BASIS FOR SELECTION OF THE PREFERRED CLEANUP ACTION

Addendum to the Remedial Investigation/Feasibility Study
Eldridge Municipal Landfill Site

Public Review Draft

Prepared for

City of Bellingham, Public Works Department
210 Lottie Street
Bellingham, WA 98225

Prepared by

Herrenkohl Consulting LLC
P.O. Box 1000
Lopez Island, WA 98261

and

Wilson Engineering, LLC
805 Dupont Street, Suite 7
Bellingham, WA 98225

September 9, 2015

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

BTC	Bellingham Technical College
City	City of Bellingham
CUL	cleanup level
Cy	cubic yard
DCAP	Draft Cleanup Action Plan
Ecology	Washington State Department of Ecology
MTCA	Model Toxics Control Act
Park	Little Squalicum Park
RI/FS	remedial investigation and feasibility study
SAP	sampling and analysis plan
TCP	Toxics Cleanup Program
WAC	Washington Administrative Code
WISHA	Washington Industrial Safety and Health Act

CERTIFICATION

I, Mark J. Herrenkohl, a professional engineering geologist in the State of Washington, certify that I have reviewed the geosciences portions of this document.

Stamp and Signature of Geologist:

Name: Mark J. Herrenkohl, LEG Date: ______________________

I, Elizabeth Sterling, a professional engineer in the State of Washington, certify that I have reviewed the engineering portions of this document.

Stamp and Signature of Engineer:

Name: Elizabeth Sterling, PE Date: ______________

1 PURPOSE AND SCOPE

This addendum to the remedial investigation/feasibility study (RI/FS) provides the basis for selection of the preferred cleanup action for the Eldridge Municipal Landfill Site (Site), including a description of the alternatives and applied technologies, evaluated in accordance with MTCA remedy selection criteria (WAC 173-340-350 and -360). WAC 173-340-360(2)(a) lists four threshold requirements for cleanup actions including:

- Protect human health and the environment,
- Comply with cleanup standards,
- Comply with applicable laws, and
- Provide for compliance monitoring.

The project alternatives and applied technologies contained in this evaluation are designed to meet these threshold requirements.

When selecting from alternatives that meet the threshold requirements listed above, the selected action must also address the following three criteria (WAC 173-340-360[2][b]):

- Use permanent solutions to the maximum extent practicable,
- Provide for a reasonable restoration time frame, and
- Consider public concerns.

The MTCA analysis of disproportionate costs is used to evaluate which cleanup alternatives are "permanent to the maximum extent practicable." This analysis compares the relative benefits and costs of cleanup alternatives proposed for the Site. Six criteria are used in the disproportionate cost analysis for the Site as specified in WAC 173-340-360(3)(f) including protectiveness, permanence, cost, long-term effectiveness, short-term risk management, implementability, and consideration of public concerns. The qualitative analysis presented in the following sections compares the relative benefits of each alternative against those provided by the most permanent alternative. Many of these criteria are environmentally based while others are related but non-environmental (e.g., implementability).

Herrenkohl Consulting LLC has written this addendum to the RI/FS with assistance from Wilson Engineering, LLC under Contract No. 2011-0142 (including modifications) with the City of Bellingham Public Works Department (City), and with direction from the Washington State Department of Ecology (Ecology) Toxics Cleanup Program.

This document and the RI/FS report are being issued for public review concurrently with the proposed Consent Decree which includes the draft cleanup action plan (DCAP).

2 PROPOSED CLEANUP TECHNOLOGIES

The following proposed cleanup technologies were considered in the evaluation of two remedial alternatives for the Site:

- **Shoring and Slope Stability:** Sheet-pile or soldier-pile installation upslope of residual contaminated areas to stabilize soils before excavation commences.
- **Removal by Excavation:** Excavation of soil by appropriate land-based equipment including excavator, bulldozer, and dump trucks.
- **Subtitle D Landfill Disposal:** Disposal of impacted material generated from removal operations at a permitted off-site Subtitle D disposal facility.
- **Institutional Controls:** Limits or prohibitions on activities that could interfere with the integrity of the cleanup action or result in exposure to impacted soils.

More information on each of these technologies is presented in the following subsections. These technologies are also considered in the evaluation of the two remedial alternatives presented in Section 3 below and summarized in Table 1 at the end of Section 4.

2.1 SHORING AND SLOPE STABILITY

Shoring refers to the process of supporting a structure or unstable slope to prevent collapse during an excavation. The most common temporary shoring used for deeper excavations are driven sheet pile or soldier pile (steel H-piles with wooden lagging) walls.

Sheet pile walls are constructed by hammer-driving or vibrating prefabricated, steel sections into the ground. The complete sheet pile wall is formed by connecting the joints of adjacent sheet pile sections in sequential installation. The main advantages of shoring with sheet piles:

- Light weight and provide high resistance to driving stresses;
- Provide long service life above or below the water table with modest protection; and
- Easy to adapt pile length by either welding or bolting, and joints are less apt to deform during driving.

The major disadvantages of sheet piles:

- Installation is difficult in soils with boulders or cobbles impacting the desired wall depths;
- The shape of the excavation may be controlled by the sheet pile section and connections; and

- Sheet pile driving may cause neighborhood disturbance and potential settlement in adjacent properties due to installation vibrations.

Soldier pile walls are some of the oldest forms of retaining systems used in deep excavations. The steel H-piles are hammer-driven or vibrated into the ground and connected with wooden lagging.

The main advantages of shoring with soldier piles:

- Typically the least expensive shoring system; and
- Allows excavating in small stages while backfilling and compacting the void space behind the lagging.

The major disadvantages are:

- Cannot be used in high water table conditions without extensive dewatering; and
- Not as stiff as other retaining systems.

2.2 EXCAVATION, TRANSPORT, AND OFF-SITE DISPOSAL OF REMAINING CONTAMINATED SOIL

Excavation followed by off-site disposal is a widely-used technique for disposal of non-hazardous and hazardous soil. Experience with many types of wastes and numerous clean-up situations has shown that impacted soils can be safely excavated and transported to an off-site disposal location. This technology was used in the successful removal and disposal of about 4,290 tons of landfill debris and contaminated soil in support of the Site interim action in 2011. The materials were transported to Roosevelt Regional Landfill in Washington State for proper disposal. Off-site disposal of remaining Site soil would involve shoring slopes (refer to Section 2.1), removal of vegetation (e.g., cottonwood trees), excavation of the impacted soil from unstable slopes and an existing wetland, loading the solids into dump trucks and/or rail cars, and transportation to the receiving facility for proper disposal. The excavation would be stabilized by placement of clean fill and hydroseeded. In addition, a ~1,000 ft^2 depressional wetland would be created within the project area to replace the impacted, existing wetland.

Excavation and transport are accomplished by standard techniques and equipment. The field personnel, though, need to be health and safety trained under the Washington Industrial Safety and Health Act (WISHA) to perform work dealing with contaminated soils. Excavation of remaining contaminated soil with off-site disposal offers several advantages:

- The source of future surface water and groundwater contamination from the Site is eliminated by removal of the residual contaminated soil.

- Removal of remaining landfill debris and contaminated soils eliminates all risk to human health and the environment at the Site.

The disadvantages with off-site disposal may include:

- The wastes are not destroyed. The safety of waste disposal is dependent on the long-term integrity of the off-site disposal site. If the off-site disposal facility loses integrity, the facility owner and the facility users may become responsible for remedial work at the site.

- Excavation of impacted soil increases potential for contaminant release while excavation is conducted.

- Transportation of the wastes may create a risk to human safety and the local environment along the transportation route.

- The method of cleanup is dependent on the availability of acceptable off-site disposal sites.

Two Subtitle D landfills have been identified as being able to accept the remaining contaminated soil from the Eldridge Landfill. The Roosevelt Regional Landfill facility in Klickitat County, Washington and the Wenatchee Landfill facility near Wenatchee, Washington can accept all remaining soils. Transport of the soils to the landfills would be accomplished through Allied Waste (Rabanco) and Recycling and Disposal Services, respectively.

2.3 INSTITUTIONAL CONTROLS

Institutional controls in the form of restrictive covenants on the property would be required if residual contaminated soils remain at the Site. The restrictive covenants would document the nature and extent of impacted soils and the remedial action completed for the Site. They may also limit uses of the area, and prohibit the modification without the prior written approval of Ecology. In addition, the restrictive covenants may require owners of the Property to notify all lessees or property purchasers of the restrictions on the use of the Property. The restrictive covenants may also require the owners of the property to provide for continued monitoring and operation and maintenance of the remedial action prior to conveying title, easement, lease or other interest in the Property. The restrictive covenants would be subject to Ecology's approval before being recorded.

3 EVALUATION OF REMEDIAL ALTERNATIVES

This section presents an analysis of the remedial alternatives and applied technologies developed for the Eldridge Landfill Site. The evaluation of each alternative considers the six criteria used in the disproportionate cost analysis listed in Section 1. "No Action" is not considered in this evaluation of remedial alternatives. Table 1 presented at the end of Section 4 provides a comparison of remedial alternatives and applied technologies in relation to the MTCA threshold requirements and six criteria. A narrative for each alternative is presented in the following subsections.

3.1 ALTERNATIVE 1 – WETLAND PLANTING, COMPLIANCE MONITORING, AND INSTITUTIONAL CONTROLS

As described in the RI/FS report, an interim action was completed at the Site in 2011. The interim action consisted of excavating 4,290 tons of landfill materials and contaminated soils and disposing of them at a permitted disposal facility. However, implementation of the interim action resulted in residual contaminated soils being left in a few locations around the periphery of the former landfill, including steep, unstable slopes and within an existing wetland area (Figure 1). Alternative 1 includes the additional measures of wetland planting, compliance groundwater monitoring, and institutional controls to address these areas of residual soil contamination.

Site conditions post-interim action are protective of human health and the environment and meet MTCA minimum requirements for an overall cleanup action (Herrenkohl Consulting and Integral Consulting 2014). Alternative 1 relies on institutional actions to reduce intrusive activities that may disturb the residual contaminated soils. Protection will require maintenance (i.e., grass cutting and removal of invasive plants and tree-starts) and deed restrictions on the property and groundwater monitoring using existing wells within the former landfill footprint. It is recommended that groundwater sampling be conducted during the wet season for two consecutive years. A full review for the need of additional monitoring would be conducted at the end of year 2.

Alternative 1 will also include a requirement for additional wetland planting for the 750 ft^2 depressional wetland created as part of the interim action. Fencing and signs indicating "critical habitat" would be placed around the two wetlands and adjacent cottonwood tree.

The estimated total cost for Alternative 1 is $237,000 (refer to Table 1 and Appendix A).

3.2 ALTERNATIVE 2 – SHORING, EXCAVATION, OFF-SITE TRANSPORT AND DISPOSAL

Alternative 2 includes shoring for slope stability and excavation of residual landfill material and contaminated soil at the Eldridge Landfill Site (Wilson Engineering 2015). As shown in Figure

2, the four areas of excavation total ~9,800 square ft for a total volume of impacted soil removal of approximately 2,950 cy (5,458 tons assuming 1.85 tons/cy). The size and volume estimates for each area are based on previous confirmation sampling upon completion of the interim action in 2011 and includes excavation of clean soil to meet shoring requirements for slope stability during excavation. Following excavation, the soils would be transported to a Subtitle D landfill for disposal.

The closest landfills are in Roosevelt and Wenatchee, Washington. Based on the concentrations of metals in soils removed during the interim action, no treatment will be required prior to disposal.

The excavation and off-site disposal alternative for all soils exceeding the MTCA cleanup levels (CULs) for metals is designed to be protective of human health and the environment. Residual soils of concern would be removed from the Site preventing possible risk from direct contact and potential contamination of surface water and groundwater, and providing the most long-term effectiveness and permanence of the two alternatives considered. Risks related to metals contamination would be transferred to an off-site disposal facility.

The off-site disposal alternative is implementable but has the greatest short-term risk to humans and the environment from disturbance of impacted soils during excavation activities. This includes the requirement for shoring of unstable slopes for Areas 2-4, adjacent to buildings on the Bellingham Technical College campus. Once shoring is established, there is no unusual difficulty expected with excavation, transport, and disposal. The equipment necessary to implement Alternative 2 is also readily available.

The estimated total cost for Alternative 2 is $1,413,000 to manage unstable slopes, excavate, and dispose of a total of 5,458 tons of residual contaminated soils off-site without treatment (refer to Appendix A). The estimated operation and maintenance costs are zero, since the remaining residual soils are removed from the Site; however, watering of the created wetland would be required during the dry summer months until wetland plants are established (about 2 years). No restrictive covenants are required for the property.

4 COMPARISON OF ALTERNATIVES AND TECHNOLOGIES: REMEDY COSTS AND BENEFITS

A summary of the disproportionate cost analysis is presented in Table 1. Appendix A contains a detailed cost breakdown for each alternative. The probable costs of the alternatives range from a low value of $237,000 for Alternative 1 to a high value of $1,413,000 for Alternative 2, each with a 30% added contingency. These costs are expressed in 2015 dollars without adjustments for future cost inflation and without present value discounting of future costs.

Alternative 1 is identified as the preferred alternative, based on a qualitative review of the MTCA analysis of disproportionate costs (Table 1). This alternative combines compliance monitoring and institutional actions while remaining practicable in overall cost. Alternative 1 is permanent to the maximum extent practicable under MTCA, and is identified as the preferred alternative.

Alternative 2 would receive a high benefit ranking, but as clearly identified in Table 1 the cost compared with the benefits gained is significantly greater and is therefore considered impracticable. The additional site preparation, removal, and disposal activities conducted in Alternative 2 expand the soil removal area and disposal volume, but apply these additional efforts to soils with lower metals levels that are safely managed using technologies included in Alternative 1.

Table 1. Detailed Evaluation of Alternatives and Applied Technologies		
Alternative Number, Description, and Ranking	**Alternative 1** Compliance Monitoring and Institutional Controls	**Alternative 2** Shoring, Excavation, Off-Site Transport, and Disposal
Volume of Soil Removal (cy)	0	2,950
Core Costs (Including contingency, refer to Appendix A)	$237,000 (2015$)	$1.413 million (2015$)
Compliance with MTCA Threshold Criteria		
<u>Protection of Human Health and the Environment</u>	Yes – Alternative will protect human health and the environment.	Yes – Alternative will protect human health and the environment.
<u>Compliance with Cleanup Standards</u>	Yes – Institutional controls are used for soils not complying with cleanup standards.	Yes – Active remedial measure (removal) is used for soils not complying with cleanup standards.
<u>Compliance with Applicable State and Federal Laws</u>	Yes – Alternative complies with applicable laws.	Yes – Alternative complies with applicable laws.
<u>Provision for Compliance Monitoring</u>	Yes – Alternative includes provisions for compliance monitoring (i.e., groundwater monitoring).	Yes – Alternative includes provisions for compliance monitoring (i.e., compliance soil sampling during removal).
Restoration Time Frame	Restoration time frame is 1 year for construction of fencing and signage. Groundwater monitoring of 2 years or more may be required to ensure compliance. Landscape maintenance is required for future (30 years).	Restoration time frame is 1 to 2 years for design and construction. Maintenance (e.g., watering) of the restored wetland will be required during the drier summer months until plants are established (~2 years).

Table 1. Detailed Evaluation of Alternatives and Applied Technologies		
Alternative Number, Description, and Ranking	**Alternative 1** Compliance Monitoring and Institutional Controls	**Alternative 2** Shoring, Excavation, Off-Site Transport, and Disposal
Evaluation of Permanence using MTCA Disproportionate Cost Analysis		
Protectiveness:	This alternative will achieve overall protection.	This alternative will be most protective for the Property.
Permanence:	Residual contaminated soils are generally isolated by fill material placed during interim action or isolated using institutional controls. This alternative is not as permanent as Alternative 2.	Alternative eliminates the volume of impacted material by completely removing, to greatest degree technically feasible, impacted surface and subsurface soils throughout the Site.
Long-Term Effectiveness:	Alternative makes most use of containment by fill placement during interim action and institutional controls.	Alternative makes greatest use of removal and off-site disposal.
Short-Term Risk Management:	Less disturbance of residual contaminated soils, most effective short-term.	Most disturbance of residual contaminated soils, least effective short-term.
Implementability:	Most Implementable; access restrictions will be required over portions of the Site permanently.	Implementable; it may require temporary access restrictions during shoring and soil excavation.
Consideration of Public Concerns:	Lower ranking relative to complete removal of residual soils – contaminated material remains onsite	Higher ranking – residual contaminated material removal from site

Notes: Refer to Section 3 for detailed description of each alternative.

5 DESCRIPTION OF THE PREFERRED CLEANUP ACTION

Alternative 1 has been selected as the preferred cleanup action for the Eldridge Municipal Landfill Site. This alternative combines removal of the highest concentrations of metals in soils (interim action) with compliance groundwater monitoring and institutional controls (refer to Section 3.1). The following sections provide additional details of the preferred cleanup action including compliance monitoring, contingency responses, and institutional controls.

5.1 TYPES, LEVELS, AND AMOUNTS OF CONTAMINATION REMAINING ONSITE

As presented in Section 8.3.2 of the RI/FS report, a stepwise approach was used to address potential ecological risks from the residual metal concentrations that exceeded remediation levels after completion of the interim action. The specific metals involved consisted of copper, lead, mercury, and zinc. This stepwise approach involved first calculating depth-weighted soil concentrations, then developing alternative ecological soil cleanup levels, and finally developing exposure-adjusted soil concentrations.

Based on the results of this evaluation, it was determined that the post interim action ecological risk assessment provides sufficient information to conclude that ecological receptors should not be at risk from residual soil metals concentrations present on the landfill site. This determination is based on the clean cover soils and underlying contaminated soils remaining undisturbed. Long-term care is therefore required to maintain these existing conditions in the following specific areas (refer to Figure 1):

- Area 1: Contaminated soils under existing wetland A and the cottonwood tree are below a depth of 0.5 ft to 1.0 ft and contain copper, lead, mercury, and zinc concentrations exceeding the CULs protective of terrestrial species, and lead exceeding a value protective of human direct contact.

- Area 2: Contaminated soils at the base of the steep slope in the southwestern corner of the Site are below a depth of 0 ft to 5.5 ft , and contain lead, mercury, and zinc concentrations exceeding cleanup levels protective of terrestrial species.

- Area 3: Contaminated soils at the base of the steep slope along the southeastern edge of the Site are below a depth of 3.0 ft to 4.0 ft and contain copper, lead, mercury and zinc concentrations exceeding cleanup levels protective of terrestrial species, and lead exceeds a value protective of human direct contact.

- Area 4: Contaminated soils at the eastern end of the Site are below a depth of 4.5 ft to 6.0 ft and contain copper, lead, mercury, and zinc concentrations exceeding cleanup levels protective of terrestrial species, and lead exceeds a value protective of human direct contact.

As also indicated in the RI/FS, the uppermost groundwater potentially impacted by landfill leachate occurs as an unconfined water-bearing zone extending from near land surface to a depth of about 10 feet. The saturated thickness in this water-bearing zone is typically between 6 and 8 feet, and the groundwater in it is separated from deeper aquifers by a silty clay aquitard. None of the compounds or metals analyzed in groundwater samples obtained following the interim action exceeded cleanup levels or were higher than background levels, except for the metals arsenic and iron. Because arsenic and iron in Site groundwater do not currently meet CULs, additional compliance monitoring is required as part of this cleanup action.

5.2 COMPLIANCE MONITORING

Compliance monitoring will be implemented for the Site in accordance with WAC 173-340-410. Compliance groundwater monitoring will be performed as described in Section 6 and with methods presented in the SAP (Herrenkohl Consulting 2012). The objective of the monitoring is to confirm that CULs have been achieved and to confirm the long-term effectiveness of the cleanup action for the Site.

5.3 INSTITUTIONAL CONTROLS

Institutional controls will be required as part of the cleanup action, and will include an environmental covenant, an operations and maintenance plan for the Site, and special boundary fencing and signage. The purpose of these institutional controls will be to protect valuable habitat, to prevent human exposure to residual soil contamination, and to protect terrestrial wildlife at the Site.

The restrictive covenants will be subject to Ecology’s approval before being recorded.

6 IMPLEMENTATION OF THE PREFERRED CLEANUP ACTION

The design and implementation of the cleanup action for the Site will be completed over a period of approximately one year, with additional time to complete compliance monitoring, as necessary. The expected schedule for design and implementation of the cleanup action is described below.

- **Wetland Planting** – Additional wetland planting and installation of a boundary fence and signage will be completed in the fall/winter of 2015. Upon completion of the planting, the plants will be watered once per month during the summer months (July, August, and September) over two consecutive years.

- **Compliance Monitoring** – Groundwater monitoring will be performed to track and confirm the expected decline of arsenic and iron concentrations in Site groundwater. Groundwater samples will be collected during the wettest season (December – March) over two years of monitoring. The samples will be obtained from wells EML-SB-01, -02, -03, and -04, and analyzed for arsenic and iron (dissolved only) following methods described in the sampling and analysis plan (SAP, Herrenkohl Consulting 2012). Standard field parameters (pH, temperature, conductivity, and the redox potential) will also be measured during each sampling event.

- **Designation of Especially Valuable Habitat -** The designation process is expected to take place by the end of 2015.

- **Recording of Environmental Covenant** – An environmental covenant restricting property use and protection of Wetland A and the cottonwood tree will be recorded upon finalization of the Consent Decree. These controls will remain in place indefinitely unless removal is approved by Ecology. Recording is expected to occur by the end of 2015.

- **Preparation of Operations and Maintenance Plan**– Preparation of this document will be completed by the end of 2015.

7 REFERENCES

Herrenkohl Consulting. 2012. Sampling and Analysis Plan, Groundwater Site Characterization, Eldridge Municipal Landfill RI/FS. Prepared for the City of Bellingham, Public Works Dept., Bellingham, WA. Prepared by Herrenkohl Consulting LLC, Bellingham, WA. April 27.

Herrenkohl Consulting and Integral Consulting. 2014. Public Review Draft Remedial Investigation/Feasibility Study, Eldridge Municipal Landfill Project, Bellingham, WA. Prepared for the City of Bellingham Public Works Department, Bellingham, WA. Prepared by Herrenkohl Consulting LLC of Lopez Island, WA in association with Integral Consulting Inc of Seattle, WA. April 18.

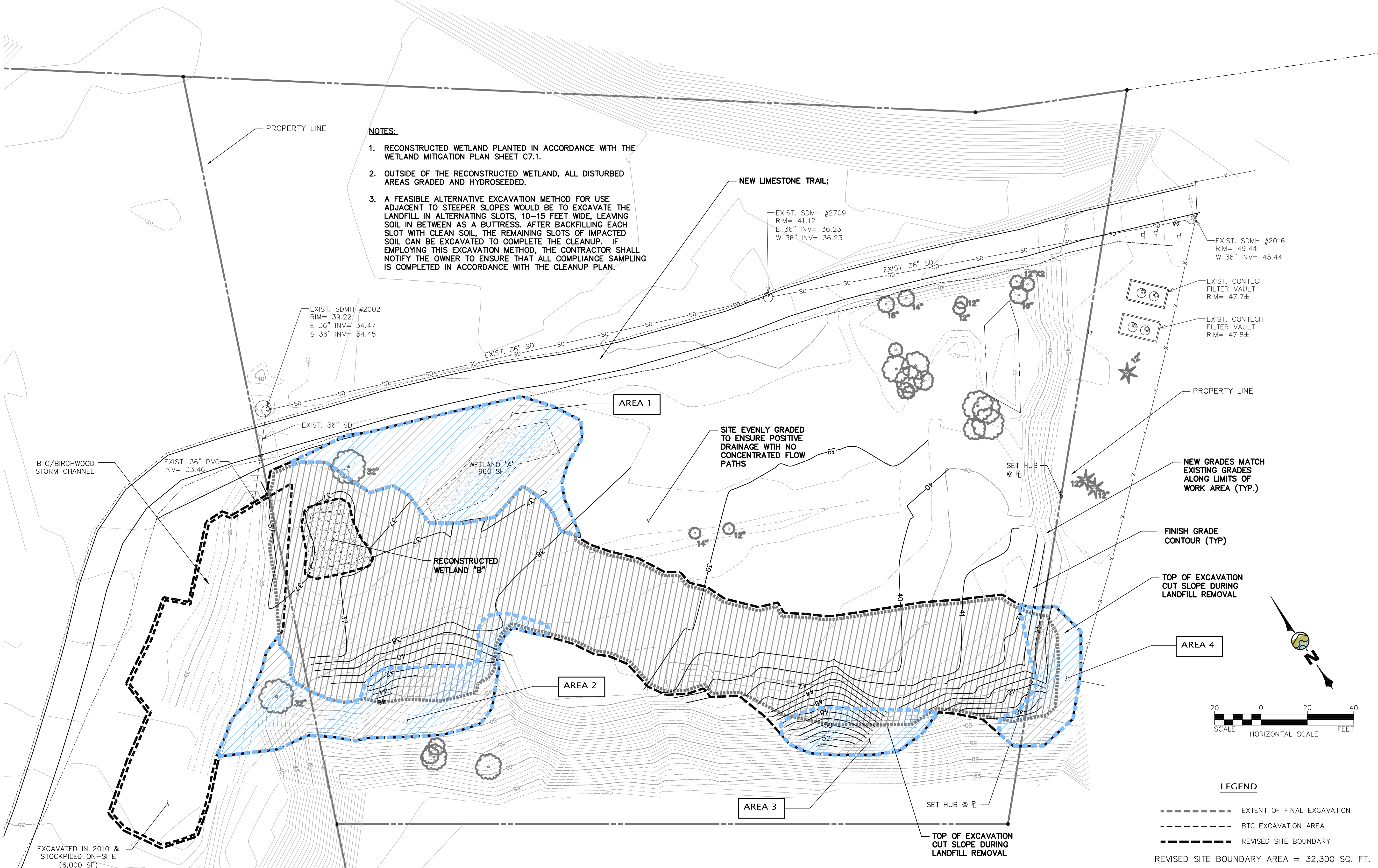
MTCA. Model Toxics Control Act (Chapter 173-340). Prepared by the Washington State Department of Ecology, Toxics Cleanup Program. Last Updated November 2007.

Wilson Engineering. 2015. Memorandum – Civil Engineering & Construction Cost Estimate, Alternative No. 2 – Shoring, Excavation, Off-Site Transport & Disposal, Eldridge Municipal Landfill. Prepared for Mark Herrenkohl, LEG, Herrenkohl Consulting LLC, Lopez Island, WA. Prepared by Elizabeth Sterling, PE, Wilson Engineering LLC, Bellingham, WA. August 31.

NO.	REVISIONS	BY	DATE

NOTES:

1. RECONSTRUCTED WETLAND PLANTED IN ACCORDANCE WITH THE WETLAND MITIGATION PLAN SHEET C7.1.
2. OUTSIDE OF THE RECONSTRUCTED WETLAND, ALL DISTURBED AREAS GRADED AND HYDROSEEDED.
3. A FEASIBLE ALTERNATIVE EXCAVATION METHOD FOR USE ADJACENT TO STEEPER SLOPES WOULD BE TO EXCAVATE THE LANDFILL IN ALTERNATING SLOTS, 10-15 FEET WIDE, LEAVING SOIL IN BETWEEN AS A BUTTRESS. AFTER BACKFILLING EACH SLOT WITH CLEAN SOIL, THE REMAINING SLOTS OF IMPACTED SOIL CAN BE EXCAVATED TO COMPLETE THE CLEANUP. IF EMPLOYING THIS EXCAVATION METHOD, THE CONTRACTOR SHALL NOTIFY THE OWNER TO ENSURE THAT ALL COMPLIANCE SAMPLING IS COMPLETED IN ACCORDANCE WITH THE CLEANUP PLAN.



LEGEND

- EXTENT OF FINAL EXCAVATION
- BTC EXCAVATION AREA
- REVISED SITE BOUNDARY

REVISED SITE BOUNDARY AREA = 32,300 SQ. FT.

AREA 1 =APPROXIMATE LOCATION OF RESIDUAL SOIL CONTAMINATION BASED ON CONFIRMATION SOIL TESTING RESULTS

CITY OF BELLINGHAM PROJECT NAME & NUMBER
ELDRIDGE MUNICIPAL LANDFILL INTERIM ACTION
PROJECT NO. EC-0015

WILSON ENGINEERING, LLC
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100 • FAX (360) 647-9061
www.wilsonengineering.com
Wilson SURVEY/ENGINEERING

ELIZABETH ANNE STERLING, STATE OF WASHINGTON, REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY EAS
DRAWN BY JGS/RDN
CHECKED BY

CITY OF BELLINGHAM

ELDRIDGE MUNICIPAL LANDFILL

SITE BOUNDARY & AREAS WITH RESIDUAL CONTAMINATION

BELLINGHAM WASHINGTON

DATE AUGUST, 2015
SCALE AS SHOWN
JOB NUMBER 2015-101
SHEET FIG 1 OF 1

SUMMARY OF SHORING, EXCAVATION, AND BACKFILL QUANTITIES

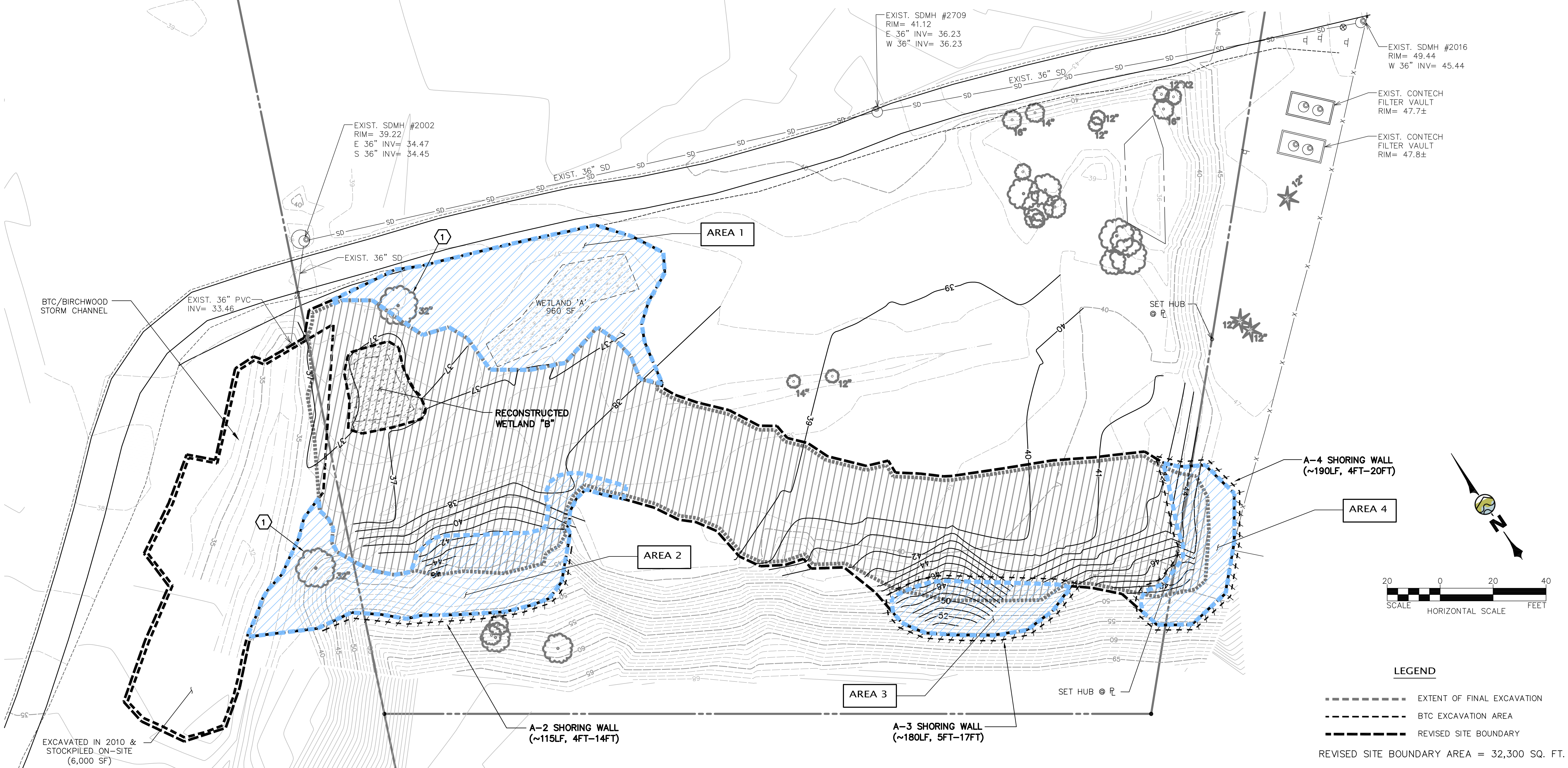
AREA	PLAN AREA	SHORING WALL LENGTH (FT)	SHORING WALL HEIGHT (FT)	SHORING WALL AREA (SF)	BOTTOM OF EXCAVATION (SEE NOTE 1)	EXCAVATION (1) VOLUME (CY) (SEE NOTES 2 & 3)	BACKFILL (2) VOLUME (CY) (SEE NOTE 4)
1	4032	0	0	0	EL. 34.00	523	TOPSOIL– 94 GRAVEL– 623
2	3378	115	4FT–14FT	1435	EL. 37.00	1126	TOPSOIL– 80 GRAVEL– 1477
3	1091	100	5FT–17FT	1890	EL. 40.00	566	TOPSOIL– 26 GRAVEL– 758
4	1322	190	4FT– 20FT	3040	EL. 38.00	735	TOPSOIL– 31 GRAVEL– 907
TOTALS	9823			6365		2950	TOPSOIL– 231 GRAVEL– 3845

NOTES:

1. THE BOTTOM OF EXCAVATION FOR EACH AREA IS BASED ON PREVIOUS CONFIRMATION SAMPLING AT THE COMPLETION OF THE 2011 INTERIM ACTION.
2. EXCAVATED VOLUME IS CALCULATED AS BANK (IN–PLACE) VOLUME.
3. EXCAVATED VOLUME LIKELY INCLUDES CLEAN SOIL TO MEET SHORING REQUIREMENT FOR SLOPE STABILITY DURING EXCAVATION.
4. BACKFILL VOLUME IS CALCULATED AS LOOSE (UNCOMPACTED) VOLUME

KEYED NOTES

(1) = REMOVE EXISTING TREE



CITY OF BELLINGHAM PROJECT NAME & NUMBER
ELDRIDGE MUNICIPAL LANDFILL INTERIM ACTION
PROJECT NO. EC-0015

LEGEND

EXTENT OF FINAL EXCAVATION

BTC EXCAVATION AREA

REVISED SITE BOUNDARY

REVISED SITE BOUNDARY AREA = 32,300 SQ. FT.

AREA 1 =APPROXIMATE LOCATION OF RESIDUAL SOIL CONTAMINATION BASED ON CONFIRMATION SOIL TESTING RESULTS

SHORING WALL

NO.	REVISIONS	BY	DATE

WILSON ENGINEERING, LLC
805 DUPONT STREET
BELLINGHAM, WA 98225
(360) 733-6100 • FAX (360) 647-9061
www.wilsonengineering.com
Wilson SURVEY/ENGINEERING
ANNE STERLING ELIZABETH STATE OF WASHINGTON 41548 REGISTERED PROFESSIONAL ENGINEER

DESIGNED BY EAS
DRAWN BY JGS/RDN
CHECKED BY

CITY OF BELLINGHAM
BELLINGHAM WASHINGTON
ELDRIDGE MUNICIPAL LANDFILL
ALTERNATIVE No. 2 – SHORING, EXCAVATION, OFF-SITE HAUL, AND DISPOSAL EXHIBIT

DATE AUGUST, 2015
SCALE AS SHOWN
JOB NUMBER 2015-101
SHEET FIG 2 OF –

W:\2015\2015-101 Herrenkohl Consulting Eldridge Cost Estimate\Dwg\2015-101 Figures-Based on 2014-016 Figures\Fig2 ALTERNATIVE.dwg, 9/1/2015 8:38:58 AM, JGS

APPENDIX A

PRELIMINARY ENGINEERS COST ESTIMATES

Preliminary Engineer's Cost Estimate	
For Compliance Monitoring and Institutional Controls	
Eldridge Municipal Landfill RI/FS	
Bellingham, WA	
Prepared by: Mark Herrenkohl, LEG	
Herrenkohl Consulting LLC	
Revision Date: 09/09/15 — **REMEDIAL ALTERNATIVE NO. 1**	
Costs Updated: City of Bellingham	
CONSTRUCTION COST ESTIMATE ASSUMPTIONS AND CALCULATIONS	
<u>**DIRECT COSTS**</u>	
PROJECT MANAGEMENT AND ENGINEERING	$ 11,070
City project management, engineering and administration	
Assume 5% of total direct and indirect costs (rounded).	
Also includes $2,500 for Operations & Maintenance Plan	
PROJECT SURVEYING	$ 2,500
Survey and mapping of fenced areas (Wetlands and Cottonwood Tree)	
Wilson Engineering LLC Proposal Dated 07/29/15	
FENCE AND SIGN INSTALLATION	$ 18,400
120 ft x 60 ft of 2-rail cedar fence	
360 linear ft at $50/ft. 4 Signs at $100 each installed on fence, no posts	
Based on Gina Austin, City of Bellingham email dated 0724/15	
WETLAND PLANTING	$ 5,000
Includes cost of plants (30 native plants), installation, and watering for 3 years	
Based on Element Solutions proposal dated 09/10/14	
TOTAL ESTIMATED DIRECT COSTS:	**$ 36,970**
<u>**INDIRECT COSTS**</u>	
SITE MAINTENANCE	$ 122,500
Site Clearing includes grass cutting, removal of invasives and tree-starts (30 years).	
Assume twice each year by City at $7,000 for first 5 years.	
Maintenance requirements of area will decrease after 5 years. Assume $3,500 x 25 years.	
Based on Marvin Harris, City of Bellingham estimate dated 08/21/15.	
Note: cost for grass cutting of open field within site included with other areas of park.	
COMPLIANCE GROUNDWATER MONITORING	$ 23,000
Groundwater monitoring for 2 years (4 onsite wells analyzed for dissoloved arsenic and iron)	
Includes annual report (2 reports).	
Based on Herrenkohl Consulting proposal dated 07/29/15	
TOTAL ESTIMATED INDIRECT COSTS:	**$ 145,500**
TOTAL ESTIMATED DIRECT + INDIRECT COSTS:	**$ 182,470**
Recommended Contingency (Assume 30% of Direct + Indirect Costs)	**$ 54,741**
TOTAL ESTIMATED PROJECT COST:	**$ 237,000**

Preliminary Engineer's Cost Estimate
For Shoring, Excavation, Off-Site Transport & Disposal
Eldridge Municipal Landfill RI/FS
Bellingham, WA

Engineering Prepared by: Elizabeth Sterling, PE of Wilson Engineering LLC
Indirect Cost and Summary Prepared by: Mark Herrenkohl, LEG, Herrenkohl Consulting LLC
Revision Date: 09/09/15

REMEDIAL ALTERNATIVE NO. 2

CONSTRUCTION COST ESTIMATE ASSUMPTIONS AND CALCULATIONS

DIRECT COSTS

	Quantity	Unit	Unit Price	Amount
PROJECT MANAGEMENT AND ENGINEERING				
Project Management	--	--	--	$ 4,260
Engineering, Permitting, Survey, & Design	--	--	--	$ 34,641
Bidding, Construction Staking & Construction Management	--	--	--	$ 27,872
Subtotal - PM & Engineering				**$ 66,773**
MOBILIZATION (~10% of total direct costs)	1	LS	$ 70,000	**$ 70,000**
TEMPORARY EROSION CONTROL				
Silt Fencing	250	LF	$ 8	$ 2,000
Compost Berm	150	LF	$ 6	$ 900
Construction Entrance	225	SY	$ 25	$ 5,625
Subtotal - Temporary Erosion Control				**$ 8,525**
SITE DEMOLITION & SHORING				
Tree Removal	1	LS	$ 12,000	$ 12,000
Clearing & Grubbing - (assume grubbing to a depth of 6-inches)	10000	SF	$ 1	$ 10,000
Dewatering	3	Mo.	$ 2,500	$ 7,500
Shoring				
Shoring Installation	6365	SF	$ 30	$ 190,950
Shoring Removal	6365	SF	$ 5	$ 31,825
Subtotal - Site Demolition & Shoring				**$ 252,275**
SITE EARTHWORK				
Excavation				
Area 1	523	CY	$ 20	$ 10,460
Area 2	1126	CY	$ 20	$ 22,520
Area 3	566	CY	$ 20	$ 11,320
Area 4	735	CY	$ 20	$ 14,700
Disposal of Spoils				
Area 1	968	ton	$ 70	$ 67,760
Area 2	2083	ton	$ 70	$ 145,810
Area 3	1047	ton	$ 70	$ 73,290
Area 4	1360	ton	$ 70	$ 95,200
Embankment				
Area 1				
Gravel Backfill	1152	ton	$ 22	$ 25,344
Top soil	188	ton	$ 60	$ 11,280
Area 2				
Gravel Backfill	2732	ton	$ 22	$ 60,104
Top soil	160	ton	$ 60	$ 9,600
Area 3				
Gravel Backfill	1402	ton	$ 22	$ 30,844
Top soil	52	ton	$ 60	$ 3,120
Area 4				
Gravel Backfill	1826	ton	$ 22	$ 40,172
Top soil	62	ton	$ 60	$ 3,720
Finish Grading	1500	SY	$ 3	$ 4,500
Hydroseeding	13500	SF	$ 0.50	$ 6,750
Wetland Restoration	1000	SF	$ 7.50	$ 7,500
Landscape Restoration	1	LS	$ 5,000	$ 5,000
Subtotal - Site Earthwork				**$ 648,994**
TOTAL ESTIMATED DIRECT COSTS:				**$ 1,046,567**

INDIRECT COSTS

ENVIRONMENTAL CONSTRUCTION OVERSIGHT	$ 20,000
Assume two weeks of oversight work for field personnel (2 persons). Includes performance sampling during construction of each area.	
PERFORMANCE MONITORING (SAMPLING AND TESTING)	$ 5,000
Five samples collected from each area (4 areas). Samples tested for total metals only.	
CONSTRUCTION COMPLETION REPORT	$ 15,000
Report documents results of construction including final volumes, grade, and performance sampling results. City and Ecology deliverable.	
TOTAL ESTIMATED INDIRECT COSTS:	**$ 40,000**
TOTAL ESTIMATED DIRECT + INDIRECT COSTS:	**$ 1,086,567**
Recommended Contingency (Assume 30% of Direct + Indirect Costs)	**$ 325,970**
TOTAL ESTIMATED PROJECT COST:	**$ 1,413,000**