Attachment 11

Drainage Design Report

Capital High School Redevelopment
Olympia, WA

Prepared For:
School District #111
1113 Legion Way SE
Olympia, WA 98502

Prepared By:
SCJ Alliance
8730 Tallon Lane NE, Suite 200
Lacey, WA 98516
360-352-1465

August 2018

SCJ ALLIANCE
CONSULTING SERVICES

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Drainage Design Report

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PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Drainage Control Plan for the Capital High School Redevelopment project has been prepared by me or under my supervision and meets the minimum standards of the City of Olympia and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

08/10/2018

Ross Jarvis, PE | Date

Ross.Jarvis@scjalliance.com
(360) 352-1465
Prepared by: Mallory Dobbs, EIT

DRAINAGE REPORT

The following report was prepared for the proposed Capital High School redevelopment project that is located on Conger Ave NW, Olympia WA. This report was prepared to comply with the minimum technical standards and requirements that are set forth in the City of Olympia *2016 Drainage Design and Erosion Control Manual (DDECM)*

SECTION 1: PROPOSED PROJECT DESCRIPTION

Project Proponent:	School District #111 1113 Legion Way SE Olympia, WA
Parcel Numbers:	12816130100
Total Parcel Area:	36.69 acres
Current Zoning:	R-4-8: Residential 4-8
Required Permits:	Grading, utility, paving, building, etc.
Site Address:	2707 Conger Ave NW, Olympia WA
Section, Township Range:	Section 16, Township 18N, Range 2W, W.M.

The proposed Capital High School redevelopment site is located on 36.69 acres. The site is bounded by Congor Ave NW to the north, residential properties to the east, residential and commercial properties to the south, and Cooper Point Road NW to the west. The proposed project will disturb approximately 2.76 acres of the parcel. Specifically, the proposed site improvements/construction activities for this project include the following:

- Demolition of a portion of the existing parking lot
- Construction of Capital High School building addition (Performing Arts Center)
- Replacement and reconfiguration of the existing parking lot
- Construction of new parking lot
- Construction/installation of on-site stormwater treatment facilities for the new and replaced parking lots

This project will be conducted in one phase. See **Appendix 3** for the Basin Map Exhibit.

A site vicinity map of the proposed project location is enclosed as **Appendix 1**. A worksheet for determining the number of Minimum Requirements for this project has been prepared and is enclosed as **Appendix 2**. Minimum requirements 1-9 are required for all of the new and replaced hard surfaces for this project. Table 1 below describes the land use of the proposed drainage basins.

LAND TYPE DESIGNATIONS	AREA (ACRES)	% OF TOTAL AREA
Total Parcel Area	**36.69**	**100**
Existing Pervious Surface	20.49	55.85
Existing Impervious Surface	16.20	44.15
Proposed Pervious Surface	20.00	54.51
Proposed Impervious Surface	16.69	45.49

Table 1: On-site Land Type Designations Summary Section

Summary of Compliance On-Site

The stormwater design complies with 5 minimum requirements as follows:

Minimum Requirement #1 – Preparation of Stormwater Site Plans – This summary is contained within the stormwater site plan.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention – A pollution prevention plan has been prepared as a standalone document which describes the 13 required elements. Further, an erosion control plan has been prepared and is part of the engineering plan set.

Minimum Requirement #3 – Source Control of Pollution – BMP's listed below are the minimum required for the site, additional BMP's not listed here may need to be implemented to meet the minimum requirements discussed in the *2016 DDECM.*

- BMP C103/C233: High Visibility Fencing/Silt Fence
- BMP 140: Dust Control
- BMP C220: Storm Drain Inlet Protection

Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls – Currently, all stormwater runoff from the project site is collected and conveyed by storm pipes and catch basins into the detention pond located on the south side of the parcel adjacent to the tennis courts. After construction, the project site will continue to be conveyed to this detention pond. Per an interlocal agreement between the City of Olympia and the school district, the pond is owned and maintained by the City of Olympia. The agreement states that the pond can be used for flow control if less than 50% of the project site is impervious surface. The pond outlets into the City of Olympia stormwater system south down Limited Lane NW, across Harrison Ave NW, down Cooper Point Road SW and into the Yauger Park stormwater facility. See **Appendix 3** for the Downstream Analysis Map.

Minimum Requirement #5 – On-site Stormwater Management, including Easements and Setbacks –According to Figure 2.4.2 of the City of Olympia *DDECM* the project triggers Minimum Requirements 1-9 for the new and replaced hard surfaces. Therefore, using Figure 2.5.1 on-site stormwater BMPs must be chosen following List #2.

- Lawn and Landscaped Areas –
    - Post Construction Soil Quality and Depth (BMP T5.13) will be followed per the *DDECM.* See landscape plans for details.
- Roofs –
    - Full Dispersion (BMP T5.30), is not feasible due to the existing development on and around the project site. There is no native vegetation adjacent to the project area for dispersion.
    - Bioretention (BMP T7.30), due to the current site plan and the proposed site plan, there is no suitable area to provide bioretention. The existing trees are being retained to the maximum extent practicable. Also, the majority of the site is underlain with approximately 8 feet of fill soils, not suitable for infiltration. Lastly, the existing stormwater conveyance systems limits the depths of the treatment facilities in order to convey the stormwater runoff to the storm pond.

- o Downspout Dispersion Systems (BMP T5.10B), is not feasible to the existing development on and around the project site.
  - o Perforated Stub-Out Connection (BMP T5.10C), a perforated stub-out connection is not feasible due to the existing site conditions. The surrounding area around the proposed building addition is paved with concrete or asphalt. Per BMP T5.10C the perforated stub out cannot be located under an impervious surface.
  - o The proposed roof and footing drains will be tight lined into the existing stormwater system on-site and discharge into the stormwater pond.
- Other Hard Surfaces –
  - o Full Dispersion (BMP T5.30) is not feasible as mentioned above.
  - o Permeable Pavement (BMP T5.15), or Rain Gardens and Bioretention (BMP T5.14) are not feasible with this redevelopment project due to the on-site soil conditions.
  - o Bioretention (BMP T7.30) is not feasible as mentioned above.
  - o All the hard surfaces (new, replaced, and existing) will continue to be detained in the stormwater pond and released into the City of Olympia stormwater system.

Minimum Requirement #6 – Runoff Treatment – Basic treatment is required for this project location and site use. On-site runoff treatment is provided by Contech stormfilters for the new and replaced hard surfaces, but not the existing hard surfaces.

Minimum Requirement #7 – Flow Control – Flow control will be provided for the entire project site by the existing stormwater pond on the south side of the parcel.

Minimum Requirement #8 – Wetlands Protection – There are no known wetlands on-site.

Minimum Requirement #9 – Operation and Maintenance – A Stormwater Facility Maintenance Program has been provided for the entire campus and is a separate document.

SECTION 2: EXISTING CONDITIONS DESCRIPTION

The subject site includes one parcel that is 36.69 acres in size. Topography within the existing development slopes gently towards catch basins located throughout the site with grades between 1 and 2 percent. The majority of the on-site stormwater runoff on-site is collected and conveyed into the stormwater pond. In the case of failure, the stormwater is allowed to overflow into the track and baseball fields to the northwest of the stormwater pond. The site has been developed with the high school since at least 1990. See Figures 1 and 2, Existing Conditions Maps below.

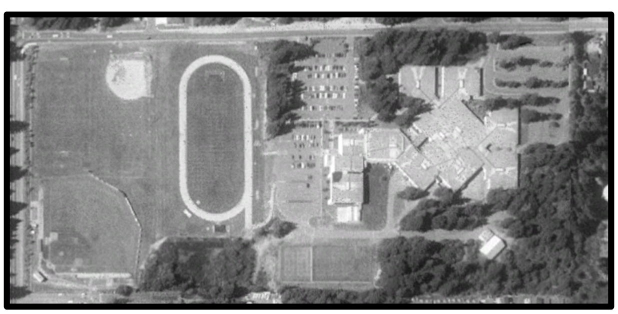

Figure 1: Existing Conditions (1990)

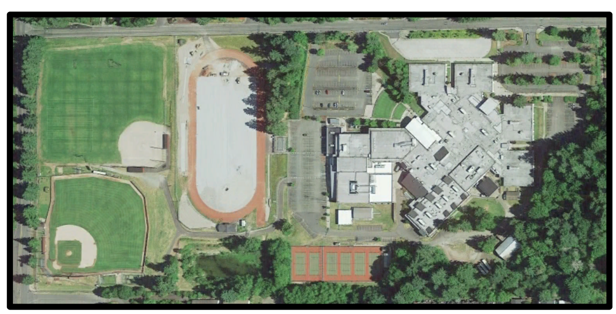

Figure 2: Existing Conditions (2017)

SECTION 3: INFILTRATION RATES/SOILS REPORTS

According to the geotechnical report prepared by Associated Earth Sciences, Inc. in March, 2004, the site is predominantly fill material from approximately 8 to 17 feet. In four of the 6 borings, they encountered medium dense to very dense, tan to gray sand with few silt and gravel interpreted as Vashon lodgement till. Dense to very dense, wet fine to medium sand with trace to few silt and gravel was also encountered below the fill soil in one boring. Infiltration rates were not given in this report. Groundwater was encountered in one boring located in the landscape island on the west side of the main building at 11 feet. See **Appendix 4** for this geotechnical report.

SECTION 4: WELLS AND SEPTIC SYSTEMS

There are no known wells or septic systems on-site.

SECTION 5: FUEL TANKS

There are no known fuel tanks on-site.

SECTION 6: SUBBASIN DESCRIPTION

Qualitative Upstream Analysis

There is no foreseen off-site run-on from the adjacent roadway or parcels that will be tributary to the existing on-site stormwater system.

Qualitative Downstream Analysis

The stormwater generated by the project site will continue to be collected, retained and released into the City of Olympia stormwater system. Stormwater runoff flows are not anticipated to increase significantly, therefore no additional off-site detention analysis is necessary. Per the stormwater agreement with the City of Olympia, the stormwater pond has sufficient storage if the project site does not have more than 50% impervious surface area coverage. After construction the parcel will have approximately 45.49% of impervious coverage therefore meeting this requirement. If the existing stormwater system fails, the stormwater will overflow into the fields located on the parcel as it does today.

SECTION 7: FLOODPLAIN ANALYSIS

The flood hazard areas within this portion of Thurston County, Washington are delineated on the Federal Emergency Mapping Agency (FEMA) National Flood Insurance Program – Flood Insurance Rate Map (FIRM) No. 53067C0162E and, 53067C0166F, revised October 16, 2012 and May 15, 2018 respectively. The project site is not located in a floodplain. See **Appendix 5** for a copy of the FEMA Map.

SECTION 8: AESTHETIC CONSIDERATIONS FOR FACILITIES

The proposed treatment facilities will be located within a storm drainage structure; therefore, it will not be visible to the public. No changes are being proposed to the existing stormwater detention system with the construction of this project. From the stormwater perspective, the project site will remain relatively unchanged.

SECTION 9: FACILITY SELECTION AND SIZING

The proposed project follows the redevelopment requirements stated in the City of Olympia 2016 *DDECM.* Following Figure 2.4.1 (See **Appendix 2**), this project qualifies as a redevelopment. The site is already substantially developed (more than 35% or more of existing hard surface coverage). This redevelopment includes the demolition of existing parking, construction of new parking, construction of a building addition, and resurfacing the existing fire lane. Following Figure 2.4.2 – Flow Chart for Determining Requirements for Redevelopment; all of the minimum requirements apply to new and replaced hard surfaces since the on-site improvements do not exceed 50% of the assessed value of the project site.

The developed site will act as a single stormwater basin with all the stormwater generated by the site being directed into the detention facility. Water quality has been sized for the new and replaced hard surfaces. The construction of this project is not anticipated to adversely affect the existing conveyance systems on-site and per the stormwater agreement the existing detention pond has sufficient capacity for the increase in impervious area.

Hydraulic Analysis

There are no known flooding problems on-site currently. The stormwater runoff flows are not anticipated to increase with the construction of this project therefore the existing conveyance system will have capacity.

Flow Control System

Flow control is provided by the existing detention facility. No new flow control facilities are proposed with this project.

Performance Standards and Goals

The basic treatment menu was applied to this project site per Section 3.5 of Volume V of the *DDECM.* There are no known treatment devices on-site currently. The proposed project will decrease the amount of pollution-generating impervious surface. Flow control is provided through the existing detention facility as mentioned before. The project will increase the total impervious surface area of the parcel by 0.49 acres. On-site conveyance is anticipated to have capacity to convey the 25-year storm within the pipe per the *DDECM*.

Water Quality System On-Site

Basic treatment is required for the new and replaced pollution-generating impervious surfaces. Based on the project areas, the proposed new and replaced hard surfaces requiring treatment is 1.70 acres. This treatment area includes the stormwater runoff from the sidewalk that will flow onto the parking areas prior to conveyance. See **Appendix 3** for the proposed areas requiring treatment. Due to the existing conveyance systems and grades in the areas requiring treatment, it is proposed that the equivalent area will be treated by one treatment facility located in the north eastern side of the parking lot.

The Contech Stormfilter using Phosphosorb media cartridges have been chosen for this project. Each 18” cartridge can treat up to 12.53 gpm. Using the Western Washington Hydrology Model (WWHM2012), the 1.70 acres of impervious surface requires treatment for 0.207 cfs (93 gpm). Therefore, this project will require 8 cartridges to treat the stormwater runoff from 1.70 acres. These cartridges will be located in a 8’x11’ vault with a grate to take stormwater runoff directly.

It is important to note that the Fire Lane around the building will be resurfaced with this project but is not included in the area calculations because it is considered a non-pollution generating surface.

SECTION 10: CONVEYANCE SYSTEM ANALYSIS AND DESIGN

All proposed conveyance systems will be sized to convey the 25-year storm in the pipe. Stormwater runoff flows are not anticipated to increase significantly with the construction of this project. There are no known flooding conditions on-site, therefore it is assumed that all on-site conveyance systems have sufficient capacity.

SECTION 11: OFFSITE ANALYSIS AND MITIGATION

All stormwater will be managed and treated on-site therefore stormwater runoff will not be received offsite.

SECTION 12: UTILITIES

All proposed utilities will be installed to avoid conflict with the existing utilities located throughout the site. The majority of the existing utilities will be protected throughout construction.

SECTION 13: COVENANTS, DEDICATIONS, EASEMENTS, AGREEMENTS

The school district will be responsible for inspection, operation, and maintenance of storm drainage facilities and execution of pollution source control programs. Per the stormwater agreement the City of Olympia is responsible for the maintenance of the stormwater detention facility.

It is also important to note that only slow release fertilizers shall be applied for the life of the development at a maximum amount of 4 lbs of nitrate as Nitrogen annually and no more than 1 lb. per application for every 1,000 square feet of turf grass. Only fertilizer formulas with a minimum of 50% water insoluble form of nitrogen are permitted for use. Approved water insoluble forms of nitrogen include sulfur and/or polymer coated fertilizers, Isobutylidene Diurea (IBDU), Methylene Urea and Ureaform, and organic fertilizers registered with Washington Department of Agriculture.

SECTION 14: OTHER PERMITS OR CONDITIONS PLACED ON THE PROJECT

Building, grading, paving, and utility permits will need to be secured prior to beginning construction activities. Coverage under Washington State Department of Ecology Phase II National Pollutant Discharge Elimination System Stormwater Permit will also need to be secured prior to beginning construction activities.

END OF DRAINAGE AND EROSION CONTROL REPORT

APPENDIX 1
SITE VICINITY MAP

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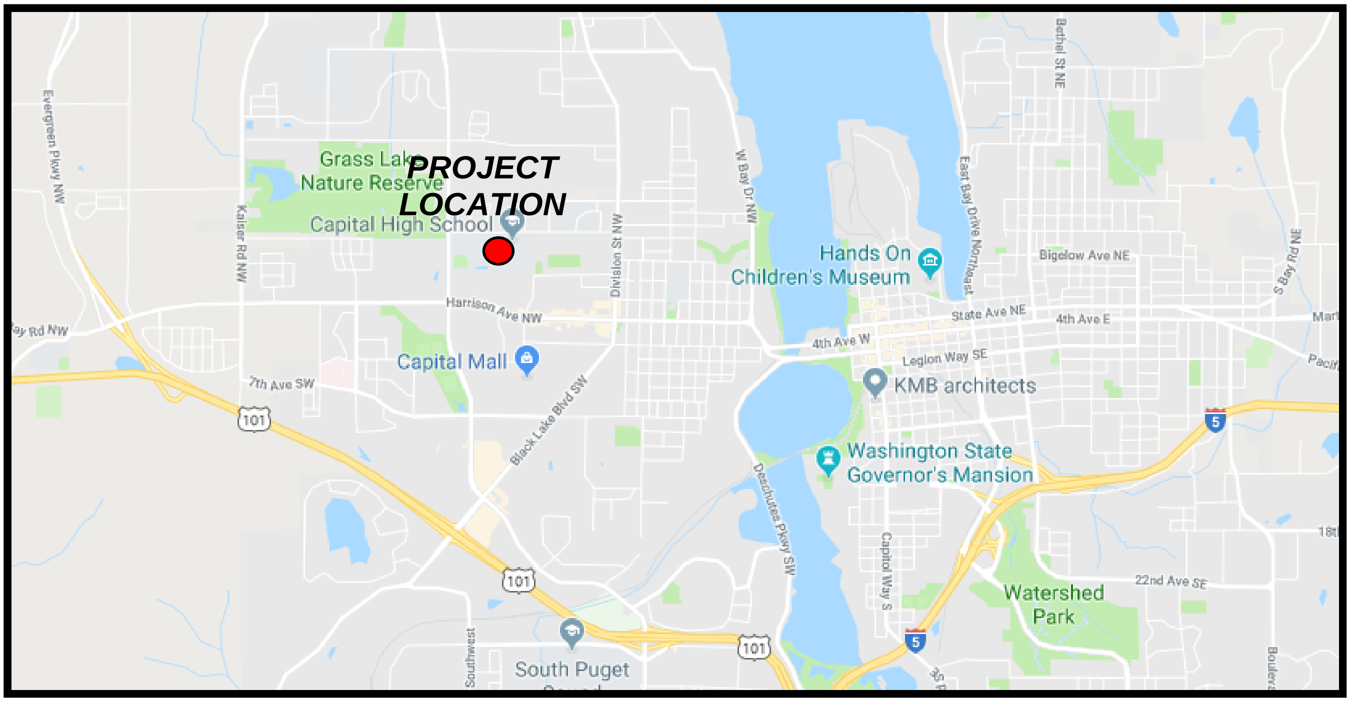
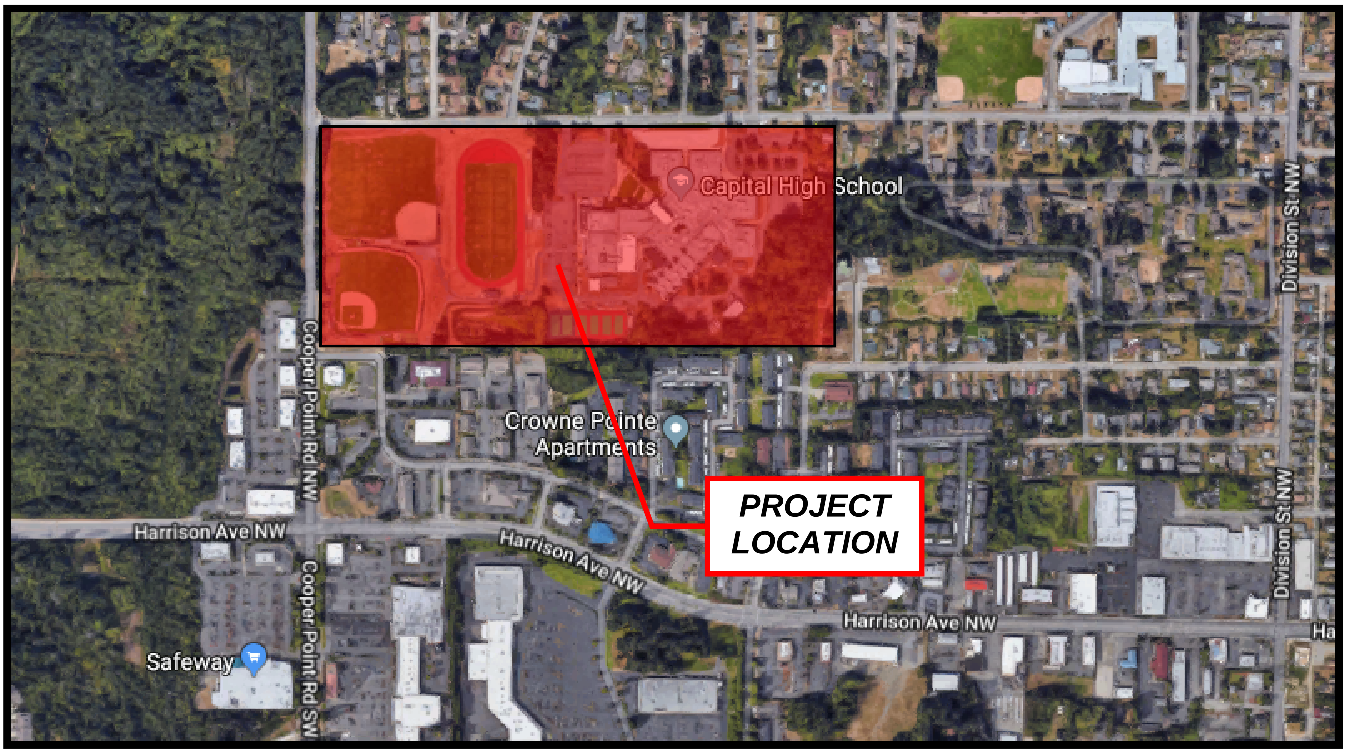




APPENDIX 2
DETERMINATION OF MINIMUM REQUIREMENTS WORKSHEET

Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

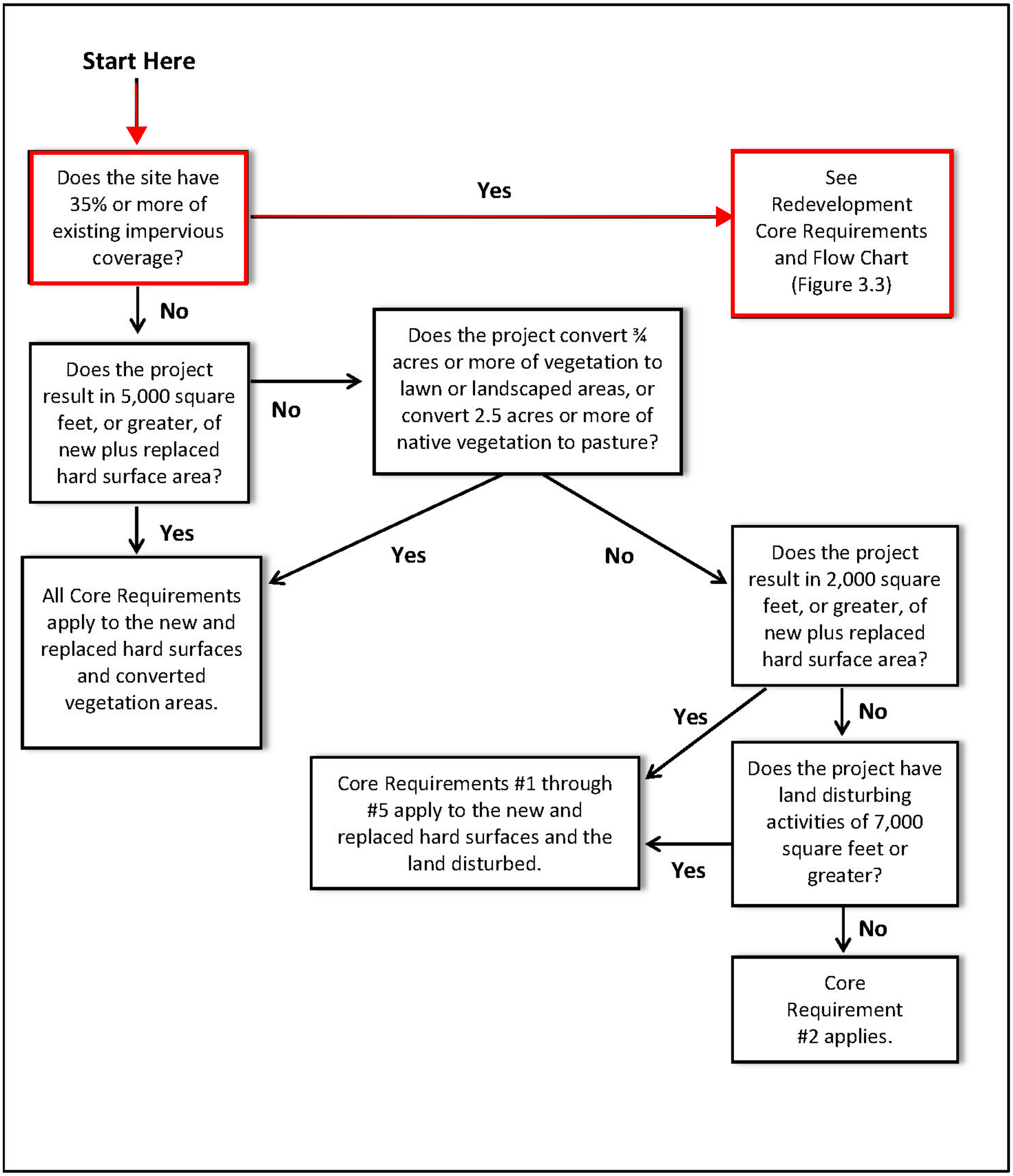
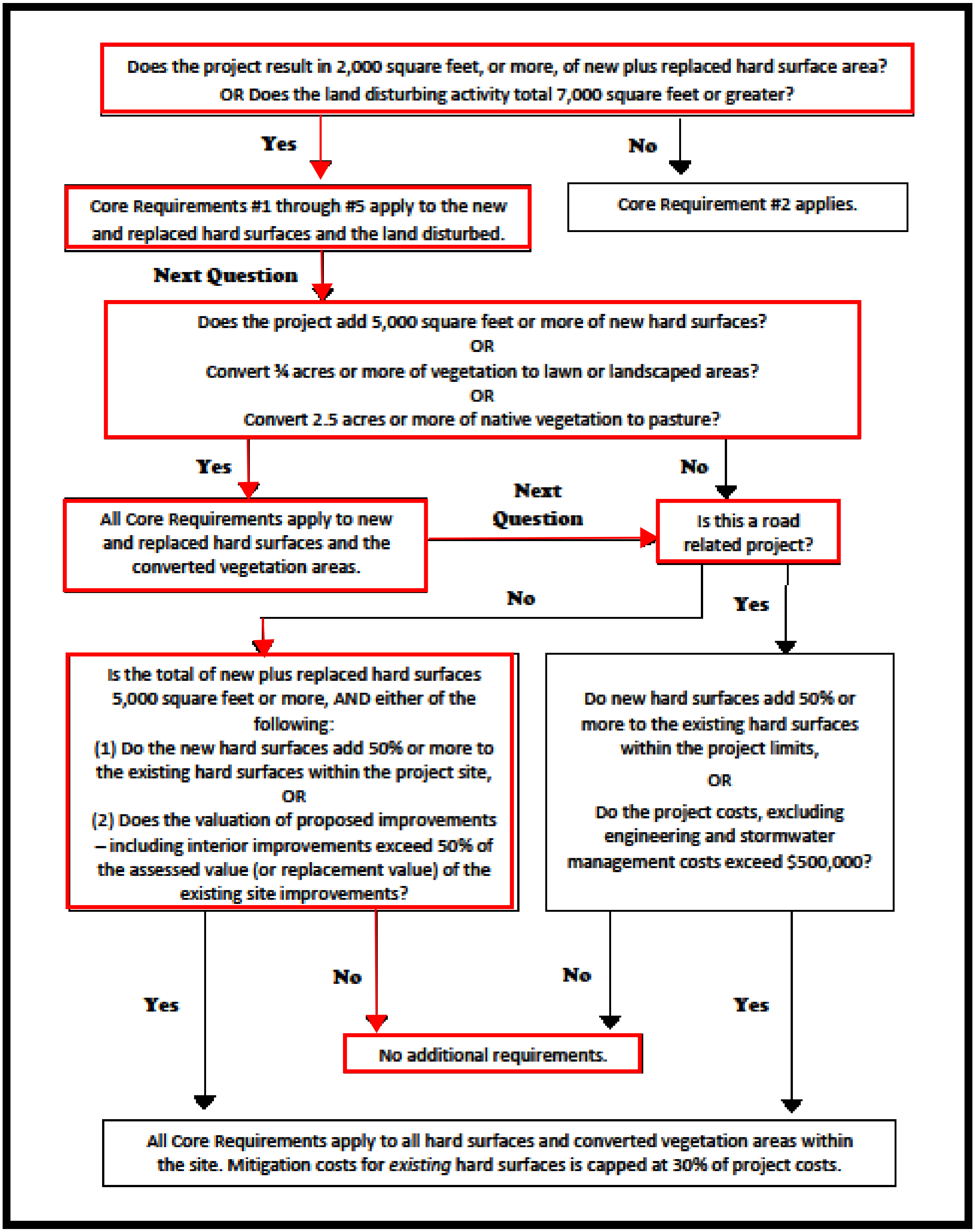


Figure 2.4.2 – Flow Chart for Determining Requirements for Redevelopment



APPENDIX 3
BASIN MAP EXHIBIT

EXISTING AREAS:

(hatched)	ROOF:	5.02 ACRES
(pink)	CONCRETE:	1.37 ACRES
(gray)	OTHER IMPERVIOUS:	9.81 ACRES
	PERVIOUS:	20.49 ACRES
	TOTAL AREA:	36.69 ACRES

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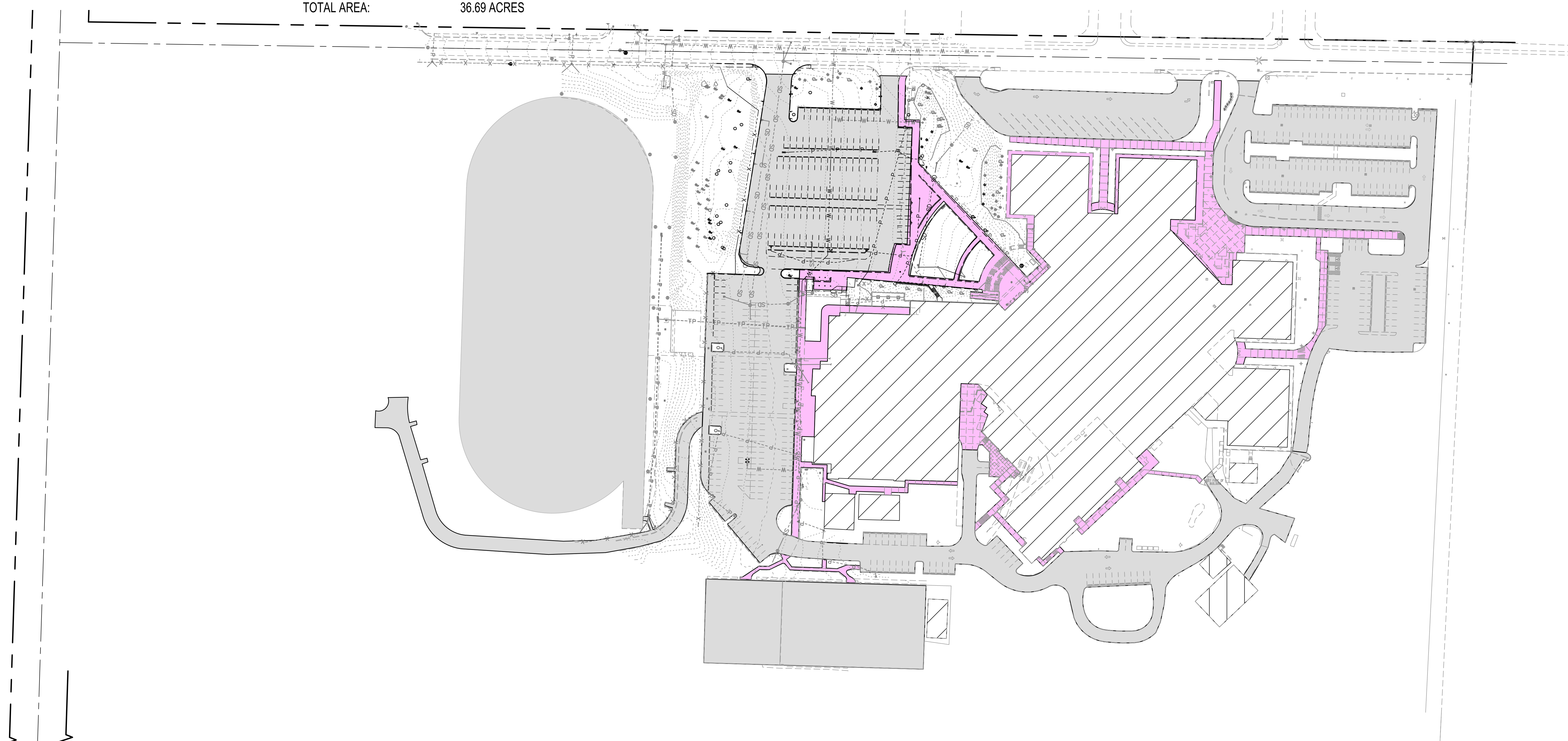
SCALE IN FEET



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HORIZONTAL SCALE: 1"=70'
DATE: AUGUST, 2018
JOB No.: 0880.11
DRAWING FILE No.: 0880.11 Ex. Conditions.dwg

EXISTING CONDITIONS MAP
CAPITAL HIGH SCHOOL REDEVELOPMENT

EXHIBIT No: 1
SHEET No: 1

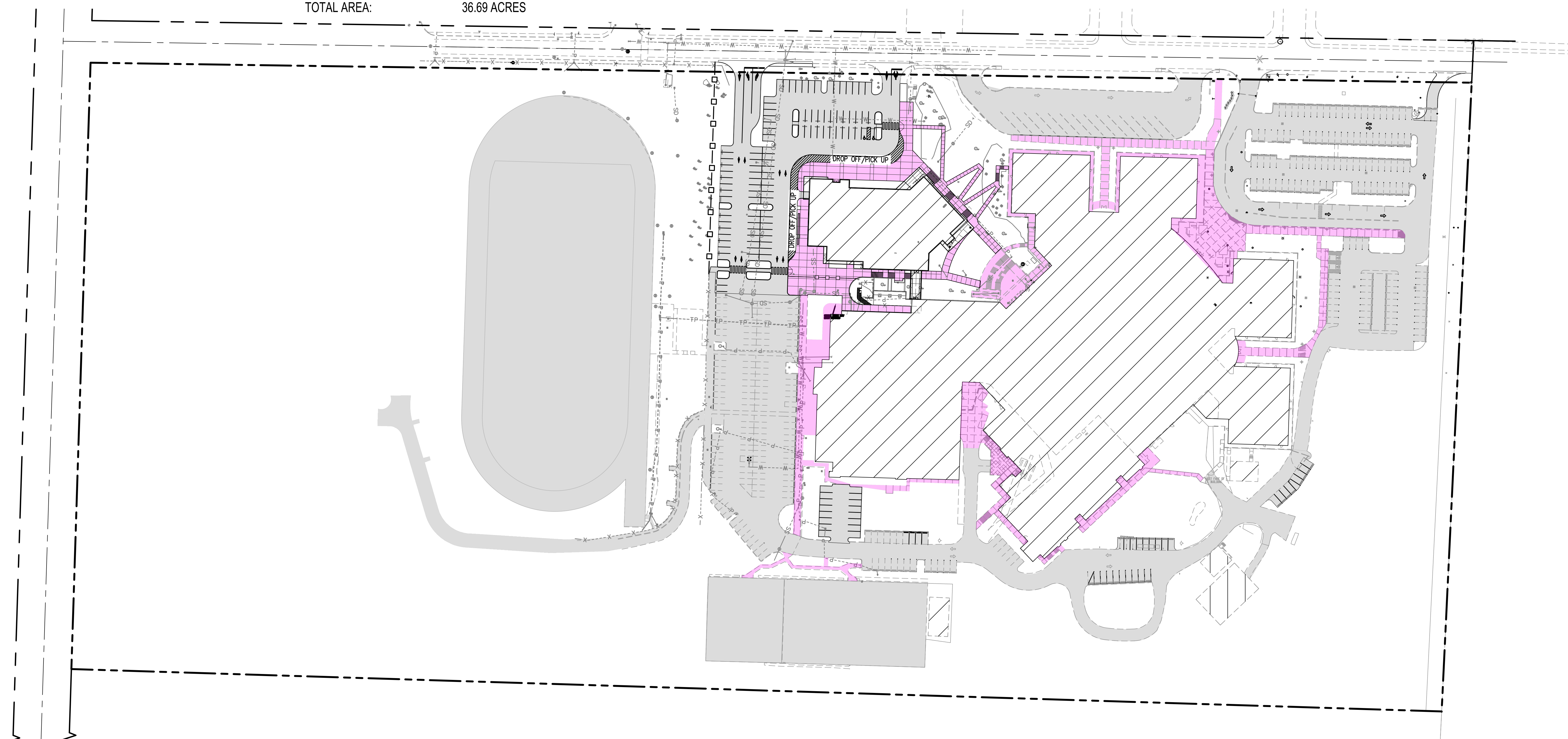
PROPOSED AREAS:

(hatched)	ROOF:	5.50 ACRES
(pink)	CONCRETE:	1.50 ACRES
(gray)	OTHER IMPERVIOUS:	9.69 ACRES
	PERVIOUS:	20.00 ACRES
	TOTAL AREA:	36.69 ACRES

N

0 20 40

SCALE IN FEET



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HORIZONTAL SCALE: 1"=70'

DATE: AUGUST, 2018

JOB No.: 0880.11

DRAWING FILE No.: 0880.11 Pr. Conditions.dwg

PROPOSED CONDITIONS MAP

CAPITAL HIGH SCHOOL REDEVELOPMENT

EXHIBIT No: 2

SHEET No: 2

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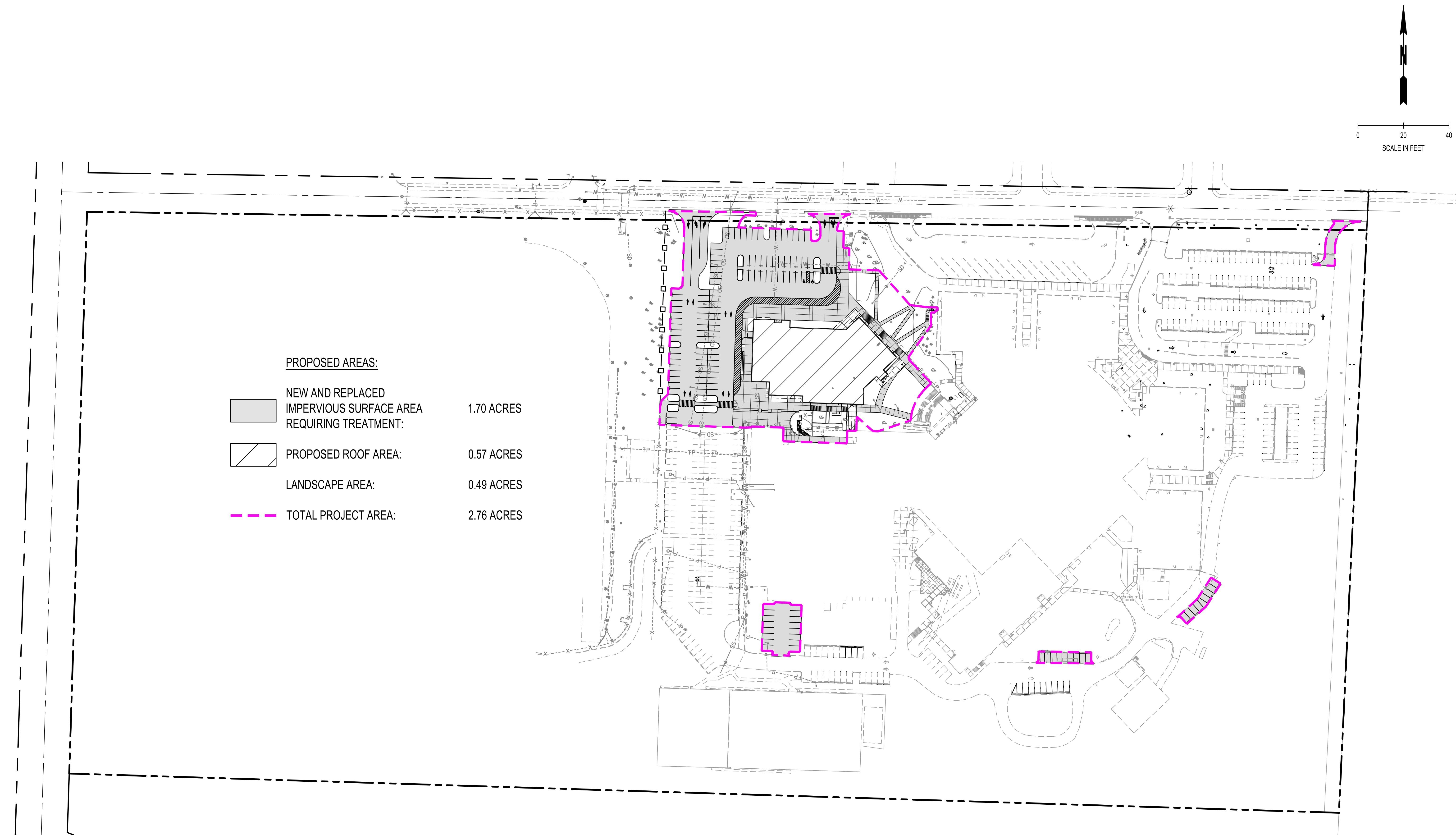

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HORIZONTAL SCALE:	1"=70'
DATE:	AUGUST, 2018
JOB No.:	0880.11
DRAWING FILE No.:	0880.11 Pr. Conditions.dwg

PROPOSED PROJECT AREAS MAP

CAPITAL HIGH SCHOOL REDEVELOPMENT

EXHIBIT No: 3

SHEET No: 3

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APPENDIX 4
GEOTECHNICAL REPORT

Subsurface Exploration, Geologic Hazards, and
Preliminary Geotechnical Engineering Report

CAPITAL HIGH SCHOOL ADDITIONS

Olympia, Washington

Prepared for:

Olympia School District

Project No. KE04044A
March 10, 2004

Associated Earth Sciences, Inc.

November 1, 2004
Project No. KE04044A

Olympia School District
1113 Legion Way SE
Olympia, Washington 98501

Attention: Mr. John McLaren

Subject: Subsurface Exploration, Geologic Hazards, and
Geotechnical Engineering Report Addendum
Proposed Capital High School Additions
Olympia, Washington

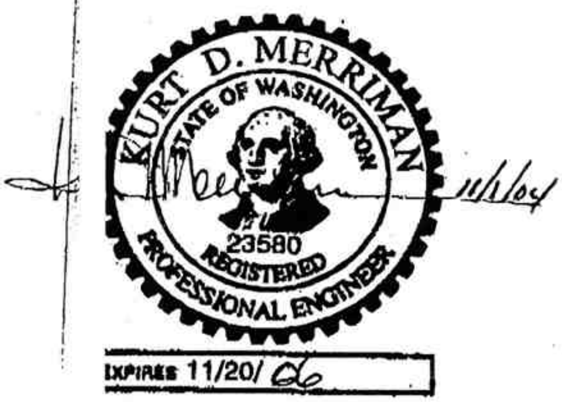
Dear Mr. McLaren:

Associated Earth Sciences, Inc. (AESI) has prepared this letter to serve as an addendum to our March 10, 2004 report titled "Subsurface Exploration, Geologic Hazards, and Preliminary Geotechnical Engineering Report - Proposed Capital High School Additions".. It is our understanding that the current project plans for the additions are as assumed within the preliminary report. As such, the March 2004 report may be viewed as the final report. We recommend that AESI perform a geotechnical review of the plans to confirm that our earthwork and foundation recommendations have been properly interpreted and implemented in the design.

We further understand that the City of Olympia has adopted the 2003 *International Building Code* (IBC). The March 2004 referenced the 2000 IBC in Section 5.4 *Ground Motion*. Information presented in Figure 1615(1) indicates a mapped spectral acceleration for short periods of S_s = 1.20g. Information presented in Figure 1615(2) indicates a mapped spectral acceleration for a 1 second period of S_1 = 0.40g. Based on the results of subsurface exploration and on an estimation of soil properties at depth utilizing available geologic data, Site Class "C" in conformance with Table 1615.1.1 may be used. Site coefficients F_a = 1.0 and F_v = 1.4 in conformance with IBC Tables 1615.1.2(1) and 1615.1.2(2), respectively, may be used.

Ve have enjoyed working with you on this study and are confident that the recommendations resented herein will aid in the successful completion of your project. If you should have any uestions, or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington



Kurt D. Merriman, P.E.
Principal Engineer

KDM/ld
KE04044A2
Projects\2004044\KE\WP

March 10, 2004
Project No. KE04044A

Olympia School District
1113 Legion Way SE
Olympia, Washington 98501

Attention: Mr. John McLaren

Subject: Subsurface Exploration, Geologic Hazards, and
Preliminary Geotechnical Engineering Report
Proposed Capital High School Additions
Olympia, Washington

Dear Mr. McLaren:

We are pleased to present our preliminary geotechnical report for the project. This report summarizes the results of our subsurface exploration, geologic hazards, and geotechnical engineering studies and offers recommendations for the design and development of the project. Our recommendations are based on preliminary site plans. Therefore, our recommendations are preliminary and we should be allowed to review and update our report as the design nears completion.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions, or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Kurt D. Merriman, P.E.
Principal Engineer

KDM/sn
KE04044A1
Projects\2004044\KE\WP - W2K

SUBSURFACE EXPLORATION, GEOLOGIC HAZARDS, AND PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

CAPITAL HIGH SCHOOL ADDITIONS

Olympia, Washington

Prepared for:
Olympia School District
1113 Legion Way SE
Olympia, Washington 98501

Prepared by:
Associated Earth Sciences, Inc.
911 5th Avenue, Suite 100
Kirkland, Washington 98033
425-827-7701
Fax: 425-827-5424

March 10, 2004
Project No. KE04044A

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of our current subsurface exploration, geologic hazards, and preliminary geotechnical engineering study for the proposed additions to the existing Capital High School. Our recommendations are based on observations gained during completion of the subsurface exploration borings referenced in this report and preliminary site plans provided by the architect. At the time of this report, construction plans have not been finalized and the recommendations contained herein should be considered preliminary. The site location is depicted on the Vicinity Map, Figure 1. The approximate exploration locations are shown on the Site and Exploration Plan, Figure 2, which is based on a copy of the site plan provided by the architect.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data to be used in the design and development of the project. Our study included reviewing selected available geologic literature, drilling exploration borings, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow ground water.

Engineering studies were also conducted to determine the type of suitable foundations, allowable foundation soil bearing pressures, anticipated settlements, basement/retaining wall lateral pressures, floor support recommendations, and drainage considerations. This report summarizes our current fieldwork and offers preliminary development recommendations based on our present understanding of the project.

1.2 Authorization

Authorization to proceed with this study was granted by the Olympia School District on February 4, 2004. Our study was accomplished in general accordance with our scope of work letter dated January 26, 2004. This report has been prepared for the exclusive use of the Olympia School District and its 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, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

This report was completed with an understanding of the project based on a preliminary site plan provided to us by the architect. The proposed project consists of construction of several new, one-story additions to the existing high school facility. New paved parking stalls are proposed on the south and west sides of the high school. A new bus drop-off lane is proposed on the north side of the high school. The project site is the location of the existing Capital High School located on the south side of Conger Avenue NW. The site is rectangular and measures approximately 880 feet (north-south) by 1,880 feet (east-west).

3.0 SUBSURFACE EXPLORATION

Our field study included drilling six exploration borings on February 18, 2004. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented in the Appendix. The depths indicated on the logs where conditions changed may represent gradational variations between sediment types in the field. If changes occurred between sample intervals in our exploration borings, they were interpreted.

The number and location of the explorations to be completed for this report were specified by the architect. However, due to conflicts with existing site features (portable classroom buildings, underground utilities, and soft/wet lawn areas) the boring locations were adjusted. Our explorations were approximately located in the field by estimating distances from known site features shown on the site plan provided to us.

The conclusions and recommendations presented in this preliminary report are based on the six exploration borings completed for this study. The number, locations, and depths of the explorations were completed within site and budget 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 appropriate changes.

3.1 Exploration Borings

The exploration borings were completed by advancing a 3½-inch inside-diameter, hollow-stem auger with a subcontracted track-mounted drill rig. During the drilling process, samples were obtained at generally 2½- to 5-foot depth intervals. The exploration borings were continuously observed and logged by a geotechnical engineer from our firm. The exploration logs presented in the Appendix are based on the field logs, drilling action, and inspection of the secured samples.

Disturbed but representative samples were obtained from the exploration borings by using the Standard Penetration Test 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 blows are recorded within one 6-inch interval, the blow count is recorded as the number of blows for the corresponding 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 exploration 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.

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 selected geologic literature. As shown on the exploration logs (included as an Appendix to this report) and detailed below, the explorations generally encountered glacial soils with some areas of fill soil.

4.1 Stratigraphy

Fill

Fill soils (those not naturally placed) were encountered in exploration borings EB-3, EB-5, and EB-6. The fill ranged in thickness from approximately 8 to 17 feet. As noted on the exploration logs, the fill consisted of loose to medium dense, moist to very moist, tan, brown and gray sand with variable amounts of silt and gravel. These materials appear to vary in both quality and depth across the site. Since the quality, thickness, and compaction of the fill materials is low or variable, the fill is considered unsuitable for structural support in its current state. Fill soil should also be expected around the existing foundations and above underground utilities.

The fill soil encountered within EB-6 (to the termination depth of the boring) is likely wall backfill. It is our understanding that the structure wall adjacent to EB-6 is a retaining wall with a footing elevation near the termination depth of EB-6. This boring was terminated at approximately 17 feet where concrete was encountered.

Lodgement Till

Four exploration borings (EB-1, EB-2, EB-4, and EB-5) encountered medium dense to very dense, tan to gray sand with few silt and gravel interpreted as Vashon lodgement till. Lodgement till was deposited at the base of an active continental glacier and was compacted by the weight of the overlying glacial ice. Lodgement till is suitable for structural support when properly prepared. Excavated lodgement till material is suitable for use in structural fill applications if suitable moisture conditions are achieved, which could require drying during favorable dry weather.

Advance Outwash

Dense to very dense, wet, fine to medium sand with trace to few silt and gravel was encountered within EB-3 below the fill soil. This material was interpreted as Vashon advance outwash. Advance outwash was deposited by meltwater streams in front of an advancing continental glacier and was subsequently compacted by the weight of the glacier. Advance outwash sediments are suitable for structural support if properly prepared, and are suitable for reuse in structural fill applications if suitable moisture conditions are achieved.

Our classification of the geologic units at the site is generally consistent with a published geologic map of the area (*Geologic Map of the South Half of the Tacoma Quadrangle, Washington* by Timothy J. Walsh, dated 1987).

4.2 Hydrology

Ground water seepage was encountered in one exploration boring (EB-3) at the time of our field study. As shown on Figure 2, this boring was located within the lawn area on the northwest side of the existing high school building. The lawn in this area was very soft and wet with some standing water observed during our field study. The ground water seepage was encountered at approximately 11 feet within EB-3 within the unit interpreted to be advance outwash.

The ground water occurrence was interpreted to represent ground water that is preferentially contained in more granular layers of interbedded soils. Ground water conditions should be expected to vary with changes in season, precipitation, on- and off-site land usage, and other factors.

II. SEISMIC HAZARDS AND MITIGATIONS

The following discussion of potential seismic hazards is based on the geologic and ground water conditions as observed and discussed herein.

5.0 SEISMIC HAZARDS AND RECOMMENDED MITIGATION

Earthquakes occur in the Puget Lowland with great regularity. Fortunately, the vast majority of these events are small and are usually not felt. However, large earthquakes do occur as evidenced by the February 28, 2001, 6.8-magnitude event, the 1965, 6.5-magnitude event, and the 1949, 7.2-magnitude event. The 1949 earthquake appears to have been the largest in this area during recorded history.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture; 2) seismically induced landslides; 3) liquefaction; and 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

5.1 Surficial Ground Rupture

Generally, the largest earthquakes, which have occurred in the Puget Sound area, are sub-crustal events with epicenters ranging from 50 to 70 kilometers in depth. For this reason, no surficial faulting, or earth rupture, as a result of deep, seismic activity has been documented to date, in the Kirkland area. Therefore, it is our opinion based on existing geologic data that the risk of surface rupture impacting the proposed project is low and no mitigations are recommended.

5.2 Seismically Induced Landslides

Due to generally dense subsurface conditions and relatively mild slope inclinations, the potential for seismically induced slope failures on the site is considered low.

5.3 Liquefaction

Liquefaction is a process through which unconsolidated soil loses strength as a result of vibratory shaking, such as that which occurs during a seismic event. During normal conditions, the weight of the soil is supported by both grain-to-grain contacts, and by the pressure within the pore spaces of the soil below the water table. Extreme vibratory shaking can disrupt the grain-to-grain contact, increase the pore pressure, and result in a decrease in soil shear strength. The soil is said to be liquefied when nearly all of the weight of the soil is supported by pore pressure alone. Liquefaction can result in deformation of the sediment, and settlement of overlying structures. Areas most susceptible to liquefaction include those areas underlain by coarse silt and sand with low relative densities, accompanied by a shallow water table.

Our exploration borings encountered medium dense to dense, fine-grained, typically unsaturated soils that are not considered susceptible to liquefaction. A rigorous liquefaction analysis was not completed and is not considered necessary for the project as it is currently envisioned.

5.4 Ground Motion

Based on the site stratigraphy and visual reconnaissance of the site, it is our opinion that any earthquake damage to the proposed additions (founded on a suitable bearing strata) would be caused by the intensity and acceleration associated with the event and not any of the above-discussed impacts. Structural design of the building should follow 1997 *Uniform Building Code* (UBC) standards for Seismic Zone 3 (Z-Factor = 0.3, 1997 UBC Table 16I), and a soil profile type S_C (1997 UBC Table 16J).

Alternatively, guidelines presented in the 2000 *International Building Code* (IBC) may be used. Information presented in Figure 1615(1) indicates a mapped spectral acceleration for short periods of S_s = 1.20g. Information presented in Figure 1615(2) indicates a mapped spectral acceleration for a 1 second period of S_1 = 0.38g. Based on the results of subsurface exploration and on an estimation of soil properties at depth utilizing available geologic data, Site Class "C" in conformance with Table 1615.1.1 may be used. Site coefficients F_a = 1.0 and F_v = 1.42 in conformance with IBC Tables 1615.1.2(1) and 1615(2), respectively, may be used.

6.0 EROSION HAZARDS AND MITIGATION

The site soils generally contain substantial quantities of silt and fine-grained sand and will be sensitive to erosion. In order to reduce the amount of sediment transport off the site during construction, the following recommendations should be followed.

1. All storm water from impermeable surfaces and adjacent downspout and footing drains should be tightlined into an approved storm water drainage system or temporary storage facilities and kept away from the proposed addition work areas.

2. If possible, construction should proceed during the drier periods of the year and disturbed areas should be revegetated, paved, or otherwise protected as soon as possible.

3. Demolition and clearing beyond the new addition areas and related new paving areas should be kept to a minimum.

4. Temporary silt fences should be provided along the lower margins of cleared/disturbed areas.

5. Temporary sediment catchment facilities should be cleaned out and maintained periodically as necessary to maintain their capacity and function.

6. Soils, which will be stockpiled at the site, should be stored in such a manner as to reduce erosion. Protective measures may include, but are not necessarily limited to, covering with plastic sheeting, or the use of straw bales/silt fences.

7. All nearby catch basins should be provided with inlet protection.

III. PRELIMINARY DESIGN RECOMMENDATIONS

7.0 INTRODUCTION

Our exploration indicates that, from a geotechnical standpoint, the subject site is suitable for the proposed additions, related paving, and associated improvements provided the recommendations contained herein are properly followed. The bearing stratum is relatively shallow and spread footing foundations may be used.

8.0 SITE PREPARATION

Site preparation of the planned addition areas should include removal of all existing landscaping and associated organic soils, existing pavement, debris resulting from the demolition of existing buildings, and any other surficial deleterious materials. Areas where loose surficial soils exist below finished grade due to demolition or grubbing operations should be considered as fill to the depth of disturbance and treated as subsequently recommended for structural fill placement. Topsoil should be removed from the site or used as fill in landscape or other non-structural areas.

Old foundations presently on the site which are under building areas or not part of future plans should be removed. Any buried utilities should be removed or relocated if they are under building areas. The resulting depressions should be backfilled with structural fill as discussed under the *Structural Fill* section.

We are not aware of any existing underground storage tanks (USTs), wells, or septic systems on-site; however, if any are present they should be decommissioned in accordance with applicable regulations and removed from beneath structural areas. Erosion and surface water control should be established around the clearing limits to satisfy City of Olympia requirements. Adequate temporary dewatering equipment should be available and used as needed to control ground water to facilitate construction activities.

8.1 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, bus loop drop-off, new parking stalls, installation of underground utilities, and other proposed improvements. 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 an effective drainage system is not used, 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 buildings at all times. Water must not be allowed to pond or to collect adjacent to foundations or within the immediate building area. We recommend 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.

8.2 Wet Weather Conditions

If construction proceeds during an extended wet weather construction period, and the moisture-sensitive fill, lodgement till, and advance outwash soils become wet, they will 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 silty 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.

8.3 Subgrade Protection

As discussed above, the site soils that were encountered beneath the proposed addition areas are considered to be moisture- and disturbance-sensitive. These soils will 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 stripping and grading activities are performed during extended dry weather periods, we anticipate that site stabilization requirements will be much less. However, it should be noted that portions of the native soils were naturally wet at the time of our exploration and that intermittent wet weather periods during the summer months could delay earthwork if soil moisture conditions become elevated above the optimum moisture content.

If construction will proceed in the winter, we recommend the use of a working surface of sand and gravel, crushed rock, or quarry spalls to protect the silty soils, particularly in areas supporting concentrated equipment traffic. In winter construction staging areas, a minimum thickness of 12 inches of quarry spalls or 18 inches of pit run sand and gravel is recommended. If subgrade conditions are soft and silty, a geotextile separation fabric such as Mirafi 500x or approved equal should be used between the subgrade and the new fill. For building pads where floor slabs and foundation construction will be completed in the winter, a similar working surface should be used, composed of at least 12 inches of pit run sand and gravel or crushed rock. Construction of working surfaces from advancing fill pads could be used to avoid directly exposing the subgrade soils to vehicular traffic.

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.

8.4 Proof-rolling and Subgrade Compaction

Following the recommended site stripping procedures and required excavation to grade, the stripped subgrade within the building additions and pavement areas should be proof-rolled with heavy rubber-tired construction equipment, such as a fully loaded tandem-axle dump truck. Proof-rolling should be performed prior to structural fill placement or foundation excavation.

The proof-roll 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.

Proof-rolling should only be attempted if soil moisture contents are at or near optimum moisture content. Proof-rolling 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.

8.5 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. During dry weather periods, soft/wet soils, which may need to be overexcavated, may be encountered in some portions of the site. If overexcavation is necessary, it should be confirmed through continuous observation and testing by Associated Earth Sciences, Inc. (AESI). 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.

8.6 Temporary and Permanent Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, however, temporary, unsupported cut slopes in the lodgement till and advance outwash deposits can be planned at a maximum slope of 1H:1V (Horizontal:Vertical) or flatter. Temporary unsupported cut slopes in existing fill can be planned at a maximum slope of 1.5H:1V or flatter.

As is typical with earthwork operations, some sloughing and raveling may occur and cut slopes may have to be adjusted in the field. If ground water seepage is encountered in cut slopes, or if surface water is not routed away from temporary cut slope faces, flatter slopes will be required. In addition, WISHA/OSHA regulations should be followed at all times.

Permanent cut and structural fill slopes that are not intended to be exposed to surface water should be designed at inclinations of 2H:1V or flatter. All permanent cut or fill slopes should be compacted to at least 95 percent of the modified Proctor maximum dry density as determined by ASTM:D 1557, and the slopes should be protected from erosion until vegetation cover can be established during favorable weather.

8.7 Frozen Subgrades

If earthwork takes place during freezing conditions, all exposed subgrades should be allowed to thaw and then be recompacted prior to placing subsequent lifts of structural fill or foundation components. Alternatively, the frozen material could be stripped from the subgrade to reveal unfrozen soil prior to placing subsequent lifts of fill or foundation components. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months.

9.0 STRUCTURAL FILL

Structural fill may be necessary to establish desired grades and backfill utility trenches. 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.

Where fill is to be placed on slopes steeper than 5H:1V, the base of the fill should be tied to firm, stable subsoil by appropriate keying and benching, which would be established in the field to suit the particular soil conditions at the time of grading. The keyway acts as a shear key to embed the toe of the new fill into the hillside. Generally, the keyway for hillside fills should be at least 8 feet wide and cut into the underlying dense to very dense native soil. Level benches should then be cut horizontally across the hill, following the contours of the slope. No specific width is required for the benches, although they are usually a few feet wider than the dozer being used to cut them. All fills proposed over a slope should be reviewed by our office prior to construction.

After stripping, planned excavation, and any required overexcavation has been performed to the satisfaction of the geotechnical engineer/engineering geologist, 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. In the case of roadway and utility trench filling, the backfill should be placed and compacted in accordance with current City of Olympia codes and standards. 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 angle of 2H:1V.

The contractor should note that any proposed fill soils must be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material 72 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. Most of the various on-site soils generally contained significant amounts of silt and are considered moisture-sensitive.

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 and with at least 25 percent retained on the No. 4 sieve.

A representative from our firm should observe the 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 identified and corrected as they are encountered. 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.

10.0 FOUNDATIONS

Spread footings may be used for building support when founded on undisturbed lodgement till, advance outwash, or on approved structural fill placed as previously discussed. To limit differential settlements between footings that bear on approved structural fill and those that bear on dense till, we recommend that an allowable bearing pressure of 3,000 pounds per square foot (psf) be used for design purposes, including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loading. Perimeter footings should be buried at least 18 inches into the surrounding soil for frost protection; interior footings require only 12 inches burial. However, all footings must penetrate to the prescribed bearing stratum and no footing should be founded in or above loose, organic, or existing fill soils. To limit settlements, 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 retaining wall, 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 bearing soils or near existing retaining walls.

Care should be exercised where new foundations are to be constructed adjacent to existing building footings. New foundation subgrade elevations should match existing if possible. New foundations placed at a higher elevation than existing footings will impose a vertical and horizontal surcharge to the existing foundations. New footings founded at a lower elevation than existing may undermine the existing foundations. Undermined foundations may need to be underpinned. We recommend the project structural engineer review the impacts, if any, of new foundations or existing foundations.

Anticipated settlement of footings founded on lodgement till, advance outwash, or approved structural fill should be on the order of ¾ inch or less. However, disturbed soil not removed from footing excavations prior to footing placement could result in increased settlement. All footing areas should be inspected by AESI prior to placing concrete to verify that the design bearing capacity of the soils has been attained and that construction conforms to the recommendations contained in this report. Such inspections may be required by the governing municipality. Perimeter footing drains should be provided as discussed under the section on *Drainage Considerations*.

11.0 LATERAL WALL PRESSURES

All backfill behind walls or around foundation units should be placed as per our recommendations for structural fill and as described in this section of the report. Horizontally backfilled walls, which are free to yield laterally at least 0.1 percent of their height, may be designed using a lateral pressure represented by an equivalent fluid equal to 35 pounds per cubic foot (pcf). Fully restrained, horizontally backfilled rigid walls that cannot yield should be designed for an equivalent fluid of 55 pcf.

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of on-site soils compacted to 90 percent of ASTM:D 1557. A higher degree of compaction is not recommended as this will increase the pressure acting on the wall. A lower compaction may result in settlement of structures supported above the walls. Thus, the compaction level is critical and must be tested by our firm during placement. Surcharges from adjacent footings, heavy construction equipment, or sloping ground must be added to the above values. Perimeter footing drains should be provided for all retaining walls as discussed under the section on *Drainage Considerations*.

It is imperative that proper drainage be provided so that hydrostatic pressures do not develop against the walls. This would involve installation of a minimum 1-foot-wide blanket drain for the full wall height using imported, washed gravel that meets Washington State Department of Transportation (WSDOT) Standard Specification 9-03.12(4) against the walls.

11.1 Passive Resistance and Friction Factors

Retaining wall footings/keyways cast directly against undisturbed, dense lodgement till or advance outwash soils in a trench may be designed for passive resistance against lateral translation represented by an equivalent fluid equal to 350 pcf. The passive equivalent fluid pressure diagram begins at the top of the footing; however, total lateral resistance should be summed only over the depth of the actual key (truncated triangular diagram). This value applies only to footings/keyways where concrete is placed directly against the trench sidewalls without the use of forms. If footings are placed on grade and then backfilled, the top of the compacted backfill must be horizontal and extend outward from the footing for a minimum lateral distance equal to three times the height of the backfill, before tapering down to grade. With backfill placed as discussed, footings may be designed for passive resistance against lateral translation using an equivalent fluid equal to 250 pcf and the truncated pressure diagram discussed above. Passive resistance values include a factor of safety of 3 in order to reduce the amount of movement necessary to generate passive resistance.

The friction coefficient for footings cast directly on undisturbed structural fill or native soils may be taken as 0.35. This is an allowable value and includes a safety factor of at least 2. Since it will be difficult to excavate these soils without disturbance, the soil under the footings must be recompacted to 95 percent of the above-mentioned standard for this value to apply.

12.0 FLOOR SUPPORT

Slab-on-grade floors may be used over structural fill or pre-rolled medium dense or denser natural ground. A subgrade modulus of 40 pounds per cubic inch (pci) can be assumed for design. The floors should be cast atop a minimum of 4 inches of washed pea gravel to act as a capillary break. They should also be protected from dampness by covering the capillary break with an impervious moisture barrier a minimum of 10 mils in thickness.

13.0 DRAINAGE CONSIDERATIONS

All retaining and footing walls should be provided with a drain at the footing 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 at 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. In addition, all retaining walls should be lined with a minimum 12-inch-thick washed gravel blanket that meets WSDOT Standard Specification 9.03.12(4) provided to within 1 foot of finish grade that ties into the footing drain.

Roof and surface runoff should 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 structure to achieve surface drainage.

14.0 PAVEMENT RECOMMENDATIONS

The proposed new parking stalls and the proposed new bus loop drop-off lane are expected to be underlain by firm native soils or structural fill. These soils are expected to provide a suitable subgrade for pavement support. Site preparation for areas to be paved should consist of overexcavating to remove the topsoil and the loose/soft portion of the upper soils and expose the underlying stable sediments. Since the density of the upper soils is variable, random, loose/soft areas may exist and the depth and extent of stripping can best be determined in the field by the geotechnical engineer. In addition, the subgrade should be slightly crowned to drain toward the edges of the paved area.

After the area to be paved is overexcavated, the exposed ground should be recompacted to 95 percent of ASTM:D 1557. If required, structural fill may then be placed to achieve desired subbase grades. Upon completion of the recompaction and structural fill, the recommended minimum pavement section in areas of planned passenger car driving and parking is:

- 2½ inches of asphaltic concrete pavement (ACP) underlain by
- 2 inches of ⁵/₈-inch crushed surfacing top course and
- 3 inches of 1¼-inch crushed surfacing base course

In heavy traffic areas, the minimum recommended pavement section should consist of:

- 3 inches of ACP underlain by
- 2 inches of ⁵/₈-inch crushed surfacing top course and
- 4 inches of 1¼-inch crushed surfacing base course

The crushed rock courses must be compacted to 95 percent of the maximum density as determined by ASTM:D 1557. All paving materials should meet gradation criteria contained in the current WSDOT Standard Specifications.

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 or structural 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.

15.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

At the time of this report, construction plans have not been finalized and the recommendations contained herein should be considered preliminary. 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 foundation 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 part of this current scope of work. If these services are desired, please let us know and we will prepare a cost proposal.

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

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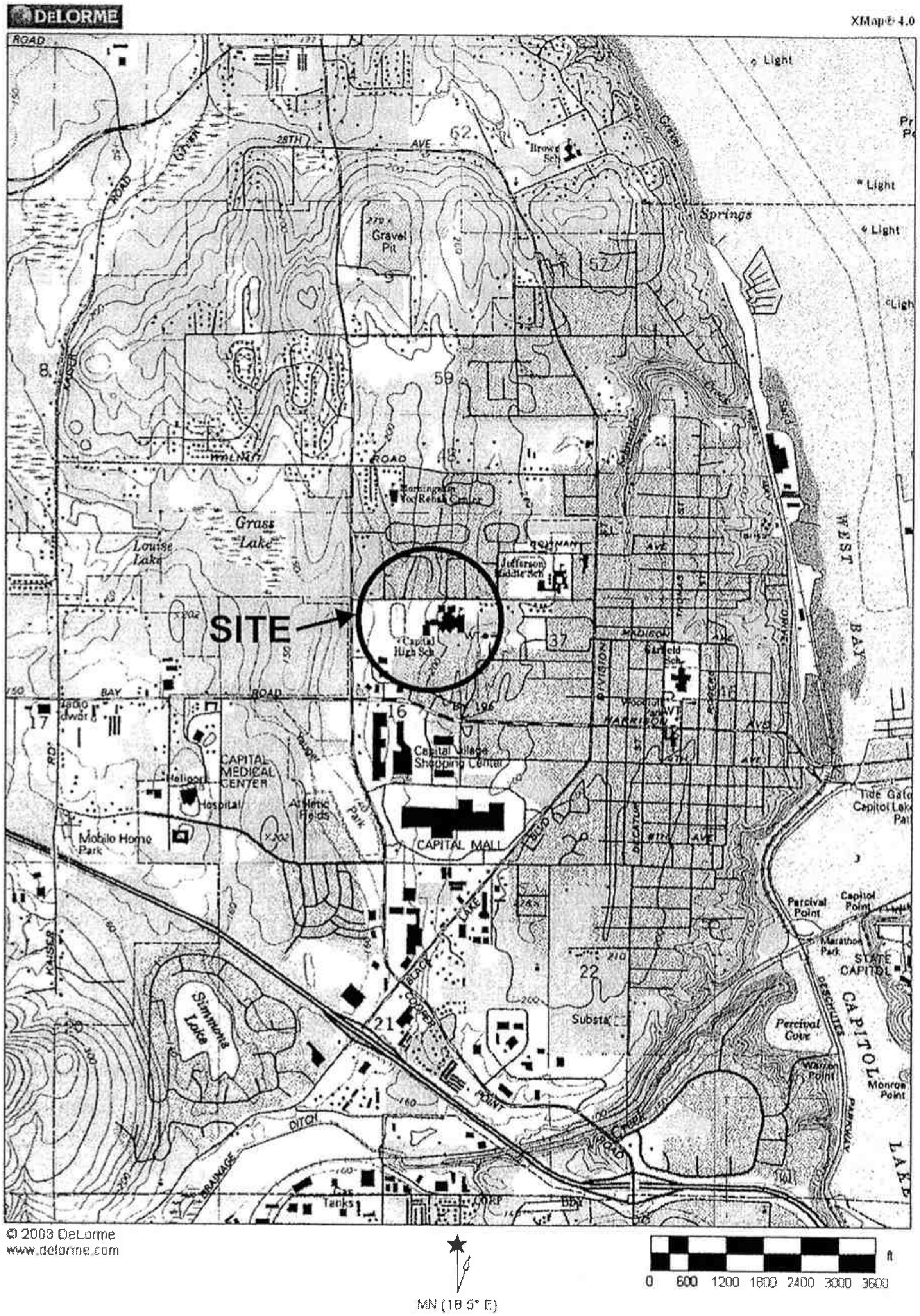
Attachments: Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan
Appendix: Exploration Logs

APPENDIX



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VICINITY MAP
CAPITAL HIGH SCHOOL ADDITIONS
OLYMPIA, WASHINGTON

FIGURE 1

DATE 2/04

PROJ. NO. KE04044A

Coarse-Grained Soils - More than 50%[1] Retained on No. 200 Sieve	Gravels - More than 50%[1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines[5]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥15% Fines[5]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50%[1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines[5]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥15% Fines[5]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50%[1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT[2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

	Consistency	SPT[2] blows/foot
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

[3] Estimated Percentage

Component	Percentage by Weight
Trace	<5
Few	5 to 10
Little	15 to 25
With	- Non-primary coarse constituents: ≥ 15% - Fines content between 5% and 15%

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols

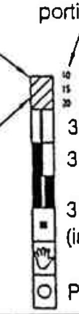
Sampler Type

Blows/6" or portion of 6"

2.0" OD Split-Spoon Sampler (SPT)

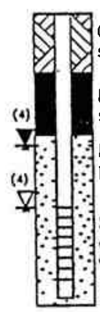
Bulk sample

Grab Sample



Sampler Type Description

3.0" OD Split-Spoon Sampler
3.25" OD Split-Spoon Ring Sampler
3.0" OD Thin-Wall Tube Sampler (including Shelby tube)
Portion not recovered



Cement grout surface seal
Bentonite seal
Filter pack with blank casing section
Screened casing or Hydrotip with filter pack
End cap

[1] Percentage by dry weight
[2] (SPT) Standard Penetration Test (ASTM D-1586)
[3] In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
[4] Depth of groundwater
▼ ATD = At time of drilling
▽ Static water level (date)
[5] Combined USCS symbols used for fines between 5% and 15%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

blocks\log_key.dwg 11/02/01

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Exploration Log Key

FIGURE
A-1

Associated Earth Sciences, Inc.

Exploration Log

Project Number	Exploration Number	Sheet
KE04044A	EB-1	1 of 1

Project Name	Capital High School Additions	Ground Surface Elevation (ft)	
Location	Olympia, WA	Datum	N/A
Driller/Equipment	Boretec	Date Start/Finish	2/18/04,2/18/04
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Till					
		S-1		Very moist, light brown grading to moist, slightly oxidized. tan, fine SAND with few silt and gravel.			2 11 11	▲22	
5		S-2		Moist, tan, fine SAND with few silt and gravel.			2 35 41	▲76	
10		S-3		Moist, tan, fine SAND with few silt and gravel.			8 50 50/4"	▲100/10"	
				Bottom of exploration boring at 11.5 feet					
15									
20									
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: MAM
Approved by:

Associated Earth Sciences, Inc.

Exploration Log

Project Number	Exploration Number	Sheet
KE04044A	EB-2	1 of 1

Project Name: Capital High School Additions
Location: Olympia, WA
Driller/Equipment: Boretec
Hammer Weight/Drop: 140# / 30"

Ground Surface Elevation (ft):
Datum: N/A
Date Start/Finish: 2/18/04,2/18/04
Hole Diameter (in):

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Till Very moist, tan, fine to medium SAND with some silt, few gravel.					
		S-1					6 8 15	▲23	
5		S-2		Moist, tan-gray, fine SAND with some silt and gravel.			29 50/5"	▲50/5"	
10		S-3		Moist, tan grading to gray, fine SAND with few silt and gravel.			50 50/3"	▲50/3"	
				Bottom of exploration boring at 11 feet					
15									
20									
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: MAM
Approved by:

Associated Earth Sciences, Inc.

Exploration Log

Project Number	Exploration Number	Sheet
KE04044A	EB-3	1 of 1

Project Name	Capital High School Additions	Ground Surface Elevation (ft)	
Location	Olympia, WA	Datum	N/A
Driller/Equipment	Boretec	Date Start/Finish	2/18/04,2/18/04
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Fill					
		S-1		Very moist, tan, fine to medium SAND with some silt and gravel.			2 9 13	▲22	
5		S-2		Moist, brown and gray, fine SAND with few silt and gravel, charcoal.			7 8 6	▲14	
				Advance Outwash					
10		S-3		Wet, gray, fine to medium SAND with trace silt and gravel.		▽	10 14 22	▲36	
15		S-4		Wet, gray, fine to medium SAND with few silt and gravel grading to moist, tan, fine SAND with few silt and gravel.			18 23 50	▲73	
				Bottom of exploration boring at 16.5 feet					
20									
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: MAM
Approved by:

Associated Earth Sciences, Inc.

Exploration Log

Project Number	Exploration Number	Sheet
KE04044A	EB-4	1 of 1

Project Name	Capital High School Additions	Ground Surface Elevation (ft)	
Location	Olympia, WA	Datum	N/A
Driller/Equipment	Boretec	Date Start/Finish	2/18/04,2/18/04
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot	Other Tests
				Till					
		S-1		Moist, tan, fine SAND with few silt and gravel.			28 33 32	65	
5		S-2		Moist, tan, fine SAND with few silt and gravel.			38 39 28	67	
10		S-3		Moist, tan, fine SAND with few silt and gravel.			26 50/4"	50/4"	
				Bottom of exploration boring at 11 feet					
15									
20									
25									
30									
35									

Sampler Type (ST):

2" OD Split Spoon Sampler (SPT) — No Recovery — M - Moisture

3" OD Split Spoon Sampler (D & M) — Ring Sample — Water Level ()

Grab Sample — Shelby Tube Sample — Water Level at time of drilling (ATD)

Logged by: MAM

Approved by:

Associated Earth Sciences, Inc.

Exploration Log

Project Number	Exploration Number	Sheet
KE04044A	EB-5	1 of 1

Project Name	Capital High School Additions	Ground Surface Elevation (ft)	
Location	Olympia, WA	Datum	N/A
Driller/Equipment	Boretec	Date Start/Finish	2/18/04,2/18/04
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	

Depth (ft)	S T	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot (10 20 30 40)	Other Tests
				Fill					
		S-1		Moist, brown SAND with few silt and gravel.			15 12 7	19	
5		S-2		Moist, brown SAND with few silt and gravel.			4 4 4	8	
				Till					
10		S-3		Moist, brown SAND with few silt and gravel.			20 45 50/5"	95/11"	
				Bottom of exploration boring at 11.5 feet					
15									
20									
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: MAM
Approved by:

Associated Earth Sciences, Inc.

Exploration Log

Project Number	Exploration Number	Sheet
KE04044A	EB-6	1 of 1

Project Name	Capital High School Additions	Ground Surface Elevation (ft)	
Location	Olympia, WA	Datum	N/A
Driller/Equipment	Boretec	Date Start/Finish	2/18/04,2/18/04
Hammer Weight/Drop	140# / 30"	Hole Diameter (in)	

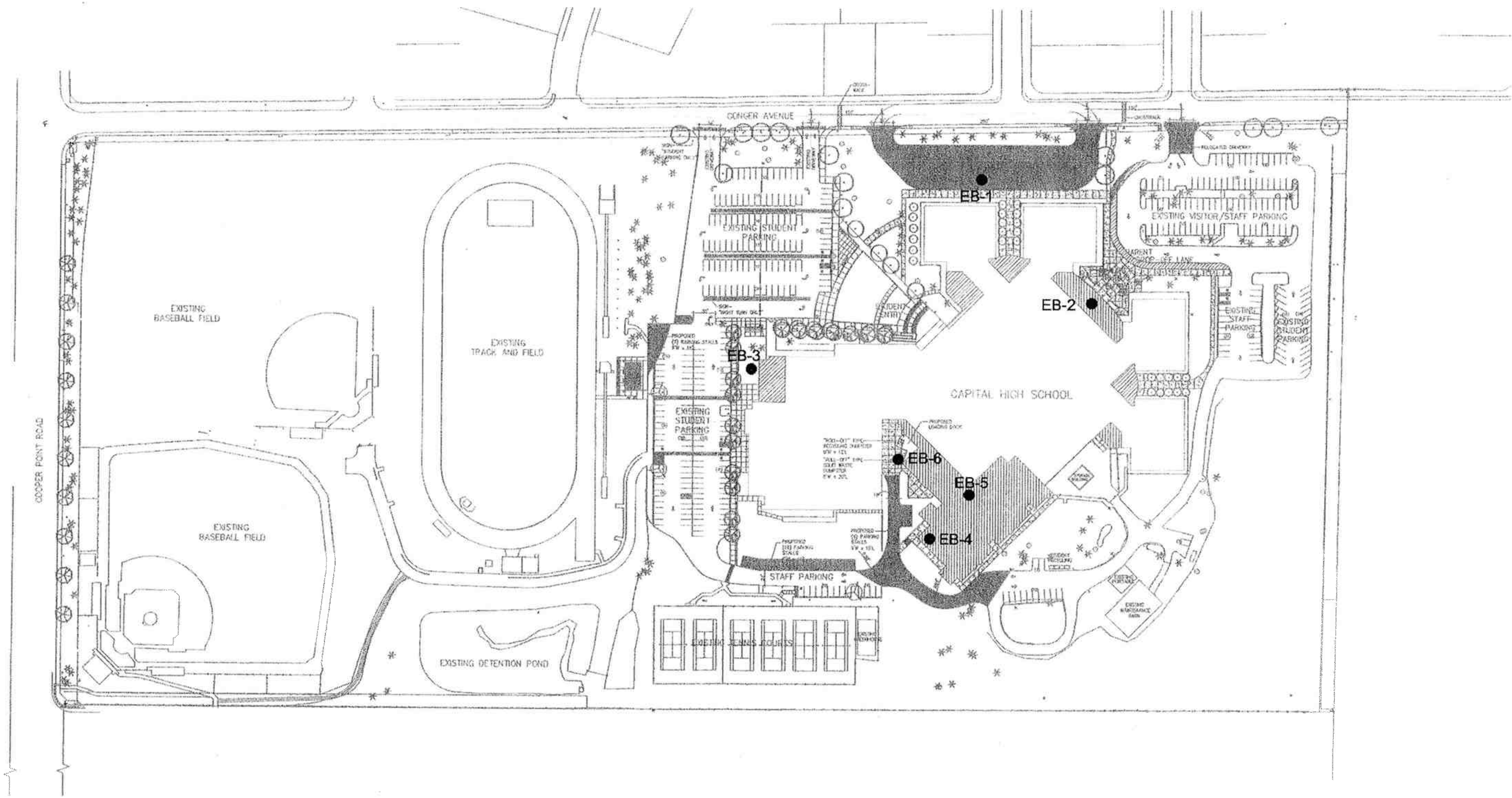
Depth (ft)	ST	Samples	Graphic Symbol	DESCRIPTION	Well Completion	Water Level	Blows/6"	Blows/Foot	Other Tests
				Fill					
		S-1		Very moist, tan SAND with some silt, few gravel.			3 8 9	17	
5		S-2		Very moist, tan SAND with some silt, few gravel.			7 7 10	17	
10		S-3		Very moist, tan SAND with some silt, few gravel.			7 5 4	9	
15		S-4		Very moist, tan SAND with few silt and gravel.			5 19 50/4"	69/10"	
				Bottom of exploration boring at 17 feet due to refusal on concrete.					
20									
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: MAM

Approved by:



LEGEND

EB-1 ● Approximate location of exploration boring

REFERENCE: BLRB ARCHITECTS.

Associated Earth Sciences, Inc.

SITE AND EXPLORATION PLAN
CAPITAL HIGH SCHOOL ADDITIONS
OLYMPIA, WASHINGTON

FIGURE 2

DATE 2/04

PROJECT NO. KE04044A

APPENDIX 5

FEMA FLOOD INSURANCE RATE MAP

National Flood Hazard Layer FIRMette

FEMA

47°3'15.36"N

122°56'30.07"W

122°55'52.61"W

47°2'50.85"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth
- Regulatory Floodway *Zone AE, AO, AH, VE, AR*

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The base map shown complies with FEMA's base map accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/27/2018 at 5:38:02 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: base map imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX 6
DESIGN CALCULATIONS AND COMPUTATIONS

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	0880.11 CHS PAC WQ Flows
Site Name:	
Site Address:	
City:	
Report Date:	8/9/2018
Gage:	Green Cove
Data Start:	1955/10/01
Data End:	2011/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2018/03/08
Version:	4.2.14

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data
Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
A B, Forest, Flat	1.7
Pervious Total	1.7
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.7

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

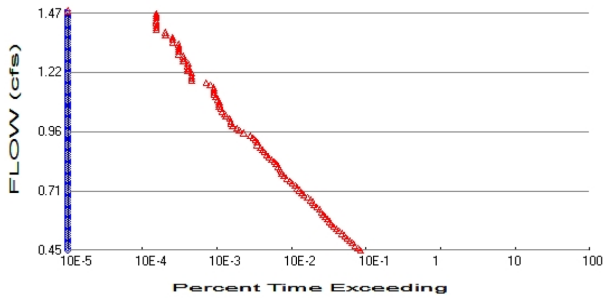
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
PARKING FLAT	1.7
Impervious Total	1.7
Basin Total	1.7

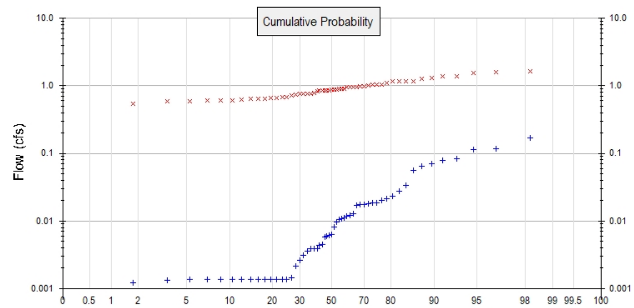
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.7
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 1.7

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.006828
5 year	0.025336
10 year	0.05102
25 year	0.108827
50 year	0.178616
100 year	0.280074

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.903636
5 year	1.164438
10 year	1.289194
25 year	1.407565
50 year	1.474529
100 year	1.527944

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.065	0.867
1957	0.012	1.164
1958	0.006	0.651
1959	0.004	1.169
1960	0.020	1.175
1961	0.084	0.542
1962	0.001	0.902
1963	0.070	1.376
1964	0.028	0.843
1965	0.018	0.943

1966	0.002	0.836
1967	0.006	0.683
1968	0.006	0.592
1969	0.004	0.594
1970	0.004	0.641
1971	0.019	0.611
1972	0.078	0.947
1973	0.001	0.615
1974	0.011	1.047
1975	0.006	0.777
1976	0.012	0.904
1977	0.001	1.178
1978	0.008	0.848
1979	0.001	1.020
1980	0.010	0.722
1981	0.013	1.033
1982	0.004	1.026
1983	0.004	1.586
1984	0.023	0.952
1985	0.001	0.686
1986	0.017	0.770
1987	0.017	0.731
1988	0.001	0.641
1989	0.001	0.881
1990	0.118	1.537
1991	0.057	1.109
1992	0.001	0.752
1993	0.001	0.843
1994	0.001	0.960
1995	0.011	0.843
1996	0.115	1.296
1997	0.018	1.258
1998	0.004	0.983
1999	0.003	0.877
2000	0.000	0.137
2001	0.171	1.394
2002	0.003	0.761
2003	0.001	0.663
2004	0.034	1.619
2005	0.001	0.627
2006	0.001	0.665
2007	0.021	0.846
2008	0.001	0.986
2009	0.010	0.764
2010	0.001	0.904
2011	0.019	0.605

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.1709	1.6188
2	0.1178	1.5863
3	0.1149	1.5373
4	0.0838	1.3939
5	0.0779	1.3760
6	0.0701	1.2956
7	0.0650	1.2575
8	0.0566	1.1777

9	0.0336	1.1753
10	0.0277	1.1690
11	0.0230	1.1639
12	0.0213	1.1093
13	0.0204	1.0469
14	0.0186	1.0331
15	0.0186	1.0255
16	0.0180	1.0201
17	0.0176	0.9862
18	0.0175	0.9827
19	0.0168	0.9603
20	0.0127	0.9517
21	0.0120	0.9473
22	0.0119	0.9427
23	0.0111	0.9044
24	0.0107	0.9040
25	0.0104	0.9016
26	0.0096	0.8807
27	0.0082	0.8771
28	0.0063	0.8668
29	0.0062	0.8484
30	0.0060	0.8462
31	0.0059	0.8434
32	0.0045	0.8431
33	0.0043	0.8430
34	0.0039	0.8362
35	0.0039	0.7772
36	0.0039	0.7698
37	0.0036	0.7643
38	0.0031	0.7613
39	0.0026	0.7525
40	0.0021	0.7314
41	0.0014	0.7222
42	0.0014	0.6862
43	0.0014	0.6828
44	0.0014	0.6646
45	0.0014	0.6629
46	0.0014	0.6509
47	0.0014	0.6413
48	0.0014	0.6407
49	0.0014	0.6268
50	0.0014	0.6150
51	0.0014	0.6110
52	0.0014	0.6046
53	0.0014	0.5944
54	0.0013	0.5919
55	0.0012	0.5425
56	0.0001	0.1367

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.304 acre-feet
On-line facility target flow:	0.3679 cfs.
Adjusted for 15 min:	0.3679 cfs.
Off-line facility target flow:	0.2067 cfs.
Adjusted for 15 min:	0.2067 cfs.

Disclaimer

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