

ENVIRONMENTAL HEALTH & SAFETY

UNIVERSITY *of* WASHINGTON

MONTLAKE LANDFILL PROJECT GUIDE

University of Washington

May 19, 2022

This document is maintained by the University of Washington Environmental Health and Safety Department with the review and input from the Montlake Landfill Oversight Committee.



TABLE OF CONTENTS

I.	Introduction	3
	History.....	3
	Oversight.....	3
II.	Project Planning.....	4
III.	Environmental Requirements and MLOC Guidelines.....	5
	A. Landfill Settlement and Displacement.....	5
	B. Grading	6
	C. Drainage.....	6
	D. Stockpiling	6
	E. Resurfacing Roads and Parking Areas	6
	F. Methane Gas	7
	G. Stormwater Control.....	8
	H. Critical Areas, Wetlands and Shorelines.....	9
	I. Landfill Media Disposal (Cap Soil, Debris, Stormwater and Groundwater)	9
	J. Asbestos-Containing Material.....	10
	K. Worker Safety.....	10
	L. Fencing.....	11
	M. Sports Fields	11
	N. Corrosion Protection.....	11
	O. Structure Foundations.....	11
	Figure 1 – Approximate Boundaries and 1000-foot Buffer Zone of the Montlake Landfill ...	13
	Table 1 - Montlake Landfill Water and Soil Analytical Requirements	14

I. Introduction

The Montlake Landfill, part of the University of Washington (UW) East Campus, is a unique environment containing the Union Bay Natural Area, shorelines, wetlands and a riparian corridor. The area is currently used for vehicle parking, teaching and research, and bird watching. Sports facilities, a golf driving range, and a helipad also occupy the site. Boundaries of the UW East Campus area are delineated in the UW Seattle Campus Master Plan, dated January 2003. Changes to these boundaries are not anticipated.

This Montlake Landfill Project Guide identifies key issues and regulations applicable to the Montlake Landfill and immediate vicinity. It presents guidelines for maintenance and construction activities on the landfill area. It is based on the 1993 East Campus Maintenance Plan and supplements the Union Bay Natural Area and Shoreline Management Guideline, 2010. In addition, it incorporates recommendations made by the Montlake Landfill Oversight Committee (MLOC) presented in the 1999 Montlake Landfill Information Summary.

History

The Montlake Landfill, also known as the Ravenna Landfill, was operated as a burn dump and eventually a landfill by the City of Seattle during the period approximately 1926 through 1966. Municipal solid waste, primarily consisting of residential wastes, was disposed in the landfill. Some limited amounts of industrial waste that could be considered hazardous were also disposed at this location.

Figure 1 presents a map of the Montlake Landfill area. Although the exact limits of the Montlake Landfill are not definitively known, available documentation suggests that the landfill is generally bounded by Montlake Boulevard NE to the west; NE 45th Street to the north; Laurel Village and the Douglas Research Conservatory to the east; and Canal Road, the Intramural Activities Building, and Union Bay to the south.

In 1971, the landfill was closed according to the landfill standards in effect at that time, and was capped with approximately two feet of clean soil. Landscaped areas received an additional six inches of topsoil. Trenching, boring, and excavations activities at the landfill since closure indicates that the cap is less than two feet thick at some locations, and solid waste may be located directly under grass or asphalt-covered locations. A protective 3-foot thick clean soil cap is currently required by the UW.

The landfill consists of varying depths of fill, refuse and peat and has therefore experienced drainage problems due to differential settlement. Clean fill has been added and minor repair work done on the roads, parking areas and sports fields to maintain site usability.

Methane gas is produced in varying concentrations both from the large underlying peat deposit and from decomposing landfill debris.

Oversight

In 1999, UW Executive Vice President Weldon Ihrig established the Montlake Landfill Oversight Committee (MLOC) as an advisory group to help ensure that landfill-related issues are not overlooked, and that appropriate use and protection of the site is ensured in perpetuity. MLOC oversight is limited to projects on UW properties. The MLOC meets each calendar quarter to

assess current and proposed activities in and near the landfill area, and to evaluate new information and regulations associated with the landfill.

In 2000, the departments of Public Health - Seattle & King County (Public Health) and Washington State Department of Ecology (Ecology) conducted a site hazard assessment of the Montlake Landfill. While their assessment did not allow the landfill to be removed from Ecology's Hazardous Sites List, results indicated that if the Montlake Landfill were left undisturbed, the risk of adverse impacts to human health and the environment would be relatively low. Remedial cleanup of the landfill area was not recommended. However, some maintenance, renovation, and construction activities have the potential to disturb the Montlake Landfill cap and debris. Therefore, EH&S must be contacted at 206.616.0585 prior to any activities having the potential to penetrate the landfill cap and disturb landfill debris.

Construction and maintenance activities on the Montlake Landfill must comply with all applicable federal, state, and local laws, regulations, codes, and ordinances.

II. Project Planning

Construction and maintenance projects on the Montlake Landfill are generally expected to have longer timelines and cost more to meet additional structural and environmental requirements. The UW Project Manager must plan ahead as much as possible to shorten timelines and minimize costs.

Permitting and approvals within or adjacent to the Montlake Landfill boundary are difficult to obtain and a lot of preplanning information is required. Wetlands, shorelines, critical areas, methane, the landfill itself all create regulatory reviews by the City, State and Corps of Engineers. Resource agencies like Ecology and Fish and Wildlife want to work with the University as partners and provide important resources and experience to guide projects in this area of campus. Project managers need to include adequate time in project schedules for permitting. Resource agencies (both city, state and federal) carefully monitor the University's activities and projects in this area of campus. Regulations are often difficult to interpret and sometimes seem to be conflicting – it is part of the project planning process to carefully determine what requirements apply to specific projects and often early contact with these experts is required.

It is also important to include University Process Partners, early in the project planning process. University experts in CPO, EH&S and Facilities Services are highly respected by the resource agencies and can provide critical advice as projects are planned in this part of campus. Schedules must allow for the coordination with University, City, State and Federal agencies. While the University has information, surprises and the unknown often occur. These can create additional project costs and time delays. For example, when the soccer field was re-graded, asphalt chunks from a demolished road were buried in the 3' cap of dirt fill, not the 2 feet of clay capping the landfill. The source of the asphalt chunks was never determined however it was thought to be from roads demolished during the construction of I-5. The end result was that this created extra costs for additional grading, infill and haul-off. New findings such as this during a project may result in the need to coordinate with resource agencies as well.

Project Managers and EH&S staff must coordinate closely whenever construction or excavation occurs on the landfill since landfill debris and cap soil within 3 feet of landfill debris cannot be reburied onsite. EH&S reviews activities having the potential to penetrate the landfill cap and disturb landfill debris. EH&S will determine proper containment, transport and disposal of excavated materials based upon sampling performed by the environmental consultant (see Section III.I – Landfill Media Disposal).

The following are general landfill project planning recommendations based on experience with previous projects:

- Investigate available records for information regarding the location and type of landfill materials in the project vicinity. Municipal solid waste (MSW) was disposed of in the landfill and includes waste that could be classified as a regulated dangerous waste. The UW Campus Engineering Records Vault has aerial photographs of the landfill which may help to determine the extent and age of specific landfill materials.
- If excavated landfill debris is expected to designate as a dangerous waste, consider alternative designs or methods.
- Adopt maintenance activities that minimize excavated landfill debris. Certain maintenance activities, such as fence pole installations and utility line repairs, may be shallow enough to avoid the protective cap and the landfill debris below it. Nonetheless, soils removed must be characterized following the analytical requirements listed in Table 1 to determine disposal options. Landfill debris and the cap soil within 3 feet of this debris cannot be reused.
- EH&S provides regulatory and technical assistance, and in most cases, is the liaison to regulatory agencies for the UW. However, the project manager may need to acquire the services of consultants to assist in environmental planning, design, and the collection of environmental samples.

III. Environmental Requirements and MLOC Guidelines

UW administrative policy (Administrative Policy Statement 11.3 Pollution Control) requires compliance with all applicable environmental regulations. This document and the Methane Action Plan, both available on the EH&S Web site, provide brief descriptions of applicable environmental and operational requirements and guidelines as they relate to activities on the landfill. The applicability of these regulations to a particular activity depends on the project scope. Applicability should be determined during the project planning.

A. Landfill Settlement and Displacement

To assess landfill settlement and the impact that landfill debris might have on Union Bay, UW Campus Engineering UW Capital Projects Office monitored landfill settlement and horizontal displacement in the landfill. Settlement was measured at twenty landfill locations. Horizontal landfill displacement was assessed at various landfill depths using ten (10) inclinometer wells located along the Union Bay shoreline. All measurements were taken at least annually. The

monitoring results assist in landfill management. Monitoring results are documented in the **Montlake Landfill Long-Term Movement Study** reports available from UW Campus Engineering. The UW may implement additional field-testing or monitoring during projects to gather information concerning soil settlement.

B. Grading

Where possible, areas may be graded to acceptable elevations and slopes using cut and fill. At some locations, it may be necessary to raise grades to accommodate sports field underground drainage systems, and to maintain a protective 3-foot thick landfill cap. A Washington State licensed civil engineer must prepare all grading plans. The site must also be inspected to determine that the grading work is done according to this plan (see “Landfill Media Disposal” for further guidance on managing landfill cap materials).

Most maintenance activities at East Campus parking lots, sports fields, and roads are exempt from SEPA (WAC 197-11-800(3)) review requirements. Contact the UW CPO Environmental Planner (206.543.5200) to verify that planned project activities are exempt from SEPA requirements.

C. Drainage

The following criteria are considered the minimum slope for positive surface drainage.

Seeded Areas 0.5% - 3%

Road/Walkways 0.5% longitudinal, 2% transverse

Roadside Drainage 0.5% longitudinal

Parking Areas 0.5%

When differential settlement has reduced the above slopes by 50% or more, the UW intends to maintain minimum slope as suitable material becomes available.

D. Stockpiling

Due to the proximity to the wetlands and concerns with differential settlement, contractors are not allowed to stockpile materials generated by construction and maintenance activities at other Seattle Campus locations on the Montlake Landfill.

The Outside Maintenance Zone, Recreational Sports Programs and Intercollegiate Athletics are allowed to stockpile clean materials on the landfill for use in general operation and maintenance of campus grounds. The quantity of stockpiled material should be minimized.

Soil that has been excavated from the Montlake Landfill must be temporarily stockpiled on plastic sheeting and covered pending waste characterization and the establishment of a waste profile to a UW approved disposal site (see section III.I – Landfill Media Disposal).

E. Resurfacing Roads and Parking Areas

Roads and parking areas should be in safe and usable condition year-round. Maintenance activities include restoring sub-grades using excavated earth to provide positive drainage to catch basins and drainage ditches. During the winter months, some of the roads and adjacent

walkways may become partly submerged due to differential settlement. Facilities Services is responsible for coordinating the maintenance of the roads, parking areas and walkways.

The existing roads and parking areas are primarily paved with asphaltic concrete; only a small portion is gravel surfaced. Because of concerns with methane accumulation underneath paved surfaces, installation of gas permeable surfacing materials is generally necessary. The Montlake Landfill Oversight Committee will review this issue on a case-by-case basis and make a recommendation.

Road and parking lot maintenance should occur primarily between April and October to minimize disruption to users and maximize favorable weather conditions. All resurfacing and paving projects will take into account protection of nearby wetlands and wildlife habitats. Stormwater sediment control measures will also be implemented as outlined in this document.

Projects involving the expansion of roads, paved areas and parking lots must be reviewed and approved by the MLOC and comply with the Campus Master Plan.

F. Methane Gas

The methane hazards include fire and explosion in confined or enclosed spaces; oxygen deficiency in underground trench vaults, conduits, and structures; and the presence of hydrogen sulfide gas, which is toxic and flammable.

Chapter 10.09 in the Title 10 King County Board of Health Solid Waste Regulations administered by Public Health - Seattle & King County impacts the UW's use of the Montlake Landfill area. Among other requirements, UW must 1) monitor methane following an approved sampling and testing program, 2) provide for adequate venting of gases generated by solid waste, 3) prevent migration of methane, and 4) follow construction standards for methane control.

UW is required to prevent methane from migrating to or beyond the property boundary above or below the ground in concentrations greater than the lower explosive limit for methane (5% by volume), or in excess of 100 parts per million by volume of hydrocarbons in off-site structures, or in excess of 25% of the lower explosive limit in on-site structures. The UW conducts quarterly methane gas monitoring and has developed a Methane Action Plan to implement methane mitigation measures whenever methane monitoring results consistently exceed regulatory actions levels. Methane monitoring surveys are done at methane wells in and around the perimeter of the landfill, at parking lot methane vents, and at UW structures on and off of the landfill. The results of these surveys can be obtained by calling EH&S at 206-616-0585.

All construction and maintenance activities that occur on or within 1000 feet of the boundary of the Montlake Landfill will prevent methane migration and comply with the King County Board of Health Code Section 10.09.060 Construction Standards for Methane Control. If new structures or major site improvements are proposed on or within 1000 feet of the Montlake Landfill, Project Managers will submit work plans, site plans, and specifications to the local building department and the Public Health – Seattle & King County's Solid Waste Program, Mail Stop: CNK-PH-1100, 401 Fifth Avenue, Suite 1100, Seattle WA 98104-1818. The plans and specifications will contain a description of the investigation and recommendations for preventing the accumulation of methane gas above regulatory limits. Public Health will review

the submittals to determine if public health risks have been adequately addressed and will provide comments, recommendations, and/or approval to the Project Manager.

Methane has been detected at explosive levels in some areas of the landfill. Therefore, any construction, especially of conduits, vaults and utility lines, must make allowances for encountering the gas. Design and construction of underground utilities must be such as to preclude their serving as conduits for conducting methane gas away from the landfill and into the structures that they serve. Every effort must be made to design and construct structures in compliance with appropriate fire and electrical codes and in a manner that will not allow the accumulation of the lighter-than-air methane in enclosed spaces and along electrical lines.

When constructing a new building, parking lot or performing other major maintenance activities on or within 1,000 feet of the landfill, be prepared to install a methane mitigation system. Methane mitigation systems may be passive or active gas venting systems. Active gas venting systems should be on emergency power and connected to a control system that alerts technicians if the system needs service.

Consult with an EH&S fire protection engineer to determine if a building or room needs methane gas detection. If detection is required, connect the gas detector to a trouble signal for service or the building fire alarm to signal a building evacuation if gas is detected at a predetermined level. A methane alarm system is not required by code for occupied facilities.

Health and safety plans must be prepared for all facility and construction projects and should include the following precautions:

- No smoking within the construction site
- Wear non-sparking shoes and use explosion-proof tools in manholes, trenches, vaults, or other enclosed areas
- Use construction equipment equipped with vertical exhausts and spark arrestors
- Conduct methane monitoring during all excavation activities
- Restrict the use of blowtorches to melt ice around manholes, instead substituting the use hot air, water or steam
- Require Confined Space Awareness and Confined Space Entry training for workers where applicable. Employees who may be exposed to a hazardous environment should not work alone. Confined space workers must have rescue equipment readily available.

G. Stormwater Control

If not properly managed, stormwater runoff associated with maintenance, renovation, and construction activities may negatively impact Union Bay water quality. The City of Seattle, Ecology, and EPA regulate stormwater runoff within the Montlake Landfill. A Certified Erosion and Sediment Control Lead (CESCL) may be required to complete reports for Ecology. Refer to the [Site Contamination Design Guide](#).

H. Critical Areas, Wetlands and Shorelines

The UW complies with applicable critical area regulations for development on an abandoned landfill (Seattle Municipal Code 25.09.220). Work plans must address liquefaction and methane mitigation.

Federal, State, and local laws protect wetlands. Wetland delineations must be conducted following the methodology outlined in the U.S. Army Corps of Engineers wetland delineation manuals. Wetlands are rated using Ecology's Washington State Wetland Rating System for Western Washington (Ecology 2014). The City sets wetland buffer widths based on the wetland rating category and level of wetland habitat function (Chapter 25.09.160 of the SMC 2015). The Union Bay Natural Area contains a large shoreline area and a riparian corridor designation along the banks of the University Slough. The University will continue to delineate wetlands and buffers as projects are proposed.

The State Shoreline Management Act of 1971 requires Shoreline Management Permits when undertaking "substantial development" on State shorelines (WAC 173-018). The UW has an agreement with the City of Seattle that says that any project within 200 feet of a shoreline district will be carefully reviewed by the Environmental Planner, UW Capital Projects Office, and the Senior Project Director, UW Planning and Management. Please contact these UW executives in the earliest stages of project planning. A Joint Aquatic Resources Permit Application (JARPA) must be completed and submitted to the U.S. Army Corp of Engineers before projects impact wetlands or shorelines.

The Center for Urban Horticulture (CUH) has responsibility for managing the Union Bay Natural Area (UBNA), wetlands and all University shorelines, including the University Slough. CUH documents how the area will be managed to preserve habitat value and research/teaching potential in the [Union Bay Natural Area and Shoreline Management Guidelines, 2010](#).

Projects expected to impact wetlands or wildlife habitat require Montlake Committee review prior to implementation. CUH and Facility Services will work together to ensure maintenance activities on the Montlake Landfill are appropriate.

I. Landfill Media Disposal (Cap Soil, Debris, Stormwater and Groundwater)

The Montlake Landfill site is on the Washington State Hazardous Sites List. Activities disturbing the landfill are subject to the Department of Ecology Solid Waste (WAC 173-350), Model Toxics Control Act (MTCA) (WAC173-340) and Dangerous Waste (WAC173-303), and Seattle King County Health Solid Waste (Chapter 10.04) requirements.

Environmental Plan - If a project is going to excavate into the landfill, an environmental plan is required that addresses procedures for collecting representative samples, laboratory analysis (see Table 1), containment and proper disposal of landfill media. Contact EH&S at 206.616.0585 to confirm the approved approach for each excavation project.

Debris and Contaminated Media Disposal - All landfill debris and contaminated media must go to a [UW approved disposal site](#). If excavated materials designate as a hazardous waste, EH&S will arrange for containment, transport and disposal of the material, otherwise the Project Manager will arrange for the containment, transport and disposal of the material at a

UW approved municipal landfill under an EH&S signed waste profile. For assistance with management and disposal of landfill media please contact EH&S at 206.616.0595.

Cap Soil - Seattle King County Health restricts the reuse of cap soil. Cap soil is defined as the 3-foot thick layer of soil located above the landfill debris. Cap soil cannot be reused and must be disposed at a UW approved facility. However soil located above this cap soil may be reused as “clean soil” fill on the landfill site if representative samples do not exceed MTCA cleanup levels (see Table 1).

Costs - Project budgets pay environmental costs and are normally recharged the final hazardous waste disposal costs. Pre-planning and addressing the costs in contract documents saves time and money. EH&S can help estimate disposal costs.

Planning - To minimize time and costs associated with excavation projects on the landfill, do the following:

- Design projects so that activities do not unnecessarily disturb landfill debris.
- Design projects so that clean soils are added to "low" areas where the cap is relatively thin, and soils are removed only from "high" areas where the cap is greater than 3-feet thick. A 3-foot minimum soil cap must be maintained.
- Segregate “clean” soil that is above the 3-foot cap, as defined above, from landfill debris whenever possible for testing, disposal and/or reuse purposes.
- Pre-characterize landfill media for disposal cost estimation. The number of borings and soil samples to adequately pre-characterize a project site vary by the square footage of the project site and the depth of the planned excavation. Contact EH&S with a sampling plan. Plan on at least 10 soil borings per ½ acre and at least 2 soil samples per boring.
- Perform non-destructive testing of the site, such as ground penetrating radar or electro-magnetic imaging to locate metallic objects such as barrels or other large obstructions above the water table.

J. Asbestos-Containing Material

Asbestos-containing (ACM) material was encountered during renovation of the E1 parking lot located within the limits of the Montlake Landfill. Asbestos-containing material may also be encountered at other locations within the boundary of the Montlake Landfill. Anticipate the cost to sample, handle, and dispose of asbestos-containing material and budget accordingly.

Contact EH&S (206-616-0585) if any landfill debris is encountered or suspected during excavation activities. Asbestos sampling, handling, and disposal work must be conducted by an accredited asbestos professional under the EPA Asbestos Emergency Response Act of 1986 (AHERA) and shall also comply with local, state and federal regulations, and UW policy [UW APS 12.1, Managing Asbestos and Other Regulated Building Materials](#).

K. Worker Safety

Physical contact with landfill debris and groundwater may negatively impact human health. Therefore, the following tasks should be completed:

- Inform all UW and contract employees who may contact landfill debris of the potential health hazards associated with landfill debris and groundwater. Worker exposure concerns include methane, hazardous materials exposure, and physical hazards. All employees must be trained to take the appropriate health and safety precautions.
- A site-specific health and safety plan must be drafted and implemented during maintenance, renovation, and/or construction activities.
- Consider hiring a consultant familiar with worker protection issues if this capability is not with the environmental consultants. Some environmental consultants are geotechnical firms but lack worker protection capability.
- Be sure the contractor and its subcontractors are performing the work in a safe manner. Contractors are responsible for protecting their workers from exposures to hazardous materials, and should ensure all workers are protected and HAZWOPER (hazardous work operations and emergency response) trained. Contractors should also ensure workers are AHERA Certified before working with potential asbestos-containing material.

L. Fencing

The East Campus area is partly fenced. Fencing may be installed in the future for safety or security reasons.

M. Sports Fields

Sports fields and other athletic facilities should be safe in order to maximize usage by UW students, faculty and staff. Necessary safety maintenance may involve fill, grading, topsoil, reseeding, landscaping, etc. Any maintenance of sports fields or Intercollegiate Athletic Facilities cannot negatively impact wetlands or shorelines. The amount of soil needed to level the fields is generally less than 500 cubic yards per year. Contact the Capital Projects Office Environmental/Land Use Compliance Officer to determine permit requirements.

The Directors of Recreational Sports Programs and Intercollegiate Athletics will be responsible for coordinating the maintenance of the recreational fields, golf driving range, competitive soccer fields and baseball facilities found in the landfill area.

N. Corrosion Protection

Consider performing a corrosivity test on the soils to determine if corrosion protection is necessary for underground utilities or foundation systems. If using steel pipe piles, consider increasing the wall thickness to achieve sufficient corrosion protection. On the IMA Expansion project, it was determined that an additional ¼ inch wall thickness of steel pile created foundations which would last in excess of 100 years.

O. Structure Foundations

The Montlake Landfill area contains a wide variety of subsurface layers. The layers generally consist of a landfill cap, mixed refuse and wood waste fill, spongy peat deposits, and soft clay over dense glacial deposits. The thickness of each layer varies greatly across the Montlake

Landfill area. Due to this complicated subsurface layering, it is essential that every new structure proposed include a geotechnical engineer and structural design engineer.

Pile Foundations- In general, new structures must be pile supported with the piles installed through the fill, refuse, and peat layers into the underlying dense glacial deposits. Auger cast piles and batter piles are not recommended. The design must account for the future settlement around new pile supported structures. Design items that must be considered include the hinging of approach sidewalks, ramps or stairs as well as providing flexible connections for all the utilities

Alternative Foundations- Consideration will be given on a case by case basis for the use of alternative foundation types if it can be adequately demonstrated that the total and differential settlements are within acceptable limits for the type of building. The UW Project Review Board and the user of the building and associated site needs to be informed of the settlement risks and subsequent long term repair costs. The alternative foundation proposed must thoroughly consider all the potential geotechnical issues including long term and differential settlement and must result in a safe stable building. The effect of settlement must consider the effect on surrounding surface features including roadways, fields, pathways, utilities etc. The existing soil cap over the refuse must be of sufficient thickness so that a minimum 3-foot clean soil cap remains below the construction of the proposed alternative foundation type and necessary sub grade treatment. In no case will conventional shallow footings be allowed except for the case of lightweight structures as described below. Preload of a site is not an allowable alternative method. Leveling methods such as jacks should be included in the design to facilitate periodic adjustment of the structure if and when differential settlement occurs.

Lightweight Structures- Shallow foundations may be used to support lightweight structures on a case by case basis. The geotechnical engineer will determine if over excavation and structural fill is needed. Such lightweight structures may include sheds, greenhouses, etc. A lightweight structure must not weigh over 50 PSF (pounds per square foot) dead load over the footprint of the structure. This 50 PSF dead load is to include the weight of any material stored for long periods (over 3 months). If a "floating" type foundation is proposed, where the new dead load does not exceed the dead load of the removed soil, this 50 PSF dead load amount for "Lightweight Structures" may not be used as an allowable increased residual dead load.

General- All foundation and building designs must consider and resolve the effect of potential soil liquefaction due to seismic movement. All foundations must maintain the minimum 3-foot deep clean soil cap thickness over landfill debris. Basement construction is prohibited. A geotechnical report must be submitted for all proposed structures. The geotechnical engineer must utilize existing geotechnical records and borings as well as perform any additional field exploration necessary to formulate their recommendations.

For all structures, refer to Section III.F -- Methane Gas for requirements to ensure protection from methane gas.

Figure 1 - Approximate Boundaries and 1000-foot Buffer Zone of the Montlake Landfill

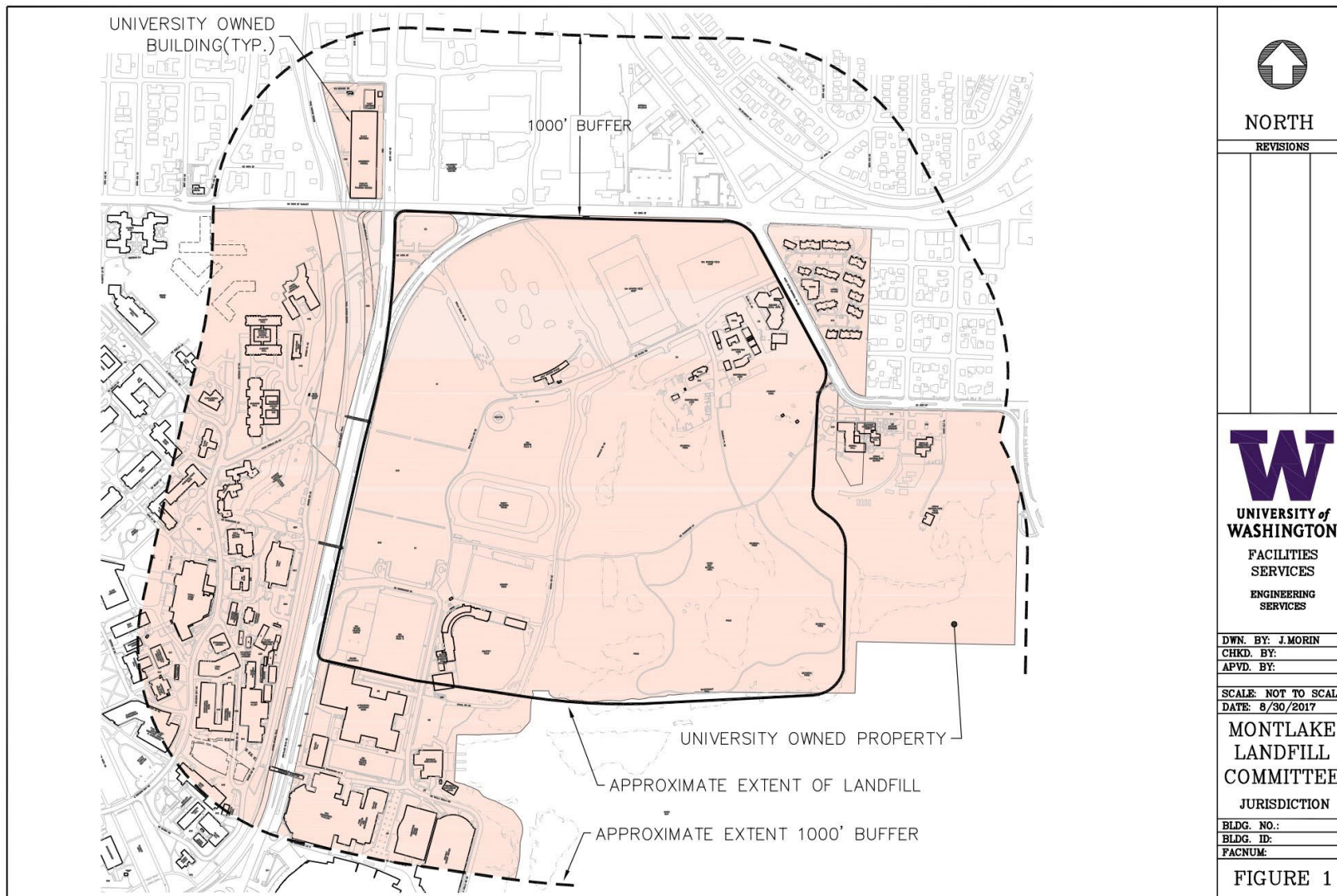


Table 1 - Montlake Landfill Water and Soil Analytical Requirements

A UW employee will hire an environmental consultant to provide environmental services such as sampling and analysis at project sites to protect UW liability.

Pre-characterize site soil and groundwater before construction: The number of borings and samples to adequately pre-characterize a project site vary by the square footage of the project site and the depth of the planned excavation. Contact EH&S with a sampling plan. Plan on at least 10 borings per ½ acre and at least 2 soil samples per boring. Collect groundwater samples if site dewatering will be necessary.

Analyzing soil stockpiles: Shall be representative of the media in question with a minimum of three composite samples per 100 cubic yards. Each composite shall include at least 10 randomly selected components. (See WAC 173-340 and the Guidance for Remediation of Petroleum Contaminated Sites - Revised June 2016).

Contaminant	EPA Test Method	Approximate Cost (ea.)*	Collection Containers	Analysis Time
Metals (Total) <ul style="list-style-type: none"> Arsenic Chromium Lead TCLP analysis may also be required to meet disposal requirements depending on the results of a total metal test.	EPA 200.7 6000 & 7000 series	\$70	Liquids: 1 liter glass (with HNO ₃) Solids: 8 oz glass jar	10 days
Asbestos If landfill debris is suspected/encountered, samples must be collected by an AHERA-certified building inspector.	EPA 600/R-93-116 Asbestos by PLM <bulk>	\$7	Plastic zip-lock bag or screw-top plastic vial	5 days
Gasoline range hydrocarbons and volatile organic compounds (BTEX)	NWTPH-Gx and BTEX EPA Method 8021	\$75	Liquids: Two glass VOA vials (40 ml with HCl, no head space) Solids: 8 oz soil	5 days
Diesel fuel/heavy oil range hydrocarbons	NWTPH-Dx	\$95	Liquids: 1 liter amber glass with PTFE seal Solids: 8 oz glass jar	5 days
Polychlorinated Biphenyls (PCBs) Required for disposal purposes when heavy oil range hydrocarbons are present	EPA Method 8082	\$95	Liquids: 1 liter amber Solids: 8 oz glass jar	10 days
Polynuclear aromatic hydrocarbons (PAHs)	EPA 8270 sim	\$215	Liquids: Two 1 liter amber glass Solids: 8 oz glass jar	10 days
Total settleable solids (TSS)	160.5	\$18	Liquids: 1 liter glass or plastic	10 days
Total dissolved solids (TDS)	160.1	\$18	Liquids: 250 ml glass or plastic	10 days
Turbidity	180.1	\$18	Liquids: 250 ml glass or plastic	10 days
pH	9045B, 150.1	\$18	Liquids: 100 ml glass or plastic	10 days
Dissolved oxygen	360.1	\$18	Liquids: 250 ml BOD bottle	10 days

*Fees are estimated and will change substantially over time and between analytical laboratories.