact(s):	Kacey Duncan, Deputy City Manager, City of Salem, Oregon 555 Liberty Street SE/Room 220 Salem, Oregon 97301

9.2 Site Description

The Wallace Marine Park occupies 10 separate tax lots and approximately 101 acres of land along the western bank of the Willamette River. This park includes a variety of sports fields, open and forested park land, a boat ramp, floating docks, riverfront beaches, walking trails, picnic areas, and play equipment. Surrounding property includes what appears to be a gravel mining operation to the north, and a mix of residential and retail/commercial property to the west. The Willamette River abuts the southern end and eastern margin of this property (Figure 9-1).

9.3 Geologic Features

Surficial geology beneath the Wallace Marine Park site is a mix of recently deposited river alluvium and lower terrace deposits of the Willamette River. The alluvium is located along the river channel and includes unconsolidated cobbles, coarse gravel, sand, and some silt and clay. The alluvium is generally 15 to 45 feet thick, and consists of stratified sands and well-rounded pebbles, gravels, and cobbles. Terrace deposits are located on the more inland areas of the site, and are typically comprised of unconsolidated to semi-consolidated cobbles, gravel, sand, silt, clay, muck, and organic matter of variable thickness (30 to 50 feet). The lower terrace deposits are located on the flood plain and lowland terrace area immediately above the river alluvium. In the case of Wallace Marine Park, these terrace deposits constitute the upland area of the site, generally from the tree band along the river inland. A typical profile of lower terrace deposits can include 5 to 20 feet of light-brown silt and clay or very fine sand overlying 10 to 45 feet of moderately well-sorted sand and locally cemented gravel (Beja 1981).

9.4 Soil Exposure Pathway

The soil exposure pathway is evaluated based on the threat to residents, nearby residents, students, and workers from soil contamination within the first 2 feet of the ground surface and within one mile of the source of contamination. Approximately 13,256 people reside within one mile of Wallace Marine Park, with 4,725 students attending a university and several public schools within the one-mile distance ring. Populations by distance ring within one mile of Wallace Marine Park are as follows.

Distance Ring	Population	Students	Total Population
0 to ¼ mile	784	0	784
¼ to ½ mile	1,571	0	1,571
½ to 1 mile	10,901	Grant Community School: 409 Highland Elementary School: 365 Parrish Middle School: 696 Walker Middle School: 530 Willamette University: 2,725	15,626
		Total Population within One Mile	**17,981**

Sources: Zawistoski 2013a; ODOE 2013; WU 2013

Wallace Marine Park is not used for commercial agriculture or silviculture, livestock production, or livestock grazing. Further, no terrestrial sensitive environments occur at the park. The park is, however, a designated recreation area.

9.5 Surface Water Migration Pathway

The park is on gently sloping land adjacent to the Willamette River and includes a small peninsula that extends approximately 0.5 mile into the river. Surface water runoff can be expected to both infiltrate the ground surface and to flow by sheet action to the Willamette River throughout the park's frontage with the river.

When evaluating the surface water pathway for a site, EPA considers the target distance limit, that is, the stretch of a water body that could be impacted by contamination. The target distance limit begins at the point where site contaminants may enter the water body, and extends downstream for 15 miles. When assessing this pathway, the EPA considers the potential for impacts to drinking water supplies, fisheries, and sensitive environments, such as wetlands and endangered species, that may be present within the target distance limit.

The 15-mile target distance limit for Wallace Marine Park begins near the southern margin of the park, at sample WP01SD. This 15-mile target distance limit is contained wholly within the Willamette River (Figure 9-2).

A search of Oregon Division of Water Resource water rights information query system for drinking water intakes within the target distance limit revealed that no such intakes exist, though several intakes exist for irrigation and livestock watering (ODWR 2013).

The Willamette River is approximately 300 miles in length. Oregon City is located at approximately river mile 26. The Willamette River is extensively used for fishing, boating, rafting, and other recreational activities. Sport fish catch for the river is reported by the Oregon Department of Fish and Wildlife, and is divided by catch in the table below. The most recent reported fish catch year is 2011. Catch is reported by numbers of individual fish caught. The number of fish caught is multiplied by the average weight per species to determine the total pounds of fish catch. Based on these values, it is estimated that the 15-mile target distance limit spans 5% of the catch area above Oregon City (i.e., 300[1] – 26[2] = 274; [15 / 274] x 100 = 5%). For this reason, 5% of the total catch above Oregon City will be attributed as occurring within the 15-mile target distance limit. Sport catch figures for the target distance limit are provided in the table below.

Fish Type	Number Caught (a)	Average Weight (b)	Total Weight (c = a x b)	Total Catch within the TDL (c x 5%)
Coho	442	10	4,420	221
Fall Chinook	61	22	1,342	67.1
Spring Chinook	582	22	12,804	640.2
Summer Steelhead	1,105	7.5	8,287.5	414.375
Winter Steelhead	180	7.5	1,350	67.5
White Sturgeon*	44	67[a]	2,948	147.4
			Total within TDL	1,557.575 rounded to **1,560**

Sources: ODWR 2011a, ODFW 2011b, Wydoski 2003.

[1] The Willamette River is approximately 300 miles in length.
[2] Oregon City is located at approximately river mile 26.

Fish Type	Number Caught (a)	Average Weight (b)	Total Weight (c = a x b)	Total Catch within the TDL (c x 5%)

Note:
* Average weight of sturgeon is calculated assuming an average catch length of 5'1".

The Willamette River contains habitat for the federal-threatened steelhead trout (*oncorhynchus mykiss*) and Chinook salmon (*oncorhynchus tshawytscha*) within the 15-mile target distance limit (Zawistoski 2013a). Approximately 3.38 miles of wetland frontage occur on the Willamette River within the target distance limit with nearest wetland occurring approximately 0.8 mile downstream of the probable point of entry (Zawistoski 2013a).

9.6 Ownership and Development History

The Wallace Marine Park site is owned by the City of Salem and maintained by the parks department. Prior to use as a park, historic aerial photos depict the site as either agricultural, or generally undeveloped, vegetated land between 1954 and 1975 (EDR 2013d). Information provided by the City reports the park was created after Paul Wallace donated 24 acres of riverfront land to the City.

Development and use as a park began in the late 1950s. Many park features have been present from the time the park was first developed; however, much of this infrastructure (roads, boat ramps, and various docks) represents the most recent "generation" of improvements, as most have suffered periodic damage and have required rebuilding after local flooding of the Willamette River (Salem 2013b). Available aerial photographs first show the central baseball/softball field complex in 1984, when this complex, as well as other roads and parking areas, are apparently under construction. By 1987, much of the development on the park was consistent with present day conditions. Sanborn Fire Insurance Maps did not include coverage of Wallace Marine Park and/or the immediately adjacent area (EDR 2013d).

9.7 Previous Reports

No previous environmental sampling and testing or review work was readily available in connection with this property. The results of the environmental database report generated for this PA are discussed below.

9.7.1 Environmental Database Report

A search of environmental database listings for the site and vicinity revealed numerous listings in the search radius. In general, the greatest numbers of listings were located in the industrial/commercial area west-southwest of the site and in the downtown Salem area, on the opposite side of the Willamette River. No listings were encountered in connection with the Wallace Marine Park property (EDR 2013d).

Releases and contamination issues documented in these areas generally include various petroleum hydrocarbons, solvents, and heavy metals, and are not considered to represent conditions significantly different than what may be encountered in most any industrially developed area. Other listings, such as the Courthouse Athletic Facility, were related to the storage of various chemicals used during business operations. In the case of Courthouse Athletic Facility, this included items such as salt (sodium chloride), calcium hypochlorite, carbon dioxide, hydrochloric acid, etc. (EDR 2013d).

The database report also included a listing for one Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) No Further Remedial Action Planned site. That site (Salem Gas Manufacturing) is located on the opposite side of the Willamette River, approximately 950 feet east of the site, and is currently a portion of Riverfront Park. Riverfront Park has been the subject of remedial investigation and feasibility study work. In addition to the manufactured gas plant, previous uses of the Riverfront Park property include sawmills, iron works, junkyards, paper manufacturing, and meat packing. Environmental studies of Riverfront Park have documented impacts to soil, ground water, and sediments by lead, polycyclic aromatic hydrocarbons (PAHs), tars, ferrocyanides, benzene, diesel, acids, and caustics. Based on the results of bioassay testing, impacts to sediments did not appear to be affecting aquatic life. As part of remedial measures, a deed restriction was placed on the Riverfront Park parcel, and a soil cap was constructed and is regularly maintained (EDR 2013d, ODEQ 2013).

9.8 Site Visit Observations

As the Wallace Marine Park property had not been identified for sampling during original project scoping, the START did not perform a site visit at this property prior to sampling activities. During sampling activities, observations of conditions, usage, and development at the Wallace Marine Park site were as previously discussed in section 9.2.

9.9 PA Sampling

Soil and sediment samples were collected from locations distributed across the Wallace Marine Park property. Sampling locations were selected based on the presence of either exposed soils/sediment, the potential for relatively high usage (e.g., picnic areas), or soils that had a greater potential for mechanical suspension as airborne dust. In addition, Viper gamma radiation screening was performed at three areas in the park. Figure 9-3 depicts soil and sediment sample locations. Figure 9-4 depicts the approximate alignment of transects with the Viper unit and range of gamma detections. All field work at the Wallace Marine Park property took place on June 11, 2013. Photographs of sample locations are included as Appendix A, Sampling Photos 20 to 33.

9.9.1 Gamma Radiation Field Screening

Gamma radiation field screening was conducted at three principal areas on the Wallace Marine Park property: the southern and northern grass fields; and two of the baseball diamonds in the baseball/softball complex. Screening in the two grass fields utilized 25-foot transect spacing aligned roughly north to south.

For the baseball diamonds, during field activities, the START elected to use “ray” patterns for these transects, with points-of-origin centered on home plate and radiating to a maximum of 25-foot spacing in the outfield area. Although the work plan had included Viper gamma radiation screening transects of all five baseball fields, as tournaments were scheduled to use three fields later in the day, the park’s maintenance personnel requested that field personnel limit occupancy on those infields. For this reason, Viper gamma radiation screening occurred on only two ballfields. Figure 9-4 depicts the transect alignments and corresponding screening results. A summary of Viper gamma radiation screening readings from this site is included in Table 6-1.

9.9.2 Surface Soil Samples

A total of eight soil samples were collected from the Wallace Marine Park property. These included the following samples:

- **WP01SS and WP08SS:** These samples were collected from the soccer fields in the southern (WP01SS) and northern (WP08SS) grass fields. WP01SS was collected from soils pushed up within a mole hill. Sample WP08SS was collected from an area of exposed soil within the eastern soccer goal of the northern field.
- **WP03SS, WP04SS, and WP05SS:** Two of these samples (WP03SS and WP04SS) were collected from beneath the sod along the right (WP03SS) and left (WP04SS) foul lines for two of the ballfields. The START had planned to collect these samples from infields; however, due to the aforementioned tournaments, maintenance personnel requested that field personnel limit access to, and refrain from diggings holes in, these areas.

  At the time of the field work, maintenance personnel also informed the field personnel that, as a result of flooding that inundated the park in 2012, the material that been previously been used on the infields of these ballfields had been removed and replaced with the current material. As the removed infield material was stockpiled on the site, one additional sample (WP05SS) was collected from this stockpile.
- **WP02SS:** This sample was collected from an area of exposed soil near a lifejacket exchange and instructional sign near the park’s boat ramp.
- **WP06SS:** This sample was collected from soil that had been pushed up in a mole hill in the picnic area at the southern portion of the park.
- **WP07SS:** This sample was collected from the crest of the gravel bar east of the southern picnic area.

Sample results are presented in Tables 6-2, 6-3, and 6-4. The analytes were detected at concentrations well below the surface soil ODEQ RBC for the direct contact pathway in a residential scenario or the applicable naturally occurring concentration.

9.9.3 Sediment Samples

Five sediment samples were collected from the park's Willamette River frontage. Samples were collected from the sand/silt beach at the southern margin of the park, near the boat ramp (WP01SD), from a silt/sand beach between the Marion Street and Center Street Bridges where people's footprints and dog tracks were noted (WP02SD), and from the southeast corner of the gravel bar located east of the picnic area (WP03SD). Two additional sediment samples (WP04SD and WP05SD) were collected north of sample WP03SD. For all of the gravel bar samples, the matrix included a large percentage of rounded river gravels. In order to facilitate collection of finer grained and/or organic materials, the fines were washed and separated from the gravels in the sampling hole, placed in the homogenizing bowl, and decanted.

Sample results are presented in Tables 6-5, 6-6, and 6-7. As no human direct contact RBC has been developed for sediments, the START has conservatively compared the contaminant concentrations to the ODEQ direct contact RBCs for surface soil or the applicable naturally occurring concentration. Using this comparison, only the benzo(a)pyrene concentrations detected in sample WP01SD exceeded the surface soil ODEQ RBCs for the direct contact pathway in a residential scenario.

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10 Orchard Heights Park

10.1 Site Location

Site Name:	Orchard Heights Park
CERCLIS ID Number:	ORN001003087
Site Address:	1201 Orchard Heights Road NW
Latitude:	44.959024 (Approximate center of site)
Longitude:	-123.061503 (Approximate center of site)
Legal Description:	Township 7N, Range 3S, Section 16, Polk County Tax Lot 7316C001100
County:	Polk County
Congressional District:	5th Congressional District
Site Owner(s):	City of Salem
Site Operator(s):	Salem Parks Department
Site Contact(s):	Kacey Duncan, Deputy City Manager, City of Salem, Oregon 555 Liberty Street SE/Room 220 Salem, Oregon 97301

10.2 Site Description

Orchard Heights Park is a single parcel that includes approximately 28 acres of land. Three additional parcels owned by the City of Salem are located along the southeast border of the site. While it is not apparent whether the three additional parcels are formerly part of the park, one of these lots was noted to be used as a public community “pea patch” garden at the time of the original site reconnaissance. Park development includes tennis and basketball courts, baseball diamonds, a swing set/play area, various trails and footbridges, and a dog off-leash area. The park as a whole is a combination of cleared and forested land. Surrounding property is residential, predominated by single-family dwellings (Figure 10-1). Historically, much of this developed area appears to have been agricultural/orchard land. The nearest industrial/commercial land use is approximately 0.6 mile south-southeast of the site, along the Willamette River, with the Willamette River located approximately one mile east of the site (Figure 2-2).

10.3 Geologic Features

Surficial geology beneath the Orchard Heights Park site is a mix of lower terrace deposits of alluvial bottomlands and high-terrace deposits. The lower terrace deposits are situated at lower elevations within the park, located along the Glenn Creek alignment. These deposits are generally located in flat, moderately to poorly drained areas with soft, organic compressible soils, and typically coincide with areas of low relief, surface water ponding, and high ground water. The lower terrace deposits typically consist of somewhat stratified very fine sands, silty sandy clays, silty clays, and silty clay loams, with slight to moderate plasticity. These deposits can be 4 to 12 feet thick along in the bottomlands of interior drainages within low, rolling, sedimentary bedrock units, such as found at the Orchard Heights Park site (Beja 1981).

With respect to the high terrace deposits, these are located at higher elevations within the park, upgradient from the lower terrace bottomlands deposits, and include semi-consolidated light-brown sand, silt, and clay ranging from 3 to 15 feet thick. These deposits are typically located in terraced areas adjacent to sedimentary bedrock foothills. In general, the high-terrace deposits are mantled by moderately well-drained and well-drained silt loam soils (Beja 1981).

10.4 Soil Exposure Pathway

The soil exposure pathway is evaluated based on the threat to residents, nearby residents, students, and workers from soil contamination within the first 2 feet of the ground surface and within one mile of the source of contamination. Approximately 11,476 people reside within one mile of Orchard Heights Park, and 1,268 students attend three schools within one mile of the site. Populations by distance ring within one mile of Orchard Heights Park are as follows.

Distance Ring	Population	Students	Total Population
0 to ¼ mile	781	0	781
¼ to ½ mile	2,470	Harritt Elementary School: 288	2,758
½ to 1 mile	8,225	Chapman Hill Elementary School: 450 Walker Middle School: 530	9,205
Total Population within One Mile			**12,744**

Sources: Zawistoski 2013d; ODOE 2013

Orchard Heights Park is not used for commercial agriculture or silviculture, livestock production, or livestock grazing. Further, no terrestrial sensitive environments occur at the park. The park is a designated recreation area.

10.5 Surface Water Migration Pathway

Glenn Creek transects the site on a north-south alignment. A plastic drainage conduit discharges to Glenn Creek; however, the source of water flowing from the conduit was not apparent. Surface water drainage in parking areas is managed by storm sewer catchment basins observed in the paved areas. Other noted drainage features include a catchment basin at the northwest corner of the baseball diamond area and smaller hand-dug ditches along the uphill edges of several trails. Other than runoff captured by the parking lot and ballfield catchment basins, surface water runoff would be expected to discharge to Glenn Creek via sheet flow. Based upon geographic information system (GIS) information provided by the City of Salem, storm water captured in nearby residential areas discharges to Glenn Creek at numerous locations within and upstream of Orchard Heights Park. Figure 10-2 shows outfalls (mapped by the City) that discharge to the creek as well as storm water infiltration galleries/ponds in the vicinity of Orchard Heights Park.

When evaluating the surface water pathway for a site, EPA looks at the target distance limit, that is, the stretch of a water body that could be impacted by contamination. The target distance limit begins at the location where site contamination may enter the water body, and extends downstream for 15 miles. When assessing this pathway, the EPA considers the potential for impacts to drinking water supplies, fisheries, and sensitive environments, such as wetlands and endangered species, which may be present within the target distance limit.

For Orchard Heights Park, the 15-mile target distance limit begins where Glenn Creek enters the park property, which is taken to represent the probable point of entry for this site. The target distance limit then continues along Glenn Creek, flowing north to discharge into the Willamette River approximately 2.7 miles downstream, and concluding 12.3 miles downstream in the Willamette River (Figure 10-3).

A search of the Oregon Division of Water Resource water rights information query system for drinking water intakes within the target distance limit revealed that no such intakes exist, though several intakes exist for irrigation and livestock watering (ODWR 2013).

The Willamette River is extensively used for fishing, boating, rafting, and other recreational activities. Sport fish catch is reported by the Oregon Department of Fish and Wildlife. These data do not report catch for Glenn Creek. For the Willamette River, harvest is divided by catch below and above Oregon City. The most recent reported fish catch year is for 2011. Catch is reported by numbers of individual fish caught. The number of fish caught is multiplied by the average weight per species to determine the total pounds of fish catch. Based on these values, it is estimated that the 15-mile TDL spans 4% of the catch area above Oregon City (i.e., 300[3] – 26[4] = 274; (12.3 / 274) x 100 = 4%). For this reason, 4% of the total catch above Oregon City will be attributed as occurring within the 15-mile target distance limit. Sport catch figures for the target distance limit are provided in the table below.

[3] The Willamette River is approximately 300 miles in length.
[4] Oregon City is located at approximately river mile 26.

Fish Type	Number Caught (a)	Average Weight (b)	Total Weight (c = a x b)	Total Catch within the TDL (c x 4%)
Coho	442	10	4,420	176.8
Fall Chinook	61	22	1,342	53.68
Spring Chinook	582	22	12,804	512.16
Summer Steelhead	1,105	7.5	8,287.5	331.5
Winter Steelhead	180	7.5	1,350	54
White Sturgeon[*]	44	67[a]	2,948	117.92
			Total within TDL	1,246.06 rounded to **1,250**

Sources: ODFW 2011a, ODFW 2011b, Wydoski 2003.
Note:
[*] Average weight of sturgeon is calculated assuming an average catch length of 5’1”.

The Willamette River contains habitat for the federal threatened steelhead trout (*oncorhynchus mykiss*) and Chinook salmon (*oncorhynchus tshawytscha*) within the 15-mile target distance limit (Zawistoski 2013a). Approximately 1.59 miles of wetland frontage occur on Glenn Creek, and additional 3.35 miles of wetland frontage occur on the Willamette River within the target distance limit. The nearest wetland to the park is approximately 750 feet downstream of the probable point of entry to Glenn Creek (Zawistoski 2013d).

10.6 Ownership and Development History

The Orchard Heights Park property was purchased from the Salem-Keizer School District in 1960 by the City’s Parks Department. In 1974, development of the park began when a multi-use court, gravel paths, and landscaping were added to the site (PCA2013a, 2013d). Historic aerial photos and assessor records show these developmental changes. Prior to use as a park, the site appears to have been an undeveloped and predominantly cleared parcel. In the earliest photo (1954), the western portion of the site appears to have been used as an orchard. Trees planted in a grid remained in this same area up until sometime between 1987 and 1994. Sanborn Fire Insurance Maps did not include coverage of Orchard Heights Park and/or the immediately adjacent area (EDR 2013c).

10.7 Previous Reports

No previous environmental sampling and testing or review work was readily available in connection with this property. The results of the environmental database report generated for this report are discussed below.

10.7.1 Environmental Database Report

A search of environmental database listings for the site and vicinity revealed that those listings located within approximately 0.5 mile of the site were associated with heating oil tank removals. Listings beyond 0.5 mile were those sites proximal to and discussed in the section of this report regarding the Walker Middle School and 7th and Patterson Ballfields sites.

10.8 Site Visit Observations

Prior to sampling activities, a site visit was conducted of the Orchard Heights Park property. Participants included:

- Joanne LaBaw, EPA, Site Assessment Manager; and
- Derek Pulvino, E & E, Project Manager.

Current site conditions are generally as described in Section 10.2, with a mixture of cleared and forested land interspersed with the various athletic fields, trails, and other recreational areas. A paved driveway and parking lot provide access to the property from Orchard Heights Road, located along the southern property margin. Photographs from this reconnaissance are included as Appendix A, Site Visit Photos 30 to 41.

10.9 PA Sampling

Soil and sediment samples were collected from locations distributed across the Orchard Heights Park property. Sampling locations were selected based on the presence of either exposed soils/sediment, potential for relatively high occupancy (i.e., picnic areas), or soils that had a greater potential for mechanical suspension as airborne dust. In addition, Viper gamma radiation screening was performed on a large portion of the cleared area of the park. Figure 10-4 depicts soil and sediment sample locations. Figure 10-5 depicts the approximate alignment of transects with the Viper unit and the range of gamma detections. All field work at the Orchard Heights Park property took place on June 13, 2013.

10.9.1 Gamma Radiation Field Screening

Gamma radiation field screening was conducted at two nearly contiguous areas on the Orchard Heights Park property: the southern baseball field, and the grass area north of the parking lot and playground. Screening of both areas proceeded on approximately 25-foot transect intervals aligned roughly north to south. Figure 10-5 depicts the transect alignments and corresponding screening results. A summary of Viper gamma radiation field screening readings from this site is included in Table 6-1.

10.9.2 Surface Soil Samples

A total of five soil samples were collected from the Orchard Heights Park property. These included two samples from southern athletic field (OH01SS and OH02SS), one sample from exposed soil near the picnic table west-northwest of the basketball court on the property (OH03SS), one sample from the grass field north of the parking lot (OH04SS), and one sample along the trail on the west side of Glenn Creek (OH05SS). These sampling locations are depicted as Appendix A, Sampling Photos 36 to 40.

Sample results are presented in Tables 6-2, 6-3, and 6-4. The analytes were present at concentrations well below the surface soil ODEQ RBCs for the direct contact pathway in a residential scenario or the applicable naturally occurring concentration.

10.9.3 Sediment Samples

Three sediment samples were collected from readily accessible areas of Glenn Creek within Orchard Heights Park. These samples were collected working from downstream to upstream areas of the creek, and included: sample OH01SD, collected just north of the elevated wood foot bridge that crosses Glenn Creek; sample OH02SD, collected from sediment on the bottom and banks of Glenn Creek at the concrete semi-submerged crossing of Glenn Creek; and sample OH03SD, collected beneath the Orchard Heights Road bridge, at the point where Glenn Creek enters the park. These sampling locations are depicted as Appendix A, Sampling Photos 41 to 43.

Sediment sample results are presented in Tables 6-5, 6-6, and 6-7. As no human direct contact RBC has been developed for sediments, the START has conservatively compared the contaminant concentrations to the ODEQ direct contact RBCs for surface soil, or the applicable naturally occurring concentration. Using this comparison, five SVOCs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were present in sediment samples at concentrations above soil RBCs. Two metals, cobalt and manganese, were detected at concentrations above the EPA Regional Screening Level and the applicable naturally occurring concentration (respectively).

11 7th and Patterson Ballfields

11.1 Site Location

Site Name:	West Salem Area, 7th and Patterson Ballfields
CERCLIS ID Number:	ORN001003084
Site Address:	800 Block of 7th Street NW, Salem, Oregon
Latitude:	44.947723 (Approximate center of ballfields)
Longitude:	-123.056912 (Approximate center of ballfields)
Legal Description:	Township 7S, Range 3W, Section 2, Portion of Polk County Tax Lot 7321DA01300
County:	Polk County
Congressional District:	5th Congressional District
Site Owner(s):	KFP Investments LLC
Site Operator(s):	Hanard Machine
Site Contact(s):	N/A

11.2 Site Description

The 7th and Patterson Ballfields site is located on a portion of a single tax parcel that includes approximately 4.45 acres of land. The ballfields area is on the west margin of this tax parcel, is enclosed with a fence, and is predominantly covered with grass. Exposed soils are only present in the infield areas. Nearby land surrounding the property is used for both residential and industrial purposes, with single- and multi-family dwellings constructed to the west, and industrial/ commercial development to the immediate north, east, and south. Walker Middle School is located to the west-northwest. The nearest off-property businesses include a boat storage/repair company and a transmission repair shop, both to the north, and a machine shop and a steel sales and processing business to the south. Until the mid- to late-1990s, Gould Battery had been located on the south side of the steel business. Hanard Machine facilities are directly east of the ballfields and on the same tax lot. Hanard Machine provides precision machining work for a variety of manufacturing uses (Figure 11-1). The Willamette River is located approximately 0.4 mile south-southeast of the site (Figure 2-2).

As previously discussed, the 7th and Patterson Ballfields are located on property that has been shared by two light-industrial businesses, including the current Hanard Machine shop and previous textile manufacturer, Asten-Hill. While the exact process used during textile manufacturing operations is not known, materials potentially associated with such operations include asbestos (Stengel

2007) as well as petroleum based lubricants and solvents. Hanard Machine uses various lubricants and coolants in the machining process. The coolants are maintained in closed-loop systems, distilled, and then recycled. Approximately 50 pounds of coolant still-sludge is disposed of annually by Hanard Machine (Carter 2013). Various metals in the form of shavings, cuttings, or other similar machining remnants are also byproducts of Hanard Machine operations.

11.3 Geologic Features

Surficial geology beneath the 7th and Patterson Ballfields site is characterized as high-terrace deposits that include semi-consolidated light-brown sand, silt, and clay ranging from 3 to 15 feet thick. These deposits are typical for many terraced areas adjacent to sedimentary bedrock foothills in the study area. Such bedrock foothills are present to the north of the site, beginning at the steep embankment on the northern side of the boat repair business. In general, the high-terrace deposits are mantled by moderately well-drained and well-drained silt loam soils (Beja 1981).

11.4 Soil Exposure Pathway

The soil exposure pathway is evaluated based on the threat to residents, nearby residents, students, and workers from soil contamination within the first 2 feet of the ground surface and within one mile of the source of contamination. Approximately 9,226 people reside within one mile of the 7th and Patterson Ballfields, and 530 students attend Walker Middle School, which is within 0.25 mile of the site. Populations by distance ring within one mile of 7th and Patterson Ballfields are as follows.

Distance Ring	Population	Students	Total Population
0 to ¼ mile	649	Walker Middle School: 530	1,179
¼ to ½ mile	2,505	0	2,505
½ to 1 mile	6,072	0	6,072
		Total Population within One Mile	**9,756**

Sources: Zawistoski 2013e; ODOE 2013

The 7th and Patterson Ballfields site is not used for commercial agriculture or silviculture, livestock production, or livestock grazing. Further, no terrestrial sensitive environments occur at the school. The site is a designated recreation area.

11.5 Ownership and Development History

The 7th and Patterson Ballfields site is owned by KFP Investments LLC. Although there is no record of prior development in the locations occupied by the ballfields, the lot as a whole includes three buildings that were constructed sometime between 1936 and 1950, which currently are owned by Hanard Machine. Over time, the nearest of these buildings has expanded westward, until reaching their present extent abutting the eastern edge of the ballfields area. A 1936 dated aerial photo shows the entire Hanard Machine property as cleared and covered with low-vegetation (Hahn 2012). A 1950 dated aerial photograph depicts what appears to be a baseball diamond at the location of the current ballfields and the eastern-most portion of the building that is currently occupied by Hanard Machine (EDR 2013a).

While Hanard Machine has operated in the West Salem area since the late 1960s, Hanard Machine did not own or occupy the parcel on which the ballfields are located until their 1995 acquisition from Asten-Hill (PCA 2012a, 2012e).

According to a representative of Hanard Machine, Asten-Hill, now Asten-Johnson, had manufactured textile products such as “dryer-sheets” for use by the pulp/paper production business (E & E 2013b). While the exact process and materials used at the Salem location is not currently known, based on legal proceedings against other Asten-Hill dryer-sheet manufacturing locations, asbestos can be associated with the manufacture of these dryer-sheets (Stengel 2007). Earlier Sanborn Fire Insurance Maps show the property occupied by a “felt manufacturing” business (1978) and a “flax textile” business (1950) (EDR 2013a). Again, little detail is currently available with regard to the processes employed, resources used, or potential contaminants that may have been associated with these earlier businesses.

Hanard Machine facilities directly east of the site and on the same tax parcel provide high-precision machining work for a variety of clients and operations. Machining work can include the use of various rare/exotic earth metals, such as titanium, zirconium, hafnium, silver, tungsten, and others (Hanard 2013). According to company representatives, machining involves turning, lathing, and machining of metals delivered to the shop. No foundry, smelting, or other extractive refining work is performed on site (E & E 2013b).

In response to concerns raised by interested parties, the START reviewed NPL-related files on the Teledyne Wah Chang Albany (TWCA) facility available from the Albany Public Library. TWCA has been a client of Hanard Machine since at least the early 1980s (TWCA 1982). The TWCA facility is located approximately 20 miles south of the 7th and Patterson facility (Figure 2-1). TWCA is a facility that produces zirconium and is included on the EPA’s NPL. Hanard Machine has performed milling/machining work for TWCA on such zirconium products (TWCA 1982). To process these zirconium products, TWCA receives zirconium sands and through a process of chlorination, separation, precipitation, and reduction, isolates the zirconium to produce high-purity zirconium metal products. As zirconium sands often include low levels of radionuclides, including radium 226 and radium 228, those radionuclides are a byproduct of the zirconium production process, and were among the contaminants of concern in TWCA’s NPL listing. NPL documents describe radium laden sands and waste water sludges being stockpiled on the TWCA manufacturing property. Off-site disposal of these materials occurred at the U.S. Ecology Low Level Radioactive Waste Site in Hanford Reservation, Washington, or the U.S. Ecology facility in Grandview, Idaho (Parametrix 2008).

Given that radium is removed from the zirconium source sands fairly early in the extraction/refining process, the documented disposal of the waste material, that Hanard Machine's association with TWCA is reportedly limited to machining of finished items, and that Hanard Machine's occupancy of the ballfields lot did not occur until 1995, disposal of TWCA associated radium laden waste products at the Hanard Machine facility or the adjacent ballfields appears extremely unlikely.

11.6 Previous Reports

Previous environmental sampling and testing performed at the Hanard Machine property has included sampling and testing performed in connection with UST removal from the site; this report was not reviewed in connection with this PA. The results of the environmental database report generated for this PA are discussed below.

11.6.1 Environmental Database Report

A search of environmental database listings for the site and vicinity revealed numerous listings, the majority of which are located in the industrial/commercial area east-southeast of the site. Releases and contamination issues documented in this area are not considered to represent conditions significantly different than what may be encountered in most any industrially developed area, generally consisting of releases of various petroleum hydrocarbons, solvents, and heavy metals. While both Walker Middle School and Hanard Machine were listed in these databases, these listings were related to releases discovered during removal of USTs that had stored petroleum products (EDR 2013a). While the UST removal efforts at the Hanard Machine site were discussed with the property owner's representative, copies of the associated removal report(s) were not provided.

Gould Battery/GNB was also listed in database report in relation to a petroleum release, and the spill of lead oxide. After participating in the Oregon's Voluntary Cleanup Program and filing an environmental covenant that limits use of the Gould Battery/GNB property to industrial purposes, that site was granted a No Further Action status by ODEQ (EDR 2013a).

Regarding other nearby properties, Walker Middle School was listed as a "HAZMAT" site in response to a chlorine cylinder leak that had occurred at the on-site pool. Several other properties in nearby residential areas were also listed, generally in connection with heating oil tank removals (EDR 2013a).

11.7 Site Visit Observations

Prior to sampling activities, a site visit was conducted at the site. Participants included:

- Joanne LaBaw, EPA, Site Assessment Manager;
- Derek Pulvino, E & E, Project Manager; and

- Mike Carter, Hanard Machine, General Manager.

At the time of the site reconnaissance, the ballfields were enclosed by a fence, predominantly covered with grass, and exposed soils were only present in baseball diamond infield areas. No disturbed vegetation, odors, or other similar conditions were noted during site review. Surface water catchment basins were noted along curbs in the adjacent roadways.

Similar to the neighboring Walker Middle School site, the 7th and Patterson Ballfields property and immediate vicinity is a generally flat alluvial plain; a steep embankment is located several hundred feet to the north and is interpreted to locally coincide with the northern limits of the Willamette River's historic meanders. The Willamette River is located approximately 0.5 mile to the south-southeast. When necessary, the ballfields are irrigated with City water. No hose bibs or drinking water fountains were observed. Photos of the 7th and Patterson Ballfields and surrounding area are included as Appendix A, Site Visit Photos 42 to 52.

11.8 PA Sampling

Soil samples were collected from locations with exposed soils. In addition, gamma field screening was performed across the ballfields area prior to sample collection. Figure 7-3 depicts soil sample locations. Figure 7-4 depicts the approximate alignment of transects with the Viper gamma radiation screening unit and the range of gamma detections. All field work at the 7th and Patterson Ballfields property took place on June 12, 2013.

11.8.1 Gamma Radiation Field Screening

Gamma radiation field screening was conducted on the ballfields area on 25-foot transect intervals aligned roughly north to south. Figure 7-4 depicts the transect alignments and corresponding screening results. A summary of the Viper gamma radiation screening readings from this site is included in Table 6-1.

11.8.2 Surface Soil Samples

A total of four soil samples were collected from the property. These included two samples each from exposed soil on the northern (SP01SS and SP02SS) and southern (SP03SS and SP04SS) baseball diamond infields.

Sample results are presented in Tables 6-2, 6-3, and 6-4. The analytes were present at concentrations well below the surface soil ODEQ RBCs for the direct contact pathway in a residential scenario or the applicable naturally occurring concentrations.

12 Summary and Conclusions

The West Salem PAs site focused on five individual properties located within an approximately 1.75-square-mile area on the west side of the Willamette River, in Salem, Oregon. This investigation was undertaken in response to petitions submitted by local residents concerned over multiple occurrences of osteosarcoma (a rare form of bone cancer) in the West Salem area of Oregon. The specific properties were selected for inclusion in the West Salem PAs during discussions that took place between the EPA, parents of the children who had osteosarcoma, and other interested parties. Locations selected for this assessment were identified as places where the children had frequented.

One of the sites under review (7th and Patterson Ballfields) is part of a parcel that is, and has been, owned and occupied by commercial/industrial interests; however, there is no record of the ballfields area of the property having been used for commercial purposes such as storage, manufacturing, disposal, etc. The remaining sites included in the West Salem PAs are currently two parks (Wallace Marine Park, Orchard Heights Park) and two schools (Walker Middle School and West Salem High School). Prior to these occupancies, these properties had been used as orchard/agricultural land and/or residential property (West Salem High School and Orchard Heights Park), or as athletic fields (Walker Middle School). Prior to use as a park, Wallace Marine Park was not previously developed.

To help with identifying properties with the potential for environmental contamination, an environmental database report was generated for each site. While these reports identified multiple cleanup sites within the database search radii, the types of contamination and cleanup work performed was similar to what one would expect to find in most any industrial/commercially developed area across the country. Two sites under study (Walker Middle School and 7th and Patterson Ballfields) were both listed in the database report; the listings were related to removal and cleanup of USTs that had stored petroleum products.

To supplement the background research and documentation, sampling and testing of sediment and soil was undertaken by the START from June 10, 2013 through June 14, 2013. A total of 45 samples, including background samples, were collected for the PAs. At least three samples were collected from each site and submitted for the analysis of pesticides, PCBs, metals, SVOCs, and radionuclides. In addition, gamma activity level field screening was performed at each property.

Based on analysis of these samples, with few exceptions, the concentrations identified in the samples were well below established health-based residential screening levels. These exceptions included some organic and inorganic constituents detected in sediment samples.

The organic constituents, or SVOCs, identified above a health-based screening levels were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. These five SVOCs were present in the three sediment samples collected from Orchard Heights Park at concentrations in excess of the soil RBC for direct contact in a residential scenario. One sample (WP01SD) collected from Wallace Marine Park contained benzo(a)pyrene at a concentration above the residential soil RBC.

In addition, cobalt was detected in the three sediment samples from Orchard Heights Park at concentrations in excess of the EPA RSL for direct contact with soil. Manganese was detected in one of the Orchard Heights Park sediment samples at a concentration above the naturally occurring concentration established by ODEQ.

The five SVOCs, also referred to as PAHs, can be created by naturally occurring processes, as well as through the incomplete combustion of organic materials such coal, oil, gas, or garbage (EPA 2008). PAHs are classified as carcinogens, exposure to which can result in lung, skin, bladder, liver, and stomach cancer; however, these cancers typically develop as a result of long-term occupational exposure (ATSDR 2008). The carcinogenicity of cobalt and manganese, both of which are naturally occurring metals, has not been established (EPA 2014a, 2014b)

With respect to the detections at Orchard Heights Park, following receipt of sample results, the START reviewed GIS data obtained from the City of Salem regarding storm water management systems in the vicinity of the Orchard Heights Park. Based on this information, surface water runoff captured by the drainage basins along the roadways from many of the surrounding residential developments is discharged to Glenn Creek. As a point of reference, four outfalls are mapped as discharging to Glenn Creek in the first approximately 400 feet after the creek enters the park.

Finally, it should be emphasized that the above discussion comparing sediment sample results to RBCs and RSLs developed for direct contact with soil in a residential scenario likely represents a very conservative comparison. This relates to the methodology used in developing action levels, which take into account both the toxicity/carcinogenicity of the substance and the time one may be in contact with the substance. Higher toxicity values and longer potential exposure times result in lower cleanup levels. As one may expect, a population spends less time in a park than at their residence, and less time still in contact with sediments in a creek or river at the park; therefore, the use of the residential soil cleanup levels for sediment samples is conservative since sediment exposure times can be expected to be lower than for soils and these lower exposure times would result in sediment cleanup values that are higher than soil cleanup values.

Various radiological substances have been detected above the minimum detectable concentration in samples analyzed during this review. In comparing these results to analysis of samples collected from the background location, many results were "elevated," as defined in Section 5 of this report. It is recognized that this method of determining elevated concentrations of radionuclides represents a very conservative approach. In response to this concern, EPA and START consulted with a Health Physicist at the Oregon Health Authority regarding radiation exposure and dosage risk.

The State of Oregon has established 25 mrem/year above natural background radiation as the annual health-based ceiling for whole-body radiation dosage. Exposure to radiation above these levels could result in negative health effects. To compare data obtained from this sampling, Oregon Health Authority calculated an inhalation dose based on the soil results for all of the samples. For example, for West Salem High School, the annual inhalation dose calculated based on the concentrations of the radionuclides, uranium 238 and thorium 232, would be 0.008 mrem/yr and 0.050 mrem/yr, respectively, which are dosages well below the annual exposure limit of 25 mrem/year. Further, even if the most prevalent natural radionuclide maximums encountered at this same location were summed, the annual inhalation dose would still be less than 0.1 mrem. The annual external radiation dose would be even lower than that calculated for the inhalation dose (OHA 2013).

In summary and given the foregoing, none of the environmental factors measured were present at concentrations that would be expected to contribute to an increased risk of osteosarcoma. Further, these assessments did not identify any sources of contamination that would require further investigation or cleanup by EPA

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13 References

ASTDR (Agency for Toxic Substances and Disease Registry), July 1, 2008, Environmental Health and Medicine Education, Polycyclic Aromatic Hydrocarbons (PAHs), What Health Effect Are Associated with PAH Exposure.

Beja, J.L., 1981, *Geology of the Rickreall, Salem West, Monmouth, and Sidney 7.5' Quadrangles*, Published by the Oregon Department of Geology and Mineral Industries. Available online at http://ngmdb.usgs.gov/Prodesc/proddesc_33028.htm..

Boatwright (Boatwright Engineering and Surveying) July 2, 1948, West Salem Jr. High School, Survey Drawing, Athletic Field Development, obtained from SKPD files.

Burns (Burns Scott, Lindsey Kassandra, Whitney Hilary, Theisen Deborah, Icefire Felicity), January 22, 2013a, Radon test results for Oregon, by ZIP code, Published by Portland State University, Department of Geology.

_____, October 17, 2013b, Telephone interview regarding radon data collection and risk ranking, with Mr. Derek Pulvino, Ecology and Environment.

Carter (Carter, Michael, Hanard Machine, General Manger), February 25, 2013, In person interview regarding operational practices and site history, with Mr. Derek Pulvino, Ecology and Environment.

CSP (Spencer Powell & Associates – P.G.P Inc,) July 19, 1999a, Valuation Analysis, 2646 Orchard Heights Road NW, Salem, Oregon, Project P99143, Prepared for Salem Keizer Public Schools.

_____, August 16, 1999b, Valuation Analysis, 1655 Doakes Ferry Road NW, Salem, Oregon, Project P99163, Prepared for Salem Keizer Public Schools

_____, July 19, 1999c, Valuation Analysis, SWC Orchard Heights & Doakes Ferry Roads NW, Salem. Oregon, P99144, Prepared for Salem Keizer Public Schools.

CWE (Century West Engineering Corporation), December 15, 2000, UST Decommissioning, Walker Middle School, 1075 8th Street NW, Salem, Oregon.

E & E (Ecology and Environment, Inc.), May 24, 2013a, Final Quality Assurance Plan, West Salem Preliminary Assessment Site, Salem, Oregon.

_____, 2013b, Log Book and Field Notes For Riverbend Marine Services, Compiled by Derek Pulvino, E & E, Seattle Washington.

EDR (Environmental Data Resources, Inc), December 27, 2012, EDR Summary Radius Map Report, Certified Sanborn Map Report, EDR Aerial Photo Decade Package, 1075 8th Street NW, Salem, Oregon (Walker Middle School), Inquiry Number 3484172.2, 3484172.3, 3484172.4.

_____, January 7, 2013a, EDR Summary Radius Map Report, Certified Sanborn Map Report, EDR Aerial Photo Decade Package, 859 7th St NW, Salem, Oregon (7th and Patterson), Inquiry Number 3489054.2, 3489054.3, 3489054.4.

_____, January 7, 2013b, EDR Summary Radius Map Report, Certified Sanborn Map Report, EDR Aerial Photo Decade Package, 1776 Titan Drive NW, Salem, Oregon (West Salem High School), Inquiry Number 348894.2, 348894.3, 348894.4.

_____, January 17, 2013c, EDR Summary Radius Map Report, Certified Sanborn Map Report, EDR Aerial Photo Decade Package, 1201 Orchard Heights RD NW, Salem, Oregon (Orchard Heights Park), Inquiry Number 3497666.2, 3497666.3, 3497666.4.

_____, April 8, 2013d, EDR Summary Radius Map Report, Certified Sanborn Map Report, EDR Aerial Photo Decade Package, 200 Glen Creek Road NW, Salem, Oregon (Wallace Marine Park), Inquiry Number 3571084.2, 3571084.3, 3571084.4.

Ellis (Kathy Ellis Sr. Industrial Hygiene Consultant and DeEtta Burrows MSPH, CIH Wise Steps, Inc.), January 23, 2013a, Industrial Hygiene Report, Walker Middle School Radon Testing.

____, February 12, 2013b, Industrial Hygiene Report, West High School Radon Testing.

EPA (United States Environmental Protection Agency), 1996, *EPA Soil Screening Guidance User's Guide.*

____, August 2000, *Guidance for the Data Quality Objectives Process,* EPA QA/G-4, Office of Research and Development, Washington, D.C., EPA/600/R-96/055.

____, April 2007, *USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, SOM01.2.*

____, January 2008, Polyclylic Aromatic Hydrocarbons (PAHs), Published by Office of Solid Waste.

____, June 2008, *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*, OSWER 9240.1-48, USEPA-540-R-08-01.

____, January 2009, *Guidance for Labeling Externally Validated Laboratory Data for Superfund Use*, EPA-540-R-08-005

____, January 2010, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*, OSWER 9240.1-51, EPA 540-R-10-011.

____, May 2011a, Regional Screening Levels.

____, September 2011b, *USEPA Contract Laboratory Program Statement of Work for Inorganic Superfund Methods, Multi-Media, Multi-Concentration, ISM01.3.*

____, Viper Wireless Monitoring System epaosc.org/viper, Accessed 2013

____, 2014a, Cobalt Compounds, http://www.epa.gov/ttnatw01/hlthef/cobalt.html, Accessed 1/29/2014.

____, 2014b, Manganese Compounds, http://www.epa.gov/ttn/atw/hlthef/manganes.html, Accessed 1/29/2014.

FE (Foundation Engineering), October 1993, Geotechnical Investigation Walker Middle School Additions, Salem, Oregon, Prepared for Salem-Keizer Public Schools, Salem, Oregon.

____, February 3, 2000, Geotechnical Investigation West Salem High School, Salem Oregon, Prepared for Salem-Keizer Publish Schools, Salem, Oregon.

FEMA (Federal Emergency Management Agency), January 2, 2003, Flood Insurance Rate Map, Marion County, Oregon and Incorporated Areas, Map Number 41047C0333, Panel 333 of 1150.

Geiser (Peter H. Geiser Appraisal Service), August 11, 1961, Appraisal Letter, Provided to Gerald H. and Inez Perry and Walker Junior High School.

Hahn (Hahn and Associates, Inc.), November 2012, Aerial Photos from Phase I Environmental Site Assessment of 859 7th Street NW, Salem, Oregon, Provided by Michael Carter, Hanard Machine.

Hanard (Hanard Machine), 2013, Website Information http://www.hanard.com/, Accessed December 27, 2013.

ODEQ (Oregon Department of Environmental Quality), 2013, Environmental Cleanup Site Information Database, Site Summary Full Report – Details for Site ID865, Salem Riverfront Park, www.deq.state.or.us/lq/ECSI/ecsidetailfull.asp?seqnbr=865, Accessed July 23, 2013.

ODFW (Oregon Department of Fish and Wildlife), 2011a, *2011 Sport Fishing Catch Expanded Final*.

_____, 2011b, *2011 Sturgeon Sport Fishing Catch Expanded Preliminary Figures*.

ODOE (Oregon Department of Education), 2013, October 1 Enrollment Summary 2012 – 2013, Salem-Keizer School District.

ODWR (Oregon Department of Water Resources), 2013, Water Rights Information Query system webpage http://apps.wrd.state.or.us/apps/wr/wrinfo/Default.aspx accessed December 1, 2013.

OHA (Oregon Health Authority), December 4, 2013, Email Communication with Daryl A. Leon, Healthy Physicist regarding radionuclide detections, with Mr. Derek Pulvino, Ecology and Environment, Inc.

Parametrix, January 8, 2008, Final Third Five-Year Review Report for the Teledyne Wah Chang Superfund Site, Prepared for U.S. Environmental Protection Agency.

PCA (Polk County Assessor), 2012a, Polk County Real Property Assessment Overview, Account #312590 (Hanard Machine/7th and Patterson), Accessed 12/27/2012.

____, 2012b, Polk County Real Property Map Summary, Account #'s 327181, 327350, 327264, 508014, 508957, 539959, (Walker Middle School), Accessed 12/27/2012.

_____, 2012c, Polk County Real Property Assessment Overview, Account #'s 267737, 565342, 267740, (West Salem High School), Accessed 12/27/2012.

_____, 2013a, Polk County Real Property Assessment Overview, Account #327053 (Orchard heights Park), Accessed 1/17/2013.

_____, 2013b, Polk County Real Property Assessment Overview, Account #'s 327024, 327037, 270238, 432056, 432069, 432072, 327574, 327615, 259947, 568378 (Wallace Marine Park), Accessed 4/8/2013.

_____, 2013c, Polk County Assessor Field Folio, Account #'s 267737, 565342, 267740, (West Salem High School), Obtained February 26, 2013.

_____, 2013d, Polk County Assessor Field Folio, Account #'s 327053, (Orchard Heights Park), Obtained February 26, 2013.

_____, 2013e, Polk County Assessor Field Folio, Account #'s 312590, (7th and Patterson Ballfields), Obtained February 26, 2013.

Pheby (Pheby, Dr. Derek, Wright, Mel), 2006, Risk Factors for Osteosarcoma in Young People in Cornwall: A Case-Control Study, Chartered Institute of Environmental Health, Volume 5, Issue 2.

Polk (Polk County GIS), 2008, Polk County Zoning Map.

Salem (City of Salem), 2012, 2012 Water Quality Report.

______, 2013a, Online Information on Minto-Brown Island Park, Park Map and Brochure, http://www.cityofsalem.net/Residents/Parks/ParkTour/Documents/Minto-Brown%20brochure%202012_1.pdf, Accessed April 23, 2013.

______, 2013b, Online information on Wallace Marine Park, http://www.cityofsalem.net/Residents/Parks/ParkTour/Documents/History%20of%20Wallace%20Marine%20Park.pdf, Accessed July 19, 2013.

SKPS (Salem-Keizer Public Schools), April 13, 1959, Photo of Walker Middle School Site, Obtained from SKPS files, Photo credited to Capital Journal.

______, December 31, 2012, Email from Vonnie Good (Environmental Safety Specialist) to Jim Jenney regarding West Salem Schools Radon Testing.

______, February 20, 2013a, Email from Vonnie Good (Environmental Safety Specialist) regarding Radon at two rooms at WSHS (West Salem High School).

_____, July 30, 2013b, Letter from Vonnie Good (Environmental Safety Specialist) to Ed John (Principal, West Salem High School) regarding radon testing.

Stengel (Stengel, J), March 30, 2007, In the United States District Court for the Eastern District of Pennsylvania, Civil Action No. 03-01552, AstenJohnson v Columbia Casualty Co., et al.

TechLaw, March 2011, *Site Inspection Report*, *Cherry City Metals*, Salem, Marion County, Oregon, Prepared for USEPA

TWCA (Teledyne Wah Chang Albany), April 5, 1982, Letter from Charles R. Knoll P.E. (Environmental Control) to Mr. Richard Reiter of Department of Environmental Quality Hazardous Waste Section.

USGS (United States Geological Survey), 2011, Salem West Quadrangle, Oregon, 7.5 Minute Series, Scale 1:24,000.

WU (Willamette University), University Quick Facts, webpage http://www.willamette.edu/about/facts/ accessed on November 27, 2013.

Wydoski and Whitney (Wydoski, Richard and Richard Whitney), 2003, *Inland Fisheries of Washington*, Second Edition, Revised and Expanded.

Zawistoski, Mark, November 21, 2013a, internal memorandum to Derek Pulvino regarding GIS Information for Wallace Marine Park.

______, February 14, 2013b, internal memorandum to Derek Pulvino regarding GIS Information for Walker Middle School.

______, February 14, 2013c, internal memorandum to Derek Pulvino regarding GIS Information for West Salem High School.

______, February 14, 2013d, internal memorandum to Derek Pulvino regarding GIS Information for Orchard Heights Park.

______, February 14, 2013e, internal memorandum to Derek Pulvino regarding GIS Information for 7th and Patterson Ballfields.

Figures

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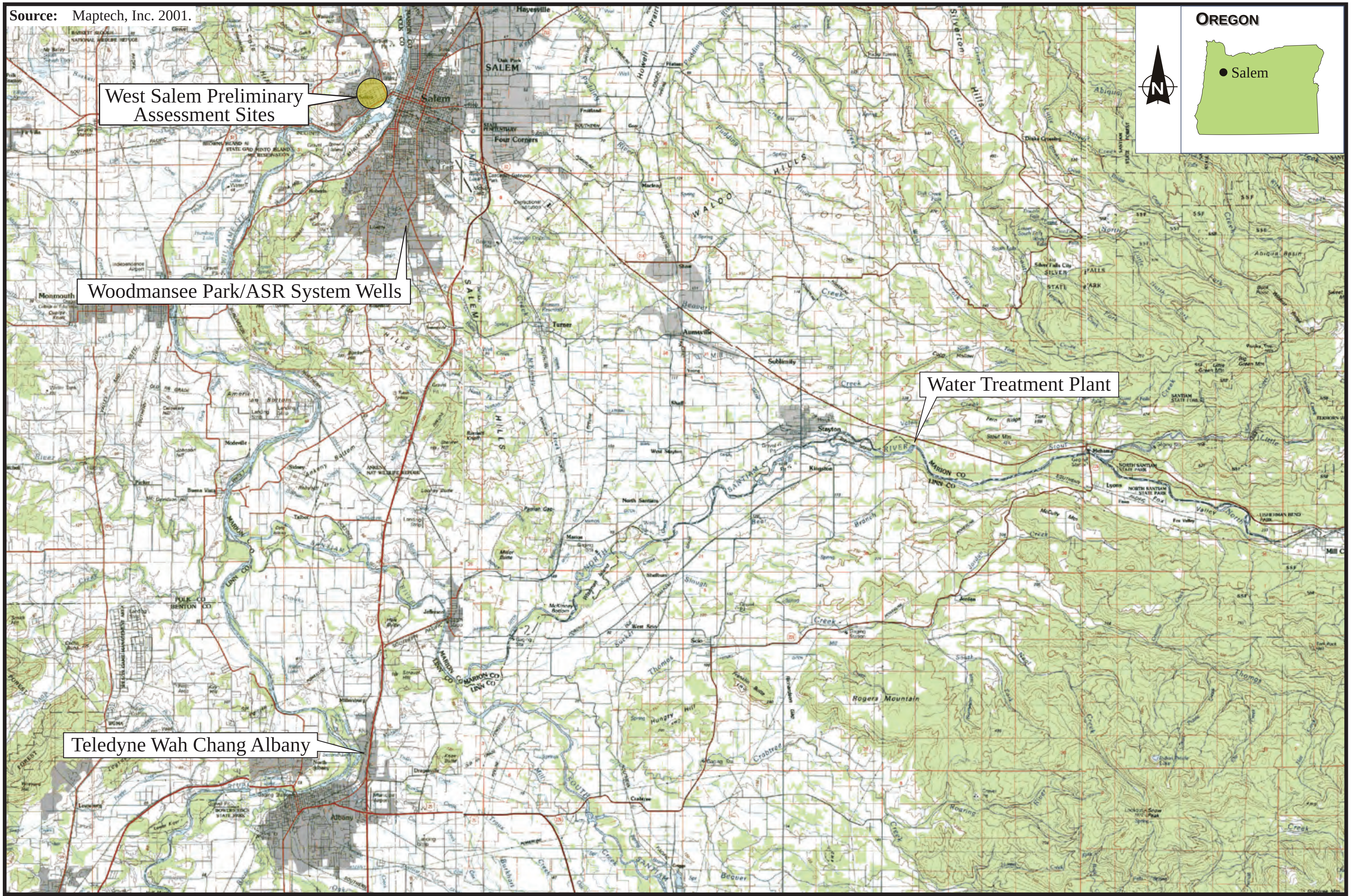


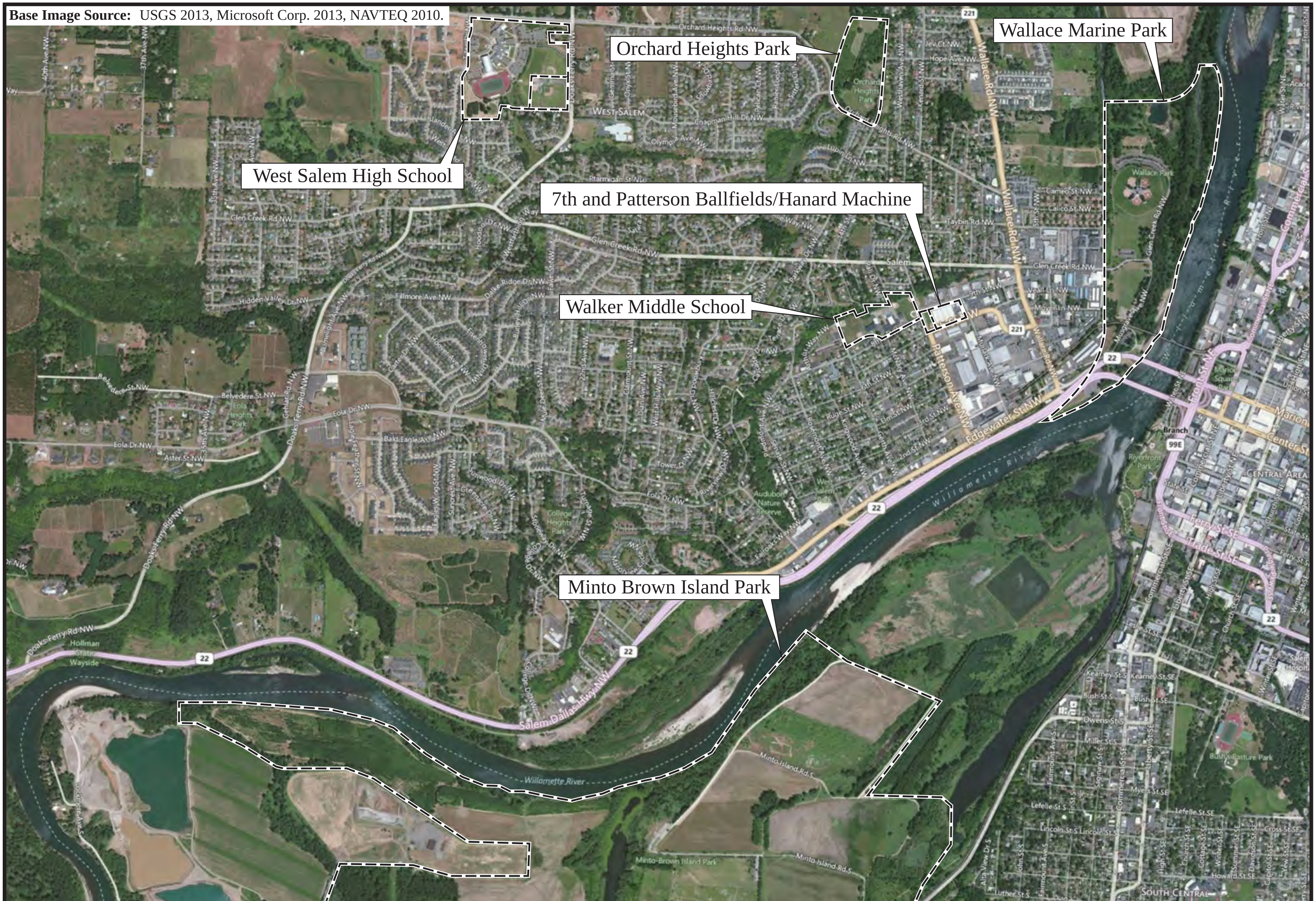
ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

0 2 4
Approximate Scale in Miles

WEST SALEM
PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 2-1
SITE LOCATION MAP

Date:	Drawn by:	
12/12/13	AES	10:START-IV\13040002\fig 2-1



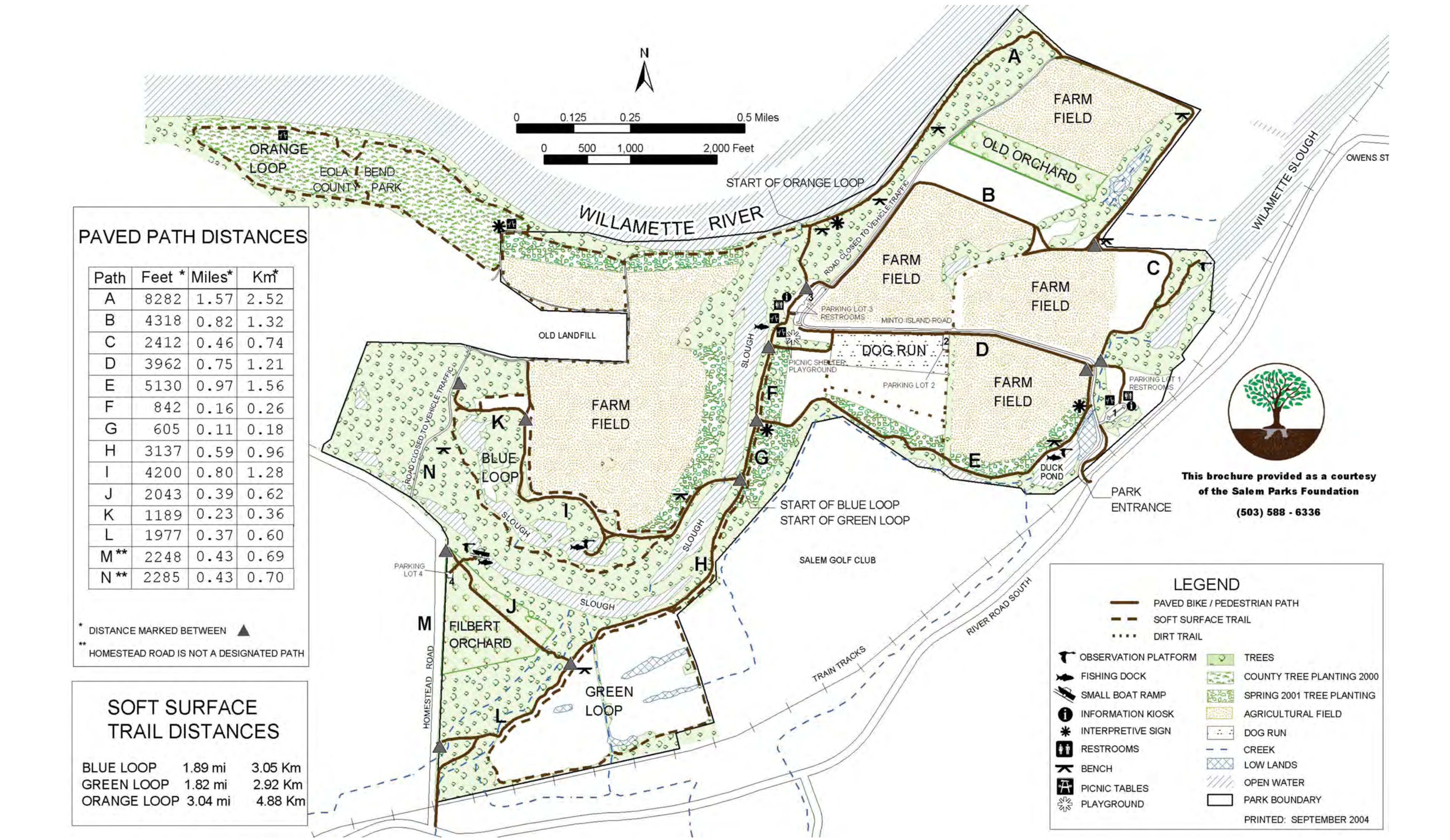
ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

0 0.25 0.5
Approximate Scale in Miles

WEST SALEM
PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 2-2
VICINITY MAP

Date:	Drawn by:	
12/20/13	AES	10:START-IV\13090016\fig 2-2



PAVED PATH DISTANCES

Path	Feet *	Miles*	Km*
A	8282	1.57	2.52
B	4318	0.82	1.32
C	2412	0.46	0.74
D	3962	0.75	1.21
E	5130	0.97	1.56
F	842	0.16	0.26
G	605	0.11	0.18
H	3137	0.59	0.96
I	4200	0.80	1.28
J	2043	0.39	0.62
K	1189	0.23	0.36
L	1977	0.37	0.60
M **	2248	0.43	0.69
N **	2285	0.43	0.70

* DISTANCE MARKED BETWEEN ▲

** HOMESTEAD ROAD IS NOT A DESIGNATED PATH

SOFT SURFACE TRAIL DISTANCES

BLUE LOOP	1.89 mi	3.05 Km
GREEN LOOP	1.82 mi	2.92 Km
ORANGE LOOP	3.04 mi	4.88 Km

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Global Environmental Specialists
Seattle, Washington

WEST SALEM PRELIMINARY ASSESSMENT
Salem, Oregon

Figure 6-1
MINTO-BROWN ISLAND PARK (BACKGROUND LOCATION)

Date:	Drawn by:	
1/29/14	AES	10:START-IV\13040002\fig 6-1

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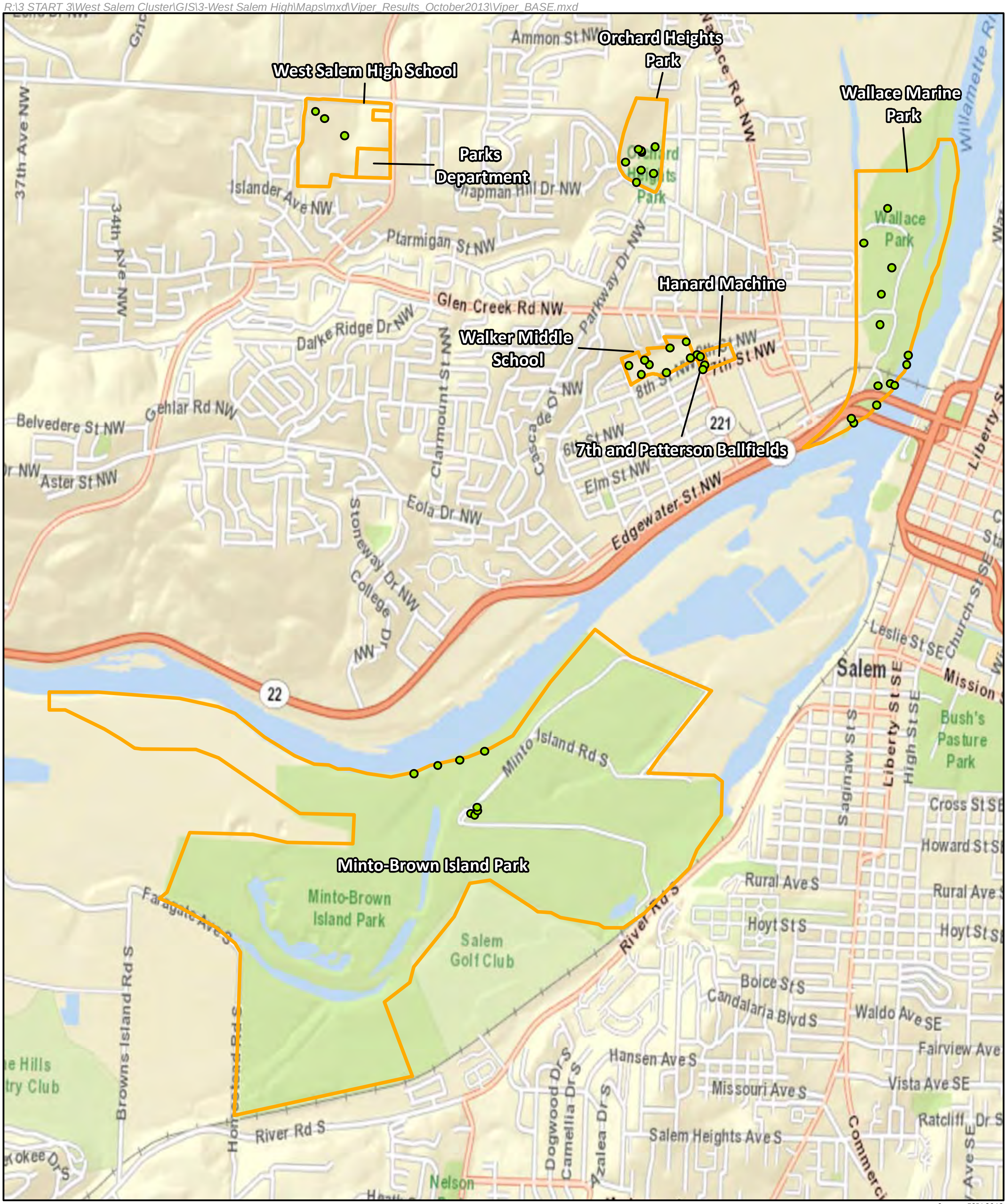


Sample Locations
Property Boundaries

0 700 1,400 2,800 Feet

N

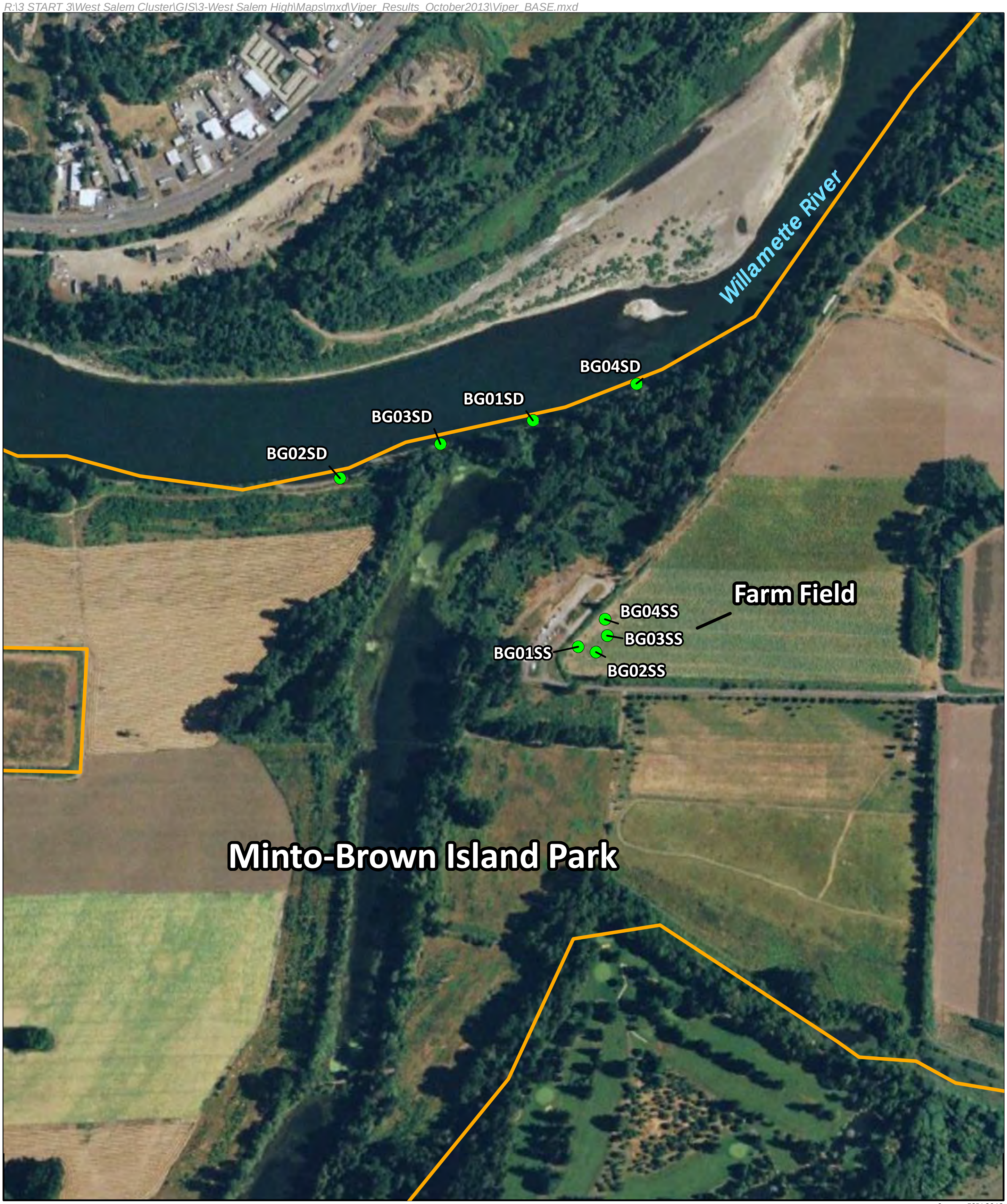
West Salem Preliminary Assessments
Site and Sample Location Map

West Salem, Oregon

Figure 6-2

ecology and environment, inc.
Global Specialists in the Environment

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd



Source: ESRI 2013

Sample Locations
Property Boundaries

0 200 400 800 Feet

N

West Salem Preliminary Assessments
Sample Location Map
Minto-Brown Park
West Salem, Oregon

Figure 6-3

ecology and environment, inc.
Global Specialists in the Environment

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd

Source: ESRI 2013

0-2.92 kC/m

Property Boundaries

0 100 200 400 Feet

N

West Salem Preliminary Assessments
Gamma Screening Transects
Minto-Brown Park
West Salem, Oregon

Figure 6-4

ecology and environment, inc.
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ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

N

0 100 200
Approximate Scale in Feet

WEST SALEM
PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 7-1
WALKER MIDDLE SCHOOL - SITE PLAN

Date:	Drawn by:	
12/12/13	AES	10:START-IV\13090016\fig 7-1

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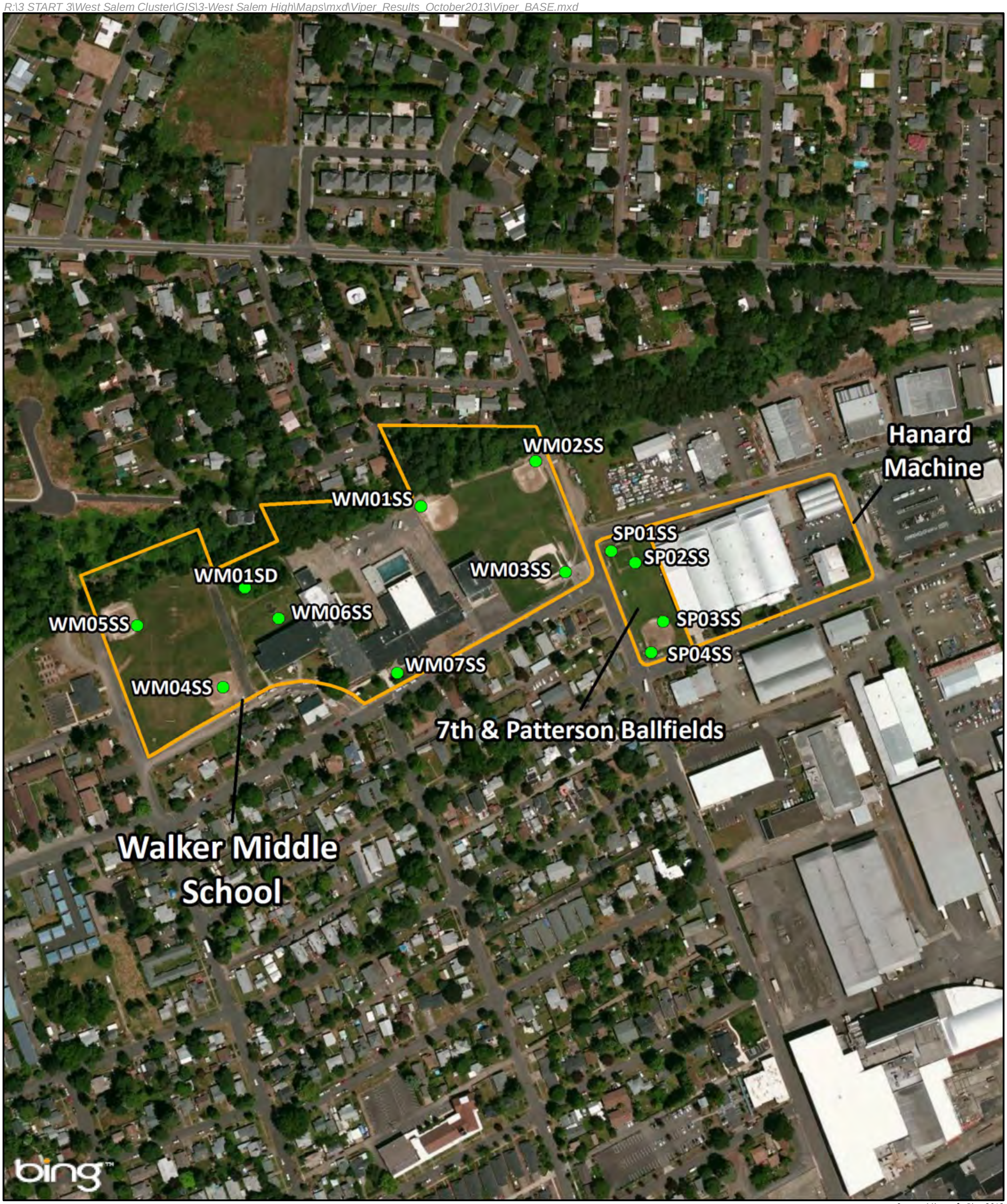
Seattle, Washington

WEST SALEM PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 7-2
WALKER MIDDLE SCHOOL AREA INDUSTRIAL/COMMERCIAL SITES

Date:	Drawn by:	
1/29/14	AES	10:START-IV\13040002\fig 7-2



Source: Microsoft, Bing 2013

Sample Locations

Property Boundaries

0 125 250 500 Feet

N

West Salem Preliminary Assessments Sample Location Map

Walker Middle School &

7th & Patterson Ballfields

West Salem, Oregon

Figure 7-3

ecology and environment, inc.

Global Specialists in the Environment

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd

Source: Microsoft, Bing 2013

0-2.92 kC/m

Property Boundaries

0 125 250 500 Feet

N

West Salem Preliminary Assessments
Gamma Screening Transects
Walker Middle School &
7th & Patterson Ballfields
West Salem, Oregon

Figure 7-4

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Global Specialists in the Environment

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Seattle, Washington

WEST SALEM
PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 8-1
WEST SALEM HIGH SCHOOL - SITE PLAN

Date:	Drawn by:	
12/12/13	AES	10:START-IV\13040002\fig 8-1

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd

Source: Microsoft, Bing 2013

Sample Locations
Property Boundaries

0 100 200 400 Feet
N

West Salem Preliminary Assessments
Sample Location Map
West Salem High School
West Salem, Oregon

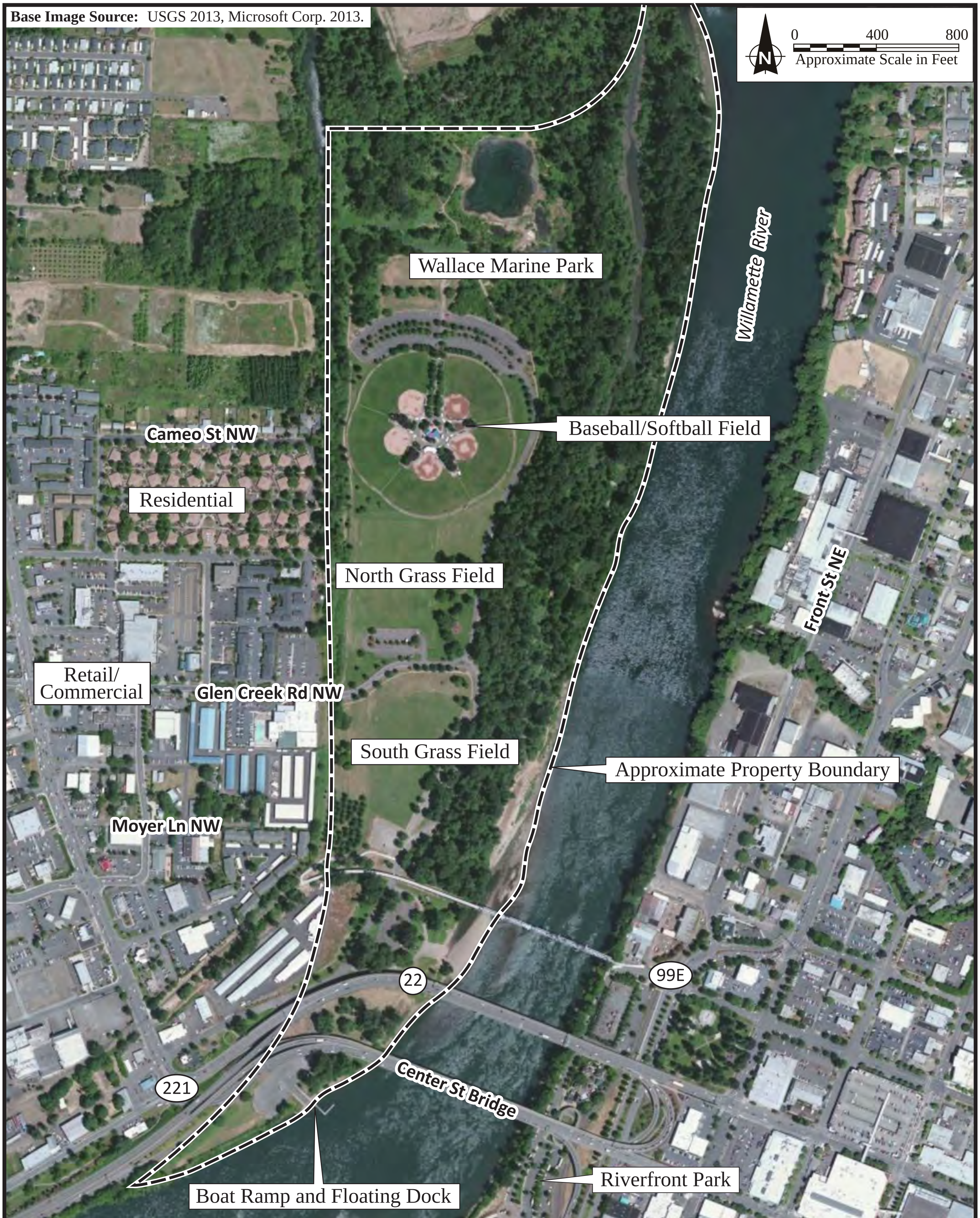
Figure 8-2

ecology and environment, inc.
Global Specialists in the Environment

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd

Source: Microsoft, Bing 2013

0-2.92 kC/m Property Boundaries	**West Salem Preliminary Assessments** **Gamma Screening Transects** **West Salem High School** *West Salem, Oregon*	**Figure 8-3**
0 100 200 400 Feet N		ecology and environment, inc. Global Specialists in the Environment



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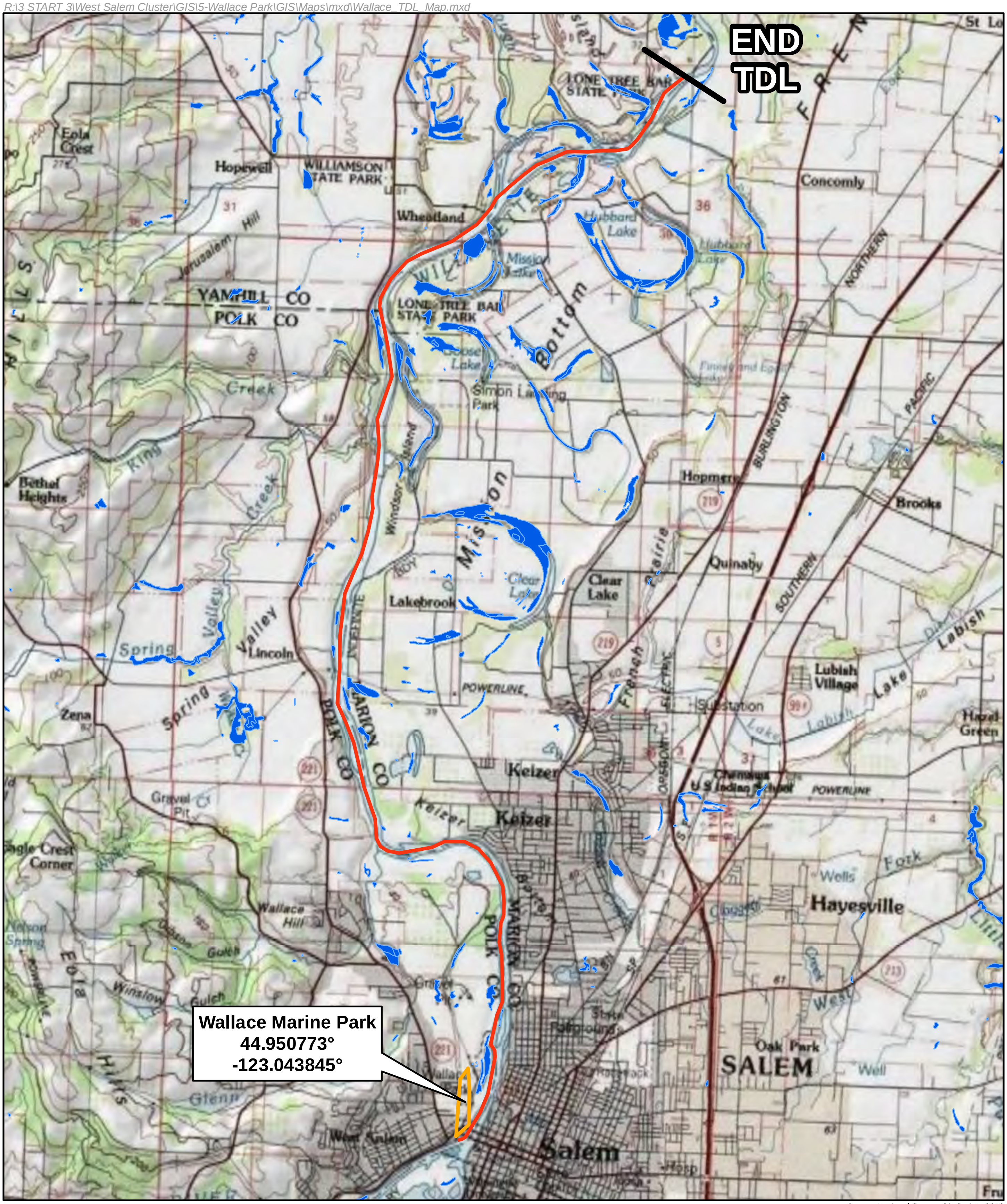
Seattle, Washington

WEST SALEM PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 9-1
WALLACE MARINE PARK - SITE PLAN

Date:	Drawn by:	
12/12/13	AES	10:START-IV\13090016\fig 9-1

R:\3 START 3\West Salem Cluster\GIS\5-Wallace Park\GIS\Maps\mxd\Wallace_TDL_Map.mxd



Source: National Geographic Society 2013

0 0.5 1 2 Miles

N

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West Salem Preliminary Assessment
Wallace Marine Park

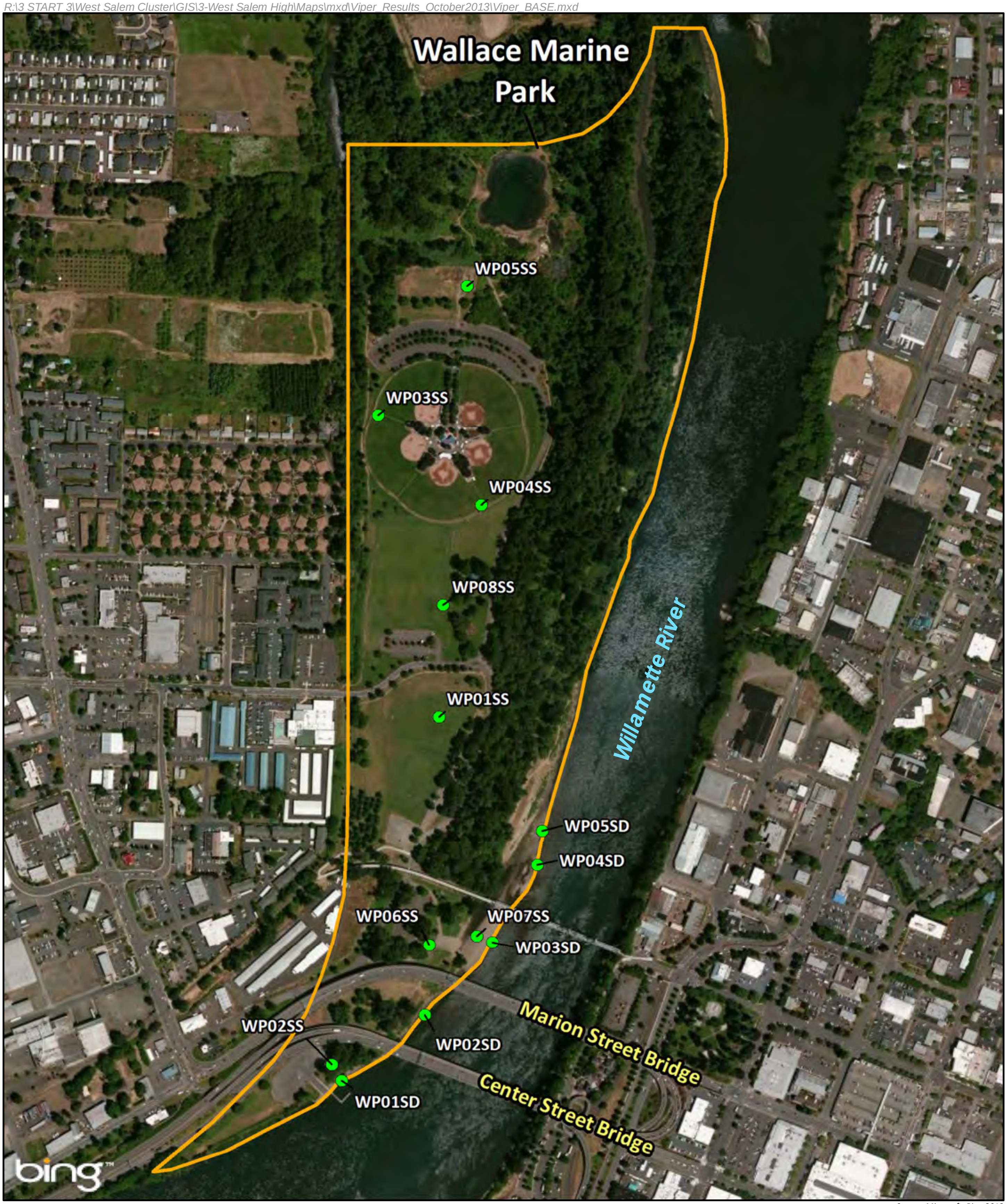
West Salem, Oregon

Site/Source Area | TDL | NWI Wetlands

Figure 9-2
15-Mile Target Distance Limit (TDL) Map

E & E added site name and coordinates to the map.
Sources: Topographic map from ESRI and NGS 2013, NWI Wetlands 2013.

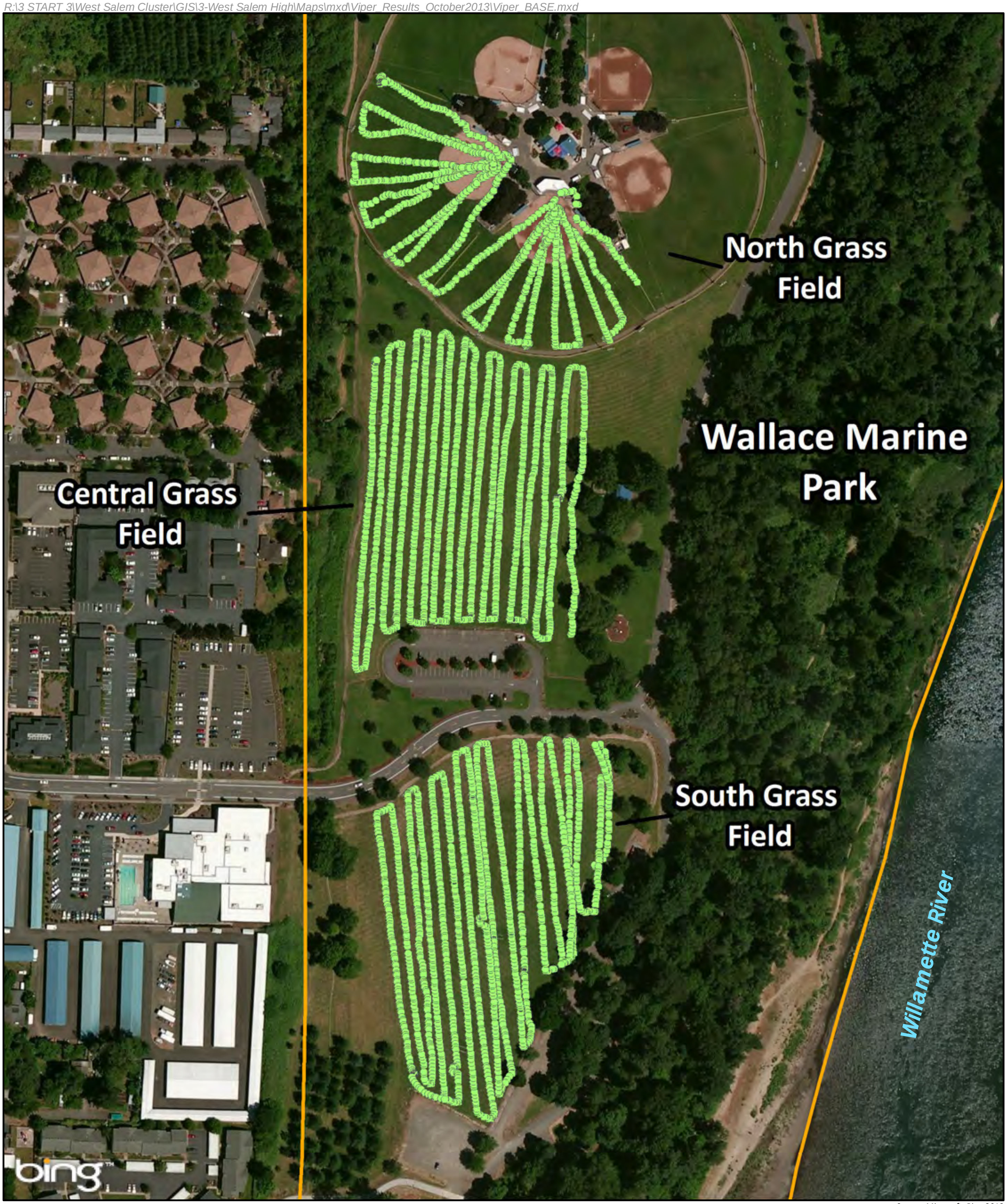
R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd



Source: Microsoft, Bing 2013

Sample Locations Property Boundaries	**West Salem Preliminary Assessments** **Sample Location Map** Wallace Marine Park *West Salem, Oregon*	**Figure 9-3**
0 200 400 800 Feet N		ecology and environment, inc. Global Specialists in the Environment

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd



Source: Microsoft, Bing 2013

0-2.92 kC/m
Property Boundaries

0 100 200 400 Feet

N

West Salem Preliminary Assessments
Gamma Screening Transects
Wallace Marine Park
West Salem, Oregon

Figure 9-4

ecology and environment, inc.
Global Specialists in the Environment

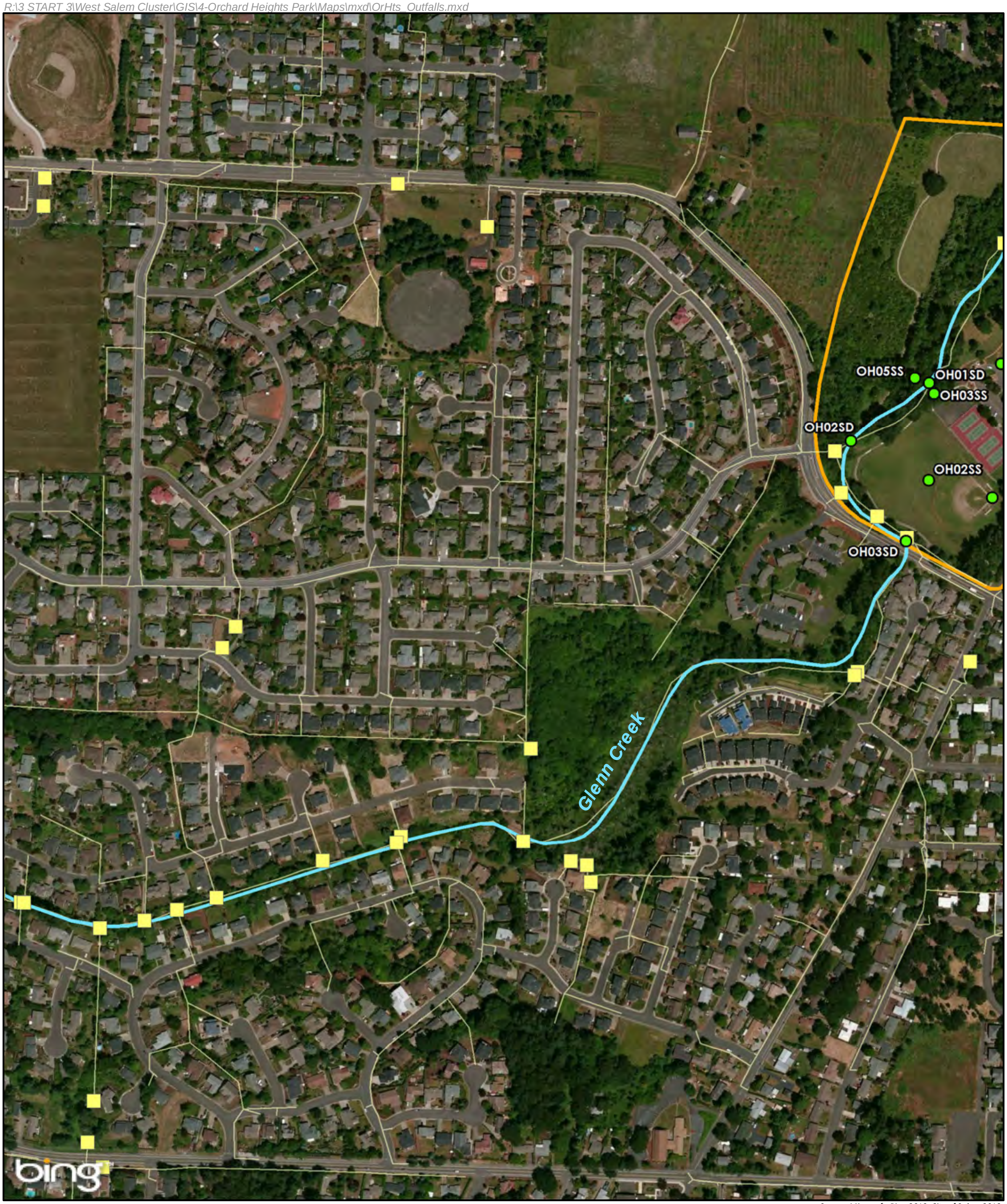
ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

WEST SALEM PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 10-1
ORCHARD HEIGHTS PARK - SITE PLAN

Date:	Drawn by:	
12/17/13	AES	10:START-IV\13040002\fig10-1

R:\3 START 3\West Salem Cluster\GIS\4-Orchard Heights Park\Maps\mxd\OrHts_Outfalls.mxd



Source: Microsoft, Bing 2013, City of Salem 2013.

Sample Locations
Storm System
Outfalls
Property Boundary

0 150 300 600 Feet

N

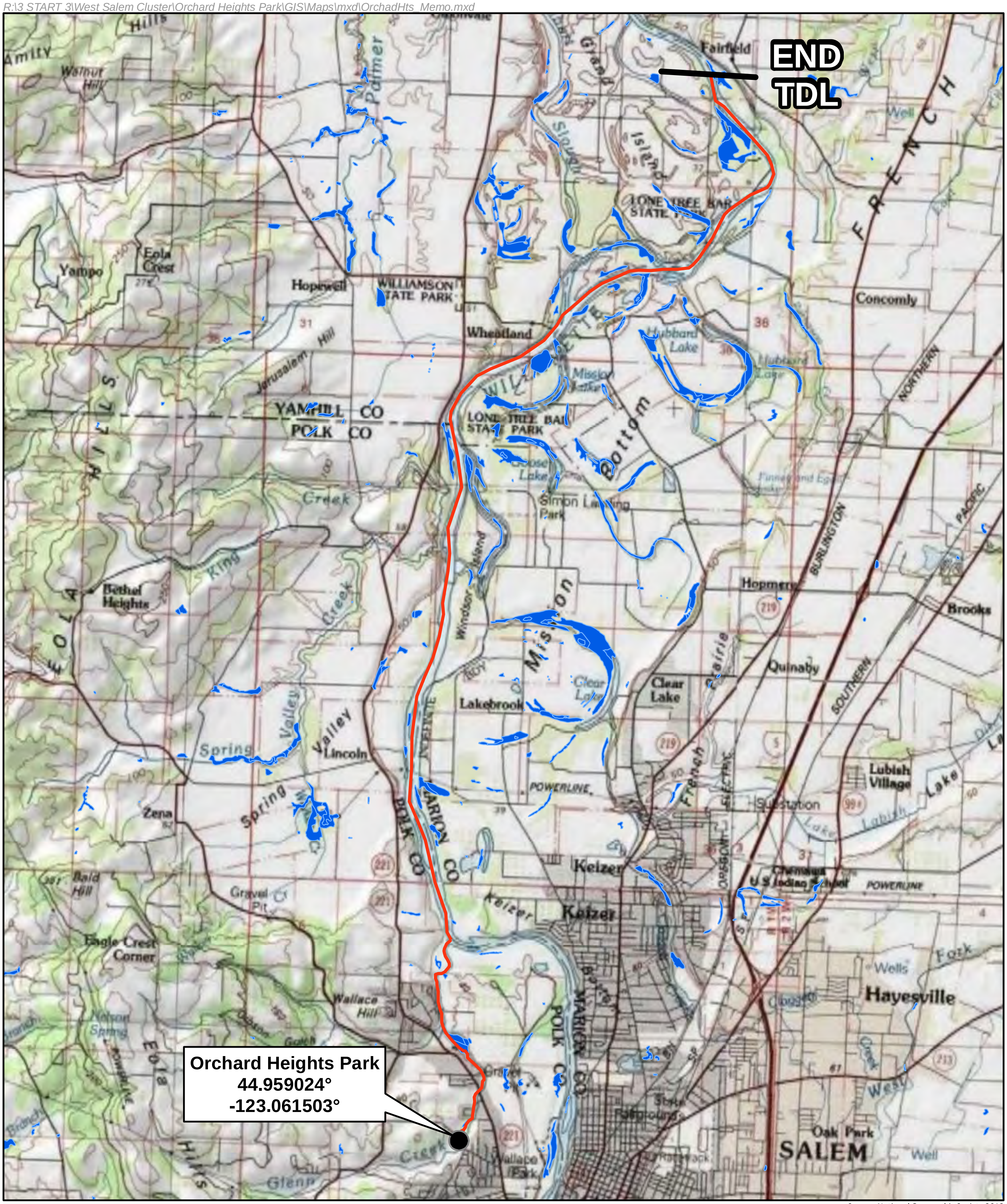
West Salem Preliminary Assessments
Orchard Heights Park
Area Storm Water Outfalls

West Salem, Oregon

Figure 10-2

ecology and environment, inc.
Global Specialists in the Environment

R:\3 START 3\West Salem Cluster\Orchard Heights Park\GIS\Maps\mxd\OrchadHts_Memo.mxd



Source: National Geographic Society 2013

0 0.5 1 2 Miles

N

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Global Environmental Specialists

West Salem Preliminary Assessment
Orchard Heights Park

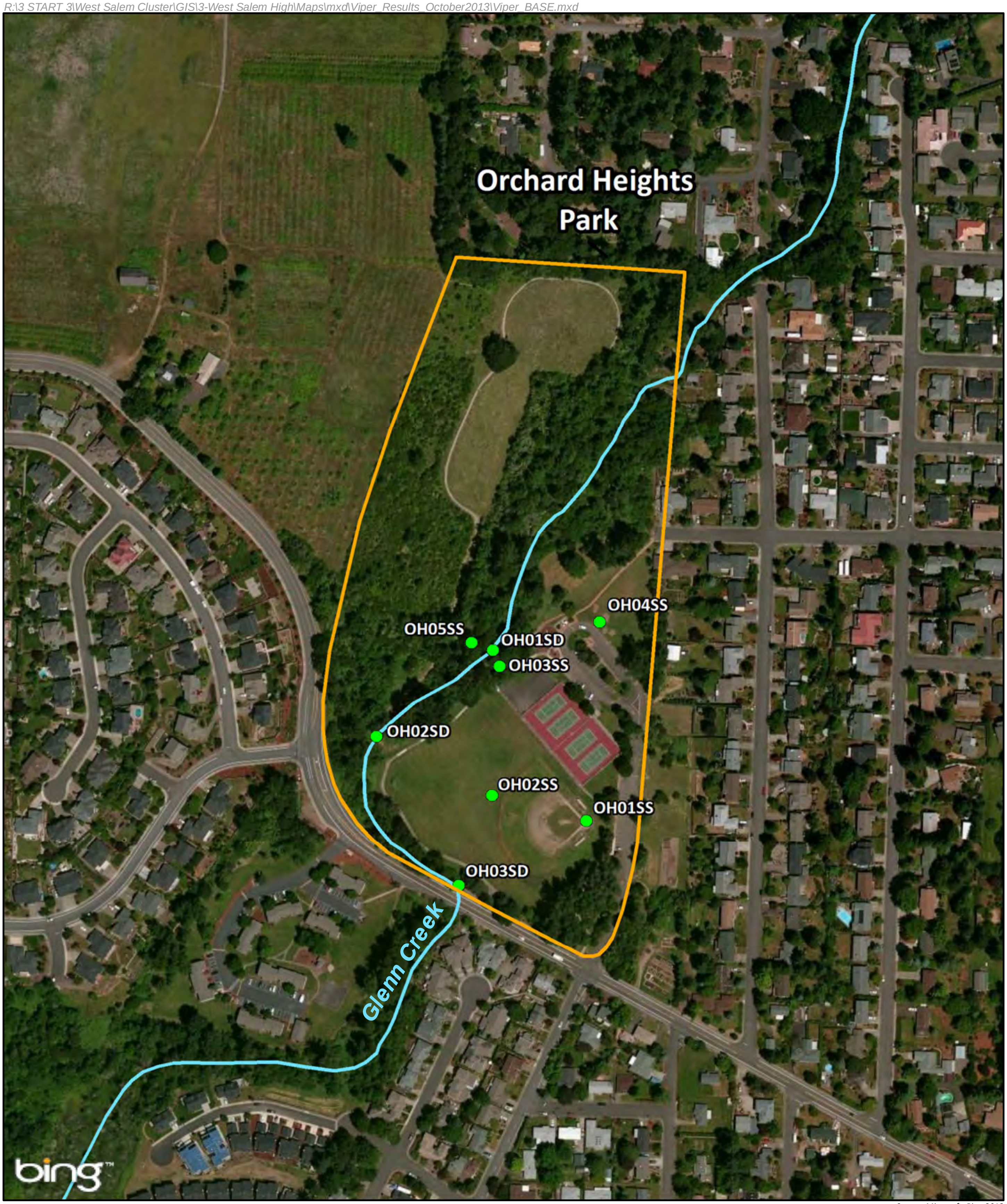
West Salem, Oregon

● Site Location — TDL ■ NWI Wetlands

Figure 10-3
15-Mile Target Distance Limit
(TDL) Map

E & E added site name and coordinates to the map.
Sources: Topographic map from ESRI and NGS 2013,
NWI Wetlands 2013.

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd



Source: Microsoft, Bing 2013

Sample Locations
Property Boundaries

0 100 200 400 Feet

N

West Salem Preliminary Assessments
Sample Location Map

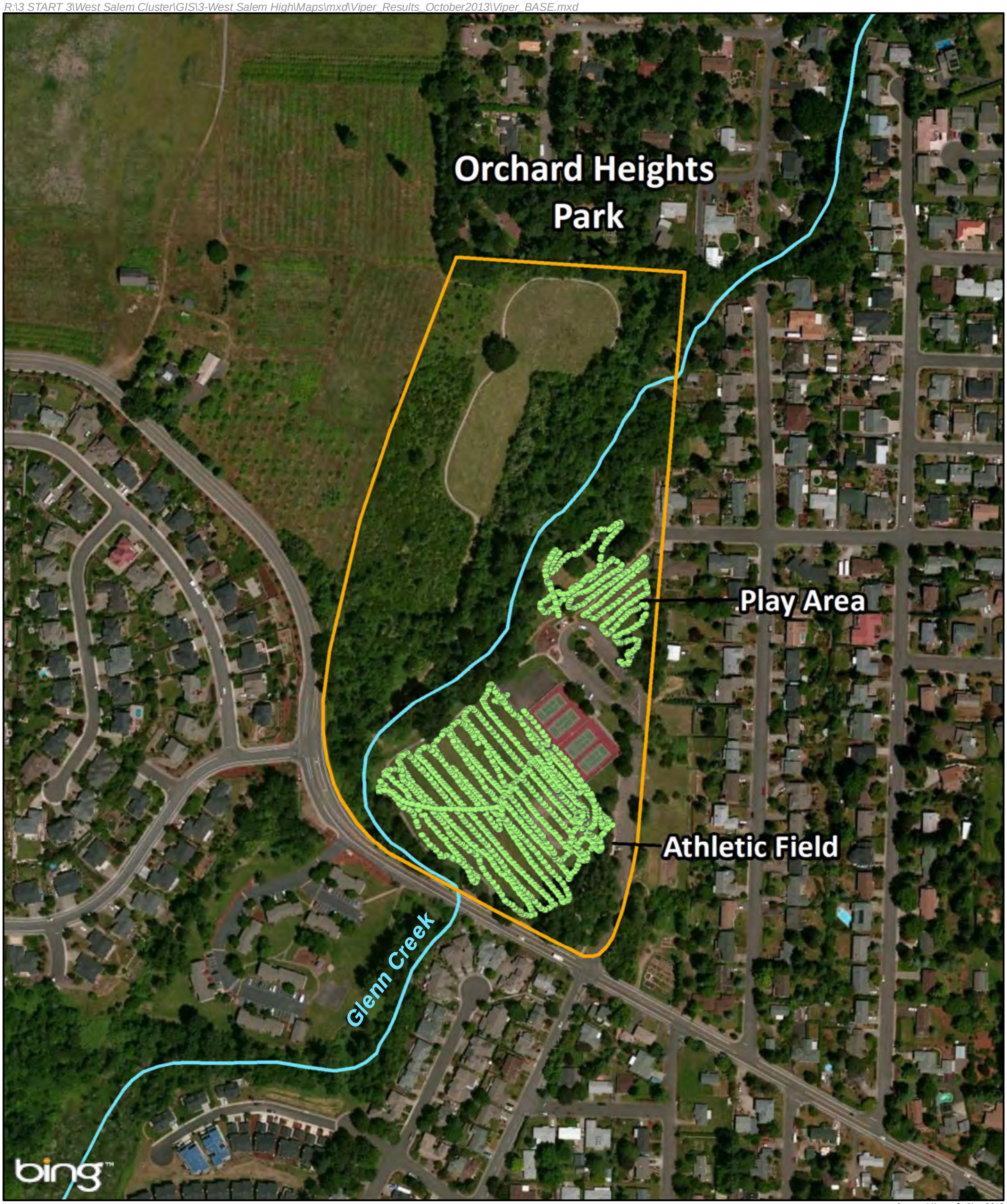
Orchard Heights Park

West Salem, Oregon

Figure 10-4

ecology and environment, inc.
Global Specialists in the Environment

R:\3 START 3\West Salem Cluster\GIS\3-West Salem High\Maps\mxd\Viper_Results_October2013\Viper_BASE.mxd



Source: Microsoft, Bing 2013

0-2.92 kC/m
Property Boundaries

0 100 200 400 Feet

N

West Salem Preliminary Assessments
Gamma Screening Transects
Orchard Heights Park
West Salem, Oregon

Figure 10-5

ecology and environment, inc.
Global Specialists in the Environment

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Seattle, Washington

0 50 100
Approximate Scale in Feet

WEST SALEM
PRELIMINARY ASSESSMENTS
Salem, Oregon

Figure 11-1
7TH AND PATTERSON
BALLFIELDS - SITE PLAN

Date: 12/20/13 | Drawn by: AES | 10:START-IV\13040002\fig 11-1

Tables

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Table 2-1 Radon Test Results for Site and Nearby Zip Codes

Zip code	Location	Long Term Test Results					Short Term Test Results				
		Number of Tests	Max. (pCi/L)	Avg. (pCi/L)	%>4 pCi/L	Radon Potential	Number of Tests	Max. (pCi/L)	Avg. (pCi/L)	%>4 pCi/L	Radon Potential
97026	Gervais	4	11.2	6.5	100		4	6.2	3.5	50	
97101	Amity	4	2.2	0.9	0		5	39.7	18.2	80	
97128	McMinnville	23	17.6	3.3	26	Moderate	28	16.3	3	18	Moderate
97301	SE Salem	136	15.8	1.5	6	Moderate	82	47.4	2.5	6	Moderate
97302	S Salem	258	14.4	2.4	23	Moderate	210	24	3.8	32	Moderate
97303	Salem	316	39.8	2.2	2	Moderate	46	39.8	2.2	4	Moderate
97304	W Salem	699	160.2	4	18	Moderate	153	114.3	7.1	33	High
97305	Salem	39	5.7	1.3	8	Low	18	5.7	2.2	6	Moderate
97306	Salem	99	25.2	3.9	18	Moderate	83	22.7	4.2	31	High
97317	Salem	1	0	0	0		13	6	2.6	23	Moderate
97338	Dallas	82	36.1	2.8	16	Moderate	22	36.1	4.3	27	High
97351	Independence	14	2.4	1.1	0	Low	11	2.2	0.5	0	Low
97352	Jefferson	12	21.5	3.2	25	Moderate	2	2.7	1.6	0	
97361	Monmouth	20	19.9	3.5	20	Moderate	14	19.9	0.6	14	Moderate
97371	Rickreall	2	6.8	3.6	50		1	0.7	0.7	0	
97378	Sheridan	1	6.1	6.1	100		2	1	0.7	0	
97392	Turner	11	12.6	3.6	27	Moderate	14	15.6	5.2	43	High

Source: Oregon Health Authority

Notes:

Radon potential is a combination of the maximum test result, the average test result, and the percentage of tests exceeding 4 pCi/L. Radon potential was not provided for zip codes with fewer than 10 test results were not categorized.

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Table 3-1 Sample Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	DATE	Sample Time	Depth	Sampler	Sample Analysis: TAL Metals	Pest/PCBs	SVOCs	Gamma Spec	Select Radionuclides	TR Metals	Description/Location
Background Samples														
13234004	BG01SD	NA	Sediment	6/10/2013	17:51	0-4 inches	Bryan Ciecko				X	X		Sediment sampled from edge of waterline. Matrix included silt with sand. Collected approximately 30 feet upriver from slough outfall, between rip rap on bank.
13234000	BG01SS	NA	Soil Surface	6/10/2013	16:24	0-4 inches	Bryan Ciecko				X	X	X	Surface soil sample collected from southwest corner of farm field at Minto-Brown Park.
13234005	BG02SD	NA	Sediment	6/10/2013	18:17	0-6 inches	Bryan Ciecko				X	X		Sample collected from waterline of gravelly beach material with interstitial fines/sand.
13234001	BG02SS	JSXT7	Soil Surface	6/10/2013	16:50	0-3 inches	Bryan Ciecko	X	X	X	X	X		Surface soil sample collected from southwest corner of farm field at Minto-Brown Park.
13234006	BG03SD	JSXT8	Sediment	6/10/2013	18:17	0-6 inches	Bryan Ciecko	X	X	X	X	X		Sandy silt sampled from below waterline. Material had accumulated atop rocks at relatively slow-moving spot on river.
13234002	BG03SS	NA	Soil Surface	6/10/2013	17:10	0-4 inches	Bryan Ciecko				X	X		Surface soil sample collected from southwest corner of farm field at Minto-Brown Park.
13234007	BG04SD	NA	Sediment	6/10/2013	18:58	0-6 inches	Bryan Ciecko				X	X	X	Silty material approximately 2 feet from waterline. Some roots in sample matrix.
13234003	BG04SS	NA	Soil Surface	6/10/2013	17:11	0-6 inches	Bryan Ciecko				X	X		Surface soil sample collected from southwest corner of farm field at Minto-Brown Park.
Walker Middle School														
13234017	WM01SD	JSXY3	Sediment	6/12/2013	18:17	0-6 inches	Derek Pulvino	X	X	X	X	X	X	Sediment from wetland area west of school. Very organic fine sand with silt and some roots.
13234008	WM01SS	JSXX6	Soil Surface	6/12/2013	14:55	0-6 inches	Bryan Ciecko	X	X	X	X	X		Soil from southern ball field in north field complex. Collected near 1st base dugout, close to home plate.
13234009	WM02SS	JSXX7	Soil Surface	6/12/2013	15:20	0-4 inches	Bryan Ciecko	X	X	X				Northwestern ballfield at north field area at Walker Middle School, in front of home base.
13234010	WM03SS	JSXX8	Soil Surface	6/12/2013	15:50	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Collected from northeast ballfield in north field area at Walker Middle School, between home plate and seating on 3rd base side.
13234011	WM04SS	JSXX9	Soil Surface	6/12/2013	17:35	0-4 inches	Derek Pulvino	X	X	X	X	X		Collected from center of infield, slightly left of pitcher mound centerline. Fine dry compacted sand. Collected from beneath of transits with gamma screener.
13234012	WM05SS	JSXY0	Soil Surface	6/12/2013	18:00	0-6 inches	Bryan Ciecko	X	X	X			X	Collected from 2nd base of northern field on west side of school. Matrix is fine sand and silt. Sampled under Viper transect.
13234013	WM06SS	JSXY1	Soil Surface	6/12/2013	18:45	0-6 inches	Bryan Ciecko	X	X	X				Sample collected approximately half way between shot-put pad and building on south. Sampled from beneath grass/bald spot. Sandy/loamy material.
13234014	WM07SS	JSXY2	Soil Surface	6/12/2013	19:14	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Sampled from bald spot in grass off of front/main entrance to school.
West Salem High School														
13234015	WH01SS	JSXZ3	Soil Surface	6/14/2013	13:20	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Medium brown silt with trace sand collected between parking lot and school near east entrance to school
13234016	WH02SS	JSXZ4	Soil Surface	6/14/2013	14:00	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Brown loamy soil (sand with silt). Sampled from area without grass in courtyard on west side of school.
13234030	WH03SS	JSXZ5	Soil Surface	6/14/2013	14:15	0-5 inches	Derek Pulvino	X	X	X				Medium reddish brown silt with sand and trace gravel west of main (west) entrance on slope on east side of parking lot at northwest corner of school property.

Table 3-1 Sample Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	DATE	Sample Time	Depth	Sampler	Sample Analysis: TAL Metals	Pest/PCBs	SVOCs	Gamma Spec	Select Radionuclides	TR Metals	Description/Location
Wallace Marine Park														
13234032	WP01SD	JSXW3	Sediment	6/11/2013	12:55	0-2 inches	Derek Pulvino	X	X	X	X	X	X	Sand with some silt and gravel collected approximately 1 foot from water in area with more silt deposits.
13234022	WP01SS	JSXT9	Soil Surface	6/11/2013	11:02	0-3 inches	Derek Pulvino	X	X	X	X	X	X	Loamy brown soil, collected from apparent mole hole were soil was exposed and no overlying grass noted. Molehill was located under one of Viper transects.
13234033	WP02SD	JSXW8	Sediment	6/11/2013	16:25	0-4 inches	Derek Pulvino	X	X	X				Fine sand/silt along shore of Willamette River located between two old bridges. Area has vegetative ground cover growing beneath dead algae mat.
13234023	WP02SS	JSXW4	Soil Surface	6/11/2013	13:35	0-4 inches	Derek Pulvino	X	X	X				Sandy soil collected from bare spot in grass with gravel. Material was hard packed with some wood chips.
13234034	WP03SD	JSXW9	Sediment	6/11/2013	17:45	0-6 inches	Bryan Ciecko	X	X	X				Gravelly river rock/gravel, mostly gravel. Minimal fines in material near surface. Sandier with depth.
13234024	WP03SS	JSXW0	Soil Surface	6/11/2013	14:20	0-6 inches	Bryan Ciecko	X	X	X	X	X		Sampled from beneath grass at right side of field. Sample collected from beneath area where sod was cut to allow access to soil.
13234035	WP04SD	JSXX0	Sediment	6/11/2013	18:25	0-6 inches	Derek Pulvino	X	X	X				Predominantly gravel with coarse sands. Fines accumulated by washing over rock in water. Sample hole dug approximately 3 feet from water line, saturated at depth.
13234025	WP04SS	JSXW5	Soil Surface	6/11/2013	14:40	0-5 inches	Bryan Ciecko	X	X	X				Sample collected from beneath left outfield grass in foul territory of field in baseball diamond complex. Sample collected from beneath cut area in sod.
13234036	WP05SD	JSXX1	Sediment	6/11/2013	18:40	0-6 inches	Derek Pulvino	X	X	X				Gravelly river stone with minimal fines. Sample collected along river at location where trail opens to river. Fines accumulated by washing from gravel in water that infiltrates hole.
13234026	WP05SS	JSXW1	Soil Surface	6/11/2013	15:10	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Sample of soil stockpile that had previously been infield material of baseball diamond area. Sand fine to medium grained material.
13234027	WP06SS	JSXW2	Soil Surface	6/11/2013	16:55	0-6 inches	Derek Pulvino	X	X	X	X	X	X	Sampled from hole in grass where mole hill had pushed up soil in middle of picnic area. Sample included some surface roots.
13234028	WP07SS	JSXW6	Soil Surface	6/11/2013	17:28	0-4 inches	Derek Pulvino	X	X	X				Rounded river gravel at end of old boat ramp. Sampled area forms gravel bar between park and river, collected near crest of sand bar.
13234029	WP08SS	JSXW7	Soil Surface	6/11/2013	18:58	0-6 inches	Bryan Ciecko	X	X	X			X	Exposed soil at center of east soccer goal. No grass in area sampled.

Table 3-1 Sample Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	DATE	Sample Time	Depth	Sampler	Sample Analysis: TAL Metals	Pest/PCBs	SVOCs	Gamma Spec	Select Radionuclides	TR Metals	Description/Location
Orchard Heights Park														
13234042	OH01SD	JSXZ2	Sediment	6/13/2013	17:00	0-3 inches	Derek Pulvino	X	X	X	X	X	X	Medium brown sand with silt, trace coarse sand. Collected from northwest side of creek near OH05SS.
13234037	OH01SS	JSXY5	Soil Surface	6/13/2013	13:35	0-6 inches	Bryan Ciecko	X	X	X	X	X		Moderately graded silty sand with fine gravel, medium reddish brown. Sampled from 1st base side of home plate on eastern ballfield at Orchard Heights Park
13234043	OH02SD	JSXZ0	Sediment	6/13/2013	17:30	0-3 inches	Derek Pulvino	X	X	X			X	Dark brown gravelly sand collected from downstream side of concrete bridge/walk at southwest corner of park.
13234038	OH02SS	JSXY6	Soil Surface	6/13/2013	14:10	0-6 inches	Bryan Ciecko	X	X	X			X	Brown to dark brown loamy silt with sand. Collected from center of southern field complex.
13234044	OH03SD	JSXZ1	Sediment	6/13/2013	17:45	0-6 inches	Derek Pulvino	X	X	X				Medium brown gravelly sand with silt. Collected where creek enters park, at southern boundary beneath bridge for Orchard Heights Road.
13234039	OH03SS	JSXY7	Soil Surface	6/13/2013	14:45	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Approximately 1.5" of bark chips on surface, underlain by 2" dark brown silt with sand underlain by 4 " of silty sandy gravel. Collected from picnic area, west of tennis court.
13234040	OH04SS	JSXY8	Soil Surface	6/13/2013	15:50	0-6 inches	Bryan Ciecko	X	X	X				Medium to dark brown silty loam with gravel and wood chips. Collected from northern dog run area.
13234041	OH05SS	JSXY9	Soil Surface	6/13/2013	16:20	0-4 inches	Bryan Ciecko	X	X	X			X	Brown sandy silt with wood chips and trace gravel. Collected just north of bridge on northwest side of creek on top of bank.
7th and Patterson Ballfields														
13234018	SP01SS	JSXX2	Soil Surface	6/12/2013	9:50	0-6 inches	Bryan Ciecko	X	X	X			X	Sample collected of soil from west ballfield behind home plate. Sample split with property owner's representative (Hahn & Assoc.).
13234019	SP02SS	JSXX3	Soil Surface	6/12/2013	10:25	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Soil collected from 2nd base area of northern field. Sample split with property owner's representative (Hahn & Assoc.).
13234020	SP03SS	JSXX4	Soil Surface	6/12/2013	11:00	0-6 inches	Bryan Ciecko	X	X	X			X	Soil collected from 2nd base area of south field at property. Sample split with property owner's representative (Hahn & Assoc.).
13234021	SP04SS	JSXX5	Soil Surface	6/12/2013	11:30	0-6 inches	Bryan Ciecko	X	X	X	X	X	X	Soil collected from home plate area of south ballfield . Sample split with property owner's representative (Hahn & Assoc.). As sample jar that metals sample was collected in was broken during processing, sample material was placed in a new jar for shipment to lab.
QC Samples														
13234045	RI01WT	JSXY4	Water	6/13/2013	13:00		Derek Pulvino	X	X	X	X	X		Rinsate sample collected from decontaminated rock hammer used to break apart denser soils for sampling.

Key

CLP = Contract Laboratory Program.
EPA = Environmental Protection Agency.
ID = Identification.
NA = Not applicable.
PCBs = Polychlorinated Biphenyls.
Pest = Pesticides
QC = Quality Control
TAL = Target Analyte List.
TCL = Target Compound List
TR = Total Recoverable Rare/Exotic Metals
Spec = Spectrometry
SVOCs = Semivolatile Organic Compounds
VOCs = Volatile Organic Compounds.

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Table 3-2 Sample Coding

Digits	Description	Code	Example
1,2	Sampling Area	BG	Background Sample
		WM	Walker Middle School
		SP	7th and Patterson
		WP	Wallace Marine Park
		OH	Orchard Heights Park
		RS	Rinsate
		WH	West Salem High School
3,4	Consecutive Sample Number	01	First sample from sampling area
5,6	Matrix Code	SD	Sediment
		SS	Surface Soil
		QC	Quality Control

Table 5-1: CRQL and RBC Levels for Organic and Inorganic Constituents

Analyte Name	CAS Number	Units	CRQL	ODEQ RBC	EPA RSL
TAL Metals (µg/kg)					
Aluminum	7429-90-5	µg/kg	20000		77000000
Antimony (metallic)	7440-36-0	µg/kg	1000		31000
Arsenic, Inorganic	7440-38-2	µg/kg	500	390	390
Barium	7440-39-3	µg/kg	5000	15000000	15000000
Beryllium and compounds	7440-41-7	µg/kg	500	160000	160000
Cadmium (Diet)	7440-43-9	µg/kg	500	39000	70000
Chromium, Total	7440-47-3	µg/kg	1000	120000000	120000000
Cobalt	7440-48-4	µg/kg	500		23000
Copper	7440-50-8	µg/kg	1000	3100000	3100000
Iron	7439-89-6	µg/kg	10000		55000000
Lead and Compounds	7439-92-1	µg/kg	500	1800000	400000
Lead and Compounds	7439-92-1	µg/kg	500	400000	400000
Mercury, Inorganic Salts	7487-94-7	µg/kg	500		23000
Nickel Soluble Salts	7440-02-0	µg/kg	500		1500000
Selenium	7782-49-2	µg/kg	2500		390000
Silver	7440-22-4	µg/kg	500	390000	390000
Thallium (Soluble Salts)	7440-28-0	µg/kg	500		780
Vanadium, Metallic	7440-62-2	µg/kg	250		390000
Zinc (Metallic)	7440-66-6	µg/kg	1000		23000000
PCBs (µg/kg)					
Aroclor 1016	12674-11-2	µg/kg	33		3900
Aroclor 1221	11104-28-2	µg/kg	33		140
Aroclor 1232	11141-16-5	µg/kg	33		140
Aroclor 1242	53469-21-9	µg/kg	33		220
Aroclor 1248	12672-29-6	µg/kg	33		220
Aroclor 1254	11097-69-1	µg/kg	33		220
Aroclor 1260	11096-82-5	µg/kg	33		220
Pesticides (µg/kg)					
Aldrin	309-00-2	µg/kg	2	25	29
Chlordane	12789-03-6	µg/kg	2		1600
DDD	72-54-8	µg/kg	3	2400	2000
DDE, p,p'-	72-55-9	µg/kg	3	1700	1400
DDT	50-29-3	µg/kg	3	1700	1700
Dieldrin	60-57-1	µg/kg	3	29	30
Endosulfan	115-29-7	µg/kg	2	370000	370000
Endrin	72-20-8	µg/kg	3	18000	18000
Heptachlor	76-44-8	µg/kg	2	100	110
Heptachlor Epoxide	1024-57-3	µg/kg	2	53	53
Hexachlorocyclohexane, Alpha-	319-84-6	µg/kg	2	70	77
Hexachlorocyclohexane, Beta-	319-85-7	µg/kg	2		270
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	µg/kg	2	380	520
Toxaphene	8001-35-2	µg/kg	170	440	440
SVOCs (µg/kg)					
Acenaphthene	83-32-9	µg/kg	170 (3.3[A])	4700000	3400000
Acetophenone	98-86-2	µg/kg	170		7800000
Anthracene	120-12-7	µg/kg	170 (3.3[A])	23000000	17000000
Atrazine	1912-24-9	µg/kg	170		2100
Benz[a]anthracene	56-55-3	µg/kg	170 (3.3[A])	150	150
Benzaldehyde	100-52-7	µg/kg	170		7800000
Benzo[a]pyrene	50-32-8	µg/kg	170 (3.3[A])	15	15
Benzo[b]fluoranthene	205-99-2	µg/kg	170 (3.3[A])	150	150
Benzo[k]fluoranthene	207-08-9	µg/kg	170 (3.3[A])	1500	1500
Bis(2-chloroethoxy)methane	111-91-1	µg/kg	170		180000
Bis(2-chloroethyl)ether	111-44-4	µg/kg	170		210

Table 5-1: CRQL and RBC Levels for Organic and Inorganic Constituents

Analyte Name	CAS Number	Units	CRQL	ODEQ RBC	EPA RSL
Bis(2-ethylhexyl)phthalate	117-81-7	µg/kg	170	35000	35000
Butyl Benzyl Phthalate	85-68-7	µg/kg	170		260000
Caprolactam	105-60-2	µg/kg	170		31000000
Chloroaniline, p-	106-47-8	µg/kg	170		2400
Chloronaphthalene, Beta-	91-58-7	µg/kg	170		6300000
Chlorophenol, 2-	95-57-8	µg/kg	170		390000
Chrysene	218-01-9	µg/kg	170 (3.3[A])	14000	15000
Cresol, p-	106-44-5	µg/kg	170		6100000
Cresol, p-chloro-m-	59-50-7	µg/kg	170		6100000
Dibenz[a,h]anthracene	53-70-3	µg/kg	170 (3.3[A])	15	15
Dibutyl Phthalate	84-74-2	µg/kg	170		6100000
Dichlorobenzidine, 3,3'-	91-94-1	µg/kg	170		1100
Dichlorophenol, 2,4-	120-83-2	µg/kg	170		180000
Diethyl Phthalate	84-66-2	µg/kg	170		49000000
Dimethylphenol, 2,4-	105-67-9	µg/kg	170		1200000
Dinitrophenol, 2,4-	51-28-5	µg/kg	330		120000
Dinitrotoluene, 2,4-	121-14-2	µg/kg	170		1600
Dinitrotoluene, 2,6-	606-20-2	µg/kg	170	61000	61000
Dioxane, 1,4-	123-91-1	µg/kg	100		4900
Fluoranthene	206-44-0	µg/kg	170 (3.3[A])	2300000	2300000
Fluorene	86-73-7	µg/kg	170 (3.3[A])	3100000	2300000
Hexachlorobenzene	118-74-1	µg/kg	170	260	300
Hexachlorocyclopentadiene	77-47-4	µg/kg	170		370000
Hexachloroethane	67-72-1	µg/kg	170	19000	12000
Indeno[1,2,3-cd]pyrene	193-39-5	µg/kg	170 (3.3[A])	150	150
Isophorone	78-59-1	µg/kg	170		510000
Methylnaphthalene, 2-	91-57-6	µg/kg	170 (3.3[A])		230000
Naphthalene	91-20-3	µg/kg	170 (3.3[A])	4600	3600
Nitroaniline, 2-	88-74-4	µg/kg	330		610000
Nitroaniline, 4-	100-01-6	µg/kg	330		24000
Nitrobenzene	98-95-3	µg/kg	330		4800
Nitroso-di-N-propylamine, N-	621-64-7	µg/kg	170		69
Nitrosodiphenylamine, N-	86-30-6	µg/kg	170		99000
Pentachlorobenzene	608-93-5	µg/kg	170		49000
Pentachlorophenol	87-86-5	µg/kg	330	890	890
Phenol	108-95-2	µg/kg	170		18000000
Pyrene	129-00-0	µg/kg	170 (3.3[A])	1700000	1700000
Trichlorophenol, 2,4,5-	95-95-4	µg/kg	170		6100000
Trichlorophenol, 2,4,6-	88-06-2	µg/kg	170	44000	44000

Note: [A] The number in parenthesis is the the CRQL for SIM analysis

Key:

µg/kg = micrograms per kilogram
CAS = Chemical Abstract Service
CRQL = Contract Required Quantitation Limit
EPA = Environmental Protection Agency
PCBs = Polychlorinated Biphenyls
RBC = Risk-based Cleanup Level for residential direct contact/ingestion scenario (State of Oregon)
RSL = Regional Screening Level
SIM = Select Ion Monitoring
SVOCs = Semivolatile Organic Compounds
TAL = Target Analyte List

Table 6-1 Summary of Gamma Survey Data Results (kC/M)

Property Location	Property Sublocation	Range of Results	Mean Result	Median Result	Standard Deviation
Background Location (Minto-Brown Island Park)	Farm Field	1.33 - 1.65	1.46	1.46	0.073
Walker Middle School	East Athletic Fields	1.2 - 1.98	1.51	1.5	0.113
	West Athletic Fields	1.18 - 1.76	1.47	1.47	0.112
	Central Grass Field	1.21 - 1.83	1.47	1.45	0.11
West Salem High	East Athletic Fields	1.24 - 1.85	1.51	1.51	0.096
	South Athletic Field	1.11 - 1.93	1.48	1.48	0.102
	Parking Area	0.98 - 1.73	1.39	1.4	0.159
	Grass Area	1.3 - 1.83	1.57	1.59	0.107
Wallace Marine Park	South Grass Field	1.33 - 1.71	1.51	1.51	0.065
	North Grass Field	1.06 - 1.31	1.18	1.18	0.037
	Ballfields 1 and 2	1.18 - 1.54	1.34	1.33	0.078
Orchard Heights Park	Athletic Field	1.51 - 2.64	2.01	2.0	0.186
	Play Area	1.59 - 2.43	1.95	1.93	0.137
Seventh and Patterson Ballfield	Baseball Fields	1.17 - 1.67	1.42	1.43	0.093

Key:

kC/M = Kilocounts per minute

Table 6-2 Soil Samples - Analytical Results Summary (Inorganic and Organic Constituents)

EPA Sample ID / Sample Location Description / CLP Sample ID / Depth (inches bgs)	Cleanup Levels[a]	13234001 BG02SS JSXT7 0-3	13234008 WM01SS JSXX6 0-6	13234009 WM02SS JSXX7 0-4	13234010 WM03SS JSXX8 0-6	13234011 WM04SS JSXX9 0-4	13234012 WM05SS JSXY0 0-6	13234013 WM06SS JSXY1 0-6	13234014 WM07SS JSXY2 0-6	13234015 WH01SS JSXZ3 0-6	13234016 WH02SS JSXZ4 0-6	13234030 WH03SS JSXZ5 0-6	13234022 WP01SS JSXT9 0-4	13234023 WP02SS JSXW4 0-6	13234024 WP03SS JSXW0 0-5	13234025 WP04SS JSXW5 0-6
Location		Background	Walker Middle School							West Salem High School			Wallace Marine Park			
Metals (mg/kg)																
Aluminum	77000[b]	**15200 JL**	**13000 JL**	**12800 JL**	**15700 JL**	**12600 JL**	**14400 JL**	**15600 JL**	**15300 JL**	**24200 JL**	**23100 JL**	**24600 JL**	**14500 JL**	**12100 JL**	**14200 JL**	**13400 JL**
Arsenic	18[c]	2.9 U	**2.8**	2.6 U	**3.2**	2.6 U	2.8 U	2.8 U	2.7 U	2.9 U	2.8 U	2.8 U	3.2 U	2.8 U	7 U	3.1 U
Barium	15000 (730[c])	**130**	**117 JL**	**105 JL**	**122 JL**	**113 JL**	**137 JL**	**140 JL**	**123 JL**	**210 JL**	**193 JL**	**120 JL**	**136**	**125**	**129**	**113**
Calcium	NA	**5530 JL**	**11900 JL**	**13000 JL**	**24500 JL**	**10700 JL**	**9430 JL**	**5590 JL**	**4950 JL**	**1420 JL**	**2010 JL**	**730 JL**	**4970 JL**	**6270 JL**	**6380 JL**	**5920 JL**
Chromium	120000	**15.9**	**9.3 JL**	**9.3 JL**	**9.5 JL**	**7.8 JL**	**10.4 JL**	**9.8 JL**	**8.9 JL**	**9.7 JL**	**8.8 JL**	5.7 UJL	**14.4**	**11.7**	**15.6**	**12.9**
Cobalt	23[b]	**12.2 JL**	**7.3 JL**	**7.3 JL**	**6.8 JL**	**7.3 JL**	**8.1 JL**	**7.3 JL**	**8.1 JL**	**21.8 JL**	**19.8 JL**	**18.5 JL**	**11.2 JL**	**9.7 JL**	**9.6 JL**	**9.5 JL**
Copper	3100	**21.8**	**12.2**	**12.7**	**10.5**	**12**	**14.7**	**16.2**	**15.1**	**13.6**	**16.2**	**7.2**	**22.1**	**20.3**	**27.5**	**26.5**
Iron	55000[b]	**26900 JL**	**22600 JL**	**24500 JL**	**21200 JL**	**23200 JL**	**23300 JL**	**23000 JL**	**26300 JL**	**83400 JL**	**89300 JL**	**115000 JL**	**26000 JL**	**24300 JL**	**25500 JL**	**24600 JL**
Lead	400	**6**	**5.1 JL**	**4.9 JL**	**6.8 JL**	**3.8 JL**	**5.4 JL**	**14.7 JL**	**27.8 JL**	**23.8 JL**	**24.8 JL**	**12.4 JL**	**21.7**	**37.7**	**7.4**	**5.4**
Magnesium	NA	**4820 JL**	**5270 JL**	**4790 JL**	**9090 JL**	**5170 JL**	**4930 JL**	**3820 JL**	**4560 JL**	**1250 JL**	**1130 JL**	**495 JL**	**4430 JL**	**3990 JL**	**3940 JL**	**4220 JL**
Manganese	2900[c]	**508 JL**	**269 JL**	**253 JL**	**272 JL**	**268 JL**	**326 JL**	**310 JL**	**345 JL**	**1160 JL**	**1120 JL**	**726 JL**	**409 JL**	**384 JL**	**362 JL**	**354 JL**
Molybdenum	NA	1.2 U	1.1 U	1 U	1.1 U	1 U	1.1 U	1.1 U	1.1 U	**1.7**	**1.9**	**2.1**	1.3 U	1 U	1.4 U	1.3 U
Nickel	1500[b]	**20.3 JL**	**12.5 JL**	**12.8 JL**	**12.8 JL**	**13 JL**	**13.9 JL**	**12.1 JL**	**13.1 JL**	**5 JL**	**5.1 JL**	**2.9 JL**	**18.9 JL**	**16 JL**	**18.6 JL**	**16.7 JL**
Potassium	NA	**724**	**1080**	**776**	**2360**	**887**	**1350**	**1110**	**978**	**942**	**1260**	295 JQ	**1120**	**935**	**1420**	**1320**
Sodium	NA	**669**	376 JQ	349 JQ	**545**	420 JQ	504 JQ	421 JQ	338 JQ	76.5 JQ	70.2 JQ	55.5 JQ	607 JQ	475 JQ	644 JQ	523 JQ
Vanadium	390[b]	**51.6 JL**	**29.1 JL**	**29.3 JL**	**25.2 JL**	**26.2 JL**	**32.7 JL**	**31 JL**	**29 JL**	**69.7 JL**	**67.6 JL**	**68.1 JL**	**51.7 JL**	**47.5 JL**	**51.6 JL**	**43.5 JL**
Zinc	23000[b]	**45.5 JL**	**81.2 JL**	**30.2 JL**	**36 JL**	**31.2 JL**	**38.3 JL**	**40.1 JL**	**41.8 JL**	**35.4 JL**	**55.9 JL**	**27.8 JL**	**62.7 JL**	**67.2 JL**	**76.3 JL**	**59.8 JL**
Pesticides (µg/kg)																
4,4'-DDE	1700 (1400[b])	3.7 U	3.6 U	3.5 U	0.21 JQ	0.79 JQ	3.7 U	**6**	0.63 JQ	**230**	**140**	1.3 JQ	0.58 JQ	3.6 U	**6.4**	**21**
4,4'-DDT	1700	**4.4**	**4.4**	1.1 JQ	1.1 JQ	**4**	0.51 JQ	**18**	2.4 JQ	**4.1**	**4.3**	0.29 JQ	1.8 JQ	2.3 JQ	0.68 JQ	**16**
Dieldrin	29	0.2 JQ (3.7 SQL)	0.46 JQ	0.3 JQ	0.31 JQ	1.3 JQ	0.078 JQ	**4.8 JK**	3.6 JQ	4 U	4 U	3.9 U	4.2 U	3.6 U	4.6 U	4.1 U
Endosulfan Sulfate	370000[d]	3.7 U	3.6 U	3.5 U	3.7 U	3.4 U	3.7 U	0.28 JQ	**230**	0.26 JQ	4 U	3.9 U	4.2 U	**370**	4.6 U	4.1 U
Semivolatile Organic Compounds (µg/kg)																
Benzo(a)anthracene	150	3.7 U	3.6 U	3.4 U	3.8 U	3.5 U	3.8 U	2.4 JQ	**8**	1.4 JQ	1.1 JQ	3.9 U	**5.6**	**9.7**	3.5 JQ	1.5 JQ
Benzo(a)pyrene	15	3.7 U	3.6 U	3.4 U	3.8 U	3.5 U	3.8 U	3.5 U	**7**	1.3 JQ	1.2 JQ	3.9 U	**5.1**	**11**	3.6 JQ	1.4 JQ
Benzo(b)fluoranthene	150	3.7 U	3.6 U	1.3 JQ	3.8 U	3.5 U	3.8 U	3.1 JQ	**5.4**	2.2 JQ	3 JQ	3.9 U	**6.2**	**13**	3.7 JQ	2 JQ
Benzo(g,h,i)perylene	NA	3.7 U	3.6 U	0.82 JQ	3.8 U	3.5 U	3.8 U	**4.1**	**6.1**	2.5 JQ	1.1 JQ	3.9 UJK	**6.8**	**11**	3.7 JQ	1.3 JQ
Chrysene	14000	1.1 JQ (3.7 SQL)	3.6 U	1 JQ	3.8 U	3.5 U	3.8 U	3.3 JQ	**8.3**	2.2 JQ	3.5 JQ	3.9 U	**8.6**	**14**	**4.7**	2.1 JQ
Fluoranthene	2300000	3.7 U	3.6 U	3.4 U	3.8 U	3.5 U	3.8 U	**3.6**	**10**	3.2 JQ	3.1 JQ	3.9 U	**8.4**	**15**	**5.5**	2.6 JQ
Fluorene	3100000 (230000[b])	3.7 U	3.6 U	3.4 U	3.8 U	3.5 U	3.8 U	3.5 U	3.6 U	3.9 U	3.8 U	3.9 U	4.2 U	**5.2**	4.6 U	4.2 U
Indeno(1,2,3-cd)pyrene	150	3.7 U	3.6 U	3.4 U	3.8 U	3.5 U	3.8 U	2 JQ	3.5 JQ	3.9 U	3.8 U	3.9 U	3.6 JQ	**6.9**	2.7 JQ	4.2 U
Phenanthrene	NA	3.7 U	3.6 U	3.4 U	3.8 U	3.5 U	3.8 U	1.5 JQ	**6**	1.5 JQ	1.6 JQ	3.9 U	3.1 JQ	**6.7**	1.6 JQ	0.96 JQ
Pyrene	1700000	1.2 JQ (3.7 SQL)	3.6 U	1.3 JQ	3.8 U	3.5 U	3.8 U	**5.3**	**13**	2.6 JQ	2.2 JQ	3.9 U	**12**	**21**	**10**	2.8 JQ

Table 6-2 Soil Samples - Analytical Results Summary (Inc

EPA Sample ID / Sample Location Description / CLP Sample ID / Depth (inches bgs)	Cleanup Levels[a]	13234001 BG02SS JSXT7 0-3	13234026 WP05SS JSXW1 0-6	13234027 WP06SS JSXW2 0-4	13234028 WP07SS JSXW6 0-6	13234029 WP08SS JSXW7 0-5	13234037 OH01SS JSXY5 0-6	13234038 OH02SS JSXY6 0-6	13234039 OH03SS JSXY7 0-6	13234040 OH04SS JSXY8 0-6	13234041 OH05SS JSXY9 0-4	13234018 SP01SS JSXX2 0-6	13234019 SP02SS JSXX3 0-6	13234020 SP03SS JSXX4 0-6	13234021 SP04SS JSXX5 0-3
Location		Background	Wallace Marine Park				Orchard Heights Park					7th and Patterson Ballfields			
Metals (mg/kg)															
Aluminum	77000[b]	15200 JL	11000 JL	14700 JL	7160 JL	14300 JL	13600 JL	13400 JL	12000 JL	14700 JL	12800 JL	15000 JL	13500 JL	13800 JL	14200 JL
Arsenic	18[c]	2.9 U	5.2 U	3 U	5.1 U	2.8 U	2.8 U	4.2	2.8 U	3.1 U	3 U	2.9 U	2.8 U	3	2.7 U
Barium	15000 (730[c])	130	148	131	61.8	107	109 JL	215 JL	119 JL	206 JL	206 JL	105 JL	114 JL	122 JL	120 JL
Calcium	NA	5530 JL	28500 JL	5380 JL	3910 JL	4960 JL	11600 JL	2260 JL	3750 JL	2670 JL	2500 JL	19900 JL	6010 JL	9200 JL	24400 JL
Chromium	120000	15.9	15.7	15.3	11.3	11.8	8.3 JL	13 JL	8.3 JL	10.5 JL	10.1 JL	7.9 JL	9.7 JL	8.4 JL	8.7 JL
Cobalt	23[b]	12.2 JL	7.8 JL	11 JL	8.1 JL	9.1 JL	7.2 JL	17.4 JL	9.2 JL	12.5 JL	12 JL	7.2 JL	7.2 JL	8.5 JL	8 JL
Copper	3100	21.8	17.8	21.8	19.9	17.2	13.1	12	12.5	11.6	9.5	11.9	14.2	11.6	11.7
Iron	55000[b]	26900 JL	18900 JL	26200 JL	25700 JL	25000 JL	26300 JL	28100 JL	32700 JL	35000 JL	36100 JL	21900 JL	24100 JL	24500 JL	23300 JL
Lead	400	6	4.5	30.7	12.1	3.9	4 JL	17.5 JL	21.9 JL	18 JL	15.4 JL	4.1 JL	5.9 JL	5.1 JL	131 JL
Magnesium	NA	4820 JL	5700 JL	5120 JL	2930 JL	4570 JL	4850 JL	2600 JL	1810 JL	2740 JL	1600 JL	6170 JL	4190 JL	5110 JL	8710 JL
Manganese	2900[c]	508 JL	289 JL	405 JL	279 JL	354 JL	280 JL	916 JL	384 JL	850 JL	602 JL	277 JL	267 JL	351 JL	309 JL
Molybdenum	NA	1.2 U	1 U	1.2 U	1 U	1.1 U	1.1 U	1.4 U	1.1 U	1.3 U	1.2 U	1.2 U	1.1 U	1.1 U	1.1 U
Nickel	1500[b]	20.3 JL	15.8 JL	19.4 JL	17.2 JL	16.5 JL	11.7 JL	8 JL	7.8 JL	7.9 JL	6.8 JL	13.3 JL	12.7 JL	14.8 JL	14 JL
Potassium	NA	724	1100	694	525	964	684	1250	937	1640	789	1620	973	1330	1550
Sodium	NA	669	570	553 JQ	363 JQ	538 JQ	468 JQ	112 JQ	172 JQ	106 JQ	73.5 JQ	489 JQ	439 JQ	477 JQ	448 JQ
Vanadium	390[b]	51.6 JL	35.4 JL	45.3 JL	33.7 JL	42.7 JL	30.1 JL	66.8 JL	48.4 JL	57.9 JL	69 JL	28.5 JL	29.5 JL	31.4 JL	27.9 JL
Zinc	23000[b]	45.5 JL	47.8 JL	52 JL	48.4 JL	43.9 JL	30.1 JL	49.7 JL	36.8 JL	52.2 JL	40.8 JL	31.4 JL	35.1 JL	31.6 JL	35.2 JL
Pesticides (µg/kg)															
4,4'-DDE	1700 (1400[b])	3.7 U	6.1	0.31 JQ	3.3 U	0.28 JQ	0.38 JQ	0.93 JQ	0.59 JQ	4.9	2.3 JQ	0.12 JQ	0.41 JQ	0.72 JQ	0.66 JQ
4,4'-DDT	1700	4.4	21	1.5 JQ	3.3 U	0.63 JQ	1.7 JQ	0.61 JQ	0.27 JQ	2.8 JQ	0.87 JQ	0.67 JQ	1.7 JQ	1.7 JQ	2.4 JQ
Dieldrin	29	0.2 JQ (3.7 SQL)	3.6 U	4 U	3.3 U	1.3 JQ	0.44 JQ	4.6 U	3.9 U	4.4 U	4 U	0.14 JQ	3.5 U	0.28 JQ	0.48 JQ
Endosulfan Sulfate	370000[d]	3.7 U	3.6 U	6.8	3.3 U	3.8 U	3.9 U	0.32 JQ	22	4.4 U	110	3.7 U	3.5 U	3.6 U	3.7 U
Semivolatile Organic Compounds (µg/kg)															
Benzo(a)anthracene	150	3.7 U	3.6 U	6.2	9.7	1.9 JQ	3.8 U	1.5 JQ	3.9 U	1.3 JQ	3.6 JQ	3.8 U	3.7 U	3.6 U	3.7 U
Benzo(a)pyrene	15	3.7 U	3.6 U	4.7	11	1.3 JQ	3.8 U	4.7 U	3.9 U	4.4 U	2.6 JQ	3.8 U	3.7 U	3.6 U	3.7 U
Benzo(b)fluoranthene	150	3.7 U	1.3 JQ	5.9	9.3	1.4 JQ	3.8 U	1.9 JQ	3.9 U	1.7 JQ	3.6 JQ	3.8 U	3.7 U	3.6 U	3.7 U
Benzo(g,h,i)perylene	NA	3.7 U	1.1 JQ	4.2	8.1	0.8 JQ	3.8 UJK	0.99 JQ	3.9 UJK	1 JQ	1.6 JQ	3.8 U	1.4 JQ	3.6 U	3.7 U
Chrysene	14000	1.1 JQ (3.7 SQL)	1.5 JQ	7.2	13	1.9 JQ	1.2 JQ	1.8 JQ	3.9 U	2.1 JQ	3.7 JQ	3.8 U	3.7 U	3.6 U	1.4 JQ
Fluoranthene	2300000	3.7 U	1.6 JQ	8.7	24	2.1 JQ	3.8 U	2.8 JQ	3.9 U	2.6 JQ	6.3	3.8 U	3.7 U	3.6 U	2.2 JQ
Fluorene	3100000 (230000[b])	3.7 U	3.6 U	4.1 U	3.4 U	3.8 U	3.8 U	4.7 U	3.9 U	4.4 U	4 U	3.8 U	3.7 U	3.6 U	3.7 U
Indeno(1,2,3-cd)pyrene	150	3.7 U	3.6 U	3.2 JQ	6.5	3.8 U	3.8 U	4.7 U	3.9 U	4.4 U	1.6 JQ	3.8 U	3.7 U	3.6 U	3.7 U
Phenanthrene	NA	3.7 U	3.6 U	5.1	15	3.8 U	3.8 U	4.7 U	3.9 U	4.4 U	2.8 JQ	3.8 U	3.7 U	3.6 U	1.3 JQ
Pyrene	1700000	1.2 JQ (3.7 SQL)	2.1 JQ	12	39	2.2 JQ	3.8 U	2.7 JQ	3.9 U	2.4 JQ	7.2	3.8 U	3.7 U	3.6 U	2.3 JQ

Notes:

Bold type indicates the sample result is above the CRQL.

Underlining indicates the sample result is elevated as defined in Section 5

a = All cleanup levels are ODEQ RBCs for direct contact, ingestion in a residential scenario unless otherwise specified

b = EPA RSL for the residential direct contact scenario

c = ODEQ established default background level for naturally occurring minerals

d = Value is for Endosulfan alpha and beta. No cleanup level has been established for Endosulfan sulfate

Key:

µg/kg = micrograms per kilogram.

bgs = Below ground surface.

CLP = Contract Laboratory Program.

CRQL = Contract Required Quantitation Limit.

EPA = United States Environmental Protection Agency.

ID = Identification.

J = The analyte was positively identified. The associated numerical value is an estimate.

L = Reported result is has a low bias

K = The direction of bias is not known.

mg/kg = milligrams per kilogram.

NA = No cleanup level or background level has been established for the given analyte

ODEQ = Oregon Department of Environmental Quality

Q = The analyte was positively identified. The associated numerical value is above the instrument detection limit but be

RBC = Risk Based Concentration

RSL = Regional Screening Level

SIM = Select ion monitoring.

SQL = Sample Quantitation Limit

U = The analyte was not detected at or above the associated value.

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Table 6-3 Soil Samples - Analytical Results Summary (Radionuclides)

Sample Location Description	Background				Background Statistical Summary		Walker Middle School				W Salem High School		Wallace Marine Park			
Sample Location Description	BG01SS	BG02SS	BG03SS	BG04SS	Mean Background[a]	Background σ[a]	WM01SS	WM03SS	WM04SS	WM07SS	WH01SS	WH02SS	WP01SS	WP03SS	WP05SS	WP06SS
EPA Sample ID	13234000	13234001	13234002	13234003			13234008	13234010	13234011	13234014	13234015	13234016	13234022	13234024	13234026	13234027
Gamma Spectrometry (pCi/G)																
Bi212	0.582 JK	0.505 JK	0.5 JK	0.598 JK	0.55	0.04	0.674 JK	0.969 JK	0.581 JK	0.602 JK	1.21 JK	1.22 JK	0.58 JK	0.452 JK	0.64 JK	0.46 JK
Bi214	0.408 JK	0.411 JK	0.391 JK	0.434 JK	0.41	0.02	0.543 JK	0.674 JK	0.482 JK	0.515 JK	0.87 JK	0.873 JK	0.392 JK	0.384 JK	0.429 JK	0.405 JK
Cs137	0.0554	0.0392	0.0381	0.0743	0.05	0.01	0.0151 U	0.0169 U	0.0132	0.128	0.0716	0.0585	0.0786	0.0192	0.0197	0.0473
K40	10.5	10.1	10.1	10.4	10.28	0.18	11.1	13.4	11.5	10.9	6.65	6.97	11.3	10.1	10.8	9.67
Pa234m	NR	1.7 JK	1.65 JK	1.25 JK	1.53	0.20	NR	NR	NR	NR	1.74 U	1.58 JK	NR	NR	1.3 JK	1.57 U
Pb212	0.404 JK	0.406 JK	0.405 JK	0.429 JK	0.41	0.01	0.552 JK	0.763 JK	0.5 JK	0.516 JK	0.962 JK	0.931 JK	0.439 JK	0.368 JK	0.424 JK	0.372 JK
Pb214	0.49 JK	0.511 JK	0.489 JK	0.523 JK	0.50	0.01	0.607 JK	0.767 JK	0.553 JK	0.565 JK	0.996 JK	1.02 JK	0.514 JK	0.463 JK	0.513 JK	0.469 JK
Ra228	0.458	0.513	0.478	0.483	0.48	0.02	0.625	0.879	0.615	0.629	1.09	1.16	0.49	0.475	0.534	0.436
Tl208	0.147 JK	0.141 JK	0.143 JK	0.14 JK	0.14	0.00	0.178 JK	0.244 JK	0.177 JK	0.196 JK	0.333 JK	0.322 JK	0.145 JK	0.129 JK	0.158 JK	0.133 JK
Gross Alpha and Beta (pCi/g)																
Alpha	6.02 U	10.2	13.2	6.02 U	7.36	4.47	7.38 U	6.17 U	7.53	7.86	19.5	14.6	9.64	5.84 U	7.38 U	5.98 U
Beta	11.9	13.4	11.3	12.8	12.35	0.81	11.8	13.2	14.8	13.2	15	13.8	13.9	11.3	14.8	12.4
Actinides by Extraction Chromatography (pCi/g)																
Th228	0.583	0.333	0.279	0.406	0.40	0.11	0.489	0.527	0.605	0.599	0.814	1.23	0.378 JK	0.413	0.564	0.365
Th230	0.433	0.545	0.462	0.517	0.49	0.04	0.764	0.747	0.538	0.353	1.04	1.21	0.496	0.497	0.377	0.704
Th232	0.295	0.378	0.372	0.265	0.33	0.05	0.523	0.649	0.404	0.541	1.04	1.12	0.403	0.423	0.44	0.499
U234	0.782	0.558	0.7 JK	0.688 JK	0.68	0.08	0.777	0.52	0.655	0.491	0.866	1.35	0.632	0.377	0.516	0.46
U238	0.802 JK	0.552		0.567	0.61	0.11	0.828	0.669	0.549	0.527	0.767	1.18	0.461	0.48 JK	0.785	0.497

0.525

Table 6-3 Soil Samples - Analytical Results Summary (Radionuclides)

	Background				Background Statistical Summary		Orchard Heights Park		7th & Patterson Ballfields	
Sample Location Description	BG01SS	BG02SS	BG03SS	BG04SS	Mean Background[a]	Background σ[a]	OH01SS	OH03SS	SP02SS	SP04SS
EPA Sample ID	13234000	13234001	13234002	13234003			13234037	13234039	13234019	13234021
Gamma Spectrometry (pCi/G)										
Bi212	**0.582 JK**	**0.505 JK**	**0.5 JK**	**0.598 JK**	0.55	0.04	**0.559 JK**	**0.878 JK**	**0.538 JK**	**0.71 JK**
Bi214	**0.408 JK**	**0.411 JK**	**0.391 JK**	**0.434 JK**	0.41	0.02	**0.548 JK**	**0.541 JK**	**0.497 JK**	**0.492 JK**
Cs137	**0.0554**	**0.0392**	**0.0381**	**0.0743**	0.05	0.01	**0.0185**	**0.025**	0.0136 U	0.0147 U
K40	**10.5**	**10.1**	**10.1**	**10.4**	10.28	0.18	**10.8**	**9.88**	**11.7**	**12.2**
Pa234m	NR	**1.7 JK**	**1.65 JK**	**1.25 JK**	1.53	0.20	NR	NR	NR	NR
Pb212	**0.404 JK**	**0.406 JK**	**0.405 JK**	**0.429 JK**	0.41	0.01	**0.511 JK**	**0.587 JK**	**0.509 JK**	**0.545 JK**
Pb214	**0.49 JK**	**0.511 JK**	**0.489 JK**	**0.523 JK**	0.50	0.01	**0.607 JK**	**0.653 JK**	**0.584 JK**	**0.572 JK**
Ra228	**0.458**	**0.513**	**0.478**	**0.483**	0.48	0.02	**0.586**	**0.781**	**0.626**	**0.621**
Tl208	**0.147 JK**	**0.141 JK**	**0.143 JK**	**0.14 JK**	0.14	0.00	**0.181 JK**	**0.209 JK**	**0.179 JK**	**0.188 JK**
Gross Alpha and Beta (pCi/g)										
Alpha	6.02 U	**10.2**	**13.2**	6.02 U	7.36	4.47	6.12 U	**10.9**	6.15 U	**9.68**
Beta	**11.9**	**13.4**	**11.3**	**12.8**	12.35	0.81	**12.9**	**13.3**	**13.9**	**13.8**
Actinides by Extraction Chromatography (pCi/g)										
Th228	**0.583**	**0.333**	**0.279**	**0.406**	0.40	0.11	**0.418**	**0.694**	**0.719**	**0.505**
Th230	**0.433**	**0.545**	**0.462**	**0.517**	0.49	0.04	**0.508**	**0.52**	**0.497**	**0.336**
Th232	**0.295**	**0.378**	**0.372**	**0.265**	0.33	0.05	**0.405**	**0.599**	**0.579**	**0.48**
U234	**0.782**	**0.558**	**0.7 JK**	**0.688 JK**	0.68	0.08	**0.572**	**0.562**	**0.498**	**0.6 JK**
U238	**0.802 JK**	**0.552**		**0.567**	0.61	0.11	**0.689**	**0.499**	**0.599 JK**	**0.61**

Notes: **0.525**

For sake of brevity, the sample specific MDC and and 2σ uncertainty values have been omitted from this table. This data is included in the analytical reports (Appendix D).

0.418 Bold type indicates the sample result is above the sample specific MDC

0.599 Underlining indicates the sample result is elevated as defined in Section 5

a = When the result for a background sample was less than the samples MDC, the mean background and background standard deviation were calculated using 1/2 MDC for that result

Key:

σ = Standard Deviation
pCi/g = Picocurries per gram on a dry weight basis
bgs = Below ground surface.
EPA = United States Environmental Protection Agency.
ID = Identification.
J = A "J" qualified indicates a result that may be significantly under or overestimated (as per NAREL)
K = The direction of bias is not known.
MDC = Sample specific minimum detectable concentration
NA = Not applicable/no standard has been developed
NR = Result for analyte not reported
U = The analyte was not detected at or above the associated value.

Table 6-4 Soil Samples - Analytical Results Summary (Total Recoverable Rare/Exotic Metals)

EPA Sample ID	Cleanup Levels	13234001	13234010	13234012	13234014	13234015	13234016	13234022	13234026	13234027	13234029	13234037	13234039	13234040	13234018	13234019	13234020	13234021
Sample Location Description		BG02SS	WM03SS	WM05SS	WM07SS	WH01SS	WH02SS	WP01SS	WP05SS	WP06SS	WP08SS	OH01SS	OH03SS	OH04SS	SP01SS	SP02SS	SP03SS	SP04SS
CLP Sample ID		JSXT7	JSXX8	JSXY0	JSXY2	JSXZ3	JSXZ4	JSXT9	JSXW1	JSXW2	JSXW7	JSXY5	JSXY7	JSXY8	JSXX2	JSXX3	JSXX4	JSXX5
Depth (inches bgs)		0-3	0-6	0-6	0-6	0-6	0-6	0-3	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6	0-6
Location		Background	Walker Middle School			West Salem High		Wallace Marine Park				Orchard Heights Park			7th and Patterson			
Total Recoverable Metals (mg/kg)																		
Niobium	NA	0.98 UJL	0.99 UJL	**2.2 JL**	**1.2 JL**	**2.5 JL**	**3 JL**	**1 JL**	1 UJL	**1 JL**	1 UJL	**1.6 JL**	**1.5 JL**	**2 JL**	1 UJL	1 UJL	1 UJL	0.99 UJL
Titanium	NA	**1550**	**912**	**1350**	**1790**	**5810**	**6090**	**1640**	**1220**	**1590**	**1510**	**1650**	**1670**	**2250**	**1400**	**1760**	**1460**	**1400**
Zirconium	NA	**19 JL**	**16 JL**	**19 JL**	**18 JL**	**56 JL**	**49 JL**	**11 JL**	**18 JL**	**14 JL**	**21 JL**	**22 JL**	**17 JL**	**14 JL**	**19 JL**	**20 JL**	**23 JL**	**20 JL**

Notes:

Bold type indicates the sample result is above the CRQL.

Underlining indicates the sample result is elevated as defined in Section 5

Key:

bgs = Below ground surface.
CLP = Contract Laboratory Program.
CRQL = Contract Required Quantitation Limit.
EPA = United States Environmental Protection Agency.
ID = Identification.
J = The analyte was positively identified. The associated numerical value is an estimate.
L = Reported result is has a low bias
mg/kg = milligrams per kilogram.
NA = No cleanup level has been established for the given analyte
Q = The analyte was positively identified. The associated numerical value is above the instrument detection limit but below the sample specific CRQL.
U = The analyte was not detected at or above the associated value.

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Table 6-5 Sediment Samples - Analytical Results Summary (Inorganic and Organic Constituents)

EPA Sample ID Station Location Description CLP Sample ID Depth (inches bgs)	Cleanup Levels[a]	13234006 BG03SD JSXT8 0-6	13234017 WM01SD JSXY3 0-6	13234032 WP01SD JSXW3 0-2	13234033 WP02SD JSXW8 0-4	13234034 WP03SD JSXW9 0-6	13234035 WP04SD JSXX0 0-6	13234036 WP05SD JSXX1 0-6	13234042 OH01SD JSXZ2 0-3	13234043 OH02SD JSXZ0 0-3	13234044 OH03SD JSXZ1 0-6
Location		Background	Walker Middle School	Wallace Marine Park					Orchard Heights Park		
Metals (mg/kg)											
Aluminum	77000[b]	10800 JL	17300 JL	11400 JL	17900 JL	9970 JL	6390 JL	8460 JL	16200 JL	12600 JL	12900 JL
Arsenic	18[c]	6.9 U	5.4 U	6.4 U	7.9 U	5.4 U	5.6 U	5.8 U	3.8 U	3.6 U	4.7
Barium	15000 (730[c])	99.6	288 JK	66.2	153	58.6	50.1	69.6	408 JK	317 JK	301 JK
Calcium	NA	4460 JL	2850	4730 JL	6330 JL	3850 JL	3170 JL	3650 JL	2430	2870	2630
Chromium	120000	11.1 JQ (13.8 SQL)	12.8 JL	9.6 JQ	18	9.2 JQ	7.4 JQ	8.7 JQ	16.1 JL	15.4 JL	18.2 JL
Cobalt	23[b]	8.7 JL	5.9 JL	9.6 JL	14.2 JL	6.9 JL	6.6 JL	7.3 JL	40.8 JL	23.9 JL	33.4 JL
Copper	3100	16.1	18.5	20.0	26.9	11.7	16.3	13.3	12.5	14.1	13.6
Iron	55000[b]	24800 JL	15500 JL	26400 JL	32800 JL	20400 JL	17600 JL	20700 JL	102000 JL	74300 JL	88000 JL
Lead	400	3.7	21.7 JL	5.0	8.1	2.9	2.8 U	3	18.5 JL	13.8 JL	19.7 JL
Magnesium	NA	4310 JL	2400	4600 JL	6020 JL	3500 JL	2790 JL	2970 JL	1790	2710	2080
Manganese	2900[c]	313 JL	123	323 JL	461 JL	294 JL	214 JL	269 JL	7660	2800	2790
Molybdenum	NA	1.4 U	2.1 U	1.3 U	1.6 U	1.1 U	1.1 U	1.1 U	2	1.4 U	1.5 U
Nickel	1500[b]	16.8 JL	9.4 JL	18.6 JL	24 JL	10.4 JL	15.7 JL	13.4 JL	9.1 JL	9.7 JL	11.8 JL
Potassium	NA	571 JQ	807 JQ	562 JQ	793	507 JQ	475 JQ	529 JQ	629 JQ	461 JQ	495 JQ
Vanadium	390[b]	38.7 JL	44.6 JL	34.8 JL	57.3 JL	27.2 UJL	28 UJL	30.8 JL	135 JL	97.3 JL	128 JL
Zinc	23000[b]	41.7 JL	72.1 JL	42.6 JL	66.4 JL	31.1 JL	31.2 JL	34.5 JL	263 JL	262 JL	184 JL
Pesticides (µg/kg)											
Endosulfan Sulfate	370000[d]	39	7.7 U	54	15	3.6 U	4.1 U	0.11 JQ	70	25	4.6 U
Gamma-bhc (lindane)	380	2.2 U	4 U	2.2 U	2.6 U	1.9 U	2.1 U	2.1 U	4.1	2.6 U	0.45 JQ
Heptachlor Epoxide	53	2.2 U	4 U	4.1	2.6 U	1.9 U	2.1 U	2.1 U	2.6 U	2.6 U	2.3 U
Methoxychlor	NA	22 U	40 U	22 U	26 U	19 U	21 U	21 U	47	10 JQ	10 JQ
Semivolatile Organic Compounds (µg/kg)											
Acenaphthene	4700000	4.3 U	7.6 U	4.4 U	5.1 U	3.6 U	4 U	4.1 U	130	7.7	25
Acenaphthylene	NA	4.3 U	2.9 JQ	4.4 U	5.1 U	3.6 U	4 U	4.1 U	9.1	2.2 JQ	3.8 JQ
Anthracene	23000000	4.3 U	2.8 JQ	3.2 JQ	5.1 U	3.6 U	4 U	4.1 U	570	110	280
Benzo(a)anthracene	150	4.3 U	11	38	2 JQ	1.5 JQ	4 U	1.8 JQ	2100	280	640
Benzo(a)pyrene	15	4.3 U	7.6 U	26	5.1 U	3.6 U	4 U	4.1 U	2200	280	680
Benzo(b)fluoranthene	150	4.3 U	5.7 JQ	29	5.1 U	3.6 U	4 U	4.1 U	3500	430	1100
Benzo(g,h,i)perylene	NA	4.3 U	4.4 JQ	12	5.1 U	3.6 U	4 U	4.1 U	910 JK	150	250
Benzo(k)fluoranthene	1500	4.3 U	7.6 U	12	5.1 U	3.6 U	4 U	4.1 U	1200	170	410

Table 6-5 Sediment Samples - Analytical Results Summary (Inorganic and Organic Constituents)

EPA Sample ID Station Location Description CLP Sample ID Depth (inches bgs)	Cleanup Levels[a]	13234006 BG03SD JSXT8 0-6	13234017 WM01SD JSXY3 0-6	13234032 WP01SD JSXW3 0-2	13234033 WP02SD JSXW8 0-4	13234034 WP03SD JSXW9 0-6	13234035 WP04SD JSXX0 0-6	13234036 WP05SD JSXX1 0-6	13234042 OH01SD JSXZ2 0-3	13234043 OH02SD JSXZ0 0-3	13234044 OH03SD JSXZ1 0-6
Location		Background	Walker Middle School	Wallace Marine Park					Orchard Heights Park		
Bis(2-ethylhexyl)phthalate	35000	220 U	390 U	230 U	260 U	190 U	210 U	210 U	150 JQ	160 JQ	**230**
Carbazole	NA	220 U	390 U	230 U	260 U	190 U	210 U	210 U	**410**	260 U	100 JQ
Chrysene	14000	4.3 U	**13**	**34**	2 JQ	1.5 JQ	4 U	1.7 JQ	**2400**	**330**	**780**
Dibenzo(a,h)anthracene	15	4.3 U	7.6 U	4 JQ	5.1 U	3.6 U	4 U	4.1 U	**400**	**49**	**74 JK**
Fluoranthene	2300000	4.3 U	**12**	**37**	2 JQ	2 JQ	4 U	2.1 JQ	**6200**	**850**	**2300**
Fluorene	3100000 (230000[b])	4.3 U	7.6 U	4.4 U	5.1 U	3.6 U	4 U	4.1 U	**240**	**15**	**55 JK**
Indeno(1,2,3-cd)pyrene	150	4.3 U	2.6 JQ	**13**	5.1 U	3.6 U	4 U	4.1 U	**910**	**170**	**280**
Phenanthrene	NA	4.3 U	**9.3**	**7.8**	5.1 U	3.6 U	4 U	4.1 U	**3700**	**320**	**1000**
Pyrene	1700000	4.3 U	**21**	**41**	2.2 JQ	2 JQ	4 U	2.2 JQ	**3900**	**560**	**1400**
Naphthalene	4600	4.3 U	7.6 U	4.4 U	5.1 U	3.6 U	4 U	4.1 U	**5.6**	1.7 JQ	1.9 JQ

Notes:

66.4 JL Bold type indicates the sample result is above the CRQL.

12 Underlining indicates the sample result is elevated as defined in Section 5

26 Shaded cells indicate sample result exceeds given cleanup level

a = All cleanup levels are ODEQ RBCs for direct contact, ingestion in a residential scenario unless otherwise specified

b = EPA RSL for the residential direct contact scenario

c = ODEQ established default background level for naturally occurring minerals

d = Value is for Endosulfan alpha and beta. No cleanup level has been established for Endosulfan sulfate

Key:

µg/kg = micrograms per kilogram.
bgs = Below ground surface.
CLP = Contract Laboratory Program.
CRQL = Contract Required Quantitation Limit.
EPA = United States Environmental Protection Agency.
ID = Identification.
J = The analyte was positively identified. The associated numerical value is an estimate.
L = Reported result is has a low bias
K = The direction of bias is not known.
mg/kg = milligrams per kilogram.
NA = No cleanup level or background level has been established for given analyte
ODEQ = Oregon Department of Environmental Quality
Q = The analyte was positively identified. The associated numerical value is above the instrument detection limit but below the sample specific CRQL.
RBC = Risk Based Concentration
RSL = Regional Screening Level
SIM = Select ion monitoring.
SQL = Sample Quantitation Limit
U = The analyte was not detected at or above the associated value.
WM = Walker Middle School

Table 6-6 Sediment Samples - Analytical Results Summary (Radionuclides)

	Background				Background Statistical Summary		Walker Middle	Wallace Marine Park	Orchard Heights Park
Sample Location Description	**BG01SD**	**BG02SD**	**BG03SD**	**BG04SD**	**Mean**	**Background**	**WM01SD**	**WP01SD**	**OH01SD**
EPA Sample ID	**13234004**	**13234005**	**13234006**	**13234007**	**Background[a]**	**σ[a]**	**13234017**	**13234032**	**13234042**
Gamma Spectrometry (pCi/G)									
Be7	NR	**0.218**	**0.276**	NR	0.247	0.029	NR	**0.309**	**0.556**
Bi212	**0.491 JK**	**0.76 JK**	**0.455 JK**	**0.578 JK**	0.571	0.118	**1.09 JK**	**0.451 JK**	**1.11 JK**
Bi214	**0.402 JK**	**0.528 JK**	**0.425 JK**	**0.411 JK**	0.442	0.051	**0.678 JK**	**0.431 JK**	**0.837 JK**
Cs137	**0.0383**	0.0134 U	**0.0162**	**0.0264**	0.022	0.012	**0.11**	**0.0319**	**0.039**
Pb212	**0.442 JK**	**0.547 JK**	**0.43 JK**	**0.396 JK**	0.454	0.056	**0.832 JK**	**0.43 JK**	**0.872 JK**
Pb214	**0.517 JK**	**0.637 JK**	**0.516 JK**	**0.457 JK**	0.532	0.065	**0.816 JK**	**0.488 JK**	**0.981 JK**
Ra228	**0.524**	**0.646**	**0.505**	**0.435**	0.528	0.076	**1.02**	**0.511**	**1.06**
Th234	0.767 UJK	**0.894 JK**	**0.722 UJK**	0.915 UJK	0.524	0.217	**1.03 JK**	NR	**1.12 JK**
Tl208	**0.146 JK**	**0.181 JK**	**0.145 JK**	**0.138 JK**	0.153	0.017	**0.282 JK**	**0.145 JK**	**0.289 JK**
Gross Alpha and Beta (pCi/g)									
Alpha	7.19 U	7.46 U	6.35 U	6.12 U	3.390	0.280	**15.9**	5.91 U	**12.3**
Beta	**15.1**	**17.7**	**14.3**	**15.4**	15.625	1.264	**14.1**	**10.6**	**12.4**
Actinides by Extraction Chromatography (pCi/g)									
Th228	**0.471 JK**	**0.575**	**0.482**	**0.314**	0.461	0.094	**0.65**	**0.367**	**0.872**
Th230	**0.519**	**0.482**	**0.399**	**0.393**	0.448	0.054	**0.93**	**0.422**	**0.855**
Th232	**0.504**	**0.341**	**0.324**	**0.335**	0.376	0.074	**0.858**	**0.468**	**0.865**
U234	**0.43**	**0.497**	**0.33**	**0.491 JK**	0.437	0.067	**0.674**	**0.595**	**0.675**
U238	**0.532**	**0.528**	**0.363**	**0.37**	0.448	0.082	**0.633**	**0.486**	**0.785**

Notes:

For sake of brevity, the sample specific MDC and and 2σ uncertainty values have been omitted from this table. This data is included in the analytical reports (Appendix D).

0.418 Bold type indicates the sample result is above the sample specific MDC

0.599 Underlining indicates the sample result is elevated as defined in Section 5

a = When the result for a background sample was less than the samples MDC, the mean background and background standard deviation were calculated using 1/2 MDC for that result

Key:

σ = Standard Deviation
pCi/g = Picocurries per gram on a dry weight basis
bgs = Below ground surface.
EPA = United States Environmental Protection Agency.
ID = Identification.
J = A "J" qualified indicates a result that may be significantly under or overestimated (as per NAREL)
K = The direction of bias is not known.
MDC = Sample specific minimum detectable concentration
NA = No screening value is included in SCDM for the given radiological constituent
NR = Result for analyte not reported
SD = Standard Deviation
U = The analyte was not detected at or above the associated value.

Table 6-7 Sediment Samples - Analytical Results Summary (Total Recoverable Rare/Exotic Metals)

EPA Sample ID Sample Location Description CLP Sample ID Depth (inches bgs)	Cleanup Levels	13234006 BG03SD JSXT8 0-6	13234017 WM01SD JSXY3 0-6	13234032 WP01SD JSXW3 0-2	13234042 OH01SD JSXZ2 0-3	13234044 OH03SD JSXZ1 0-6
Location		Backgound	Walker Middle School	Wallace Marine Park	Orchard Heights Park	
Total Recoverable Metals (mg/kg)						
Niobium	NA	0.98 UJL	**<u>2.1 JL</u>**	1 UJL	**<u>1.6 JL</u>**	**<u>1.1 JL</u>**
Titanium	NA	**1610**	**1910**	**1940**	**3490**	**2440**
Zirconium	NA	**19 JL**	**21 JL**	**19 JL**	**39 JL**	**27 JL**

Notes:

Bold type indicates the sample result is above the CRQL.

Underlining indicates the sample result is elevated as defined in Section 5

Key:

bgs = Below ground surface.

CLP = Contract Laboratory Program.

CRQL = Contract Required Quantitation Limit.

EPA = United States Environmental Protection Agency.

ID = Identification.

J = The analyte was positively identified. The associated numerical value is an estimate.

L = Reported result has a low bias

mg/kg = milligrams per kilogram.

NA = No cleanup level has been established for the given analyte

U = The analyte was not detected at or above the associated value.