



**Analysis of Brownfield Cleanup
Alternatives
Heritage Square**

1153 Duane Street, Astoria, Oregon

ECSI Site #4075

October 30, 2024

Prepared for:

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Sign-off Sheet

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**ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES
HERITAGE SQUARE, ASTORIA, OR**

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Acronyms and Abbreviations

AACE	American Association of Cost Estimating
ABCA	analysis of brownfield cleanup alternatives
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure
bgs	below ground surface
CFR	Code of Federal Regulations
CMMP	contaminated media management plan
DEQ	Oregon Department of Environmental Quality
DUs	decision units
ECSI	Environmental Cleanup Site Information
EPA	US Environmental Protection Agency
HAI	Hahn and Associates, Inc.
HVOCs	halogenated volatile organic compounds
IRAM	Interim Remedial Action Measures
ISM	incremental sampling methodology
µg/kg	microgram per kilogram
mg/kg	milligram per kilogram
NFA	No Further Action
OAR	Oregon Administrative Rule
OPC	opinion of probable costs
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
pg/g	picogram per gram
psf	pound per square foot
QAPP/SAP	Quality Assurance Project Plan and Sampling Analysis Plan
QEP	Qualified environmental professional
RAOs	remedial action objectives
RBCs	risk-based screening concentrations
Stantec	Stantec Consulting Services Inc.
TEFs	Toxic Equivalency Factors
TEQ	Toxic Equivalent
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
VOCs	volatile organic compounds



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Introduction and Background

1.0 INTRODUCTION AND BACKGROUND

On behalf of the City of Astoria, Oregon, Stantec Consulting Services Inc. (Stantec) has prepared this Analysis of Brownfield Cleanup Alternatives (ABCA) report for the Heritage Square property located at 1153 Duane Street in Astoria, Oregon (referred to as “Property”). The City was awarded a United States Environmental Protection Agency (EPA) multi-purpose brownfield pilot grant in 2012 for assessment and cleanup of the Site (Brownfields Grant Number 00J67901). The Property was partially cleaned up using the multi-purpose grant in 2016. The Property is identified on the Oregon Department of Environmental Quality (DEQ) Environmental Cleanup Site Information (ECSI) database as site #4075.

This ABCA report presents an evaluation of practical remedial alternatives that would reduce contaminant exposure to protect human health and the environment, based on site-specific conditions, technical feasibility, and preliminary cost evaluations. This ABCA was completed in general accordance with EPA guidelines for conducting removal actions (National Contingency Plan 300.415[a][4][i]) and Oregon DEQ removal authority (Oregon Administrative Rules [OAR] 340-122-0040).

The Property is an approximately 1.37-acre parcel of land located at 1153 Duane Street in Astoria, Oregon, and comprised of a single Clatsop County Tax Lot (80908CD00100). The Property contains a public park (Garden of Surging Waves) and an asphalt-paved parking lot to the west. A depression from the former Safeway grocery store basement is in the middle of the Property. An elevated parking deck is in the eastern portion of the Property. A 0.11-acre portion of the lot is occupied by the American Legion, located adjacent to the Property to the south-southwest. The Property is zoned by Clatsop County as Central Commercial Zone (C-4). Surrounding sites are generally commercial in use. A Property location map is illustrated on **Figure 1**.

1.1 SITE ASSESSMENT FINDINGS

The following section provides a summary of the environmental background and recent investigations completed at the Property.

1.1.1 2015 Amec Foster Wheeler Environment & Infrastructure ABCA

Multiple investigations have taken place on the Property, including the following reports referenced and discussed in the 2015 ABCA:

- **Phase I Environmental Site Assessment:** 1.48-Acre Safeway/American Legion Property, 1153 Duane Street and 1132 Exchange Street, Astoria, Oregon; January 17, 2003; Hahn and Associates, Inc. (HAI).
- **Phase II Environmental Site Assessment:** 1.48-Acre Safeway/American Legion Property, 1153 Duane Street and 1132 Exchange Street, Astoria, Oregon; April 14, 2003; HAI.
- **Subsurface Investigation Report:** Safeway Property, 1153 Duane Street, Astoria, Oregon; December 16, 2003; HAI.
- **Tank Decommissioning Report:** Safeway Property, 1153 Duane Street, Astoria, Oregon; December 17, 2003; HAI.



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- **Technical Memorandum:** Data Evaluation and Scope of Work Development, Former Safeway Property, 1153 Duane Street (Tax Lot 100) American Legion Property, 1132 Exchange Street (Tax Lot 400), Astoria, Oregon; April 5, 2012; HAI.
- **Site Investigation Report:** Heritage Square, Astoria, Oregon (ECSI #4075); June 29, 2012; GeoEngineers, Inc.
- **Phase II Environmental Site Assessment:** Heritage Square, Astoria, Oregon; June 9, 2015; Amec Foster Wheeler.

In 2015, Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) completed an ABCA on the Property to assist the City of Astoria, Oregon with selecting a cleanup alternative. At the time the report was written, there were three stockpiles on-site. Two stockpiles were generated during the construction of the adjacent Garden of Surging Waves, and the piles were located in the former Safeway grocery store basement. A third stockpile was located beneath the northwest corner of the elevated parking deck. All three stockpiles exceeded urban residential, occupational, and construction worker direct contact risk-based screening concentrations (RBCs), which have since been updated (DEQ 2023). The stockpile beneath the parking deck also had detections of lead in leachate. Additionally, there was soil with exceedances of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and metals found beneath the parking deck, soil with elevated levels of arsenic in the southwestern corner of the Property, and volatile organic compounds (VOCs) in groundwater beneath the northwest corner of the parking deck. The 2015 ABCA included alternatives for both soil and groundwater, which consisted of the following:

Soil alternatives:

1. No action;
2. Institutional and engineering controls;
- 3a. Soil removal (Safeway stockpiles only);
- 3b. Removal (Safeway stockpiles plus stockpile and hotspot beneath parking deck); or
- 3c. Removal (Safeway Stockpiles, Stockpile and Hotspot Beneath Parking Deck, and removal of soil that exceeds RBCs in the area beneath the parking deck).

Groundwater alternatives:

4. No action;
5. Institutional control; or
6. Groundwater Monitoring with Institutional and Engineering Controls.

Findings of the 2015 ABCA included the selection of Alternative 3c for soil and 6 for groundwater. Alternative 3c scored high in terms of effectiveness, reliability, sustainability, and climate change resilience due to the removal of all contaminated soil exceeding RBCs to secure a No Further Action (NFA) from the DEQ. Alternative 6 was chosen for groundwater due to increased level of confidence of removing groundwater contamination and reduced risk of off-site migration.



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1.1.2 2017 Amec Foster Wheeler Cleanup Activities

In 2017, Amec Foster Wheeler completed soil cleanup activities on the Property as documented in the Soil Cleanup Report (Amec Foster Wheeler 2017a). Cleanup activities were conducted in accordance with the 2015 ABCA report and a DEQ-approved Interim Remedial Action Measures (IRAM) Work Plan dated December 23, 2016. The 2017 Soil Cleanup Report describes the removal of three stockpiles of contaminated soils on-site and surface samples collected from three decision units (DUs) using incremental sampling methodology (ISM). A Toxic Equivalent (TEQ) was calculated for each analyzed soil sample for dioxins/furans. The three stockpiles of impacted and hazardous soil were successfully removed from the Property, and access to remaining impacted soil was restricted using engineering controls. Findings from the 2017 Soil Cleanup Report indicated:

- One benzo(a)pyrene sample in DU-2 and DU-3, one lead sample in DU-2, and TEQ concentrations for dioxins and furans in DU-1, DU-2, and DU-3 exceeded the DEQ urban residential (direct contact) RBCs. It should be noted that since the finalization of the 2017 Soil Cleanup Report, the DEQ urban residential (direct contact) RBCs have updated for PAHs. Following the August 2023 revision, the benzo(a)pyrene sample in DU-2 and DU-3 no longer exceeds the DEQ urban residential (direct contact) RBCs (DEQ, 2023).
- TEQ concentrations for dioxins and furans exceeded the DEQ occupational (direct contact) RBC and the DEQ construction worker (direct contact) RBC in DU-3.
- PCB concentrations were not found to exceed applicable RBCs.
- Toxicity characteristic leaching procedure (TCLP) metals were not found to exceed their hazardous waste criteria.
- Clean fill (DEQ 2019) standards were exceeded in all three DUs for metals and PAHs (benzo[b]fluoranthene) in DU-3.

The report concluded that additional soil removal would not feasibly remove contamination due to the widespread low concentration of contaminants. The final recommendation was to install a protective cap in conjunction with the development of a contaminated media management plan (CMMP) and development of a basement security plan to obtain an NFA Determination from the DEQ.

1.1.3 2017 Amec Foster Wheeler Groundwater Assessment

In 2017 Amec Foster Wheeler evaluated groundwater near the Property as documented in the Groundwater Assessment Report (Amec Foster Wheeler 2017b) on the Property based on results from an assessment of localized groundwater conditions. The installation of MW-1 was completed in accordance with the Revised Quality Assurance Project Plan and Sampling Analysis Plan (QAPP/SAP) Addendum #3, dated June 29, 2016. The groundwater assessment included the sampling of MW-1 for VOCs, an update to BIOCHLOR model results, and the placement of an institutional control that stated groundwater use at the Property cannot be for drinking water or industrial use.



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Groundwater samples were collected from MW-1 during “low groundwater conditions” in July 2016 and during “high groundwater conditions” in January 2017. Additionally, site-specific measurements taken during the installation of MW-1 and lab data were used to update the BIOCHLOR fate and transport model.

Findings of the 2017 Groundwater Assessment Report indicated that reductive dechlorination is active in groundwater collected from MW-1, and that concentrations of halogenated volatile organic compounds (HVOCs) were stable and decline rapidly with distance downgradient from the Property. It was determined that there was no ongoing release of contamination due to the removal of much of the source material described in the 2017 Soil Cleanup Report. The updated BIOCHLOR model results indicated that vinyl chloride concentrations at the Property are low and do not present a risk to ecological receptors at the Columbia River. The final recommendation was similar to the 2017 Soil Cleanup Report, which included the development of a basement security plan and the installation of a protective cap and CMMP to obtain an NFA Determination from the DEQ.



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Applicable Regulations and Cleanup Standards

2.0 APPLICABLE REGULATIONS AND CLEANUP STANDARDS

Additional cleanup actions on the Property performed must provide adequate protection of human health and the environmental health based on the current and future uses of the Site.

2.1 POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

Based on the findings of the Soil Cleanup Report for the Property (Amec Foster Wheeler, 2017a), the contaminants of concern for the Property are dioxins/furans, PAHs, and metals. Since the finalization of the 2017 Soil Cleanup Report, the DEQ urban residential (direct contact) RBCs have updated for polycyclic aromatic hydrocarbons (PAHs) based on revised toxicity data. Following the August 2023 revision to toxicity values, the benzo(a)pyrene detections in samples collected from DU-2 and DU-3 no longer exceed the DEQ urban residential (direct contact) RBC as presented in Table 1.

However, concentrations of dioxins and furans were detected above the DEQ urban residential (direct contact) RBCs in the eastern portion of the Property (DU-1, -2, -3) and exceeded the DEQ occupational (direct contact) RBC and the DEQ construction worker (direct contact) RBC in the southeastern portion of the Property (DU-3). Metals (lead) were detected above background concentrations (DEQ 2018) the DEQ urban residential (direct contact) RBCs in the northeastern corner of the Property (DU-2). Detected concentrations of dioxins and furans in analyzed samples from DU-3 exceeded occupational and construction worker DEQ RBCs and are considered to pose an unacceptable risk to human health. Exposure to hazardous materials in Property soils by occupational and construction workers could occur during redevelopment activities at the Property through inhalation, ingestion, and/or dermal contact. Additionally, metals in all three DUs and PAHs (benzo[b]fluoranthene) in DU-3 exceeded clean fill (DEQ 2019) standards. Vertical delineation of subsurface impacts was not achieved during previous assessment activities.

Considering that redevelopment activities are expected at the Property, construction workers, excavation workers, and trespassers have been identified as the most applicable potential human receptors. Redevelopment and reuse plans for the Property are still in the planning phase and are expected to be mixed-use as recreational and occupational in nature. Therefore, occupational receptors will also be considered.

Potential exposure during the remedial work would be managed with a Health and Safety Plan and a Community Air Monitoring Plan designed to protect site workers and the public from fugitive emissions of contaminants of concern during the remedial activities. An exclusion zone in the form of a perimeter fence would be implemented during remedial work to prevent the public from accessing the Property. Potential future exposures to residual contamination, if any, would be mitigated using institutional and engineering controls and a Site Management Plan.

Ecological receptors are not anticipated to be exposed to contaminated media on the Property. It has been demonstrated that impacts to groundwater are localized and would not migrate to the Columbia River where potential exposure to ecological receptors may occur. Furthermore, the Property is not



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planned to be developed for habitat and exposure by sensitive ecological receptors is not likely to occur. If the Property is to be designated as habitat or ecological receptors are anticipated to be impacted by remedial activities, then the applicable cleanup standards and remedial action objectives should be revised accordingly.

2.2 CLEANUP STANDARDS

Contaminants of concern at the Property are defined as the substances for which the concentrations in soil exceed the associated Oregon DEQ RBCs (DEQ 2023). The RBC values exceeded at the Property are for protection of human health via the ingestion, dermal contact, or inhalation pathways.

Impacted soil with residual contamination above DEQ RBCs that may be left in-place would be managed with a Site Management Plan which would be implemented for potential future disturbances and with environmental engineering and institutional controls (e.g., placement of a clean soil cover). If it is not feasible to achieve the applicable DEQ RBCs for soil, site-specific cleanup levels would be established for the Property that, in conjunction with institutional and engineering controls, would attain conditions protective of public health and the environment for the intended and reasonably anticipated use of the Property.

Relevant regulations and cleanup standards for the Site are listed below:

- OAR 340-122-0040 (2)
- OAR 340-122-0090
- Hazardous Waste Regulations, 40 CFR (Code of Federal Regulations) 261.31

2.3 CLEANUP GOAL

Future development plans for the Property are currently in the planning phase, with the end goal of providing a community gathering space for downtown Astoria. The initial plans include the construction of a public plaza, a performance space, a pavilion, and surrounding landscaping and walkways for the public. As such, the intention of the remedial alternatives is to achieve compliance with the DEQ regulation and remediate the Property to levels appropriate for commercial land use. The City of Astoria plans to request an NFA determination by DEQ following remediation so that the Property can be redeveloped. The cleanup criteria are summarized in Table 2, below.

The remedial action objectives are:

- Prevent direct contact between human receptors and soil exceeding urban residential risk-based concentrations;
- Remediate/remove source-area soils to the extent feasible (especially if highly concentrated “hot spots” are encountered following removal activities).

Table 2: Cleanup Criteria for Commercial Land Uses

Analyte	Remedial Action Objective
Dioxins/furans	12 pg/g



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Metals (lead)	400 mg/kg
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Cleanup Alternatives

CLEANUP ALTERNATIVES

2.4 CLEANUP ALTERNATIVES CONSIDERED

The nature and extent of contamination are presented in the Soil Cleanup Report (Amec Foster Wheeler, 2017a). The DU's are outlined below and depicted on **Figures 2 and 3**. The following sections provide a description of alternatives analyzed as part of this report.

Under DEQ removal authority (OAR 340-122-0090) and EPA guidance, remedial alternatives are evaluated using the following criteria:

- Effectiveness;
- Implementability;
- Long-term Reliability;
- Implementation Risk; and
- Reasonableness of Cost.

2.4.1 Description of Alternatives

Cost details and assumptions are presented in **Table 3 and Table 4**.

To address the management of impacted soil at the Property, three remedial alternatives were considered in addition to the base scope of work:

- Alternative #1: Capping Impacted Soils and Management of Soil In-Place
- Alternative #2: Excavation and Off-Site Disposal of Impacted Soils
- Alternative #3: No Action

2.4.2 Alternative #1 – Capping Impacted Soils and Management of Soil In-Place

This alternative would involve capping the impacted soils with visqueen and gravel in order to eliminate the exposure pathway. The cap would be graded so that when covered it would match the necessary grade for desired redevelopment and/or long-term maintenance. The impacted soils would be covered with a visqueen liner and a minimum of 12 inches of crushed gravel imported from a local source. Approximately 21,160 square feet of the Property would be covered by the gravel cap. The groundwater monitoring well (MW-1) would also be abandoned as part of this alternative.

Additionally, the depression from the former Safeway grocery store basement would be backfilled with clean granular gravel to restrict access to contaminated soil beneath the parking deck. The former basement has many openings and access points. Therefore, filling the basement to street grade is the safest and most effective way to permanently eliminate the exposure pathway. The backfill area would include approximately 11,040 square feet at a depth of 10 feet below ground surface (bgs). This would require a geotechnical and structural engineering evaluation due to the predicted load of backfill soils on underlying soils that support the parking area column foundations and predicted soil pressures against



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the existing walls surrounding the former basement. An L shaped cantilevered retaining wall would be installed along the three existing walls of the basement approximately 10' high assuming an allowable static bearing pressure of approximately 2,000 pounds per square foot (psf). A schematic showing a cross section of typical cantilevered wall design is included in **Attachment 1**. The existing concrete slab of the former basement would be broken into pieces less than 1-2 feet in width to allow for drainage. Due to the large volume of soils as part of this scope, a 15% contingency was applied to these soil areas. These improvements assume that seismic design is not required for the proposed improvements nor evaluated for the surrounding parking structure. Fill loads may result in static settlement that would result in too much settlement for surrounding structures and a light weight fill such as controlled density fill (CDF) may be required.

Because the impacted soil would be contained on the Property, institutional and engineering controls would be used to mitigate residual risk. A CMMP would be developed for this alternative to obtain an NFA Determination from the DEQ. Long-term operation & maintenance in the form of routine inspection to document site conditions would also be required to uphold the CMMP and to maintain the asphalt cap. Repairs for any issues identified during inspections would need to be implemented on a routine basis.

2.4.3 Alternative #2 – Excavation and Off-Site Disposal of Impacted Soils

This remedial alternative would include the excavation and disposal of impacted soils from DU-1, DU-2, and DU-3 with dioxins and furans, and metals concentrations greater than DEQ RBCs for direct contact urban residential receptors. Additionally, groundwater monitoring well MW-1 would be abandoned as part of this alternative.

In DU-1, DU-2, and DU-3, soils will be excavated 2 feet bgs using an excavator and stockpiled on-site. Based on the available data, it was estimated that a total of 1,567 cubic yards of soil would be excavated and disposed of off-site. Due to the large volume of soils excavated as part of this scope and inherent uncertainty of environmental investigation, a 15% contingency was applied to these soil volumes.

The proposed excavation would be executed beneath a parking deck currently supported by a grid of columns. Due to the 2 feet bgs excavation depth needed to remove impacted soils, the columns and footings may be undermined, and the structural integrity of the parking deck may be compromised. Therefore, a geotechnical evaluation would need to be completed for this alternative. An average of 1 to 2 helical augers and 2 to 3 pin piles would be installed per footing for approximately 120 column footings below the elevated parking deck. Additionally, one helical auger every 5 linear feet and one pin pile every 3 linear feet would be installed along the walls of the elevated parking deck. The augers would be installed 30 feet bgs and the pin piles would be installed 40 feet bgs, assuming a bearing depth of 40 feet bgs. These depths do not account for the requirements needed to withstand a seismic event, which would require additional evaluation and design.

Waste characterization composite samples would be collected from on-site stockpiles following excavation. Assuming the samples are favorable for disposal at a designated receiving facility, the stockpiled material would be loaded into trucks for transport to a Subtitle D Landfill. Proper disposal of these soils as a non-hazardous waste would be confirmed via waste characterization sampling conducted per the selected disposal facilities requirements.



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Confirmatory soil samples will be collected from the floor and sidewalls when excavations are deemed complete to be submitted for laboratory analyses. Excavation areas would not be backfilled until confirmation samples are received to verify that remedial action objectives (RAOs) are met. Backfill material would be sourced from imported clean fill from a local source following DEQ's clean fill guidelines (DEQ 2019). It is anticipated that the required backfill soil volume would be approximately 1,567 cubic yards.

2.4.4 Alternative #3 – No Action

Alternative 3 is the baseline against which all other alternatives are compared. Under this alternative, contaminated soils would be left in place in their current configuration. No mitigation measures would be implemented to prohibit access or remove contaminated soils from the Property. This alternative would include ongoing security costs for the basement below the elevated parking deck to maintain the preexisting Basement Security Plan included in Appendix E of the Soil Cleanup Report (Amec Foster Wheeler, 2017a). The City has been implementing the Basement Security Plan for the Property since 2017.

2.5 EVALUATION OF CLEANUP ALTERNATIVES

Potential cleanup alternatives are evaluated herein based on the following criteria: effectiveness, implementability, long-term reliability, implementation risk, and reasonableness of cost. **Tables 3 and 4** provide a breakdown of applicable costs and assumptions.

2.5.1 Alternative #1 – Capping Impacted Soils and Management of Soil In-Place

Effectiveness – This alternative eliminates the potential for direct contact with the most-impacted materials located on the Property. A gravel cap with a visqueen liner would mitigate in-place the direct exposure risk posed by the impacted soil beneath the parking deck, and backfilling the former Safeway basement would remove access to the area beneath the parking deck and contaminated soils therein. The overall effectiveness of this alternative is considered high, and it would allow for the City of Astoria to request an NFA determination by DEQ to allow for development of the Property.

Implementability – Implementation of this alternative would be feasible using relatively routine construction methods, including trucking and transportation of materials. Additionally, it will require a geotechnical and structural engineering evaluation for the former Safeway grocery store basement due to the load that will be placed on the existing foundation and walls from the backfill material. This requires a cantilevered retaining wall and preparation of the existing concrete slab which adds additional equipment and labor for this alternative. The overall implementability of this alternative is considered to be relatively simple and straightforward using standard construction methods for environmental cleanup.

Long-term Reliability – This alternative's success will be dependent on long-term monitoring and maintenance of engineering controls (capped areas). The cap materials will be robust and confined in a secure environment therefore this alternative is expected to be very reliable to mitigate Property



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contamination. This long-term maintenance substantially contributes to the overall costs although the maintenance period can likely be negotiated with the DEQ.

Implementation Risk – Alternative #1 would entail less truck traffic than Alternative #2; therefore, Alternative #1 would generate the least amount of greenhouse gases of the actionable alternatives. The cap will help reduce risk of exposure to both the community and workers; however, the Property would remain impacted by dioxins and furans, and metals.

Reasonableness of Cost – This alternative is the most cost effective of the actionable alternatives. Due to the requirement to maintain the cap and CMMP, this alternative would require routine annual monitoring and reporting. This includes the geotechnical and structural engineering evaluation, cap design and implementation, closure reporting and oversight costs from a qualified environmental professional (QEP) and the DEQ. The total costs for this alternative are estimated at \$1,233,000.

2.5.2 Alternative #2 – Excavation and Off-Site Disposal of Impacted Soils

Effectiveness – Comprehensive soil excavation and off-site disposal is an effective remedial method since it removes impacted soils and utilizes an approved off-site disposal facility for final disposition of contaminated media. This alternative is an effective way to eliminate potential future exposure to contaminated soils at the Property through comprehensive source removal. Due to the widespread contamination on the Property, it is possible that over-excavated remaining soils may still show exceedances. If all contaminated soil can be removed, this alternative will effectively eliminate future contact with contaminated soils on-site. This alternative is anticipated to achieve the remedial action objectives for the future development of the Property, and an NFA determination by the DEQ could be requested by the City.

Implementability – This alternative would logistically include more trucking, transportation and disposal when compared to Alternative #1. Additionally, it will require a somewhat complex geotechnical and structural engineering evaluation due to excavation underneath a parking deck with multiple columns and footings that would need to be supported during excavation of this material. It is likely that excavation will be needed below the footers, which will require design and planning to ensure the structure is not compromised. Due to the special requirements of the excavation and the added materials needed for foundation support, construction progress would be limited, and additional equipment and labor hours may be required to complete the excavation. Implementation of this alternative would be complicated because of the requirement to support the parking deck and the complexity of conducting excavation activities within an enclosed sub-grade area.

Long-term Reliability – This alternative provides good long-term management of the Property impacts. This option does not limit the potential reuse of the Property as the contaminated soils would not be retained on the Property.

Implementation Risk – This alternative would entail the most truck traffic and therefore, when compared to remaining alternatives, would generate the most greenhouse gases. However, the Property would not remain impacted by dioxins and furans, and metals if all contaminated soil can be removed. Remaining contaminated soil has not been vertically delineated on the Property. Therefore, the excavation depths to



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remediate soils beneath the parking deck are estimates. Deeper excavations may be required based on confirmation sampling results. This uncertainty in estimated excavation volumes to remove all contaminated soils above screening levels presents an implementation risk.

Reasonableness of Cost – The total costs for this alternative are estimated at \$3,516,300. This includes the geotechnical and structural engineering evaluation, additional foundation support materials, the excavation and disposal of excavated material, analysis costs, closure reporting and oversight costs from a QEP and the DEQ.

2.5.3 Alternative #3 – No Action

Effectiveness – Alternative 3 can not be evaluated as effective since there is no action implemented and thus no protection to human receptors would be provided. It is also not protective of current or future receptors at the Property. It simply maintains the Basement Security Plan already in place by the City of Astoria.

Implementability - This alternative is relatively easy to implement because no action is required. Under this alternative, the City would continue to implement their Basement Security Plan which requires regular inspection of the Property and some maintenance to limit access to residual contamination beneath the parking deck.

Long-term Reliability – Alternative #3 has low long-term reliability because it does not remove existing contamination.

Implementation Risk – Alternative #3 is moderately sustainable. No greenhouse gas emissions would be produced by this alternative; however, the Property would remain impacted by dioxins and furans, and metals. Implementation risk is considered to be low for this alternative because no activities would be conducted outside of the existing monitoring outlined in the Basement Security Plan.

Reasonableness of Cost – The cost to implement this alternative includes the continued execution of the Basement Security Plan by the City of Astoria and oversight costs from the DEQ. The total costs for this alternative are estimated at \$123,000 for a 30 year period.



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Recommended Cleanup Alternative

RECOMMENDED CLEANUP ALTERNATIVE

The recommended cleanup alternative for the Heritage Square Property is Alternative 1 – Capping Impacted Soils and Managing In-Place. This alternative would effectively provide the City with a low-carbon footprint cleanup alternative that is relatively cost-effective and would allow the Property to be redeveloped. This recommendation assumes that the capped area of the Property will require an annual inspection for a 30-year period. This inspection period can likely be reduced or negotiated with the DEQ based on the results of remedial activities but is included in this ABCA as a conservative estimate.

DRAFT



ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES

Opinion of Probable Cost Limitations

3.0 OPINION OF PROBABLE COST LIMITATIONS

The opinion of probable costs (OPC) presented herein represents a Class 5 estimate as defined by the American Association of Cost Estimating (AACE) International. The AACE defines a Class 5 estimate as follows:

Class 5 estimates are generally prepared based on very limited information, and subsequently have wide accuracy ranges. They are often prepared for strategic planning purposes, market studies, assessment of viability, project location studies, and long-range capital planning. Virtually all Class 5 estimates use stochastic estimating methods such as cost curves, capacity factors, and other parametric techniques. Expected accuracy ranges are from –20% to –50% on the low side and +30% to 100% on the high side, depending on technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.

Stantec has used its professional judgement given the available information and our experience with similar remedial techniques on other sites. Accordingly, the Client agrees that Stantec cannot and does not make any warranty, promise, guarantee, or representation, either expressed or implied, that proposals, bids, project construction costs, or cost of operation or maintenance would not vary substantially from this good-faith cost estimate.

Data gaps remain in terms of fully delineating subsurface impacts. Accordingly, the extent and magnitude of subsurface impacts requiring remediation upon which the OPC has been developed is unknown. Therefore, the final extent of excavation, and resultant costs, would be dependent upon the collection and laboratory analyses of confirmatory soil samples at the time of excavation.



ANALYSIS OF BROWNFIELD CLEANUP ALTERNATIVES

References

4.0 REFERENCES

Amec Foster Wheeler 2017a. Soil Cleanup Report, Heritage Square, 1153 Duane Street, Astoria, Oregon, Cooperative Agreement BF-00J67901, ESCI #4075. March 6, 2017.

Amec Foster Wheeler 2017b. Revised Groundwater Assessment Report, Heritage Square, 1153 Duane Street, Astoria, Oregon, Cooperative Agreement BF-00J67901, ESCI #4075. November 9, 2017.

Amec Foster Wheeler 2015. Analysis of Brownfield Cleanup Alternatives, Heritage Square, 1153 Duane Street, Astoria, Oregon, Cooperative Agreement BF-00J67901, ESCI #4075. August 6, 2015.

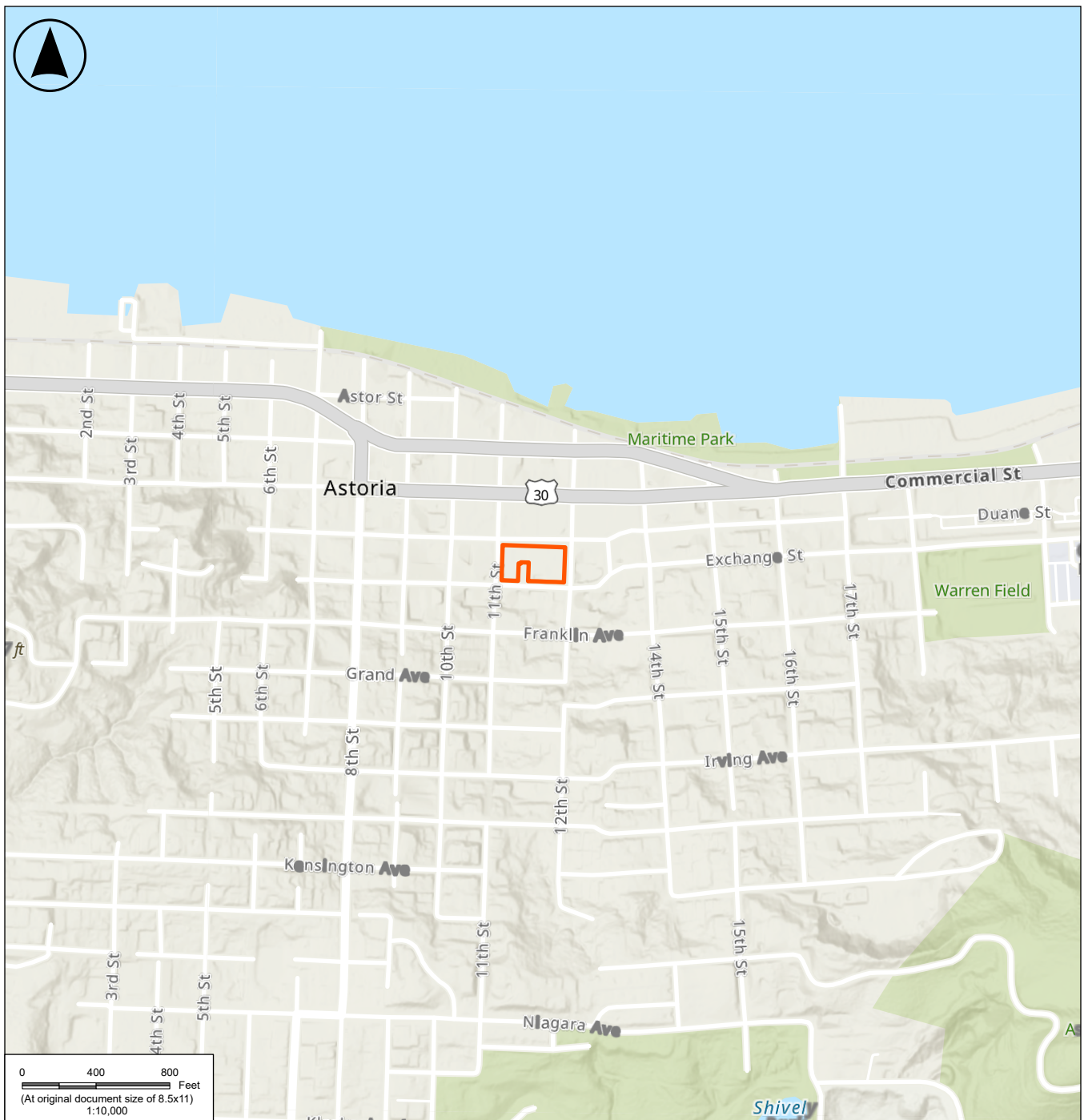
DEQ 2018. Development of Oregon Background Metals Concentrations in Soil, Technical Report. January 25, 2018.

DEQ 2023. Guidance for Risk-Based Decision Making for the Remediation of Contaminated Sites. Concentrations for Individual Chemicals. Updated May 2018. Amended June 2023. Revised August 2023.

DEQ 2019. Clean Fill Determinations. Updated February 2019.



FIGURES



 Site Location



Project Location
1153 Duane Street
Astoria, Oregon

Client/Project 203724092

City of Astoria
Community Development Department
EPA Community-Wide Assessment Grant
Analysis of Brownfields Cleanup Alternatives

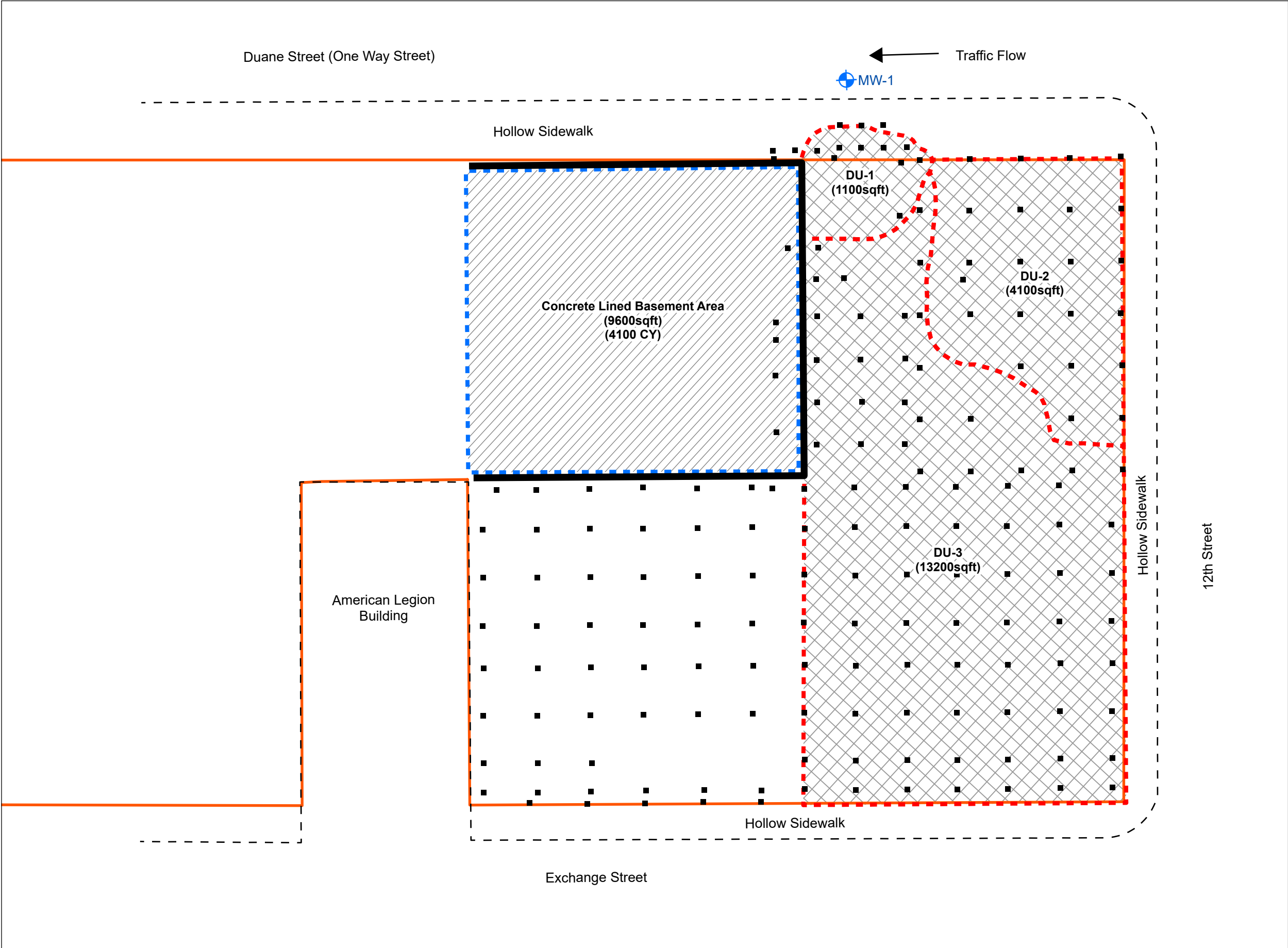
Title
Site Location Map

Figure No.

1

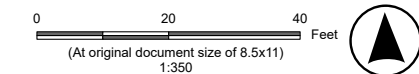
Notes

1. Coordinate System: NAD 1983 UTM Zone 10N
2. Background: Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, Esri Community Maps Contributors, Oregon State Parks, State of Oregon GEO, WA State Parks GIS, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US Census Bureau, USDA, USFWS, Esri, NASA, NGA, USGS, FEMA



- Decision Unit
- Former Safeway Grocery Store Basement
- Capping Area
- Backfill Area
- Cantilevered Retaining Wall
- Groundwater Monitoring Well
- Site Location

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Background: Based on AMEC Foster Wheeler Soil Cleanup Report, 2016

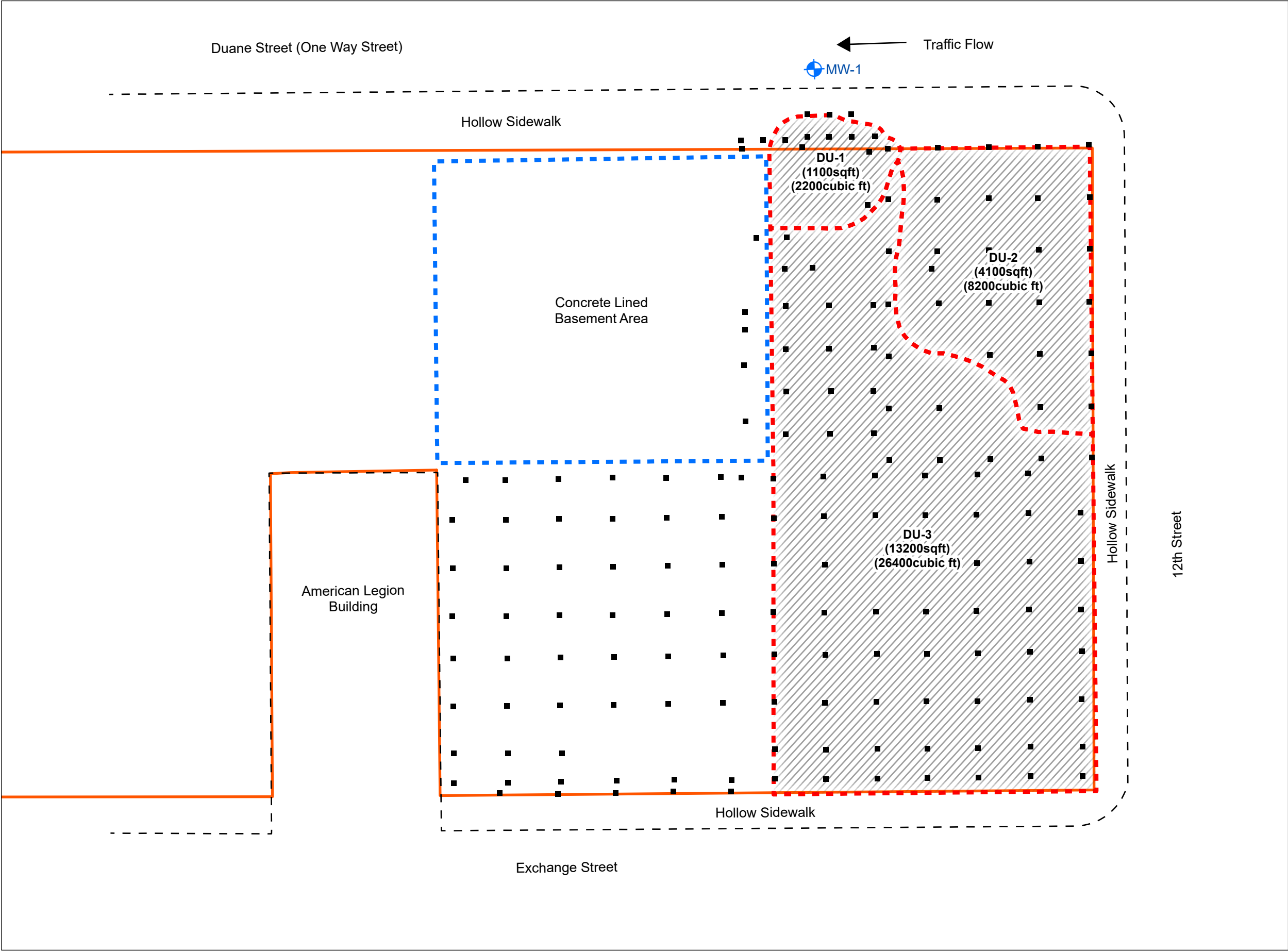


Project Location
1153 Duane Street
Astoria, Oregon

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City of Astoria
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Analysis of Brownfields Cleanup Alternatives

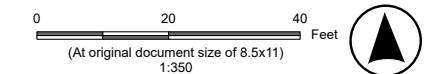
Title
Alternative #1: Capping
Impacted Soils and
Management of Soil In-
Place

Figure No.
2



- Decision Unit
- Former Safeway Grocery Store Basement
- Excavation Area
- Groundwater Monitoring Well
- Site Location

Notes
1. Coordinate System: NAD 1983 UTM Zone 10N
2. Background: Based on AMEC Foster Wheeler Soil Cleanup Report, 2016



Project Location
1153 Duane Street
Astoria, Oregon

Client/Project
City of Astoria
Community Development Department
EPA Community-Wide Assessment Grant
Analysis of Brownfields Cleanup Alternatives

Title
Alternative #2: Excavation
and Off-Site Disposal of
Impacted Soils

Figure No.
3

TABLES

TABLE 1
2016 POLYCYCLIC AROMATIC HYDROCARBON SOIL DATA
COMPARED TO 2023 RBCS

Attachment G | Draft Analysis of Brownfield Cleanup Alternatives (ABCA)

Table 1: 2016 Polycyclic Aromatic Hydrocarbon Soil Data Compared to 2023 RBCs

Analysis of Brownfield Cleanup Alternatives
Heritage Square

Sample ID	Analysis Date	1-Methyl-naphthalene	2-Methyl-naphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)-anthracene	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(g,h,i)-perylene	Benzo(k)-fluoranthene	Chrysene	Dibenz(a,h)-anthracene	Fluoranthene	Indeno(1,2,3-cd)-pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo[a]-pyrene TEQ (ND=0)
DU1 -0100	3/4/2016	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.071	0.072	0.050 U	0.050 U	0.050 U	0.076	0.050 U	0.050 U	0.050 U	0.076	0.00782
DU2 -0100	3/4/2016	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.062	0.11	0.079	0.050 U	0.060	0.050 U	0.096	0.053	0.050 U	0.050 U	0.093	0.0792
DU3 -0100	3/4/2016	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.087	0.094	0.17	0.087	0.050 U	0.096	0.050 U	0.18	0.068	0.050 U	0.071	0.16	0.127
DU3 -0100 Dup	3/4/2016	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.084	0.093	0.17	0.087	0.050 U	0.094	0.050 U	0.17	0.066	0.050 U	0.067	0.16	0.126
DU3 -0100 Trip	3/4/2016	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.085	0.089	0.16	0.086	0.050 U	0.094	0.050 U	0.16	0.068	0.050 U	0.066	0.16	0.121
DU3 -0200	3/4/2016	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.070	0.080	0.14	0.082	0.050 U	0.091	0.050 U	0.13	0.062	0.050 U	0.066	0.13	0.108
DU3 -0300	3/4/2016	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.057	0.073	0.15	0.088	0.050 U	0.090	0.050 U	0.12	0.065	0.050 U	0.071	0.12	0.101
Clean Fill Screening Values		0.36	11	0.25	120	6.8	0.73	0.11	1.1	25	11	3.1	0.11	10	1.1	0.077	NA	10	0.11
Soil Ingestion, Dermal Contact, and Inhalation		NA	NA	9,400	NA	47,000	2.5	0.25	2.5	NA	25	250	0.25	4,800	2.5	25	NA	3,600	0.25
Soil Ingestion, Dermal Contact, and Inhalation		NA	NA	70,000	NA	350,000	21	2.1	21	NA	210	2,100	2.1	30,000	21	23	NA	23,000	2.1
Soil Ingestion, Dermal Contact, and Inhalation		NA	NA	21,000	NA	110,000	170	17	170	NA	1,700	17,000	17	10,000	170	580	NA	7,500	17
Soil Ingestion, Dermal Contact, and Inhalation		NA	NA	590,000	NA	NA	4,800	490	4,900	NA	49,000	490,000	490	280,000	4,900	16,000	NA	210,000	490
Leaching to Groundwater RBC - Urban		NA	NA	NA	NA	NA	6.0	NA	NA	NA	NA	NA	NA	NA	NA	0.37	NA	NA	NA
Leaching to Groundwater RBC - Occupational		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.34	NA	NA	NA

Table 1: 2016 Polycyclic Aromatic Hydrocarbon Soil Data Compared to 2023 RBCs
Analysis of Brownfield Cleanup Alternatives

Notes:
All results expressed as milligrams per kilogram
bold = indicates concentrations detected above the laboratory reporting limit
= indicates concentration exceeds clean fill screening value
NA = Not Available, no screening value is listed for this analyte.
ND = non-detect
TEQ = Toxic Equivalence Quotient

U = Not detected above the reported value

Clean Fill Screening Values, Oregon DEQ April 2019 revision
RBCs = Oregon DEQ Risk-Based Concentrations, Revision: May 2018 amended June 2023

TABLE 2
CLEANUP CRITERIA FOR UNRESTRICTED LAND USES
(PROVIDED WITHIN TEXT)

TABLE 3
COSTING ASSUMPTIONS

Soil Excavation and Off-Site Disposal

- All excavated soils are assumed to meet treatment standards based on observed contaminant concentrations.
- Confirmation of waste characteristics and proper disposal would be evaluated during the testing and laboratory analyses of waste characterization samples at the time of remediation.
- No excavation area will extend beyond the limits of the property boundary of the Site.
- Excavation volumes assume vertical sidewalls.
- Shoring of excavations may be required to protect structures or utilities. This is accounted for in the structural and geotechnical evaluations.
- No groundwater collection, management, testing, treatment or disposal is included.
- No abandonment or replacement of existing utilities will be required.
- Confirmatory soil samples will be collected from each sidewall and the floor of each excavation area prior to backfill. Confirmatory samples will only be collected for the analyte for which the boring exceeded DEQ CULs.
- Backfill will be imported soils that meet import requirements.
- All soils will meet requirements for disposal as non-hazardous.
- Landfill for non-hazardous disposal will be Waste Management Subtitle D landfill in Hillsboro, Oregon. Transportation of soil from Astoria to the landfill will require solo dump trucks with a 15-ton minimum charge per load.
- Disposal and transportation costs of non-hazardous soil from 2024 Waste Management quote used for disposal costs.

General Assumptions

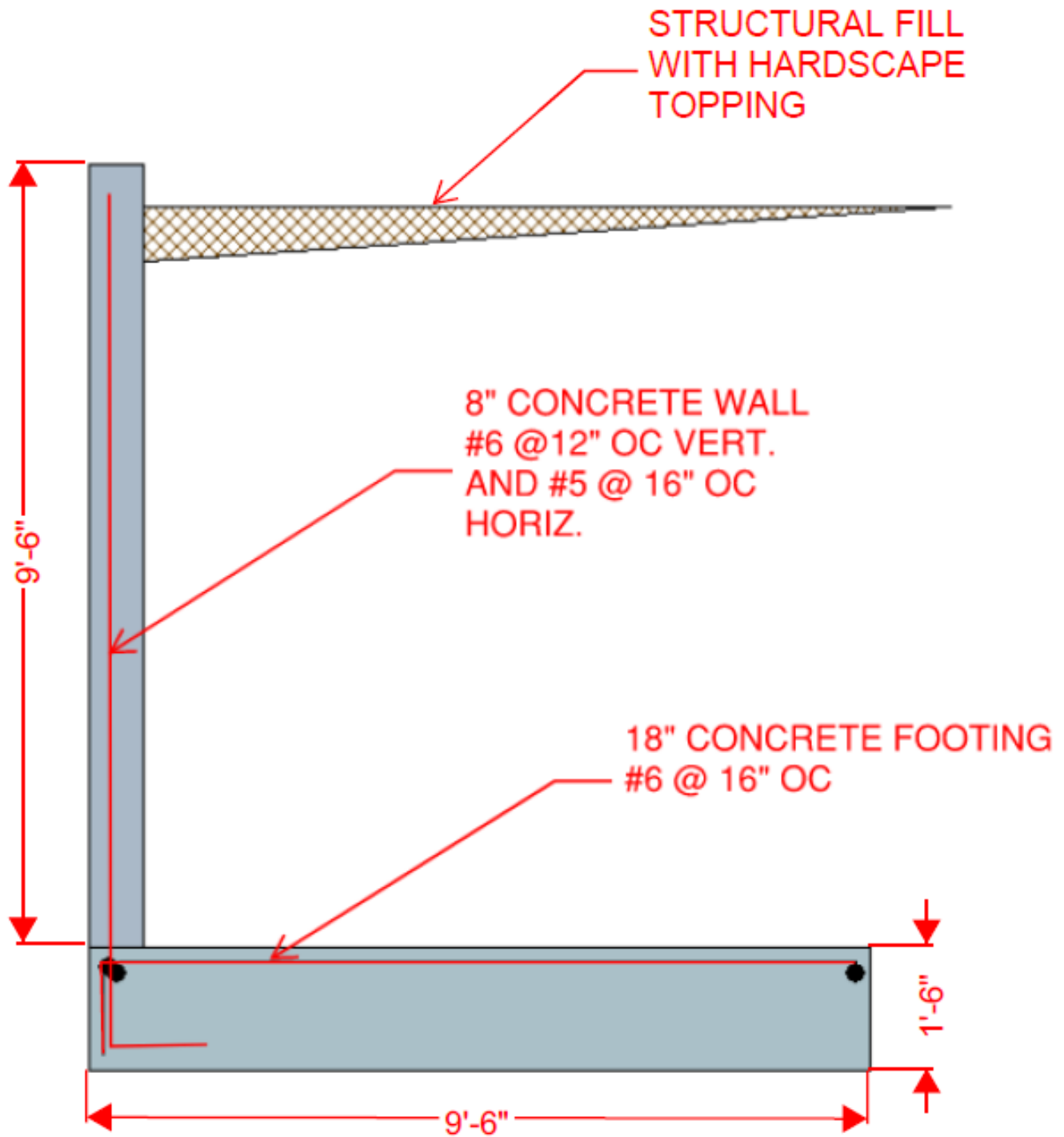
- A 4% inflation rate was applied to all line items not available from RS Means or recent project experience to account for inflation from the time of original development of opinion of probable cost in 2023 to 2024 (i.e., approximately 4% per year).
- Yearly inflation over 30 years is not included in the estimate.
- A 15% contingency was applied to soil volumes for Alternatives 1 and 2 due the larger scale of the site excavations and limited sampling performed prior to remedial implementation.
- Backfill will restore each decision unit to existing respective grades. Alterations to existing grade may affect costing accordingly.
- No historical preservation costs have been included.
- Contractor will have full and unfettered access to the site for the duration of their work.
- Soil density is assumed to be 1.5 Tons/CY.
- The OPC was prepared prior to remedial design and without the formal solicitation of contractor bids, and are therefore based upon related project experience, RSMeans 2024 Cost Estimating Software, anticipated field conditions, and the estimated scope of work.
- Project-specific unit rates will need to be developed once regulatory review and approval processes are completed.
- Contractor mobilization is assumed to be 5% of total task cost.
- No sales tax is applied to project costing with the exception of state and local taxes for transportation and disposal of soil wastes.
- No groundwater investigation or remediation is included as part of this ABCA.
- Cap includes 6 in. stone base, 4 in. binder course.
- Alternatives 1 and 3 would require on-going monitoring, maintenance and inspection. This duration was estimated at 30 years, with annual maintenance until the monitoring period of 30 years is reached. This duration and frequency and associated costs is subject to change.
- Assumed an average bearing depth of 40 ft bgs based on previous soil borings at the site with the elevated parking deck 10 ft bgs.

TABLE 4
PRELIMINARY OPINION OF PROBABLE CLEANUP COSTS

Table 4: Preliminary Opinion of Probable Cleanup Costs
Analysis of Brownfield Cleanup Alternatives - Heritage Square

Description	Quantity	Unit	Unit Cost	Cost	Notes/Assumptions
Alternative 1 - Surface Capping of Soils					
Contractor mobilization/demobilization	1	LS	\$ 53,019.00	\$ 53,019	5% of task total
Cleanup Workplan	1	LS	\$ 7,500.00	\$ 7,500	Project experience
MW-1 Well abandonment	1	LS	\$ 7,500.00	\$ 7,500	Project experience
Geotechnical and structural engineering evaluation	1	LS	\$ 150,000.00	\$ 150,000	Project experience
Breaking up existing former Safeway Basement concrete slab	11,040	SF	\$ 1.00	\$ 11,040	RS Means 024116170440
Construction of cantilevered retaining wall for basement backfill	270	LF	\$ 460.00	\$ 124,200	RS Means 323213103100
Imported soils (on-site) laboratory analysis	20	EA	\$ 750.00	\$ 15,000	Project experience
Haul, place and compact clean, granular backfill soils into former Safeway Basement up to existing grade.	4,100	CY	\$ 36.00	\$ 147,600	RSMeans 312323141000, 312323240700, 312323200554, project experience.
Site preparation work and installation of gravel cap for beneath parking structure (6 in. stone base with a visqueen liner)	21,160	SF	\$ 21.00	\$ 444,360	RS Means - Paving for parking lots (excludes hauling). 6x multiplier for remote location and for sub grade work
Import trucking	300	CY	\$ 25.00	\$ 7,500	RSMeans 030513251200 - aggregate trucking 30 mile round trip
Cap periodic maintenance	14,400	SY	\$ 1.45	\$ 20,880	RSMeans 320113623040 - Surface treatment 6 occurrences (once every 5 years)
Generation of Site-Specific Contaminated Media Management Plan (CMMP)	1	LS	\$ 10,000.00	\$ 10,000	Project experience
Community Monitoring Plan	24	HR	\$ 200.00	\$ 4,800	Project experience
Consultant oversight during Cleanup	200	HR	\$ 200.00	\$ 40,000	Project experience
Closure Reporting	1	LS	\$ 10,000.00	\$ 10,000	
DEQ Oversight	150	HR	\$ 250.00	\$ 37,500	Project experience
Annual Cap Inspections	30	YR	\$ 1,000.00	\$ 30,000	Project experience
Alternative Subtotal				\$ 1,120,899	
Contingency				10%	
Alternative Total				\$ 1,233,000	
Alternative 2 - Excavation and Off-Site Disposal of Soils					
Contractor mobilization/demobilization	1	LS	\$ 151,741.03	\$ 151,741	5% of task total
MW-1 Well abandonment	1	LS	\$ 7,500.00	\$ 7,500	Project experience
Geotechnical and structural evaluation	1	LS	\$ 150,000.00	\$ 150,000	Project experience
Foundation Support Pin Piles	24,533	VLF	\$ 69.20	\$ 1,697,707	RS Means 316333105040
Foundation Support Helical Augers	11,760	VLF	\$ 35.17	\$ 413,599	RS Means 316329130085
Excavation and stockpiling of non-hazardous soils	1,567	CY	\$ 30.00	\$ 47,022	Project experience, RSMeans
Waste characterization collection via composite samples from stockpiles	1	LS	\$ 2,000.00	\$ 2,000	Project experience
Waste characterization laboratory analysis	3	EA	\$ 546.00	\$ 1,638	Stantec Eurofins MSA Rates, 1 sample per 1000 tons
Confirmatory soil laboratory analysis (analyte with exceedance only, each area)	15	EA	\$ 520.00	\$ 7,800	Project experience (single analyte for each excavation only, five for each excavation)
Loading of stockpiles into trucks for transport	1,567	CY	\$ 18.00	\$ 28,213	Project experience, RSMeans 312316420020 4x multiplier for subgrade work
Hauling non-hazardous soil to local Subtitle D landfill	2,400	TON	\$ 92.00	\$ 220,800	2024 Waste Management Quote
Disposal of non-hazardous soil to local Subtitle D landfill	2,400	TON	\$ 63.50	\$ 152,400	2024 Waste Management Quote
Subtitle D Landfill Waste Profile	1	LS	\$ 92.00	\$ 92	2024 Waste Management Quote
Imported soils (on-site) laboratory analysis	7	EA	\$ 728.00	\$ 5,096	Project experience
Haul, place and compact clean, granular backfill soils into excavations up to existing grade. 6" of topsoil.	1,567	CY	\$ 133.12	\$ 208,653	RSMeans 312323141000, 312323240700, 312323200554, project experience. 4x multiplier for subgrade work
Generation of Site-Specific Contaminated Media Management Plan (CMMP)	1	LS	\$ 10,000.00	\$ 10,000	Project experience
Community Monitoring Plan	24	HR	\$ 200.00	\$ 4,800	Project experience
DEQ Oversight	150	HR	\$ 250.00	\$ 37,500	Project experience
Consultant oversight & Closure reporting	200	HR	\$ 200.00	\$ 40,000	Project experience
Closure Reporting	1	LS	\$ 10,000.00	\$ 10,000	
Alternative Subtotal				\$ 3,196,562	
Contingency				10%	
Alternative Total				\$ 3,516,300	
Alternative 3 - No Action					
DEQ Oversight	60	HR	250	\$ 15,000	Estimate based on 2 hrs annually for 30 additional years
Maintain the Site's Basement Security Plan	360	MONTH	\$ 300.00	\$ 108,000	City of Astoria estimate, assume for 30 more years
Alternative Subtotal				\$ 123,000	
Alternative Total				\$ 123,000	

ATTACHMENTS



Client/Project

Project Location

1153 Duane Street
Astoria, Oregon

City of Astoria
Community Development Department
EPA Community-Wide Assessment Grant
Analysis of Brownfields Cleanup Alternatives



Stantec

Title

**Typical Cantilevered Wall
Schematic**

203724092

Attachment

1

Structural Engineering Considerations – Heritage Square - Astoria, Oregon

Structural considerations for each alternative:

Alternative 1: Placing fill in the existing basement and/or as a cap in surrounding areas.

Structural Considerations:

- Assume an “L-shaped” property line type cantilevered concrete retaining wall will be feasible for retaining the new fill material. Currently, we envision the wall on three sides of the basement, and soil being placed against the existing wall on one side.
- Assume that the existing wall (on one side) is a retaining wall with existing soil on the backside. While this would theoretically reduce wall stresses, we are assuming shotcrete strengthening of the wall and mechanical support of the existing footing may be required in the form of helical augers or pin piles. An alternative to wall strengthening might be adding another property line type retaining wall adjacent to the existing wall to avoid placing soil against the existing wall.
- The new retaining walls are assumed to be structurally independent from adjacent existing structures and will not brace or support adjacent existing structures.
- The following soil design parameters are assumed.
 - Retained soil height is assumed to be 9 feet or less.
 - Active soil pressure is 35 pounds per cubic foot (equivalent fluid pressure) or less.
 - Allowable soil bearing pressure is 2,000 psf (pounds per square foot) (preliminary footing sizing shows that with 1,500 psf soil bearing, the footing size diverges to exceedingly large for a property line type footing).
 - 100 psf surcharge loading for public assembly live loads and light weight structures.
- Shotcrete at existing walls can be assumed to be 8-inches thick with #5 rebar at 12-inches on center (oc) each way.

Alternative 2: Removal of all contaminated soils.

Structural Considerations:

- We are assuming that the existing structures are supported on shallow spread foundations and not on pile foundations.
- Removal of material surrounding column footings and wall foundations needs to be completed such that foundations are not undermined or bearing capacity is reduced such that column or wall failures will occur.
- Mechanical support of footings may be required in the form of helical augers or pin piles. Installation of these elements will be difficult and thus more expensive than standard installation due to the confined space below the parking lot.
- This option will require back and forth coordination with geotechnical engineer regarding loads in the existing structures and pile capacity, etc.
- Diagonal piles would be required to provide adequate lateral bracing.
- This option would require small excavation equipment or hand excavation to dig around piles.
- Assume shotcrete strengthening and mechanical support of footings will be required in the form of helical augers or pin piles at existing walls and footings.
- Shotcrete at existing walls can be assumed to be 8-inches thick with #5 rebar at 12” oc each way.

Client/Project

Project Location

1153 Duane Street
Astoria, OregonCity of Astoria
Community Development Department
EPA Community-Wide Assessment Grant
Analysis of Brownfields Cleanup Alternatives

Stantec

Title

Typical Cantilevered Wall
Schematic Notes

203724092

Attachment

1