KAYAK POINT PARK
BEACH STABILIZATION

Prepared for Snohomish County
Park & Recreation

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1986

1986

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"The preparation of this report was financially aided through a grant from the Washington State Department of Ecology with funds obtained from the National Oceanic and Atmospheric Administration, and appropriated for Section 306b of the Coastal Zone Management Act of 1972."

BRUCE
DEES &
ASSOCIATES
Landscape Architecture • Urban Design
Site Planning • Recreation Facilities Design

June 30, 1986

Mr. Ron Martin
Snohomish County Parks & Rec.
P.O. Box 310
Monroe, WA 98272

Job No. 10-05-01

RE: Beach Stabilization
Summary Report

Dear Mr. Martin,

This report includes a summary of our findings and conclusions regarding the Kayak Point Park shoreline stabilization study. The report responds to the "Scope of Services" outlined in your Coastal Zone Management Agreement, and includes a detailed geotechnical report prepared by Applied Geotechnology.

Kayak Point Park is a very valuable asset to the region and the importance of protecting this resource is vital. We appreciate the opportunity to be of service to Snohomish County, especially when it involves a resource as important as Kayak Point Park.

Sincerely,

BRUCE DEES & ASSOCIATES

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Bruce Dees, ASLA

ABD:rmr
Enclosure

U.S. DEPARTMENT OF COMMERCE NOAA
COASTAL SERVICES CENTER
2234 SOUTH HOBSON AVENUE
CHARLESTON, SC 29405-2413

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KAYAK POINT PARK SHORELINE STABILIZATION STUDY SUMMARY REPORT

Study Area: Beach/shoreline area within Kayak Point Park (Section 30 Township 31 Range 4- northwest of Everett on Possession Sound.

Project Description: Major work items as follows:

Determine the cause and degree of bulkhead failure.

Kayak Point Park including the eighteen acre beach area was originally developed by a private resort operator. At that time a steel bulkhead approximately 24" high was placed around the point and back filled with soil material to create the existing lawn area. Over the years, the bulkhead has deteriorated to a point where the remnants of the section around the point itself, approximately 500 feet were removed entirely.

Identify the natural processes contributing to shoreline erosion, including adjacent area which may be contributing to destabilization, and formulate a problem statement.

Problem Statement:

With the bulkhead now missing, the beach has undergone some erosion, particularly at the point itself. In some areas, the beach has retreated to a point of threatening the shoulder of the existing park road.

Natural processes contributing to the erosion include:

1. A maximum wind speed of 70 mph with a 25 year return.
2. A tidal fetch length of 5 miles.
3. A maximum spring high tide elevation of 7 feet.
4. A near shore beach gradient between 20:1 and 10:1 (horizontal:vertical)

The top 2 to 3 feet of beach material consists of "gray gravelly sand" which is loose, wet, coarse sand, and fine subangular gravel; some seashells and occasional fine gravel seams. This is the portion that is eroding down to approximately 3' where the material becomes dense.

Rank according to impact those adjacent shoreline areas which have contributed to bulkhead failure and identify a range of solutions for stabilization.

In that the beach has been stable over the years since construction of the bulkhead, and that no changes in wind or current direction or velocity are recorded, it is apparent that removal of the bulkhead is the single factor resulting in the erosion and unstable condition of the beach in that area. Other portions of the beach where the bulkhead remains intact have had no visible signs of change over the years.

Shoreline Protection Systems

There are three alternative shoreline protection systems. These include a gabion basket wall, a sheetpile wall, and a rock wall. Typical details of each wall are illustrated on Figure A. A short description of each wall system is provided in the following paragraphs. Technical Specifications for construction are provided for each wall in Section IV of the geotechnical report.

Gabion Basket Wall

The gabion basket wall comprises a set of galvanized steel wire mesh box shaped baskets as shown on Typical Detail 1. The baskets are filled inplace with gabion fill which is a clean hard angular rock with pieces ranging in size from 3 to 8 inches in diameter. Adjacent baskets are wired together during installation to form a wall. For this application, a filter fabric is placed on the shore side of individual baskets.

In addition, a drift log could be secured to the gabion baskets by means of a chain encircling the basket and bolted to the drift log to disguise the baskets.

The gabion baskets should be installed in a trench excavated to a depth of 3 feet below the surrounding ground surface. Once the gabion basket has been installed and filled with the gabion fill and wrapped with the log securing chain, the trench should be backfilled with on-site material excavated from the trench and compacted to a density of at least 90 percent. More details for assembly and placement of the gabion basket and chained log are included in Section IV, Technical Specifications of this report.

Rock Wall

The buried rock wall as shown on Typical Detail 2 shall consist of 4 to 6 man size rocks, each weighing within the range of 1700 to 2500 pounds and carefully placed in a 3 foot deep pre-excavated trench. Rocks should be placed so the top of each rock is approximately at beach grade elevation. An acceptable rock is a sound, unweathered ledge rock. Individual rocks shall be selected so that, when placed on the excavated trench subgrade, they will remain standing without support. Rocks which will not remain free-standing should not be accepted. Each rock shall be positioned in the trench to be in contact with the adjacent rock.

In order to adequately secure the driftwood log, a metal plate and securing chain should be located beneath an individual rock, but not between adjacent rocks. More specific details regarding the subgrade preparation and rock wall construction are contained in Section IV, Technical specifications.

Sheetpile Wall

The sheetpile wall as shown in Typical Detail 3 shall consist of new or used sheetpiles in reasonably good condition. Used individual sheet piles, if selected, must be relatively undistorted and corrosion free. The sheets should be capable of interlocking to adjacent sections. The sheetpiles should be installed and temporarily supported in a pre-excavated trench. The trench should then be backfilled with on-site fill material and compacted to at least 90 percent of the ASTM D-1557-78 standard. Once backfilling is complete, a driftwood log and securing chain should be installed.

We understand the original sheetpile wall of the park was removed because the exposed ragged top of the piles caused a potential source of injury for park patrons. To avoid this, a concrete protective cap is cast on top of the wall. More specific details for subgrade and sheetpile wall construction are contained in Section IV, Technical Specifications.

Detail feasible solutions, including: 1) schematic drawings, 2) engineering designs, 3) cost estimates and 4) preliminary SEPA analysis for each design. Recommend a single best design solution.

Drawings and Designs

Reductions of final engineering plans and specifications are provided in this report.

Costs

The estimated probable constructions cost for the three alternatives are as follows:

Alternative	Cost Per Foot	Estimated Length	Total
Gabion Wall	$ 43.12	500	$ 21,560.00
Rock Wall	$ 46.10	500	$ 23,050.00
Sheetpile Wall	$ 52.32	500	$ 26,160.00

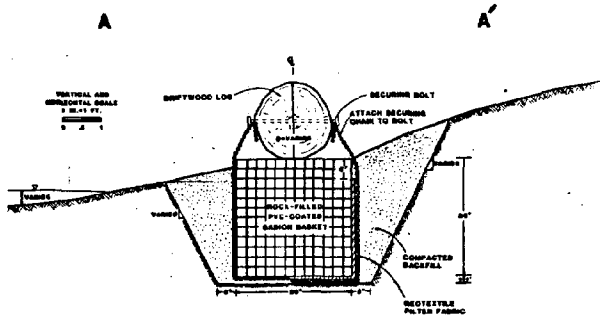
Preliminary SEPA Analysis

The designs were presented to the Snohomish County Planning Department. Preliminary indications are that an environmental checklist only will be required and that the work would constitute repair of an existing condition if any of the old bulkhead were in-place.

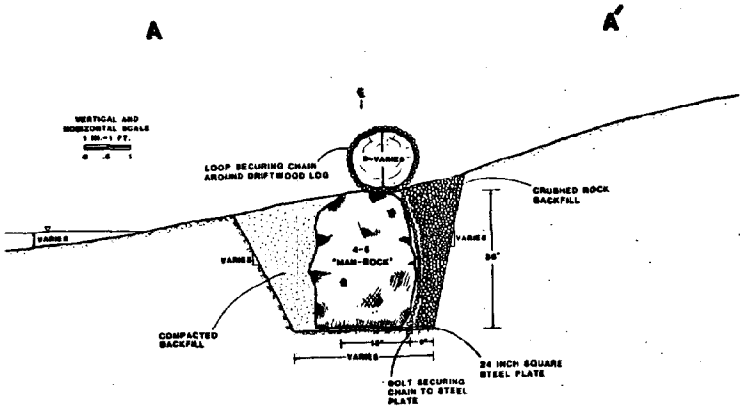
Recommended Design Solutions

The sheetpile design is the recommended solution for the following reasons:

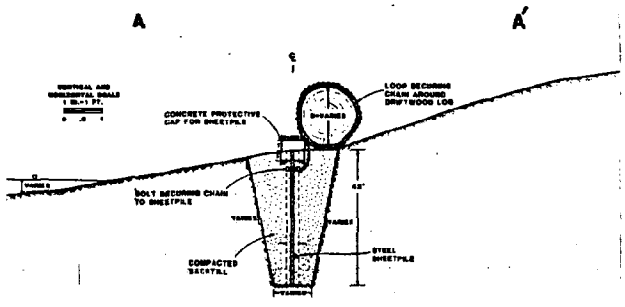
1. It has proven effectiveness against shoreline erosion at this site.
2. A concrete cap will prevent deterioration and hazard from any exposed edge. Driftwood logs secured in-place will disguise the concrete cap and maintain the natural setting.
3. The other designs, while considered to be effective, present a hazard to beach visitors if any portions of the rock or gabion become exposed. In addition, exposed portions of the rock or gabion would compromise the natural character of the beach.



TYPICAL DETAIL OF PROTECTIVE GABION WALL ①

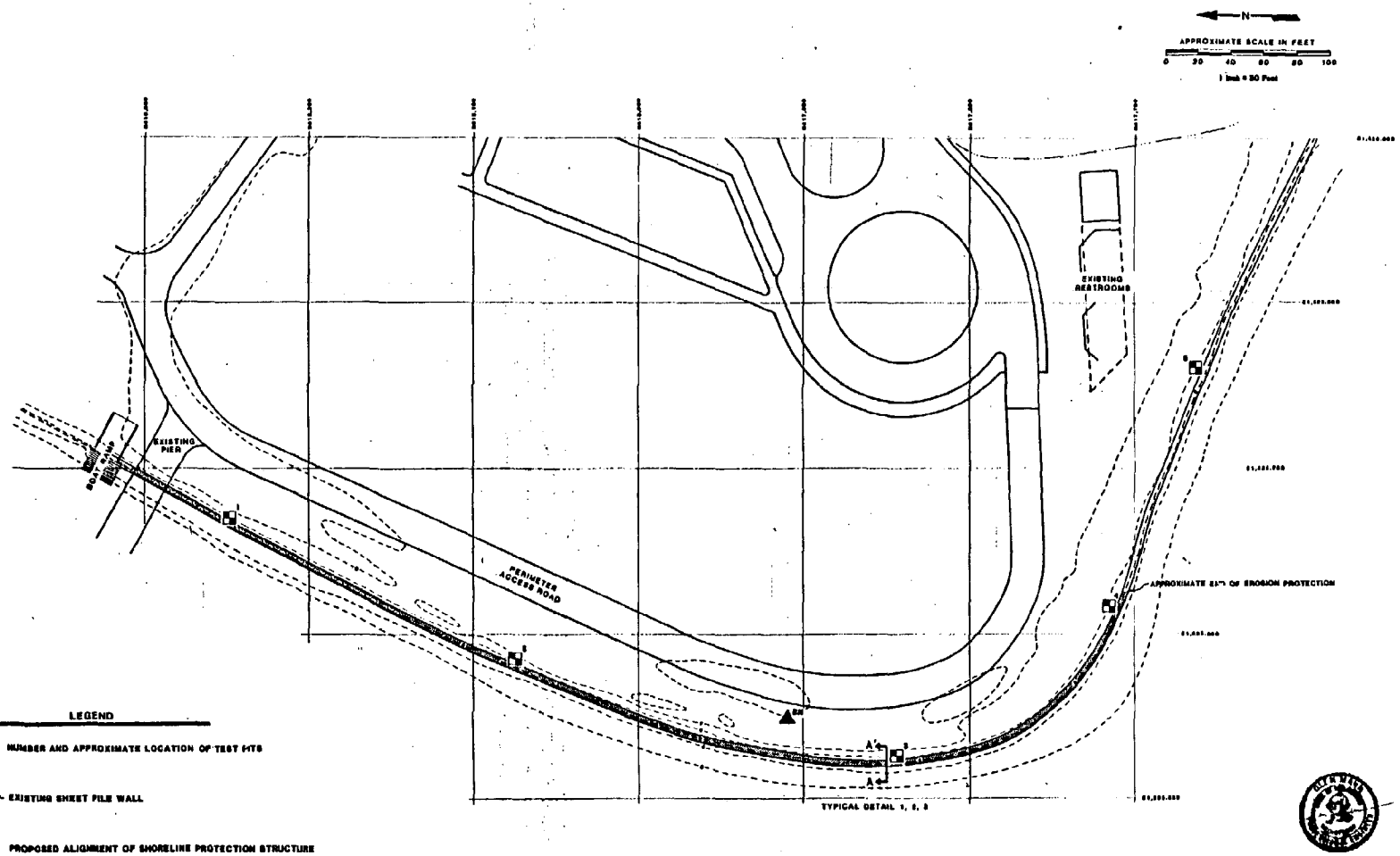


TYPICAL DETAIL OF PROTECTIVE ROCK WALL ②



TYPICAL DETAIL OF PROTECTIVE SHEETPILE WALL ③

PROTECTIVE WALL DETAILS
Figure A



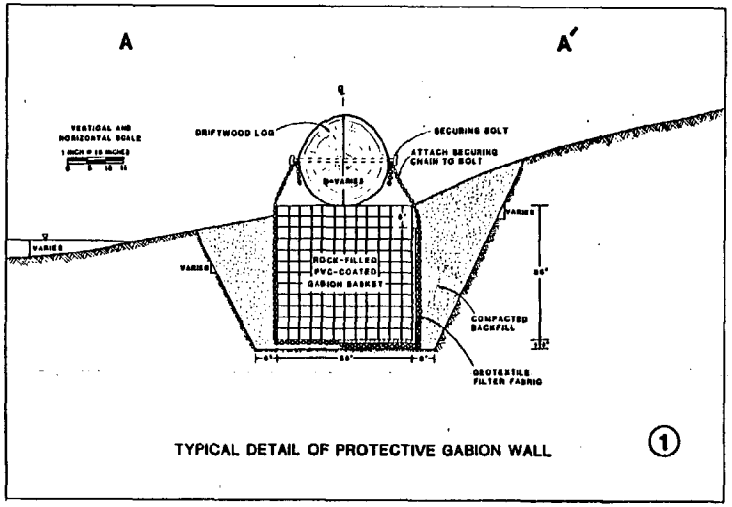
APPLIED GEOTECHNOLOGY INC.
GEOTECHNICAL ENGINEERING
GEOLOGY & HYDROGEOLOGY

SITE PLAN

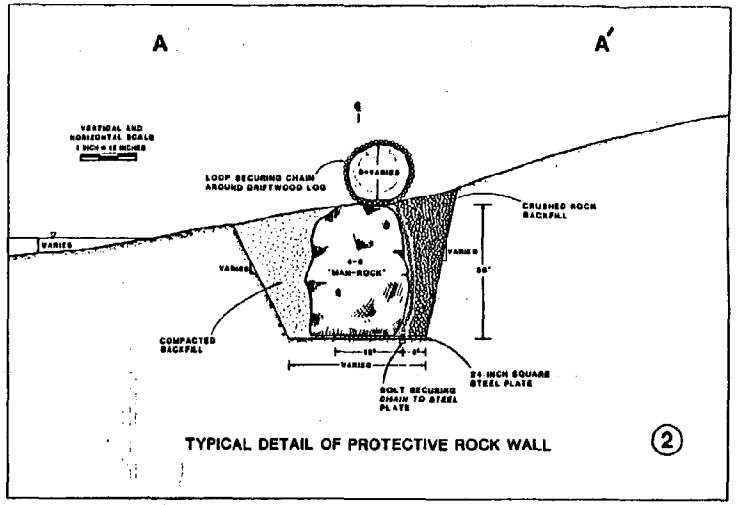
KAYAK POINT COUNTY PARK
SNOHOMISH COUNTY, WASHINGTON

SHEET 1/2

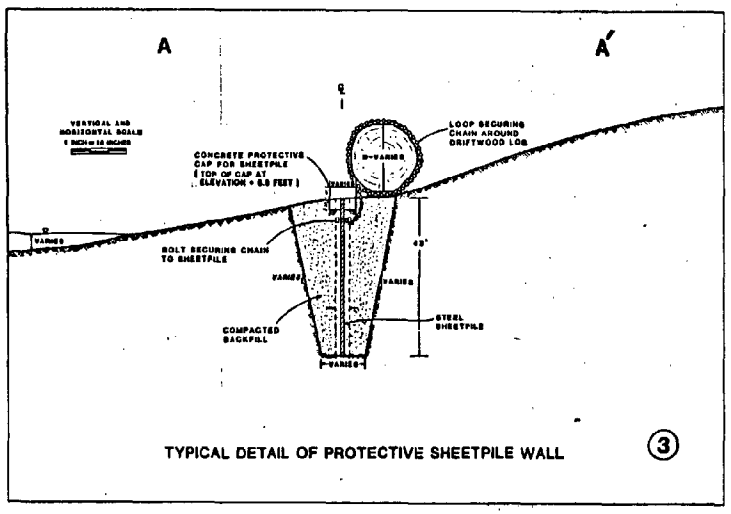
JOB NUMBER	DRAWN BY	APPROVED	DATE
14, 846.008	KER		6/20/86



TYPICAL DETAIL OF PROTECTIVE GABION WALL ①



TYPICAL DETAIL OF PROTECTIVE ROCK WALL ②



TYPICAL DETAIL OF PROTECTIVE SHEETPILE WALL ③

[redacted]

General: Refer to general specifications provided for each wall type.

Backfill: Backfill to consist of free-draining granular material and should be compacted to at least 90 percent with ASTM D-1557 Method C Standard.

Driftwood Log: Shall be best quality timber available on beach with average diameter and length as shown. Length to be not less than 10 feet.

Securing Chain: Chain shall be as specified and should be looped around, or attached to bolts extending through the log. Spacing between chains to be not greater than 10 feet or a minimum of 3 chains for each log position, whichever is the smaller.

Gabion

Gabion Basket: Basket to be at least 1 foot square in section and all wires provided with a protective PVC coating to prevent corrosion or abrasion.

Filter Fabric: Fabric should extend beneath the lowest half of the wall and up the back face to approximately 6 inches from the top of the gabion.

Sheet Pile

Sheet Pile Type: Sheet pile with section modulus equal to or greater than 4 cubic inches. Used sheet pile sections are acceptable provided they are relatively unobstructed and free of excessive corrosion damage.

Embedded Depth: Tips of any wall segment on south of sheet pile section used. Tip should be at least 5 inches below that minimum section depth "d".

Rock Wall

Steel Plates: Steel plates to be at least 12 inches on each side and 1/2 inch thick. Plate and attached securing chain should be located between adjacent rocks at the intersection of the wall.

Crushed Rock Backfill: To be dumped into place between the riprap and the excavation sidewall as the lowermost step.

Rock: Acceptable rock shall be 4 to 6 man rock in size weighing not less than approximately 1700-2000 pounds

APPLIED GEOTECHNOLOGY INC GEOTECHNICAL ENGINEERING GEOLOGY & HYDROGEOLOGY	EROSION PROTECTION ALTERNATIVE DETAILS KAYAK POINT COUNTY PARK SNOHOMISH COUNTY, WASHINGTON		SHEET 2/2
JOB NUMBER 14.848.008	DRAWN BY KER	APPROVED	DATE 1/14

GEOTECHNICAL REPORT

A report prepared for

Snohomish County Department of Parks and Recreation
c/o Bruce Dees & Associates
2501 East "D" Street, # 204
Tacoma, Washington 98421

GEOTECHNICAL ENGINEERING STUDY
BEACHFRONT EROSION PROTECTION
KYAK POINT COUNTY PARK
SNOHOMISH COUNTY, WASHINGTON

AGI Project No. 14,845.005

by

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Project Engineer

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June 23, 1986

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I. INTRODUCTION

A. General

This report presents the results of our geotechnical engineering study for a proposed shoreline protection structure at Kyak Point County Park in Snohomish County, Washington. The scope of services was originally presented in our February 12, 1986, proposal. We received your authorization to proceed on April 25, 1986. Generalized descriptions of three types of shoreline protection systems are presented here along with the general technical specifications and drawing for each of the three systems.

B. Project Description

Based on our recent discussions with Mr. Bruce Dees, we understand the Snohomish County Department of Parks and Recreation would like to construct a shoreline protection system to replace a recently removed short steel sheetpile wall. The former sheetpile wall was badly corroded and deformed and was removed during 1985. The beach in the area of the former wall and along the high tide line has since undergone some erosion. In some areas, the beach has retreated to the point of threatening the shoulder of the existing park road. Our January 6, 1986, letter to you briefly outlined our preliminary conclusions and recommendations for a shoreline protection system consisting of a gabion basket bulkhead wall to reestablish and provide some protection for the beach in this area. Based on later discussions with Mr. Dees, we understand you simply wish to reestablish the erosion controls previously removed by the construction of a below grade shoreline protection system and that no bulkhead wall is proposed to increase the height of roadside fills. The proposed protection system will be buried at or just above the high tide line with the intention of merely replacing the now removed sheetpile wall with a similar system. The exact height and embedment depth and length of the new system were established by Mr. Dees on the basis of our site exploration data and engineering analyses.

C. Scope of Services

The purpose of our geotechnical engineering study was to explore and evaluate the subsurface soil and groundwater conditions as a basis for providing generalized Technical Specifications for the design and construction of three proposed shoreline protection system alternatives. In summary, our scope of services includes the following:

- Evaluation of subsurface soil and groundwater conditions at the site.
- Specifications for site preparation and grading, earthwork procedures, including details of the placement and compaction of select fill.
- Recommendations regarding the suitability of the on-site materials for use as compacted fills.

- Descriptions and installation specifications for the three shoreline protection system alternatives, including a gabion wall, a sheetpile wall, and a rock wall.

As part of our services, we observed and logged the soil and groundwater conditions exposed in five test pits excavated by a backhoe and operator supplied by the Snohomish County Parks Department. The approximate locations of the test pits are shown on the Site Plan, Sheet 1 of 2, attached. A more detailed description of our field exploration program is provided in Appendix A of this report.

II. SITE CONDITIONS

A. Surface

The location of the proposed shoreline protection system is along the western and southwestern shorelines of Kyak County Park in Snohomish County, Washington, as shown on Sheet 1 of 2, attached. The area is bounded on the north by a fishing pier and boat ramp and extends several hundred feet around the point to the south. Drift logs are presently grounded on the beach along the high tide line. The gently sloping beach in this area consists predominantly of loose fine to medium gravelly sand.

B. Site Soils

Our test pits generally encountered similar subsurface conditions. With the exception of Test Pits 4 and 5, our excavations encountered loose to medium dense gray, gravelly sand to the depths explored. Test Pits 4 and 5 encountered an effluent drainfield fill in the gray gravelly sand at a depth of between 4-1/2 and 5-1/2 feet below the existing site grade. The drainfield fill consists of soft gray clayey silt to brown organic silt. More detailed descriptions of the subsurface conditions encountered at each test pit location are provided on the individual test pit logs contained in Appendix A.

C. Groundwater

We encountered an established groundwater table in our test pits at depths that ranged from 4 to 7 feet below surrounding site grades. This level appeared to coincide very closely with adjacent sea levels. We expect the amount of subsurface seepage and the elevations at which it occurs will vary seasonally and with the local tidal conditions. Groundwater levels should be expected to be at their highest at high tides and during the wet winter months of October through May. Lower groundwater levels may be expected during low tides and in the drier summer months.

III. DISCUSSION AND CONCLUSIONS

A. General

Based on the results of our subsurface exploration and geotechnical engineering evaluation, it appears a shoreline protection system can be constructed on this site generally as planned. Presented here are generalized descriptions of the three types of shoreline protection systems; gabion wall, sheetpile wall and rock wall. Also included with this report are general technical specifications for each of the three systems and a Site Plan, Sheet 1 of 2, and Typical Details 1, 2, and 3 of the Shoreline Protection Systems Sheet 2 of 2.

B. Beach Scour

In accordance with your request, we evaluated the general suitability of three types of shoreline protection systems for this project a gabion wall, a sheetpile wall, and a rock wall. Our non-rigorous analysis of these three systems included estimating and evaluating the potential for scour likely at the proposed wall locations. To evaluate this we made the following assumptions concerning the design tidal conditions and shoreline geometry:

- A fastest mile windspeed of 70 mph with a 25-year return period.
- A tidal fetch length of 5 miles.
- A maximum spring high tide elevation of 7 feet based on the location of the existing driftwood logs and the topography shown on the Site Plan (Sheet 1 of 2, taken from the plan dated 8/1/75, by Wilsey & Ham Inc., and provided to us by Mr. Dees.)
- The near shore beach gradient between 20:1 and 10:1 (Horizontal: Vertical).

Based on these assumptions and the procedures outlined in the U.S. Army Corps of Engineers Shoreline Protection Manual (1981), we estimate there is a potential scour depth immediately in front of the proposed wall of between 1.5 and 3 feet during spring high tides and on the order of 4 feet of scour during a storm surge capable of depositing the large driftwood logs above the assumed high tide line (Elevation 5 feet). Therefore, any shoreline protection system that is expected to survive the high tide storm surge must be founded well below the estimated scour depth of 4 feet.

In the interest of economy, you have elected to found the shoreline protection system proposed here at a depth of 3 feet below surrounding grades. This is a similar depth to the former sheetpile wall. We understand you must make a tradeoff from an initial low construction budget to a long term maintenance budget, and are consequently willing to accept the risk that the proposed shoreline protection systems described in the subsequent section of this report may be undermined and suffer damage caused by wave action or floating logs during a moderate to severe storm.

It is difficult at best to attempt to characterize the risk here. However, based on the available data, it is possible to say that if the design life of the project is to be 20 years, there is a 56 percent probability that the 25-year return period storm (severe storm) will occur during the project life and an 88 percent probability that a 10-year storm (moderate storm) will occur. Either one of these two storms could be expected to seriously undermine or damage the systems discussed here, especially if floating logs are involved.

A detailed study of the actual and tidal conditions at the park are beyond the scope of our services and, therefore, we cannot more accurately estimate the magnitude of the entire risk involved. In our opinion, the three-foot specified embedment depth selected by you for the three shoreline protection systems is adequate for the average tidal and wave conditions. It is, therefore, only capable of withstanding small to moderate storm surges and relatively minor undermining. With more severe storm conditions, we estimate that there is a significant risk that portions of the wall may be undermined by scour activity.

C. Shoreline Protection Systems

We present here three alternative shoreline protection systems. These include a gabion basket wall, a sheetpile wall, and a rock wall. Typical details of each wall are illustrated on Sheet 2 of 2 in the attached drawings. A short description of each wall system is provided in the following paragraphs. Technical Specifications for construction are provided for each wall in Section IV of this report.

D. Gabion Basket Wall

The gabion basket wall comprises a set of galvanized steel wire mesh box shaped baskets as shown on Typical Detail 1 on Drawing 2 of 2. The baskets are filled inplace with gabion fill which is a clean hard angular rock with pieces ranging in size from 3 to 8 inches in diameter. Adjacent baskets are wired together during installation to form a wall. For this application, we recommend a filter fabric as described in the Technical Specifications be placed on the shore side of individual baskets.

In addition, at your request a drift log is to be secured to the gabion baskets by means of a chain encircling the basket and bolted to the drift log.

The gabion baskets should be installed in a trench excavated to a depth of 3 feet below the surrounding ground surface. Once the gabion basket has been installed and filled with the gabion fill and wrapped with the log securing chain, the trench should be backfilled with on-site material excavated from the trench and compacted to a density of at least 90 Percent of the ASTM D-1557-78 Standard. More details for assembly and placement of the gabion basket and chained log are included in Section IV, Technical Specificiations.

E. Rock Wall

The buried rock wall as shown on Typical Detail 2 of Sheet 2 of 2 shall consist of 4 to 6-man size rocks, each weighing within the range of 1700 to 2500 pounds and carefully placed in a 3-foot deep pre-excavated trench. Rocks should be placed so the top of each rock is approximately at beach grade elevation. An acceptable rock is a sound, unweathered ledge rock. Individual rocks shall be selected so that, when placed on the excavated trench subgrade, they will remain standing without support. Rocks which will not remain free-standing should not be accepted. Each rock shall be positioned in the trench to be in contact with the adjacent rock.

In order to adequately secure the driftwood log, a metal plate and securing chain should be located beneath an individual rock, but not between adjacent rocks. More specific details regarding the subgrade preparation and rock wall construction are contained in Section IV, Technical Specifications.

F. Sheetpile Wall

The sheetpile wall as shown in Typical Detail 3 on Sheet 2 of 2 shall consist of new or used sheetpiles in reasonably good condition. Used individual sheet piles, if selected, must be relatively undistorted and corrosion free. The sheets should be capable of interlocking to adjacent sections. The sheetpiles should be installed and temporarily supported in a pre-excavated trench. The trench should then be backfilled with onsite fill material and compacted to at least 90 percent of the ASTM D-1557-78 standard. Once backfilling is complete, a driftwood log and securing chain should be installed.

We understand the original sheetpile wall of the park was removed because the exposed ragged top of the piles caused a potential source of injury for park patrons. To avoid this, we recommend you install a concrete protective cap atop the newly installed wall. More specific details for subgrade and sheetpile wall construction are contained in Section IV, Technical Specifications.

G. Limitations and Additional Services

This report has been prepared for the exclusive use of the Snohomish County Department of Parks and Recreation and their other consultants, for this project only. The conclusions and recommendations in this report are based on conditions encountered at the time of our field exploration, design information you provided, the assumptions described in this report, and our experience and engineering judgement. AGI cannot be responsible for the interpretation of the data contained herein by others.

Our work has been performed in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the area. No other warranty, express or implied, is made.

We must presume the conditions encountered are representative of the entire property. However, you should be aware that subsurface conditions may vary between exploration locations and with time, and unanticipated conditions can and often do occur. If differing conditions are exposed during construction, or the design is modified, we should be requested to reevaluate our recommendations and to provide a written confirmation or modification, as necessary. We cannot be responsible for the applicability of our recommendations if not afforded this opportunity. To allow for these eventualities, we recommend a contingency be provided in both your construction budget and schedule.

To provide a measure of continuity, we recommend we be retained to provide part-time construction monitoring services during project construction. This will allow us to verify subsurface conditions are as anticipated, and to observe and test the contractors work as your representative.

IV. TECHNICAL SPECIFICATIONS

1.0 GENERAL

1.1 DESCRIPTION OF WORK

1.1.1 Work Summary

The purpose of this work is to construct a shoreline protection wall along a portion of the beachfront at Kyak Point Park, Snohomish County, Washington. Modifications to improve shoreline protection will include earthwork and construction of either a buried gabion wall, or rock wall or a sheetpile wall.

The Plans and Specifications provide minimum material requirements, dimensions, and tolerances for the three shoreline protection options, along with a list of materials typically used for such construction. The Contractor shall submit a wall design that meets or exceeds the minimum specified material requirements, has the same overall dimensions, and meets specified tolerances.

1.1.2 Standard Specifications

Where possible, this specification refers to the latest edition of the State of Washington Standard Specifications for Road, Bridge, and Municipal Construction.

1.1.3 Reference Standards

Certain referenced standards used in this specification are from the latest editions of:

American Society for Testing and Materials (ASTM)

1.1.4 Contractor's Responsibilities

The Contractor shall be responsible for:

- Providing all labor, supervision, materials, tools, and equipment to locate and install the work as shown on the Plans and in accordance with these Specifications.
- Notifying the Geotechnical Engineer at least 5 working days prior to commencing work.
- Verifying the location of all utilities and protecting them from damage.

- Surveying as necessary to correctly locate the construction as shown on the Plans.

- Verifying lines and grades as shown on the Plans and notifying the Geotechnical Engineer of any variation.

- Quality control.

1.1.5 Geotechnical Engineer

Bruce Dees & Associates will retain Applied Geotechnology Inc. as the Geotechnical Engineer during construction to observe and monitor the Contractor's work on a part-time basis. The Geotechnical Engineer will compare the actual conditions encountered with those anticipated and will recommend plan and specification modifications to Bruce Dees & Associates, if necessary. However, observation and monitoring by the Geotechnical Engineer does not in any way release the Contractor from the responsibility for performing his work in such a manner as to provide a satisfactory job that meets the requirements of the Plans and Specifications, or from meeting his contractual obligations to Bruce Dees & Associates.

1.2 QUALITY ASSURANCE

1.2.1 Qualifications

The Contractor shall have at least 10 years experience on earthwork projects of a similar magnitude and complexity. The Contractor's personnel responsible for continuous daily supervision of the work shall have at least 5 years experience, as above.

1.2.2 Submittals

The Contractor shall submit samples of each of the required materials to the Geotechnical Engineer for evaluation and approval prior to use. The samples shall be submitted at least 5 working days prior to using the materials and sufficiently in advance of the work to allow the Contractor to identify alternate sources if the material proves to be unsatisfactory.

The Contractor shall submit samples of the following:

Materials

- The gabion basket or sheetpile type, trade name and manufacturer's specifications as appropriate.

- The name, location, and manager's name and telephone number of the proposed quarry source of the quarry spalls and other rocks.

- The geotextile filter fabric type, trade name, and manufacturer's specifications including at least those items specified in Section 3.2.3.

1.2.3 Construction Monitoring

The Geotechnical Engineer will observe and monitor the Contractor's work on a part-time basis. In addition, the Geotechnical Engineer will prepare a daily report of construction activities, work progress, and bid item quantities.

The Contractor shall notify the Geotechnical Engineer at least 5 working days in advance of starting, or restarting work. The Geotechnical Engineer shall at all times have access to the work, and the Contractor shall furnish the Geotechnical Engineer with every reasonable facility for checking the workmanship for conformance with the Plans and these specifications.

Copies of all construction monitoring records will be made available to the Contractor for his review and to assist him in his satisfactory completion of the work.

1.3 CONSTRUCTION SITE SAFETY

Nothing contained in the Plans and these specifications is intended to direct construction means, methods, techniques, sequences or procedures, except as specifically described. The Contractor shall be responsible for supervision and for construction site safety and compliance with local, state, and federal safety requirements.

2.0 EARTHWORK

2.1 GENERAL

2.1.1 Scope of Work

Earthwork consists of clearing, grubbing, excavation, fill placement and compaction, slope finishing and erosion protection, and all subsidiary work necessary to complete the installation of the shoreline protection wall to conform with the lines, grades, and slopes shown on the Plans.

Applied Geotechnology Inc. performed a geotechnical investigation of the project site. A summary of the geotechnical conditions, including a description of subsurface conditions, test pit logs, are provided as an attachment to these Plans and Specifications.

2.1.2 Terms

- Percent Compaction is the required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material as determined by ASTM Test Method C-1557-78 (Modified Proctor).

- Optimum Moisture Content is the moisture content (percent by dry weight) corresponding to the maximum dry density of the same material as determined by ASTM Test Method D-1557-78.

2.1.3 Erosion, Seepage, and General Site Control

Surface water runoff or groundwater seepage that would interfere with the Contractor's work shall be controlled during construction. Control may consist of temporary drainage ditches or sumps and pumps. Installation, maintenance, and reclamation of such measures shall be the Contractor's responsibility.

2.2 MATERIALS

2.2.1 Select Fill

Select Fill is imported soil, free of organic material and debris, and consisting of sand and gravel that meets the following particle size gradation specifications:

Standard U.S. Size Sieve Opening	Percent of Soil Passing
6 inches	100
3/4-inch	70 to 90
No. 4	50 to 70
No. 20	30 to 50
No. 200	Less than 5 percent by weight of the minus 3/4-inch fraction

2.2.2 Suitable On-Site Fill

Suitable On-Site Fill is excavated on-site material that is free of organic matter, debris, and rocks greater than six inches in maximum diameter, and is capable of being compacted to at least 90 Percent Compaction. Moisture conditioning (drying) of the on-site materials may be required to prepare them for placement and compaction.

2.3 EXECUTION

2.3.1 Clearing and Grubbing

Clearing and grubbing shall include removal and disposal from the site of existing trees, logs, organic material, vegetation, and topsoil. The site shall be cleared and grubbed in advance of excavation and move-in with equipment and materials. The Contractor shall remove all debris and dispose of it off-site. No on-site burning will be permitted. The Contractor shall clear and grub areas only as necessary for access, excavation, and storage of excavated material, and for storage of equipment and materials required for accomplishing the work. The Contractor shall grub as necessary to keep organic matter out of fill materials.

2.3.2 Excavation

Excavation consists of removing on-site soils to sufficient depth to achieve design grades. In general, on-site soils can be excavated using standard earthmoving equipment. Excavation shall be made so as to avoid disturbance or loosening of adjacent soils. Excavations should be kept free of water at all times and all loose material should be removed from excavations prior to beginning placement of the shoreline protection wall, or any Fill material.

The Contractor shall remove excess excavated soil not to be used as On-Site Fill or Select Fill and dispose of it at the designated on-site area. Some excavated material may be used as On-site Fill or Select Fill, in which case this material shall be stockpiled, if necessary, on-site and subsequently used as On-Site Fill or Select Fill.

The Geotechnical Engineer will observe excavation of the shoreline protection wall trench, as shown on the Plans and described in Section 3.3.1, and indicate to the Contractor that the subgrade is suitable for foundation support of the wall prior to beginning wall construction.

2.3.3 On-Site Fill Placement and Compaction

This section covers the placement and compaction of On-Site Fill material to achieve the planned slope grades behind and in front of the wall. Suitable On-Site Fill material shall be placed in thin 8-inch loose lifts and compacted to at least 90 Percent Compaction. The On-Site Fill may be several percentage points above its Optimum Moisture Content. Some sorting of the On-Site material and/or moisture conditioning (drying) may likely be required to prepare the material for placement and compaction. If field density tests indicate the required Percent Compaction has not been obtained, the fill material shall be reconditioned as necessary or replaced and recompacted to the required Percent Compaction before placing any additional material.

2.3.4 Select Fill Placement and Compaction

This section covers the placement and compaction of Select Fill to achieve the planned grades. Fill material shall be placed in layers twelve inches or less in loose thickness, moisture conditioned if necessary, and compacted to 90 Percent Compaction. If field density tests indicate the required Percent Compaction has not been obtained, the fill material shall be reconditioned as necessary and recompacted to the required Percent Compaction before placing any additional material.

3.0 GABION WALLS

3.1 GENERAL

3.1.1 Scope of Work

This section covers construction of wire gabion walls in accordance with the details shown in the Plans and these Specifications in close conformity with the lines and grades shown on the Plans.

3.1.2 Terms

- Gabions are defined as galvanized steel wire mesh box-shaped baskets of various sizes. The baskets are filled in-place with Gabion Fill.
- Selvedges are the thicker perimeter and edge wires to which the wire mesh is securely tied.

- Reinforcing wires are the thicker wires incorporated into the netting during fabrication.
- Diaphragms are internal wire ;mesh partitions which divide the gabion into cells.
- Lacing or binding wire is the wire used to assemble and join the gabion units.
- Connecting wires are the internal wires used to prevent the gabions from bulging.
- Non-raveling is defined as the ability of the wire mesh to resist pulling apart at any of the connections forming the mesh when a single strand in a section of mesh is cut.

3.2 MATERIALS

3.2.1 PVC-Coated Wire Mesh Gabions

Gabion basket units shall be of non-raveling construction and fabricated from PVC-coated, hot-dipped, galvanized steel wire not less than U.S. Gauge 11 after galvanization. The steel wire used shall be galvanized prior to weaving into mesh. All gabion wire shall equal or exceed U.S. Federal Specification QQ-W-461H Finish 5; soft hardness; medium tensile strength; Class 3 zinc coating.

Mesh openings shall be uniform in size measuring no more than 3-1/4 inches by 4-1/2 inches. Selvedge wire shall be not less than U.S. Gauge 9 after galvanization. Lacing and connecting wire shall meet the same specifications as the wire used in the gabion body except that it shall be not less than U.S. Gauge 13-1/2 after galvanization. All gabion dimensions shall be within a tolerance limit of $\pm$ 5% of the sizes shown on the Plans.

3.2.2 Gabion Fill

The material used for gabion fill shall be clean, hard angular rock with pieces ranging from three (3) to eight (8) inches in greatest dimension, which has a minimum Degradation Factor of 30.

3.2.3 Filter Fabric

Filter fabric shall be a non-woven fabric of polyester or polypropylene filaments or fibers bonded through heat or needle punching. Filter fabric shall meet the following requirements:

- Thickness - 100 mils minimum
- EOS - 70-100 U.S. Sieve D50
- Mullen Burst Strength - 400 psi

3.3 EXECUTION

3.3.1 Fabrication

Gabions shall be fabricated in such a manner that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of the sizes shown on the Plans. Gabions shall be of single unit construction; the base, lid, ends, and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the connecting point is at least equal to that of the mesh. Where the length of the gabion exceeds one and one-half its horizontal width, the gabion shall be divided by diaphragms of the same mesh and gauge as the body of the gabions, into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying is required at this juncture.

3.3.2 Assembling and Placing

Each gabion shall be assembled by tying all untied edges with PVC-coated binding wire. The binding wire shall be tightly looped around every other mesh opening along the seams in such a manner that single and double loops are alternated.

A line of empty gabions shall be placed into position according to the Plans and binding wire shall be used to securely tie each unit to the adjoining one along the vertical reinforced edges and top selvedges. To achieve better alignment and finish in retaining walls, gabion stretching is recommended.

Connecting PVC-coated wires shall be inserted in 36-inch gabions during the filling operation in the following manner:

- Gabions shall be filled to a depth of twelve (12) inches.
- One connecting wire in each direction shall be tightly tied to opposite faces of each gabion cell at a height of twelve (12) inches above the base.
- Gabions shall be filled with a further depth of twelve (12) inches, and two connecting wires shall similarly be tied at this level

All connecting wires shall be looped around two mesh openings and the ends of the PVC-coated wires shall be securely twisted to prevent their loosening.

The gabions in any row shall be filled in stages so that local deformations may be avoided. That is, at no time shall any gabion be filled to a depth exceeding one foot more than the adjoining gabion.

When a gabion has been filled, the lid shall be bent over by hand until it meets the front and ends. Then the lid shall be tightly bound to the rest of the basket with the lacing wire along all edges and internal cell diaphragms in the same manner described above for assembly.

3.3.3 Filling

Gabions may be filled by hand or by mechanical means. Every effort shall be made to keep voids and bulges in the gabions to a minimum in order to ensure proper alignment and a neat, compact, square appearance.

The last layer in each gabion basket shall completely fill the gabion basket so the lid, when secure, will bear on the gabion filler. Gabion baskets shall be securely fastened to all, the lid shall then be secured to the sides, ends, and diaphragms in the same manner required for assembling adjacent gabion baskets.

4.0 SHEETPILE WALL

4.1 GENERAL

4.1.1 Scope of Work

This section covers construction of a sheetpile wall in accordance with the details shown in the Plans and these Specifications in close conformity with the lines and grades shown on the Plans.

4.1.2 Terms

- Sheetpiles are defined as preformed steel sheets with standard dimensions and mechanical properties which may be interlocked to form the sheetpile wall.
- Protective cap is a concrete cap formed on top of the sheetpile wall after sheetpile installation is complete. Its purpose is to cover the exposed top of the wall for aesthetic and public safety reasons.

4.2 Materials

4.2.1 Sheetpiles

Sheetpile sections shall be a standard sized A-36 steel sheetpile with the dimensions shown on the plans and shall conform to the design details provided in the AISC Manual of Steel Construction, 8th Edition, for the appropriate size member. The use of salvaged sheetpile sections is acceptable provided they are relatively undistorted and free of excessive corrosion damage.

4.2.2 Securing Chain and Bolt/Nut

Securing chain shall be a 3/8 inch galvanized proof coil chain with a minimum working load of 5100 pounds. The nut shall be galvanized steel and compatible to the chain. Link diameter shall be between 1-1/2 and 3 inches in longest dimension.

4.2.3 Driftwood Logs

Driftwood logs shall be selected from available logs on the beach front. Selected logs shall be best quality timber available with average diameter not less than 12 inches.

4.2.4 Concrete

Shall be in accordance with Standard Specifications Section 6-02.3(1) Class B Concrete.

4.3 Execution

4.3.1 Fabrication

The individual sheetpile will be fabricated in such a manner that they can be interlocked during installation to produce a continuous sheetpile wall.

4.3.2 Assembling and Placing

Each sheetpile shall be lowered into position in the excavated trench and supported by bracing until backfilling is completed as specified in the earthwork Section 2.0. Adjacent sheetpiles shall be interlocked to produce a continuous sheetpile wall.

4.3.3 Securing Chain

The driftwood log securing chain attachment bolt shall be installed and the chain attached as shown on the Plans.

4.3.4 Protective Cap

When backfilling and compaction is complete, the protective cap should be formed as shown on the Plans. The width of the cap is determined by the maximum depth of the selected sheetpile section. The cap shall be at least 3 inches wider than the maximum sheet pile section depth and shall be centrally located on top of the wall.

4.3.5 Driftwood Log

The driftwood log shall be placed on the inboard side of the protective cap and attached to the sheetpile wall with the securing chain as shown on the plan.

5.0 ROCK WALL

5.1 GENERAL

5.1.1 Scope of Work

This section covers construction of a rock wall in accordance with the details shown in the Plans and these specifications in close conformity with the lines and grades shown on the Plans.

5.1.2 Terms

- Rock is a sound, unweathered ledge rock.
- Crushed rock is a mechanically produced angular rock meeting Standard Specifications 9.03.9(3).
- Securing chain is a steel linked chain as described in Section 4.2.2 which attaches the driftwood log to the rock wall.

5.2 MATERIALS

5.2.1 Wall Rock

Individual wall rock shall be a clean, hard, angular rock from an established source that has demonstrated that it produces suitable rock. The rock should be free of fractures and clay seams and be of a weathering resistant type. It should be 4 to 6 man rock in size weighing between 1700 to 2500 pounds with an average diameter of 36 inches within a tolerance limit of $\pm$ 10%.

5.2.2 Crushed Rock Backfill

The material used for backfill behind the rock wall shall be clean, hard, angular rock meeting the requirements of Section 9-03.9(3) crushed surfacing, base coarse in the Standard Specifications.

5.2.3 Securing Chain

Securing chain shall be 3/8 inch galvanized proof coil chain with a minimum working load of 5100 pounds. The nut shall be galvanized steel and compatible to the chain. Link diameter shall be between 1-1/2 and 3 inches in longest dimension.

5.2.4 Securing Chain Plate

The plate shall be fabricated from A-36 steel plate with minimum thickness 3/8 inch and shall be square with minimum side length of 24 inches.

5.2.5 Driftwood Log

Driftwood logs shall be selected from available logs on the beach front. Selected logs shall be best quality timber available with average diameter not less than 12 inches.

5.3 EXECUTION

5.3.1 Assembling and Placing

The securing chain and steel plate assemblies shall be located in the excavated trench as shown on the Plans. The plates shall be located beneath an individual rock and not between adjacent rocks. The 4 to 6 man rocks shall then be placed into position according to the Plans. The crushed rock backfill shall then be carefully tamped into place on the inboard side of the wall as shown on the Plans. Imported Select Fill or a suitable On-Site Fill shall then be placed and compacted to 90 Percent Compaction in accordance with the specification included in the Earthwork Section 2.0.

5.3.2 Driftwood Log

The driftwood log shall be positioned on top of the wall and secured with the chain as shown on the Plans.

6.0 MEASUREMENT AND PAYMENT

6.1 GENERAL

It is the intention of these specifications that the performance of all work under the bid for each item shall result in the complete construction, in accepted operating condition, of each item.

Work and material not specifically listed in the proposal but required according to the Plans, specifications, and general practice shall be included in the Contractor's bid price.

6.2 BID ITEMS

6.2.1 Clearing and Grubbing

The price covers complete cost of grubbing and clearing, including all labor, materials, and equipment necessary for complete removal and disposal.

Payment will be made by lump sum.

6.2.2 Excavation

The unit price covers complete cost of removal and disposal of soil including all labor, materials, and equipment necessary for completion.

Payment will be made by lump sum.

6.2.3 On-Site Fill Placement and Compaction

The total price covers the complete cost of work including labor equipment and materials necessary to cut, haul, place and compact On-Site Fill as indicated on the Plans.

Payment will be by lump sum.

6.2.4 Import Select Fill Placement and Compaction

The unit price covers complete cost of work including all labor, equipment, and materials necessary to import, place, and compact Select Fill.

Payment will be based on Select Fill delivered to the site by cubic yard in place.

6.2.5 Gabion Wall

The unit price covers complete cost of gabion wall and driftwood log cap including labor, equipment, and materials required for fabrication, assembling and placing, and filling, excluding Filter Fabric.

Payment will be made by cubic yard of gabion in place.

Filter Fabric

The unit price covers complete cost of labor, equipment and material to furnish and install filter fabric for gabion drainage as shown on the Plans and specified herein.

Payment will be made by square yard of filter fabric in place.

6.2.6 Sheetpile Wall

The unit price covers complete cost of sheetpile wall, protective concrete cap, and driftwood log cap including labor, equipment, and materials required for fabrication, assembling, and placing.

Payment will be made by linear foot of wall length.

6.2.7 Rock Wall

The unit price coves complete cost of rock wall and driftwood log cap including labor, equipment and materials required for fabrication, assembling and placing excluding the crushed rock backfill.

Payment will be made by lineal foot of wall.

Crushed Rock Backfill

The unit price covers complete cost of work including all labor, equipment, and materials necessary to import and tamp into place crushed rock backfill.

Payment will be based on crushed rock delivered to the site by cubic yard in place.

NOTES

General: Refer to material specifications provided for each wall type.

Backfill: Backfill to consist of free-draining granular material and should be compacted to at least 90 percent ASTM D-1557 Method C Standard.

Driftwood Log: Shall be best quality timber available on beach with average diameter not less than 12 inches. Length to be not less than 10 feet.

Securing Chain: Chain shall be as specified and should be looped around, or attached to bolts extending through the log. Spacing between chains to be not greater than 15 feet or a minimum of 2 chains for each log section, whichever is the smaller.

Gabion

Gabion Basket: Basket to be at least 3 feet square in section and all wires provided with a protective PVC coating to prevent corrosion by seawater.

Filter Fabric: Fabric should extend beneath the inboard half of the wall and up the back face to approximately 6 inches from the top of the gabion.

Sheet Pile

Sheet Pile Type: Sheet pile with section modulus equal to or greater than a RZ10 is acceptable. Used sheet pile sections are acceptable provided they are relatively undistorted and free of excessive corrosion damage.

Concrete Cap: Width of cap will depend on depth of sheet pile section used. Cap should be at least 3 inches wider than maximum section depth 'd'.

Rock Wall

Steel Plate: Steel plate to be at least 24 inches on each side and 3/8 inch thick. Plate and attached securing chain should be located between adjacent rocks at the centerline of the wall.

Crushed Rock Backfill: To be tamped into place between the rockwall and the excavation sidewall on the inboard side.

Rock: Acceptable rock shall be 4 to 6 man rock in size weighing not less than approximately 1700-2500 pounds with an average diameter of 36 inches.

APPENDIX

APPENDIX A

Field Exploration

We explored subsurface conditions at the site on May 1, 1986, by excavating a total of five test pits to a maximum depth of 7 feet below the existing site grade at the approximate locations indicated on the attached Site Plan, Sheet 1 of 2. The test pits were excavated using a rubber-tired tractor-mounted backhoe provided by the Parks Department.

The test pit excavations were located in the field by pacing from the existing roadway and fishing pier. Pit elevations were determined by interpolation between contour lines shown on the Site Plan provided by Mr. Dees (Grading and Staking by Wilsey & Ham, Inc., Sheet 4 of 7, dated 8/1/75 for Snohomish County Parks and Recreation Department). The locations and elevations should only be considered accurate to the degree implied by the method used.

The test pits excavations were monitored by our engineer who determined specific test pit locations, examined and classified the materials encountered, obtained representative soil samples and recorded pertinent information including soil samples, stratigraphy, soil engineering characteristics, and groundwater occurrence. Representative soil samples were obtained and were classified in accordance with the Unified Soil Classification System which is presented, with a key to the test pit logs, on the Soil Classification/Legend, Plate 1.

All samples were sealed to limit moisture loss, labeled, and returned to our laboratory for further examination and testing. The test pit logs, modified to reflect the results of laboratory examination and testing, are presented on Plates 2 through 4. The stratification lines, shown on the individual logs, represent the approximate boundaries between soil types; actual transitions may be either more gradual or more severe. The conditions depicted are for the date and locations indicated only, and it should not necessarily be expected that they are representative of conditions at other locations and times.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS					TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN HALF IS LARGER THAN NO. 200 SIEVE)	GRAVELS (MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE)	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP		POORLY GRADED GRAVELS GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM		SILTY GRAVELS, POORLY GRADED GRAVEL-SAND - SILT MIXTURES
			GC		CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND - CLAY MIXTURES
	SANDS (MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE)	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS
			SP		POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 12% FINES	SM		SILTY SANDS, POORLY GRADED SAND - SILT MIXTURES
			SC		CLAYEY SANDS, POORLY GRADED SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN HALF IS SMALLER THAN NO. 200 SIEVE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL		ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT GREATER THAN 50)		MH		INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH		INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS
			OH		ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
			Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS

LEGEND

SAMPLE
- ■ "Undisturbed"
- ⊠ Bulk
- □ Not Recovered

GRAPHIC LOG
- Well Defined Change
- Gradational Change
- Obscure Change
- End of Exploration

BLOWS/FOOT

Hammer is 140 pounds with 30 inch drop, unless otherwise noted
S - SPT Sampler (2.0 Inch O.D.)
T - Thin Wall Sampler (2.8 Inch Sample)
H - Split Barrel Sampler (2.4 Inch Sample)

MOISTURE DESCRIPTION

Dry - Considerably less than optimum for compaction
Moist - Near optimum moisture content
Wet - Over optimum moisture content
Saturated - Below water table, in capillary zone, or in perched groundwater

LABORATORY TESTS

Consol - Consolidation
LL - Liquid Limit
PL - Plastic Limit
Gs - Specific Gravity
SA - Size Analysis
Tx - Triaxial Shear
DS - Direct Shear
VS - Vane Shear
Comp - Compaction

UU - Unconsolidated • Undrained
CU - Consolidated • Undrained
CD - Consolidated • Drained

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SOIL CLASSIFICATION/LEGEND

Kyak Point County Park
Snohomish County, Washington

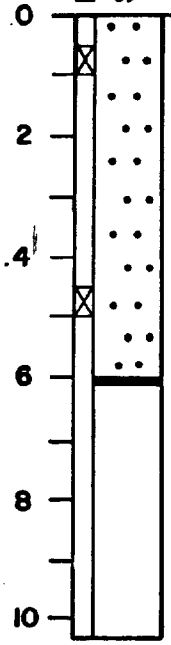
PLATE 1

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,845.001			6/26/86		

Dry Density (pcf) | Moisture Content (%) | Depth (ft) | Sample

Test Pit Number 1

Elevation 8 feet* **Date** 5/1/86



GRAY GRAVELLY SAND (SP) loose, wet; coarse sand, fine subangular gravel, some seashells, occasional fine gravel seams

Becomes medium dense at 3.0 feet.

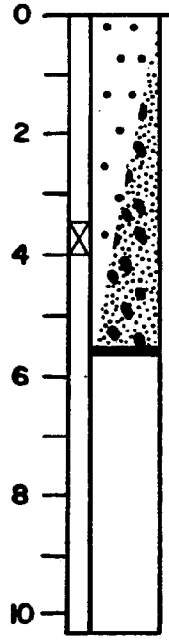
Seepage at 4.0 feet.

Test pit terminated at depth of 6.0 feet on 5/1/86.

*Temporary benchmark used is USGS Brassie adjacent to paved road approximately 400 feet south of existing pier at assumed Elevation 10 feet.

Test Pit Number 2

Elevation 8 feet **Date** 5/1/86



GRAY GRAVELLY SAND (SP) loose, wet; some seashells, occasional gravelly lenses, medium to coarse-grained sand, fine subround to subangular gravel

Becomes dense at 2 feet.

Sides of test pit caving below 4 feet.

Test pit terminated at depth of 5.5 feet on 5/1/86.

Seepage at 5.0 feet.

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

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LOG OF TEST PITS 1 AND 2

Kyak Point County Park
Snohomish County, Washington

PLATE **2**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,845.005	LDS		6/2/86		

Dry Density (pcf) | Moisture Content (%) | Depth (ft) | Sample

Test Pit Number 3

Elevation 8 feet **Date** 5/1/86

0
2
4
6
8
10

GRAY SANDY GRAVEL (GP) loose, wet; some sea shells, medium to coarse sand, fine subangular to subround gravel, occasional more gravelly lenses

Slight sloughing of hole at 4 feet.

Test pit terminated at depth of 6 feet on 5/1/86.

Seepage at 5 feet.

Test Pit Number 4

Elevation 8 feet **Date** 5/1/86

0
2
4
6
8
10

GRAY SANDY GRAVEL (GP) loose, wet; some seashells, medium to coarse sand, fine subangular to subround gravel

Drainfield flow at 5 feet.

GRAY CLAYEY SILT (ML) soft, saturated; with some rounded gravel

GRAY GRAVELLY SAND (SP) medium dense, saturated; medium to coarse sand, fine gravel

Test pit terminated at depth of 7 feet on 5/1/86.

Notes Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

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LOG OF TEST PITS 3 AND 4

Kyak Point County Park
Snohomish County, Washington

PLATE 3

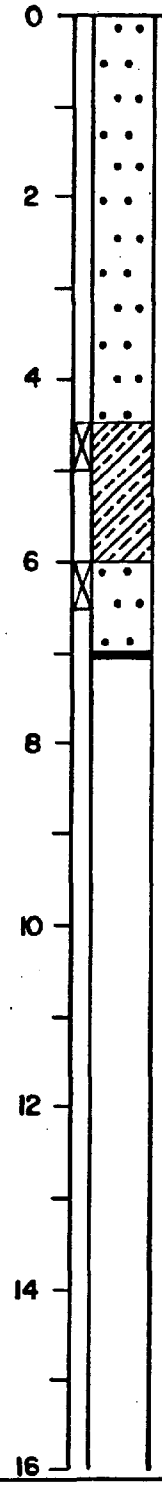
JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,845.005	LDS		6/20/86		

Laboratory Tests

Blows/foot | Moisture Content (%) | Dry Density (pcf) | Depth (ft) | Sample

Equipment MF 40 Backhoe

Elevation 8 feet Date 5/1/86



GRAY GRAVELLY SAND (SP) loose, wet; some seashells, medium to coarse sand, fine subangular and subround gravel, occasional gravel lense

Drainfield at 4.5 feet.

GRAY-BROWN ORGANIC SILT (OH) soft, saturated; with some fine sands, old plants

GRAY SAND (SW) medium dense, saturated; fine to coarse sand

Test pit terminated at depth of 7 feet on 5/1/86.

Notes

Subsurface conditions depicted are for the time and location of the individual exploration hole only, they should not necessarily be considered representative of conditions at other times or locations.

AGI can not be responsible for the interpretation by others of the information presented on this log sheet.

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LOG OF TEST PIT 5

Kyak Point County Park
Snohomish County, Washington

PLATE 4

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,845.005	LDS		6/20/86		

DATE DUE

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