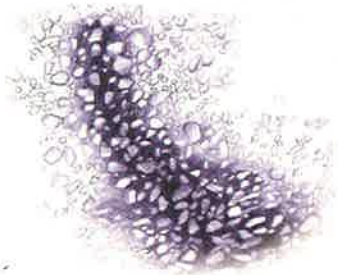
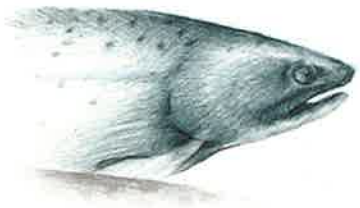
Geotechnical Engineering

Water Resources



Solid and Hazardous Waste



Ecological/Biological Sciences

Geologic Assessments

Associated Earth Sciences, Inc.

Subsurface Exploration and
Geotechnical Engineering Report

SAFEWAY STORE #534 ADDITION

Smokey Point area of
Arlington, Washington

Prepared for

The Dykeman Architects, P.S.

Project No. KE01153G
March 26, 2001

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING REPORT

SAFEWAY STORE #534 ADDITION

Smokey Point area of Arlington, Washington

Prepared for:
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March 26, 2001
Project No. KE01153G

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering study for the proposed Safeway Store #534 addition in the Smokey Point area of Arlington, Washington. The site location and approximate locations of exploration borings completed for this study are presented on the Site and Exploration Plan, Figure 1. Specific design plans were not available at the time of this report writing; however a preliminary site plan depicting the location of the proposed additions with site topography and approximate elevations prepared by The Dykeman Architects, P.S. dated January 20, 2001 was provided to us. Our recommendations are based on the preliminary site plan, assumed structural loads, and the referenced site survey. Once a final site development plan is available, the conclusions and recommendations contained in this report should be reviewed and modified, or verified, as necessary to reflect the project elements.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface soil and shallow ground water data to be utilized in the design and development of the proposed additions. Our study included a review of available geologic literature, drilling of exploration borings, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow ground water conditions. Geotechnical engineering studies were also conducted to determine the type of suitable foundation, allowable bearing pressures, anticipated settlements, floor support recommendations, pavement subgrade preparation recommendations, and drainage considerations. This report summarizes our current fieldwork and offers development recommendations based on our present understanding of the project.

1.2 Authorization

Authorization to proceed with this study was granted by Mr. Gary O'Leary of The Dykeman Architects, P.S. via facsimile transmittal on March 15, 2001. Our study was accomplished in general accordance with our proposal dated March 14, 2001. This report has been prepared for the exclusive use of The Dykeman Architects, P.S., Safeway Stores, Inc., and their agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, expressed or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

This report was completed with an understanding of the project based on our discussions with representatives from The Dykeman Architects, P.S., and the preliminary site plan, as prepared by The Dykeman Architects, P.S. Present plans call for the construction of two additions to the existing Safeway Store #534, one small addition to the northwest corner, and one large addition to the east. In total, the additions will add 7,559 square feet to the existing store. Building loads are expected to be moderate with continuous wall loads of 3 to 5 kips per foot and column loads of 50 to 150 kips. A slab-on-grade concrete floor is also expected.

Safeway Store #534 is located at 3252 172nd Street NE in Smokey Point, to the southwest of Arlington, Washington. The store occupies the west end of the strip mall at the southeast corner of the intersection between 172nd Street NE and 35th Avenue NE. An extensive parking lot exists to the north and west of the store with a driveway around the back to the south.

The site topography is generally flat with minor slopes towards the storm water catch basins within the parking lot. Site vegetation is restricted to the decorative planter beds spread throughout the surrounding parking lot.

3.0 SUBSURFACE EXPLORATION

The three exploration borings (EB-1 through EB-3) were completed on March 20, 2001 using a truck-mounted drill rig under subcontract to our firm. Representative samples of subsurface soils were obtained from each exploration boring at 5-foot intervals. The borings were observed and logged by a geologist from our firm. The exploration logs presented in the Appendix are based on the field logs, drilling action, and inspection of the samples secured.

Disturbed but representative samples were obtained by using the Standard Penetration Test (SPT) procedure in accordance with ASTM:D 1586. This test and sampling method consists of driving a standard 2-inch outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 is recorded within one 6-inch interval, the blow count is recorded as 50 blows for the number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are plotted on the attached boring logs.

The samples obtained from the split-barrel sampler were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification and laboratory testing, as necessary.

Exploration borings EB-1 through EB-3 were advanced through the pavement within the parking spaces nearest to the proposed additions in the northwest, northeast, and southeast corners of the existing store, respectively.

The conclusions and recommendations presented in this report are based on the three exploration borings completed for this study. The number, location, and depth of the explorations were completed within site and budgetary constraints. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions may sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make the appropriate changes.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of applicable geologic literature. As shown on the field logs, the exploration borings generally encountered medium dense, wet, gray, medium sands with varying gravel content. The following section presents more detailed subsurface information organized from the upper (youngest) to the lower (oldest) sediment types.

4.1 Stratigraphy

Marysville Sand Member (Qvrm)

This unit was observed within all of our exploration borings, EB-1 through EB-3, beneath a layer of previously placed fill at a depth of 3 feet. This unit extended beyond the depths of our exploration borings at 19 feet each. The upper portion of this unit typically consisted of medium dense, damp, brown, fine to medium sands and graded to a medium dense, wet, gray, medium sand with varying gravel content at an approximate depth of 7 feet. These sediments are classified as the Marysville sand member and are considered recessional outwash deposits.

These sediments were deposited by meltwater streams from the retreating glacial ice during the Vashon Stade of the Fraser Glaciation approximately 15,000 years ago.

A review of the *Distribution and Description of the Geologic Units in the Arlington West Quadrangle, Washington* (James P. Minard, 1980) indicates that the sediments encountered in our explorations are generally consistent with those identified on the referenced maps.

5.0 HYDROLOGY

Ground water was observed in exploration borings EB-1 through EB-3 at the time of our field exploration on March 20, 2001. Depth to ground water ranged between 7 and 8 feet and probably indicated the actual regional water table. The moisture conditions increased from damp to wet and sample coloration changed from brown to gray near the ground water horizon. It should be noted that fluctuations in the level of ground water may occur due to the time of year and variations in rainfall. Our experience in the Smokey Point area is that ground water levels can fluctuate to within a few feet of the ground surface. Once encountered during excavation, the quantity and duration of flow of ground water will vary depending on season.

II. DESIGN RECOMMENDATIONS

6.0 INTRODUCTION

Our explorations indicate that, from a geotechnical standpoint, the parcel is suitable for the proposed development provided the risks discussed are accepted and the recommendations contained herein are properly followed. The foundation bearing stratum is relatively shallow across much of the site and, therefore, conventional spread footing foundations may be utilized for support of the structure.

7.0 SITE PREPARATION

Based upon the subsurface conditions encountered during exploration, the following site preparation procedures have been developed and include recommendations regarding site drainage, subgrade protection, proofrolling, and subgrade compaction. However, site preparation effort is expected to be dependent upon the time of year that construction proceeds. Therefore, bids for site preparation, earthwork, and paving operations should be based upon the time of year that construction will proceed. It is recommended that a representative of our firm observe the soil conditions prior to and during site preparation activities to evaluate the suitability of stripped subgrades prior to placement of structural fill, and construction of foundation elements and floors.

7.1 Site Drainage and Surface Water Control

Adequate temporary and permanent control of surface water runoff and possible subsurface seepage will be required in order to allow site access and grading for construction of the new additions. Excavation, filling, subgrade, and grade preparation should be performed in a manner and sequence that will provide controlled drainage at all times and proper control of erosion. Surface water should be collected and pumped or drained to provide a suitable working platform.

The site should be graded to prevent water from ponding in construction areas and/or flowing into excavations. Exposed grades should be crowned, sloped, and smooth-drum rolled at the end of each day to facilitate drainage. Accumulated water must be removed from subgrades and work areas immediately prior to performing further work in the area. Equipment access may be limited and the amount of soil rendered unfit for use as structural fill may be greatly increased if drainage efforts are not accomplished in a timely sequence. If a working drainage

system is not utilized, project delays and increased costs could be incurred due to the greater quantities of wet and unsuitable fill or poor access and unstable conditions.

Final exterior grades should promote free and positive drainage away from the additions at all times. Water must not be allowed to pond or to collect adjacent to foundations or within the immediate building area. It is recommended that a gradient of at least 3 percent for a minimum distance of 10 feet from the building perimeter be provided, except in paved locations. In paved locations, a minimum gradient of 1 percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structure. Additionally, pavement subgrades should be crowned to provide drainage toward catch basins and pavement edges.

7.2 Wet Weather Conditions

If construction proceeds during an extended wet weather construction period, and the native soils become saturated, they may become unstable. Therefore, the bids for site grading operations should be based upon the time of year that construction will proceed. It is expected that in wet conditions additional soils may need to be removed and/or other stabilization methods used, such as a coarse crushed rock working mat to develop a stable condition if subgrade soils are disturbed in the presence of excess moisture. The severity of construction problems will be dependent, in part, on the precautions that are taken by the contractor to protect the moisture- and disturbance-sensitive site soils. If overexcavation is necessary, it should be confirmed through continuous observation and testing by a representative of our firm.

7.3 Subgrade Protection

Site soils consist predominately of medium sands with varying gravel content and are considered to be moisture and disturbance sensitive. These soils may become unstable if disturbed by construction equipment while at elevated moisture contents, requiring additional soil removal at an increased cost. Therefore, in addition to the recommendations presented in the *Site Drainage and Surface Water Control* section of this report, site preparation and initial construction activities should be planned to minimize disturbance to the existing ground surface particularly during extended wet weather periods and the wet season (typically October through May). Construction traffic should be restricted to specific drive areas to limit the area where disturbance of the subgrade will occur. If site grading activities are performed during extended dry weather periods, extensive subgrade stabilization is not expected to be necessary. However, intermittent wet weather periods during the summer months could delay earthwork if soil moisture conditions become elevated above the optimum moisture content. The use of a working surface of crushed rock, or quarry spalls, may be required to protect the medium sand

soils, particularly in areas supporting concentrated equipment traffic. In winter construction and staging areas, a minimum thickness of 12 inches of quarry spalls or 18 inches of pit run sand and gravel are recommended to protect subgrades.

Foundation subgrades may require protection from foot and equipment traffic and ponding of runoff during wet weather conditions. Typically, compacted crushed rock or a lean-mix concrete mat placed over a properly prepared subgrade provides adequate subgrade protection. Foundation concrete should be placed and excavations backfilled as soon as possible to protect the bearing grade.

7.4 Proofrolling and Subgrade Compaction

Following the recommended site grading procedures, the subgrade within the building and pavement areas should be proofrolled with heavy rubber-tired construction equipment, such as a fully loaded tandem-axle dump truck. Proofrolling should be performed prior to structural fill placement or foundation excavation. The proofroll should be monitored by the geotechnical engineer so that any soft or yielding subgrade soils can be identified. Any soft/loose, yielding soils should be removed to a stable subgrade. The subgrade should then be scarified, adjusted in moisture content, and recompacted to the required density. Proofrolling should only be attempted if soil moisture contents are at or near optimum moisture. Proofrolling of wet subgrades could result in further degradation. Low areas and excavations may then be raised to the planned finished grade with compacted structural fill. Subgrade preparation and selection, placement, and compaction of structural fill should be performed under engineering controlled conditions in accordance with the project specifications.

7.5 Overexcavation/Stabilization

Construction during extended wet weather periods could create the need to overexcavate exposed soils if they become disturbed and cannot be recompacted due to elevated moisture content and/or weather conditions. If overexcavation is necessary, it should be confirmed through continuous observation and testing by a qualified geotechnical engineer. Soils that have become unstable may require remedial measures in the form of one or more of the following:

1. Drying and recompaction. Selective drying may be accomplished by scarifying or windrowing surficial material during extended periods of dry and warm weather.

2. Removal of affected soils to expose a suitable bearing subgrade and replacement with compacted structural fill.

3. Mechanical stabilization with a coarse crushed aggregate compacted into the subgrade, possibly in conjunction with a geotextile.

7.6 Cut Slope Recommendations

In our opinion, stable construction slopes are the responsibility of the contractor, and adequate temporary slope inclinations should be determined during construction. For estimating purposes, however, we anticipate that temporary, unsupported cut slopes in the medium dense, natural sediments can be made at a maximum slope of 1.5H:1V (Horizontal:Vertical), in accordance with WISHA regulations for Type C soils. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

Permanent, unsupported cut slopes should not exceed a maximum gradient of 2H:1V. Flatter slopes should be expected on the interior of man-made ponds and where persistent seepage requires flatter slope angles. All permanent slopes should be revegetated or otherwise protected from erosion as soon as possible after they are constructed.

8.0 STRUCTURAL FILL

Structural fill may be used to establish desired grades in some areas. All references to structural fill in this report refer to subgrade preparation, fill type, placement, and compaction of materials as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

After overexcavation/stripping has been performed to the satisfaction of the geotechnical engineer, the upper 12 inches of exposed ground should be recompacted to 90 percent of the modified Proctor maximum density using ASTM:D 1557 as the standard. If the subgrade contains too much moisture, adequate recompaction may be difficult or impossible to obtain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

After recompaction of the exposed ground is tested and approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to 95 percent of the modified Proctor maximum density

using ASTM:D 1557 as the standard. The top of the compacted fill should extend horizontally outward a minimum distance of 3 feet beyond the location of the perimeter footings or roadway edge before sloping down at a maximum inclination of 2H:1V.

The contractor should note that any proposed fill soils must be evaluated by Associated Earth Sciences, Inc. (AESI) prior to their use in fills. This would require that we have a sample of the material 48 hours in advance of filling activities to perform a Proctor test and determine its field compaction standard. Soils in which the amount of fine-grained material (smaller than the No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture sensitive. Use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions. On-site soils, such as the Marysville sand member, may be used as structural fill provided it is placed and compacted at a moisture content that allows for the minimum specified compaction. If earthwork proceeds during or shortly after rainy periods, some drying of wet soils should be anticipated prior to their compaction. In addition, construction equipment traversing the site when the soils are wet can cause considerable disturbance. If fill is placed during wet weather or if proper compaction cannot be obtained, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction.

A representative from our firm should inspect the stripped subgrade and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses and any problem areas may be corrected at that time. It is important to understand that taking random compaction tests on a part-time basis will not assure uniformity or acceptable performance of a fill. As such, we are available to aid the owner in developing a suitable monitoring and testing program.

9.0 FOUNDATIONS

Spread footings may be used for building support when founded on the natural, medium dense soils of the Marysville sand member, or structural fill placed as previously discussed (refer to the *Site Preparation* section concerning the removal of any loose debris, organic soils, or fill). We recommend that a maximum allowable soil bearing pressure of 2,500 pounds per square foot (psf) be utilized for design purposes, including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loadings. Perimeter footings should be buried at least 18 inches below final exterior grade for frost protection; interior footings require only 12 inches of burial. However, all footings must penetrate to the prescribed

bearing stratum and no footing should be founded on or above loose soil, organic soil, or uncompacted fill soils. All footings should have a minimum width of 18 inches.

It should be noted that the area bounded by lines extending downward at 1H:1V from any footing must not intersect another footing or intersect a filled area that has not been compacted to at least 95 percent of ASTM:D 1557. In addition, a 1.5H:1V line extending down from any footing must not daylight because sloughing or raveling may eventually undermine the footing. Thus, footings should not be placed near the edge of steps or cuts in the foundation bearing soils.

Care should be exercised where new footings are constructed adjacent to existing building foundations. The new footing excavation should not undermine existing foundation support soils. New footings should be founded at the same elevation as existing elements to reduce the potential for impacting new horizontal or vertical loads on existing foundations. Since the bearing stratum is granular, new foundation settlement should occur rapidly during dead load application. To reduce the potential for visual evidence of differential movement, brittle or settlement-sensitive surfaces or finishes should be deferred as long as practical.

Anticipated settlement of footings founded on the native bearing soils or approved structural fill should be less than ¾ inch. However, disturbed soil not removed from the footing excavations prior to footing concrete placement could result in increased foundation settlements. We recommend that all footing excavations be observed by AESI prior to placing the footing concrete to verify that the design bearing capacity of the soils has been attained and that construction conforms with the recommendations contained in this report. The governing municipality may require such inspections. Perimeter footing drains should be provided as discussed under the section on *Drainage Considerations*.

10.0 FLOOR SUPPORT

Slab-on-grade floors for structures may be placed over structural fill or natural, medium dense sediments after compacting the upper foot of soil to a minimum of 90 percent of ASTM:D 1557. A polyethylene plastic vapor barrier and a capillary break layer consisting of 4 inches of washed granulithic material or pea gravel should be used under the floors. Based on the American Concrete Institutes recommendation, we recommend placing a 2- to 3-inch layer of clean sand over the vapor barrier to protect the vapor barrier from construction punctures, and to allow necessary moisture loss through the bottom of the slab to reduce concrete warping during curing. We recommend that we be allowed to review the capillary break submittal prior to use.

11.0 PAVEMENT SUBGRADE PREPARATION RECOMMENDATIONS

The parking lot and driveways surrounding the remodeled store will either be constructed on cut, undisturbed, native soils of the Marysville sand member, or on structural fill placed and compacted on top of these suitable, native, sandy soils. In areas of loose debris, at least the upper 2 feet of these materials should be removed and recompacted or replaced with approved structural fill. Some areas may require deeper excavations depending upon the existing conditions of these materials. Preparation of pavement subgrade areas should follow the recommendations of the *Site Preparation* and *Structural Fill* sections of this report. The proposed subgrade, whether it is cut native soils, compacted structural fill, or recompacted loose soils, should have a minimum density of 95 percent based on the ASTM:D 1557 test procedure within the upper foot below the pavement section. Subsequent to compaction or recompaction, the subgrade should be proofrolled with a loaded dump truck. Any deflecting areas or soft spots detected during proofrolling should be excavated and replaced with properly compacted structural fill. Upon completion of any recompaction and proofrolling, a pavement section consisting of 2½ inches of asphalt concrete pavement (ACP) underlain by 4 inches of 1¼-inch crushed surfacing base course is recommended for car parking areas. In delivery truck driveway areas, a heavier section, consisting of a minimum of 3 inches of ACP underlain by 6 inches of 1¼-inch crushed rock base course is recommended. The upper 1 inch of 1¼-inch crushed rock can be replaced with 1½ inches of 5/8-inch crushed rock as a leveling course, if desired. The crushed rock course must be compacted to at least 95 percent of the maximum density.

Depending on construction staging and desired performance, the crushed base course material may be substituted with asphalt treated base (ATB) beneath the final asphalt surfacing. The substitution of ATB should be as follows: 4 inches of crushed rock can be substituted with 3 inches of ATB, and 6 inches of crushed rock may be substituted with 4 inches of ATB. ATB should be placed over a properly compacted, native structural fill, or existing fill subgrade compacted to minimum 95 percent relative density, and a 1½- to 2-inch thickness of crushed rock to act as a working surface. If ATB is used for construction access and staging areas, some rutting and disturbance of the ATB surface should be expected. The general contractor should remove affected areas and replace them with properly compacted ATB prior to final surfacing.

12.0 DRAINAGE CONSIDERATIONS

The underlying soils of the Marysville sand member are relatively permeable and water will tend to infiltrate this stratum. However, because of the relative proximity of ground water, storm water infiltration may not be possible for this site. Additionally, traffic across these

soils when they are damp or wet will result in disturbance of the otherwise firm stratum. Therefore, prior to site work and construction, a temporary erosion and sedimentation control (TESC) plan must be designed, approved, and implemented by the contractor. The contractor should also be prepared to provide drainage and subgrade protection, as necessary. Additional recommendations are provided in Section 7.1, *Site Drainage and Surface Water Control.*

All perimeter foundation walls should be provided with a drain at the footing base elevation. Drains should consist of rigid, perforated, PVC pipe surrounded by washed pea gravel. The level of the perforations in the pipe should be set 2 inches below the bottom of the footing at all locations and the drains should be constructed with sufficient gradient to allow gravity discharge away from the building. Roof and surface runoff must not discharge into the footing drain system but should be handled by a separate, rigid, tightline drain. In planning, exterior grades adjacent to walls should be sloped downward away from the structures to achieve surface drainage.

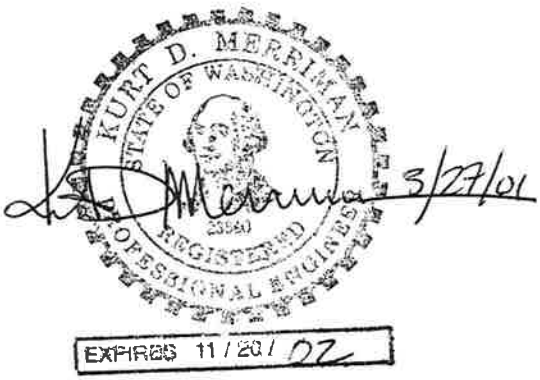
13.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

At the time of this report, site grading, structural plans, and construction methods have not been finalized. We are available to provide additional geotechnical consultation as the project design develops and possibly changes from that upon which this report is based. We recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, our earthwork and geotechnical recommendations may be properly interpreted and implemented in the design.

We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundation depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not a part of this current scope of work. The implementation of the geologic and geotechnical recommendations contained in this report must be confirmed at the time of construction by AESI to verify compliance with this report. We would be pleased to prepare a cost proposal for these services.

We have enjoyed working with you on this study and are confident that these recommendations will aid in the successful completion of your project. If you should have any questions, or require further assistance, please do not hesitate to call.

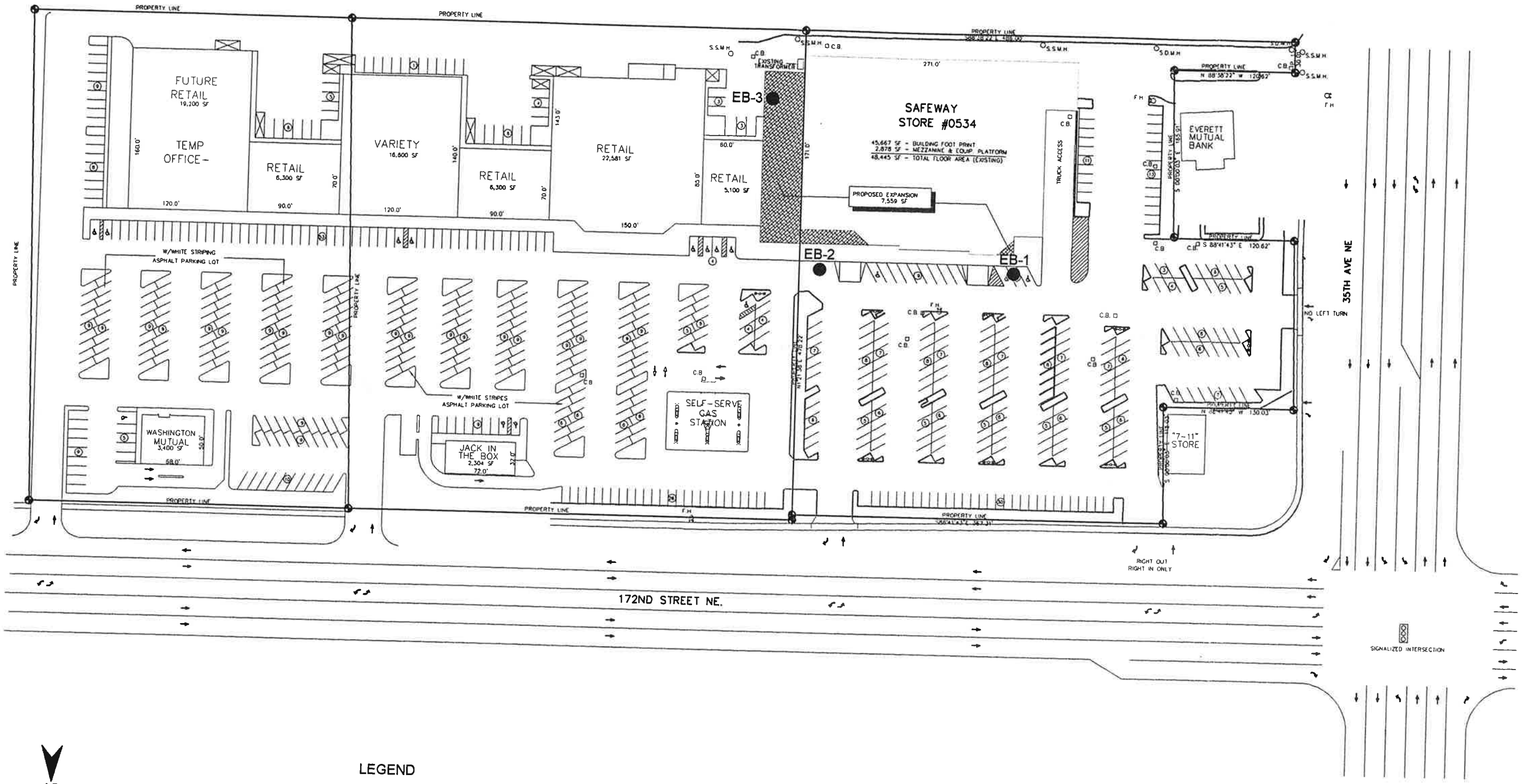
Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington



Jesse P. Overton
Staff Geologist

Kurt D. Merriman, P.E.
Associate Engineer

Attachments: Figure 1: Site and Exploration Plan
Appendix: Exploration Logs



LEGEND

EB-1 ● Approximate location of exploration boring

REFERENCE: THE DYKEMAN ARCHITECTS. 1/20/01.

Associated Earth Sciences, Inc.

SITE AND EXPLORATION PLAN

SMOKEY POINT SAFEWAY
ARLINGTON, WASHINGTON

FIGURE 1

DATE 3/01

PROJECT NO. KE01153G

APPENDIX

ASSOCIATED EARTH SCIENCES, INC

Exploration Log

Project Number	Exploration Number	Sheet
KE01153G	EB-1	1 of 1

Project Name: Smokey Point Safeway
Location: Arlington, WA
Driller/Equipment: Environmental
Hammer Weight/Drop: 140# / 30"

Ground Surface Elevation (ft):
Datum: N/A
Date Start/Finish: 03/20/01,3/20/2001
Hole Diameter (in):

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Asphalt					
				Fill					
		S-1		**Marysville Sand Member (Qvrm)** Medium dense, damp, brown, medium SAND, trace gravel.			7 12 11	▲23	
5									
		S-2		Medium dense, wet, gray, medium SAND, some gravel.		▼	7 11 12	▲23	
10									
		S-3		Medium dense, wet, gray, medium SAND with gravel.			7 9 17	▲26	
15									
		S-4		Medium dense, wet, gray, medium to coarse SAND.			4 5 10	▲15	
20				Bottom of exploration boring at 19 feet					
25									
30									
35									

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

Logged by: JPO
Approved by:

AESIBOR 01153.GPJ March 27, 2001

ASSOCIATED EARTH SCIENCES, INC

Exploration Log

Project Number	Exploration Number	Sheet
KE01153G	EB-2	1 of 1

Project Name: Smokey Point Safeway
Location: Arlington, WA
Driller/Equipment: Environmental
Hammer Weight/Drop: 140# / 30"

Ground Surface Elevation (ft):
Datum: N/A
Date Start/Finish: 03/20/01,3/20/2001
Hole Diameter (in):

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Asphalt					
				Fill					
		S-1		**Marysville Sand Member (Qvrm)** Loose to medium dense, damp, gray SAND, some gravel. * Blow count overstated due to rock in tip.			4 4 20	▲24*	
5									
		S-2		Medium dense, very moist, gray, medium SAND, some gravel.		▼	4 5 8	▲13	
10									
		S-3		Medium dense, wet, gray, medium SAND with gravel.			5 8 16	▲24	
15									
		S-4		Medium dense, wet, gray, GRAVELLY SAND.			6 9 11	▲20	
20				Bottom of exploration boring at 19 feet					
25									
30									
35									

Sampler Type (ST):
- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

Logged by: JPO
Approved by:

AESIBOR 01153.GPJ March 27, 2001

ASSOCIATED EARTH SCIENCES, INC

Exploration Log

Project Number	Exploration Number	Sheet
KE01153G	EB-3	1 of 1

Project Name	Smokey Point Safeway	Ground Surface Elevation (ft)	
Location	Arlington, WA	Datum	N/A
Driller/Equipment	Environmental	Date Start/Finish	03/20/01,3/20/2001
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	

Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Asphalt					
				Fill					
		S-1		**Marysville Sand Member (Qvrm)** Loose to medium dense, moist, orange mottled brown, fine to medium SAND.			2 4 7	▲11	
5						▼			
		S-2		Medium dense, wet, gray, medium SAND.			5 5 9	▲14	
10									
		S-3		Medium dense, wet, gray, medium to coarse SAND, some gravel.			7 11 14	▲25	
15									
		S-4		Medium dense, wet, gray, medium to coarse SAND.			7 9 15	▲24	
20				Bottom of exploration boring at 19 feet					
25									
30									
35									

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample

M - Moisture

▽ Water Level ()

▼ Water Level at time of drilling (ATD)

Logged by: JPO

Approved by:

AESIBOR 01153.GPJ March 27, 2001