APPENDIX A

Phase 1 Advisory Committee Final Report and Recommendations

Scriber Creek Flood Reduction Advisory Committee

Final Report and Recommendations to Lynnwood City Council

July 2014

Scriber Creek Flood Reduction Advisory Committee Members

The following Advisory Committee members submit this report on Scriber Creek Flood Reduction to City Council for their consideration. Committee members express their appreciation to City Council for the opportunity to provide input in this process.

Josh Brower, Great Floors Representative

Miran Che, Eunla Plaza

Nora Chin, Citizen

Dave Gilbertson, Parks Board

Brian Harding, Edmonds School District

Larry Ingraham, Citizen

Chris Nyhus, Business Owner

Matt Pease, Business Owner

David Plodwick, Citizen

Ed dos Remedios, Citizen

Roz Smith, Casa Del Rey

Eric Whitehead, Casa Del Rey

TABLE OF CONTENTS

Executive Summary

Scriber Creek flooding has adversely affected residents, businesses, and neighborhoods in the creek's corridor, specifically those residing and working between 188th Street SW and 196th Street SW in Lynnwood. In October 2013, the City of Lynnwood ("the City") hired a team of consultants led by Herrera Environmental Consultants to assess the creek's existing conditions, determine a suite of flood reduction alternatives that would help alleviate flood risk in the corridor, and to evaluate those alternatives in detail to form recommendations for a flood reduction action plan. To help ensure that the alternatives chosen by the City were both technically feasible and supported by the public, the City of Lynnwood Mayor Nicola Smith authorized the formation of the Scriber Creek Flood Reduction Advisory Committee ("the Committee") to help guide the City and its consultant team in selecting which flood reduction alternatives to evaluate in their technical studies.

From March to June 2014, the Committee met four times and dedicated a combined 120 hours to discuss flooding patterns, known flood events, comparative evaluation criteria that should be used to guide the City's decision-making, and potential flood reduction alternatives. This Recommendations Report is the culmination of the Committee's work and outlines the preferred flood reduction alternatives that the Committee would like to see the technical consultants evaluate in the second phase of the Scriber Creek Flood Reduction Study. The Committee recommends evaluating the following alternatives:

1. Creating a regional flood storage site at the Edmonds School District property.

2. Realigning the culvert beneath the Casa Del Rey condominiums access roadway and improving the channel between Casa Del Rey and 196th St. SW, particularly the section of the creek under the rear entrance to the Parkview Square Business Center.

3. Increasing flood storage at Scriber Lake, while reconfiguring the lake inlet and outlet controls.

4. Use hydraulic modeling to evaluate flood prone properties at a specified level of service to determine where flood prone properties are both currently and if stream culverts are replaced. With this knowledge, the City can consider buyouts of flood prone properties and/or incorporate distributed detention/storage ponds where possible.

5. Replacing the culvert(s) under 196thSt. SW.

6. Raising the road at 188th St. SW and possibly excavating upland areas around the existing wetland area through which the creek flows to create more flood storage.

7. Raising portions of "old 196th," and driveway access to Park View Plaza and Great Floors and/or removing the old 196th bridge.

8. Developing a continuous sediment removal program that would remove sediment deposition in the creek channel as needed, as well as engaging in channel stabilization where the creek banks are eroding to reduce the sediment sources within the channel.

Background

Repeated and significant flooding has occurred for the past 20 years in the Scriber Creek corridor between 188th Street SW and 196th Street SW in Lynnwood, impacting private residences, businesses, property, streets, and other infrastructure. The flooding problems within this portion of the Scriber Creek basin occur on both public and private property. Homeowners, businesses, and the travelling public are all adversely affected when flooding occurs. The City of Lynnwood (City) is commencing a concerted effort to plan for flood reduction improvements in this corridor, and seeks to collaborate with affected land owners, residents, businesses, and other interested parties to identify specific flooding problems, evaluate a range of solutions, and ultimately to implement a suite of actions to effectively address flooding problems.

Introduction

On January 15, 2014, City of Lynnwood Mayor Nicola Smith authorized the formation of the Scriber Creek Flood Reduction Advisory Committee ("the Committee") to advise the City on the public's preferred suite of flood reduction alternatives that the City's technical consultants should focus evaluation efforts on in the second phase of the Scriber Creek Flood Reduction Study. The City of Lynnwood hired Triangle Associates, Inc. (Triangle), as part of the Herrera Environmental Consultants team, to facilitate the Committee's business.

The Committee's purpose was two-fold:

1. Document where community members have seen flooding and the severity of that flooding; and
2. Provide community perspectives on proposed solutions that are put forward by either the City or Committee members.

The City was looking for advice and innovation from the Committee, and will incorporate the Committee's input, as well as feedback from the broader public, into its decision-making process to the maximum extent feasible.

Process

The Scriber Creek Flood Reduction Advisory Committee met four times dedicated a combined 120 hours in an effort to identify which suite of flood reduction alternatives warrant thorough evaluation by the City. During these meetings, Committee members provided the project team with narrative feedback on past flood events in the study corridor, identified the Committee member's goals, objectives, and criteria for the project, and outlined their preferred suite of flood reduction alternatives.

The Advisory Committee has compiled its recommendations in this report to the Lynnwood City Council.

Scriber Creek Flood Reduction Advisory Committee Participants

Nick Aldrich	City of Lynnwood Parks Board Representative
Josh Brower	Great Floors Representative
Miran Che	Owner of Eunia Plaza
Nora Chin	Homeowner
Dave Gilbertson	City of Lynnwood Parks Board Representative
Brian Harding	Edmonds School District Facilities Operations Director
Larry Ingraham	Citizen
Chris Nyhus	Park View Plaza Business Owner

Matt Pease	East Park View Plaza Business Owner
David Plodwick	Homeowner
Ed dos Remedios	Homeowner
Roz Smith	Casa Del Rey Condominiums
Eric Whitehead	Casa Del Rey Condominiums

Meeting Attendance

	Meeting 1 3/17/14	Meeting 2 4/21/14	Meeting 3 5/19/14	Meeting 4 6/16/14
Nick Aldrich	✓			
Josh Brower	✓	✓	✓	✓
Miran Che	✓			✓
Nora Chin	✓	✓		✓
Dave Gilbertson	✓		✓	✓
Brian Harding	✓	✓		
Larry Ingraham	✓	✓	✓	✓
Chris Nyhus	✓	✓		✓
Matt Pease		✓		✓
David Plodwick	✓	✓	✓	✓
Ed dos Remedios		✓	✓	✓
Roz Smith	✓	✓	✓	✓
Eric Whitehead	✓	✓	✓	✓

Consensus Definition

The Committee aimed to come to consensus on which alternatives to put forward as recommendations to the City Council. According to the Advisory Committee operating protocols:

"Consensus is defined as agreement of all members, and will be the preferred method of determining Committee agreement on issues. Full consensus involves agreement of all members, described as:

Consensus: The group will reach consensus on an issue when it agrees upon a suite of alternatives and each participant can honestly say:

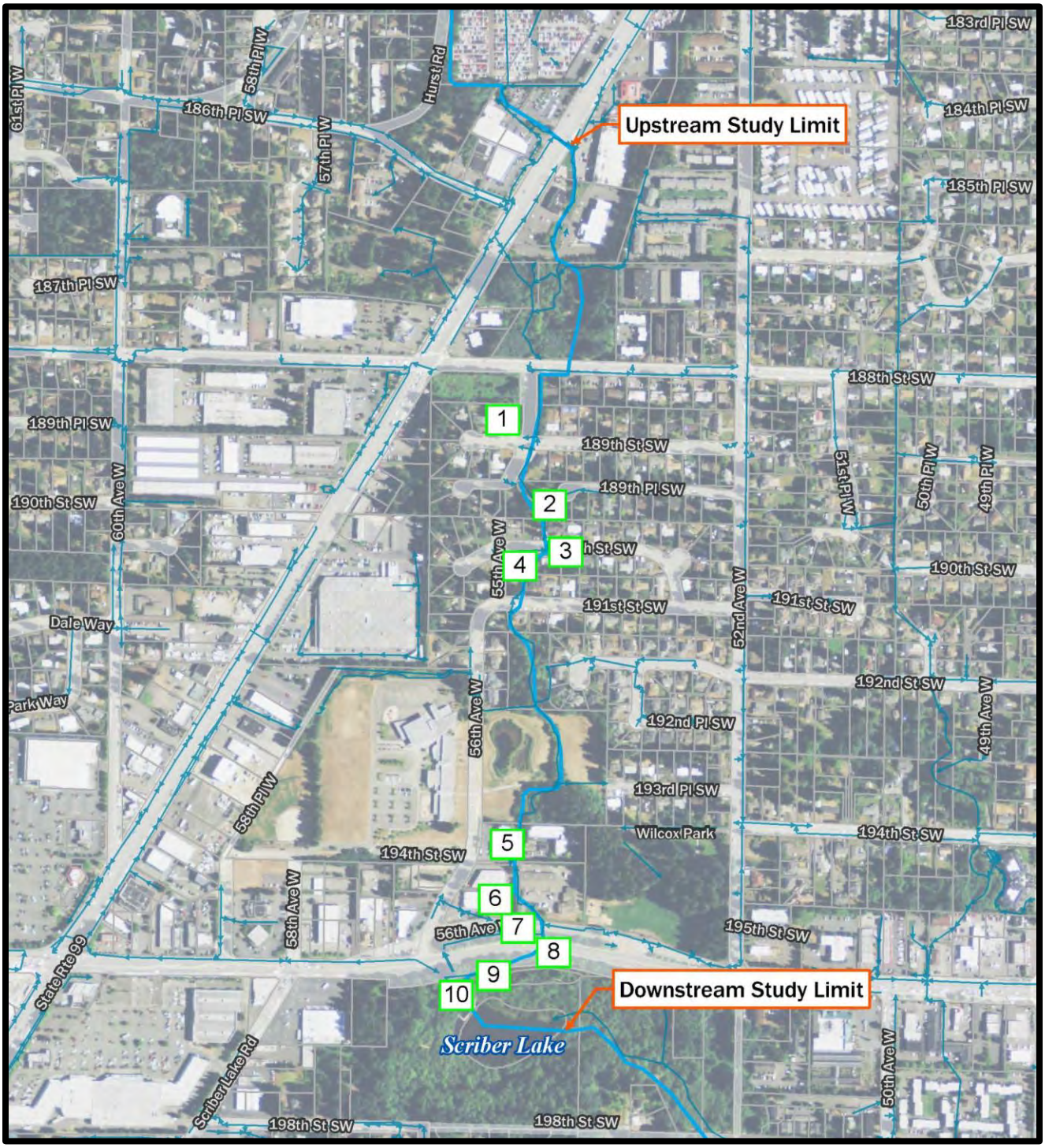
- *I believe that other participants understand my point of view.*
- *I believe I understand other participants' points of view.*
- *Whether or not I prefer this alternative, I support it because it was arrived at openly and fairly, and it is the best decision for us at this time.*

In instances where consensus cannot be reached, recommendations will be approved if supported by a majority of the representatives (or alternates) present. Meeting summaries and/or reports will capture agreements and differing perspectives."

Alternatives that were not significantly opposed by any member of the Committee are categorized in this report as recommendations. This report captures if and when differing perspectives were heard.

Identified Flooding Characteristics

Advisory Committee members identified site specific issues and commented on when flood events have occurred in the neighborhood. The figure below shows specific locations where Committee members offered information on past flooding observations.



Comments organized by site location (green numbered boxes in the figure):

Site 1:

- In 2012, flooding of the garage and above the finished floor occurred at the northwest corner of 55th Ave. W and 189th St. SW.

Site 2:

- In 2006, flooding up to the back of the house at the west end of 189th Pl SW was observed.

Site 3:

- Portions of the channel in the vicinity of the 190th St. SW crossing are armored with rock. On occasion, some rocks have been observed to be picked up by turbulent flood water and carried downstream.

Site 4:

- The parcel at the southeast corner of the intersection of 190th St. SW and 55th Ave. W was flooded above the finished floor in 2006. The adjacent intersection floods more frequently.
- Creek flooding has not affected the three parcels in the Brookmore Estates development at the west end of 192nd St. SW.

Site 5 (Casa Del Rey Condominiums):

- During the December 2007 flood event, the access road on the south side of the Casa del Rey property was significantly overtopped and vehicles could not pass through this area. The East building had flooding in the first floor hall and in the units, especially in the northwest Unit #110, which has severe flood damage from water that came from the property to the north through the fence. Additionally, during this flood, the roof gutters were unable to drain into the creek as they normally do, thus causing severe water leaks at every non-sealed joint.
- There is a storm drain emanating from the west that directs flow to the creek with an outlet along the north side of the Edmonds School District stormwater pond. When it rains hard, that storm drain "shoots" flow out under pressure.
    - When there is a flood event in the creek, the flow coming out of that storm drain wraps around the stormwater pond (between creek and stormwater pond), and does not enter the creek until it gets closer to Casa Del Rey. The pond outflow combined with overbank creek water and the aforementioned storm drain flow is a sheet of water as it flows over the floodplain toward Casa Del Rey.
- Committee members from Casa Del Rey expressed that they do not think the Edmonds School District detention pond is working like it is supposed to.
- When the creek is running high, the zig zag alignment of the creek channel approaching the Casa Del Rey fence line gets bypassed and the flow takes a wide diagonal swath/approach to Casa Del Rey.
- Casa Del Rey did not experience overbank flooding in November 2012, when significant flooding occurred upstream in the study corridor.

Site 6 (Business Park – Great Floors & Park View Plaza):

- The creek flooding has not been above the Great Floors finished floor elevation.
- The building west of Great Floors has not been flooded above the finished floor, but has been subject to sanitary sewer backups.
- Upstream of the "old 196th bridge", during high flows the creek jumps out of the bank and into the Great Floors detention pond and from there spills onto old 196th.

Site 7 (Just Downstream of Park View Plaza):

- A high water mark was mentioned as water up to the 2nd board of the old bridge during the 2007 event.
- Old 196th street is inundated very frequently and not just during big storms.

Site 8:

- There is chronic sediment build up in the section of the creek upstream of the old bridge crossing, including the short section of channel within the business park and the section of channel paralleling 196th.

Site 9:

- Between the old bridge and the culverts under 196th St. SW (where the creek flows west, parallel to the roadway), mitigation planting was done along the channel for the upstream regional detention pond project. The planting is overgrown and there is concern that it negatively affects the stream conveyance capacity.

Site 10:

- The upstream end of the culvert crossing of 196th St. SW may have settled to the extent that it is now at reverse grade and negatively affecting conveyance capacity.

Goals

The fundamental goal of this study is to identify a suite of feasible alternatives that will reduce flooding to desired levels, in ways that can be readily maintained. Additional goals that the Advisory Committee wants addressed include the following:

- Improve aesthetics in the area.
- Take advantage of partnership opportunities with community groups and public agencies.
- Return the holistic functionality of the corridor, including a return to native vegetation.
- Improve the quality of life for those living and working in the corridor.

Flood reduction actions should be implemented quickly, successfully, and in a way that manages future development to control impacts to the creek area.

Objectives

The Advisory Committee defined the following objectives in support of the goals listed above:

- By June 2015, select flood reduction alternatives that will reduce flooding to the desired levels and be easily maintained indefinitely.
- When implemented, flood reduction alternatives will improve aesthetics along the corridor, specifically near old 196th, which includes planting native vegetation.
- Flood reduction alternatives will include partnership opportunities with the Edmonds School District, Edmonds Community College, and the City of Lynnwood Parks Board.
- Flood reduction alternatives will be implemented in a timely manner.
- Flood reduction alternatives will consider impacts on residents and business owners, including the evaluation of property value impacts.

Evaluation Criteria

The Committee reviewed and generally agreed on a set of example criteria for comparing flood reduction alternatives provided by Herrera:

- Potential to **reduce flooding** in the study area
- Effects on **flooding downstream** of Scriber Lake
- **Social impacts/benefits** (this includes aesthetics, odors, mosquitoes, etc.)
- **Public safety** considerations (e.g. could a solution have some potential concerns for safety, like creating a drowning hazard?)
- Effects on **stream and riparian habitat**
- **Implementation** feasibility (from a design and construction standpoint)
- **Land ownership**/easements (potentially affects complexity, cost, timing)
- **Permitting requirements** (Is the project readily permittable? Is expensive environmental mitigation likely?)
- **Construction costs**
- **Operation and maintenance requirements** and costs (post-construction, long-term costs)

Committee members added the following criteria for the City to consider:

- Ease of **maintenance**
- **Partnership** opportunities
- Ability to return a more **natural flow pattern** in the corridor
- **Aesthetics**
- **Timing** – how quickly will the project be successful?
- Use of **native plantings**
- Financing/**funding** (who is paying for it – increase for rate payers?)
- Reduction of **sediment transport**
- Effects on **humans**
- Potential to help management of **future development**
- Effects on **property values**

Committee members would like to see the City give more weight to the following criteria:

- Implementation feasibility
- Ease of maintenance
- Effects on humans (property values, etc.)
- Potential to help management of future development
- Financing

The criteria described above were aggregated into six categories for initial assessment of potential flood reduction alternatives. These categories are:

- Community considerations
- Flood reduction performance
- Cost
- Ease of construction/implementation
- Ease of Maintenance
- Habitat Improvements

Recommendations

Advisory Committee members were asked to rate each alternative brainstormed by the Committee according to the "community considerations" category on a scale of 1 (lowest value) to 5 (highest value), but not for the other categories that require either specialized expertise or additional information not yet generated by the project team. The following section describes the results of the Committee's ratings of potential alternatives with respect to community considerations, which capture the following issues:

- **Aesthetics** impacts/benefits (appearance, odors, mosquitoes, etc.)
- **Public safety** considerations
- **Land ownership**/easements
- **Partnership** opportunities
- Potential to help **management of future development**
- Effects on **property values**

Based on their analysis, the Scriber Creek Flood Reduction Advisory Committee strongly recommends the City evaluate eight specific flood reduction alternatives, which are described below. The Committee understands that more alternatives may need to be implemented in order to create a complete, holistic solution to the flooding issues so that the most severe and long-standing problems in the corridor are adequately addressed. Additionally, the Committee understands that the alternatives evaluated and described in the next section, "Alternatives Considered," are likely still on the table during the second phase of work on this study, but urges the City to gear future efforts toward the more strongly recommended alternatives listed in the table below.

The average scores listed in this table are Committee members' rating of each alternative according to community considerations.

Recommendations Table

The Committee would like to emphasize that the below recommended alternatives take a holistic approach to reducing flood risk in the study corridor that includes short-term, mid-term, and long-term recommendations. Some flood reduction actions may work best if volunteers are used (such as Recommendation #8) who would work alongside and in partnership with City staff. Throughout all of these recommendations, it is important to keep in mind ways to address improvements to the natural habitat areas along the stream corridor and potentially look for future opportunities to daylight the stream and reduce reliance on pipes and culverts.

Additionally, it is important to be clear that these flood reduction recommendations are focused in the study area – from Highway 99 to Scriber Lake. It may not be clear what the impact upstream of the study area could have on the area that is being considered if there is additional development in the upstream area. If this occurs, additional actions may be needed upstream to improve the overall flood reduction effort.

Recommended Alternatives to Evaluate	Average Score
Recommendation #1: Regional flood storage site at Edmonds School District property.	**4.4**
Recommendation #2: Realign the culvert beneath the Casa Del Rey access roadway and improve the channel between Casa Del Rey and 196th St. SW, paying particular attention to the section of the Creek that occurs mainly under the rear entrance are to the Parkview Square Business Center.	**4.4**

Recommendation #3: Increase flood storage at Scriber Lake and reconfigure lake inlet and outlet controls.	**4.4**
Recommendation #4: Use a hydraulic model to evaluate flood prone properties at a specified level of service to determine where flood prone properties are both currently and if existing stream culverts are replaced. With this knowledge, the City can consider buyouts of flood prone properties and/or incorporate distributed detention/storage ponds where possible, such as locating small storage ponds on the properties that may be bought out, or other available properties such as the school district open area (also listed as a separate measure above).	**4.3**
Recommendation #5: Replace the culvert(s) under SW 196th St.	**4.3**
Recommendation #6: Raise the road at 188th St. SW and possibly excavate upland areas around the wetland to create more storage. One possibility is to not upsize the culvert, thus creating a sort of taller dam to impound more water in the upstream wetland.	**3.9***
Recommendation #7: Raise portions of old 196th and driveway access to Park View Plaza and Great Floors and/or remove the old 196th bridge.	**3.9****
Recommendation #8: Develop a continuous sediment removal program that would remove sediment deposition before, during, and on an ongoing basis after construction. This effort can be combined with channel stabilization measures to help reduce the source of sediment deposition.	**3.3 – 3.9*****

** Although this alternative scored lower than some of the other alternatives considered, the Committee strongly recommends this alternative because it would help reduce some of the flooding pressure on the upper and mid-areas of the corridor, which had not been captured in the initial prioritization of alternatives.*

*** This alternative was strongly recommended by the Committee even though the average score was less than 4.0 because the Committee has noticed a significant amount of debris collecting in this area due to the dip in elevation.*

****During group discussion, the Committee combined two alternatives – ongoing Sediment Removal Program (which had an average score of 3.3) and Channel Stabilization (which had an average score of 3.9). Committee members felt very strongly that an ongoing sediment removal program should be championed by the City as soon as possible, even though this was not necessarily reflected in the average score.*

Other Alternatives Considered

Other flood reduction alternatives considered by the Advisory Committee, and the average score given by Committee members for each respective alternative with respect to community considerations, are listed in the table below.

Alternative Brainstormed	Average Score
Zoning Review – Identify undeveloped areas and see where building may occur. Are setbacks adequate?	**3.9**

Alternative Brainstormed	Average Score
Underground storage vaults – possibly at School District site. • Can reduce public safety concerns surrounding above-ground detention facilities.	**3.6**
Stormwater pump stations – could potentially increase storage in Scriber Lake and have a short pump station under 196th.	**3.6**
Increase storm drain pipe sizes to enable in-pipe flow control when completing future road projects to support corridor flood management.	**3.5**
Levees/berms at north end of corridor – near Eunia Plaza/Flynn's Carpet Cents.	**3.3**
Enlarge Scriber Lake by removing hill between Scriber Lake and smaller body of water.	**3.3**
Incentives for stormwater retrofits – Incentives for landowners to retrofit to retain stormwater on-site, such as through reduced surface water utility rates.	**3.2**
Regional flood storage site at empty lot southwest of the intersection of 188th St. SW and 55th Ave. W.	**2.9**
Address tributary inflows to the creek. This could be done via stormwater retrofits to reduce inflows to Scriber Creek.	**2.85**
Water reuse through stormwater retrofit incentives for businesses • Incentivize businesses to retain their water like the PCC in Edmonds. • Tax incentives for stormwater retrofits.	**2.7**
Flood proofing – elevate structures so they are not damaged by flood waters.	**2.2**
Earthen levees – spot solutions throughout corridor.	**2.2**
Sediment deposition ponds – inline with the creek channel or adjacent to the creek, that can be routinely maintained to restore sediment storage capacity as needed	**2.2**
Diversion pipes/channels	**1.9**

Closing Remarks

The members of the Scriber Creek Flood Reduction Advisory Committee wish to thank the City of Lynnwood for the opportunity to provide input and feedback on the important matter of reducing flood risk associated with Scriber Creek. This process demonstrates the City's commitment to involving the public in decisions that affect the daily lives of City residents and businesses. The Committee has made thoughtful, deliberate recommendations, and we hope our efforts are given serious consideration.

Appendices

A. Mayor's Authorization of Advisory Committee for Oversight of Scriber Creek Corridor Flood Study in 2014
B. Compilation of Evaluated Alternatives Worksheet
C. Initial Flood Reduction Alternative Summary
D. Meeting Notes

LYNNWOOD
WASHINGTON
PUBLIC WORKS

MEMORANDUM

DATE: January 15, 2014

TO: Mayor Nicola Smith

FROM: Public Works Director Franz

RE: Mayor Authorization of Task Force for Oversight of Scriber Creek Corridor Flood Study in 2014

In accordance with the Lynnwood Municipal Code 2.24.010 a Scriber Creek Corridor Flood Study Task Force is hereby authorized under the control of the Director of Public Works. The purpose of this Task Force is to meet with staff during 2014 as needed and to provide input and oversight concerning the development of the Scriber Creek Corridor Flood Study. The Task Force shall consist of Lynnwood citizens and/or property owners who are affected by flooding.

I concur: _____

Mayor Nicola Smith

Chapter 2.24
ADVISORY BODIES – GENERAL PROVISIONS

Sections:

2.24.010 Definitions.

For the purposes of this chapter, the following definitions shall apply:

An "advisory body" means any board or commission, and named board or commission in the ordinance or resolution creating the same, previously, or hereafter, created by the city council to give advice on subjects and perform such other functions as prescribed by the city council. "Advisory body" does not mean task forces, informal committees, or working groups appointed by the mayor or created by the city council for short periods of time or for specific tasks.

"Resident" means a registered voter of the city of Lynnwood or a registered voter of an area that has successfully petitioned or voted to annex to the city where an annexation ordinance has been adopted by the city council. (Ord. 2121 § 1, 1997)

Compiled Responses:

The below table ranks by average score the flood reduction alternatives brainstormed and individually scored by the Committee. If an alternative is highlighted in green, this means the average score was above 4.0. If the alternative is highlighted in yellow, this means the alternative scored between 3.0 and 4.0. If an alternative had an average score of less than 3.0, it is highlighted in red.

Flood Risk Reduction Measure	#1	#2	#3	#4	#5	#6*	#7	#8	#9	Average
Regional Storage Site at Edmonds School District Property.	**5**	**5 –** This is something that will have future benefits at little additional cost.	**3**	**3**	**5**	**5**	**4**	**5 –** Combines many of the ideas/ benefits discussed by creating a regional solution on a large site with a single property owner, thereby reducing time, cost, and complexity compared to negotiating with tens or hundreds of property owners. Also, the educational benefits are an added bonus.	**5**	**4.4**
Culvert Realignment – realign culvert beneath Casa Del Rey access roadway.	**5**	**5 –** This would help grow the relationship with the property owners.	**4**	**5**	**4**	**4**	**5**	**4 –** Provides real time/ immediate benefit by eliminating a choke/pinch-point.	**4**	**4.4**
Scriber Lake Outlet Control – increase storage, re-do inlet control.	**4**	**5 –** I like this idea.	**4**	**4**	**5**	**5**	**5**	**2.5 –** While this is a good idea, the real problem is not the outlet from the Lake but the inlet, which runs uphill, thereby causing backups/flooding on the other side of 196th. So long as water has to flow uphill to get into the Lake, changing the outlet will not significantly reduce upstream flooding.	**5**	**4.4**
Use modeling to **evaluate flood prone properties** at a specified level of service (e.g. 25-year level of service).	**2**	**4**	**5**	**3**	**4 –** Important to know where these properties	**5**	**5**	**4.5 –** Modeling is an excellent idea and a necessary tool in	**5**	**4.3**

Flood Risk Reduction Measure	#1	#2	#3	#4	#5	#6*	#7	#8	#9	Average
• Model where these properties are both with the existing culverts and if the culverts were replaced • Consider buy outs of flood prone properties • Incorporate distributed detention/storage ponds where possible, such as locating small storage ponds on the properties that may be bought out, or other available properties such as the school district open area (also described as a separate measure below).					are, but not in favor of any "buy outs" without the "Zoning review."			that it will provide much needed data that can be used throughout the basin to evaluate and design other solutions/fixes. Also, while it may not be possible to buy-out all of the identified properties, modeling should help focus on the high-priority/high-benefit properties that could be prioritized for purchase.		
Culvert Replacements – replace culverts under 196th.	**4**	**4 –** Hard to see how the City can avoid this. Will the State help? How about raising the roadway so that the creek could flow without the need for culverts?		**5**	**3**	**3**	**5**	**5 –** Essentially removes the "cork" in the dam and would facilitate better drainage throughout the entire basin and would use an existing "storage" facility (the lake in the park) instead of requiring a new storage facility. One way to reduce cost and increase storage might be to tunnel underneath the log fill and create an underground storage facility that would act as a siphon into the lake.	**5**	**4.3**
Zoning Review – Identify undeveloped areas and see where building may occur. Are setbacks adequate?	**5**	**5**		**3**	**5**	**5**	**2**		**2**	**3.9**
Raising Roads – raise road at 188th and possibly excavate upland areas around the wetland to create more storage. Do not upsize the culvert,	**4**	**4**	**4**	**4**	**3 –** More an accommodation than long-term solution.	**4**	**5**	**3.5 –** This creates an "early win" by solving a perennial problem with a simple fix.	**4**	**3.9**

Flood Risk Reduction Measure	#1	#2	#3	#4	#5	#6*	#7	#8	#9	Average
thus creating a sort of taller dam to impound more water in the upstream wetland.								Also, providing more storage in the wetland should provide additional upstream benefits.		
Raising Roads – raise portions of old 196th and driveway access of Park View Plaza and Great Floors.	**3**	**2 –** Don't feel this would work without culvert improvements under new 196th.	**5**	**5**	**3–** More an accommodation than long-term solution.	**4**	**4**	**4 –** Creates an "early win" by solving a perennial problem with a simple fix.	**5**	**3.9**
Channel Stabilization – to control erosion.	**4**	**4 –** I see this as a good thing once the creek flooding is diminished.	**3**	**4**	**5**	**4**	**5**	**4.5 –** Bigger benefits (both habitat and educational, etc.) for the buck and addresses the long-term problem with a natural, habitat-based solution.	**2**	**3.9**
Underground storage vaults – possibly at School District site. • Can reduce public safety concerns surrounding above-ground detention facilities.	**4**	**5 –** Many East coast regions have been doing this for years with good success.		**2**	**5**	**2**	**3**	**3 –** Good for a limited number of potential target sites that might provide system-wide benefits.	**5**	**3.6**
Stormwater pump stations – could potentially increase storage in Scriber Lake and have a short pump station under 196th.	**3**	**1 –** This feels like passing the problem to another location.		**5**	**4**	**3**	**4**	**3.5 –** May help alleviate localized, short-term flooding in the lower basin but does not address the input-issue of upstream impacts.	**5**	**3.6**
Increase storm drain pipe sizes to enable in-pipe flow control when completing future road projects to support corridor flood management.	**4**	**4 –** Seems this should be two items. One for new road projects and a second for retrofitting existing pipe.		**4**	**5**	**3**	**5**	**2.5 –** Too complex, too much potential maintenance, too much up-front cost, and will take too long.	**1**	**3.6**
Increase creek channel size – where possible, potentially near 188th.	**3**	**4 –** Must consider effects on downstream & upstream properties.		**4**	**5**	**3**	**3**	**3 –** Should be combined with some form of flow/release control to mitigate downstream impacts.	**3**	**3.5**
Sediment Removal at problem areas (such as Casa Del Rey and others);	**3**	**4 –**	**3**	**5**	**5**	**3**	**2**	**3 –**	**4**	**3.3**

Flood Risk Reduction Measure	#1	#2	#3	#4	#5	#6*	#7	#8	#9	Average
could include volunteer participation.		Sediment removal could be on a regular schedule ongoing.						This only makes sense if it can be done on a regular basis (e.g. annually, bi-annually, etc.) because sediment transport/build-up will reoccur over time.		
Levees/berms at north end of corridor – near Eunia Plaza/Flynn's Carpet.	**3**	**5**	**4**	**2**	**5**	**4**	**3**	**1.5 –** Not really solving downstream problems.	**2**	**3.3**
Enlarge Scriber Lake by removing hill between Scriber Lake and smaller body of water.	**2**	**4 –** My guess is that the hill is manmade from fill from some other years ago project. If so, might be easy to remove.	**3**	**2**	**2–** More an accommodation than long-term solution.	**5**	**4**	**3.5 to 4 –** Only if coupled with inlet fix discussed above.	**4**	**3.3**
Incentives for stormwater retrofits – Incentives for landowners to retrofit to retain stormwater on-site, such as through reduced surface water utility rates.	**3**	**2**			**5**	**2**	**3**	**3.5 –** Could actually be a high-benefit alternative if the City focused on a few properties that could provide large benefit/ greater return on investment instead of trying to get hundreds of smaller properties involved. One or two large-scale facilities in well-placed locations could provide basin-wide benefits.	**4**	**3.2**
Regional Storage Site at empty lot south of 188th on 55th Ave.	**4**	**2 –** Future development could be impeded by having a pond on the property.	**4**	**1**	**5**	**4**	**2**	**2.5 –** Only if it provided controlled-release upstream storage to mitigate and control downstream effects.	**2**	**2.9**
Address tributary inflows to the creek. This could be stormwater retrofits to reduce inflows to Scriber Creek.	**2**	**2 –** All new developments need to do this at their cost.	**4**	**1**	**3**	**3**	**3**	**3.5 to 4 –** In general, this is a great approach because source elimination goes a long way	**4**	**2.85**

Flood Risk Reduction Measure	#1	#2	#3	#4	#5	#6*	#7	#8	#9	Average
								to addressing flooding impacts. The problems/ drawbacks are that it will be time consuming, expensive, complex, and may depend on waiting for subject-property redevelopment in order to be implemented on a parcel-by-parcel basis.		
Water reuse through stormwater retrofit incentives for businesses • Incentivize businesses to retain their water like PCC in Edmonds. • Tax incentives for stormwater retrofits.	**2**	**5 –** Would need to educate the property owners about how this works.		**1**	**5**	**3**	**1**	**1.5 –** Probably unfeasible in the current regulatory regime/climate and would only produce benefits from big source/user properties and not small-scale residential properties.	**3**	**2.7**
Flood proofing – elevate structures so they are not damaged by flood waters.	**2**	**1**	**5**	**2**	**2 –** More an accommodation than long-term solution.	**1**	**1**	**1 –** This is an expensive and probably unfeasible measure because it is difficult if not impossible to lift and elevate some of the impacted structures (i.e., large, multi-family housing units or large commercial structures). While it may help certain single-family dwellings, it is a Band-Aid, not a long-term solution.	**5**	**2.2**
Earthen Levees – spot solutions throughout corridor.	**3**	**1 –** Expecting resident cooperation might be too much to ask.	**2**	**1**	**2**	**4**	**4**	**1.5 –** Just a Band-Aid, not a solution because they do nothing to slow the discharge or eliminate/ alleviate downstream flooding impacts and instead just focus and funnel flow downhill.	**1**	**2.2**

Flood Risk Reduction Measure	#1	#2	#3	#4	#5	#6*	#7	#8	#9	Average
Sediment Deposition Ponds	**3**	**1**		**1**	**5**	**1**	**3**	**1.5 –** A Band-Aid since they do not address the source of sediment and instead just deal with a problem instead of fixing/eliminating the source.	**2**	**2.2**
Diversion channels	**2**	**1 –** No immediate impact.		**1**	**3**	**1**	**3**	**1 –** Just moves, not solves, the problem.	**3**	**1.9**

* This individual commented that alternatives that support flood reduction, enhance habitat and open spaces, result in park improvements, and have educational benefits and opportunities to get the community involved are preferred. These types of alternatives are consistent with the City's Lynnwood Community Visioning document. Alternatives that support and enhance a future streamside trail system leading from Scriber Creek Park to Lund's Gulch and Puget Sound are supported.

Flood Reduction Alternatives Summary

When Committee members ranked the flood reduction alternatives, the following information was provided. Considerations in the table were both brainstormed by Committee members at the May meeting and also provided by the technical consultants.

Avoidance Strategies

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance*	Habitat Improvements*
Sediment Removal at problem areas (such as Casa Del Rey and others); could include volunteer participation.	**Score:** **-** Educational benefits, this is an opportunity to get community members out in the stream and teach them about the stream.	If implemented alone, will not result in noticeable flood reduction, but could locally improve flow conveyance.	Low	- Sediment removal as part of a holistic plan may be more permittable. - Regulators may be more amenable if removal is done by hand instead of by heavy equipment. - Access on private land is an obstacle.	Not a concern since post-excavation there is no maintenance expected.	Difficult to improve habitat with this measure, unless the channel bed is over-excavated to allow room for backfill with natural stream substrate.
Use modeling to **evaluate flood prone properties** at a specified level of service (e.g. 25-year level of service). • Model where these properties are both with the existing culverts and if the culverts were replaced • Consider buy outs of flood prone properties • Incorporate distributed detention/ storage ponds where possible, such as	**Score:** - Environmental benefits, more open space. - Reduced occurrence of flooding of inhabited properties, which could slightly enhance property values nearby. - Purchased properties could provide opportunities for recreational/ interpretive uses	- Having small storage ponds along the creek corridor would help reduce flooding elsewhere. - Purchasing larger areas (such as school district open area) could add even more storage.	Medium to high, depending on how many properties bought out and extent of storage added to the system.	Relatively difficult and time consuming given need to buy properties one-by-one, and property buyouts not a common approach for the City.	New flood storage ponds on cleared properties would generally not require maintenance beyond occasional inspections, litter removal, and pruning of new plantings.	New flood storage ponds could be designed to provide off-channel habitat for fish, and to provide habitat for other wildlife.

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance*	Habitat Improvements*
locating small storage ponds on the properties that may be bought out, or other available properties such as the school district open area (also described as a separate measure below).	and educational purposes (partner with school).					
Flood proofing – elevate structures so they are not damaged by flood waters.	**Score:** While damage to structures would be reduced, continued flooding of roads and properties could be a nuisance and/or safety concern.	Prevents flooding of the structure that is raised, but minimal effect on flood levels elsewhere in the corridor (e.g. road flooding would continue). One plus is that this option would not increase downstream flows.	Medium to high depending on how many structures were raised.	Moderately difficult and time consuming since the City does not have a process in place to routinely do this. In addition, individual property agreements would be needed.	No maintenance needed once the structure is raised.	None.
Zoning Review – Identify undeveloped areas and see where building may occur. Are setbacks adequate?	**Score:**	Prevents future flooding from being worse, but no effect on existing flooding problems.	Minimal.	Moderately complex City process to adopt modified zoning designations.	Not applicable.	Not applicable.
Incentives for stormwater retrofits – Incentives for landowners to retrofit to retain stormwater on-site, such as through reduced surface water utility rates.	**Score:**	Minor, unless hundreds of properties take part.	Low.	Moderately complex, and potentially would take many years to get a large number of properties involved. Past efforts by other	Simple.	None.

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance*	Habitat Improvements*
				communities have been marginally successful.		

Structural Solutions

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance	Habitat Improvements
Raising Roads – raise road at 188th and possibly excavate upland areas around the wetland to create more storage. Do not upsize the culvert, thus creating a sort of taller dam to impound more water in the upstream wetland.	**Score:** Potential park benefits.	Would need to look at impacts upstream, as there are already some flood prone areas upstream of the study corridor.	Medium to high.	Moderately complicated due to ripple effects on roadside areas, temporary traffic rerouting, getting permit approvals, etc.	No additional maintenance burden.	Potential for enhanced or somewhat degraded habitat conditions upstream of road depending on how the project is designed.
Raising Roads – raise portions of old 196th and driveway access of Park View Plaza and Great Floors.	**Score:** Significant partnership opportunities.	- Need to consider upstream impact of this project if culverts are not enlarged. - Significant improvement in accessibility to businesses during high flow events	Medium.	- Would not necessarily have to deal with permits since there would be no in-water work. - Could be implemented quickly with private landowner agreements.	No additional maintenance burden.	None within the creek, though reduced incidence of creek flow spilling onto roadways could benefit fish by keeping them in the creek channel.
Regional Storage Site at Edmonds School District Property.	**Score:** Co-benefits include educational partnerships, environmental, and	Potentially significant.	Medium to high.	Somewhat time consuming and complex due to need for property use agreement,	Not much maintenance needed beyond routine inspections and litter removal,	Substantial habitat benefits could be achieved in the design.

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance	Habitat Improvements
	parks potential.			multiple permits, and substantial design effort.	similar to City-owned stormwater ponds.	
Regional Storage Site at empty lot south of 188th on 55th Ave.	**Score:** No wetlands on property.	Minor.	Medium.	Somewhat time consuming and complex due to need for property acquisition, multiple permits, and design effort.	Not much maintenance needed beyond routine inspections and litter removal, similar to City-owned stormwater ponds.	Moderate habitat benefits could be achieved in the design.
Increase creek channel size – where possible, potentially near 188th.	**Score:**	Minor improvement in flooding as wider channel allows greater conveyance capacity, thus reducing water surface level and reducing incidence of overbank flow.	Medium.	Moderately difficult and time consuming as it would require private property owners to give up some of their property, and would require numerous permits.	No maintenance needed.	Potentially substantial habitat enhancement could be achieved.
Levees/berms at north end of corridor – near Eunia Plaza/Flynn's Carpet.	**Score:** Levees and berms can have trails on top.	- Minor, localized benefit. - Need to consider upstream impact of this option. - This option could be implemented along with raising 188th to get added storage.	Low – could be a cost-effective short-term solution.	Relatively easy, pending property owner approval and participation in funding.	Minimal maintenance requirements.	None.
Earthen Levees – spot solutions throughout	**Score:** **-** Not aesthetically	Minor, localized benefit.	Low.	Relatively easy, pending property	Minimal maintenance	None, unless significant amount

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance	Habitat Improvements
corridor.	pleasing unless densely planted and carefully designed to blend into landscape topography. - Could lower property values.			owner approval and participation in funding.	requirements.	of plantings on levee improve upon existing wildlife habitat locally, in which case benefits would be minor.
Diversion channels	**Score:**	Potentially significant within the corridor, but raises concern for flooding at downstream outlet location.	High due to numerous property acquisitions or easements, utility conflicts, etc.	Complex and time consuming, and potentially not feasible.	Substantial maintenance requirements.	None, other than habitat benefit that may occur in existing channel due to reduced high flow effects on fish and aquatic life.
Culvert Realignment – realign culvert beneath Casa Del Rey access roadway.	**Score:** Significant partnership opportunities.	**-** Could solve more than one issue. - Have to consider downstream effects.	Medium.	Straightforward once private site owner agreement reached, including participation in funding.	Minimal maintenance requirements.	None, unless channel habitat enhancements included in project upstream and/or downstream of culvert (which would likely be a permit requirement).
Culvert Replacements – replace culverts under 196th.	**Score:**	Potentially substantial upstream of 196th - would allow water to flow faster and help lower end of study corridor, but could worsen flooding	Medium to high.	- Log fill beneath 196th roadway could pose significant construction challenges and increase costs. - Requires multiple permitting agencies	Moderate.	None, unless channel habitat enhancements included in project upstream and/or downstream of culvert (which would likely be a permit

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance	Habitat Improvements
		downstream unless otherwise mitigated.		to be involved including WSDOT. - Time consuming.		requirement).
Scriber Lake Outlet Control – increase storage, re-do inlet control.	**Score:** **-** Co-benefits include educational, park, and environmental benefits. - Huge opportunity to improve Park.	Would need to implement projects upstream to reduce flooding, such as culvert replacements.	Low.	- Complex because it would require a number of regulatory and topography considerations. - Would need coordination with Parks Department.	Moderate.	Potential for enhanced or somewhat degraded habitat conditions surrounding the lake depending on how the project is designed.
Sediment Deposition Ponds	**Score:**	Minor.	Medium.	Moderately difficult due to need for connection to creek and the fact that regulatory agencies do not like these kinds of facilities.	Moderate.	- Minor, due to prevention of sedimentation within the existing channel and its adverse effects on habitat. - Expect that some habitat enhancement would be needed to obtain permits.
Channel Stabilization – to control erosion.	**Score:** Channel stabilization and restoration could be introduced with some sort of "adopt-a-stream" program for the community.	Minor as a standalone project. However, long term advantage is removal of source sediment that deposits in the reaches by the old 196th road.	Low to moderate.	Straightforward once private site owner agreement reached, including participation in funding.	Minimal.	Minor if native riparian vegetation is planted on improved banks (i.e., "bioengineered" design).

Watershed-wide Projects

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance	Habitat Improvements
Enlarge Scriber Lake by removing hill between Scriber Lake and smaller body of water.	**Score:** Can add a walking path(s) around the lake; park improvements.	Potentially substantial in vicinity of lake and downstream. Other system improvements (such as culvert replacements) would still be needed upstream.	Medium to high.	Complex and time consuming, subject to major public involvement process and numerous permits.	Moderate.	Moderate, given that existing habitat in the park is generally high quality.
Address tributary inflows to the creek. This could be stormwater retrofits to reduce inflows to Scriber Creek.	**Score:**	Potentially significant if large-scale stormwater runoff flow reductions are accomplished.	High.	Complex and time consuming, with an uncertain number of properties and City staff resources needed to implement.	Potentially substantial.	None, other than habitat benefit that may occur in existing channel due to reduced high flow effects on fish and aquatic life.
Water reuse through stormwater retrofit incentives for businesses • Incentivize businesses to retain their water like PCC in Edmonds. • Tax incentives for stormwater retrofits.	**Score:**	Minor.	May not have the ability to affect tax structure.	Straightforward once private site owner agreement reached, including participation in funding of reuse infrastructure. One potential issue is that the Lake Washington basin is a Closed (water right) Basin and while rain barrels have been	Simple to moderate depending on reuse components.	None.

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance	Habitat Improvements
				approved in the basin, other forms of rainwater reuse may not be permitted.		
Underground storage vaults – possibly at School District site. - Can reduce public safety concerns surrounding above-ground detention facilities.	**Score:**	Minor to moderate depending on size.	Medium to high. Cost for underground storage is generally high, however, it does potentially allow the continued use of the land (i.e., parking).	Potentially complex and time consuming, in part due to permitting related to connection to creek and getting private property approvals.	Moderate (harder to maintain underground facilities than above ground for same amount of flow storage).	None, other than perhaps minor habitat enhancement at connection to creek, as result of permit requirements.
Stormwater pump stations – could potentially increase storage in Scriber Lake and have a short pump station under 196th.	**Score:**	Potentially substantial in the lower part of the corridor, if there is no adverse effect on flooding at outlet location. Upper corridor would still need improvements (e.g., culvert replacements).	High.	Complex and time consuming, in part due to permitting related to connection to creek.	High.	None, other than perhaps minor habitat enhancement at connection to creek as a result of permit requirements.
Increase storm drain pipe sizes to enable in-pipe flow control when completing future road projects to support corridor flood management.	**Score:**	Potentially significant if done on large scale in several tributary drainage networks.	High, particularly if done as retrofits not associated with other road project improvements.	Complex and time consuming; could take decades to fully implement.	Moderate to high.	None, other than habitat benefit that may occur in existing channel due to reduced high flow effects on fish and aquatic life.

**Note: these evaluation criteria are more technical in nature and we are not requesting that Committee members will provide ratings for these criteria. However, these elements are extremely important to consider in any decision-making process and we listed these criteria for you to keep in mind during this process. The City has provided some narrative under these criteria to give Committee members an overview of the types of issues that may be associated with each project.*

***Under community considerations, a higher score means the alternative positively addresses most, if not all, of your considerations outlined under "community considerations" below.*

At the April Advisory Committee meeting, Committee members reviewed and generally agreed on a set of criteria. The evaluation matrix above captures these criteria as follows:

Flood reduction

- Potential to **reduce flooding** in study area
- Effects on **flooding downstream** of Scriber Lake

Community Considerations

- **Aesthetics** impacts/benefits (appearance, odors, mosquitoes, etc.)
- **Public safety** considerations
- **Land ownership**/easements
- **Partnership** opportunities
- Potential to help management of **future development**
- Effects on **property values**

Cost

- Financing/**funding** (who is paying for it – increase for rate payers?)
- **Construction costs**

Habitat improvements

- Effects on **stream and riparian habitat**
- Ability to return corridor to a more **natural flow pattern**
- Use of **native plantings**
- Reduction of **sediment transport**

Ease of construction/implementation

- **Implementation** feasibility (design and construction)
- **Permitting requirements** (Is the project readily permittable)
- **Timing** – how quickly will the project be successful?

Ease of maintenance

- **Operation and maintenance requirements** and costs
- Ease of **maintenance**
- **Permitting requirements** for maintenance work

Scriber Creek Advisory Committee
DRAFT Meeting Summary

March 17, 2014, 5:00 p.m. – 7:00 p.m.
19100 44th Avenue West, Lynnwood, WA 98046
Lynnwood Civic Center

Action Items

	Action Items	Person Responsible
1.	Review Operating Protocols and send any suggested revisions to Shanese Crosby (scrosby@triangleassociates.com) by April 21, 2014.	Committee Members
2.	Outline the area of service for Lift Station 16 and the proposed construction schedule at the April 21st meeting.	City of Lynnwood
3.	Coordinate with David Plodwick to examine the gate valve on his property.	City of Lynnwood
4.	Provide information on what fish are in the creek at the April 21st meeting.	City of Lynnwood
5.	Provide information on the history of the old 196th bridge and the fill that it was built upon.	City of Lynnwood
6.	Roz will take a picture of how the creek behaves between Casa Del Rey and the 196th bridge during a rain event.	Roz Smith

Welcome/Introductions

The purpose of the meeting was to discuss the framework of the Advisory Committee including the Committee's purpose, protocols, communication methods, and plan for the upcoming months, as well as describe the stream study corridor, the problem, assessment tools, and how the Advisory Committee will fit into the overall Study.

Attendees

Advisory Committee	Project Team
Nick Aldrich, Parks Board	**Robert Victor,** City of Lynnwood Project Manager
Josh Brower, Representing Great Floors Owner	**Jared Bond,** City of Lynnwood
Myran Che, Eunia Plaza	**Jeff Elekes,** City of Lynnwood
Nora Chin, Citizen	**Mark Ewbank,** Herrera
Dave Gilbertson, Parks Board	**Mike Giseburt,** Leidos
Brian Harding, Edmonds School District	**Cynthia Carlstad,** Triangle
Larry Ingraham, Citizen	**Shanese Crosby,** Triangle
Chris Nyhus, Park View Plaza Business Owner	
David Plodwick, Citizen	
Roz Smith, Casa Del Rey	
Eric Whitehead, Casa Del Rey	

Opening

Cynthia Carlstad (Triangle Associates) opened the meeting and reviewed the agenda. The Advisory Committee then introduced themselves and briefly discussed what they expected from their participation on the Committee (outlined below).

Expectations

- See what can be done to reduce flooding
- Reduce flooding
- Look for opportunities to work with Parks
- Learn about the issue and help where possible
- Find solutions – drainage control
- Listen and learn
- Solve the problem and contribute to the solution
- Listen and help
- Get rid of flooding

Cynthia then reviewed the Committee's purpose, workplan, and the operating protocols. The Phase 1 workplan calls for the committee to learn and provide input about the flooding issues in the study corridor, and consider the types of actions and solutions that could be evaluated in Phase 2 of the project. The Committee's goal is to develop a memo to be presented to City Council that describes the Committee's preferences for what solutions will be evaluated. This memo can include differing perspectives from individuals in the committee. Cynthia asked the group to review the operating protocols by the next meeting and send any suggested revisions to Shanese Crosby.

Questions

City/Project Team answers are designated in italics.

- There seems to be two problems in this corridor – a stormwater problem and a sanitary sewer issue. Is this effort only looking at the stormwater problem?
    - *Yes.*
- Is it possible for the City of Lynnwood (City) to provide the Committee with some background on how they are addressing the sanitary sewer issue?
    - *Yes. The City is currently under contract to build Lift Station 16, which will be located near Great Floors on 56th. The City expects to complete the Lift Station in the next one to two years. The sanitary sewer issue is tied to capacity concerns, so the City is limited in the options it can pursue. The sewer utility rate increase in January was specifically to help pay for Lift Station 16 and a few other lift stations in the City.*
- Could the City provide the Advisory Committee with an overview of the area the Lift Station is designed to serve and the construction schedule?
    - *Yes, this will be done at the April meeting.*
- Is the City looking at how downstream water levels in Scriber Lake may affect flooding in the study corridor?
    - *From the Team's understanding, there is no backwater coming from Scriber Lake that is contributing to the flooding problems. The study corridor does purposely extend to Scriber Lake so that lake outlet control can be considered.*

Comments

- If the City was able to control the outlet of Scriber Lake, it could really help the problem. When the City knows an event is coming, it could drain the Lake.

- The Committee and Project Team should remember that Scriber Creek is a jewel for Lynnwood. As the Committee discusses solutions, it should keep in mind that this is an opportunity to better the City, not just stop the flood problem.

Technical Presentation

Mark Ewbank (Herrera) gave an overview of the study corridor and discussed the causes of Scriber Creek flooding. Highlights from the presentation include:

- Flooding is a natural occurrence. In this corridor, development has increased the frequency and severity of the flooding.
- The creek channel has been confined by development and is not quite big enough in some areas to adequately carry the amount of water required during storm events. This is also true of some culverts.
- The channel is at a reverse grade as it approaches the 196th crossing and does not have efficient conveyance to allow the water to flow through this area.
- Storm drainage conveyance systems in this study area and throughout the city are typically sized for peak flows in a 25-year storm event. It would be difficult to build capacity for a higher storm event (e.g. 50 or 100-year event) as it requires a significant monetary investment and much larger structures.
- Once street catch basins are full, the water will flow down the path of least resistance, which sometimes means it flows through private properties.
- In the late 1990s, the City installed a regional stormwater detention pond in line with Scriber Creek that holds 50 acre feet of water on the NW corner behind the Walmart parking lot. Right now, the City can hold back a greater amount of water in this facility for eight months out of the year, but it is required to lower the facility outlet for the months of March to June coinciding with the early to mid-growing season for natural vegetation in the facility. The lowered outlet reduces its storage capacity in those months.

Questions

- What buffer zone is required for development along Scriber Creek?
    - *It varies from 70 to 110 feet, with an additional 15 feet required for buildings. The buffer zone is ideally planted with native vegetation.*
- Near 5410 189th Pl SW, there is a headgate on a storm pipe. Can this be monitored or controlled?
    - *The City is unaware of the purpose of this gate and would like to take a look at it.*
- Are culverts required to be fish passable?
    - *Yes, and this will be discussed at a later meeting.*
- Can we explore the option of increasing storage in the retention pond near Walmart?
    - *Yes. It is important to keep in mind the permitting requirements that come with a project like this. We have to consider impacts to wetlands, fish habitat, and other factors.*
    - *The wetland just upstream from 188th could be a candidate for improvements if mitigation is needed for a solution such as enlarging a detention pond.*
    - *The culvert under 188th has capacity restrictions that help back the water into that wetland.*
- Who owns the area near the wetland (north of 188th)?
    - *Primarily the City, but some of the land is owned in partnership with Parks.*
    - *In this area, flooding is limited mostly to City property on the east and west sides of the Creek, but there is some flooding of private property to the north.*

Comments

- There is a lot of sediment going into the creek. On the Casa Del Rey property, we have a tremendous amount of sediment that is taking away the creek's capacity to keep the water in the channel. The sediment has just built up and up.
    - *Sediment accumulation is a typical problem when the natural flood plains are built up.*
- The Delridge neighborhood in West Seattle built terracing to help with flooding. They did this through volunteers.
- When it rains and/or snows, a significant amount of water drains down from the street into the creek at the bottom of the hill (189th St SW and 55th Ave SW). Over the years, erosion has occurred in this area. Depending on how much rain, the duration of the storm event, and the force of water flows downstream, the water will move dirt, rocks, and grass into the creek. When dirt and sediment build up in the creek, then during rain events, the water rises higher than normal.
- When it snows, and then rains, the area sees tremendous flooding (e.g. December 2007).
- Other countries have water collection systems, such as rain barrels. Could this be required when new developments are built? Residents could use the water for their gardens or other activities.

Photos of the Corridor

Mark shared photos of the corridor taken recently by City staff, allowing the Committee to go on a virtual tour of the study corridor. Highlights include:

- There are some manmade features (such as a concrete block walls) that border the creek. Removing these structures and building the slope in a way to increase flood storage and flow conveyance capacity could be a low-cost solution.
- There are two large culverts under the driveway of Eunia Plaza, along with a "birdcage" debris rack. The cage is protecting one of the two culverts from blockages.
- Any solutions that affect the wetlands near 188th or the 196th bridge would require a number of environmental permits and wetland improvements (mitigation) somewhere else in the study area.
- As the creek moves downstream of 188th, the channel gets smaller.
- North of the School District property, the City did some habitat restoration work last summer, which included adding woody debris for fish habitat. Some of the sediment will fall out behind these logs.
- At 189th SW looking downstream, there is an inefficient culvert crossing. The flow is bouncing off the wall until it finds its way into the culvert. There is also a sewer manhole right next to the culvert entrance, which would need to be moved if we decide to give the stream more space in this area. This is an issue likely to arise in many locations in the creek corridor: the presence of water, sewer, and other utilities could be a constraint or an added cost to relocate them.
- There is a water main under the bridge on the north (upstream) side of 196th, which will have to be moved if we decided to straighten out the creek between 196th and Scriber Lake. This would be expensive.
- Right before Scriber Lake there are two culverts conveying the creek under 196th. When water enters this area, it is sent through an oil-water separator. When there is a rain event, the water bypasses this system because of lack of capacity.

Questions

- Can you still use round corrugate metal pipes as culverts?
    - *Yes.*

Comments

- Just northwest of photo point 1, there is a significant source of the sediment. There are some box culverts that seem to be heavily silted near the vicinity of Hertz, where it intersects with Highway 99.
- Historically, the last week of November is the wettest week of the year.
- The inlet of the storm pipes start to creep up near Walmart and the data center, but this may be a site specific problem.
- In a storm event, the 190th culvert turns into a lake.
- There is erosion near 5422 189th St SW on the west side of the downstream side.
- When there are heavy rains, the water leaves the channel on the School District's land and flows to the left of the chain link fence. There is a stormwater pipe that discharges toward the creek just upstream from the School District's detention pond. Water from the pipe doesn't make it to the creek, and flows overland instead.
- All the vegetation growing in the creek on Casa Del Rey's property was not there a couple of years ago – it is growing in recent sediment deposits.
- Casa Del Rey has seen water back up to the top of their fence. The bottom of the fence is pressure built plywood that is slowly failing.
- During a rain event, the creek makes its own channel between Casa Del Rey and the 196th bridge.

Closing

The Committee agreed to hold the third Monday of each month as their standard meeting time. The next meeting will be April 21st, 2014 from 5:00 p.m. to 7:00 p.m.

Scriber Creek Advisory Committee
DRAFT Meeting Summary

April 21, 2014, 5:00 p.m. – 7:00 p.m.
19200 44th Avenue West, Lynnwood, WA 98046
Lynnwood Library

Action Items

	Action Items	Person Responsible
1.	Send out timeline graphic to Advisory Committee members.	Triangle
2.	Develop template for recommendations memo for Committee review.	Triangle

Welcome/Introductions

The purpose of the meeting was to identify and describe site specific problem areas and identify and discuss the Advisory Committee's goals, objectives, and evaluation criteria related to the Scriber Creek Flood Reduction Study.

Attendees

Advisory Committee	Project Team
Josh Brower, Representing Great Floors Owner **Nora Chin,** Citizen **Ed dos Remedios**, Citizen **Brian Harding,** Edmonds School District **Larry Ingraham,** Citizen **Chris Nyhus,** Park View Plaza Business Owner **Matt Pease**, Business Owner **David Plodwick,** Citizen **Roz Smith,** Casa Del Rey **Eric Whitehead,** Casa Del Rey	**Robert Victor,** City of Lynnwood Project Manager **Jared Bond,** City of Lynnwood **Jeff Elekes,** City of Lynnwood **Mark Ewbank,** Herrera, Consultant Project Manager **Mike Giseburt,** Leidos **Cynthia Carlstad,** Triangle **Shanese Crosby,** Triangle

Opening

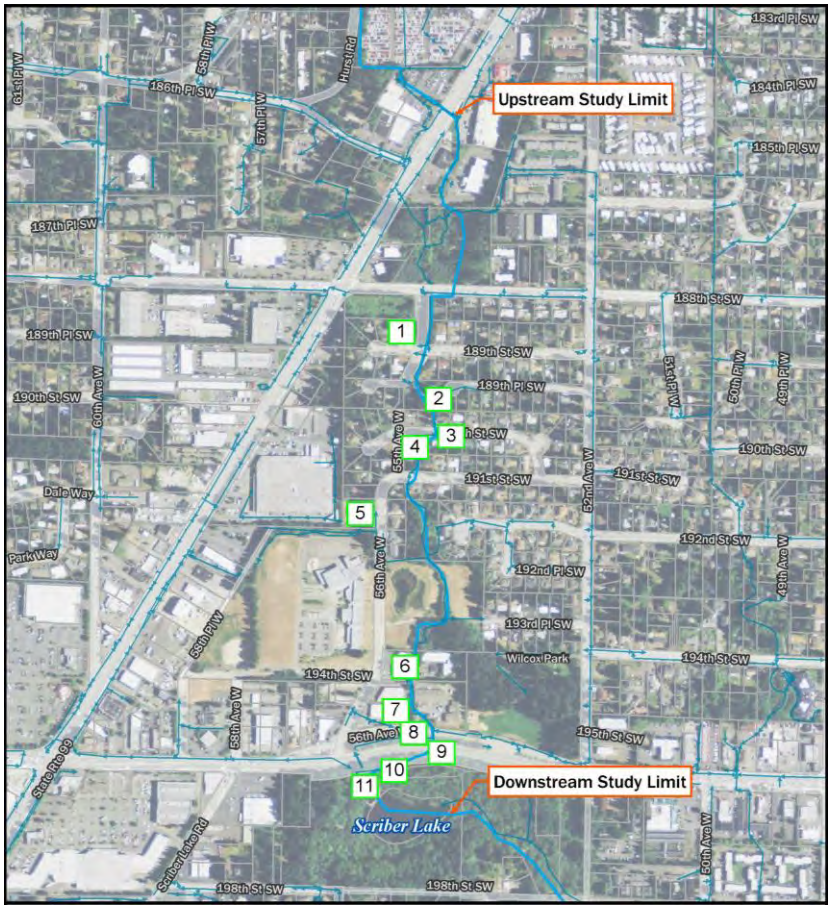
Mayor Smith (City of Lynnwood) opened the meeting and thanked everyone for participating in this process. Cynthia Carlstad (Triangle Associates) then reviewed the agenda and work plan, and led the Committee in a round of introductions.

General Business

There were no comments on the operating protocols or the meeting summary. Committee members can send any suggested comments to Shanese Crosby (Triangle Associates). Meeting summaries will be posted online, with addresses removed.

Identification & Discussion of Flooding and Drainage Problems

Advisory Committee members identified site specific issues and commented on when flood events have occurred in the neighborhood.



Comments organized by site location (green boxes):

Site 1:

In 2012, flooding of the garage and above the finished floor occurred at the northwest corner of 55th Ave W and 189th St SW.

Site 2:

In 2006, flooding up to the back of the house at the west end of 189th Pl SW was observed.

Site 3:

Portions of the channel in the vicinity of the 190th St SW crossing are armored with rock. On occasion, some rocks have been observed to be picked up and carried downstream.

Site 4:

- The parcel at the southeast corner of the intersection of 190th St SW and 55th Ave W was flooded above the finished floor in 2006. The adjacent intersection floods more frequently.
- Creek flooding has not affected the three parcels at the west end of Brookmore Estates (the west end of 192nd St SW).

Site 5:

- There is a storm drain emanating from the west that directs flow toward the creek with an outlet along the north side of the Edmonds School District stormwater pond. When it rains hard, that storm drain "shoots" flow out of it under pressure. When there is a flood event in the creek, the flow coming out of that storm drain goes overland around the stormwater pond (between creek and stormwater pond) and does not enter the creek until it gets closer to Casa Del Rey. The pond outflow combined with overbank creek water and the aforementioned storm drain flow sheet flows over the floodplain toward Casa Del Rey.

Site 6 (Casa Del Rey):

- The road on the south side of Casa Del Rey was overtopped during the 2007 event.
- Casa Del Rey residents expressed that they do not think the school district detention pond is working like it is supposed to.

- When the creek is running high, the zig zag alignment approaching the Casa Del Rey fence line gets bypassed and the flow takes a wide diagonal swath/approach to Casa Del Rey.
- Casa Del Rey didn't experience overbank flooding in Nov 2012.

Site 7 (Business Park – Great Floors & Park View Plaza):

- The creek flooding has not been above the Great Floors finished floor elevation.
- The building west of Great Floors has not been flooded above the finished floor, but has been subject to sanitary sewer backups.
- Upstream of the old bridge, during high flows the creek jumps out of the bank and into the Great Floors detention pond and heads to the street.

Site 8 (Just Downstream of Park View Plaza):

- A high water mark up to the 2nd board of the old bridge was observed during the 2007 event.
- Old 196th street is inundated very frequently and not just during big storms.

Site 9:

- There is frequent sediment build-up in the lower section of the creek around the old bridge crossing, including the short section of upstream channel.

Site 10:

- Between the old bridge and the culvert under 196th street (where the creek flows west), there was mitigation planting done along the channel for the upstream regional detention project. The planting is overgrown and there is concern that it negatively affects the stream conveyance.

Site 11:

- The upstream end of the culvert crossing of 196th street may have settled and this culvert may be at reverse grade and negatively affecting conveyance.

Project Goals, Objectives, & Criteria

The Advisory Committee broke into two groups to discuss five questions related to the members' goals, objectives, and preferred evaluation criteria. A one-page handout on goals, objectives and example criteria was provided (see **Attachment 1**). The remarks from each group's report-out are shown in the tables below.

Question #1: Other than flood reduction, what do you need to see at the end of the project to consider it a success?
Create a more natural/sustainable area along 196th and along the Creek.
A commitment from the City to maintain whatever is constructed.
Maintenance of corridor/channel.
Partnerships for culvert and channel maintenance.
Aesthetics (improved aesthetics along 196th).
High probability of success.
Reducing obstacles along creek (culverts, pinch-points, such as the culvert by Casa Del Rey).
Other uses – education, etc.
No bad impacts downstream.
Alleviate perpetual standing water on roadway (Great Floors, CDR).
Holistic functionality of corridor.
Easier regulatory hurdles (e.g. use of a long-term permit with set guidelines).

Question #2: Looking at the example criteria, what's missing?
Time to design/permit/construct (schedule – how quickly will the project be successful?)
Selection of proper plantings where applicable.
Removal of invasive species.
Financing/funding (who is paying for it – increase for rate payers?)
Removed from designated flood zone (change flood zone designation).
25-year flood protection.
Partner with school district, community college, and parks and education opportunities.

Question #3: In your opinion, what is the most important criterion the City should consider?
Implementation of plan.
No WDFW.
Maintenance and ease (e.g. pre-approved rules).
Use of volunteers to assist with maintenance.
Reduced sediment transport.
Effects on humans.
A feasible, buildable alternative that can be maintained over the long term.
Assurance that it will work.
Manage future development to control impacts to the creek/environmentally sensitive areas.
Financing.

Question #4: The example criteria lists "social impacts/benefits" as a criterion. What does that mean to you?
Financial impact of owning property near the Creek.
Sensitive to private property.
Increase property values.
Removal of invasive plants and replacement with native plants.
Operate corridor as a utility.

Question #5: What do you think are the biggest obstacles/constraints that may affect the project's success? What are ways to address these constraints?
Regulations.
Agencies.
Cost.
Cost and permitting.
Solution: Partnerships.
Solution: Local Improvement District (LID) or Flood District.
Solution: Define responsibilities of the City, Property Owners, DOE/State, Edmonds School District.

Follow-up Requests from Meeting #1

The City of Lynnwood presented information on two follow-up requests from the March Advisory Committee meeting.

Lift Station 16

The Lift Station is currently at the 30% design stage. The City has found a contractor, who is expected to finalize the design in July/August 2014. The City anticipates construction beginning in September/October 2014, with the station up and running 12 to 18 months after construction begins. Upon completion, the sewer system will be repaired and sewer backups should no longer be an issue.

Questions

- How far is Lift Station 16 to the next closest lift station?
    - *Lift Station 16 will not connect with the closest lift station. It will connect with Lift Station 12 in Edmonds. The sewage will be pumped up 196th, across Scriber Creek Road, until it eventually hits a gravity line that transfers the sewage to Station 12.*
- Where is the Station located?
    - *Lift Station 16 is located upstream of the School District at the Old Lynnwood City Hall site. It will pick up the sewer line at the school district site.*
- Will the design take care of the issues associated with significant rainfall?
    - *Yes, because the Lift Station is a peaking pump station. The City has been assured by the engineers that there will not be a sewage back up again associated with this system.*
- Can the pump have enough influence to lower the water table?
    - *No. It only takes what's in the sewer pipe. There will be a new sewer bypass point at the manhole upstream of Casa Del Rey.*
- Will the pump have axillary power?
    - *Yes, it will have a diesel generator in case of a power outage. Lift stations are considered a critical facility, like a hospital or City Hall.*

196th Street SW / State Route 524 Fill

Historical photos were displayed to illustrate how the road fill supporting the modern-day 196th Street SW was constructed and how its characteristics affect potential flood reduction solutions. Importantly, because a "raft" of logs was placed for hundreds of feet of length to spread the weight of the road fill on the soft, wet soils, it will be difficult to realign the creek, as it would require boring through the logs. The City commented that, even considering this difficulty, Creek realignment is on the table.

- The original "Old 196th" roadway (which included a bridge that is still is there) was constructed in 1932 as a two lane highway.
- In 1960, the State determined that the two-lane highway could no longer support traffic volumes and expanded the bridge to a four-lane highway. The road footprint was extended in the direction of Scriber Lake, so the north edge of the lake, which formerly extended close to "old 196th", was filled in. During construction, the weight of the new road fill caused major lateral displacement of the soft soil beneath it, creating what has since been known as the North Lagoon as the displaced soil formed a raised mound on the north side of the lake (south side of the lagoon) that partially isolated the low-lying ground amidst the lagoon area.
    - The large-scale soil displacement into the Lake reduced the Lake's water storage capacity by 50%.
- After the failure, the City decommissioned the old wooden bridge. The financial resources to reconstruct the bridge for vehicular traffic make reconstruction an infeasible option, especially considering that the bridge is a wooden structure at the end of its life.
- Now, the bridge is used for pedestrian traffic and for utilities.

Next Steps

The next meeting will be May 19th, 2014 from 5:00 p.m. to 7:00 p.m.

Attachment 1 – Goals, Objectives, & Evaluation Criteria

This document provides example goals, objectives, and evaluation criteria for the Scriber Creek Flood Reduction Advisory Committee to consider as the Committee develops their own goals, objectives, and evaluation criteria for flood reduction solutions related to Scriber Creek.

Goal
A goal statement reflects what the project is working towards. An example for the Scriber Creek Flood Reduction Study is:

"With a comprehensive approach for defining and evaluating alternatives, it is expected that the study will result in recommendations for a suite of feasible actions to reduce flooding to desired levels. Community support for the recommendations should be accomplished via implementing a robust public and stakeholder involvement process. It is critical that these recommendations include accurate predictions for the costs to implement them."

Objectives
Many times objectives fall out of the goal statement. Objectives should be "SMART" (specific, measureable, achievable, relevant, and time-bound). In this example, objectives for the Scriber Creek Flood Reduction Study could be:

- Comprehensively define and evaluate potential flood reduction alternatives that can be funded in entirety within 10 years of study completion
- By April 2015, develop a recommended suite of feasible flood reduction alternatives that, when implemented, will reduce flooding to desired levels
- Meaningfully involve the community in the decision-making process
- Accurately predict costs for potential flood reduction alternatives

Evaluation Criteria
Engineers use evaluation criteria to determine which potential solutions meet the project's goals and objectives. Criteria should be specific and measureable (ranging from a direct measurement to a scale, such as high, medium, low). For the Scriber Creek Flood Reduction Study, potential criteria include:

- Potential to **reduce flooding** in study area
- Effects on **flooding downstream** of Scriber Lake
- **Social impacts/benefits** (this includes aesthetics, odors, mosquitoes, etc.)
- **Public safety** considerations (e.g. could a solution have some potential concerns for safety, like creating a drowning hazard?)
- Effects on **stream and riparian habitat**
- **Implementation** feasibility (from design and construction standpoint)
- **Land ownership**/easements (potentially affects complexity, cost, timing)
- **Permitting requirements** (Is the project readily permittable? Is expensive environmental mitigation likely?)
- **Construction costs**
- **Operation and maintenance requirements** and costs (post-construction, long-term costs)

Scriber Creek Advisory Committee
DRAFT Meeting Summary

May 19, 2014, 5:00 p.m. – 7:00 p.m.
19200 44th Avenue West, Lynnwood, WA 98046
Lynnwood Library

Action Items

	Action Items	Person Responsible
1.	Committee members will fill-in the evaluation criteria matrix and return the completed matrix to Shanese Crosby (scrosby@triangleassociates.com) by **June 5th**.	Committee members
2.	Add an "Alternatives Considered" section in the Recommendations Memorandum Template.	Triangle
3.	Present Committee members a photo of the half-collapsed culvert just upstream of the study area.	City of Lynnwood

Welcome/Introductions

The purpose of this meeting was to brainstorm and discuss potential flood reduction alternatives.

Attendees

Advisory Committee	Project Team
Josh Brower, Representing Great Floors Owner	**Robert Victor,** City of Lynnwood Project Manager
Ed dos Remedios, Citizen	**Jared Bond,** City of Lynnwood
Dave Gilbertson, Parks Board	**Mark Ewbank,** Herrera, Consultant Project Manager
Larry Ingraham, Citizen	**Mike Giseburt,** Leidos
David Plodwick, Citizen	**Cynthia Carlstad,** Triangle
Roz Smith, Casa Del Rey	**Shanese Crosby,** Triangle
Eric Whitehead, Casa Del Rey	

General Business

There were no comments on the April meeting summary. Committee members can send any suggested comments to Shanese Crosby (Triangle Associates). The March meeting summary is now available online, with addresses removed.

Development of Alternatives

Advisory Committee members brainstormed potential alternatives for the project team to evaluate in Phase 2 of the Scriber Creek Flood Reduction Study.

	Potential Avoidance Strategies to be Evaluated	Potential Co-Benefits	Discussion	Early Action?
1.	**Sediment Removal** at problem areas (such as Casa Del Rey and others); could include volunteer participation.	• **Educational benefits** – this is an opportunity to get community members out in the stream and teach them about the stream.	• Sediment removal as part of a holistic plan may be more permittable. • Regulators may be	✓

	Potential Avoidance Strategies to be Evaluated	Potential Co-Benefits	Discussion	Early Action?
			more amenable if removal is done by hand instead of by heavy equipment.	
2.	Use **modeling to evaluate flood prone properties** at a specified level of service (e.g. 25-year level of service). • Model where these properties are both with the existing culverts and if the culverts were replaced • Consider buy outs of flood prone properties • Incorporate distributed detention/ storage ponds where possible, such as locating small storage ponds on the properties that may be bought out, or other available properties such as the school district open area (also described as a separate measure below).	• **Environmental benefits** – potentially more open space.	• This would help flooding throughout the corridor. • Could use a similar financing framework as a utility project.	
3.	**Flood proofing** – elevate structures so they are not damaged by flood waters.			
4.	**Zoning Review** – Identify undeveloped areas and see where building may occur. Are setbacks adequate?		• There is little undeveloped land in the study corridor.	
5.	**Incentives for stormwater retrofits** – Incentives for landowners to retrofit to retain stormwater on-site. Could reduce surface water utility rates as an incentive.			

	Potential Structural Strategies to be Evaluated	Potential Co-Benefits	Discussion	Early Action?
1.	**Raising Roads** – raise road at 188th and possibly excavate upland areas around the wetland to create more storage. Do not upsize the culvert, thus creating a sort of taller dam to impound more water in the upstream wetland.	• **Partnership Opportunities** – potential to partner with Parks Department		
2.	**Raising Roads** – raise portions of old 196th and driveway access of Park View Plaza and Great Floors.	• **Partnership Opportunities** – potential to partner with private businesses and the Parks Department.	• Need to consider upstream impact of this project if culverts are not enlarged. • Would not necessarily have to deal with permits since there would be no in-water work.	

	Potential Structural Strategies to be Evaluated	Potential Co-Benefits	Discussion	Early Action?
3.	**Regional Storage Site** at Edmonds School District Property.	• **Educational benefits** – could include educational programs at the site. • **Partnership Opportunities** – potential to partner with the Parks Department.	• Would likely provide relief to Casa Del Rey. • Because of the buffer zone requirements, there is little the School District can do with the land. • Could additionally excavate the site for more storage and keep the setback the same.	
4.	**Regional Storage Site** at empty lot south of 188th on 55th Ave.		• There are no wetlands on this property.	
5.	**Increase creek channel size** – where possible, potentially near 188th.		• May not solve the problem, and it will be difficult to get community buy-in as private businesses may have to give up parking spaces under this alternative.	
6.	**Levees/berms at north end of project site** – near Eunia Plaza/Flynn's Carpet	• **Recreation benefit** – levees and berms can have walking/bike trails on top of them.	• Could be a cost-effective, short-term solution.	
7.	**Earthen Levees or HESCO barriers**– spot solutions.		• Cheap to deploy. • Not aesthetically pleasing. • Will not contribute to an increase in sediment deposition.	
8.	**Diversion pipes or channels.** To convey high flows so existing creek channel does not overtop its banks.		• Common technique, but may be difficult to implement in this corridor.	
9.	**Culvert Realignment** – realign culvert beneath Casa Del Rey access roadway.	• **Partnership Opportunities** – potential to partner with private residents.	• Have to consider downstream effects. • Could resolve more than one issue.	
10.	**Culvert Replacements** – replace culverts under 196th.		• Log fill beneath 196th roadway could pose significant construction	

	Potential Structural Strategies to be Evaluated	Potential Co-Benefits	Discussion	Early Action?
			challenges and increase costs.	
11.	**Scriber Lake Outlet Control** – increase storage, re-do inlet control.	• **Educational benefits** – could include educational programs at the site. • **Partnership Opportunities** – potential to partner with the Parks Department.		
12.	**Sediment Deposition Ponds.**			
13.	**Channel Stabilization** – to control erosion.			

	Potential Watershed-wide Projects to be Evaluated	Potential Co-Benefits	Discussion	Early Action?
1.	**Enlarge Scriber Lake** by removing hill between Scriber Lake and smaller body of water.		• Can add a walking path(s) around the lake; park improvements.	
2.	**Address tributary inflows** to the creek. This could be stormwater retrofits to reduce inflows to Scriber Creek.			
3.	**Water reuse through stormwater retrofit incentives for businesses.** • Incentivize businesses to retain their water like PCC in Edmonds. • Tax incentives for stormwater retrofits.		• Likely cannot change the tax structure as a result of this Study.	
4.	**Underground storage vaults** – possibly at School District site. • Can reduce public safety concerns surrounding above-ground detention facilities.	• **Public safety**	• This solution is usually only possible if there a large lot available.	
5.	**Stormwater pump stations** – could potentially increase storage in Scriber Lake and have a short pump station under 196th.		• Very expensive. • Could have negative downstream effects.	
6.	**Increase storm drain pipe sizes to enable in-pipe flow control** when completing future road projects to support corridor flood management.		• Complex and time consuming; could take decades to fully implement.	

Questions & Answers

During the alternatives development brainstorm, Committee members asked the following questions. City answers are in *italics.*

- In general, how long does it take to secure a permit?
    - *It depends on what the permit is for. At a minimum, projects of these types require the City to go through the State Environmental Protection Act (SEPA) process and coordinate with*

multiple permitting agencies. The State Department of Fish and Wildlife has 30 days to make a decision after the SEPA process is complete.
    - *For smaller maintenance type projects, like the removal of sediment at specific problem areas, a permit could possibly be achieved within a year, but it is not common.*
- Is the City pursuing grant funding for these projects?
    - *Yes, the City is actively seeking grants.*
- How much does the City spend on flood recovery when it does flood? Can that funding be reallocated for flood reduction projects?
    - *The details of this budget are not known to the project team at this time. The City has set aside some seed funding for project implementation. Phase 2 of the Scriber Creek Flood Reduction Study will include the identification of outside funding sources.*
- Are culverts more prone to fill with sediment than open channels?
    - *Not necessarily, it depends on flow velocities and adjacent channel characteristics.*
- Does the City have a culvert maintenance program?
    - *Yes, but it depends on the regulatory cycle. The City usually receives a permit to complete ongoing maintenance work on a 5-year timeline.*

Next Steps

The final Advisory Committee meeting will be held on June 16, 2014 from 5:00 – 7:00 p.m.

Before the next meeting, Committee members will fill out the "community considerations" criterion for the alternatives brainstormed at the May 19th meeting. Triangle will compile the members' analysis and add this information to the Recommendations Memorandum for Committee members' consideration at the June meeting.

Attachment 1 – Flood Reduction Categories Worksheet

This document provides common categories of flood reduction alternatives for the Scriber Creek Flood Reduction Advisory Committee to consider as it brainstorms potential solutions to address long-term flooding in the Scriber Creek corridor. The City of Lynnwood is interested in hearing creative, innovative solutions from Committee members, in addition to the more common types of flood reduction projects.

Avoidance
Avoidance includes projects that help ensure areas at risk of flooding are not developed, unless development can occur without increasing flood risk elsewhere. Examples include:

- Zoning laws / critical area designations / setbacks
- Acquisition of flood-prone property
- ***Discussion Question:*** What do you see as the most important action the City can take to avoid flooding impacts?

Structural
Structural measures to reduce flooding impacts encompass solutions that are constructed, such as:

- Stormwater storage ponds (Edmonds School District stormwater pond)
- Creek flow storage (such as the North Scriber Creek Detention Facility north of 172nd & west of SR 99)
- Levees and berms
- Diversion channels or pipes (for high flows)
- Culvert replacements (for greater flow capacity)
- Channel enlargement and/or realignment
- Outlet control on Scriber Lake
- Pumping
- ***Discussion Question:*** What do you want to see the City construct to help alleviate flooding?

Watershed Scale Projects
Watershed scale projects occur at the watershed level, meaning the solutions are not site specific. Examples include:

- Distributed stormwater storage/detention to reduce storm flows to the creek
- Low impact development stormwater standards to reduce storm flows that leave developed sites, including homes
- ***Discussion Question:*** What do you want to see the City implement at the watershed level to reduce flooding impacts?

Site Specific Projects
Site specific projects help improve flooding impacts at specific problem areas. Examples include:

- Flood easement acquisitions
- Improved drainage systems (catch basins, ditches and culverts that convey stormwater away from homes, developed properties and roads)
- ***Discussion Question:*** Based on the problem areas identified by the Advisory Committee over the course of this project, what are potential solutions to alleviate flooding at these specific locations?

Flood Response

Flood response alternatives concentrate on providing support to the community once a flood event takes place. This may include:

- Plan for sand bag distribution and disposal
- Communication protocols between the City and community residents in the event of a flood
- Emergency pumping
- ***Discussion Question:*** What type of support would you like to see from the City when a flood event occurs?

Multi-use Projects

Multi-use projects can add a layer of complexity to any flood reduction project, as these alternatives often require coordination between multiple entities. However, these types of projects provide community members with benefits beyond flood reduction. Examples include:

- Partnering with the Parks Department to improve open space/recreational areas
- Partnering with the Edmonds School District to provide educational opportunities
- Prioritizing projects that produce the greatest environmental benefits
- ***Discussion Questions:*** How would you like to see the City partner with the Parks Department and what would you like to see as a result of this partnership? With the Edmonds School District? Others? How can these ideas be incorporated into flood reduction solutions?

Evaluation Criteria Matrix

The Committee brainstormed ideas for flood reduction projects in several categories, including avoidance strategies, structural, and watershed-wide solutions. The matrix below outlines these ideas, along with the criteria suggested by the Committee (for a full list of criteria brainstormed, see next page). Some of the criteria are purely technical in nature and require more information, but others can be more accurately measured or supplemented with information and input from the community. We would like Committee members to rate the flood reduction ideas for the "community considerations" criteria as homework (see "Flood Reduction Alternatives Summary" document" to designate on a scale of **1-5** (5 being the "most positive" – e.g. most benefit) where you see each project measuring up and provide any comments you may have).

Flood Risk Reduction Measure	Community Considerations**	Flood Reduction*	Cost*	Ease of Construction/ Implementation*	Ease of Maintenance*	Habitat Improvements*

**Note: these evaluation criteria are more technical in nature and we do not anticipate that Committee members will provide rankings for these criteria. However, these considerations are important elements in any decision-making process, and we expect to have a conversation about each of these criteria relative to the Committee's alternatives and discuss any concerns or issues that Committee members may have. The City and technical consultants will act as a sounding board and will provide their expertise as the Committee discusses these criteria.*

***Under community considerations, a higher score means the alternative positively addresses most, if not all, of your considerations outlined under "community considerations" below.*

At the April Advisory Committee meeting, Committee members reviewed and generally agreed on a set of criteria. The evaluation matrix above captures these criteria as follows:

Flood reduction

- Potential to **reduce flooding** in study area
- Effects on **flooding downstream** of Scriber Lake

Community Considerations

- **Aesthetics** impacts/benefits (appearance, odors, mosquitoes, etc.)
- **Public safety** considerations
- **Land ownership**/easements
- **Partnership** opportunities
- Potential to help management of **future development**
- Effects on **property values**

Cost

- Financing/**funding** (who is paying for it – increase for rate payers?)
- **Construction costs**

Habitat improvements

- Effects on **stream and riparian habitat**
- Ability to return corridor to a more **natural flow pattern**
- Use of **native plantings**
- Reduction of **sediment transport**

Ease of construction/implementation

- **Implementation** feasibility (design and construction)
- **Permitting requirements** (Is the project readily permittable)
- **Timing** – how quickly will the project be successful?

Ease of maintenance

- **Operation and maintenance requirements** and costs
- Ease of **maintenance**
- **Permitting requirements** for maintenance work

Scriber Creek Advisory Committee
DRAFT Meeting Summary

June 16, 2014, 5:00 p.m. – 7:00 p.m.
19200 44th Avenue West, Lynnwood, WA 98046
Lynnwood Library

Action Items

	Action Items	Person Responsible
1.	Triangle to finalize Recommendations Memo by July 3rd.	Triangle
2.	Committee members to sign Memo signature page the week of July 7th. The signature page will be available at the front desk of the Lynnwood Civic Center (19100 44th Avenue West) from July 7th to the 15th.	Committee members
3.	The City will provide monthly email updates to Committee Members on the Study's progress.	City of Lynnwood

Welcome/Introductions

The purpose of this meeting was to confirm prioritization rankings of flood reduction alternatives, finalize content for the Recommendations Memorandum, and determine next steps.

Attendees

Advisory Committee	Project Team
Josh Brower, Representing Great Floors Owner **Miran Che,** Eunia Plaza **Nora Chin,** Citizen **Ed dos Remedios,** Citizen **Dave Gilbertson,** Parks Board **Larry Ingraham,** Citizen **Chris Nyhus,** Park View Business Owner **Matt Pease,** Park View Business Owner **David Plodwick,** Citizen **Roz Smith,** Casa Del Rey **Eric Whitehead,** Casa Del Rey	**Robert Victor,** City of Lynnwood Project Manager **Jared Bond,** City of Lynnwood **Mark Ewbank,** Herrera, Consultant Project Manager **Mike Giseburt,** Leidos **Cynthia Carlstad,** Triangle **Shanese Crosby,** Triangle

General Business

There were no comments on the May meeting summary. Committee members can send any suggested comments to Shanese Crosby (Triangle Associates). The March and April meeting summaries are now available online, with addresses removed.

Review Compilation of Evaluated Alternatives Worksheet

Advisory Committee members reviewed the Compilation of Evaluated Alternatives Worksheet to ensure the alternatives that scored highest were the alternatives the Committee wanted to recommend to the City for further evaluation (see **Appendix B** for completed worksheet). The Committee recommended making the following changes:

- The "culvert realignment beneath Casa Del Rey access road" alternative was expanded to include improvements to the creek channel between Casa Del Rey and 196th to help resolve some of the flow regime and sediment deposition issues that occur within this stretch of the creek.
- "Raising the road at 188th" was moved to the "green" category to help address flooding upstream and in the middle area of the study corridor, paying close attention to impacts on upstream properties.
- "Raising the road at 196th" was moved to the "green" category to address the elevation dip that allows for debris and sediment to collect in the area. Additionally, the Committee added the option of "removing old 196th bridge" which may be more effective than raising the roadways.
- The "sediment removal" alternative was combined with "channel stabilization" and moved to the "green" category in an effort to reduce the source of sediment deposits and establish an ongoing sediment maintenance program.
    - *The City commented that establishing an ongoing sediment removal program is difficult as there are many competing opinions on whether or not the City should take on that liability. Committee members felt strongly this should be a recommendation, and that the responsibilities of the City and private property owners should at least be delineated.*

Questions & Comments

During the review of the Compilation of Evaluated Alternatives Worksheet, Committee members asked the following questions. City answers are in *italics.*

- Will the City and the technical consultant be looking at the most appropriate sequencing for implementing these alternatives?
    - *Yes. During Phase 2, the City will look at the sequencing of the alternatives to determine what makes most sense so that flooding is not worsened anywhere in the creek corridor (including downstream of Scriber Lake).*
- How difficult will it be to get the downstream alternatives approved because of the high cost associated with these projects?
    - *The most expensive project will likely be outlet control at Scriber Lake, followed by building a regional detention pond, and then addressing the drainage issues around the old 196th bridge. It may be a possibility for the Washington State Department of Transportation (WSDOT) to help fund addressing the issues around old 196th as WSDOT has a mandate to make stream culverts they have jurisdiction over more fish passable.*
    - *Part of Phase 2 will be identifying funding sources.*
        - Has the City contacted WSDOT at this time?
            - *Yes, and WSDOT asked the City to again reach out to the Agency once the City is further along in the process.*
- How difficult is the analysis to determine if 188th can be raised efficiently?
    - *It wouldn't be too complicated. Enough engineering needs to be done to figure out how much the project would cost, and roadway design standards would need to be considered.*
- If 188th was raised, how would this increased water storage affect the park? Could it enhance the area or will it be a deterrent?
    - *The area is currently a wetland. 188th overtops during a 10-year storm, so there is some existing storage there already.*
        - As part of this project, invasive species could be removed and a walking path could be added.
- Has the habitat restoration project near Brookmore Estates led to a decrease in sediment entering the creek?

  - *The City completed this project in December 2013. There is no requirement or provision for follow-up monitoring related to this site.*
- Are there any opportunities to address tributary inflow?
  - *This gets into incentives, which are difficult to get started. The City is also bound to development cycles, and often times property owners' buildings are grandfathered in.*
- What is the possibility of having the Committee's recommendations trumped by one of the Councilmembers?
  - *Having community support for projects goes a long way.*
    - One Committee member stated that during the presentation to the Council, the Committee can mention that they spent a combined 120 hours looking at this information.
- Are there any other kinds of projects being implemented in surrounding jurisdictions that could potentially be considered in this study that the Committee has not talked about?
  - *The types of projects being considered by similar jurisdictions are accounted for in the alternatives brainstormed by the Committee.*
- Committee members have seen a lot of debris, specifically from the 7/11, in the lower reaches of the creek.
- The Recommendations Memo should highlight a comprehensive suite of alternatives to evaluate to help ensure that the problem is resolved appropriately.

Review Recommendations Memo

The Committee briefly reviewed the contents of the Recommendations Memorandum. The schedule for finalizing the Recommendation Memo is as follows:

Activity	Due Date
Triangle to send out updated Recommendations Memo based on June 16th meeting feedback to the Committee.	Monday, June 23rd
Committee member feedback due to Triangle	Monday, June 30th
Final Recommendations Memo to Committee	Thursday, July 3rd
Signature Page available at City of Lynnwood Civic Center (19100 44th Ave W)	Monday, July 7th – Tuesday, July 15th
Committee Presentation to City Council	September

All Committee members are invited to present the Committee's recommendations to City Council. The City anticipates that the presentation will occur in September. Matt Pease (Park View Plaza) volunteered to help present the Committee's recommendations.

Next Steps

This was the last scheduled Scriber Creek Flood Reduction Advisory Committee meeting. The City anticipates re-convening the Committee during Phase 2 of the Flood Reduction Study and potentially holding a public meeting. The Committee recommended the following next steps:

- A minimum of monthly email updates from the City on the Study's progress (more when appropriate).
- Evaluation of the process.

APPENDIX B

Photographic Documentation

SCRIBER CREEK CORRIDOR MANAGEMENT PLAN—STATE ROUTE 99 TO SCRIBER LAKE PHOTOGRAPHIC DOCUMENTATION

Photo Number	Photo Description
1	December 3, 2007, flooding north of Casa Del Ray a
2	December 3, 2007, flooding north of Casa Del Ray b
3	December 3, 2007, flooding north of Casa Del Ray c
4	December 3, 2007, flooding northeast corner 189th and 55th
5	December 3, 2007, flooding near 188th and 55th b
6	December 3, 2007, flooding near 189th Pl and 55th
7	December 3, 2007, flooding near 190th and 55th a
8	December 3, 2007, flooding near 190th and 55th b
9	December 3, 2007, flooding near 190th and 55th c
10	December 3, 2007, flooding near 190th and 55th d
11	December 3, 2007, flooding near 18600 99 a
12	December 3, 2007, flooding near 18600 99 b
13	December 3, 2007, flooding near 18600 99 c
14	December 3, 2007, flooding near 18600 99 d
15	December 3, 2007, flooding near 18600 99 e
16	December 3, 2007, flooding near 18600 99 f
17	December 3, 2007, flooding near Casa Del Ray a
18	December 3, 2007, flooding near Casa Del Ray b
19	December 3, 2007, flooding near Casa Del Ray c
20	December 3, 2007, flooding near Casa Del Ray d
21	December 3, 2007, flooding near Casa Del Ray e
22	December 3, 2007, flooding near 188th and 55th a
23	December 3, 2007, flooding northwest corner 189th and 55th
24	December 3, 2007, flooding at Old Buzz Inn 1
25	December 3, 2007, flooding at Old Buzz Inn 2
26	December 3, 2007, flooding at Old Buzz Inn 3
27	December 3, 2007, flooding at Old Buzz Inn 4
28	December 3, 2007, flooding at Old Buzz Inn
29	December 3, 2007, 190th and 55th flooding
30	December 3, 2007, Casa Del Rey flooding, Roz Smith
31	December 3, 2007, flooding at 18600 99

Photo Number	Photo Description
32	December 3, 2007, Old 196th Street SW flooding a
33	December 3, 2007, Old 196th Street SW flooding c
34	December 3, 2007, Old 196th Street SW flooding d
35	March 14, 2011, Culvert surcharge near Eunia Plaza
36	March 14, 2011, flooding near Eunia Plaza 1
37	March 14, 2011, flooding near Eunia Plaza 2
38	March 14, 2011, flooding near Eunia Plaza 3
39	March 14, 2011, flooding near Flynn's Carpets 01
40	March 14, 2011, flooding near Flynn's Carpets 02
41	March 14, 2011, flooding near Flynn's Carpets 03
42	March 14, 2011, flooding near Flynn's Carpets 04
43	March 14, 2011, flooding near Flynn's Carpets 05
44	March 14, 2011, flooding near Old Buzz Inn
45	November 23, 2011, flooding near Diversion Structure 001
46	November 23, 2011, flooding near Diversion Structure 002
47	November 23, 2011, flooding near Diversion Structure 003
48	November 23, 2011, flooding near Diversion Structure 004
49	November 23, 2011, flooding near Diversion Structure 005
50	November 19, 2012, 190th Street and culvert overtopping 001
51	November 19, 2012, 190th Street and culvert overtopping 002
52	November 19, 2012, 190th Street and culvert overtopping 003
53	November 19, 2012, 190th Street and culvert overtopping 004
54	November 19, 2012, 190th Street overtopping 01
55	November 19, 2012, 190th Street overtopping 02
56	November 19, 2012, 190th Street residential flooding 001
57	November 19, 2012, flooding down 55th 01
58	November 19, 2012, flooding down 55th 02
59	November 19, 2012, flooding down 55th 03
60	November 19, 2012, flooding down 55th near 189th Street SW
61	November 19, 2012, flooding down 55th near 190th
62	November 19, 2012, flooding near 189th Street SW and 55th 01
63	November 19, 2012, flooding near 189th Street SW and 55th 02
64	November 19, 2012, flooding near 189th Street SW and 55th 03
65	November 19, 2012, 189th Street SW flooding north 01
66	November 19, 2012, 189th Street SW flooding north 02
67	November 19, 2012, 189th Street SW flooding west 01
68	November 19, 2012, 190th Street SW flooding west 02
69	November 19, 2012, 190th Street SW flooding west 03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Casa del Rey Condominiums- Photo of flooding on Dec. 3, 2007 (taken from patio of #115)


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Flynn's
CARPET SERVICE
TOP WHOLESALE
42


TOP WHOLESALE
BICYCLES WEST
TREK
OPEN TO THE PUBLIC
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APPENDIX C

Survey Base Map

SCRIBER CREEK FLOOD REDUCTION STUDY

PORTIONS OF THE NW 1/4 AND THE SW 1/4 OF SEC 16 AND THE NW 1/4 OF SEC. 21, TWN. 27 N., RGE. 04 E. W.M.
CITY OF LYNNWOOD, SNOHOMISH COUNTY, WASHINGTON.

VERTICAL DATUM

NAVD 88
CITY OF LYNNWOOD BENCHMARK 68
TOP OF FLANGE BOLT BY THE LETTER "O" IN OPEN ON THE TOP OF FIRE HYDRANT LOCATED ON THE WEST SIDE OF HIGHWAY 99 APPROXIMATELY 1200' NORTH OF 188TH ST SW, 68' SOUTH OF PP# P-222.
ELEV: (370.26' NGVD29)+3.62'=373.88'

BASIS OF BEARING

NAD 1983
WASHINGTON STATE PLANE NORTH PROJECTION, BASED ON GPS OBSERVATIONS USING WSRN AND GEOID 2012A. UNITS OF MEASUREMENT ARE US SURVEY FEET.

LEGEND

- SET NAIL AND WASHER
- SET REBAR AND CAP
- WELL CASING
- BOLLARD
- SIGN
- SANITARY SEWER MANHOLE
- STORM CATCH BASIN
- STORM MANHOLE
- POWER TRANSFORMER
- GUY ANCHOR
- UTILITY POWER POLE
- JUNCTION BOX
- LUMINAIRE
- ELECTRICAL METER
- COMMUNICATION MANHOLE
- COMMUNICATION RISER
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- WATER VALVE
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- ——— S ——— SEWER LINE
- ——— W ——— WATER LINE
- ——— P ——— ELECTRICAL LINE
- ——— T ——— COMMUNICATION LINE
- —x—x—x—x— FENCE

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1. SURFACE UTILITY FACILITIES ARE SHOWN HEREON PER FIELD LOCATED VISIBLE EVIDENCE. THERE MAY BE UTILITIES THAT EXIST ON THIS SITE OTHER THAN THOSE GRAPHICALLY DEPICTED HEREON.

2. UNDERGROUND (BURIED) UTILITIES SHOWN HEREON ARE BASED ON COMBINATIONS OF VISIBLE SURFACE EVIDENCE, UTILITY LOCATOR MARKINGS AND RECORD DATA (SUCH AS AS-BUILT OR UTILITY DESIGN DRAWINGS). ALL UNDERGROUND UTILITIES SHOWN HEREON ARE APPROXIMATE AND, IN SOME CASES, ARE SHOWN AS STRAIGHT LINES BETWEEN FIELD LOCATED SURFACE UTILITY FACILITIES. UNDERGROUND UTILITIES MAY HAVE BENDS, CURVES OR CONNECTIONS WHICH ARE NOT SHOWN.

3. ALTHOUGH LOCATIONS OF UNDERGROUND UTILITIES BASED ON UTILITY LOCATOR MARKINGS AND RECORD DATA (SUCH AS AS-BUILT OR UTILITY DESIGN DRAWINGS) ARE DEEMED RELIABLE, AHBL, INC. ASSUMES NO LIABILITY FOR THE ACCURACY OF SAID DATA.

4. CALL 1-800-424-5555 BEFORE ANY CONSTRUCTION.

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EQUIPMENT USED

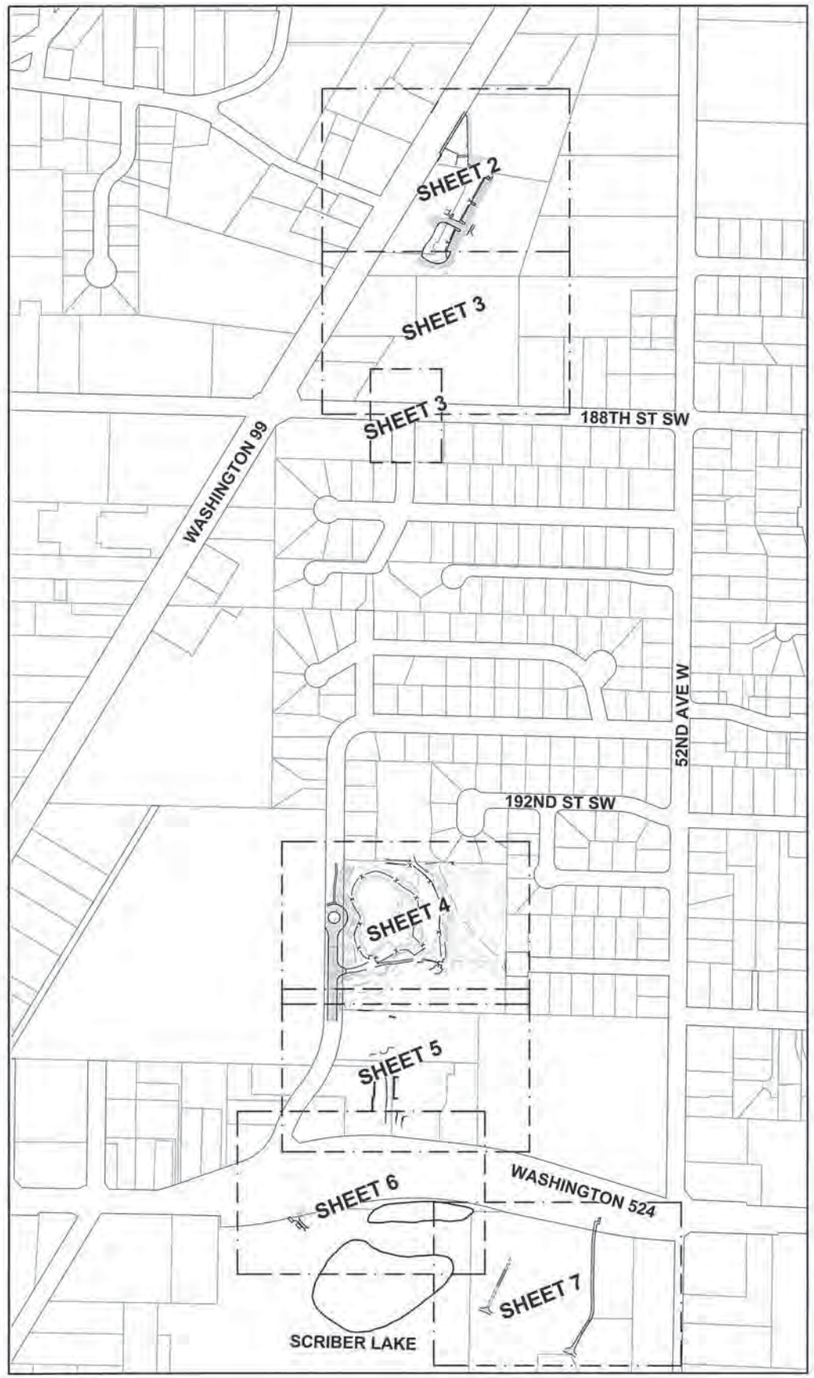
3" TOTAL STATION UTILIZING STANDARD FIELD TRAVERSE METHODS FOR CONTROL AND STAKING.

SURVEYOR'S CERTIFICATE

I, DAVID C. FOLLANSBEE, A PROFESSIONAL LAND SURVEYOR IN THE STATE OF WASHINGTON, HEREBY CERTIFY THAT THIS MAP CORRECTLY REPRESENTS A SURVEY MADE BY ME OR UNDER MY DIRECT SUPERVISION IN FEBRUARY 2015, AT THE REQUEST OF HERRERA ENVIRONMENTAL CONSULTANTS.

4-6-15

DAVID C. FOLLANSBEE, PLS 45161 DATE



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811 Know what's below. Call before you dig.

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Client:
HERRERA ENVIRONMENTAL CONSULTANTS
2200 SIXTH AVENUE, SUITE 1100
SEATTLE, WA 98121

Job No.
2130183.50

Issue Set & Date:
APRIL 6, 2015

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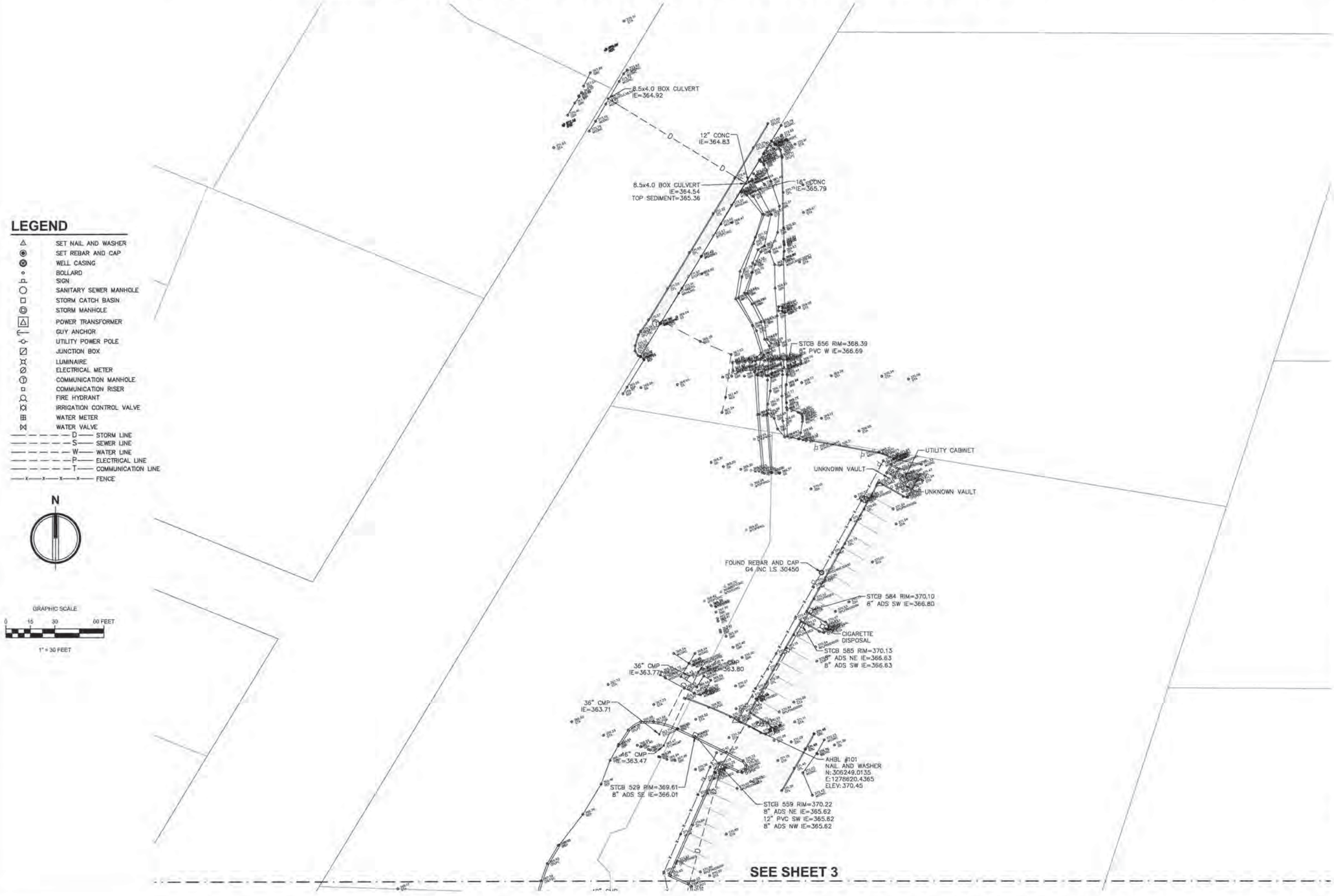

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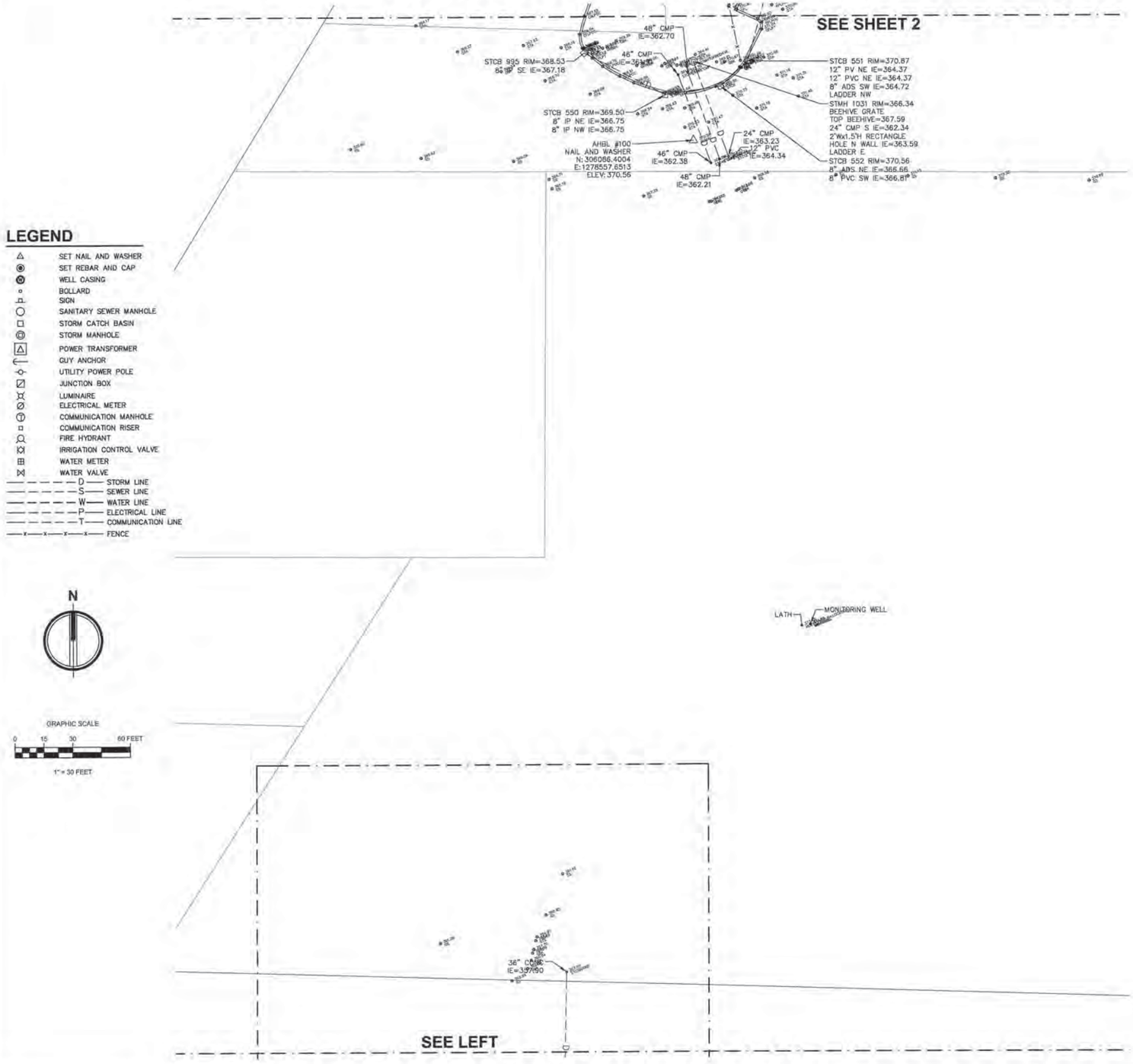

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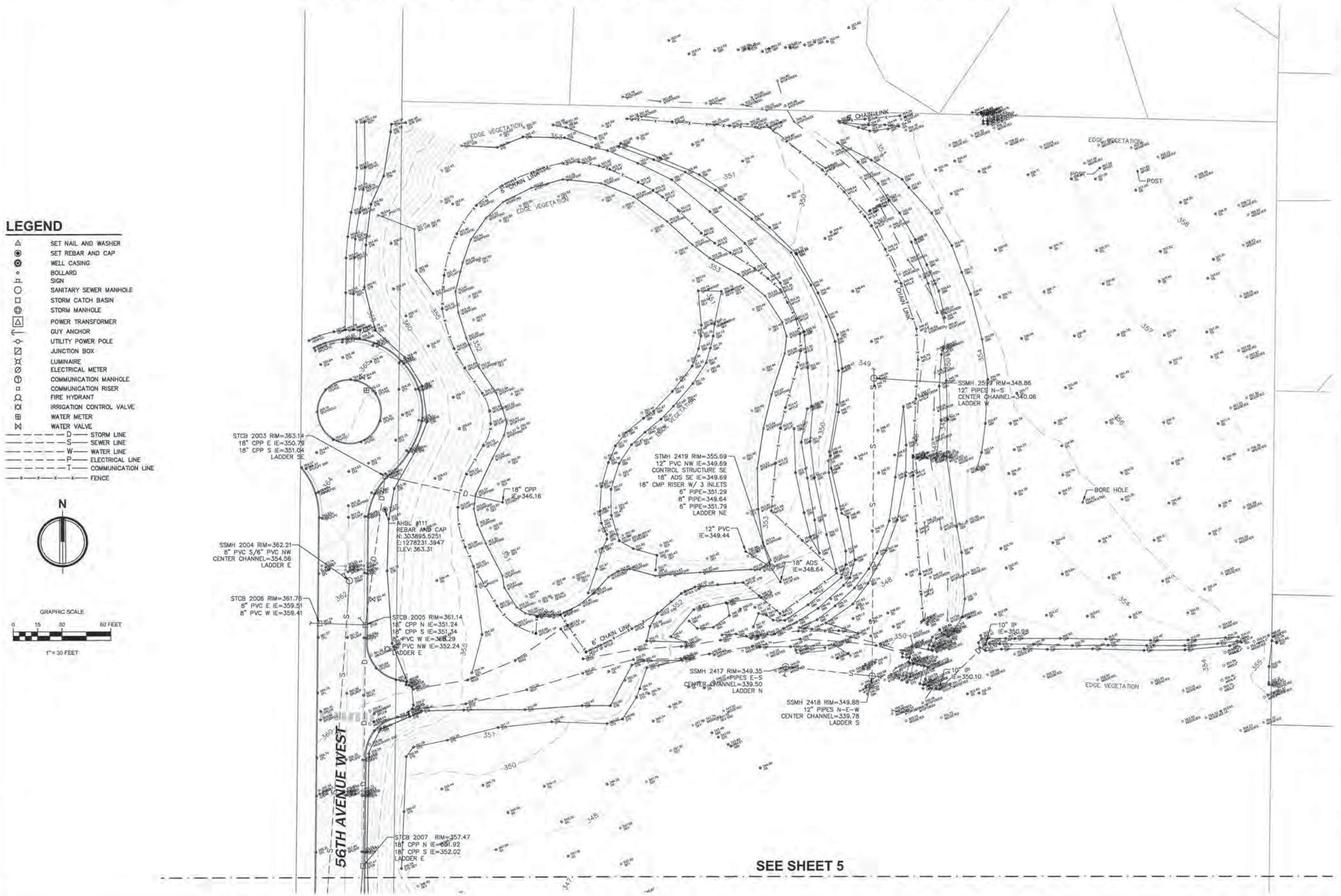

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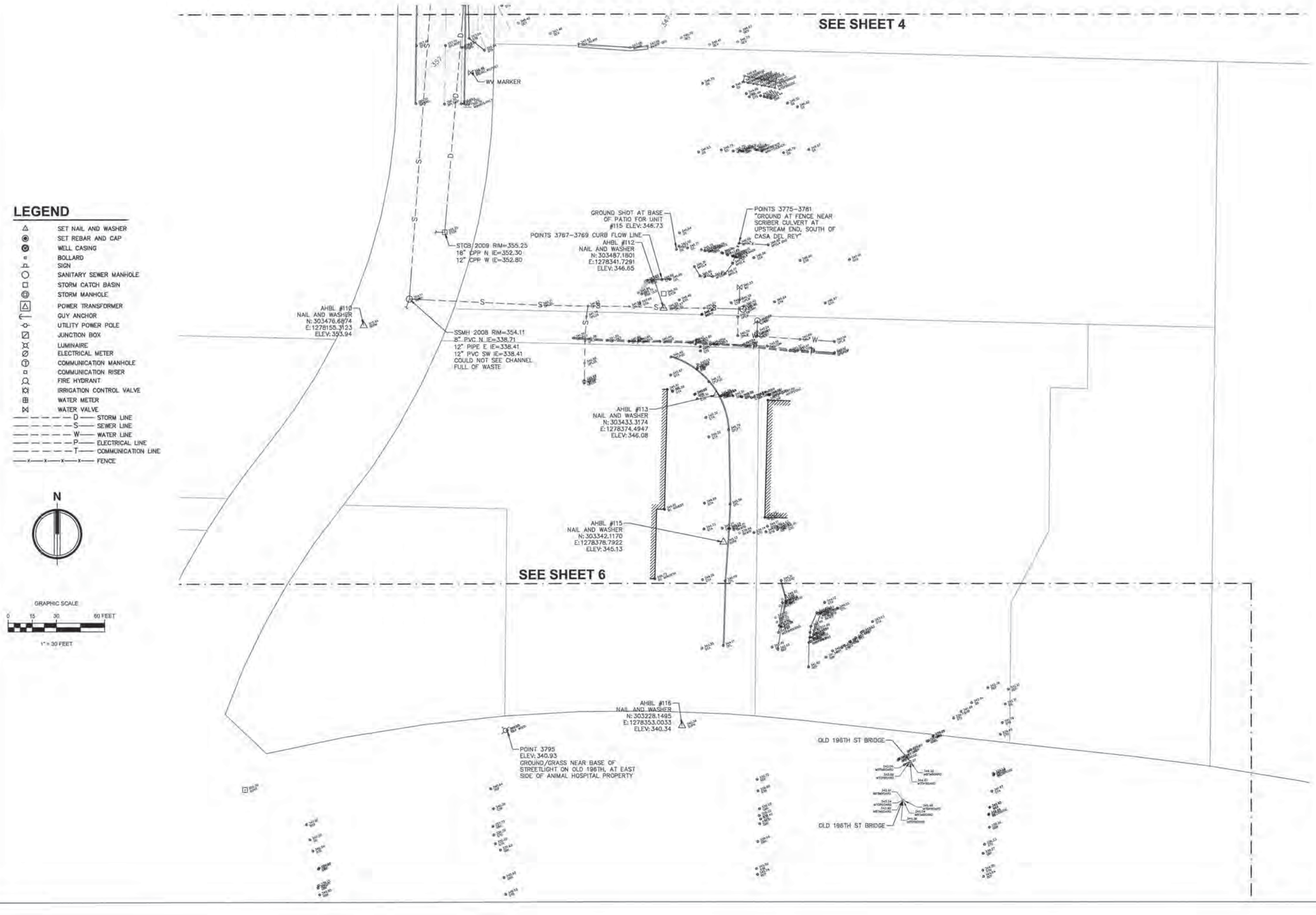

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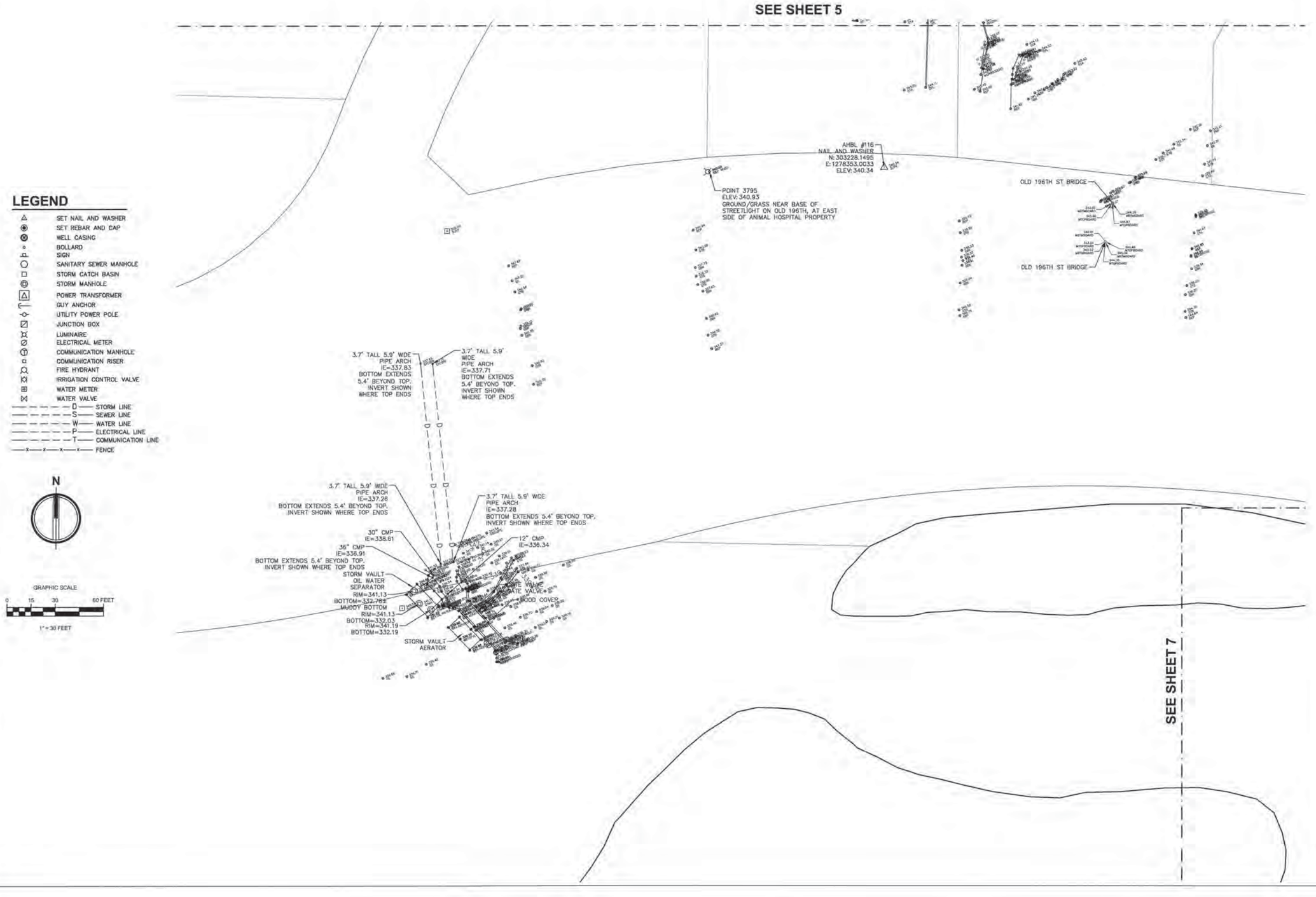

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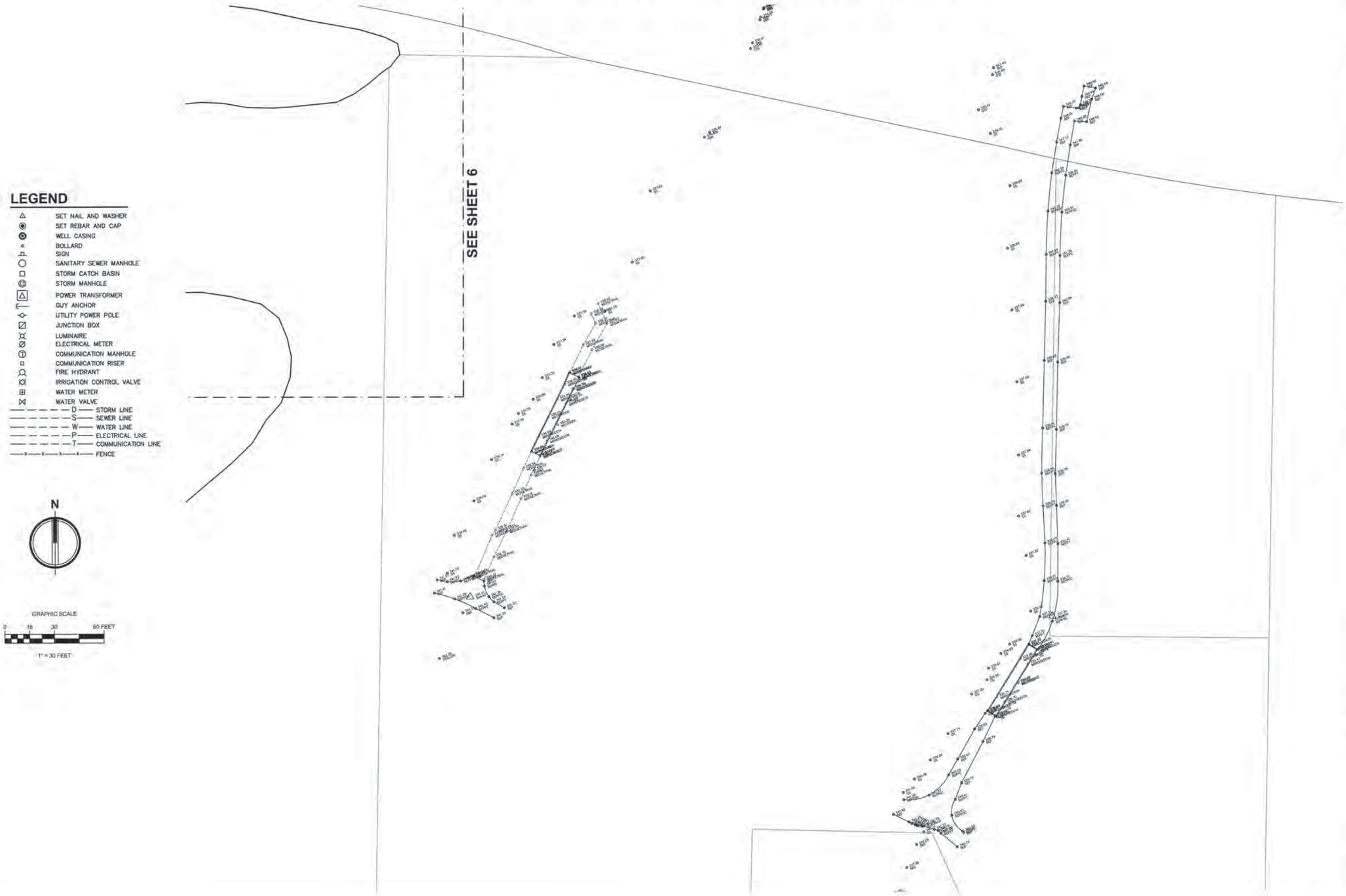

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APPENDIX D

Geotechnical Analysis Report

GEOTECHNICAL ALTERNATIVES REPORT

Scriber Creek Flood Reduction Study
Lynnwood, Washington

HWA Project No. 2014-180-21

Prepared for
Herrera Environmental Consultants

September 30, 2016

HWA GeoSciences Inc.
• Geotechnical Engineering
• Hydrogeology
• Geoenvironmental Services
• Inspection & Testing

HWA GEOSCIENCES INC.
Geotechnical & Pavement Engineering • Hydrogeology • Geoenvironmental • Inspection & Testing

September 30, 2016
HWA Project No. 2014-180-21

City of Lynnwood
19100 44th Avenue West
Lynnwood, Washington 98036

Attention: Robert Victor, P.E.

Subject: **PRELIMINARY GEOTECHNICAL REPORT**
Scriber Creek Flood Reduction Study
Lynnwood, Washington

Dear Mr. Victor:

We are pleased to submit this preliminary geotechnical report for the Scriber Creek Flood Reduction Study in Lynnwood, Washington. This report presents our preliminary geotechnical recommendations for the proposed alternatives based on our review of existing subsurface information and our geotechnical investigation performed for this phase of the project. We appreciate the opportunity to provide geotechnical services on this project. Please call if you have questions, or if we may be of further service.

Sincerely,

HWA GEOSCIENCES INC.

JoLyn Gillie, P.E.
Geotechnical Engineer, Principal

JLG:RNB:jlg

21312 30th Drive SE
Suite 110
Bothell, WA 98021.7010

Tel: 425.774.0106
Fax: 425.774.2714
www.hwageo.com

TABLE OF CONTENTS

LIST OF FIGURES (FOLLOWING TEXT)

APPENDICES

PRELIMINARY GEOTECHNICAL REPORT
SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

1 INTRODUCTION

1.1 GENERAL

This report summarizes the results of a geotechnical investigation by HWA GeoSciences Inc. (HWA) to provide preliminary design recommendations in support of the Scriber Creek Flood Reduction Study. This study concerns a corridor along Scriber Creek between 188th Street SW and 196th Street SW in Lynnwood, Washington. The purpose of our investigation was to evaluate the subsurface conditions at two sites along the alignment and provide preliminary geotechnical recommendations for design of the various alternatives that are proposed to reduce flooding along the Scriber Creek corridor.

1.2 PROJECT UNDERSTANDING

The project site is located within the City of Lynnwood, Washington, along the Scriber Creek corridor between 188th Street SW and 196th Street SW, as shown on the Vicinity Map, Figure 1. Significant flooding has occurred several times within this corridor in the last 20 years impacting nearby residences and businesses. In 2013 the City hired a consultant team and formed an advisory committee to identify various alternatives for reducing flooding of the creek. In July 2014 the committee made their recommendations for the preferred alternatives. These alternatives are presented in the *Final Report and Recommendations to the Lynnwood City Council* (Triangle, 2014).

The flood reduction study is currently in Phase 2. The intent of this phase is to assess the creek's existing conditions and determine the technical feasibility of the preferred alternatives.

1.3 WORK SCOPE

Our scope of work included (1) reviewing available geotechnical information along the corridor; (2) performing investigations in potential floodplain storage areas; (3) performing analyses of soil and groundwater characteristics at selected locations, and (4) preparing a preliminary engineering report commensurate with the level of geotechnical analyses performed for this planning study.

2 FIELD AND LABORATORY TESTING

2.1 AVAILABLE GEOTECHNICAL DATA

The following documents have been reviewed as background for this study:

- Washington State Highway Commission (WSHC), (1965), *C.S. 3130 SSH 1-W, Lynnwood Easterly, (Jct. SR 99 to Jct. SR 5), Job No. L-2899,* Letter dated January 7, 1965, prepared for Mr. C. C. Prahl, Director of Highways.

- WSHC, (1967), Borings for SSH 1-W SR 104 Section 64th Avenue West in Lynnwood to Jct. PSH 1, Subsection Scriber Lake Fill, drilled August 3 through 8, 1967 and October 9 through 11, 1967.

- Applied Geotechnology Inc., (1984), *Geotechnical Investigation, Scriber Lake Park, Phase II, Lynnwood, Washington*, dated June 21, 1984, prepared for Bruce Dees and Associates.

- Hong West and Associates, Inc. (HWA), (1996a), *Geotechnical Engineering Investigation, SR 99 Improvements Project, 244th Street S.W. to 148th Street S.W., Snohomish County, Washington*, dated January 3, 1996, prepared for Entranco.

- HWA, (1996b), *Geotechnical Engineering Evaluation, Existing Pile Foundation System, Scriber Creek Bridge, Lynnwood, Washington*, dated January 11, 1996, prepared for Reid Middleton.

- Landau Associates, Inc. (1999), *Geotechnical Engineering Services, Cedar Valley Community School, Edmonds School District, Lynnwood, Washington,* dated November 15, 1999, prepared for Mahlum Architects, Inc.

Relevant exploration logs from these previous investigations are included in Appendices C through G. The approximate locations of the previous explorations by others are shown on Figures 2A through 2F.

2.2 CURRENT FIELD EXPLORATIONS

Our current site investigation included two test borings; one located about 200 feet north of 188th Street SW near its intersection with 55th Avenue W and the second located in the playfield east of Cedar Valley Community School, about 100 feet east of Scriber Creek. Approximate borehole locations are shown on Figures 2B and 2D. Field exploration methods are described in more detail and summary boring logs are presented in Appendix A.

2.3 LABORATORY TESTING

Laboratory tests were conducted on selected soil samples to characterize relevant engineering properties of the on-site soils. Laboratory tests, as described in Appendix B, included moisture content determination, grain size distribution, and organic content. Appendix B provides details of the tests performed and the results of the testing.

3 SITE CONDITIONS

3.1 SITE DESCRIPTION

The study area begins at SR 99 about 400 feet north of its intersection with 186th Place SW and extends south along the Scriber Creek corridor to Scriber Lake, south of 196th Street SW. Scriber Creek flows in a north-south trending valley located between SR 99 to the west and 52nd Avenue W to the east. The corridor passes through both residential and commercial developments. Due to the surrounding development, the original creek alignment has been modified. As part of these modifications, the stream has been rerouted through culverts in several places. The culverts are generally located where the creek passes below roadways and through parking areas.

3.2 GENERAL GEOLOGY

The study area is located in the north-central portion of Puget Sound Lowland. The Puget Lowland is an elongated topographic and structural depression bordered by the Cascade Mountains to the east and the Olympics Mountains to the west. Low-rolling relief with some deeply cut ravines characterize the Lowland.

The Puget Lowland has periodically been occupied by a lobe of the Cordilleran Ice Sheet, one of two continental glaciers that developed during the recent ice ages of the Quaternary Period. The Cordilleran Ice Sheet was centered over the Coast Ranges of British Columbia. A portion of the ice sheet, termed the Puget Lobe, advanced south from British Columbia to occupy the lowlands of western Washington. At least four such advances occurred. The southern termini of these glacial advances were generally in the area of the Black Hills, south of Olympia, Washington.

Between and following these glacial advances, the Puget Lowland was partially filled with alluvium (stream channel) and lacustrine (lake) sediments deposited by runoff from the western slopes of the Cascades and the eastern slopes of the Olympics. Erosion of certain deposits, as well as local re-deposition of sediments, further complicates the geologic setting. As a result, the Puget Sound area is underlain by a thick, complex sequence of glacial and interglacial sediments. Because they have been over-ridden by great thicknesses of glacial ice, the interglacial deposits are typically very hard / dense, exhibiting low compressibility and high shear strengths.

The Scriber Creek corridor is a former glacial outwash channel. The channel formed by glacial meltwater running off the "Intercity Plateau" (the glacial drift plain that extends from Everett to Seattle) down to Swamp Creek, then to the Sammamish Valley and into Lake Washington. At the south end of the site, Scriber Lake formed and is situated within a glacial depression; possibly the result of ice gouging and/or the incorporation and subsequent melting of a large glacial ice block. Upon the cessation of local glacial activity, the broad depression situated along the western margin of Scriber Creek developed into Scriber Bog. The lake itself is essentially a bog pond, although unlike most typical ponds, it receives inflows from Scriber Creek.

3.3 LOCAL GEOLOGY

Geologic information for the study area along the Scriber Creek corridor was obtained from the U.S. Geological survey Map for the area, *Geology of the Edmonds East Quadrangle, Washington* (Minard, 1983). In general, the corridor is underlain by a sequence of glacial till and glacial outwash soils with recent non-glacially consolidated deposits overlying the till and outwash soils. The recent non-glacial sediments typically consist of manmade fills, alluvial silts, sands and peats. A generalized description of each major soil unit is presented below.

Fill is highly variable in composition, and its engineering properties are dependent upon the methods used to place it.

Alluvial deposits consist of soft to medium stiff, sandy organic silts and very loose to medium dense, sands that accumulate in lakes, ponds, bogs or the low energy environments within Scriber Creek and its tributaries. These materials typically exhibit low shear strength, high settlement potential, and are potentially liquefiable during a moderate level earthquake.

Peat soils are composed predominately of somewhat consolidated remnant plant material. These soils typically exhibit low strength, very high settlement potential, and are not typically liquefiable.

Glacial Till is a general category encompassing several different specific types of till including meltout, lodgment and ablation till and silty diamicts (i.e. a matrix-supported soil with the coarser material embedded in the finer grained matrix). Most till is a relatively heterogeneous mixture of gravel, sand and silt with the coarser grained material being embedded in the matrix of the finer grained material. Generally speaking, lodgement tills have relatively high shear strengths and low permeability and compressibility, and is often referred to as 'hardpan'. Till is relatively impermeable, except where sandy zones are encountered. Generally the till forms an impervious layer below which surface water cannot penetrate. Where sand overlies the till, water is often perched on top of the till. Ablation till is soil which was entrained in the glacial ice and was deposited down onto the ground surface as the ice melted. Thus, this deposit is not overconsolidated by the weight of the ice. While it may have the appearance of lodgement till, it

is generally medium dense to dense, and may have been locally reworked by stream action resulting in variable grain-size.

Glacial (advance) outwash is deposited in front of an advancing glacier or during inter-glacial periods, this fluvial deposit consists primarily of slightly silty, sandy, gravel to clean, medium to fine sand. The primary difference between this and other glaciofluvial deposits is the relative density, which is commonly dense to very dense due to the fact it was overridden by the weight of the advancing ice sheet. It is often water bearing. Outwash can be massive or laminated, with layers of gravel, and silt layers and lenses. Typically, advance outwash soils have relatively high shear strengths and high permeability and low compressibility.

3.4 SOILS

According to the Soil Conservation Maps for Snohomish County (NRCS, 2015), the Scriber Creek Corridor is predominately overlain by three major soil series: McKenna gravelly silt loam, 0 to 8 percent slopes situated along the main drainage way and flanked on the west and east by soils belonging to the Alderwood-Urban land complex, 8 to 15 percent slopes, and the Alderwood-Urban land complex, 2 to 8 percent slopes, respectively. The area immediately surrounding Scriber Lake is mapped as Mukilteo muck. A soils map for the project area is depicted on Figure 3.

The Mckenna soils form on glacial till in depressional areas or along drainage ways. These soils are slowly permeable, runoff is slow and erosion hazard is slight. The Alderwood-Urban land series vary only to the degree that one series formed on steeper slopes and subsequently has a moderate potential for erosion while the other is only considered to have slight potential. These soils formed on glacial till soils and intermingled with areas that are covered by streets, buildings, parking lots, and other structures that obscure or alter soils so that identification is not possible.

The Mukilteo muck is a very deep, very poorly drained soil that forms in depressional areas. It forms in organic material derived dominantly from sedges commonly referred to as peat.

3.5 SUBSURFACE CONDITIONS

Subsurface information has been obtained for three main areas along the Scriber Creek corridor. This information is presented beginning from the northern end of the site first. The locations of each of the explorations referenced in this section are provided on the Site and Exploration Plan, Figures 2A through 2F. Detailed information regarding the soils observed in the explorations in each area are presented in the following sections.

3.5.1 North of 188th Street SW

Existing data was obtained near 188th Street SW from previous HWA borings drilled along SR 99 (HWA, 1996a), including borings BH-15, BH-16, BH-35, and BH-36. HWA boring BH-1, drilled for this study, was located near Scriber Creek about 200 feet north of 188th Street SW, as shown on Figure 2B.

Borings in this area identified the presence of varying thicknesses of fill overlying alluvium or glacial till. BH-36 and BH-1 were located in close proximity to Scriber Creek and the major soil units observed in each of these borings are described below.

Fill: Boring BH-36, located at the northern end of the study area, encountered fill in the upper 8.5 feet. BH-1, located at the top of an embankment that appears to have been built up several feet above the creek elevation, encountered fill to a depth of about 12.5 feet. The fill in each of these borings generally consisted of very loose to medium dense, brown, gravelly, slightly silty to silty sand.

Alluvium: Alluvial deposits were encountered below the fill in both BH-36 and BH-1. The upper 2 to 3 feet of the alluvium consisted of very soft to medium stiff, dark brown, silt, with organics. The alluvium then graded to loose to medium dense, sand to silty sand, with interbeds of sandy silt. BH-36 was terminated in the alluvium at a depth of 16.5 feet. The alluvium extended to a depth of 17.5 feet in BH-1. Locally the thickness of alluvium in this area is expected to vary and was only fully penetrated at the location of BH-1 where it was approximately 5 feet thick.

Glacial Till: In BH-1, glacial till was encountered below the alluvium. The glacial till was characterized by very dense, olive gray to gray, silty, gravelly to very gravelly, sand. The thickness of this unit was not determined as it was not fully penetrated by our exploration.

3.5.2 Edmonds School District Property at Cedar Valley Community School

Existing data near Scriber Creek at the Cedar Valley Community School includes the borings, designated B-1 through B-16, conducted for design of the school building (Landau, 1999). These borings are located about 500 feet west of Scriber Creek where the creek flows east of the existing stormwater pond. The HWA boring, BH-2, drilled for this study, was completed in the playfield east of the creek about 100 feet, as shown on Figure 2D.

The borings at Cedar Valley Community School indicate the site is underlain by varying thicknesses of fill over ablation till and glacial (lodgement) till. The fill increases in thickness along the east side of the school property. Fill was placed on the east side to provide a level building pad for the school. The subsurface conditions at BH-2, drilled about 600 feet east of the borings for the school encountered similar deposits. Material in the upper approximately 2.5 feet was observed to consist of topsoil for the grass sod at the ground surface. Below about 5 feet,

ablation till was encountered, which extended to about 12.5 feet bgs. At about 12.5 feet bgs, the soil graded to lodgement till, with higher relative density, and lower moisture content than the ablation till.

3.5.3 196th Street SW and Scriber Lake

Existing information at 196th Street SW was obtained from the Washington State Highway Commission (WSHC), two HWA borings, and several peat probes by Applied Geotechnology Inc. (AGI). The data from WSHC include a 1964 site plan showing depth of peat, as encountered prior to construction of the expansion of 196th Street in 1967. During construction, the embankment fill that was intended to float over the peat on a bed of hog fuel and brush, displaced the peat and sank below the lake level. The weight of the fill pushed the peat to the side significantly decreasing the size of Scriber Lake. Five borings, designed H-1 through H-5 were then drilled in 1967 by the WSHC following displacement of the peat by the roadway fill. In 1995 HWA drilled two borings, designated BH-1 and BH-2, to explore the existing subsurface conditions for the old Scriber Creek Bridge. The borings were located near the abutments, with one boring at each end of the bridge (HWA, 1996b). Several peat probes (numbered 12 through 19) were performed by AGI for design of the trail along the southeast corner of Scriber Creek Park (AGI, 1984). Approximate locations of each of the explorations referenced in this section are provided on Figures 2E and 2F. The major soil units observed in the explorations are described below.

Fill: Fill in this area is highly variable in composition, and its engineering properties are dependent upon the methods used to place it. Fill placed for the present configuration of SR 524 (196th Street) includes granular fill, broken logs, hogfuel, and concrete rubble. These materials were observed to depths ranging from about 20 feet at H-3, near the culvert crossing under 196th Street, to 60 feet near H-5. Loose to dense sand and gravel fill was observed at the abutments of the old 196th Street bridge, ranging in depth from 13 feet in BH-1 at the west end of the bridge to 3 feet in BH-2 at the east end of the bridge. Other fill materials known to be used in the area include granular materials placed as utility trench backfill, subgrade and base course for roadways, parking areas and paved trails, and lightweight fills (hogfuel) for trails over bog areas within Scriber Lake Park.

Peat: Peat was observed in each of the explorations obtained from our review of the existing data. The WSHC map from 1964 shows the approximate depths to bottom of the peat prior to construction of the 196th Street embankment. North of the old Scriber Creek bridge the depth of peat ranged from about 4 feet to 30 feet, with the thickness generally increasing toward the south. South of the bridge the peat was shown to be as much as 37 feet deep. A cross-section along the old Scriber Creek Bridge shows similar peat depths, which ranged from about 20 feet below ground surface at the east end to 40 feet near the middle of the bridge (HWA, 1996b). The HWA borings provide information about the peat thickness, which ranged from about 21 feet at the west end of the bridge to about 7 feet at the east end of the bridge. No logs were available for the

map provided by WSHC in 1964, so no estimate of total peat thickness is available. At the southeast corner of Scriber Lake Park, the peat probes by AGI indicate the peat depth (and thickness) range from about 6 to 9 feet.

Sand and Gravel: Each of the explorations in this area were terminated in granular soils consisting of loose to very dense sand and gravel, with varying amounts of silt. The upper loose to medium dense soils are likely either alluvium deposited prior to the peat or recessional outwash deposited by the meltwater of the retreating glaciers. The dense to very dense soils are likely glacial advance outwash deposits.

3.6 GROUND WATER CONDITIONS

Shallow ground water was observed in nearly all the explorations reviewed for this study. In general, the ground water level coincides with the water level of Scriber Creek and Scriber Lake. Note that most of the water levels were obtained during drilling, which can be erratic and not indicative of the stabilized ground water level. To provide additional ground water level information, a stand pipe (well) was installed in the boring designated BH-1, which was drilled for this study. Table 1 presents the ground water levels for the previous explorations with ground water data near Scriber Creek within the study area. Table 2 present the ground water levels for the explorations completed for this study. The vertical datum used in this report is NAVD 88.

Table 1 – Ground Water Data for Previous Explorations in Study Area

Exploration ID	Ground Water Level (feet below ground surface)	Location Description	Reference
BH-36	8.9 feet, during drilling	North end of culvert on SR 99 at north end of study area	HWA, 1996a
BH-1	9 feet, during drilling	West end Scriber Creek Bridge	HWA, 1996b
BH-2	2 feet, during drilling	East end Scriber Creek Bridge	HWA, 1996b
H-2	5 feet, 62 hrs after drilling stopped	SR 524	WSHC, 1967
H-4	6.5 feet, immediately after casing removal	SR 524	WSHC, 1967

Table 2 – Ground Water Data for Borings in Current Study

Exploration ID	Ground Water Level (feet below ground surface)	Ground Water Elevation NAVD88 (feet)	Date
BH-1	9.7	363.9	3/22/2015
	10.4	363.2	4/22/2015
	12.2	361.4	7/9/2015
BH-2	2.5	351.5	2/12/15 (during drilling)

4 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

As part of the project alternatives analyses, thirteen (13) separate projects have been proposed to reduce flooding along the Scriber Creek alignment. The proposed projects are described individually in the following sections, which provide a summary of the general geotechnical considerations that are expected for the various projects along the corridor. Locations of the projects are shown on Figure 2, the Site and Exploration Plan, with the exception of Project #8.

4.1 DESCRIPTIONS BY PROJECT

Project #1 – Scriber Lake Trail and Berm Improvements

This project would raise the elevation of the existing trail to a minimum of Elev. 340 feet, as well as extend a small berm across the low area downstream of the lake. This would require placement of about 1 to 2.4 feet of fill in this area. The existing footbridge over the creek would also need to be reconstructed to match the new elevation of the trail. Considerations for preliminary design of the embankment and the foot bridge are addressed in Sections 4.2 and 4.3, respectively.

Project #2 – Remove Diversion Structure Downstream of 196th Street SW

This project proposes to remove the diversion structure and oil water separator located on the south (downstream) side of the culverts that flow under 196th Street SW. Earthwork and dewatering considerations that pertain to this project are similar to those for culverts, which are addressed in Sections 4.4.

Project #3 – Replace 196th Street SW Culverts in Existing Location

This project would replace the existing twin 5.9' wide by 3.7' tall arch corrugated metal pipe (CMP) culverts with 12.5' wide by 6.5' tall precast concrete box culverts. The culverts would be partially buried per the Washington Department of Fish and Wildlife guidelines for scour resistance and fish habitat. Preliminary design and construction considerations relating to installation of culverts are provided in Section 4.4.

Project #4 – Raise Old 196th Street SW

This project would raise the old 196th Street SW to an elevation of 342 feet starting near the west end of the bridge that currently provides pedestrian access to Wilcox Park. The project would also raise the access driveways of the local businesses to meet the new elevation of Old 196th Street SW. Recommendations for preliminary design of this embankment are provided in Section 4.2.

Project #5 – Parkview Plaza Culvert Replacement

This project would replace the driveway and culvert to Parkview Plaza by replacing the existing 60-inch diameter culvert with a 12.5' wide by 5.5' high concrete box culvert. It would also raise the bank on the west side of the culvert. Preliminary design and construction considerations relating to installation of culverts are provided in Section 4.4.

Project #6 – Scriber Creek Culvert Replacement as Casa Del Rey Condominiums Driveway

This project would replace the existing twin 42-inch diameter concrete pipe and CMP culverts with a 12.5' wide by 5.5' high 3-sided concrete culvert. Preliminary design and construction considerations relating to installation of culverts are provided in Section 4.4.

Project #7 – Off-Channel Storage on Edmonds School District Property

This project would increase the off-channel storage by creating a side-channel flood storage area. The project proposes excavating the grassy area east of Scriber Creek on the school district property. The area would be created to be inundated primarily during peak flood events. Wetland hummocks and large woody debris would be installed and the entire area revegetated with native wetland and riparian vegetation. Preliminary recommendations for earthwork and erosion control are provided in Section 4.5.

Project #8 – Acquire Frequently Flooded Properties between 188th Street and 191st Street

This project acquires properties that are frequently flooded. No geotechnical considerations are needed for this project at this time.

Projects #9a, #9b, and #9c – Replace Culverts at 191st Street SW, 190th Street SW, and 189th Street SW

These projects would replace the culverts that flow below the roadway with counter-sunk box culverts to provide scour resistance and natural stream habitat for fish. Preliminary design and construction considerations relating to installation of culverts are provided in Section 4.4.

Project #10 – 188th Street SW Flood Wall

This project would construct an approximately 200-foot long, concrete retaining wall along the north side of 188th Street SW in the vicinity of the Scriber Creek culvert crossing. The 1- to 3-foot tall wall would retain flood water on the upstream side of the wall so that it would be contained within the proposed flood storage area created in Project #11. Preliminary design and construction considerations are provided in Section 4.6.

Project #11 – Off-Channel Storage on City of Lynnwood Property North of 188th Street

This project would increase the off-channel storage by creating a side-channel flood storage area. The project proposes excavating the area east of Scriber Creek on the property owned by the City of Lynnwood, north of 188th Street SW. The area would be created to be inundated primarily during peak flood events. Wetland hummocks and large woody debris would be installed and the entire area revegetated with native wetland and riparian vegetation. Preliminary recommendations for earthwork and erosion control are provided in Section 4.5.

Project #12 – Install Small Berms near Eunia Plaza and Flynn's Carpets

This project would construct low berms along the open channel segments of Scriber Creek between the driveway culverts near Flynn's Carpets and Eunia Plaza. This includes installing a berm along the western side of the open channel between the two culverts at Eunia Plaza. The berm here would have a top elevation of 368.30 feet. At Flynn's Carpets the berm would be built along both sides of the channel. Preliminary recommendations for berm construction are provided in Section 4.7.

Project #13 – Replace Driveway Culverts near Eunia Plaza

This project would replace the existing driveway culverts with pre-cast box culverts. The twin 48-inch diameter culverts at each location would be replaced with 10' wide by 4 to 5.5 feet high box culverts, which would be countersunk to provide natural fish habitat. Preliminary design and construction considerations relating to installation of culverts are provided in Section 4.4.

4.2 EMBANKMENT FILLS FOR TRAILS AND ROADWAYS

Projects #1 and #4 propose the placement of one to three feet of fill in areas where soft, compressible materials are either known to exist or are anticipated. Placing additional fill on top of these materials will cause them to compress under the new loading resulting in settlement.

Settlement due to this amount of fill will likely be of the order of several inches. Some of the settlement will be long-term, occurring over a period of years; and would likely require placement of additional fill in the future to maintain the required top elevation. Because of the organic nature of the compressible materials, some settlement due to biodegradation of the organics will also occur over time even without placing additional fill.

To account for the anticipated settlement, the proposed embankments could be overbuilt so that the initial elevation of the top of the embankment is higher than the desired minimum elevation. This would involve estimating the long-term settlement to determine the embankment height needed so that the top of the trail does not settle below the desired elevation. Lighter weight materials could also be used, such as hog fuel, uniformly graded sand, and/or recycled crushed surfacing base course. Additional explorations would be recommended for Project #1, as there is no existing data to provide an estimate of the depth of peat along the alignment. For Project #4, the existing subsurface explorations could be used to provide estimates of peat thickness and an estimate of a range of settlements could be obtained from data for similar peat deposits. Final design should consider the impact that settlement may have on any utilities that may be located within the roadway.

4.3 DESIGN OF FOOT BRIDGE FOUNDATIONS

The fill proposed for Project #1 would require that the existing foot bridge which crosses Scriber Creek be raised to match the new trail grade. Given the soft, compressible materials at this location, we recommend the foot bridge be supported on pin-piles driven through the soft material to bear in the competent material below. Pin-piles typically consist of 2-inch to 6-inch diameter steel pipe that is driven into the ground using a pneumatic or hydraulic hammer. Two-inch diameter pin-piles can be driven with a 140-lb jack hammer and can be designed for an ultimate capacity of 4 kips. Larger capacities can be achieved using larger pipe. Loads on the piles would need to include downdrag loading that would be exerted by the compressible materials as they settle around the pile. Explorations at the proposed foot bridge location are recommended to determine the estimated depth of the pin-piles and the expected downdrag loading. The information obtained from these borings could also be used for evaluating the magnitude of settlement to expect for the trail embankment.

With the bridge founded on piles, it would not experience settlement, while the surrounding embankment would settle. As a result, differential settlement is likely to occur between the bridge and the trail. Articulating approach slabs should be included in the design to span the gap which is likely to form as the ground settles around the bridge. Otherwise, periodic placement of fill materials would be needed to maintain a smooth walking surface.

4.4 CULVERT REPLACEMENT DESIGN AND CONSTRUCTION CONSIDERATIONS

Several culvert replacements are being considered for the improvements to reduce flooding. Projects that include culvert replacements are #3, #5, #6, #9a through #9c, and #13. Each of the projects propose using a pre-cast concrete box culvert. Design of the culverts will depend on the types of materials that exist at each location. Where granular materials are encountered below the culvert, the box culverts can be designed to bear directly on these materials. If the materials are dense, the culvert could be supported on strip footings with an open bottom. However, if looser materials are encountered, we would recommend the culvert be constructed as a four-sided box to provide resistance to differential settlement for long-term loading, as well as during a seismic event in which liquefaction of the foundation materials could occur.

If soft, compressible materials are encountered below the culvert, as is likely at the location of the culvert for Project #5, it may be necessary to provide support for the culvert on deep foundations to provide adequate bearing capacity and limit long-term settlement. One option would be to install piles. For culverts crossing under driveways or residential streets, pin-piles could be used, which would provide a significant cost savings over standard piles. Average cost per unit length for pin-piles is about $25 per lineal foot. With the culvert founded on pin-piles, it would not experience settlement; however, we would expect the surrounding embankment to experience settlement. As a result, a difference in elevation could develop between the culvert and the roadway embankment over time. Articulating approach slabs may be included in the design to span the gap that could form as the ground settles around the culvert.

We recommend that borings be conducted near the proposed alignments to identify the existing subsurface soils and provide design parameters for culvert foundation design.

Construction considerations for the installation of culverts include determining: the anticipated extent of excavation, the need for temporary shoring, and the associated dewatering requirements. Dewatering should be limited in areas where compressible materials are present, because dewatering typically induces additional settlement of these soils. Depending on the excavation depths, this could require that the culvert be constructed within a relatively water-tight shored excavation, such as an interlocking sheet pile cofferdam. The inside of the shored area can then be dewatered while limiting the drawdown of the local ground water outside the shoring. Each of the culvert replacements is likely to require a temporary stream by-pass during construction. Construction should be performed during the summer months, when the ground water levels are typically lower than the wetter, winter months.

4.5 FLOOD STORAGE EXCAVATIONS

Projects #7 and #11 propose the excavation of large areas to provide temporary off-channel storage for floodwaters. The design provides for positive drainage to the stream so that water

does not become backed up within storage areas. We anticipate the storage areas will typically have water levels equal to those of the stream.

4.5.1 Edmonds School Property

At the Edmonds School Property (Project #7) the excavation would extend 3 to 5 feet below the existing ground surface. It should be noted that the ground water was observed to be within 3 feet of the ground surface during our explorations, which is similar to the elevation of the adjacent stream at the time of drilling.

Excavation for this storage area would extend through the topsoil at the site into the dense to very dense glacial till soils encountered in BH-2. These materials would be suitable for permanent slopes of 3H:1V (horizontal to vertical). There is potential for the side walls to experience some seepage where the ground water perches on top of the till materials. This will likely result in some sloughing of the saturated side slopes. If plants are established on the side slopes, the sloughing is likely to be limited. We recommend providing temporary erosion control on the slopes at the end of the project to allow the plants to establish themselves. Alternatively, the upper two feet of the material on the side slopes could be constructed using higher strength fill materials that also provide drainage, such as Crushed Surfacing Base Course (CSBC), as specified in Section 9-03.9(3) of the WSDOT Standard Specifications (WSDOT, 2016).

4.5.2 City of Lynnwood Property

At the City of Lynnwood Property north of 188th Street SW (Project #11), the excavation for the off-channel storage area will extend two to three feet below the ground surface at the west side and about 16 feet below the ground surface at the east side. Based on our readings of the ground water in the stand pipe piezometer, the ground water ranged from about 9 to 12 feet below the ground surface. These water levels indicate the ground water is typically a few feet above the bottom of the storage pond. However, once the storage area is constructed, the water levels in the storage area will likely be similar to those in the adjacent creek.

Based on our observations from BH-1, the excavation would extend through very loose to loose fill and into medium stiff alluvial silt. These soils are suitable to for permanent slopes of 3H:1V. There is potential for the eastern slope to experience some seepage where the ground water perches on top of the alluvial silt. As with the storage area at the Edmonds Property, we recommend providing temporary erosion control and vegetating the slopes, or placing higher strength fill materials that also provide drainage.

4.5.3 Construction Considerations

Excavations for these storage areas can be accomplished with conventional excavation equipment. The topsoil and alluvial silt materials may be suitable for reuse as topsoil. The fill

and glacial till could potentially be reused for non-structural fill applications. They are moisture sensitive and will likely be difficult to compact, particularly if construction occurs during wet weather. The glacial till could potentially be used to provide low permeability fill for the low berms being considered for Project #12 near Eunia Plaza and Flynn's Carpets.

4.6 FLOOD WALL AT 188TH STREET SW

Project #10 will construct a low level wall at the top of the existing bank along the north side of 188th Street SW near the Scriber Creek crossing. The wall itself will retain flood waters and should be designed to resist the forces induced by the floodwaters. The foundations should be designed to resist the anticipated loads from the floodwaters. The wall foundation should be designed with an allowable bearing capacity up to 1,500 pounds per square foot. The footings should bear at least 18 inches below the ground surface. During construction the subgrade should be exposed and any soft soils should be removed and replaced with CSBC, as specified in Section 9-03.9(3) of the WSDOT Standard Specifications (WSDOT, 2016).

Final design should consider the potential increase in groundwater levels to adjacent properties that could occur in response to an increase in the elevation of the water that ponds behind the flood wall.

4.7 FLOODWATER CONTAINMENT BERMS

Project #12 proposes constructing 1 to 2-foot tall berms around the open-channel portions of Scriber Creek near Eunia Plaza and Flynn's Carpets. These berms should be constructed with low-permeability fill. The slope on the creek side of the berm should be sloped no greater than 3H:1V. The outside slope of the berms can be sloped at up to 2H:1V. Guidelines for specifying low permeability fill are provided in Section 3.2.1 of Volume III of the *Stormwater Management Manual for Western Washington* (Department of Ecology, 2012). The low permeability fill berm should be keyed into the existing ground surface.

Prior to placement of embankment soils, the subgrade soils should be densely compacted, firm, and unyielding. Low permeability soil should be placed in loose, horizontal lifts less than 6 inches thick and be compacted in-place to at least 95% of its Maximum Dry Density. The soils should be placed between optimum to 3 percent wet of the optimum moisture content as determined by ASTM D 1557.

5 CONDITIONS AND LIMITATIONS

We have prepared this geotechnical report for the City of Lynnwood and Herrera Environmental Consultants for use in evaluating the proposed alternatives and preliminary design of this project. Additional analyses and recommendations will be required for final design. The conclusions and interpretations presented in this report should not be construed as our warranty of subsurface

conditions at the site. Experience has shown that soil and ground water conditions can vary significantly over small distances and with time. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study of this scope and nature. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, HWA should be notified for review of the recommendations of this report, and revision of such if necessary. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations, it is recommended that this report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse.

Within the limitations of approved scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, express or implied, is made.

HWA does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and cannot be responsible for the safety of personnel other than our own on the site. As such, the safety of others is the responsibility of the contractor. However, the contractor should notify the owner if any of the recommended actions presented herein are considered unsafe.

We appreciate this opportunity to be of service. If you have any questions or require additional information, please contact any of the undersigned at (425) 774-0106.

Sincerely,

HWA GEOSCIENCES INC.

JoLyn Gillie, P.E.
Geotechnical Engineer

Ralph N. Boirum, P.E.
Principal Geotechnical Engineer

6 REFERENCES

Applied Geotechnology Inc., (1984), *Geotechnical Investigation, Scriber Lake Park, Phase II, Lynnwood, Washington*, dated June 21, 1984, prepared for Bruce Dees and Associates.

Department of Ecology, (2012), *Stormwater Management Manual of Western Washington*, August 2012, Department of Ecology, Washington State.

Hong West and Associates, Inc., (HWA), (1996a), *Geotechnical Engineering Investigation, SR 99 Improvements Project, 244th Street S.W. to 148th Street S.W., Snohomish County, Washington*, dated January 3, 1996, prepared for Entranco.

HWA, (1996b), *Geotechnical Engineering Evaluation, Existing Pile Foundation System, Scriber Creek Bridge, Lynnwood, Washington*, dated January 11, 1996, prepared for Reid Middleton.

Landau Associates, Inc., (1999), *Geotechnical Engineering Services, Cedar Valley Community School, Edmonds School District, Lynnwood, Washington*, dated November 15, 1999, prepared for Mahlum Architects, Inc.

Minard, J.P., (1983), *Geologic map of the Edmonds East and part of the Edmonds West quadrangles, Washington*, U.S. Geologic Survey, Miscellaneous Field Studies Map MF-1541.

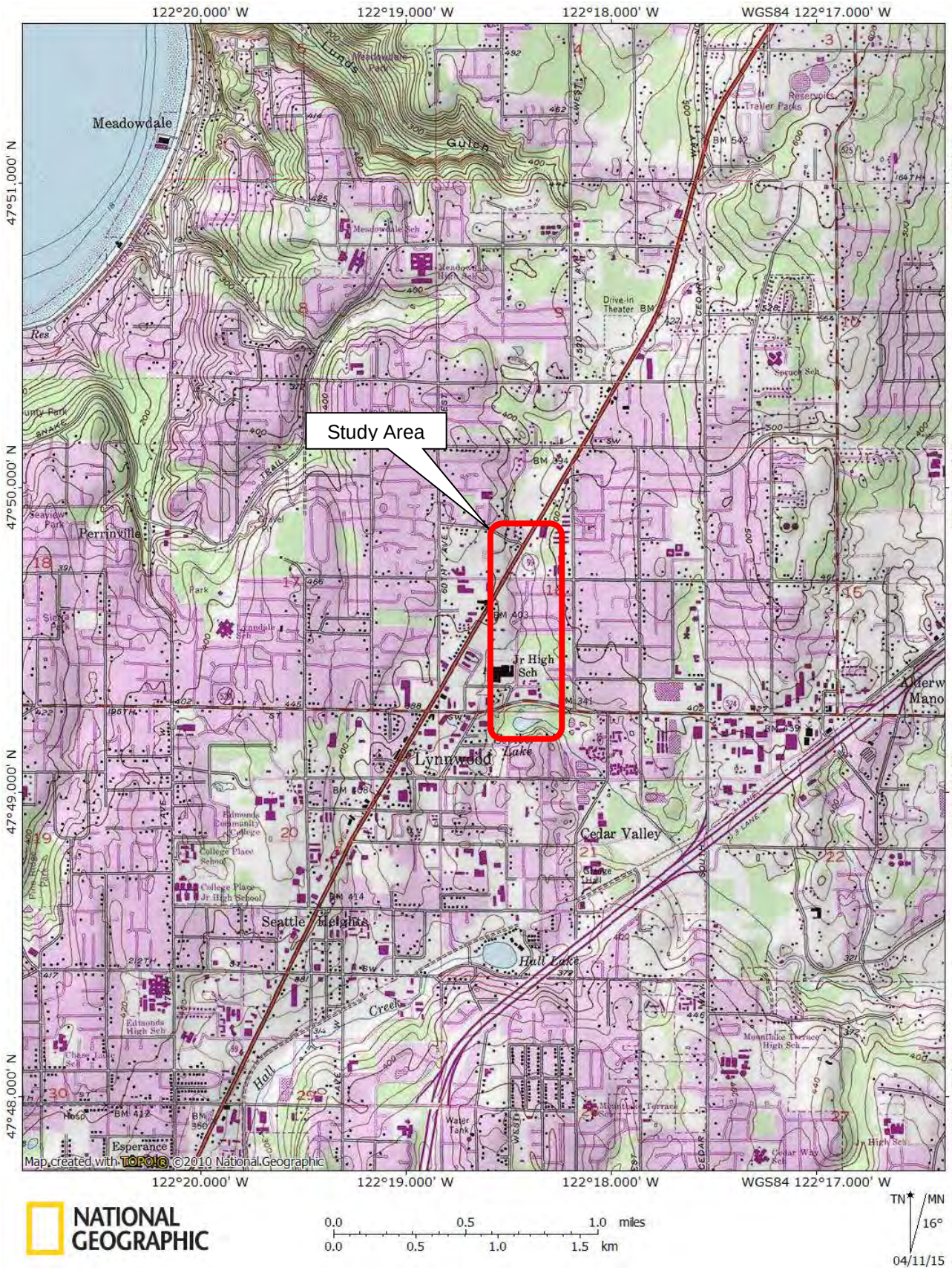
Natural Resources Conservation Service, (2015), *Web Soil Survey, National Cooperative Soil Survey*, available online, accessed April 11, 2015.

Triangle Associates, Inc., (2014), *Scriber Creek Flood Reduction Advisory Committee, Final Report and Recommendations to Lynnwood City Council*, prepared July 2014.

Washington State Department of Transportation (WSDOT), (2016), *Standard Specifications for Road, Bridge and Municipal Construction*, M 41-10.

Washington State Highway Commission (WSHC), (1965), *C.S. 3130 SSH 1-W, Lynnwood Easterly, (Jct. SR 99 to Jct. SR 5), Job No. L-2899*, Letter dated January 7, 1965, prepared for Mr. C. C. Prahl, Director of Highways.

WSHC, (1967), Borings for SSH 1-W SR 104 Section 64th Avenue West in Lynnwood to Jct. PSH 1, Subsection Scriber Lake Fill, drilled August 3 through 8, 1967 and October 9 through 11, 1967.



VICINITY MAP

FIGURE NO. 1

PROJECT NO. 2014-180

HWA GEOSCIENCES INC.

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

MATCHLINE FIGURE 2B

PROJECT LOCATIONS

HWA GeoSciences Inc.

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

SITE AND EXPLORATION PLAN

DRAWN BY	EFK
CHECK BY	JG
DATE:	04.09.15
FIGURE #	2A
PROJECT #	2014-180-21

S:\2014 PROJECTS\2014-180-21 SCRIBER CRK FLOOD REDUCTION STUDY\CAD 2014-180\HWA 2014-180.DWG <Layout2> Plotted: 4/1/2016 10:57 AM

MATCHLINE FIGURE 2A

PROJECT #12
EUNIA PLAZA

BH-35

PROJECT #13

(SR 99) PACIFIC HWY

PROJECT #11

BH-1

PROJECT #10

BH-16

BH-15

188th St SW

LEGEND

BH-1 — BORING DESIGNATION AND APPROXIMATE LOCATION (HWA, Current Study)

18 — PROBE DESIGNATION AND APPROXIMATE LOCATION (APPLIED GEOTECHNOLOGY INC, 1984)

BH-36 — BORING DESIGNATION AND APPROXIMATE LOCATION (HWA, 1996a)

BH-2 — BORING DESIGNATION AND APPROXIMATE LOCATION (HWA, 1996b)

B-15 — BORING DESIGNATION AND APPROXIMATE LOCATION (LANDAU, 1999)

H-5 — BORING DESIGNATION AND APPROXIMATE LOCATION (WSHC, 1967)

WEST EAST — CROSS-SECTION DESIGNATION AND APPROXIMATE LOCATION (HWA, 1996b)

A A' — CROSS-SECTION DESIGNATION AND APPROXIMATE LOCATION (LANDAU,1999)

N

0 50 100 150 200

MATCHLINE FIGURE 2C

PROJECT LOCATIONS

HWA GeoSciences Inc.

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

SITE AND EXPLORATION PLAN

DRAWN BY	EFK
CHECK BY	JG
DATE:	04.09.15
FIGURE #	2B
PROJECT #	2014-180-21

S:\2014 PROJECTS\2014-180-21 SCRIBER CRK FLOOD REDUCTION STUDY\CAD 2014-180\HWA 2014-180.DWG <Layout2> Plotted: 4/1/2016 10:55 AM

MATCHLINE FIGURE 2B

MATCHLINE FIGURE 2D

PROJECT LOCATIONS

HWA GEOSCIENCES INC.

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

SITE AND EXPLORATION PLAN

DRAWN BY	EFK
CHECK BY	JG
DATE:	04.09.15
FIGURE #	2C
PROJECT #	2014-180-21

S:\2014 PROJECTS\2014-180-21 SCRIBER CRK FLOOD REDUCTION STUDY\CAD 2014-180\HWA 2014-180.DWG <Layout2> Plotted: 3/30/2016 9:52 PM

MATCHLINE FIGURE 2C

MATCHLINE FIGURE 2E

PROJECT LOCATIONS

HWA GeoSciences Inc.

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

SITE AND EXPLORATION PLAN

DRAWN BY	EFK
CHECK BY	JG
DATE:	04.09.15
FIGURE #	2D
PROJECT #	2014-180-21

S:\2014 PROJECTS\2014-180-21 SCRIBER CRK FLOOD REDUCTION STUDY\CAD 2014-180\HWA 2014-180.DWG <Layout2> Plotted: 4/1/2016 10:52 AM

MATCHLINE FIGURE 2D

CEDAR VALLEY COMMUNITY SCHOOL

B-8

B-1

B-4

B-2

A

56th Avenue W

PROJECT #6

PROJECT #5

PROJECT #4

PROJECT #3

PROJECT #2

BH-1

BH-2

WEST

EAST

(SR 526) 196th St SW

H-3

H-2

H-5

H-1

H-4

LEGEND

BH-1 BORING DESIGNATION AND APPROXIMATE LOCATION (HWA, Current Study)

18 PROBE DESIGNATION AND APPROXIMATE LOCATION (APPLIED GEOTECHNOLOGY INC, 1984)

BH-36 BORING DESIGNATION AND APPROXIMATE LOCATION (HWA, 1996a)

BH-2 BORING DESIGNATION AND APPROXIMATE LOCATION (HWA, 1996b)

B-15 BORING DESIGNATION AND APPROXIMATE LOCATION (LANDAU, 1999)

H-5 BORING DESIGNATION AND APPROXIMATE LOCATION (WSHC, 1967)

WEST EAST CROSS-SECTION DESIGNATION AND APPROXIMATE LOCATION (HWA, 1996b)

A A' CROSS-SECTION DESIGNATION AND APPROXIMATE LOCATION (LANDAU,1999)

N

0 50 100 150 200

MATCHLINE FIGURE 2F

PROJECT LOCATIONS

HWA GeoSciences Inc.

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

SITE AND EXPLORATION PLAN

DRAWN BY	EFK
CHECK BY	JG
DATE:	04.09.15
FIGURE #	2E
PROJECT #	2014-180-21

S:\2014 PROJECTS\2014-180-21 SCRIBER CRK FLOOD REDUCTION STUDY\CAD 2014-180\HWA 2014-180.DWG <Layout2> Plotted: 4/1/2016 10:37 AM

MATCHLINE FIGURE 2E

PROJECT LOCATIONS

BASE MAP PROVIDED BY:

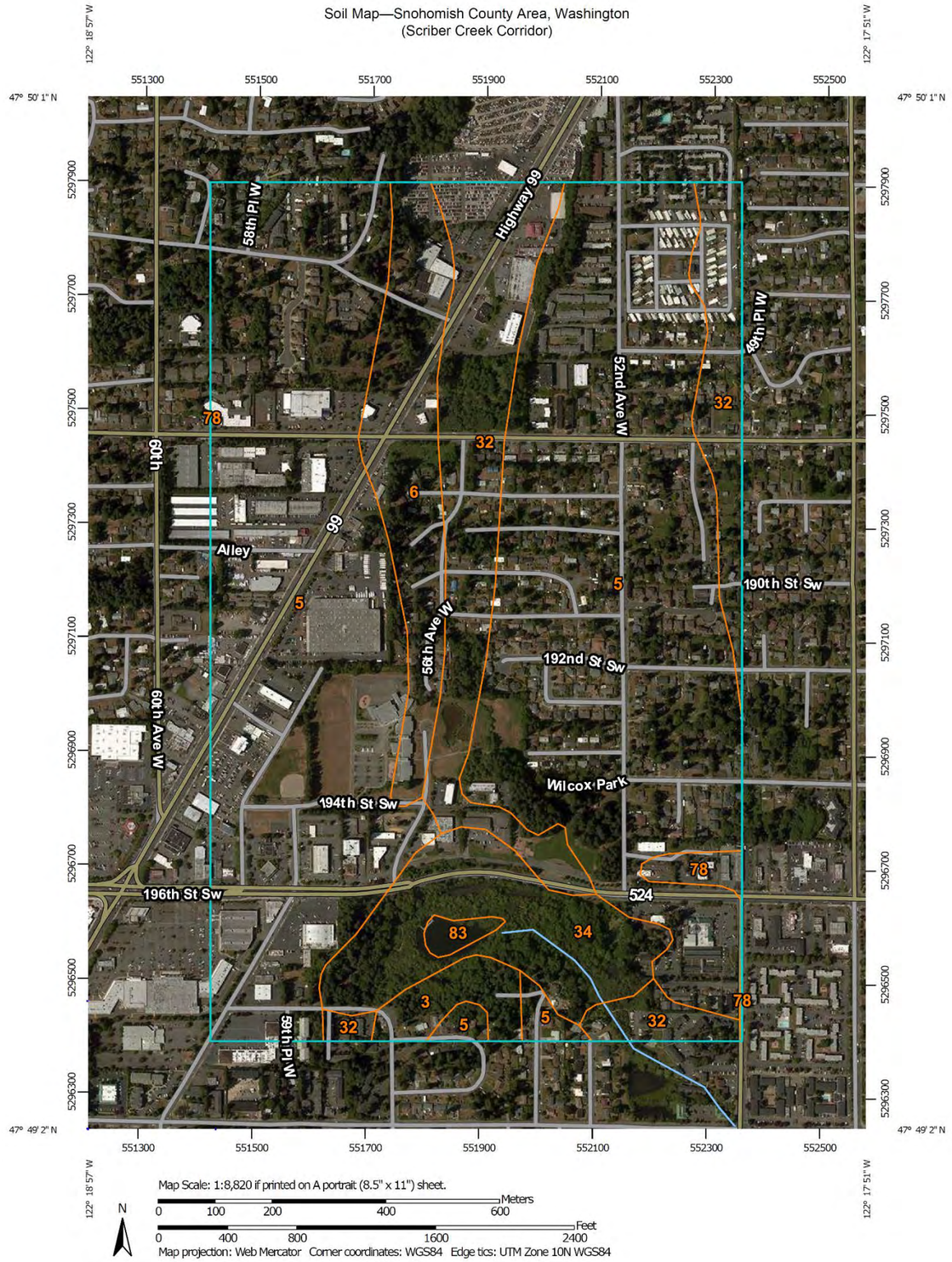
HWA GeoSciences Inc.

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

SITE AND EXPLORATION PLAN

DRAWN BY	EFK
CHECK BY	JG
DATE:	04.09.15
FIGURE #	2F
PROJECT #	2014-180-21

S:\2014 PROJECTS\2014-180-21 SCRIBER CRK FLOOD REDUCTION STUDY\CAD 2014-180\HWA 2014-180.DWG <Layout2> Plotted: 3/30/2016 9:56 PM



Map Unit Legend

Snohomish County Area, Washington (WA661)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
3	Alderwood gravelly sandy loam, 15 to 30 percent slopes	6.2	1.8%
5	Alderwood-Urban land complex, 2 to 8 percent slopes	234.6	67.1%
6	Alderwood-Urban land complex, 8 to 15 percent slopes	25.5	7.3%
32	McKenna gravelly silt loam, 0 to 8 percent slopes	53.1	15.2%
34	Mukilteo muck	26.2	7.5%
78	Urban land	2.5	0.7%
83	Water	1.6	0.5%
Totals for Area of Interest		**349.7**	**100.0%**

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 12, Sep 30, 2014

HWA GeoSciences Inc.

SOILS MAP

SCRIBER CREEK FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

FIGURE NO. 3

PROJECT NO. 2014-180

APPENDIX A

FIELD INVESTIGATION

APPENDIX A

FIELD INVESTIGATION

On February 12, 2015, HWA conducted explorations at the City of Lynnwood property north of 188th Street SW and in the playfield owned by the Edmonds School District east of the Cedar Valley Community School. The exploration at the City property, designated BH-1, was drilled to a depth of 30.5 feet below the ground surface (bgs). The exploration on the Edmonds School District property, designated BH-2, was drilled to 15.5 feet bgs. The approximate locations of the boreholes are indicated on Figures 2B and 2D, the Site and Exploration Plan.

The boreholes were drilled by Holocene Drilling, Inc. of Fife, Washington under subcontract to HWA. The borings were drilled with a track-mounted CME-850 drill rig using 4-¼ inch inside-diameter, continuous flight, hollow stem augers. Soil samples were collected at 2½- to 5-foot intervals using Standard Penetration Test (SPT) sampling in general accordance with ASTM D-1586. SPT sampling consisted of using a 2-inch outside diameter, split-spoon sampler driven with a 140-pound autohammer. During the test, samples were obtained by driving the sampler 18 inches into the soil with a hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The Standard Penetration Resistance ("N-value") of the soil was calculated as the number of blows required for the final 12 inches of penetration. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. At the completion of drilling at BH-1, a 2-inch diameter PVC standpipe was installed for monitoring ground water levels. Upon completion of drilling at BH-2, the borehole was abandoned with bentonite chips.

Collected soil samples were placed in plastic bags and taken to our Bothell, Washington laboratory for further examination and testing. The soils were classified in general accordance with the classification system described in Figure A-1. A key to the exploration log symbols is also presented on Figure A-1. The summary exploration logs are presented on Figures A-2 and A-3.

The stratigraphic contacts shown on the individual summary logs represent the approximate boundaries between soil types; actual conditions may be more gradual. The soil and ground water conditions depicted are only for the specific date and locations reported, and therefore, are not necessarily be representative of other locations and times.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
			GP	Poorly-graded GRAVEL
	More than 50% of Coarse Fraction Retained on No. 4 Sieve	Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
More than 50% Retained on No. 200 Sieve Size	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-graded SAND
			SP	Poorly-graded SAND
	50% or More of Coarse Fraction Passing No. 4 Sieve	Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY
50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILT/Organic CLAY
Highly Organic Soils			PT	PEAT

TEST SYMBOLS

%F	Percent Fines
AL	Atterberg Limits: PL = Plastic Limit, LL = Liquid Limit
CBR	California Bearing Ratio
CN	Consolidation
DD	Dry Density (pcf)
DS	Direct Shear
GS	Grain Size Distribution
K	Permeability
MD	Moisture/Density Relationship (Proctor)
MR	Resilient Modulus
PID	Photoionization Device Reading
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)
SG	Specific Gravity
TC	Triaxial Compression
TV	Torvane Approx. Shear Strength (tsf)
UC	Unconfined Compression

SAMPLE TYPE SYMBOLS

- 2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
- Shelby Tube
- 3-1/4" OD Split Spoon with Brass Rings
- Small Bag Sample
- Large Bag (Bulk) Sample
- Core Run
- Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

- Groundwater Level (measured at time of drilling)
- Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation.
Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

HWA GEOSCIENCES INC.

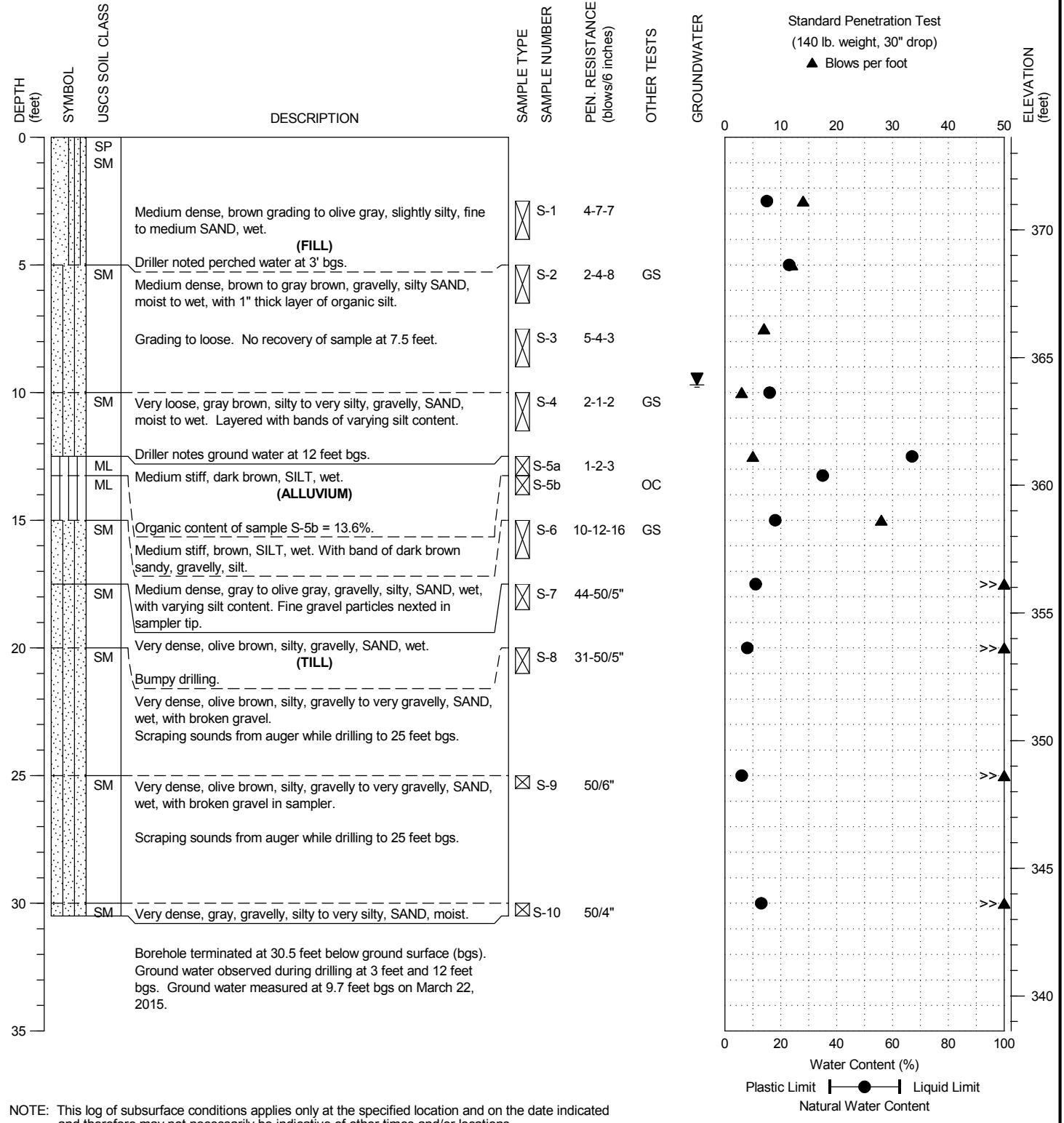
SCRIBER CREEK
FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 2014-180-21 FIGURE: A-1

DRILLING COMPANY: Holocene Drilling
DRILLING METHOD: Track-mounted, CME-850, 4-1/4" HSA
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 2A

DATE STARTED: 2/12/2015
DATE COMPLETED: 2/12/2015
LOGGED BY: J. Gillie
SURFACE ELEVATION: 373.6 ± feet



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

SCRIBER CREEK
FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

BORING:
BH-1

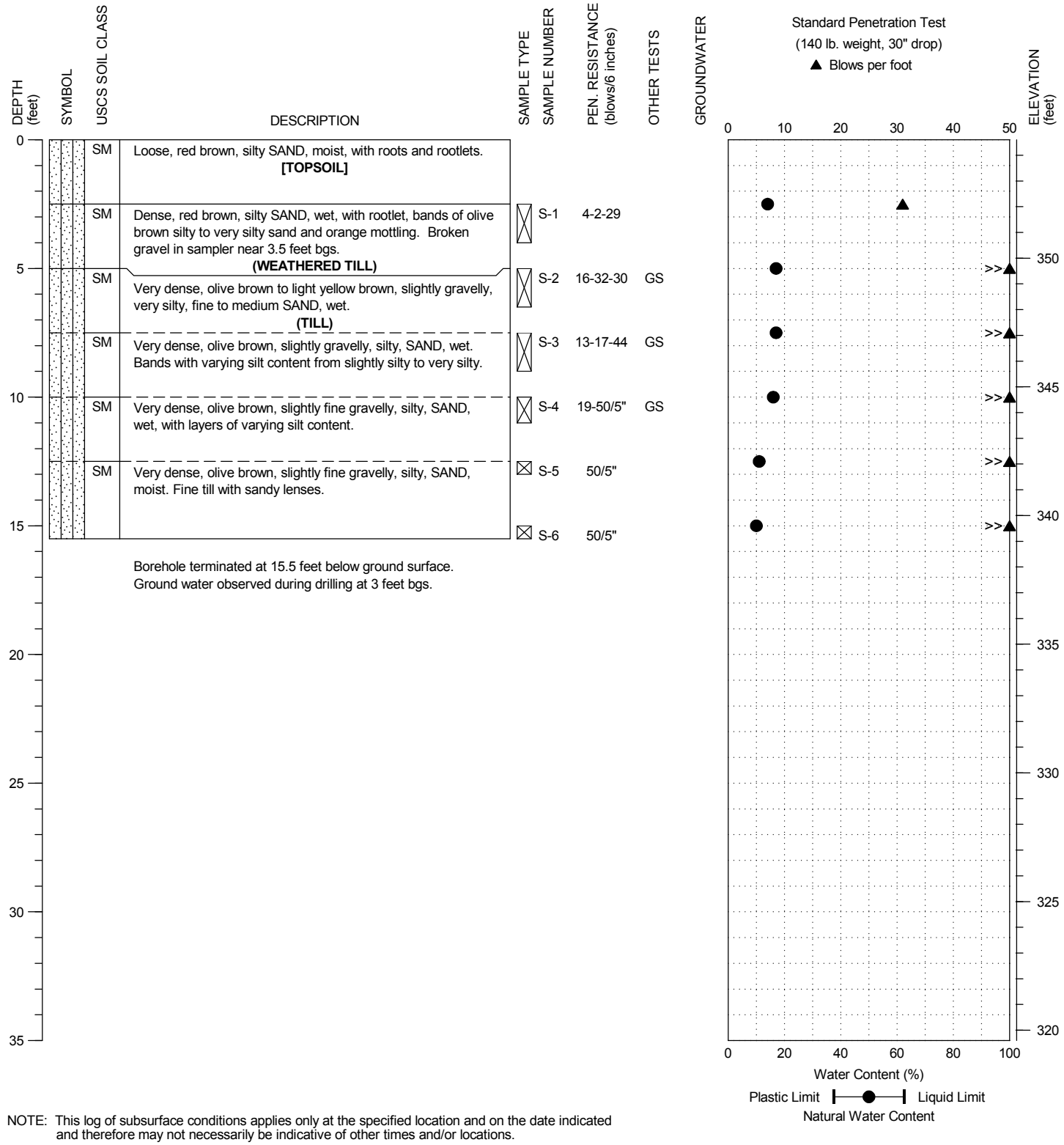
PAGE: 1 of 1

PROJECT NO.: 2014-180-21 FIGURE: A-2

BORING-DSM 2014-180.GPJ 4/13/15

DRILLING COMPANY: Holocene Drilling
DRILLING METHOD: Track-mounted, CME-850, 4-1/4" HSA
SAMPLING METHOD: SPT w/Autohammer
LOCATION: See Figure 2B

DATE STARTED: 2/12/2015
DATE COMPLETED: 2/12/2015
LOGGED BY: J. Gillie
SURFACE ELEVATION: 354.6 ± feet



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

SCRIBER CREEK
FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

BORING:
BH-2

PAGE: 1 of 1

PROJECT NO.: 2014-180-21 FIGURE: A-3

BORING-DSM 2014-180.GPJ 4/13/15

APPENDIX B

LABORATORY TEST RESULTS

APPENDIX B

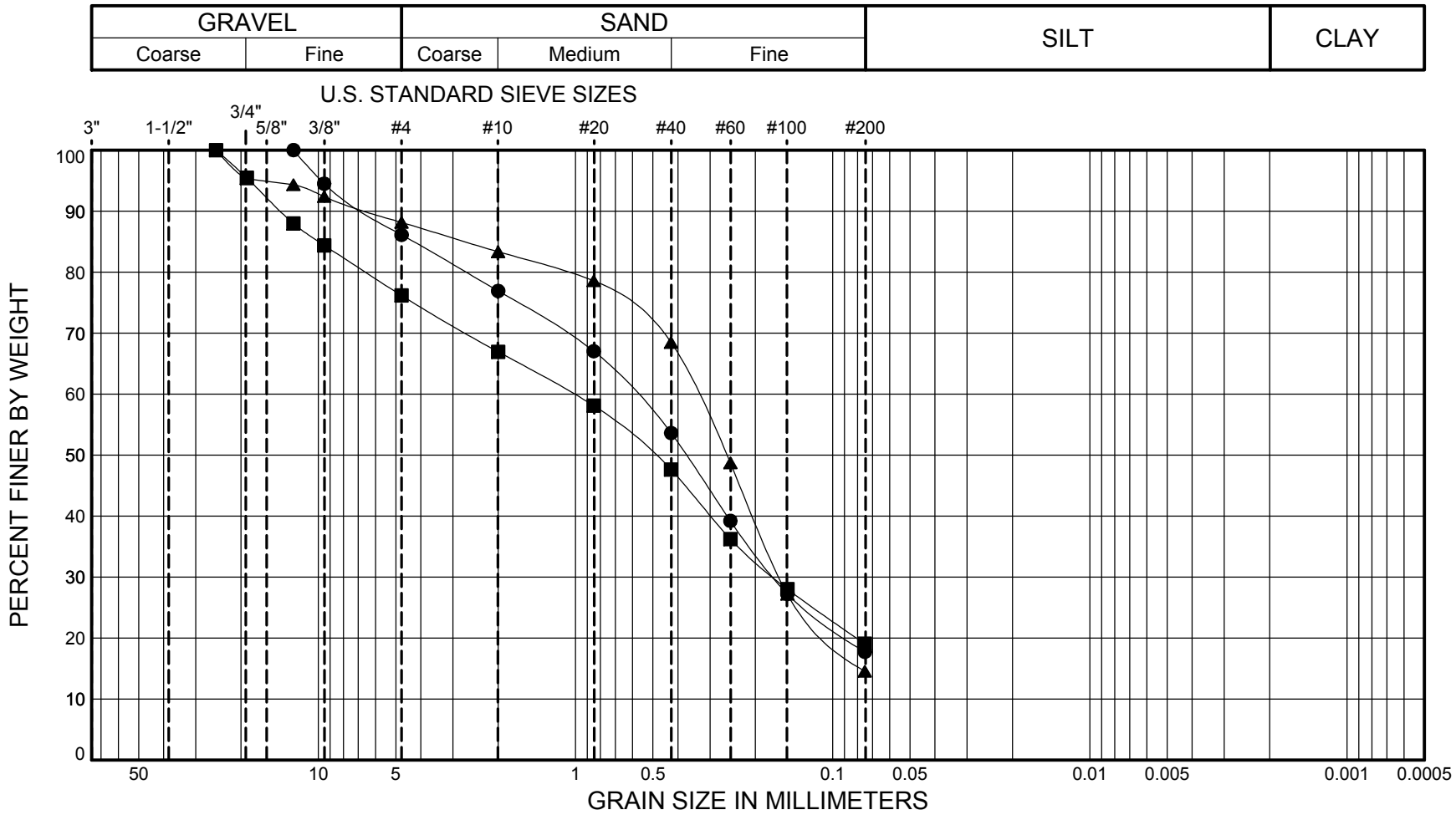
LABORATORY TESTING

Representative soil samples obtained from the explorations were returned to HWA's laboratory for further examination and testing. Laboratory tests were conducted on selected soil samples to characterize relevant engineering properties of the on-site materials. The laboratory testing program was performed in general accordance with appropriate ASTM Standards as outlined below.

MOISTURE CONTENT OF SOIL: The moisture content of selected soil samples (percent by dry mass) was determined in accordance with ASTM D 2216. The results are shown at the sampled intervals on the appropriate summary logs in Appendix A.

PARTICLE SIZE ANALYSIS OF SOILS: Selected samples were tested to determine the particle distribution of material in general accordance with ASTM D422. The results are summarized on the attached Grain Size Distribution reports, which also provide information regarding the classification of the sample and the moisture content at the time of testing.

MOISTURE CONTENT, ASH, AND ORGANIC MATTER: Selected samples were tested in general accordance with method ASTM D 2974, using moisture content method 'A', (oven dried at 105^0 C) and ash content method 'C' (burned at 440^0 C). The results are shown at the sampled intervals on the appropriate summary logs in Appendix A. The results are percent by weight of dry soil.



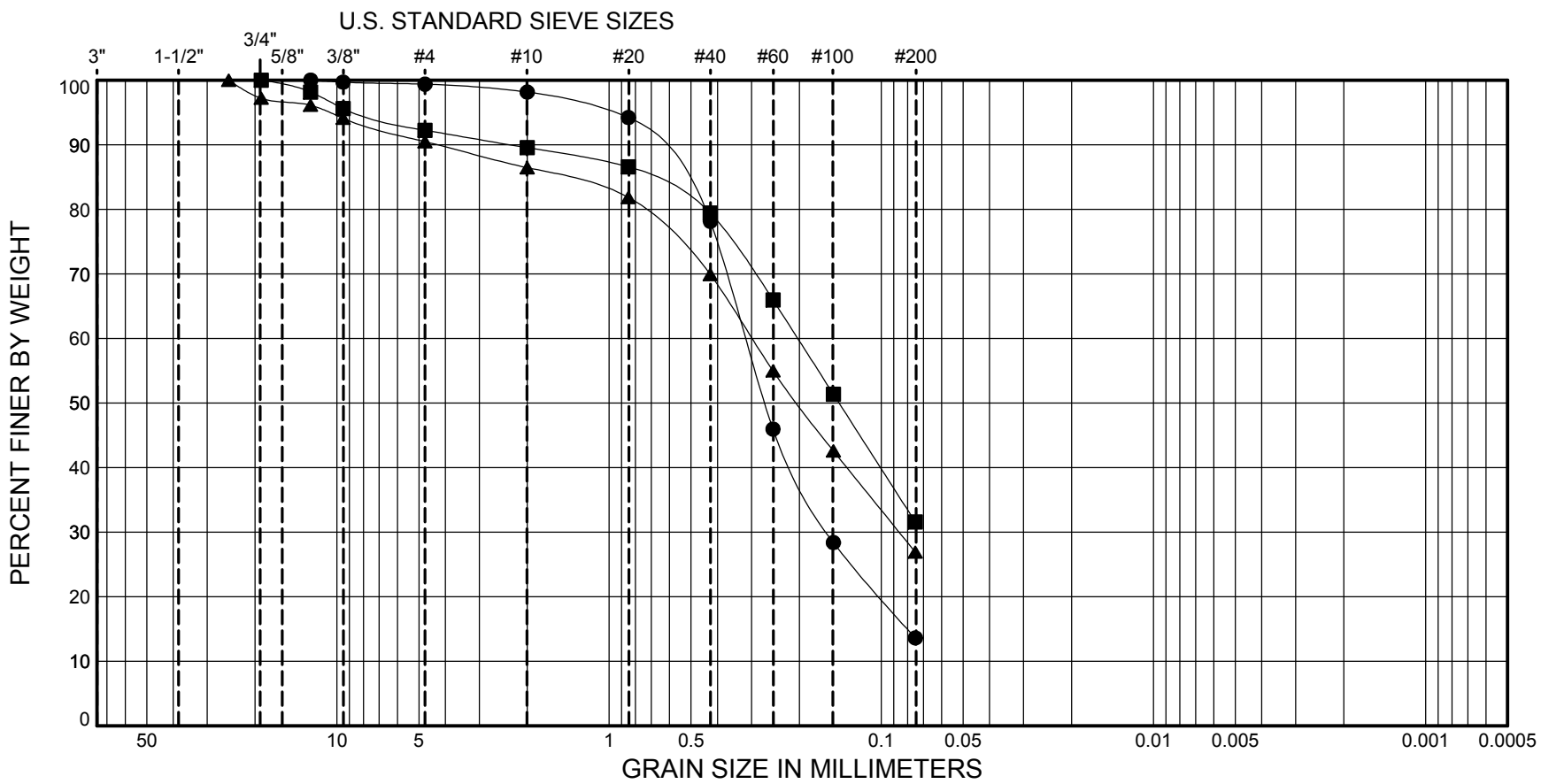
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-1	S-2	5.0 - 6.5	(SM) Very dark grayish brown, Silty SAND	23				13.9	68.4	17.7
■	BH-1	S-4	10.0 - 11.5	(SM) Dark olive brown, Silty SAND with gravel	16				23.8	57.1	19.1
▲	BH-1	S-6	15.0 - 16.5	(SM) Dark grayish brown, Silty SAND	18				11.9	73.6	14.5

HWA GEOSCIENCES INC.

SCRIBER CREEK
FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2014-180-21 FIGURE: B-1



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	BH-2	S-2	5.0 - 6.5	(SM) Olive brown, Silty SAND	17				0.6	85.8	13.6
■	BH-2	S-3	7.5 - 9.0	(SM) Olive brown, Silty SAND	17				7.8	60.7	31.6
▲	BH-2	S-4	10.0 - 11.0	(SM) Olive brown, Silty SAND	16				9.5	63.6	26.9

HWA GEOSCIENCES INC.

SCRIBER CREEK
FLOOD REDUCTION STUDY
LYNNWOOD, WASHINGTON

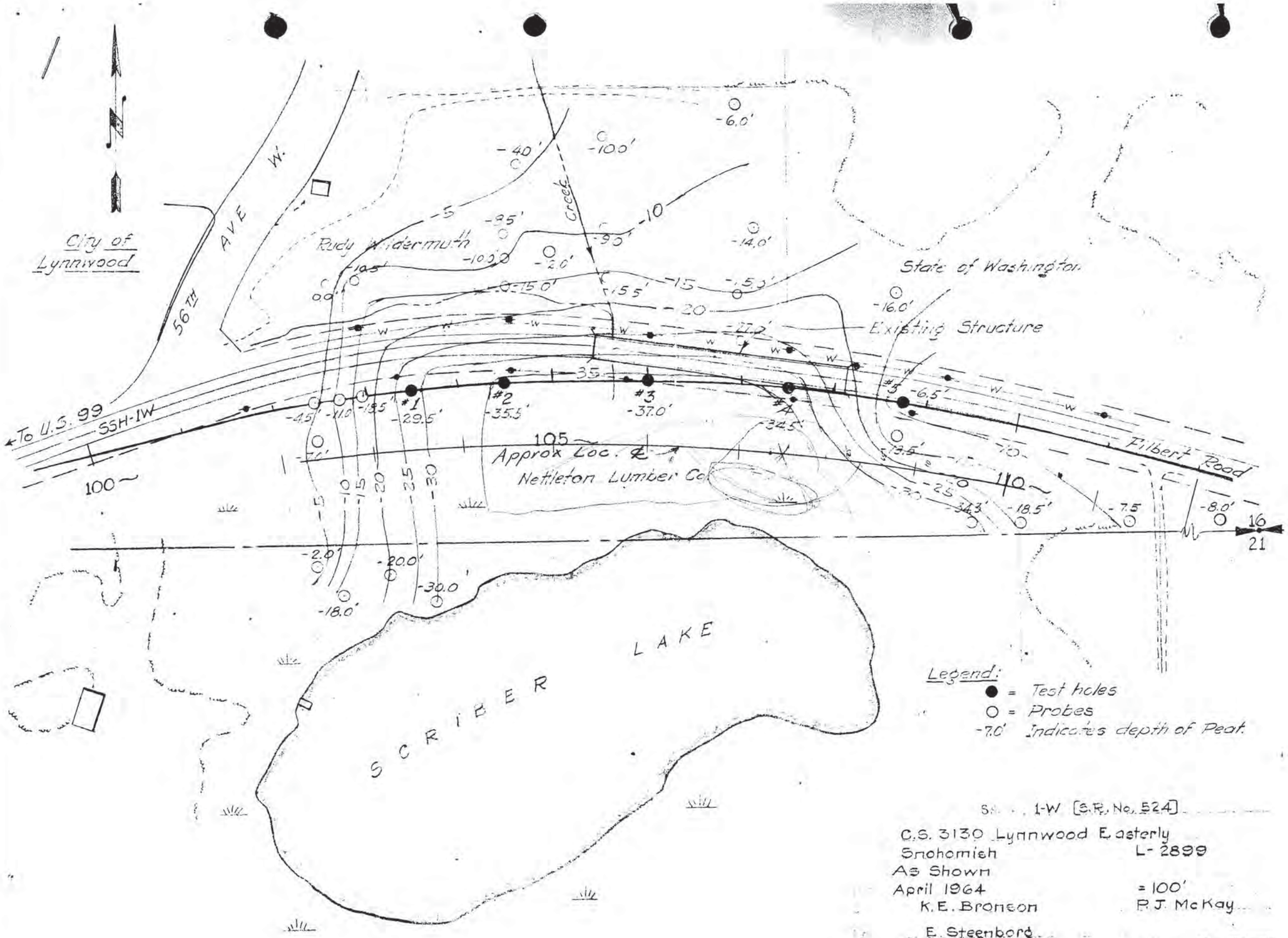
PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2014-180-21 FIGURE: B-2

APPENDIX C

SUBSURFACE DATA FROM THE WASHINGTON STATE HIGHWAY COMMISSION 1964 AND 1967

Note that the test borings #1 through #5 shown on this figure are not represented by the logs for H-1 through H-5 provided in this Appendix.



Legend:
- ● = Test holes
- ○ = Probes
- -7.0' Indicates depth of Peat

S. . . 1-W [S.R. No. 524]

C.S. 3130 Lynnwood Easterly
Snohomish L-2899
As Shown
April 1964 = 100'
K.E. Bronson R.J. McKay
E. Steenberg

REV. June 9, 1964 - ADD. Holes -

1 2

H. F. 28.68 (Rev. 5-67)

WASHINGTON
STATE HIGHWAY COMMISSION
DEPARTMENT OF HIGHWAYS

Original to Materials Engineer
Copy to Bridge Engineer
Copy to District Engineer
Copy to _____

LOG OF TEST BORING

S.H. 1-W S.R. 104 Section 64TH AVE. W. IN LYNNWOOD TO JCT. PSH 1 Job No. CONT. 8161
Hole No. H-1 Sub Section SCRIBER LAKE FILL Cont. Sec. 313.0
Station 107 + 2.7 Offset 3' RT. ℄ Ground El. 341.0
Type of Boring ROTARY 8C48-8 Casing 4" 38.5 W.T. El. NOT OBTAINED
Inspector CALVIN LOCKWOOD Date 3-AUG-1967 Sheet 1 of 3

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				FOREIGN FILL MATERIAL — FINE SAND ON BRUSH, RUBBLE, & LOGS
5				(ON CONCRETE RUBBLE 8.0 - SMALL PIECES)
10				(ON RUBBLE AT 13.0 - OF & ON CONCRETE, WOOD, ETC. - TO 35.0
15				(LOST ALL WATER AT NUMEROUS DEPTHS WHEN OUT OF CASING
20				(ON CHUNK OF CONCRETE AT 17.5 APPROXIMATELY 4" THICK

F. 25.66-A (Rev. 5-67)

Hole No. H-1 Sub Section SCRIBER LAKE FILL Sheet 2 of 3

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
20				
25				
30				
35				(AT 34.5 ON LOG)
				(AT 35.0 ON LOG - HARD TO CUT)
				(FIR NEEDLES - LIMBS - WOOD ALMOST
				CONTINUOUS 35-0 TO 45.0 MIXED WITH SAND)
40				
45				

Fi 26.66-A (Rev. 5-67)

Hole No. H-1 Sub Section SCRIBER LAKE FILL Sheet 3 of 3

DEPTH 45	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				PEATY SAND — FINE, GREY
				SAND & GRAVEL — VERY DENSE, GREY, ALL
50	77		26 35 42 53 STD PEN 1	GRADES SAND, & FINE & MEDIUM GRAVEL
				TEST BORING STOPPED AT 51.0
				HOLE CAVED AT −5.0 UPON CASING REMOVAL
55				

H. F. 2-3.66 (Rev. 5-67)

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LOG OF TEST BORING

S S.H. I-W S.R. 104 Section 64TH AVE. W. IN LYNNWOOD TO JCT. PSH 1 Job No. CONT. 8161
Hole No. H-2 Sub Section SCRIBER LAKE FILL Cont. Sec. 3130
Station 105+00 Offset 32' RT. ℄ Ground El. 341.2
Type of Boring ROTARY BCAS-8 Casing 4"-29' 3"-46' W.T. El. 336.2
Inspector CALVIN LOCKWOOD Date 4-AUG-1967 Sheet 1 of 3

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				FOREIGN FILL MATERIAL — FINE SAND
				ON BRUSH - RUBBLE - LOGS
5				
10				
15				
20				

H. F. 36.66-A (Rev. 5-67)

Hole No. H-2 Sub Section SCRIBER LAKE FILL Sheet 2 of 3

DEPTH 5.0	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				(ON LOG AT 20.5 – HARD, GREEN TIMBER)
				(HIT WOOD OFF & ON FROM 20.0 TO 50.0
25				
				(ON LOG AT 28.0 – APPROXIMATELY 1FT. DIAMETER
				(4" INTO LOG WITH 4" CASING & HUNG UP –
30				WENT TO 3" CASING)
35				
				(IN WASHING DOWN TO 40.0 GOT REPEATED
				CAVE BACK IN CASING OF FINE SAND – AS MUCH
				AS 3.0 TO 4.0 FT.
				(PIECE OF BRICK PICKED UP IN SAMPLER AT
40				39.0 AREA – SMALL LOG AT 39.0)
				(LOG AT 42.0)
	11		10 7 STD. PEN.	(MORE WOOD AT 44.0)
45			4 4 1	(GRAY FINE SAND - FAIRLY CLEAN WITH PIECES WOOD – ONE PIECE MEDIUM GRAVEL THIS SAMPLE)

H. F. 26.68-A (Rev. 5-67)

Hole No. H-2 Sub Section SCRIBER LAKE FILL Sheet 3 of 3

DEPTH 45	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				(ON LOG AT 46.0 - APPROXIMATELY 8" THROUGH)
	3/6"		3 STD. PEN.	> FINE SAND
			26.	> ON WOOD - ALDER OR COTTONWOOD
50			2190 2	
				SAND - LOOSE TO COMPACT, GREY, FINE
	11		2 3 STD. PEN. 5 6 3	
			7 10	(1 FT. OVERDRIVE) (1 PC. WATERWORN GRAVEL IN BIT)
55			10 14 STD. PEN. 19 17 4	SAND & GRAVEL - COMPACT, GREY, FINE SAND WITH SMALL AMOUNT ASSORTED SIZES SAND - ¼ FINE ¼ MEDIUM GRAVEL
	33			TEST BORING STOPPED AT 57.0
				4" CASING TO 29.0
60				3" CASING TO 46.0
				WATER LEVEL: -5.0 62 HRS. AFTER DRILLING STOPPED
				LOST NEARLY ALL WATER & AT TIMES ALL, WHEN OUT OF CASING - THROUGHOUT HOLE

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LOG OF TEST BORING

S S.H. I-W S.R. 104 Section 64TH AVE. W. IN LYNNWOOD TO JCT. PSH 1 Job No. CONT. 8161
Hole No. H-3 Sub Section SCRIBER LAKE FILL Cont. Sec. 3130
Station 102+75 Offset 17' RT. ℄ Ground El. 343.0
Type of Boring 8CA6-8 ROTARY Casing 4" 12.0 W.T. El. NOT OBTAINED
Inspector CALVIN LOCKWOOD Date 7-AUG-1967 Sheet 1 of 2

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				FOREIGN FILL MATERIAL — FINE SAND ON BRUSH — RUBBLE — & LOGS
5				
10				(ON LOG OR WOOD AT 10.0)
				(A LITTLE COARSE SAND & FINE & MEDIUM GRAVEL 10.0 TO 12.0
				(LOG AT 12.0 — APPROXIMATELY 20" THROUGH)
				(LOST PARTIAL WATER WHEN DRILLING OUT
15				OF CASING FROM 12.0 TO 20.0)
				(17.0 AREA IN BRUSH — SAWDUST — BARK — HOGGED FUEL)
20				

H. F. 26.66-A (Rev. 5-67)

Hole No. H-3 Sub Section SCRIBER LAKE FILL Sheet 2 of 2

DEPTH 20	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			A B C D U-1	STIFF BROWN PEAT
25			24 STD. 28 20 16 PEN. 2	SAND & GRAVEL - DENSE, GREY, ALL GRADES SAND & FINE & MEDIUM GRAVEL
				TEST BORING STOPPED AT 26.5
				4" CASING TO 12.0 - ROTARY WITH TRI-CONE TO 24.5
30				PARTIAL WATER LOST WHEN OUT OF CASING
				SAMPLES WET
				HOLE CAVED AT - 4.5 UPON CASING REMOVAL

H. F. 26.66 (Rev. 5-67)

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LOG OF TEST BORING

S.S.H. I-W S.R. 104 Section 64TH AVE. W. IN LYNNWOOD TO JCT PS# 1 Job No. CONT. 8161
Hole No. H-4 Sub Section SCRIBER LAKE FILL Cont. Sec. 3130
Station 109+00 Offset 27' RT. ℄ Ground El. 342.1
Type of Boring BC48-8 ROTARY Casing 4" 15.0 W.T. El. 335.6
Inspector CALVIN LOCKWOOD Date 8-AUG-1967 Sheet 1 of 2

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				FOREIGN FILL MATERIAL — FINE SAND ON BRUSH, RUBBLE, & LOGS
5				(PIECES CONCRETE AT 6.0 TO 7.0)
				(WOOD AT 9.0)
10				(A LITTLE COARSE SAND & FINE GRAVEL MIXED IN 9.0 TO 26.0)
15				
20				

H. F. 26.66-A (Rev. 5-67)

Hole No. H-4 Sub Section SCRIBER LAKE FILL Sheet 2 of 2

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
20				
				(FIR NEEDLES & LIMBS AT 22.0 AREA)
25				
				(ON LOG AT 26.0 – APPROX. 12" THROUGH)
				(AT 27.0 SOME MORE ASSORTED SIZES SAND & FINE GRAVEL)
				(AT 27.5 ON LOG – APPROX. 14" THROUGH)
				(AT 28.5 LOST ALL WATER & PARTIAL LOSS THEREON)
30				~~(ON LOG AT 29.0 – APPROX. 6" – HARD)~~ SAND – LOOSE, BROWN, SLIGHTLY SILTY, FINE
			STD. PEN. 1	
	6/24"		6/24"	
35				
				(SMALL PIECES OF PEAT MIXED IN WITH FINE SAND 35.0 TO 39.0 AREA)
			18 21 STD. PEN. 2	
40	41		20 18	SAND & GRAVEL – DENSE, GREY, SLIGHTLY SILTY
				ALL GRADES SAND & FINE & MEDIUM GRAVEL
				TEST BORING STOPPED AT 41.0
				4" CASING TO 15.0 – ROTARY TO 29.5 – WASH WITH
				PENETROMETER 29.5 TO 39.0
45				WATER LEVEL: -6.5 IMMEDIATELY UPON CASING REMOVAL

H. F. 26.66 (Rev. 5-67)

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LOG OF TEST BORING

S S.H. I-W S.R. 104 Section 64TH AVE. W. IN LYNNWOOD TO JCT. PSH 1 Job No. CONT. 8161
Hole No. H-5 Sub Section SCRIBER LAKE FILL Cont. Sec. 3130
Station 106+10 Offset 6' RT. ℄ Ground El. 348.7
Type of Boring ROTARY 8C48-8 Casing 4" 54.0 W.T. El. NOT TAKEN
Inspector CALVIN LOCKWOOD Date 9-11-OCT-1967 Sheet 1 of 3

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				FOREIGN FILL MATERIAL — SAND & GRAVEL
				LOOSE, ALL GRADES SAND & GRAVEL UP TO 4" DIAMETER
5				
				FOREIGN FILL MATERIAL — SAND, BRUSH, RUBBLE, LOGS — LOOSE TO
10				SLIGHTLY COMPACT SAND
15				
20	8		6 5 STD. PEN. 1	

H. F. 26.66-A (Rev. 5-67)

Hole No. H-5 Sub Section SCRIBER LAKE FILL Sheet 2 of 3

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
20	8		3 2 ↓ STD. PEN.	
				(CASING ON TIMBER AT 24' 3" – CUT THROUGH WITH BIT FOR 4"
25				
				(TIMBER OR LOGS AT 26.5 TO 29.0 AREA)
			9 ↑ STD.	(POOR RECOVERY – WOOD IN BIT FROM 1ST 6" TO 1ST
			5 PEN.	
30	6		1 2	← (POSSIBLE VOID OR SAND IN LIQUID STATE THIS 6")
			4 ↓	
35				
			4 ↑ STD.	(MAGAZINE PRINT FROM THIS DEPTH – IN SAMPLE)
			6 PEN.	
	10		4 3	
			6 ↓	
40				(TIMBERS OR LOGS 39.5 TO 41.5)
				(CUT THROUGH APPROXIMATE 15" LOG AT 43.5)
45				

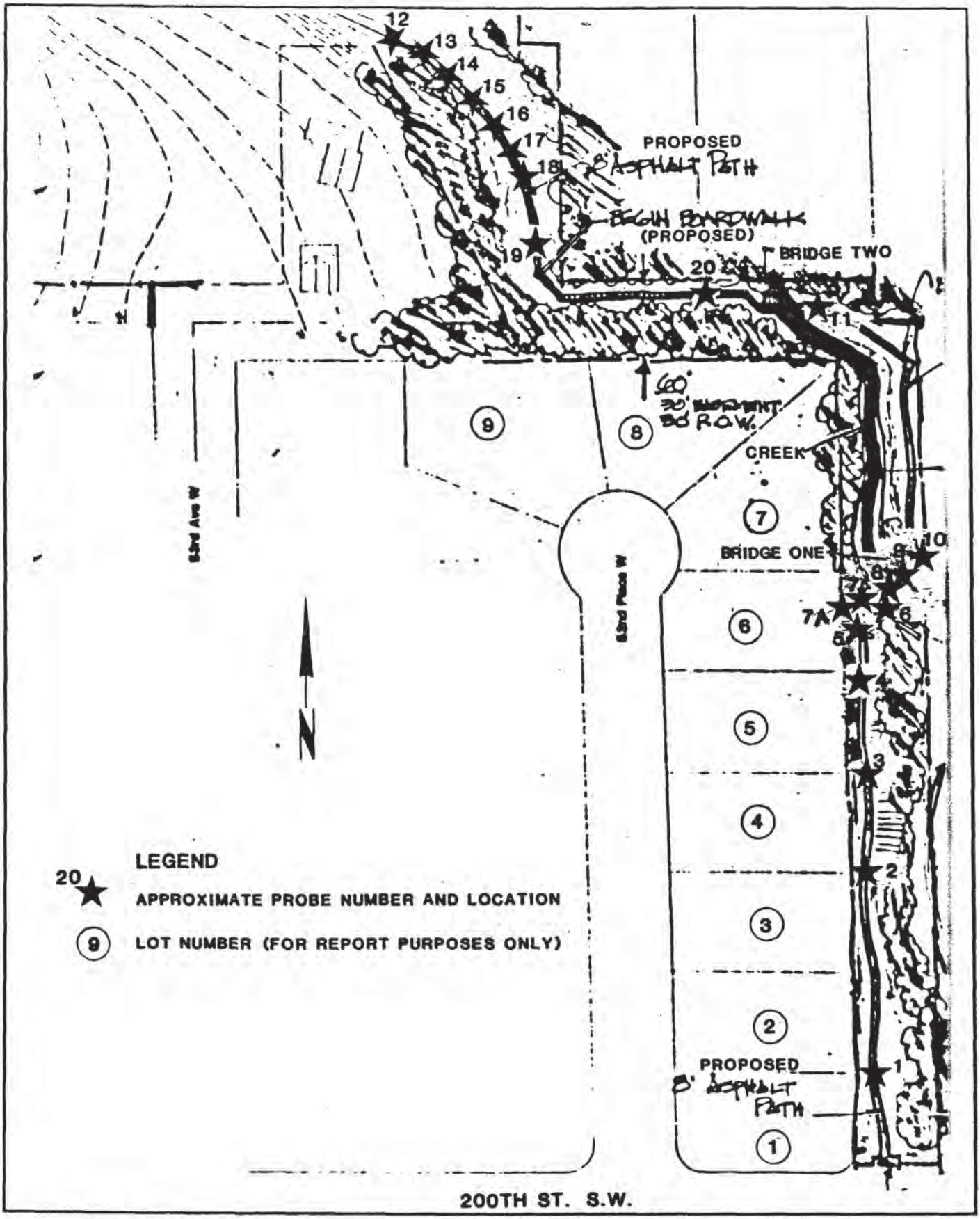
H. F. 26.66-A (Rev. 5-67)

Hole No. H-5 Sub Section SCRIBER LAKE FILL Sheet 3 of 3

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
45				
			4 STD.	
	13		5 PEN.	
			8 4	
			9	
50				
55				
			1 STD.	
	4		2 PEN.	
			2 5	
			3	(59.5 – 65.5)
60				PEAT – VERY SOFT, BROWN
			1 STD.	
	3		1 PEN.	
			2 6	
			2 STD.	
	3		1 PEN.	
			2 7	
			2 STD.	
65	5		3	
			2 PEN.	(65.5 – 66.0)
	20/6"		20 8	LAKE BED – SILT – VERY STIFF, GREY – WITH SMALL AMOUNT PEAT
	50/4"		4"/50	SAND – VERY DENSE, GREY, FINE (66.0 – 66.3)
				TEST BORING STOPPED AT 66.3
				SAMPLES WET THROUGHOUT HOLE
				CASING TO 54.0 – SAMPLED WITH PENETROMETER THEREON
70				LOST ALL WATER WHEN OUT OF CASING – XCEPT FROM 59.5 ON

APPENDIX D

SUBSURFACE DATA FROM APPLIED GEOTECHNOLOGY INC. 1984 SCRIBER CREEK PARK, PHASE II



Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

SITE PLAN

Scriber Lake Park - Phase II
Lynnwood, Washington

PLATE **1**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
BJT	14,845.001		5/20/88		

APPENDIX

HAND PROBE LOGS

Probe No.	Depth (Feet) From	To	Soil Description
1 *	0	0.5	Gray-brown silty sand (SM) dense, moist (Glacial Till or well compacted Fill)
2 *	0	0.5	As Above
3 *	0	0.5	As Above
4 *	0	0.5	As Above
5 *	0	0.5	As Above
6	0	1	Water
	1	2	Silty sand fill, some gravel
	2	10	Peat
	10	10+	No penetration or recovery
7	0	4	Gray-brown silty sand (SM) medium dense, wet with gravel
	4	4+	No penetration or recovery
7A	0	0.5	Brown silty sand Topsoil
	0.5	1	Gray brown silty sand (SM) dense, moist (Glacial Till)
8	0	20	Peat
	20	20+	Gray clayey silt (ML) very stiff, wet
9	0	3	Brown sand (SP) to silty sand (SM), loose to medium dense, wet (Fill)
	3	3.5	Dark brown organic silt (ML), soft, wet (Old Topsoil)
	3.5	3.5+	Peat

Hand Probe Logs (continued)

Probe No.	Depth (Feet) From	To	Soil Description
10	0	2.5	Brown silty sand (SM) loose , wet, with wood fragments (Fill) (Strong creosote smell)
	2.5	20	Peat
	20	20+	Gray clayey silt (ML) stiff to very stiff, wet
11	0	22	Peat
	22	22+	Gray-brown silty sand (SM) dense, wet
12	0	9	Peat
	9	9+	Sand
13	0	9	Peat
	9	9+	Sand
14	0	4	Peat (possibly on log at 4 feet)
15	0	6	Peat
	6	6+	Sand
16	0	8	Peat
	8	8+	Sand
17	0	9	Peat
	9	9+	Sand
18	0	4	Peat (possibly on log at 4 feet)
19	0	8	Peat
	8	8+	Sand
20	0	26	Peat
	26	26+	No penetration or recovery

*Probes 1 through 3 performed with Post Hole Auger. All remainder performed with hand operated peat probe.

APPENDIX E

SUBSURFACE DATA FROM HWA 1996
SR 99 IMPROVEMENTS PROJECT

APPENDIX A

FIELD INVESTIGATION

The field investigation was performed between August 14 and September 15, 1995, and consisted of drilling and sampling 65 exploratory borings (BH-1 through BH-65) at selected locations along the project alignment. The borings were advanced to depths ranging from about 3.2 to 8.1 meters (10½ to 26½ feet) below the existing ground surface. The boreholes were located approximately in the field by taping distances from survey points established by Entranco along the centerline of the project alignment and plotted on the Site and Exploration Plans (Figures 3 through 18). A legend to the terms and symbols used on the boring logs is presented on Figure A-1. Summary borehole logs are presented on Figures A-2 through A-66.

Geotechnical drilling was performed by Gregory Drilling, Inc. of Redmond, Washington and Associated Drilling, Inc. of Seattle, Washington under subcontract to HWA. Gregory Drilling used a truck-mounted, CME 75 drill rig with 4¼-inch diameter, continuous flight hollow stem augers and a trip-release mechanism for performing Standard Penetration Tests; Associated Drilling used a truck-mounted Mobile B-61 drill rig with 4-inch inside diameter continuous flight hollow stem augers and a standard hammer equipped with a rope and cathead mechanism. Upon completion of drilling, the borings were backfilled with bentonite chips. Explorations located in areas of existing pavement were repaired using either an asphalt or quick setting concrete patch.

At each boring location, Standard Penetration Test sampling was performed in general accordance with ASTM D 1586, using a 2-inch outside diameter split-spoon sampler and a 140-pound hammer. During the test, a sample is obtained by driving the sampler 18 inches into the soil with a hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration is recorded. The Standard Penetration Resistance ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration. If a total of 50 blows is recorded within a single 6 inch interval, the test is terminated, and the blow count is recorded as 50 blows for the number of inches of penetration. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils.

At several boring locations, a 2½-inch inside diameter split spoon sampler with brass liners was used to obtain relatively undisturbed soil samples. The sampler was driven using a 140-pound hammer free falling 30 inches per stroke. The recorded penetration resistance is used only as a qualitative indication of the consistency/density of the soil. Relatively

undisturbed soil samples were also obtained by introducing a thin-walled sampler (Shelby tube) into the borehole and pushing the tube into the soil mass ahead of the lead auger a distance of about 30 inches. Shelby tube sampling was performed in general accordance with ASTM D 1587.

The borings were drilled under the full-time observation of HWA personnel. Soil samples obtained from the split-barrel samplers were classified in the field and representative portions were placed in air-tight, plastic bags. These soil samples were returned to our Lynnwood, Washington laboratory for further examination and testing. In addition, pertinent information including soil sample depths, stratigraphy, soil engineering characteristics, and groundwater occurrence was recorded. The stratigraphic contacts shown on the individual borehole logs represent the approximate boundaries between soil types; actual transitions may be more gradual. The soil and groundwater conditions depicted are only for the specific dates and locations reported, and therefore, are not necessarily representative of other locations and times.

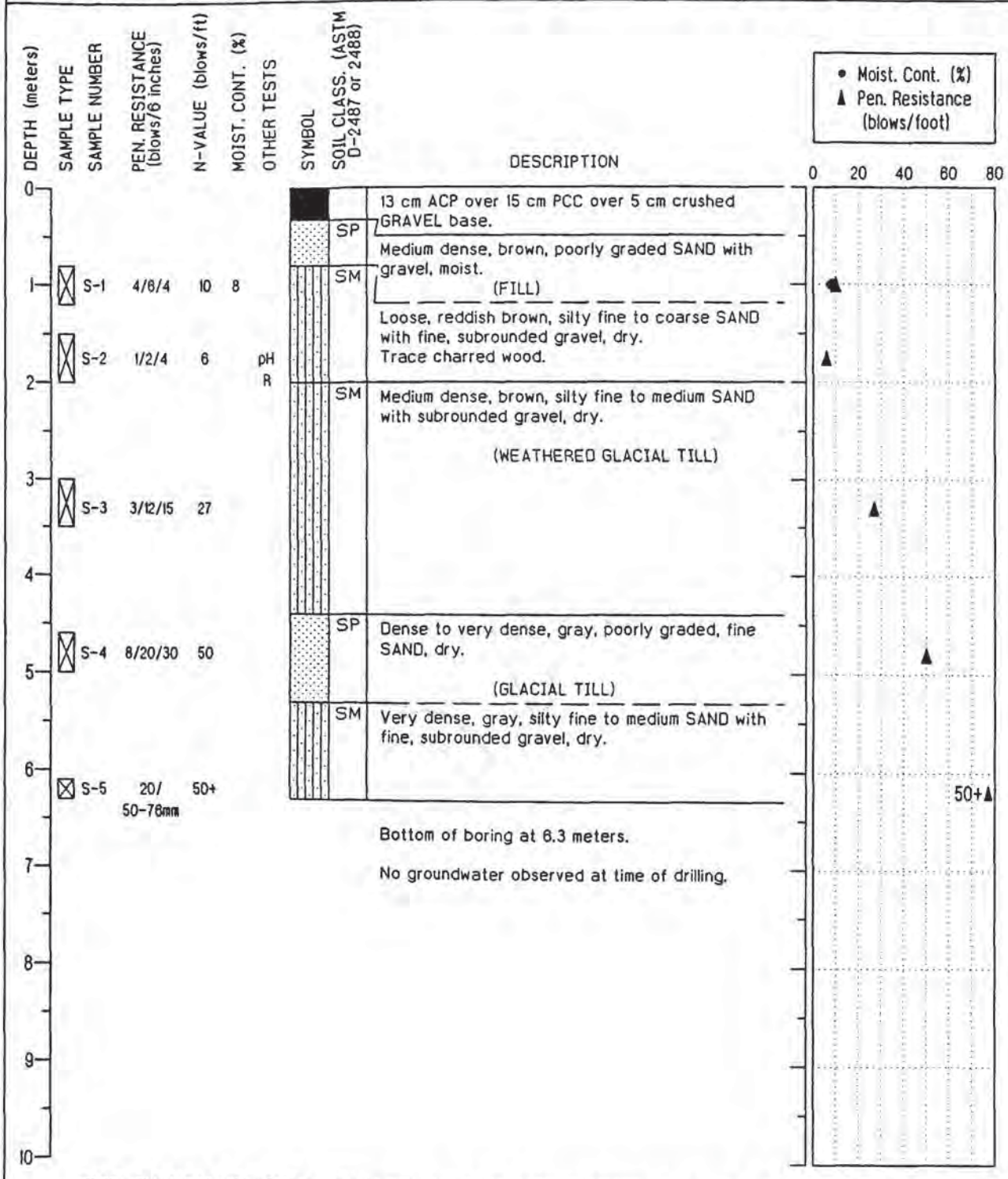
As noted above, the hammer on the CME drill rig was equipped with a trip-release mechanism for performing Standard Penetration Tests. The trip-release mechanism generally delivers a higher energy than a "standard" hammer equipped with a rope and cathead mechanism. Based on previous studies (Skempton, 1986), a 79 percent energy ratio should be used in interpreting the recorded SPT blow-counts obtained with a trip hammer, instead of the 60 percent energy ratio for a safety hammer with a rope and cathead system. As such, N-values measured with the automatic trip-release hammer should be multiplied by about 1.3 to convert them to "standard" SPT N-values (N_{60}).

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Gregory Drilling, Inc.
DRILLING METHOD: CME 75 10.8cm ID CFHS Auger
SAMPLING METHOD: SPT

TOTAL DEPTH: 6.3 Meters
SURFACE ELEVATION: 118.5± Meters
MEASURING POINT EL.: Meters



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

PROJECT: SR-99 Improvements

BORING: BH-15

LOCATION: SR-99, Sta 6+287.4, 7.1m Rt.
DATE COMPLETED: August 23, 1995
LOGGED BY: R.F. Faubion

PROJECT NUMBER: 90115

PAGE: 1 OF 1

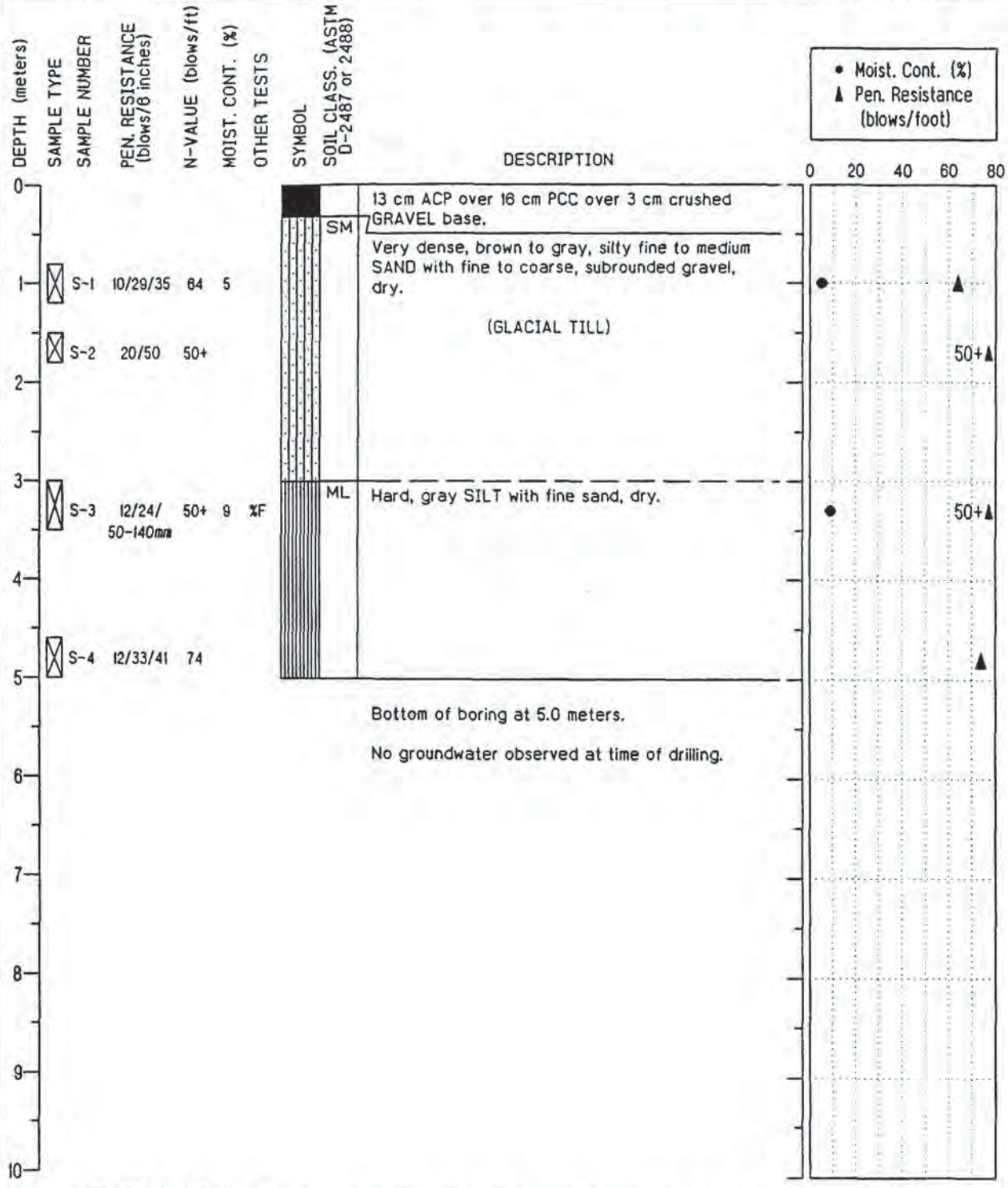
Figure A-16

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Gregory Drilling, Inc.
DRILLING METHOD: CME 75 10.8cm ID CFHS Auger
SAMPLING METHOD: SPT

TOTAL DEPTH: 5.0 Meters
SURFACE ELEVATION: 116.8± Meters
MEASURING POINT EL.: Meters



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

PROJECT: SR-99 Improvements

BORING: BH-16

LOCATION: SR-99, Sta 6+333.6, 8.4m Rt.
DATE COMPLETED: August 24, 1995
LOGGED BY: R.F. Faubion

PROJECT NUMBER: 90115

PAGE: 1 OF 1

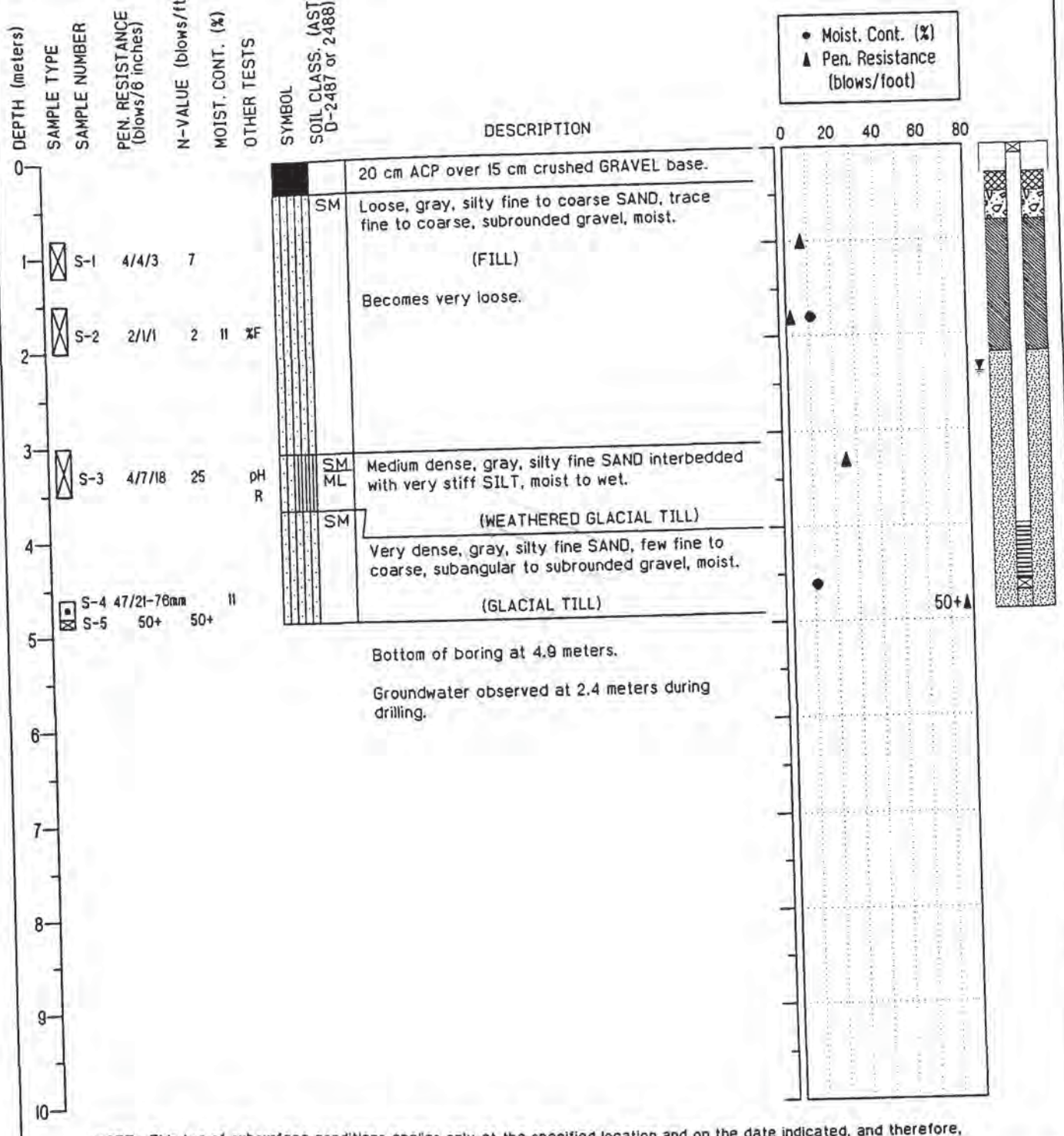
Figure A-17

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Gregory Drilling, Inc.
DRILLING METHOD: CME 75 10.8cm ID CFHS Auger
SAMPLING METHOD: SPT, RING

TOTAL DEPTH: 4.9 Meters
SURFACE ELEVATION: 111.6 ± Meters
MEASURING POINT EL.: Meters



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

PROJECT: SR-99 Improvements

BORING: BH-35

LOCATION: SR-99, Sta 6+484.1, 7.0m Rt.
DATE COMPLETED: August 23, 1995
LOGGED BY: R.F. Faubion

PROJECT NUMBER: 90115

PAGE: 1 OF 1

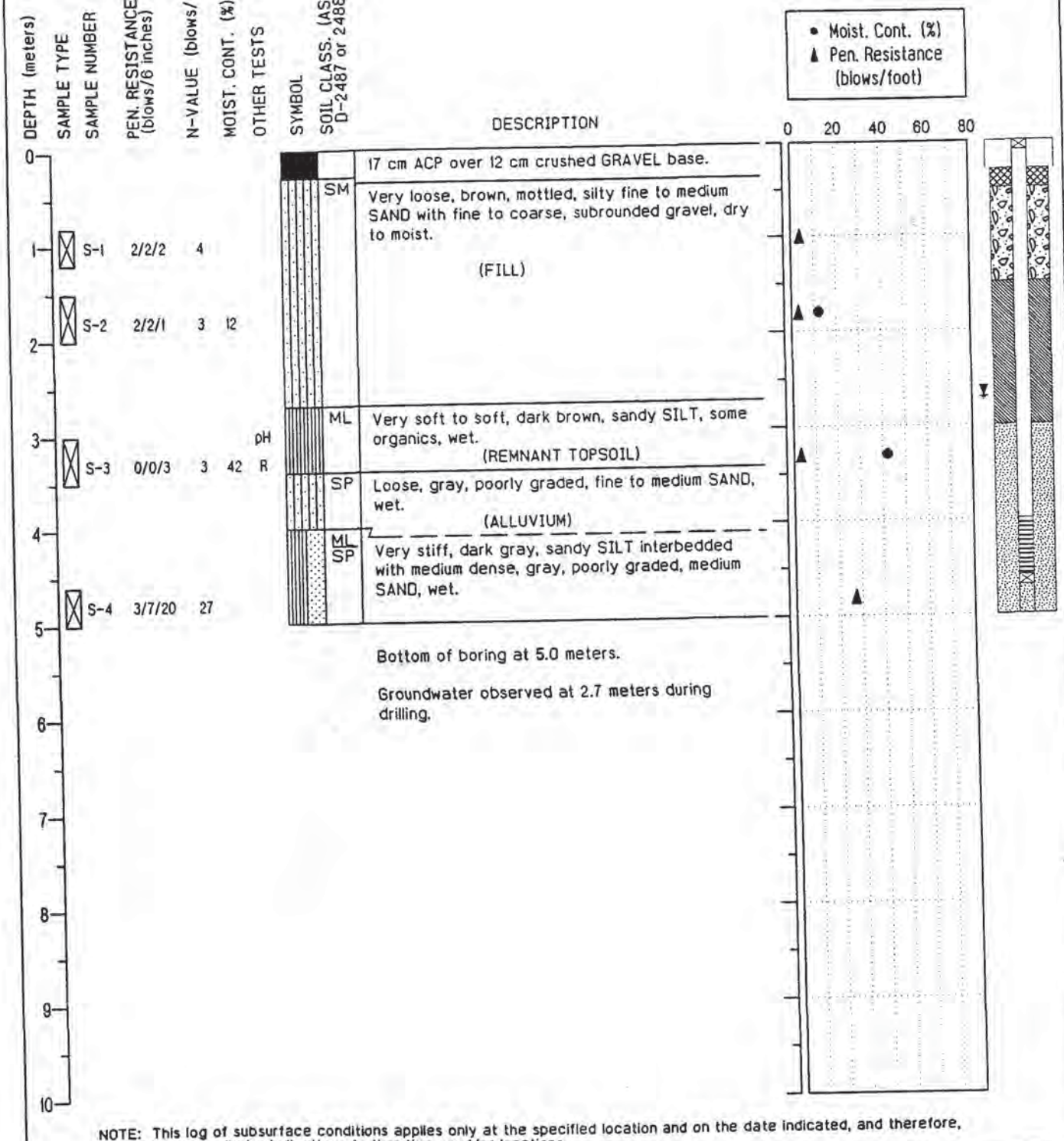
Figure A-36

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Gregory Drilling, Inc.
DRILLING METHOD: CME 75 10.8cm ID CFHS Auger
SAMPLING METHOD: SPT

TOTAL DEPTH: 5.0 Meters
SURFACE ELEVATION: 112.8± Meters
MEASURING POINT EL.: Meters



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

PROJECT: SR-99 Improvements

BORING: ~~BH-38~~

LOCATION: SR-99, Sta 6+661.4, 8.0m Lt.
DATE COMPLETED: August 24, 1995
LOGGED BY: R.F. Faubion

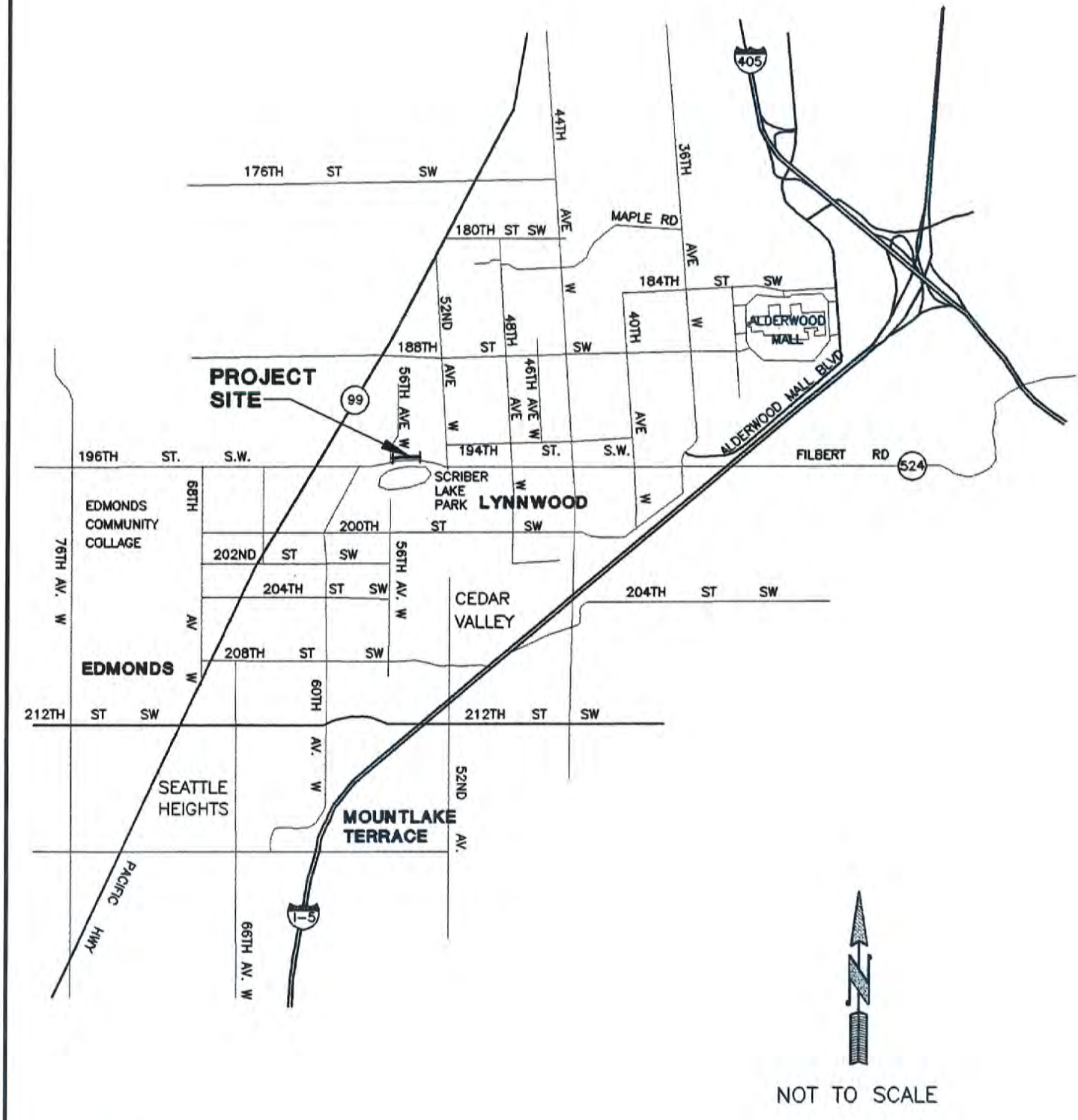
PROJECT NUMBER: 90115

PAGE: 1 OF 1

Figure A-37

APPENDIX F

SUBSURFACE DATA AND HISTORICAL INFORMATION FROM HWA 1996 SCRIBER CREEK BRIDGE EVALUATION



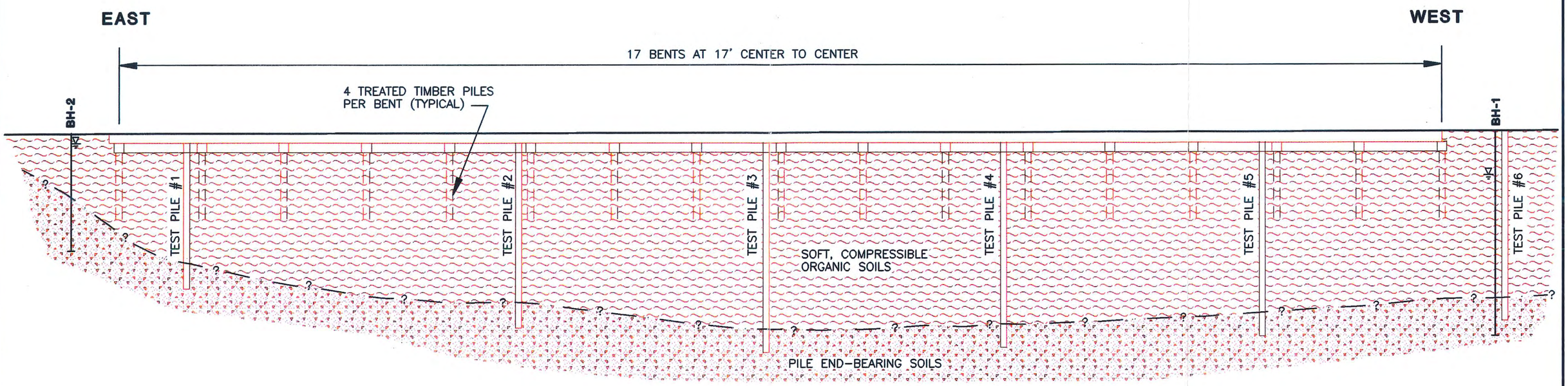
HWA HONGWEST & ASSOCIATES, INC.

SCRIBER CREEK BRIDGE

VICINITY MAP

PROJECT NO.: 94125 FIGURE: 1

C:\JOBS\94125\94125001.DWG



LEGEND

BH-2 — BORING DESIGNATION AND APPROXIMATE LOCATION

APPROXIMATE WATER LEVEL OBSERVED AT TIME OF DRILLING

BOTTOM OF BORING

— ? — ? — INFERRED GEOLOGIC CONTACT

NOTES

1. Subsurface conditions shown are based on interpolation between widely spaced borings and test pile data and should be considered approximate.
2. Test pile locations and lengths were interpreted from data shown on the referenced plans. The test pile program was completed for the original construction.
3. Approximate location of end-bearing layer based on assumption that test piles penetrate approximately 5 feet into end bearing soils.
4. East-West orientation of profile based on correlation between test pile lengths and subsurface conditions observed in borings. Bridge curvature shown on referenced plans also suggests East-West orientation as shown.

0 20 40

HORIZONTAL SCALE: 1" = 20'

REFERENCE: "Bridge No. 428 over Scriber Lake, Layout," Snohomish County, April 1933.

C:\JOBS\94125\94125002.DWG

HWA HONGWEST & ASSOCIATES, INC.

SCRIBER CREEK BRIDGE

BRIDGE LAYOUT AND SUBSURFACE PROFILE

PROJECT NO.: 94125 FIGURE: 2

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psi)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

ASTM SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
	More than 50% of Coarse Fraction Retained on No. 4 Sieve		GP	Poorly-graded GRAVEL
		Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
More than 50% Retained on No. 200 Sieve Size	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-graded SAND
	50% or More of Coarse Fraction Passing on No. 4 Sieve		SP	Poorly-graded SAND
		Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY.
50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT.
			CH	Fat CLAY
			OH	Organic Silt/Organic Clay.
Highly Organic Soils			PT	PEAT

TEST SYMBOLS

GS	Grain Size Distribution
%F	Percent Fines
CN	Consolidation
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained
UC	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength (tsf)
TV	Torvane Approximate Shear Strength (tsf)
CBR	California Bearing Ratio
MD	Moisture/Density Relationship
PID	Photoionization Device Reading
AL	Atterberg Limits PL Plastic Limit LL Liquid Limit

SAMPLE TYPE SYMBOLS

- 2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
- Shelby Tube
- 3.0" OD Split Spoon with Brass Rings
- Disturbed Bulk Sample (cuttings)
- Core Run
- Non-standard Penetration Test (with split spoon sampler)

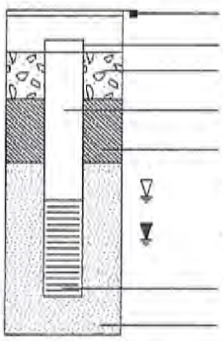
COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	0 - 5%
Few	5 - 10%
Little	15 - 25%
Some	30 - 45%
Mostly	50 - 100%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

GROUNDWATER WELL COMPLETIONS



NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation in general accordance with ASTM D 2487 and ASTM D 2488. Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

HONGWEST & ASSOCIATES, INC.

SCRIBER CREEK BRIDGE

LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 94125 FIGURE: 3

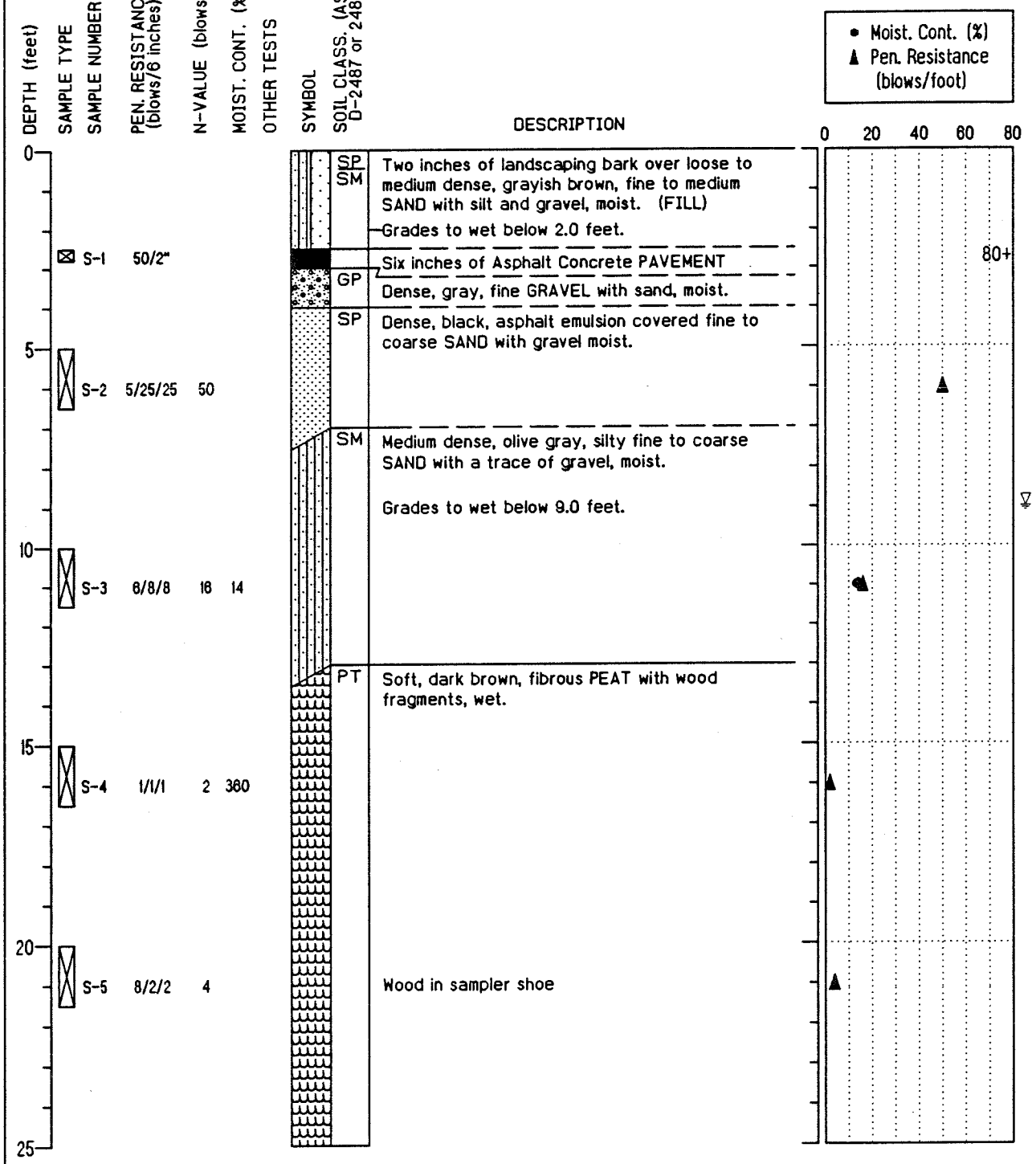
C:\JOBS\94124\94125003.DWG

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Associated Drilling
DRILLING METHOD: HSA 4.25" ID, B-51 Drill Rig
SAMPLING METHOD: SPT

TOTAL DEPTH: 41.5 Feet
SURFACE ELEVATION: Feet
MEASURING POINT EL.: Feet



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

PROJECT: Scriber Creek Bridge

BORING: BH-1

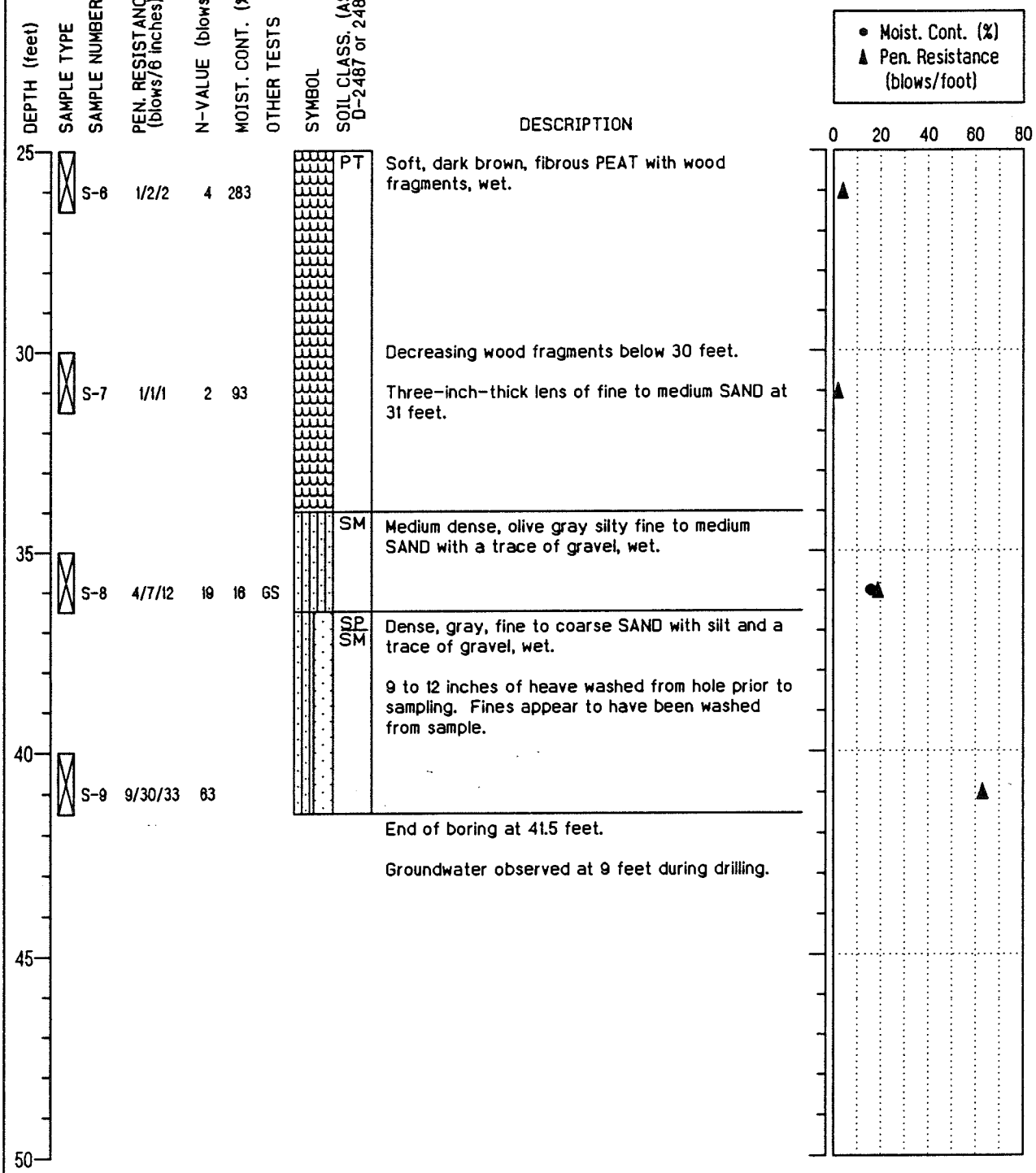
LOCATION: 11' west and 9' north of SW corner of bridge
DATE COMPLETED: 6-1-95
LOGGED BY: DJC

PROJECT NUMBER: 94125

PAGE: 1 OF 2

Figure 4

HONG WEST & ASSOCIATES, INC.
BORING LOG



PROJECT: Scriber Creek Bridge

LOCATION: 11' west and 9' north of SW corner of bridge
DATE COMPLETED: 6-1-95
LOGGED BY: DJC

BORING: BH-1

PROJECT NUMBER: 94125

PAGE: 2 OF 2

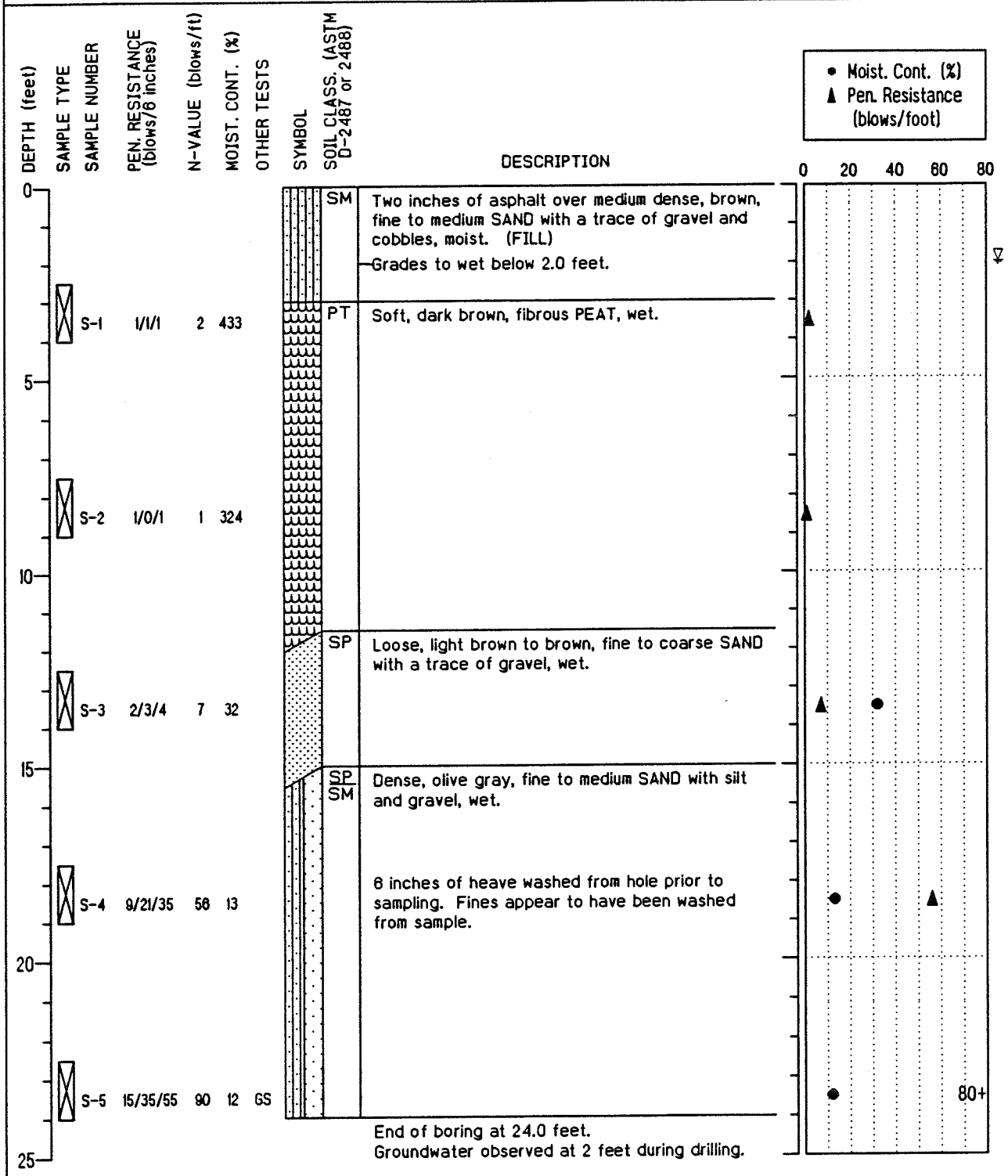
Figure 4

HONG WEST & ASSOCIATES, INC.

BORING LOG

DRILLING COMPANY: Associated Drilling
DRILLING METHOD: HSA 4.25" ID, B-51 Drill Rig
SAMPLING METHOD: SPT

TOTAL DEPTH: 24.0 Feet
SURFACE ELEVATION: Feet
MEASURING POINT EL.: Feet



NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated, and therefore, may not necessarily be indicative of other times and/or locations.

PROJECT: Scriber Creek Bridge

BORING: BH-2

LOCATION: 8' east and 11' south of NE corner of bridge.
DATE COMPLETED: 6-1-95
LOGGED BY: DJC

PROJECT NUMBER: 94125

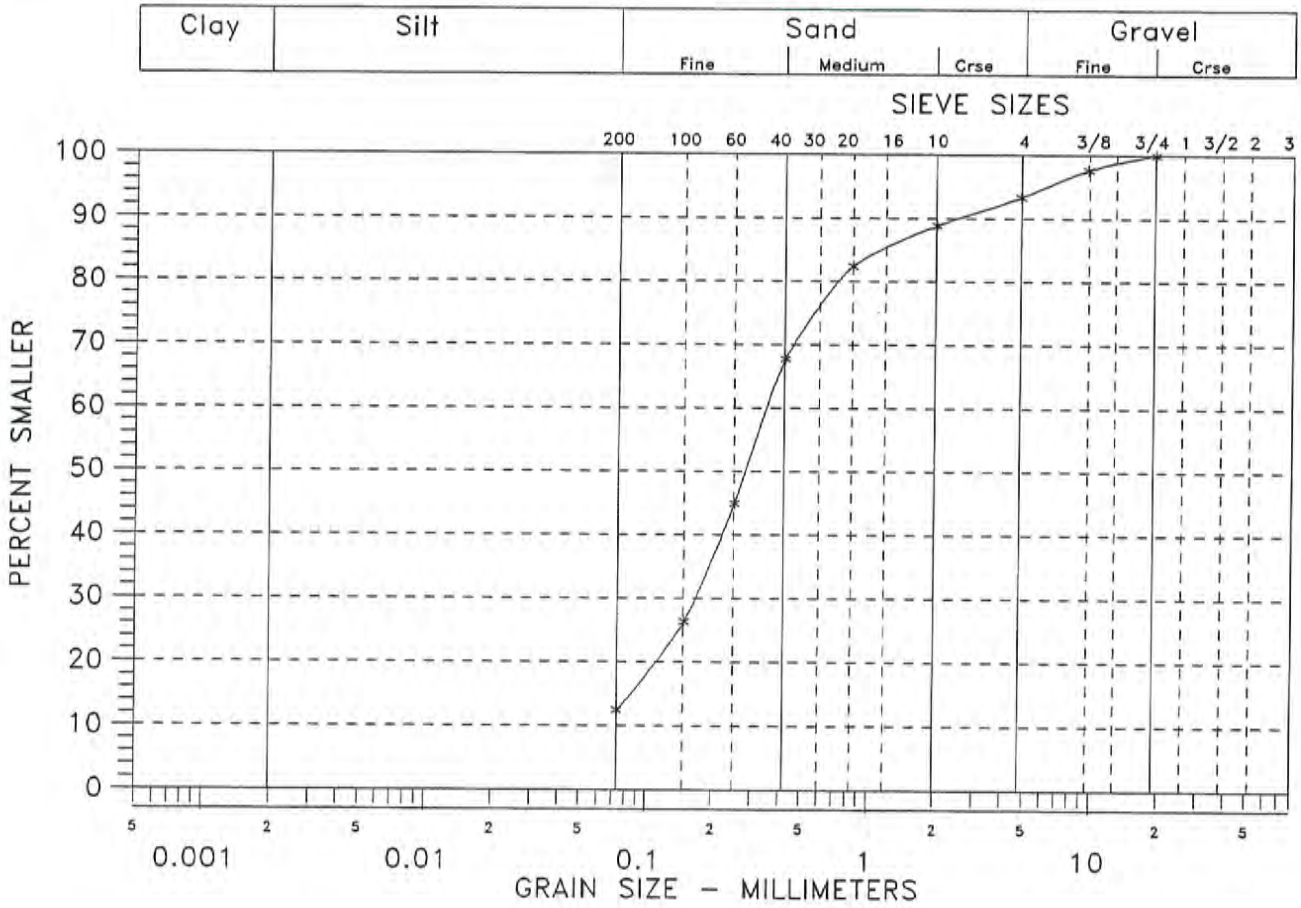
PAGE: 1 OF 1

Figure 5

GRAIN SIZE DISTRIBUTION

Project: Scriber Creek Bridge
Location: Lynnwood, Washington
Project Number: 94125
Date Tested: 6-16-95
Remarks: Olive gray, silty SAND (SM)

Location: BH-1
Sample Number: S-8
Depth: 35.0-36.5 feet
Sample Description:
Gravel: 6.6
Sand: 80.9
Fines: 12.5



HONGWEST & ASSOCIATES, INC.

SCRIBER CREEK BRIDGE

GRAIN SIZE DISTRIBUTION CURVE

PROJECT NO.: 94125 FIGURE: 6

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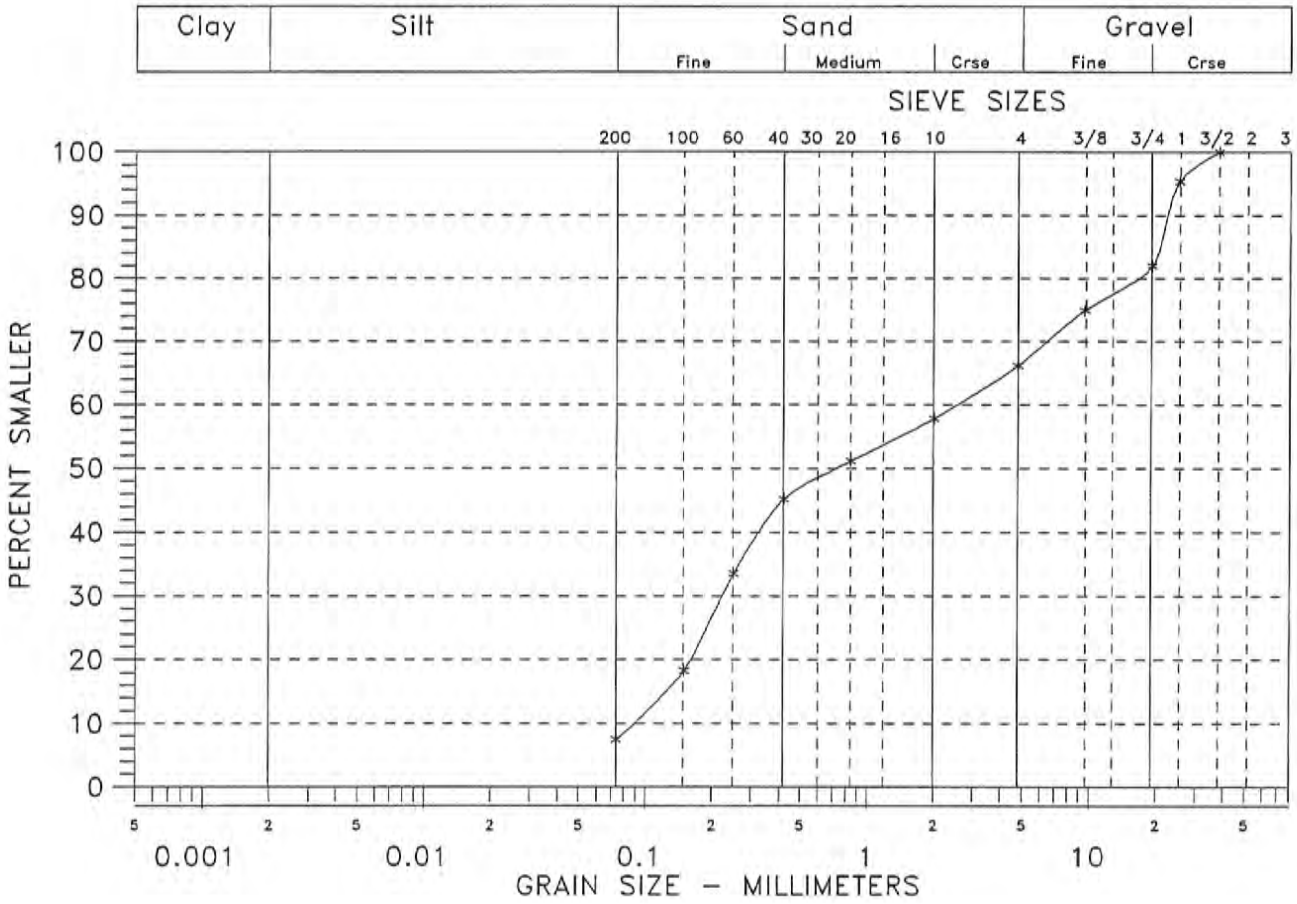
GRAIN SIZE DISTRIBUTION

Project: Scriber Creek Bridge
Location: Lynnwood, Washington
Project Number: 94125
Date Tested: 6-16-95
Remarks: Olive gray, poorly graded SAND with silt and gravel (SP-SM)

Location: BH-2
Sample Number: S-5
Depth: 22.5-24.0 feet
Sample Description:
Gravel: 33.9
Sand: 58.6
Fines: 7.5



HWA HONGWEST & ASSOCIATES, INC.

SCRIBER CREEK BRIDGE

GRAIN SIZE DISTRIBUTION CURVE

PROJECT NO.: 94125 FIGURE: 7

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APPENDIX A

RESEARCH ARTICLES

APPENDIX A

RESEARCH ARTICLES

The following articles and photographs regarding the 196th Street SW embankment construction and failure were obtained from the WSDOT (Washington State Department of Transportion) Materials Laboratory in Olympia, Washington--File No. L-2899, SSH-1W, Lynnwood to Junction FAI-405 (196th SW).

LYNNWOOD AREA GETS ITS OWN 'SKID ROAD'

SWINGING into place is another huge log for Lynnwood area's new "skid road" base to highway improvement. It was preceded by an estimated 3500 Christmas trees. Journal Staff Photo

THE CURVING roadway at left would be replaced by a straight path from Lynnwood to Alderwood Manor when construction is completed, possibly this summer. Also underway is connecting roadway to the Interstate Freeway (U.S. 5) out of sight to the right. It should relieve much of the congestion in Lynnwood area. Journal Staff Photo

LOGS, logs everywhere look like the famed "skid road" of Seattle pioneer days. But Lynnwood road will have conventional paving poured when this bog cover settles. Journal Staff

L-2899

John W. Schade, right, watched as his men and equipment placed logs to form a base for a section of highway being built over a boggy area in Lynnwood.

To Build a Highway: Hog Fuel and Brush

By BOB LANE

Concrete and steel are the accepted ingredients for modern highways, but in Lynnwood second - growth timber, hog fuel and brush have been added to the list.

A 1,200-foot stretch of 196th Street Southwest, being reconstructed by the state through a boggy area along Scriber Lake, will be supported by a thick mat of logs, woodchips and even some old Christmas trees.

Motorists driving by the construction site near the Lynnwood Civic Center slow to watch as bulldozers and cranes drag and shove the logs into place and work them into the ooze. Hog fuel (wood chips, shavings and other debris from saw mills) is poured between the logs to fill the voids and provide better footing for the workmen.

THE LOG MAT will range from two feet in depth along the edge of the existing roadway to four feet near the lake shore.

John W. Schade, the Seattle contractor building the mat for the prime contractor, the Red Samm Mining Co., said the log pad will be 1,200 feet long and about 92, feet across at the widest point.

Schade said he is using only coniferous timber (fir, spruce, hemlock, cedar) in the fill. It was logged earlier near Redmond and is being hauled the 22 miles to the construction site.

The old Christmas trees, nd brush cut from the ht - of - way, were ead over the land before the contractor began placing the logs in long, tight parallel rows. The wood chips are then poured in, another layer of logs is laid perpendicular to the first layer and the voids are filled with hog fuel.

AFTER THE MAT has been completed the prime contractor will fill the area with eight feet of earth. After the fill has settled and compacted about four feet will be stripped off to bring the roadway to grade, Schade said.

Won't the timber mat rot?

"No," said Schade. "It should last indefinitely if either the air or the water is sealed out.

"This should last at least 100 years, maybe 200."

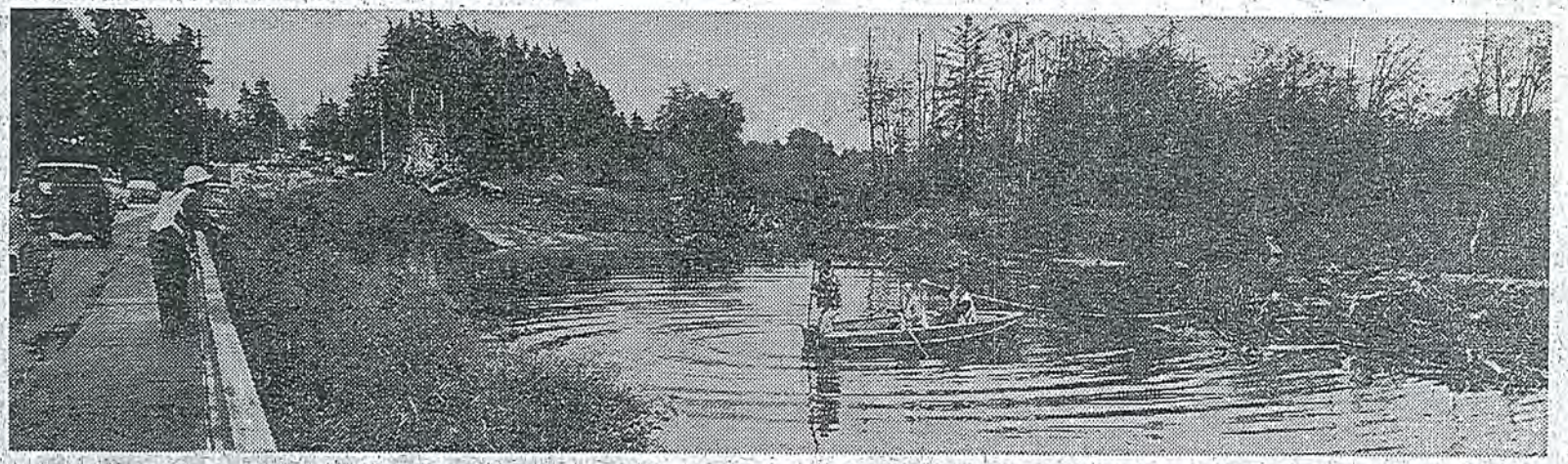
Schade said he is working under a $55,000 subcontract.

The prime contractor won the job last year on a low bid of $829,989. Work began in early January and is to be finished in 180 working days.

WHEN COMPLETED, the narrow two-lane highway, a reminder of Lynnwood's recent rural past, will be widened to four lanes. It also will include a fifth lane for turning vehicles. A bend in the highway around the edge of Scriber Lake is being removed.

The state project runs from 65th Avenue West east to about 37th Avenue West along 196th Street Southwest. It also includes improvement of 44th Avenue West from 196th Street Southwest south to a freeway interchange.

The city of Lynnwood install sidewalks along n of the improved highway make improvements to water system and st lights along the route.



—Post-Intelligencer Photo by Tom Brownell.

WORKMEN PROBED FOR BOTTOM OF LAKE THURSDAY AFTER LAST OF LYNNWOOD'S FLOATING HIGHWAY SANK FROM SIGHT

Brush and parts of broken up frame houses, seen in background, are being used in a attempt to provide a road base

Back to the Old Drawing Board

BY WALTER A. EVANS

Lynnwood's floating highway is turning into more of a submarine scenic route.

In fact, the highway has disappeared.

A section of the road, being built along 196th Street SW in Lynnwood crosses a peat bog near swampy Scriber's Lake.

The State Highways Department planned to fill in a roadbed with brush and logs, lay a base of sand over that, then add the hard top.

THINGS WERE going along fine until a couple of weeks ago when a 150' by 60' lake appeared in the project, leaving only a one-lane strip of road along the bog.

Now the last lane has gone to the bottom.

"There's more settlement than we expected," a Highways Department spokesman deadpanned.

"But we'll keep working. I think we're on something solid now."

Originally the department hoped brush would do the work, with sawdust added for a filler.

"We're down too far now for that," the spokesman said. "Now we're mixing broken up frame houses with sand."

THE LAKE AREA in the middle of the road looks as if a group of demented beavers had decided to build a dam, then quit.

Workmen were busy Thursday trying to find bottom — or at least the 100-foot section of the road that made the latest dive into the hole.

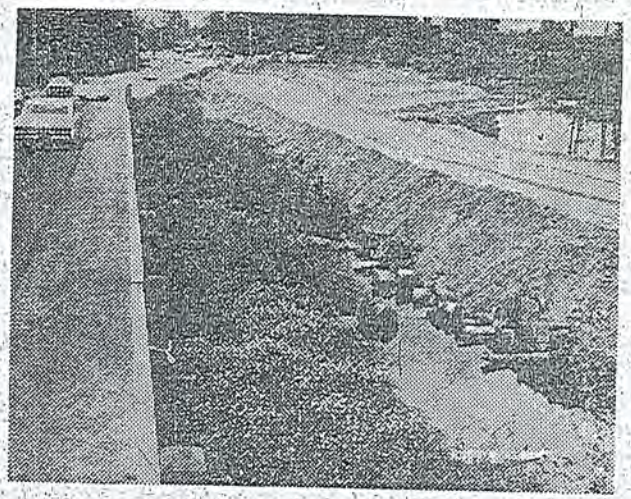
"But," an engineer admitted, "we don't know where the bottom is."

So the road that started on a base of Christmas trees, with a middle layer of sawdust, brush and logs, now is getting a layer of old houses and sand on the top.

It may take an entire urban renewal project to fill the hole, however.

"But take it easy on us," an engineer pleaded.

"We're doing the best we can."



—P-I Photo.

A PORTION OF THE FLOATING HIGWAY

When it was still floating on peat bog

Engineers Hope No Road Delay

By JIM HALEY
Staff Writer

LYNNWOOD — The State Highway Department engineer working on the widening of 196th Street SW in Lynnwood says that recent setbacks in the project should not delay completion past a middle-of-September scheduled deadline.

But he hesitated before he made this statement.

"As yet we have not been delayed by the sinking of the area around Scriber Lake," said Jack Lunceford, engineer. "We have been working on the rest of the project which has been going smoothly. This will be the last to be completed."

Last spring, deep and wide holes appeared in the roadbed near a former stream course. Originally a log and brush base was put down and several feet of sand put on top of the logs. The quarter-mile section was dubbed "the floating road" by residents of the area. The log base, presumably, should have been buoyed in the soft swampy land near the lake.

In some areas, however, it didn't, and two large holes appeared. The first was filled and construction workers still are attempting to fill the second.

The depression reached widths of nearly 500 feet and depths of 40 feet below the lake level. Since that time, more than 25,000 cubic yards of broken lumber from demolition projects in the area have been poured into the gaping hole.

The area now looks like a scene from a science fiction magazine, with broken bits of lumber sticking in every direction.

How long before engineers know if the solution this time would remain stable?

"I don't think anyone knows for sure," Lunceford stated. "Your guess is as good as mine."

The strategy used is to keep dumping the fill material with wood and gradually fill the edges with additional sand.

"We think we are progressing. We'll just have to keep filling until the settling stops. We should have it filled within a month. Then it will be a matter of overloading with sand until it stops settling."

The project has been somewhat of a headache for the engineer, the state representative on the job. "I've never had anything like this before," he said.

When speaking about possible delay in the project, Lunceford stated that there always was a possibility, but if things go right from now on, he couldn't see anything which would stop progress.

"We want to make the road a good one before we start paving," he said.

Lunceford said that it was probably the weight of the log bed combined with the weight of sand on top that pushed the bed so deep. He said that rains which occurred just before the sinking probably had no effect other than adding weight to the sand.

"The rain could have been the straw which broke the camel's back," he said.

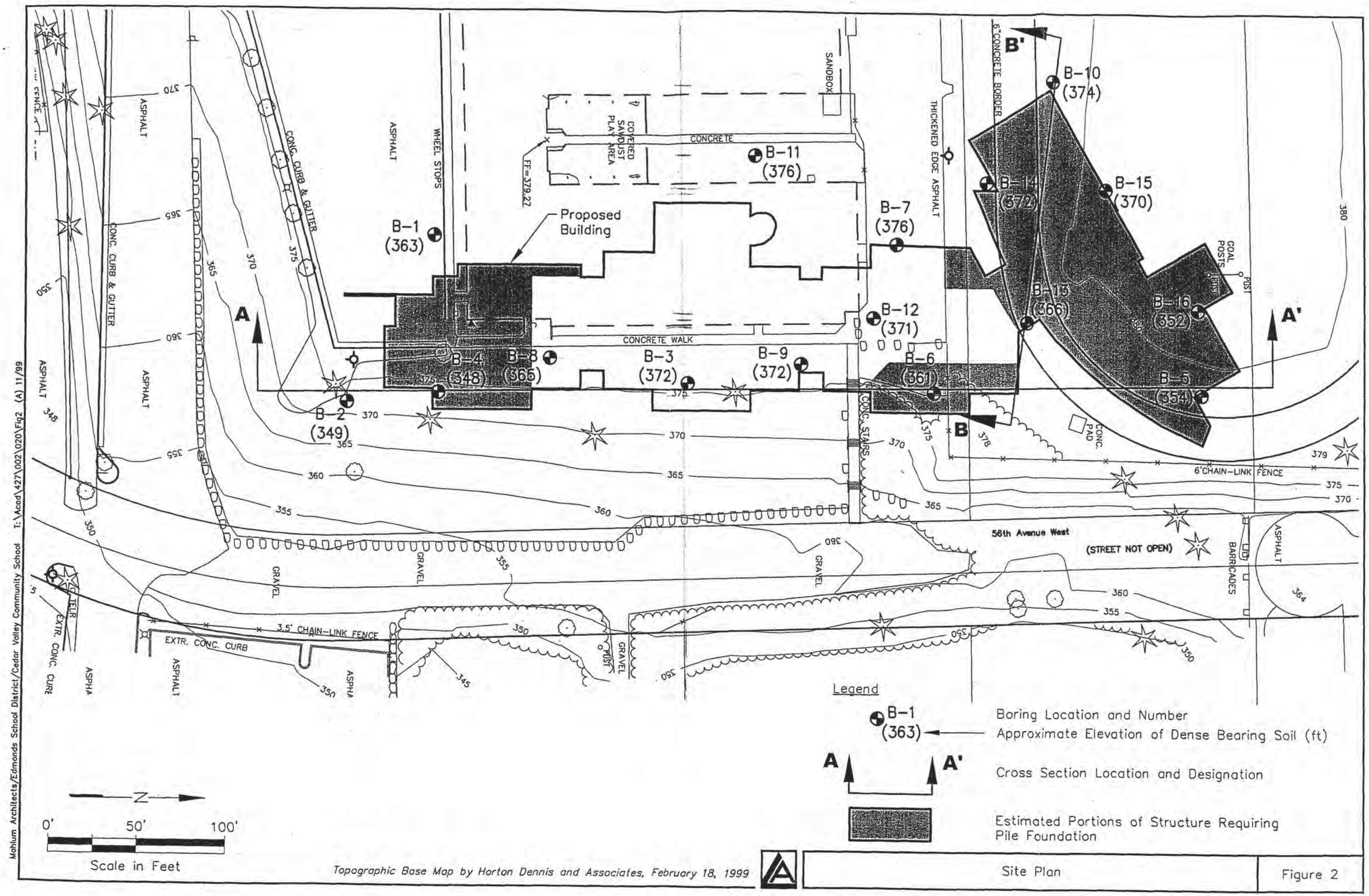
The engineer said that the gap is now only about 150 feet wide and that progress, "slow but sure," is being made.

Excess mud which has been forced to the side of the project by the weight of the logs, is being taken out to clear a channel for the small creek running under Scriber Bridge.

'HAT SINKING FEELING—This is an aerial view of the project along 196th street near Scriber Lake. Hundreds of truck-loads of broken wood have been used o fill the large hole in the road bed which appeared last spring. The arrow indicates the lake level. The bed sunk as much as 40 feet below the level of the lake. 'he weight of logs and sand in the road bed pushed much of soft bog below to the ide. (Staff Photo by Pete Kinch, Courtesy of Cal-Aero.)

APPENDIX G

SUBSURFACE DATA FROM LANDAU 1999
CEDAR VALLEY COMMUNITY SCHOOL



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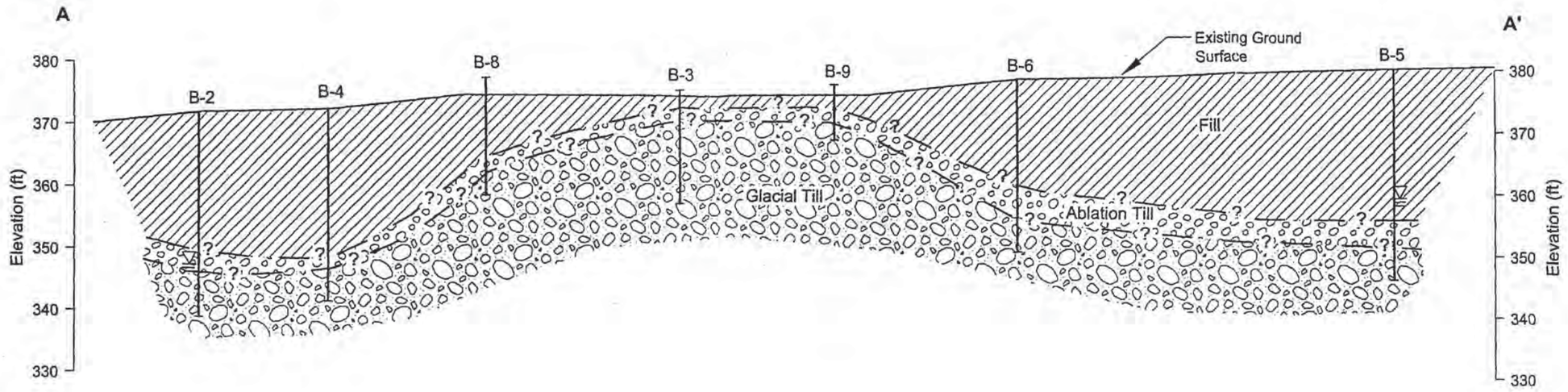
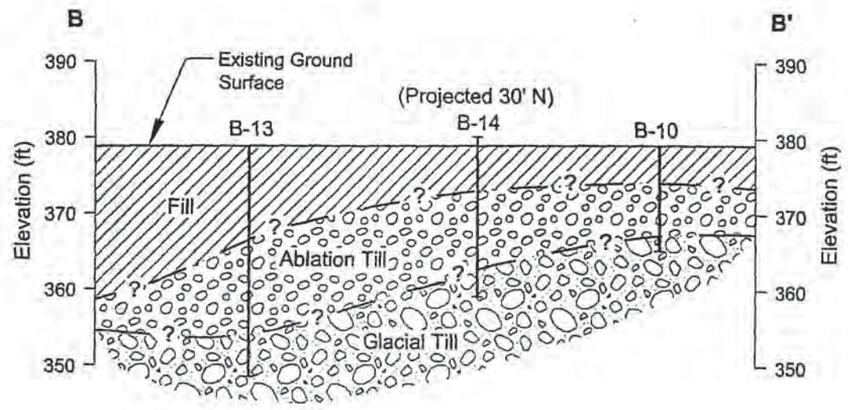
Mahlum Architects/Edmonds School District/Cedar Valley Community School

Topographic Base Map by Horton Dennis and Associates, February 18, 1999

Site Plan

Figure 2





Legend

- B-5 — Boring Location and Number
- Approximate Water Level Observed at Time of Drilling
- Fill
- Ablation Till
- Glacial Till

Scale in Feet (Horizontal)
0 50' 100'
0 20' 40'
Scale in Feet (Vertical)

Notes:

1. Refer to Figure 2 for locations of cross section
2. The generalized soil profiles were compiled from available subsurface information. These profiles are interpretive in nature; actual subsurface conditions between explorations may vary from those shown.

Cross Sections

Figure 3

APPENDIX A

FIELD EXPLORATIONS AND LABORATORY TESTING

Subsurface conditions at the proposed Cedar Valley Community School site were explored by advancing 16 exploratory borings (B-1 through B-16) at the approximate locations illustrated on the Site Plan, Figure 2. The borings were advanced to depths ranging from about 9 to 34 ft below the existing ground surface using a truck-mounted, Mobile B-61 drill rig equipped with hollow-stem auger equipment. Borings B-1 through B-10 were drilled on May 11 and 12, 1999, during our preliminary geotechnical study. Six additional borings were advanced between October 28 and November 1, 1999, during the current design-phase investigation in order to further evaluate the conditions in the northern portion of the site.

The field explorations were coordinated and monitored by a geologist or geotechnical engineer from our staff who also maintained detailed records of observed subsurface soil and groundwater conditions and obtained representative soil samples. Each representative soil type observed in our borings was described using the Unified Soil Classification System (Figure A-1) in general accordance with ASTM D 2488 *Standard Recommended Practice for Description of Soil (Visual-Manual Procedures)*. Logs of the explorations are presented on Figures A-2 through A-17. These logs represent our interpretation of subsurface conditions identified during the field explorations. The stratigraphic contacts shown on the individual boring logs represent the approximate boundaries between soil types; actual transitions may be more gradual. Also, the soil and groundwater conditions depicted are only for the specific dates and locations reported, and therefore, are not necessarily representative of other locations and times.

The explorations were located approximately in the field by hand taping distances from existing physical features and referenced to a site plan provided by Mahlum Architects. Ground surface elevations at the boring locations were estimated based on the topographical map provided by Mahlum Architects (by Horton Dennis and Associates, dated February 18, 1999).

Disturbed bag samples of the soil encountered in the borings were obtained at selected intervals and taken to our laboratory for further examination and testing. Laboratory tests were performed on representative soil samples to characterize certain physical properties of the soil. The laboratory testing program was limited to visual inspection to confirm our field soil descriptions, and determination of natural moisture content and grain size distribution.

The natural moisture contents of selected soil samples were determined in general accordance with ASTM D 2216 test procedures. The results from the moisture determinations are indicated on the logs, adjacent to the corresponding samples. Grain size analyses of selected soil samples were conducted in general accordance with ASTM D 422 test procedures. The results are presented in the form of grain size distribution curves on Figures A-18 and A-19.

B-1

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 378.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	1" ASPHALT Mottled gray and brown, silty, fine to medium SAND with gravel (loose, moist) (fill)	
	1	b2	8	W=15				
5	2	b2	4					
	3	b2	13	W=19		ML	Gray brown, sandy SILT with wood fragments (stiff, wet) (fill)	
10	4	b2	10			SM	Gray, silty, fine to medium SAND with gravel and organic material (loose to medium dense, moist to wet) (fill)	
	5	b2	13					
15	6	b2	40	W=6		SM	Gray, silty, fine SAND with gravel (dense, moist to wet) (ablation till)	
	7	b2	31					
20	8	b2	39					
25	9	b2	85/ 9"			SM	Gray, silty, fine to medium SAND with gravel (very dense, moist) (glacial till)	
30								
35								
40								

Boring Completed 05/11/99
Total Depth of Boring = 28.3 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

427002.10 Mahlum Architects/Edmonds School District/Cedar Valley Community School/Geotechnical SOIL BORING LOG S:\MODELING\GINTW\PROJECTS\CEDARV.GPJ 11/11/99

Log of Boring B-1

Figure A-2

B-2

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 372.0 (MSL) Drilled By: Environmental Drilling, Inc.	Water Level
0						SP-SM	3" ASPHALT Gray, fine SAND with gravel and silt (loose, moist to wet) (fill)	
5	1	b2	14	W=10		SM	Reddish gray, silty, fine to medium SAND with gravel (medium dense, moist to wet) (fill)	
	2	b2	11					
10	3	b2	12					
	4	b2	8	W=12			Grades loose to very loose	
15	5	b2	3					
	6	b2	8	W=16			Grades loose to medium dense	
20	7	b2	14					
	8	b2	28	W=14		SM	Gray, silty, fine SAND with gravel (medium dense, wet) (ablation till)	
25								ATD
	9	b2	50/5"	W=14		SM	Gray, silty, fine to medium SAND with gravel (very dense, moist to wet) (glacial till)	
30	10	b2	74					
35								
40								

Boring Completed 05/11/99
Total Depth of Boring = 33.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

427002.10 Mahlum Architects/Edmonds School District/Cedar Valley Community School/Geotechnical SOIL BORING LOG S:\MODELING\GINT\WPROJECTS\CEDARV.GPJ 11/11/99

Log of Boring B-2

Figure A-3

B-3

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 376.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SP-SM	3" GRASS SOD Gray, fine SAND with gravel and silt (loose, moist) (fill)	
	1	b2	42	W=10		SM	Gray, silty, fine to medium SAND with gravel (dense, moist) (ablation till)	
5	2	b2	65/ 11.5"			SM	Gray, silty, fine to medium SAND with gravel (very dense, moist) (glacial till)	
	3	b2	85	W=9				
10	4	b2	74/ 11"					
15	5	b2	83/ 9"					
20								
25								
30								
35								
40								

Boring Completed 05/11/99
Total Depth of Boring = 18.3 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Log of Boring B-3

Figure A-4

B-4

Drilling Method: Mobile B-61, 4" ID HSA
Ground Elevation (ft): 373.0 (MSL)
Drilled By: Environmental Drilling, Inc.

Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	SOIL PROFILE	GROUNDWATER
0						SP-SM	3" GRASS SOD Gray, fine SAND with gravel and silt (loose, moist) (fill)	
	1	b2	15			SM	Gray to reddish gray, silty, fine to medium SAND with gravel (medium dense, moist) (fill)	
5	2	b2	12	W=9				
	3	b2	15					
10	4	b2	7	W=10			Grades loose and wet	
	5	b2	15					
15	6	b2	4					
	7	b2	3	W=22		WD	WOOD FRAGMENTS with gray, silty, fine SAND (loose to medium dense, wet) (fill)	
20	8	b2	15	W=74				
						SM	Black and brown, silty, fine to medium SAND with gravel (medium dense, moist to wet) (fill)	
	9	b2	27					
25						SM	Brown, silty, fine to medium SAND with gravel (medium dense to dense, moist to wet) (ablation till)	
	10	b2	55			SM	Gray, silty, fine to medium SAND with gravel (very dense, moist) (glacial till)	
30	11	b2	92/7"					
35								
40								

Boring Completed 05/11/99
Total Depth of Boring = 31.1 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Log of Boring B-4

Figure A-5

B-5

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 379.5 (MSL) Drilled By: Environmental Drilling, Inc.	Water Level
0						SP-SM	3" GRASS SOD Gray, fine SAND with gravel and silt (loose, moist) (fill)	
	1	b2	15	W=11		SM	Brown and gray, silty, fine SAND with gravel (medium dense, moist) (fill)	
5	2	b2	28	W=11				
	3	b2	13					
10	4	b2	9	W=9				
	5	b2	9	W=9			Grades loose and wet	
15	6	b2	10					
	7	b2	9					
20								ATD
	8	b2	4				Grades very loose	
25						SM	Gray, silty, fine to medium SAND with gravel (very dense, wet) (glacial till)	
	9	b2	83/11"					
30								
	10	b2	78/11"					
35								
40								

Boring Completed 05/11/99
Total Depth of Boring = 33.9 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-5

Figure A-6

B-6

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 378.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	3" GRASS SOD Gray, silty, fine to medium SAND with gravel (loose to medium dense, moist) (fill)	
	1	b2	9	W=10				
5	2	b2	10	W=11				
	3	b2	16	W=9 GS			Grades gravelly	
10	4	b2	15					
	5	b2	7	W=21		SM	Brown, silty, fine SAND with gravel and wood fragments (loose to very loose, wet) (fill)	
15	6	b2	0				Very loose, wet soil causes sampler to drop due to weight of hammer only	
	7	b2	43	W=11		SM	Gray, silty, fine to medium SAND with gravel (dense, moist to wet) (ablation till)	
20								
	8	b2	55			SM	Gray, silty, fine to medium SAND with gravel (very dense, wet) (glacial till)	
25								
	9	b2	83/11"					
30								
35								
40								

Boring Completed 05/11/99
Total Depth of Boring = 28.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-6

Figure A-7

B-7

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 378.5 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	1" ASPHALT Brown, silty, fine SAND with gravel (loose, moist) (fill)	
2.5	1	b2	31	W=8		SM	Brownish gray to gray, silty, fine to medium SAND with gravel (dense, moist to wet) (ablation till)	
5	2	b2	33	W=10 GS			Grades gravelly	
	3	b2	26				Grades medium dense	
10	4	b2	28	W=16				
12.5	5	b2	80/12"			SM	Gray, silty, fine to medium SAND with gravel (very dense, moist) (glacial till)	
15							Boring Completed 05/11/99 Total Depth of Boring = 13.5 ft.	
20								
25								
30								
35								
40								

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Log of Boring B-7

Figure A-8

B-8

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 378.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	3" GRASS SOD Gray, silty, fine SAND with gravel (loose, moist to wet) (fill)	
	1	b2	7	W=7 GS			Grades very silty and gravelly	
5	2	b2	7					
	3	b2	12			SM	Reddish gray, silty, fine to medium SAND with gravel (medium dense, wet) (fill)	
10	4	b2	14	W=10				
	5	b2	43			SM	Gray, silty, fine to medium SAND with gravel (dense, wet) (ablation till)	
15	6	b2	49					
20								
25								
30								
35								
40								

Boring Completed 05/12/99
Total Depth of Boring = 19.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

Log of Boring B-8

Figure A-9

B-9

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 377.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	3" GRASS SOD Gray, silty, fine to medium SAND with gravel (loose to medium dense, moist to wet) (fill)	
	1	b2	25	W=9		SM	Gray, silty, fine to medium SAND with gravel (medium dense, moist) (ablation till)	
5						SM	Gray, silty, fine to medium SAND with gravel (very dense, moist) (glacial till)	
	2	b2	56	W=9				
10							Boring Completed 05/12/99 Total Depth of Boring = 9.0 ft.	
15								
20								
25								
30								
35								
40								

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-9

Figure A-10

B-10

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 379.5 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	1" ASPHALT Gray, silty, fine SAND with gravel (loose, moist) (fill)	
	1	b2	8	W=11				
6						SM	Reddish gray, silty, fine to medium SAND with gravel (dense, moist to wet) (ablation till)	
	2	b2	41	W=12				
10	3	b2	35					
	4	b2	59			SM	Gray, silty, fine to medium SAND with gravel (very dense, wet) (glacial till)	
15								

Boring Completed 05/12/99
Total Depth of Boring = 14.0 ft.

20
25
30
35
40

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-10

Figure A-11

B-11

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 379.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	Light brown, gravelly, silty, fine SAND, (very dense, moist) (ablation till)	
	1	b2	63	W=7				
5	2	b2	68					
10	3	b2	55	W=11				
15	4	b2	50/5"			SM	Light brown to gray, gravelly, silty, fine SAND (very dense, moist) (glacial till)	

Boring Completed 11/01/99
Total Depth of Boring = 15.4 ft.

20
25
30
35
40

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-11

Figure A-12

B-12

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 379.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	Reddish brown to light brown, gravelly, silty, fine to medium SAND (medium dense, moist) (fill)	
	1	b2	12					
5	2	b2	16	W=10				
						SM	Light brown, gravelly, silty, fine SAND (dense, moist) (ablation till)	
	3	b2	45					
10	4	b2	38					
	5	b2	53	W=10			Grades very dense	
15						SM	Light brown, very silty, fine SAND with trace coarse gravel (very dense, moist to wet) (glacial till)	
	6	b2	90					
20								
25								
30								
35								
40								

Boring Completed 11/01/99
Total Depth of Boring = 19.0 ft.

Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-12

Figure A-13

B-13

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 379.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	Light brown to gray, silty, fine to medium SAND with gravel (loose to medium dense, moist) (fill)	
	1	b2	10	W=9				
5	2	b2	22			SM	Mottled light brown to reddish brown, gravelly, silty, fine to medium SAND (medium dense, moist) (fill) Large cobble or debris at 6 feet Cobbles at 8 to 9.5 feet	
	3	b2	33	W=10				
10	4	b2	25					
	5	b2	46	W=6		SM	Gray, gravelly, silty, fine SAND (dense, moist) (ablation till)	
15	6	b2	50					
20	7	b2	36	W=7 GS			Grades very gravelly	
25	8	b2	50/ 6"			SM	Gray, gravelly, silty, fine to medium SAND (very dense, moist to wet) (glacial till)	
						SM	Gray, very silty, fine SAND with trace gravel and medium to coarse sand (very dense, moist) (glacial till)	
30	9	b2	76/ 11"	W=16				
35								
40								

Boring Completed 11/01/99
Total Depth of Boring = 30.9 ft.

Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-13

Figure A-14

B-14

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 380.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0						SM	Reddish brown to brown, very silty, gravelly, fine to coarse SAND (medium dense, moist) (fill)	
	1	b2	13	W=10 GS				
5	2A 2B	b2	17			ML	Dark brown, fine sandy, SILT with abundant fine organics and some wood and trace evergreen needles (stiff, moist) (fill) (cobbles at 6.5 feet)	
	3	b2	28	W=7		SM	Light brown and reddish brown, silty, gravelly, SAND (medium dense, moist) (ablation till)	
10	4	b2	74/ 10"			SM	Light brown to gray, gravelly, silty, fine to medium SAND (very dense, moist) (ablation till)	
15	5	b2	42	W=11			Grades dense	
						SM	Gray, gravelly, silty, fine to medium SAND (very dense, moist) (glacial till)	
20	6	b2	50/ 1"					

Boring Completed 11/01/99
Total Depth of Boring = 21.5 ft.

25
30
35
40

Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-14 | Figure A-15

B-15

SAMPLE DATA					SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Mobile B-61, 4" ID HSA Ground Elevation (ft): 380.0 (MSL) Drilled By: Environmental Drilling, Inc.	
0	1	b2	26	W=9		SM	Mottled light brown to gray, gravelly, silty, fine to medium SAND with some fine organics and wood (medium dense, moist to wet) (fill)	
5	2	b2	20			GM	Interbedded dark brown, gray, and light brown, very sandy, silty, GRAVEL with fine organics and roots (medium dense, moist) (fill)	
	3	b2	17	W=12 GS		SM	Brown, silty, very gravelly, SAND with trace fine roots and silt interbeds (very dense, moist)	
10	4A 4B	b2	51			SM	Gray, gravelly, silty, fine to medium SAND (dense, moist) (ablation till)	
	5	b2	30	W=8				
15	6	b2	32	W=9				
20	7	b2	50/ 6"			SM	Gray, silty, very gravelly, fine to medium SAND (very dense, moist to wet) (glacial till)	
25								
30								
35								
40								

Boring Completed 10/28/99
Total Depth of Boring = 20.9 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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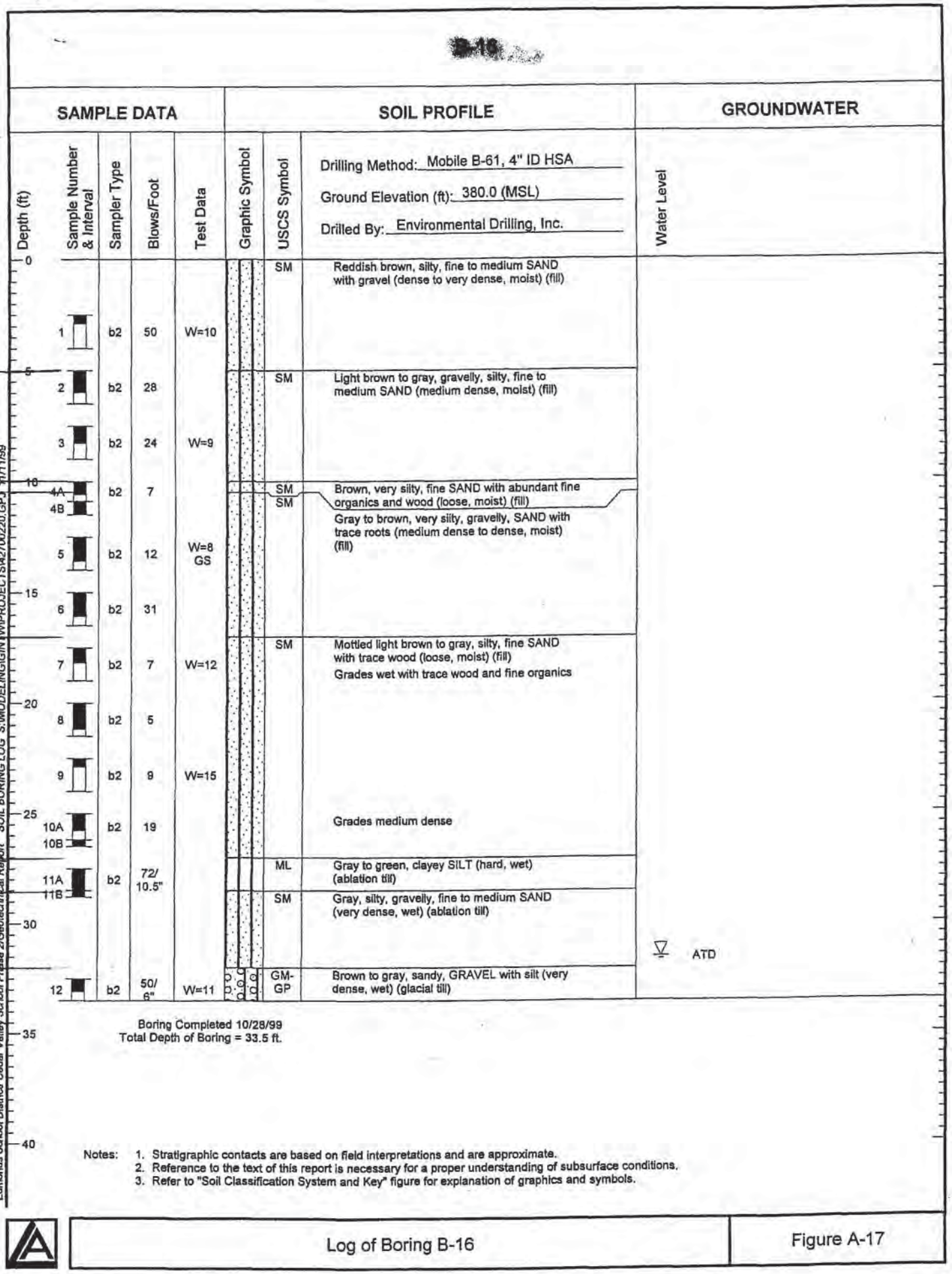
Log of Boring B-15

Figure A-16



Boring Completed 10/28/99
Total Depth of Boring = 33.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Log of Boring B-16

Figure A-17