

DRAFT ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES

OREGON STATE UNIVERSITY-CASCADES: LANDFILL
REMEDICATION, BEND, OREGON

DRAFT



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Prepared for
OREGON STATE UNIVERSITY-CASCADES
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Project No. M1290.01.006

Prepared by
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OREGON STATE UNIVERSITY-CASCADES: LANDFILL REMEDIATION, BEND, OREGON
ECSI NO. 4884

*The material and data in this report were prepared
under the supervision and direction of the undersigned.*

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ACRONYMS AND ABBREVIATIONS

| | |
|--------------------|--|
| 1200-C Permit | National Pollutant Discharge Elimination System Construction Stormwater Discharge Permit 1200-C |
| ABCA | analysis of brownfield cleanup alternatives |
| ACM | asbestos-containing materials |
| Apex | Apex Companies, LLC |
| bgs | below ground surface |
| cy | cubic yard |
| DEA | David Evans and Associates, Inc. |
| DEQ | Oregon Department of Environmental Quality |
| EPA | U.S. Environmental Protection Agency |
| ESA | environmental site assessment |
| GBB | Gershman, Brickner & Bratton, Inc. |
| IDR | Innovation District Remediation |
| MFA | Maul Foster & Alongi, Inc. |
| OAR | Oregon Administrative Rule |
| OSU-Cascades | Oregon State University, Cascades campus |
| PBS | PBS Engineering + Environmental |
| PPA | prospective purchaser agreement |
| RBC | DEQ risk-based concentration |
| Site | the 72-acre former Deschutes County Landfill |
| Solid Waste Permit | DEQ Solid Waste Permit No. 215 |
| URS | URS Corporation |
| VOC | volatile organic compound |

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this analysis of brownfield cleanup alternatives (ABCA) report for the Innovation District Remediation (IDR) Phase I at the Oregon State University, Cascades campus (OSU-Cascades) in Bend, Oregon. The project area encompasses an 8-acre portion of the 72-acre former Deschutes County Landfill owned by OSU-Cascades (the Site, see Figure 1-1). The ABCA report was prepared to meet the requirements of the U.S. Environmental Protection Agency (EPA) Brownfields Cleanup Grants program and the applicable Oregon Department of Environmental Quality (DEQ) regulatory requirements and remedial action objectives for protection of human health and the environment.

This ABCA report includes:

- Information about landfill cells 1, 2, and 3, comprising 48 acres (see Figure 1-2).
- Previous investigations and known contamination, cleanup standards, and applicable laws.
- Effectiveness, implementability, and costs of the evaluated cleanup alternatives.
- Selection of a preferred cleanup alternative.

Redevelopment is not being conducted specifically to improve environmental quality, but improvement is a collateral benefit. Redevelopment of the Site includes an expansion of the OSU-Cascades campus, which will serve the community and improve the environmental quality of the encumbered Site. OSU-Cascades will develop a highly interdisciplinary and collaborative campus culture by creating facilities that serve a mix of program uses including academic facilities and housing, as well as an innovation district with industry and research partners and recreation facilities, which is the focus of this ABCA.

2 BACKGROUND

2.1 Site Description

The Site is located in the northwest quarter of section 6, township 18 south, range 12 east of the Willamette Meridian. It is currently owned by OSU-Cascades and is in the southwest portion of Bend, Oregon. The Site is bordered to the north and west by residential properties, to the east by commercial development, and to the south by an OSU-Cascades-owned former surface pumice mine and the current OSU-Cascades campus.

The geology of the Site consists primarily of volcanic soils with tuff, cinder, and basalt. As a construction and demolition waste landfill, the Site has been extensively landfilled with mill waste,

construction-demolition waste, and cover soil. The landfill operated from 1972 to 1996 to dispose of construction and demolition waste, industrial waste, wood waste, brush, and tires and operated under the DEQ Solid Waste Permit No. 215 (the Solid Waste Permit).

As shown on Figure 1-2, the Site was developed in three distinct areas. A previous site investigation conducted by Gershman, Brickner & Bratton, Inc. (GBB 2008) estimated the waste limits (defined in this report as waste cells) and composition in each area:

- Area 1 is in the eastern portion of the Site (tax parcels 1812060000110 and 181206A000719). Area 1 is the oldest landfill area and was filled with a large quantity of wood waste from local sawmills. Area 1 is 23.2 acres; however, the waste footprint, Cell 1, extends beyond the western parcel boundary into property owned by the Bend Park and Recreation District. The full footprint of Area 1 is estimated to be approximately 24.7 acres. A portion of Cell 1 has been undergoing pyrolysis,¹ and therefore has not received closure certification from the DEQ. The IDR Phase I project area encompasses the southern 8 acres of Area 1.
- Area 2 is in the south-center portion of the Site (southeast portion of tax parcel 1812060000111). The waste composition in Area 2 is very similar to that of Area 1, except that it also contains construction and demolition debris. Area 2 is 9.8 acres, and the waste footprint, Cell 2, is estimated to be 5.7 acres. Cell 2 was closed in 1997. Approximately 1.4 acres of Cell 2 were remediated by OSU-Cascades in 2020.
- Area 3 is in the western portion of the Site (north portion of tax parcel 1812060000111). Area 3 is 39.4 acres, and the waste footprint, Cell 3, is estimated to be 19.5 acres. Cell 3 waste includes mill waste, construction and demolition debris, and large woody debris such as logs and stumps.² Cell 3 was closed in 1997.

2.2 Previous Investigations

The various environmental investigations conducted at the Site are summarized below:

- **Subsurface Assessment (David Evans and Associates, Inc. [DEA] 1997):** The primary focus of this investigation was the assessment of Area 1. Nine test pits ranging from 3 feet to 21 feet below ground surface (bgs) were advanced. Twenty-eight borings, ranging from 5.5 feet to 34.5 feet bgs, were advanced, meeting with refusal in some instances. Eight deeper borings were also advanced. This assessment identified the issue of pyrolysis associated with the anaerobic decomposition of wood waste in the landfill.
- **Demolition Landfill Redevelopment Study (URS Corporation [URS] 2002):** URS provided the County with a redevelopment study for the Site. The purpose of the report

¹ Pyrolysis is thermochemical decomposition of organic material at elevated temperatures in the absence of oxygen.² Note that the Solid Waste Permit allowed for disposal of industrial waste, but none was specifically identified in the prior investigations (Apex 2016, GBB 2008).

² Note that the Solid Waste Permit allowed for disposal of industrial waste, but none was specifically identified in the prior investigations (Apex 2016, GBB 2008).

was to convey site conditions and to identify possible reuse. The report reviewed then-current vegetation, zoning, available utilities in the area, transportation considerations, nearby water rights, and a groundwater beneficial use survey. The report included a property evaluation and identified potential reuse scenarios.

- **Demolition Landfill Subsurface Investigations Study (GBB 2008):** GBB provided the County a summary of completed site investigations and performed additional site assessment activities to supplement the 1997 DEA investigation and provide more information on the waste composition and the potential for impacts to the native material below the landfill. GBB completed full-depth drilling into waste and underlying soils; this included 13 exploratory borings and 14 shallow test pits (to 20 feet bgs), as well as replacement of three landfill-gas wells and three temperature probes. Test pits were advanced primarily to identify waste composition and materials. Waste consisted primarily of ash, sawdust, metal, tires, wood waste, roofing materials, and fill/fines. In addition, potential asbestos-containing materials (ACM) were observed in a few test pits. GBB also performed a subsurface magnetic and electrical resistivity survey to understand waste thicknesses.

Waste and underlying soils from borings were sampled and analyzed for metals, total petroleum hydrocarbons, volatile organic compounds (VOCs), semivolatile organic compounds, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and pesticides/herbicides, in addition to moisture and organic content. The analytical results were screened against DEQ risk-based concentrations (RBCs) established at the time. The results showed exceedances in soil of residential vapor intrusion, direct contact, and leaching-to-groundwater RBCs for several constituents.

GBB concluded that the deepest point of waste in the landfill is more than 200 feet above the static groundwater level, and that infiltration to the soil below the landfill was not indicated.

- **Phase I Environmental Site Assessment (ESA), Adjacent Property (PBS Engineering + Environmental [PBS] 2013b):** PBS completed a Phase I ESA for two properties owned by OSU-Cascades that are adjacent south of the Site (the pumice mine) and west of the Site (a strip between the landfill and SW Mount Washington Drive). The ESA identified no recognized environmental conditions pertaining to the properties but indicated that the adjacent landfill cap extended onto the properties and recommended an investigation to understand if landfill material was present.
- **Focused Site Investigation, Adjacent Property (PBS 2013c):** Based on the 2013 PBS Phase I ESA recommendation, PBS completed a focused subsurface investigation of two properties south adjacent to the Site. Test pits advanced along the property boundary near Area 1 of the Site confirmed that solid waste material extends approximately 20 feet south from the northern edge of one of the properties and approximately 340 feet laterally along the boundary. Solid waste was not observed to extend onto the other adjacent property near Area 2 of the Site.

- **Phase II Characterization Report (PBS 2013a):** PBS advanced three deep borings, ranging from 265 feet to 315 feet bgs, which were completed as monitoring wells in March and April 2013. Groundwater was encountered between 242 and 293 feet bgs at the Site. Groundwater was noted to be approximately 150 feet below fill waste and not in contact with landfill materials. Groundwater monitoring was completed in accordance with the Solid Waste Permit. Analytical results showed a closure permit exceedance for pH in groundwater from two of the three monitoring wells. Arsenic, barium, chromium, vanadium, and zinc were detected in one or more monitoring wells but at concentrations below EPA maximum contaminant levels and DEQ guidance levels. Additionally, PBS visually assessed the pumice mine adjacent to the Site to interpret the subsurface geology within the uppermost 100 feet. Rock coring was completed at the Site to 260 feet bgs, and a site geologic interpretation of the volcanoclastic material was provided.
- **Former Demolition Landfill Mitigation Evaluation (Apex Companies, LLC [Apex] 2014):** Apex completed a geoenvironmental conditions summary for development of mitigation alternatives for future redevelopment at the Site. Apex identified four primary site redevelopment constraints: areas that contain significant landfill material; areas where pyrolysis may be occurring; requirements of the Solid Waste Permit pertaining to the Site; and migration/impacts to the surrounding community, including fugitive odors and trucking impacts. Many alternatives and approaches were identified, including avoidance of landfilled areas during redevelopment, excavation, and reconsolidation of landfill materials on site.
- **Focused Site Investigation (MFA 2016):** MFA performed a focused site investigation in 2016. This investigation included surface soil and soil vapor sampling. Lithology showed that cap thickness ranges from 0.5 feet to 5 feet in Areas 1 and 2. A deeper boring was advanced to confirm cap thickness in Area 3, where past investigations had observed a thicker cap. Observations at this boring showed a cap thickness of approximately 40 feet. Landfill soil gas samples were collected from temporary boreholes screened from approximately 5 feet to 10 feet bgs. Methane was not detected in soil gas collected from two borings but was detected from 1.2 percent to 10.8 percent in four borings. VOCs were detected in all samples; however, only two VOCs, ethylbenzene and naphthalene, were detected at concentrations exceeding their respective RBCs for urban residential vapor intrusion into buildings.
- **Phase I ESA (MFA 2018):** MFA completed a Phase I ESA for OSU-Cascades to support the property transaction. Soil gas was identified as a recognized environmental condition, as methane levels were at or above the DEQ guidance concentration for methane mitigation for structures and confined-space entry, and ethylbenzene and naphthalene were above the RBCs for urban residential vapor intrusion into buildings. The presence of the landfill and associated waste was identified as a controlled recognized environmental condition because detections of petroleum hydrocarbons, benzene, trichloroethylene, benzo(a)pyrene, arsenic, and lead were above the RBCs for residential receptors. Additionally, ACM is likely to be present in the landfill.

2.3 Nature and Extent of Contamination

While the conditions of the Solid Waste Permit did not allow the intake of certain types of materials (e.g., municipal solid waste, used oil), not all portions of loads were inspected, and records indicate that there were periods of unattended dumping on some portions of the landfill. Samples collected from waste material in the landfill had concentrations of petroleum hydrocarbons, benzene, trichloroethylene, benzo(a)pyrene, arsenic, and lead above the RBCs for residential receptors. There were two exceedances of soil vapor RBCs for urban residential and occupational direct contact for ethylbenzene and naphthalene and methane above DEQ guidance. As the landfill is unlined and contains constituents of concern, there is a possibility of a release from the Site; however, this possibility is considered applicable only to soil, as groundwater appears 150 to 200 feet below the waste material. This controlled recognized environmental condition is currently managed through restricted access to the Site, the presence of the cover material, the depth at which native soil is present, the composition of substrate (largely basalt), and depth to groundwater. Additionally, the demolition and industrial waste landfill is managed through compliance with the Solid Waste Permit.

3 APPLICABLE REGULATIONS AND CLEANUP STANDARDS

3.1 State Oversight and Regulations

3.1.1 Cleanup

The DEQ is responsible for overseeing cleanup at the Site. Documents prepared for the Site are submitted to the DEQ under state Environmental Cleanup Site Information number 4884. Cleanup at the Site is expected to be governed under Oregon Administrative Rule (OAR) 340-122—the Hazardous Substance and Remedial Action Rules. These rules require that any removal or remedial action be conducted in a manner that assures protection of the environment and present and future public health, safety, and welfare.

An Easement and Equitable Servitudes covering the Site, between the Board of Trustees of Oregon State University and the DEQ, was recorded on April 9, 2018. Additionally, remedial actions will be conducted under the Consent Judgment filed with the Circuit Court of the State of Oregon on June 6, 2018.

3.1.2 Solid Waste

The landfill is currently subject to the Solid Waste Permit, issued to the current owner and operator, Oregon State University, along with co-operator Deschutes County. As stated in the Easement and Equitable Servitudes, all work in all portions of the Site where waste may be present shall be in accordance with the Solid Waste Permit.

3.2 Construction Permits

The project is exempt from the City of Bend clearing, grading, and erosion-control permit as it is related to landfill operations, consistent with the DEQ permit related to postclosure activities at a landfill. However, the project will be subject to the Performance Standards that are described in City of Bend Code Sections 16.10.070 through 16.10.100 and Section 16.15.040.

The National Pollutant Discharge Elimination System Construction Stormwater Discharge Permit 1200-C (1200-C Permit) regulates stormwater runoff to surface waters from construction activities that disturb 1 or more acres in Oregon. The 1200-C Permit is a general permit, meaning that it outlines requirements for site construction and is not specific to the Site. A site-specific erosion and sediment control plan will be attached to the 1200-C Permit.

4 CLEANUP ALTERNATIVES

The purpose of this ABCA is to identify and evaluate remedial alternatives to address environmental contamination and ensure protectiveness of human health and the environment in the IDR Phase I project area. This ABCA was completed in general accordance with EPA guidelines for conducting an ABCA and Oregon regulations for conducting feasibility studies (OAR 340-122-0085).

4.1 Remedial Objectives

Typically, under DEQ removal authority (OAR 340-122-0090), remedial alternatives are evaluated based on the following criteria:

- Effectiveness
- Long-term reliability
- Implementability
- Implementation risk
- Reasonableness of cost

These factors are discussed below, along with a discussion of climate change and sustainability related to resilience per EPA guidance (EPA 2014).

4.2 Remedial Alternatives

The objective of the remedial alternatives described below is to mitigate environmental risk and protect human health and the environment.

4.2.1 Alternative 1—Long-Term Monitoring

Alternative 1 includes no construction, only long-term monitoring and maintenance. Thirty years of monitoring are assumed. This alternative is included as a baseline condition. This alternative would not include any activities to remove or treat landfill waste. If landfill waste is left in place and the Solid Waste Permit requirements are not fully followed, human and ecological exposure is possible, and there may be potential for contaminant migration via erosion.

Consistent with the Solid Waste Permit, the following engineering controls are likely:

- Long-term landfill gas perimeter and/or surface monitoring
- Long-term site monitoring (inspections, landfill gas measurements)
- Long-term physical cap and surface maintenance (settlement, vegetation management, etc.)
- Subsurface temperature monitoring, taking into consideration the area of pyrolysis in Cell 1

Additionally, if conditions change, landfill gas extraction/venting systems and/or long-term groundwater monitoring may be required. Landfill gas, pyrolysis, and differential settlement are the primary concerns for short- and long-term development scenarios. Due to the arid climate and deep groundwater, leachate control is a concern for the Site.

4.2.2 Alternative 2—Landfill Consolidation

Alternative 2 assumes that landfill waste would be processed into a beneficial material acceptable for reuse or, if unacceptable for reuse, consolidated in Cell 3.

The IDR Phase I project includes the remediation of 8 acres of Cell 1. Approximately 410,000 cubic yards (cy) of waste would be excavated and screened to reclaim usable soil. Approximately 205,000 cy of reclaimed soil would be used as backfill in the future site development. Waste would be re-landfilled in Area 3 in the existing permitted landfill area. The project would create approximately 8 acres of property ready for redevelopment.

Open spaces where waste is consolidated, i.e., Cell 3, would likely require the following institutional and engineering controls:

- Long-term landfill gas perimeter and surface monitoring
- Long-term site monitoring (inspections, landfill gas measurements)
- Long-term physical cap and surface maintenance (settlement, vegetation management, etc.)

Landfill gas and differential settlement are the primary concerns for short- and long-term development under this alternative. Due to the arid climate and deep groundwater, leachate control is unlikely to be a concern for the Site.

4.2.3 Alternative 3—Off-Site Disposal of Landfill Waste

The third redevelopment scenario (Alternative 3) assumes that all landfill waste from the IDR Phase I project area would be excavated and hauled to a designated landfill. Approximately 410,000 cy of waste would be hauled approximately 6 miles to the Knott Landfill. Waste not acceptable for disposal at Knott Landfill would be treated and/or disposed of at other permitted facilities. Alternative 3 would generate an estimated 20,000 truck trips for waste hauling and would reduce the remaining capacity at the municipal landfill for local waste disposal.

4.3 Evaluation of Cleanup Alternatives

4.3.1 Effectiveness

The alternatives are judged to be effective in addressing environmental risk. Alternative 1 does not actively address pyrolysis, although under the Solid Waste Permit, the DEQ can require management of this risk. Alternatives 2 and 3 are more effective, as they reduce and actively address human and/or ecological receptors' exposure to contaminants.

4.3.2 Long-Term Reliability

Following well-established protocols as specified in the Solid Waste Permit, Alternatives 1 and 2 provide long-term reliability. They involve institutional controls (i.e., the Solid Waste Permit) and the maintenance of engineering controls (i.e., cap) to prevent exposure of human and/or ecological receptors to contaminants. Alternative 3 would remove all landfill waste from the project area and would not require long-term monitoring; thus it is judged to provide marginally longer-term reliability.

4.3.3 Implementability

Alternative 1 is readily implementable. Alternatives 2 and 3 employ common construction practices, although Alternative 2 is more technically complex. Alternative 3 imparts significant negative impacts to the surrounding community to the point that it may not be fully implementable. Consequently, Alternative 2 is judged to be more implementable than Alternative 3.

4.3.4 Implementation Risk

Alternative 1 has limited action, so implementation risk is low. Alternative 3 is judged to have more implementation risk than Alternative 2 due to the impact on the community (e.g., noise, dust, traffic, and potential truck accidents). Alternative 3 generates an extensive amount of truck trips for off-site waste disposal and for import of backfill materials. Alternative 2 limits off-site truck trips because it manages reclaimed soil on site for use as fill and consolidates waste materials into Area 3. Alternatives 2 and 3 would incorporate comparable on-site controls to reduce/eliminate releases (e.g., dust), excess

noise, and stormwater runoff. For all alternatives, worker risk would be minimized by adherence to a health and safety plan.

4.3.5 Sustainability

Alternative 2 is judged to be more sustainable than Alternative 3, as it requires considerably fewer truck trips both for hauling waste off site and for backfill import. The additional emissions from construction activities in Alternative 3 are more significant than the emissions related to excavation, screening, and construction hauling in Alternative 2. Alternative 1 requires limited action; however, it does not actively address pyrolysis in Cell 1 and does not allow for redevelopment of a brownfield, whereas Alternative 2 allows for removal of the pyrolysis material and development. Redeveloping on brownfields allows use of existing infrastructure and is a more sustainable approach.

4.3.6 Climate Change Concerns

Climate change has the potential to increase variability in weather conditions in Oregon, including precipitation, temperature, and snowpack. Taking a more active remediation approach to address and consolidate the landfill waste hedges against variability in the weather system and how it might impact the landfill waste material. In comparison to Alternative 3, Alternative 2 allows for a more active remedial approach and greater reductions in greenhouse gas emissions. Alternative 1 subjects the existing landfill, which is undergoing pyrolysis, to the uncertainty of climate change; this may lead to changes in the stability of the landfill cover.

4.3.7 Cost

The conceptual-level cost estimate to implement Alternative 1 is approximately \$81,000; for Alternative 2, approximately \$11.9M; and for Alternative 3, approximately \$39.4M. See Tables 4-1 through 4-3.

4.3.8 Public Participation

OSU-Cascades participated in a public comment process in the issuance of the prospective purchaser agreement (PPA) in early 2018; this report reflects the approach outlined in the PPA. The ABCA process mandates that public concerns be addressed during the selection of a cleanup alternative. This ABCA report will be included in the EPA grant application to be presented for public comment. Additional public comment period(s) will be included as required by the cleanup action's permitting process.

5 PREFERRED CLEANUP ALTERNATIVE

The preferred remedial alternative is Alternative 2, which includes:

- Consolidation of waste from IDR Phase I in Cell 3
- Active remediation of pyrolysis in Cell 1 in the project area
- Screening and reuse of cover soil and waste material acceptable for engineered fill
- Creation of approximately 8 acres of unencumbered developable land
- Capping of Cell 3
- Long-term monitoring and maintenance

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LIMITATIONS

The services undertaken in completing this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report.

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TABLES




**Table 4-1—Alternative 1 Conceptual Cost Estimate
Analysis of Brownfield Cleanup Alternatives
Oregon State University-Cascades**


| DRAFT—Alternative 1 Conceptual Cost Estimate | | | | | |
|---|---------------|---------|--------------|------|-----------------|
| Project: Oregon State University-Cascades: Landfill Remediation | | | | | |
| Client: Oregon State University-Cascades | | | | | |
| Summary: Long-Term Monitoring | | | | | |
| Project #/Task: M1290.01.006-001 | | | | | |
| Prepared By: Krysta Krippaehne-Stein | | | | | |
| Checked By: Erik Bakkom, PE | | | | | |
| Date: 10/14/2022 | | | | | |
| Revision #No.: 1 | | | | | |
|  MAUL FOSTER ALONG! 3140 NE Broadway Street Portland, OR 97232 971.544.2139 (p) 971.544.2140 (f) www.maulfoster.com | | | | | |
| Line Item | Frequency | Cost | No. of Units | Cost | Total Cost |
| Monitoring | | | | | |
| Monitoring (30 years) | annual | \$4,000 | | | |
| Maintenance (30 years) | every 5 years | \$1,920 | | | |
| ALTERNATIVE TOTAL (net present value, rounded to nearest \$1,000) | | | | | \$81,000 |

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**Table 4-2—Alternative 2 Conceptual Cost Estimate
Analysis of Brownfield Cleanup Alternatives
Oregon State University-Cascades**

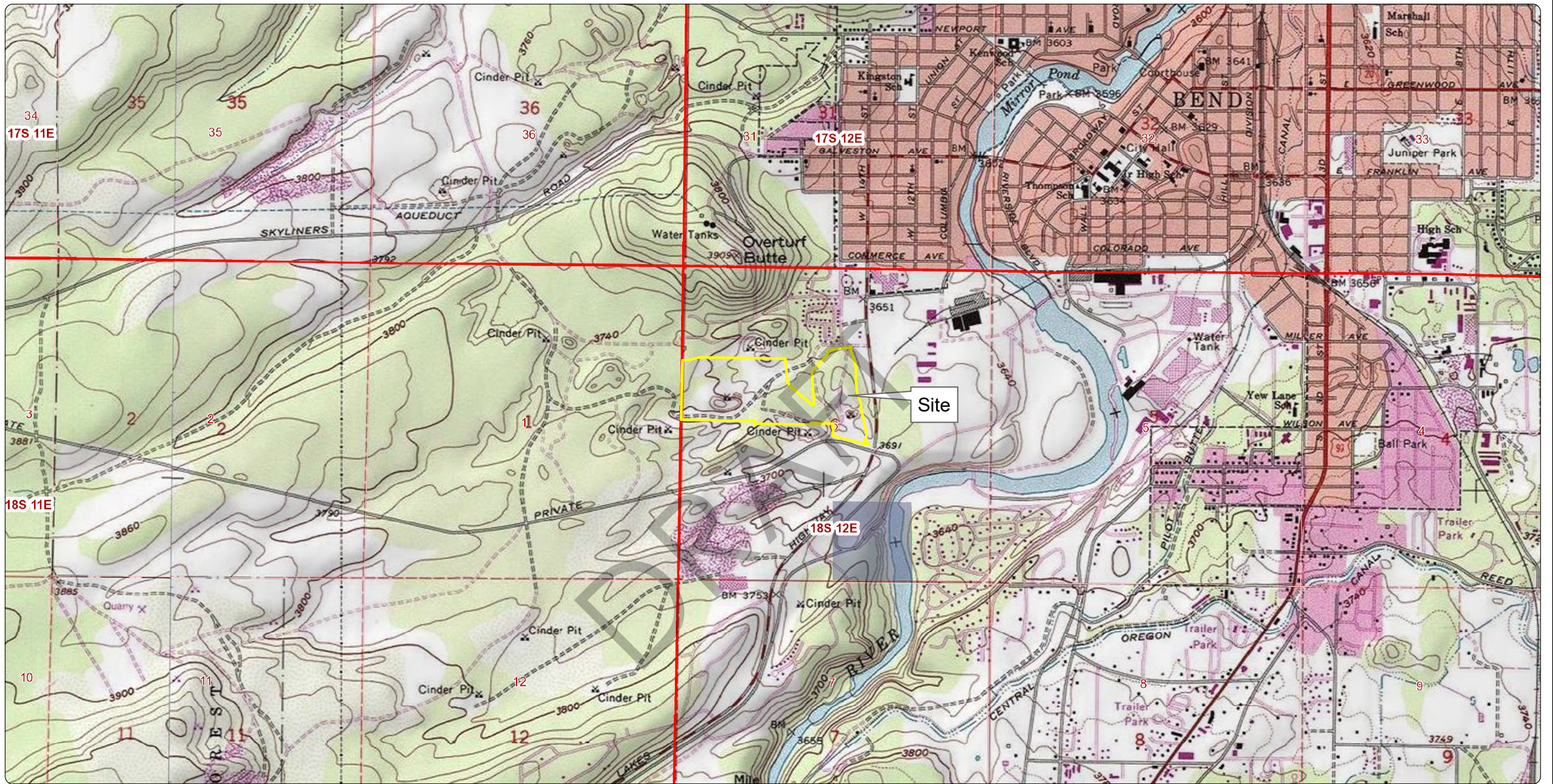
| DRAFT—Alternative 2 Conceptual Cost Estimate | | | | | | |
|---|---------------|-----------|--------------|-------------|-------------|--|
| Project: Oregon State University-Cascades: Landfill Remediation | | | | | |  <p>MAUL FOSTER ALONG I 3140 NE Broadway Street Portland, OR 97232 971.544.2139 (p) 971.544.2140 (f) www.maulfooster.com</p> |
| Client: Oregon State University-Cascades | | | | | | |
| Summary: Consolidate an 8-acre portion of landfill Cell 1 | | | | | | |
| Project #/Task: M1290.01.006-001 | | | | | | |
| Prepared By: Krysta Krippaehne-Stein | | | | | | |
| Checked By: Erik Bakkom, PE | | | | | | |
| Date: 10/14/2022 | | | | | | |
| Revision #No.: 1 | | | | | | |
| Line Item | Units | Unit Cost | No. of Units | Cost | Total Cost | |
| Construction Cost | | | | | | |
| Mobilization | LS | \$450,000 | 1 | \$450,000 | | |
| Construction Surveying | LS | \$15,000 | 1 | \$15,000 | | |
| Excavation of Waste | CY | \$2 | 410,000 | \$984,000 | | |
| Excavation and Processing of Pyrolysis Waste | CY | \$18 | 30,400 | \$547,200 | | |
| Removal and Stockpile of Cover Soil | CY | \$5 | 65,000 | \$312,000 | | |
| Processing and Placement of Waste | CY | \$15 | 410,000 | \$6,150,000 | | |
| Tire Collection and Disposal | TON | \$212 | 600 | \$127,500 | | |
| Dust Control | LS | \$96,000 | 1 | \$96,000 | | |
| Shoring | SF | \$60 | 4,000 | \$240,000 | | |
| Temperature Monitoring/Fire Suppression | LS | \$19,200 | 1 | \$19,200 | | |
| Subtotal | | | | | \$8,940,900 | |
| Contingency | | | 20% | | \$1,788,180 | |
| Professional Services | | | | | | |
| Design/Permitting | LS | \$320,000 | 1 | \$320,000 | | |
| Procurement/Contracting | LS | \$30,000 | 1 | \$30,000 | | |
| Construction Oversight | LS | \$700,000 | 1 | \$700,000 | | |
| Completion Report/As-Built | LS | \$45,000 | 1 | \$45,000 | | |
| Monitoring | | | | | | |
| Monitoring (30 years) | annual | \$6,000 | | | | |
| Maintenance (30 years) | every 5 years | \$1,920 | | | | |
| Monitoring and Maintenance (NPV) | | | | | \$117,000 | |
| ALTERNATIVE TOTAL (rounded to nearest \$1,000) | | | | | | \$11,941,000 |
| Notes | | | | | | |
| CY = cubic yard. | | | | | | |
| LS = lump sum. | | | | | | |
| NPV = net present value. | | | | | | |
| SF = square feet. | | | | | | |

**Table 4-3—Alternative 3 Conceptual Cost Estimate
Analysis of Brownfield Cleanup Alternatives
Oregon State University-Cascades**

| DRAFT—Alternative 3 Conceptual Cost Estimate | | | | |  <p>3140 NE Broadway Street Portland, OR 97232 971.544.2139 (p) 971.544.2140 (f) www.maulfooster.com</p> | |
|---|---------------|-----------|--------------|--------------|---|--|
| Project: Oregon State University-Cascades: Landfill Remediation | | | | | | |
| Client: Oregon State University-Cascades | | | | | | |
| Summary: Dispose of landfill waste off site | | | | | | |
| Project #/Task: M1290.01.006-001 | | | | | | |
| Prepared By: Krysta Krippaehne-Stein | | | | | | |
| Checked By: Erik Bakkom, PE | | | | | | |
| Date: 10/14/2022 | | | | | | |
| Revision #No.: 1 | | | | | | |
| Line Item | Units | Unit Cost | No. of Units | Cost | Total Cost | |
| Construction Cost | | | | | | |
| Mobilization | LS | \$450,000 | 1 | \$450,000 | | |
| Construction Surveying | LS | \$15,000 | 1 | \$15,000 | | |
| Excavation of Waste | CY | \$2 | 410,000 | \$984,000 | | |
| Excavation and Processing of Pyrolysis Waste | CY | \$18 | 30,400 | \$547,200 | | |
| Removal and Stockpile of Cover Soil | CY | \$5 | 65,000 | \$312,000 | | |
| Hauling & Disposal of Waste | TON | \$60 | 492,000 | \$29,520,000 | | |
| Tire Collection and Disposal | TON | \$212 | 600 | \$127,500 | | |
| Dust Control | LS | \$96,000 | 1 | \$96,000 | | |
| Shoring | SF | \$60 | 4,000 | \$240,000 | | |
| Temperature Monitoring/Fire Suppression | LS | \$19,200 | 1 | \$19,200 | | |
| Subtotal | | | | \$32,310,900 | | |
| Contingency | | | 20% | \$6,462,180 | | |
| Professional Services | | | | | | |
| Design/Permitting | LS | \$320,000 | 1 | \$320,000 | | |
| Procurement/Contracting | LS | \$30,000 | 1 | \$30,000 | | |
| Construction Oversight | LS | \$240,000 | 1 | \$240,000 | | |
| Completion Report/As-Built | LS | \$20,000 | 1 | \$20,000 | | |
| Monitoring | | | | | | |
| Monitoring (30 years) | annual | \$0 | | | | |
| Maintenance (30 years) | every 5 years | \$0 | | | | |
| Monitoring and Maintenance (NPV) | | | | \$0 | | |
| ALTERNATIVE TOTAL (rounded to nearest \$1,000) | | | | | \$39,383,000 | |
| Notes | | | | | | |
| CY = cubic yard. | | | | | | |
| LS = lump sum. | | | | | | |
| NPV = net present value. | | | | | | |
| SF = square feet. | | | | | | |

DRAFT FIGURES





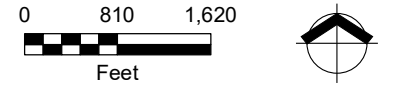
Oregon State University Cascades Campus, Bend, Oregon
 Source: U.S. Geological Survey (1986) 7.5-minute topographic
 quadrangle: Bend, section 6, township 18 south, range 12 east

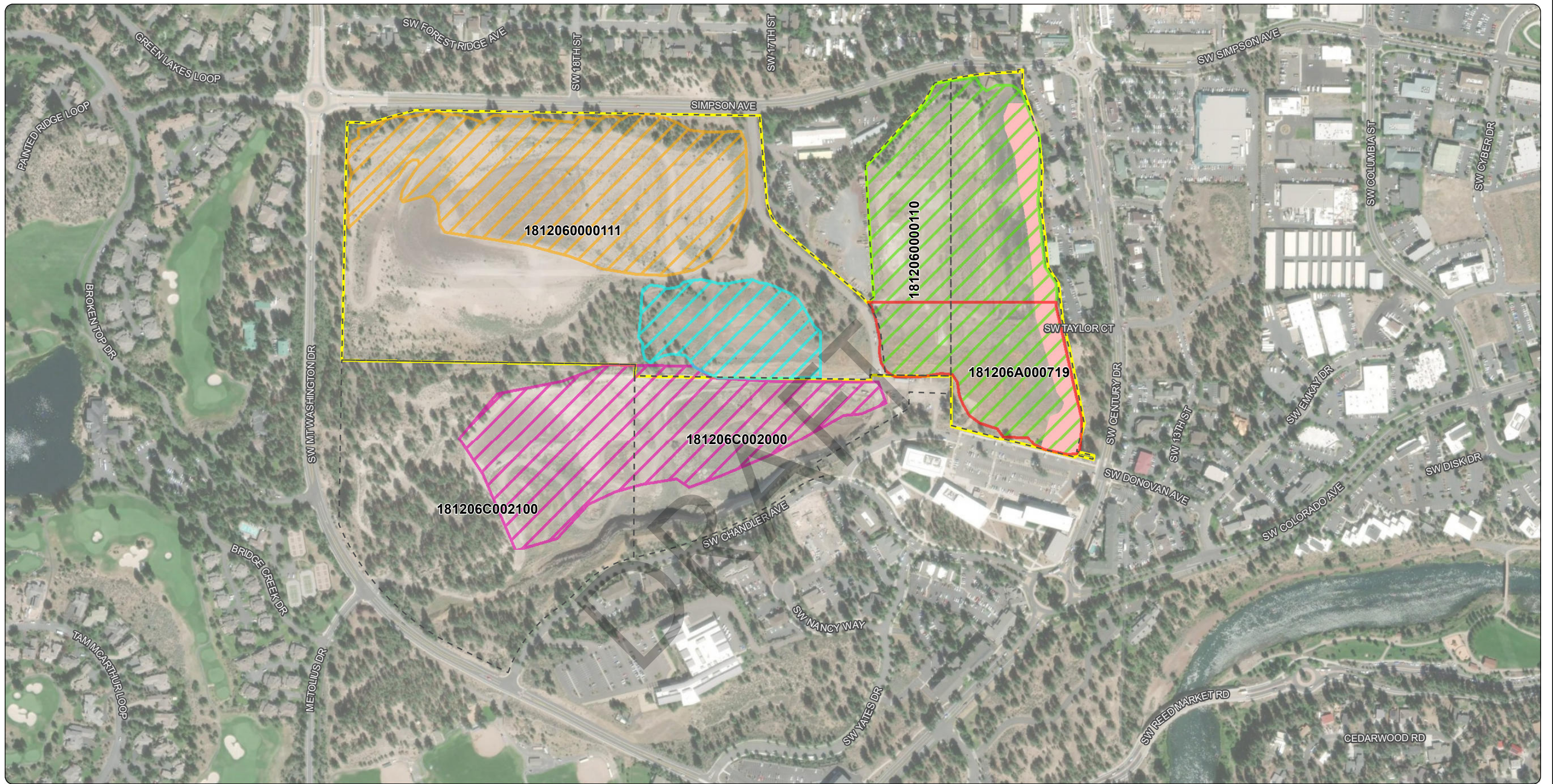
Legend
 Tax Lots Site Boundary (approximate)

**Figure 1-1
 Site Location**
 Oregon State University Cascades Campus
 Bend, Oregon



This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.





Notes:
 U.S. Geological Survey (2021) 7.5-minute
 topographic quadrangle: Bend.
 Township 18 south, range 12 east, section 6.
 IDR = Innovation District Remediation.

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This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

Data Sources:
 The tax lot boundaries as shown are based on data obtained from Deschutes County and are current as of 6/21/2017; the property boundary is based on survey data provided by Sun Country Engineering & Surveying on 04/06/2018. Aerial imagery obtained from Mapbox.

- Legend**
- Cell 1 Footprint
 - Cell 2 Footprint
 - Cell 3 Footprint
 - IDR Phase 1 Boundary
 - Pumice Mine
 - Site Boundary (approximate)
 - Tax Lot

Figure 1-2
Site Overview / Site Access
 Oregon State University Cascades Campus
 Bend, Oregon

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0 250 500
 Feet