Attachment N

INSPIRING KIDS PRESERVE

THURSTON COUNTY, WASHINGTON

Project # 10181900021

Drainage and Erosion Control Plan

June 3, 2020

Prepared for:

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kpff

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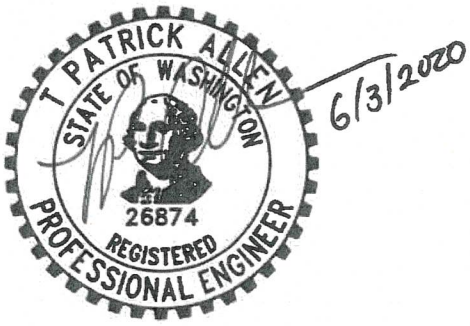
PROJECT ENGINEERS CERTIFICATION:

I hereby state that this Drainage and Erosion Control Plan/Construction SWPPP for Inspiring Kids Preserve has been prepared by me or under my supervision and meets the requirements of the Thurston County Drainage Design and Erosion Control Manual and the standard of care and expertise which is usual and customary in this community for professional engineers. I understand that Thurston County does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.



Capital Land Trust
Inspiring Kids Preserve
PROJECT # 10181900021
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1.0 PROJECT DESCRIPTION

1.1 Permits

Project may require the following permits from Thurston County:

- Conditional Use Permit
- Right-of-Way Permit
- Wetlands/Critical Areas Permit
- Forest Land Conversion
- SEPA
- Shoreline Permit.
- Grading Permit
- Construction Permit
- Building Permit
- On-Site Septic Approval
- Group B Water System Approval

1.2 Project Location

The project at is located at 4849 Johnson Point Road SE Olympia, Washington.

The project site is located on Thurston County Parcel Numbers: 11929110500, 11928220800, 11928230100, 11929140000, 11928230200, 11929440200, 11928320500, and 11928320000.

See Appendix A, Vicinity Map for project location.

The project location is situated between Johnson Point Road on the east and Henderson Inlet on the west. The property is currently undeveloped land owned by the Capital Land Trust.

1.3 Property Boundaries and Zoning

Parcels 11928230100, 11928230200, 11928320500, and 11928320000 are adjacent to Johnson Point Road.

See Appendices B and C Pre-Developed and Developed Site Conditions.

The parcels is zoned RRR 1/5 (Rural Residential/Recourse – One unit per five acre).

Under the RRR 1/5 zoning, educational facilities are allowed with a Special Use Permit. Maximum building coverage in this zone under a Special Use Permit is 20,000 square feet for parcels over ten acres in size. Hard surface limits for new construction in this zone is, for lots 2.5 acres and greater, ten percent.

Under Special Use provisions of TCC Title 20.54, the proposed site use is not listed as a specific Special Use. Per the pre-submittal meeting held with Thurston County, the County may find a similar permitted use and review the proposed use as similar to the permitted use. The County indicated that an Academic School (TCC 2.054.070(1) may be the most similar listed permitted use by a Special Use Permit. The project is subject to the specific and general standards of Title 20.54.

1.4 Project Description

The project site is a 112-acre nature preserve located off Johnson Point Road in northern Thurston County, including a mile of shoreline along Henderson Inlet. The purpose of the project is to facilitate the use of the nature preserve for educational purposes. Proposed improvements include a new access road, parking, a vehicle/bus turnaround loop, plaza, open air building, restroom with on-site septic system, Group B water system and access to site trails.

The new access from Johnson Point Road requires installation of a new culvert and construction of ingress and egress tapers consistent with Thurston County Road Standards for access to a major collector.

A 24-ft width, paved, access road with a paved 5-ft sidewalk along the north side will extend approximately 450-feet to a proposed bus/vehicle turnaround loop. A plaza area with a small (40-ft x 30-ft, 1200 sf) open air interpretive center building will be constructed at the far western end of the project.

The vehicle turnaround loop will provide access to the building and plaza as well as proposed interpretive trails. Two vehicle parking areas are proposed including an 8-stall parking area along the north side of the access road beginning about 75-ft from Johnson Point Road and a 16-stall parking area within the loop turnaround. Three handicap stalls will be provided. Vertical curbs will be provided along the roadway in front of the plaza area. In other areas, the sidewalk will be at grade to facilitate sheet flow runoff to dispersion areas.

Current plans not include a new well for water service and a small bathroom facility with associated on-site septic system.

The project area is approximately 1.4 acres and the site is currently undeveloped forest land with some isolated wetlands. The project proposes approximately 33,000 square feet of new impervious surfaces and 26,000 square feet of converted pervious surfaces.

1.5 Timing of the Project

It is anticipated that construction of the project will begin as soon as the Thurston County Construction Permit is obtained and is anticipated to be completed within 6 months of start of construction.

1.6 Summary of Core requirements

1.1.1 Core Requirement #1: Stormwater Site Planning

The project does not meet the criteria for an Abbreviated Drainage Plan and therefore requires a full Drainage and Erosion Plan (DECP) including a Drainage Report (this document), Construction SWPPP, Drawings and Specifications, and a Maintenance Plan.

1.1.2 Core Requirement #2: Construction Stormwater Pollution Plan

A full Construction SWPPP will be prepared as part of the final DECP and will be included in Appendix F.

1.1.3 Core Requirement #3: Source Control of Pollution

A source control plan will be prepared as part of the final DECP and will be included in Appendix G. Appendix G contains the source control checklist submitted with the Scoping Report.

1.1.4 Core Requirement #4: Preservation of Natural Drainage System and Outfalls

The project site consists of two Threshold Discharge Areas (TDAs) with about 60% of the developed area within the eastern TDA and the remaining 40% in the western TDA (see Appendix E, Stormwater Work Map). The project generally maintains the existing natural drainage patterns. Due to site grades, some small areas from the west TDA are routed to the east TDA; however, all drainage is dispersed to native vegetation and this minor diversion is inconsequential.

1.1.5 Core Requirement #5: On-site Stormwater Management

Core Requirement #5 will be met through the use of full dispersion in accordance with LID.11. Dispersion of runoff from the majority of impervious and converted pervious surfaces will be dispersed into at least 100-feet of native vegetation. A small area of the site (<5,000 sf impervious) will drain directly to Johnson Point Road and its adjacent ditch. Another small area (2,375 sf) near Johnson Point Road will sheet flow through between 25 and 100-ft of native vegetation before reaching the roadside ditch/wetland along Johnson Point Road.

Full dispersion is feasible because 65% of the site will remain in native conditions and impervious areas make up less than 10% of the site.

Dispersion of runoff will be through a combination of sheet flow dispersion directly from proposed roads and other impervious areas as well as multiple point discharges to rock pads and dispersion into a minimum of 100-ft of native vegetation. All point discharges will be for flows of less than 0.2 CFS.

1.1.6 Core Requirement #6: Runoff Treatment

With the exception of the small areas adjacent to Johnson Point Road, all impervious surfaces are fully dispersed in accordance with LID.11 therefore; the discharge of untreated stormwater into the ground is permitted.

For the area immediately adjacent to Johnson Point Road, runoff will either sheet flow down a fill embankment to the adjacent roadside ditch or flow to the south edge of the proposed new access apron and sheet flow to the new culvert outlet point. Runoff continues south in the roadside ditch toward a small wetland area within the subject property.

1.1.7 Core Requirement #7: Flow Control

With the exception of the area immediately adjacent to Johnson Point Road, all runoff from the site is fully dispersed in accordance with LID.11, which results in eliminating the flow control facility requirement. See CR #5 for description of dispersion facilities. The total impervious surface in the area of Johnson Point Road is less than 10,000 square feet and the increase in flow from the existing to the post-developed is less than 0.15 cfs (0.08 per WWHM), therefore this area is not subject to flow control

1.1.8 Core Requirement #8: Wetland Protection

Wetlands are present on the project site and on adjacent areas to the property. Discharges to dispersion areas at such that the dispersion flow path does not intersect most on-site wetlands within 100-feet. However, at the entrance from Johnson Point Road, two sub-basins discharge to a roadside wetland. The total impervious area of this discharge is less than 10,000 square feet and the discharge does not result in an increase in flows greater than 0.15 cfs (0.08 cfs, see Appendix D, WWHM Results) from the pre-developed conditions; therefore, the provisions of Core Requirement #8 do not apply to that discharge.

1.1.9 Core Requirement #9: Operation and Maintenance

An Operation and Maintenance Manual will be completed and recorded with the maintenance agreement prior to final project acceptance by Thurston County. Responsibility for operation and maintenance of the stormwater facilities will be by the property owner, Capital Land Trust.

1.1.10 Core Requirement #10: Financial Liability

Since there are no significant stormwater facilities for this project except point discharges to dispersion areas, and sheet flow, the applicant requests to be exempted from the financial liability requirement of the DDECM.

1.1.11 Core Requirement #11: Off-site Analysis and Mitigation

With the exception of the small area at the site entrance, all stormwater runoff will be fully dispersed on-site into at least 100-ft of native vegetation. Based on a review of site maps, Thurston County Geodata and a site visit by the project engineer, for the small area discharging to the Johnson Point Road ditch, it appears that the existing ditch along Johnson Point road drains to existing low areas and wetlands on the subject property and does not connect to any downstream receiving waters or conveyances. No known drainage problems occur in the vicinity of the project downstream from the property.

2.0 EXISTING SITE CONDITIONS

2.1 Site Topography

Site topography varies from relatively flat to slopes approaching 20 percent within the project limits.

Along the west side of Johnson Point Road there is a drop to the toe of the road embankment of about four to five feet, then, along the proposed road alignment, the ground rises for about 400 feet at slopes of five to six percent to a high-point at elevation 140. It then slopes down to the west at five to seven percent for about 200 feet. Beyond this the slope steepens to about 15 to 18 percent and in some locations up to about 20 percent at the far west end beyond the developed area.

2.2 Ground Cover

Vegetation consists of evergreen and deciduous trees, brush and some grassy open areas. By aerial photograph records it appears the site was logged, but not completely clear-cut, just prior to 2002 and has regrown since then. It also appears that tree re-planting may have occurred around 2009. Dirt roads appear in aerial photographs from 2002 to 2009 but have now grown over due to lack of use.

There are known wetlands on the property, most are outside the proposed project limits. Two small wetlands are located north and south of the access from Johnson Point Road, a wetland mitigation plan is being prepared for impacts to those two wetlands due to construction of the access point. In areas of wetlands, typical wetland plants would be expected. A wetland delineation was conducted of wetlands which are mapped on the site plan and a wetlands report is available.

No known unique or sensitive vegetation occurs within the project limits.

2.3 Drainage

Drainage within the project area is split into two Threshold Discharge Areas (TDA). The developed area is split 60/40 between the eastern and western TDAs, respectively.

The eastern TDA drains southerly and easterly toward Johnson Point Road and the adjacent property to the south. Several small wetlands occur within this area both within and beyond the project limits and some drainage is to those wetlands.

The western TDA drains southerly and westerly toward Henderson Inlet located about 600 feet to the west of the westerly project limits. Runoff from the project area does not appear to discharge via any defined channels prior to reaching Henderson Inlet.

2.4 Soils

A geotechnical report was prepared for the site by Landau and Associates in March of 2020. A copy of the geotechnical report is included in Appendix I. Five test pits were excavated at the site to depth of between 12 and 15 feet on February 26, 2020. Locations are shown on the TESC plan sheet.

Subsurface conditions at the site are mapped as Vashon Till (Qgt), a highly compact mixture of low permeability clay, sand and gravel deposited directly by glaciation.

Soils underlying the surface conditions (6 to 10 inches of topsoil) are categorized into two units: Recessional Lacustrine and Glacial Till. The Recessional material was observed in all test pits and exhibits low bearing capacity and very low infiltration rates. The Glacial Till was observed in two test pits (TP-4 and TP-5). Cobbles were observed in one test pit (TP-4) and are often found in glacial deposits.

The geotechnical report indicates that perched groundwater was observed at 6-feet below ground surface at one test pit (TP-4), which is located near a small isolated wetland south of the project limits. No groundwater was located in any other test pits. A true groundwater table was not observed during site explorations.

The Natural Resources Conservation Service (NRCS) mapped soils within the project limits and into the proposed dispersion areas include Alderwood Gravelly Sandy Loam, 15 to 30 percent slopes (HSG B) and Kapowsin Silt Loam (HSG D), 3 to 15 percent slopes. The Kapowsin soils cover the majority of the proposed developed area of the site including the majority of the roadway and most of the dispersion areas. The Alderwood soils are located on the far west end of the project toward the end of the roadway and in the vicinity of the proposed plaza and building.

According to NRCS, both Alderwood and Kapowsin soils are moderately well drained with a low to moderately low infiltration rate (Ksat) of 0.00 to 0.06 in/hr. The geotechnical report indicates that site infiltration capacity is limited (0.05 in/hr).

The NRCS soils map and report for the site is included in Appendix H.

2.5 Critical Areas

The site has been assessed for critical area impacts based on review of the critical area maps available on the Thurston County Geodata website and it has been determined that there are several wetlands located throughout the parcel. Wetlands were delineated and a wetlands report prepared. A mitigation approach is proposed for the impact to the two small wetlands located immediately adjacent to Johnson Point Road. No other wetlands are within the limits of the proposed project improvements.

No other critical areas are identified within the limits of the proposed project improvements. Geologic hazard areas associated with marine bluffs and steep slopes are located approximately 800-ft to the southwest off the proposed project on adjacent land under separate ownership.

The area along Henderson Inlet, approximately 600-ft west of the proposed project area is subject to Shorelines regulations and is designated Conservancy shoreline. Development limitations within the Conservancy Shoreline generally begin when work occurs less than 200-ft from the shoreline.

2.6 Adjacent Areas

The project site abuts Johnson Point Road where a new access point will be constructed consistent with Thurston County Road Standards. Property to the south and downslope of the property is residential, with a single home on a large lot. The property is located over 500-feet south of the proposed developed area. Across Johnson Point Road to the east there are several single-family residences. Property immediately to the North is owned by the Capital Land Trust and north of that (over 1000-feet) is additional residential development on large lots.

2.7 Precipitation Records

Precipitation records within the WWHM 2012 model will be used for all stormwater analysis on this project.

2.8 Reports and Studies

The Henderson Inlet is subject to a TMDL. A Basin Plan for the Woodland Creek basin was prepared, but this project is outside of the study area of that Basin Plan. No additional requirements are known to apply to this project at this site based on existing studies and reports.

3.0 GEOTECHNICAL REPORT

See Appendix I for Geotechnical Report.

4.0 WELLS AND SEPTIC SYSTEMS

There are no wells or septic systems on the subject property or within the proposed development area. Wells and septic systems exist associated with the home to the south (>500-feet from the project area) and across Johnson Point Road to the east.

The site is not within the Well Head Protection Area of a public water system.

5.0 FUEL TANKS

There are no known fuel tanks (in-use or abandoned) on the project site.

6.0 ANALYSIS OF THE 100 YEAR FLOOD

The Federal Emergency Management Agency (FEMA) Floor Insurance Rate Map (FIRM) for the property shows a 100-year flood (1% annual probability) zone adjacent to Henderson Inlet. The flood zone is AE, with a flood elevation of 14. The project site is over 300-ft from the boundary of the flood zone and the lowest elevation of the project area is approximately 110 feet. A copy of the FEMA FIRM panel is included in Appendix J.

7.0 AESTHETIC CONSIDERATIONS FOR FACILITIES

The only facilities proposed are dispersion devices which will generally not be visible from the developed area of the project. No other aesthetic considerations are applicable for stormwater management on the project.

8.0 FACILITY SIZING AND OFF-SITE ANALYSIS

8.1 Basin Description and Areas

As described previously the project includes two Threshold Discharge Areas, an eastern TDA that includes about 60% of the developed area and a western TDA with about 40% of the developed area. The developed area is comprised of 13 separate sub-basins designated A through M. Each sub-basin is shown on the stormwater work map included in Appendix E. The areas of each sub-basin and the stormwater approach proposed for each is listed in Table 1.

TABLE 1: BASIN SUMMARY

Sub-Basin	Area (sf)	Area (acres)	How Stormwater Managed (see Note)
Project Parcel	n/a	29.33	--
AREA DISTURBED	59,000	1.36	--
NEW IMPERVIOUS	32,800	0.75	--
CONVERTED PERVIOUS	26,200	0.60	--
A	4925	0.1096	Drains to Johnson Pt Road Ditch
B	2375	0.0545	Sheet flow dispersion, 32 to 100' flow path
C	3000	0.0689	Mixed point discharge/sheet flow
D	1925	0.0442	Sheet flow dispersion, >100' flow path
E	3550	0.0815	Sheet flow dispersion, >100' flow path
F	2400	0.0551	Sheet flow dispersion, >100' flow path
G	4200	0.0964	Point discharge, >100' flow path
H	1500	0.0344	Point discharge, >100' flow path
I	5250	0.1205	Sheet flow dispersion, >100' flow path
J	4050	0.0930	Point discharge, >100' flow path
K (Total)	7900	0.1814	Point discharge, >100' flow path
K (Impervious)	4775	0.1096	--
K (pervious)	3125	0.0717	--
L	5450	0.1251	Point discharge, >100' flow path
M	7175	0.1647	Sheet flow dispersion, >100' flow path

Note: WWHM 2012 modeling indicates that the contributing area to a point discharge can be up to 5,660 square feet of impervious surface and not exceed the 0.2 cfs threshold for a point discharge. Therefore, while some of the sub-basins above include pervious surfaces, they are not broken out if the total sub-basin areas is less than 5,500 sf.

8.2 Proposed BMP Design

Full Dispersion, BMP LID.11 is proposed for managing the majority of runoff from the parking areas, sidewalks and 2-lane driveway. The proposed impervious surface is less than 10% of the total parcel and over 65% of native vegetation will be retained. This site is owned by the Capital Land Trust as a preserve which ensures that future development

will be limited in extent and the native vegetation areas will remain at greater than 65% of the property.

Full dispersion will be obtained through the use of dispersion methods consistent with BMP LID.11 including sheet flow dispersion and concentrated flow dispersion. See drainage plan for location of dispersion devices. All sheet flow dispersion from the roadway will be across a 2-ft width of gravel beyond the roadway edge. All point discharges from swales will include a minimum 3-ft wide by 4-ft long by 6-inch deep quarry spall pad. Point discharges from pipes (2 locations) will include a quarry spall dispersion pad of 7-ft width by 8-ft length by 1-ft depth.

Two sub-basins drain to Johnson Point Road ditch without being fully dispersed. Basin A (4,925 sf) drains directly from the access apron and first part of the access road directly to the Johnson Point Road ditch. Basin B (2,375 sf) also drains to the Johnson Point Road ditch, but sheet flows across between 30 and 100-ft of native vegetation before arriving at the ditch or roadside wetland. Since the direct discharge is less than 5,000 square feet of impervious surface and the remaining 2,375 square feet is dispersed and not recollected prior to leaving the site, runoff treatment is not required for this discharge. The total impervious surface within this basin area is less than 10,000 square feet and the increase in flows from the pre-developed (existing) condition is less than 0.15 cfs (0.08) therefor flow control for this small area is not required, nor is wetland analysis required (CR #8).

No other aesthetic considerations are applicable for stormwater management on the project.

8.3 Off-site Analysis

With the exception of the small area (<5,000 sf) at the site entrance, all stormwater runoff will be fully dispersed on-site into at least 100-ft of native vegetation. Based on a review of site maps, Thurston County Geodata and a site visit by the project engineer, for the small area discharging to the Johnson Point Road ditch, it the existing ditch along Johnson Point road drains to the south to low areas on the subject property and does not connect to any downstream receiving waters or conveyances. No known drainage problems occur in the vicinity of the project downstream from the property.

9.0 UTILITIES

Electric service will be provided by Puget Sound Energy. An on-site water supply well will be developed to provide water service. A new on-site septic system will be developed to serve a small bathroom facility for the site. An existing overhead powerline runs along the west side of Johnson Point Road in the vicinity of the proposed new access road. No other underground utilities are known to exist along the west side of Johnson Point Road in the project vicinity.

10.0 COVENANTS, DEDICATIONS, EASEMENTS

There are no easements, dedications or covenants associated with this project. The proposed permanent dispersion areas will be shown on the site plans, and included in the O&M Plan which becomes part of the Agreement to Maintain executed with Thurston County and recorded against the property.

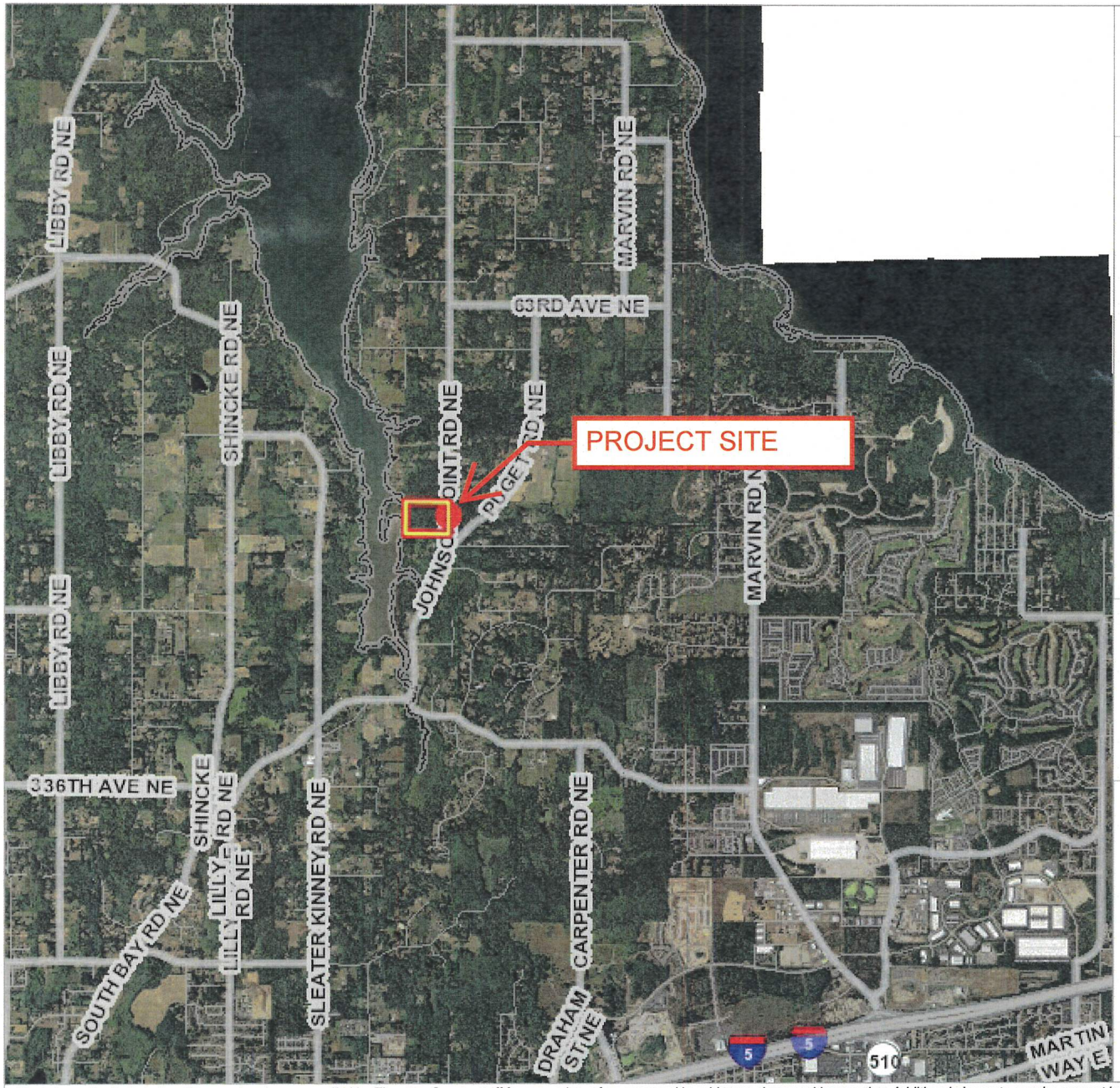
11.0 PROPERTY OWNERS ASSOCIATIONS ARTICLES OF INCORPORATIONS

There are no property owners associations associated with the project.

APPENDIX A

Vicinity Map

VICINITY MAP



Legend

- Roads - Major
  - Major Roads
  - Ramp
  - I 5; US 101
- Roads (Small Scale)
- Railroads
- County Border

Scale 1: 85,903

0 0.5 1

Miles

Map Created Using GeoData Public Website

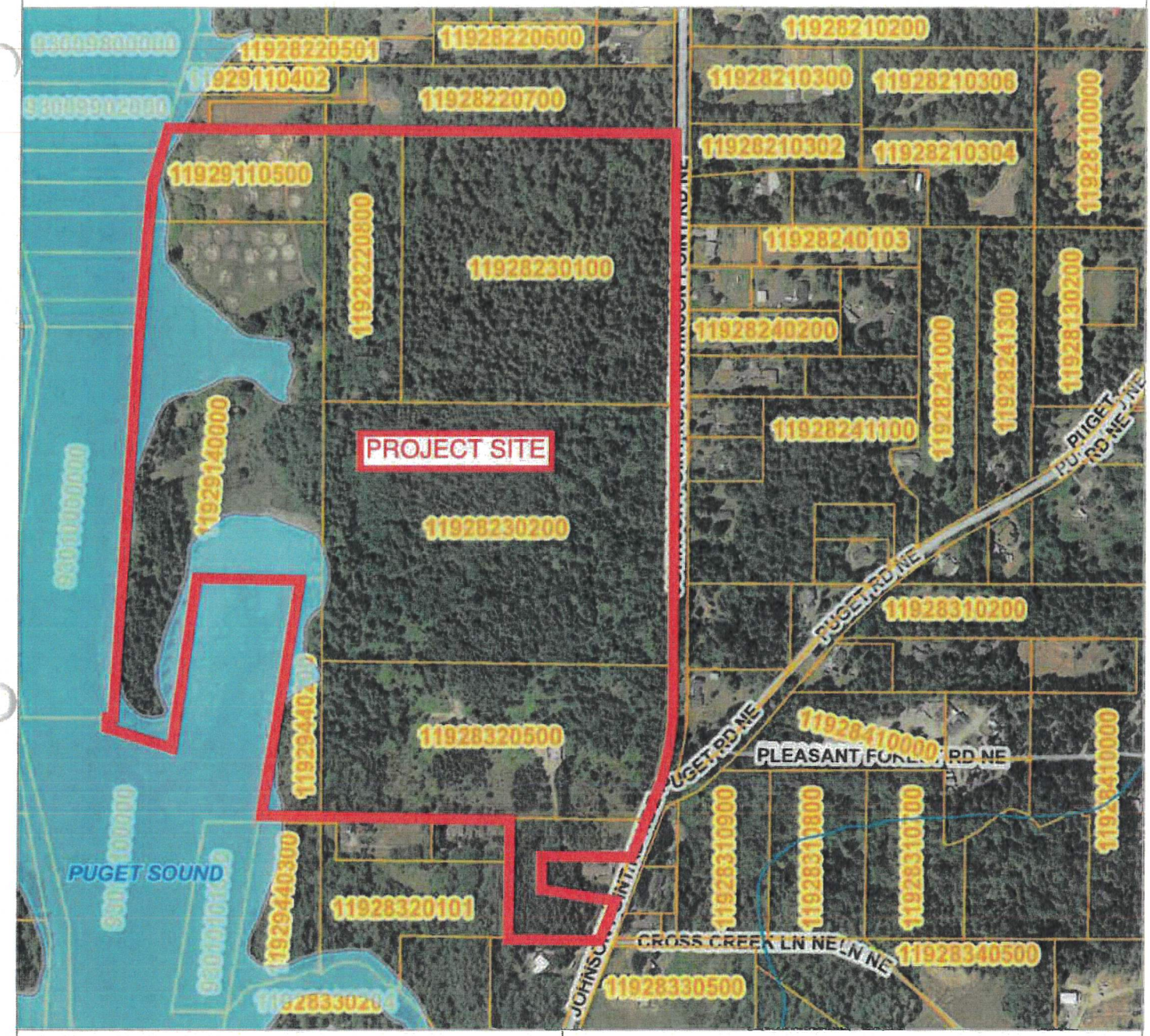
Published: 6/2/2020

Note:

THURSTON COUNTY
WASHINGTON
SINCE 1852

Thurston County GeoData Center

VICINITY MAP



Legend

- Streams
- Waterbodies
- Label - Parcel Number
- Parcel Boundaries
- Roads - Major
  - Major Roads
  - Ramp
  - I 5; US 101
- Roads (Large Scale)
- Railroads
- County Border

Scale 1: 9,843

0 450 900

Feet

Map Created Using GeoData Public Website

Published: 2/14/2019

Note: Existing topography not visible at this scale

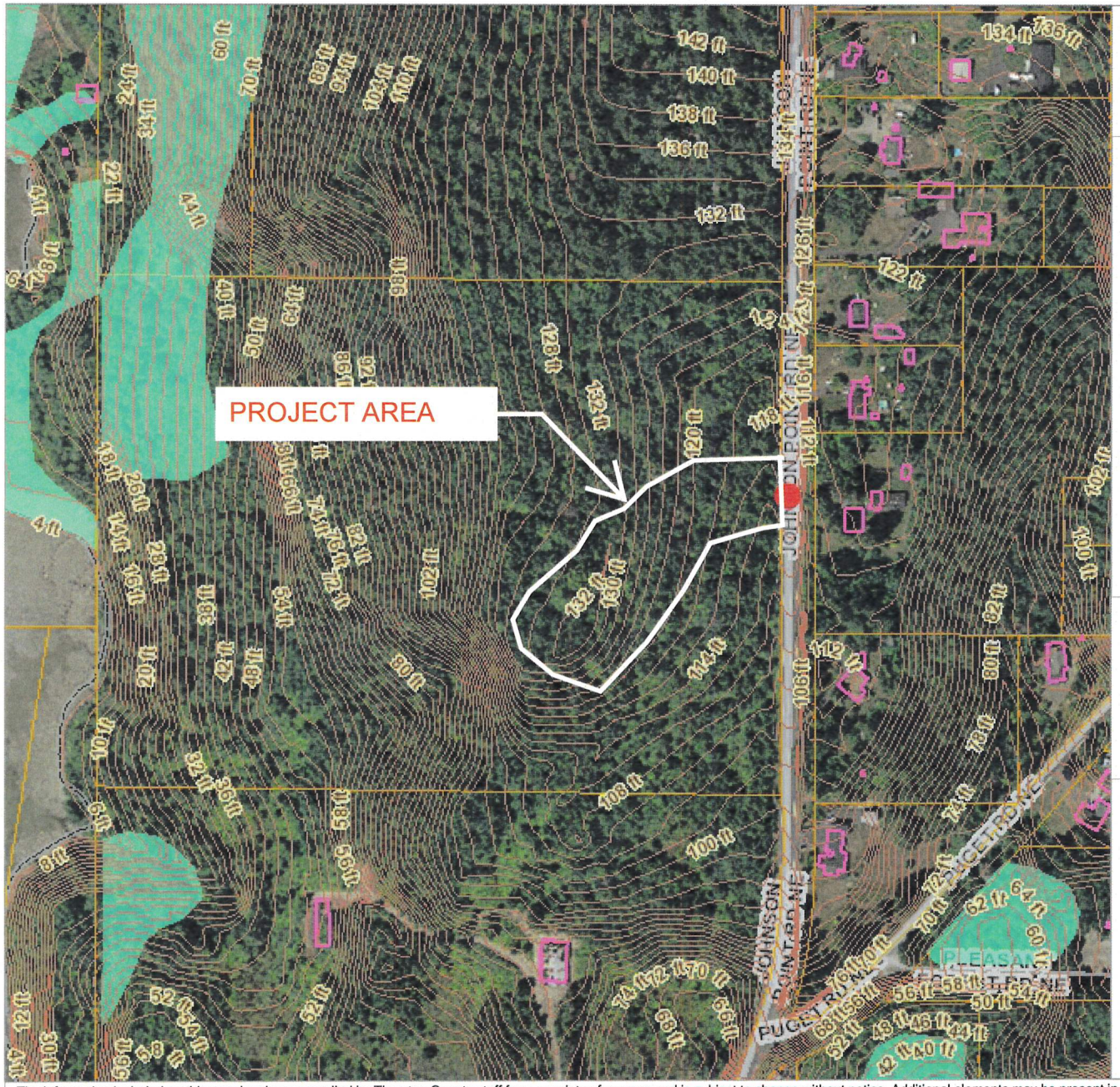
THURSTON COUNTY

Thurston County GeoData Center

APPENDIX B

Pre-Developed Site Conditions

EXISTING SITE CONDITIONS



Legend

- Contours 2ft 1996 (NGVD 29)
- Building Footprints
- Wetlands
- Parcel Boundaries
- Roads - Major
  - Major Roads
  - Ramp
  - I 5; US 101
- Roads (Large Scale)
- Railroads
- County Border

Scale 1: 5,369

0 250 500

Feet

Map Created Using GeoData Public Website

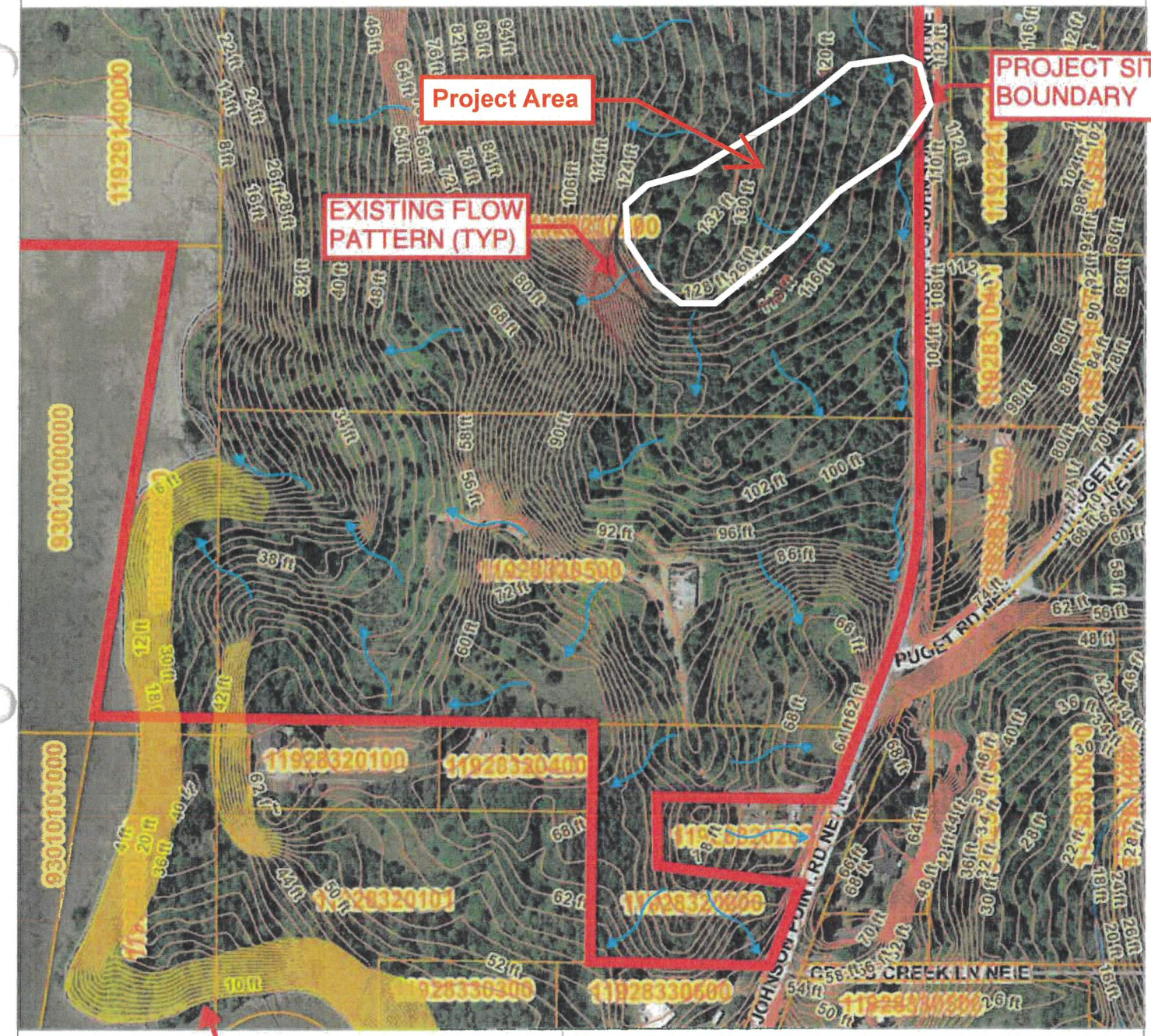
Published: 6/2/2020

Note:

THURSTON COUNTY
WASHINGTON
SINCE 1852

Thurston County GeoData Center

EXISTING SITE CONDITIONS MAP



Legend

- Contours 2ft 1996 (NGVD 29)
- Streams
- Label - Parcel Number
- Parcel Boundaries
- Roads - Major
  - Major Roads
  - Ramp
  - I 5; US 101
- Roads (Large Scale)
- Railroads

Scale 1: 4,922

0 200 400

Feet

Map Created Using GeoData Public Website

Published: 2/19/2019

Note:

THURSTON COUNTY

Thurston County GeoData Center

APPENDIX C

Developed Site Conditions

Drainage Legend

- CULVERT - HDPE N-12 DUAL WALL PIPE
- SPLASH PAD - 7'Wx12'Lx1' DEEP QUARRY SPALLS PER WSDOT STD. SPECIFICATION 9-13.1(5)
- SPLASH PAD - 3'Wx4'Lx0.5' DEEP QUARRY SPALLS PER WSDOT STD. SPECIFICATION 9-13.1(5)
- TRENCH DRAIN
- 100-FT. NATURAL VEGETATION DISPERSION AREA - PROTECT FROM FUTURE DISTURBANCE.
- IE IN=122.10 / IE OUT=121.50 PIPE INVERT ELEVATIONS

WETLAND C

GRADING LIMIT

TRENCH DRAIN
IE OUT=129.90

IE IN=130.38

WELL PUMP HOUSE

GRADING LIMIT

FUTURE SEPTIC TANK
1,500 SQ. FT. INFILTRATION GALLERY

FUTURE PUMP VAULT
1,500 SQ. FT. INFILTRATION GALLERY

WETLAND F

NEWLY MAPPED WETLAND - 25'

GRADING LIMIT

IE IN=117.70

12" CULVERT - 43' @ 0.70% BEVEL ENDS TO MATCH EMBANKMENT GRADE

IE OUT=117.40

7'Wx12'Lx1'D OUTFALL PAD

GRADING LIMIT

IE IN=122.10

IE OUT=121.50

8" CULVERT - 46' @ 1.30% BEVEL ENDS TO MATCH EMBANKMENT GRADE

7'Wx12'Lx1'D OUTFALL PAD

NEWLY MAPPED WETLAND

JOHNSON POINT ROAD

SCALE: 1"=20'
0' 10' 20' 30' 40'

811 Call 811 two business days before you dig

60% REVIEW SUBMITTAL - NOT FOR CONSTRUCTION

Inspiring K Preserve

Capitol Land Trust
Lacey, WA

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Landscape Architect,
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Landscape Architec
Site Plan
Athletic Facility De
Urban De
Land Plan
Project Manager

STATE OF WASHINGTON
ROBERT W. DRO
No. 388 EXP. 6/30/2020
LANDSCAPE ARCHITECT

PROJECT NO. _____
DRAWING _____

DESIGNED BY _____
DRAWN BY _____
CHECKED BY _____

REVISION

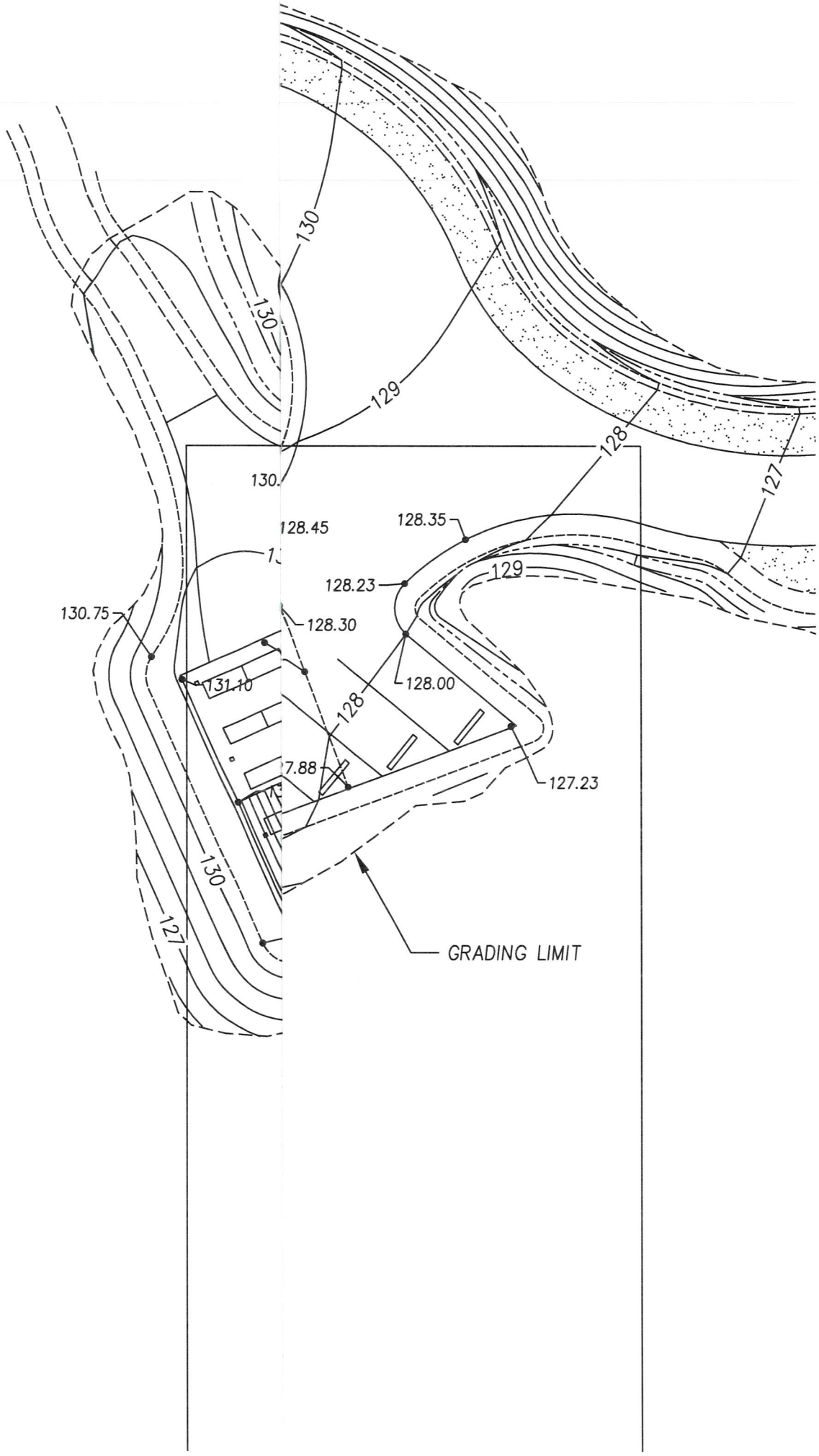
DATE	CHANGE

DATE: MAY 22,

Drainage Pl

L4.0

Sheet - of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128.45
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GRADING LIMIT

APPENDIX D

WWHM Calculations

Attach WWHM 2012 Runs for the following:

0.2 CFS Generic Area

Area K Flow

Area A Flow

WWHM2012

PROJECT REPORT

IKP Preserve
0.2 CFS Area

General Model Information

Project Name:	FullDisp_.2CFS
Site Name:	Kids Preserve
Site Address:	Johnson Pt Rd
City:	Olympia, WA
Report Date:	3/30/2020
Gage:	Woodard Creek
Data Start:	1955/10/01
Data End:	2011/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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, Mod	0.13
Pervious Total	0.13
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.13

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

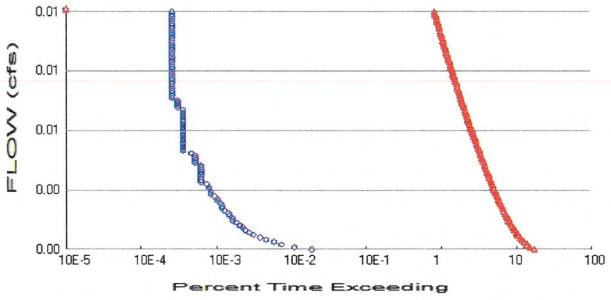
Basin 1

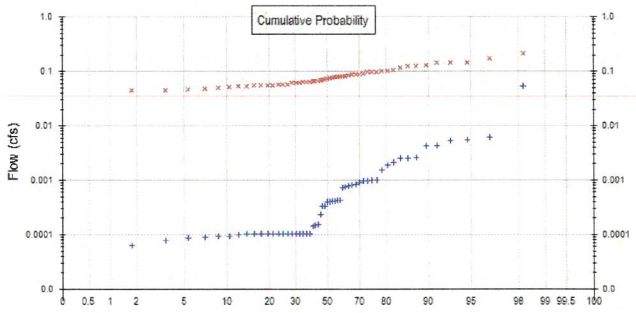
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS MOD	0.13
Impervious Total	0.13
Basin Total	0.13

Element Flows To:

Surface	Interflow	Groundwater

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.13
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.13

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000344
5 year	0.00136
10 year	0.003053
25 year	0.007767
50 year	0.014772
100 year	0.027062

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.073813
5 year	0.102245
10 year	0.123417
25 year	0.152964
50 year	0.177091
100 year	0.203102

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1956	0.003	0.061
1957	0.000	0.098
1958	0.000	0.055
1959	0.000	0.079
1960	0.001	0.145
1961	0.006	0.061
1962	0.000	0.055
1963	0.003	0.117
1964	0.004	0.081
1965	0.002	0.063

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0326 acre-feet
On-line facility target flow:	0.0427 cfs.
Adjusted for 15 min:	0.0427 cfs.
Off-line facility target flow:	0.0242 cfs.
Adjusted for 15 min:	0.0242 cfs.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Disclaimer

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WWHM2012

PROJECT REPORT

IKP PRESERVE
AREA A/B FLOW

General Model Information

Project Name:	Area_A-B_Flow
Site Name:	IKP Area A/B
Site Address:	Johnson Pt Rd
City:	Olympia, WA
Report Date:	6/3/2020
Gage:	Woodard Creek
Data Start:	1955/10/01
Data End:	2011/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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
SAT, Forest, Mod	0.1613
SAT, Pasture, Steep	0.00403
Pervious Total	0.16533

Impervious Land Use	acre
ROADS FLAT	0.0023
Impervious Total	0.0023
Basin Total	0.16763

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SAT, Lawn, Mod	0.0545
Pervious Total	0.0545

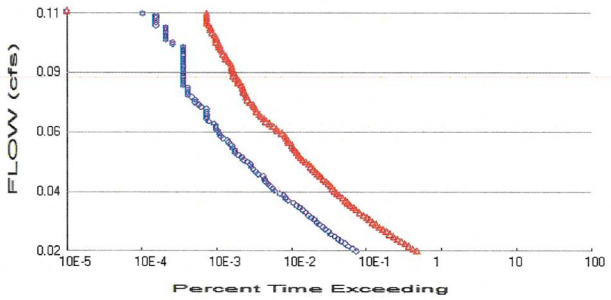
Impervious Land Use	acre
ROADS FLAT	0.0098
ROADS MOD	0.1033
Impervious Total	0.1131
Basin Total	0.1676

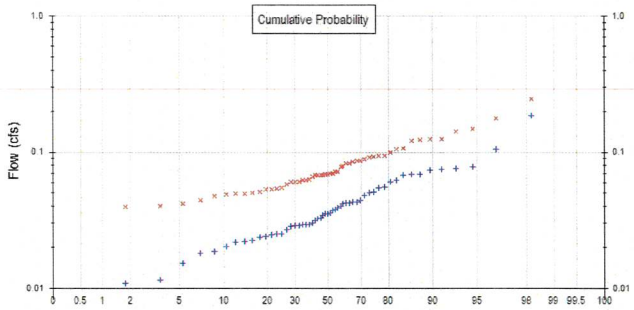
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.16533
Total Impervious Area: 0.0023

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.0545
Total Impervious Area: 0.1131

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.036214
5 year	0.058386
10 year	0.074139
25 year	0.09488
50 year	0.110787
100 year	0.126993

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.071009
5 year	0.100454
10 year	0.122739
25 year	0.15425
50 year	0.180277
100 year	0.208596

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.036	0.066
1957	0.069	0.106
1958	0.029	0.055
1959	0.027	0.069
1960	0.076	0.141
1961	0.029	0.060
1962	0.011	0.047
1963	0.073	0.123
1964	0.060	0.089
1965	0.050	0.070

1966	0.018	0.042
1967	0.037	0.061
1968	0.024	0.054
1969	0.044	0.099
1970	0.029	0.054
1971	0.030	0.058
1972	0.063	0.079
1973	0.031	0.063
1974	0.029	0.085
1975	0.034	0.070
1976	0.042	0.062
1977	0.024	0.083
1978	0.043	0.078
1979	0.035	0.083
1980	0.042	0.086
1981	0.055	0.092
1982	0.043	0.072
1983	0.040	0.124
1984	0.039	0.067
1985	0.022	0.068
1986	0.048	0.068
1987	0.068	0.094
1988	0.015	0.044
1989	0.020	0.086
1990	0.043	0.092
1991	0.068	0.094
1992	0.186	0.246
1993	0.032	0.063
1994	0.025	0.050
1995	0.029	0.068
1996	0.055	0.122
1997	0.105	0.177
1998	0.074	0.125
1999	0.022	0.049
2000	0.011	0.053
2001	0.005	0.039
2002	0.033	0.051
2003	0.025	0.050
2004	0.029	0.049
2005	0.019	0.039
2006	0.025	0.060
2007	0.035	0.107
2008	0.051	0.071
2009	0.038	0.068
2010	0.078	0.147
2011	0.022	0.040

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1855	0.2459
2	0.1051	0.1771
3	0.0781	0.1474
4	0.0757	0.1411
5	0.0743	0.1251
6	0.0733	0.1244
7	0.0689	0.1234
8	0.0683	0.1216

9	0.0679	0.1067
10	0.0625	0.1057
11	0.0600	0.0988
12	0.0555	0.0941
13	0.0546	0.0940
14	0.0513	0.0921
15	0.0500	0.0916
16	0.0479	0.0888
17	0.0444	0.0857
18	0.0432	0.0856
19	0.0431	0.0853
20	0.0427	0.0828
21	0.0422	0.0828
22	0.0419	0.0793
23	0.0400	0.0776
24	0.0391	0.0719
25	0.0380	0.0712
26	0.0371	0.0700
27	0.0359	0.0698
28	0.0352	0.0687
29	0.0351	0.0682
30	0.0342	0.0679
31	0.0327	0.0678
32	0.0323	0.0678
33	0.0315	0.0674
34	0.0302	0.0656
35	0.0294	0.0635
36	0.0293	0.0625
37	0.0293	0.0618
38	0.0290	0.0608
39	0.0288	0.0602
40	0.0285	0.0602
41	0.0270	0.0576
42	0.0252	0.0546
43	0.0251	0.0543
44	0.0247	0.0535
45	0.0241	0.0531
46	0.0239	0.0508
47	0.0225	0.0501
48	0.0222	0.0498
49	0.0217	0.0493
50	0.0202	0.0487
51	0.0187	0.0475
52	0.0182	0.0443
53	0.0153	0.0417
54	0.0114	0.0402
55	0.0108	0.0393
56	0.0055	0.0389

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic

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Local (360)943-0304

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WWHM2012

PROJECT REPORT

IKP Preserve
AREA K FLOW

General Model Information

Project Name:	Area_K_Flow
Site Name:	IKP
Site Address:	Johnson Pt Rd
City:	Olympia, WA
Report Date:	6/3/2020
Gage:	Woodard Creek
Data Start:	1955/10/01
Data End:	2011/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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
C, Forest, Flat	0.1813
SAT, Forest, Flat	0.1813
Pervious Total	0.3626
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.3626

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
SAT, Pasture, Flat	0.0717
Pervious Total	0.0717

Impervious Land Use	acre
ROADS FLAT	0.1096
Impervious Total	0.1096
Basin Total	0.1813

Element Flows To:

Surface	Interflow	Groundwater
Channel 1	Channel 1	

Mitigated Routing

Channel 1

Bottom Length:	100.00 ft.
Bottom Width:	4.00 ft.
Manning's n:	0.03
Channel bottom slope 1:	0.02 To 1
Channel Left side slope 0:	3 To 1
Channel right side slope 2:	3 To 1
Infiltration On	
Infiltration rate:	0.1
Infiltration safety factor:	1
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	1.336
Total Volume Through Riser (ac-ft.):	23.667
Total Volume Through Facility (ac-ft.):	25.003
Percent Infiltrated:	5.34
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	0 ft.
Riser Diameter:	0 in.
Element Flows To:	
Outlet 1	Outlet 2

Channel Hydraulic Table

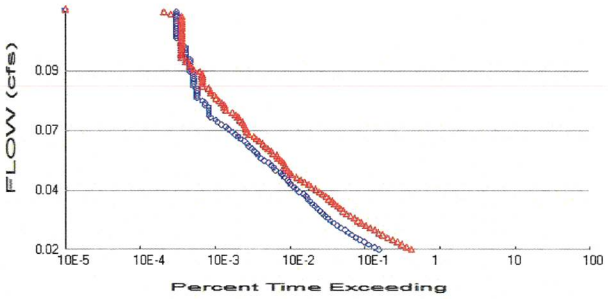
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.009	0.000	0.000	0.000
0.0111	0.009	0.000	0.015	0.000
0.0222	0.009	0.000	0.049	0.001
0.0333	0.009	0.000	0.097	0.001
0.0444	0.009	0.000	0.158	0.001
0.0556	0.009	0.000	0.230	0.001
0.0667	0.010	0.000	0.312	0.001
0.0778	0.010	0.000	0.405	0.001
0.0889	0.010	0.000	0.507	0.001
0.1000	0.010	0.001	0.619	0.001
0.1111	0.010	0.001	0.740	0.001
0.1222	0.010	0.001	0.870	0.001
0.1333	0.011	0.001	1.008	0.001
0.1444	0.011	0.001	1.156	0.001
0.1556	0.011	0.001	1.312	0.001
0.1667	0.011	0.001	1.476	0.001
0.1778	0.011	0.001	1.649	0.001
0.1889	0.011	0.002	1.830	0.001
0.2000	0.011	0.002	2.019	0.001
0.2111	0.012	0.002	2.217	0.001
0.2222	0.012	0.002	2.423	0.001
0.2333	0.012	0.002	2.636	0.001
0.2444	0.012	0.002	2.858	0.001
0.2556	0.012	0.002	3.088	0.001
0.2667	0.012	0.002	3.326	0.001
0.2778	0.013	0.003	3.573	0.001
0.2889	0.013	0.003	3.827	0.001
0.3000	0.013	0.003	4.089	0.001

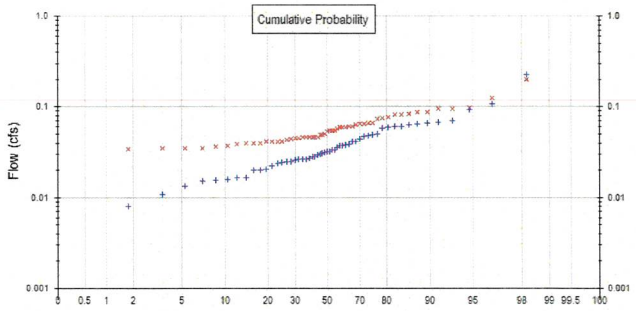
0.3111	0.013	0.003	4.359	0.001
0.3222	0.013	0.003	4.638	0.001
0.3333	0.013	0.003	4.924	0.001
0.3444	0.013	0.004	5.219	0.001
0.3556	0.014	0.004	5.522	0.001
0.3667	0.014	0.004	5.832	0.001
0.3778	0.014	0.004	6.151	0.001
0.3889	0.014	0.004	6.479	0.001
0.4000	0.014	0.004	6.814	0.001
0.4111	0.014	0.004	7.157	0.001
0.4222	0.015	0.005	7.509	0.001
0.4333	0.015	0.005	7.869	0.001
0.4444	0.015	0.005	8.237	0.001
0.4556	0.015	0.005	8.614	0.001
0.4667	0.015	0.005	8.999	0.001
0.4778	0.015	0.006	9.392	0.001
0.4889	0.015	0.006	9.793	0.001
0.5000	0.016	0.006	10.20	0.001
0.5111	0.016	0.006	10.62	0.001
0.5222	0.016	0.006	11.04	0.001
0.5333	0.016	0.006	11.48	0.001
0.5444	0.016	0.007	11.92	0.001
0.5556	0.016	0.007	12.38	0.001
0.5667	0.017	0.007	12.84	0.001
0.5778	0.017	0.007	13.31	0.001
0.5889	0.017	0.007	13.79	0.001
0.6000	0.017	0.008	14.27	0.001
0.6111	0.017	0.008	14.77	0.001
0.6222	0.017	0.008	15.27	0.001
0.6333	0.017	0.008	15.79	0.001
0.6444	0.018	0.008	16.31	0.001
0.6556	0.018	0.009	16.84	0.001
0.6667	0.018	0.009	17.38	0.001
0.6778	0.018	0.009	17.93	0.001
0.6889	0.018	0.009	18.49	0.001
0.7000	0.018	0.009	19.06	0.001
0.7111	0.019	0.010	19.63	0.001
0.7222	0.019	0.010	20.22	0.001
0.7333	0.019	0.010	20.81	0.001
0.7444	0.019	0.010	21.42	0.002
0.7556	0.019	0.010	22.03	0.002
0.7667	0.019	0.011	22.65	0.002
0.7778	0.019	0.011	23.29	0.002
0.7889	0.020	0.011	23.93	0.002
0.8000	0.020	0.011	24.58	0.002
0.8111	0.020	0.012	25.24	0.002
0.8222	0.020	0.012	25.91	0.002
0.8333	0.020	0.012	26.59	0.002
0.8444	0.020	0.012	27.27	0.002
0.8556	0.021	0.012	27.97	0.002
0.8667	0.021	0.013	28.68	0.002
0.8778	0.021	0.013	29.40	0.002
0.8889	0.021	0.013	30.13	0.002
0.9000	0.021	0.013	30.86	0.002
0.9111	0.021	0.014	31.61	0.002
0.9222	0.021	0.014	32.37	0.002
0.9333	0.022	0.014	33.13	0.002
0.9444	0.022	0.014	33.91	0.002

0.9556	0.022	0.015	34.70	0.002
0.9667	0.022	0.015	35.49	0.002
0.9778	0.022	0.015	36.30	0.002
0.9889	0.022	0.015	37.11	0.002
1.0000	0.023	0.016	37.94	0.002
1.0111	0.023	0.016	38.78	0.002

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.3626
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.0717
Total Impervious Area: 0.1096

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.032697
5 year	0.056234
10 year	0.074207
25 year	0.09929
50 year	0.119541
100 year	0.141027

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.053032
5 year	0.07354
10 year	0.089141
25 year	0.1113
50 year	0.129684
100 year	0.149764

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1956	0.037	0.049
1957	0.071	0.076
1958	0.026	0.040
1959	0.024	0.046
1960	0.063	0.081
1961	0.025	0.042
1962	0.008	0.037
1963	0.060	0.087
1964	0.042	0.061
1965	0.047	0.054

1966	0.016	0.032
1967	0.037	0.045
1968	0.027	0.034
1969	0.030	0.059
1970	0.032	0.037
1971	0.033	0.041
1972	0.066	0.074
1973	0.028	0.041
1974	0.026	0.054
1975	0.022	0.045
1976	0.044	0.046
1977	0.016	0.065
1978	0.034	0.063
1979	0.032	0.059
1980	0.039	0.060
1981	0.049	0.066
1982	0.036	0.053
1983	0.041	0.086
1984	0.030	0.046
1985	0.016	0.043
1986	0.050	0.054
1987	0.058	0.074
1988	0.013	0.039
1989	0.020	0.060
1990	0.061	0.066
1991	0.093	0.082
1992	0.225	0.200
1993	0.020	0.044
1994	0.020	0.046
1995	0.026	0.050
1996	0.048	0.097
1997	0.108	0.125
1998	0.067	0.083
1999	0.028	0.046
2000	0.011	0.040
2001	0.004	0.035
2002	0.031	0.046
2003	0.017	0.039
2004	0.024	0.041
2005	0.015	0.035
2006	0.026	0.049
2007	0.038	0.095
2008	0.061	0.065
2009	0.031	0.057
2010	0.064	0.094
2011	0.025	0.035

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.2248	0.1995
2	0.1078	0.1246
3	0.0927	0.0970
4	0.0710	0.0953
5	0.0667	0.0940
6	0.0665	0.0872
7	0.0645	0.0861
8	0.0634	0.0834

9	0.0612	0.0815
10	0.0607	0.0811
11	0.0599	0.0759
12	0.0580	0.0742
13	0.0501	0.0741
14	0.0486	0.0659
15	0.0476	0.0656
16	0.0470	0.0652
17	0.0445	0.0651
18	0.0416	0.0629
19	0.0414	0.0606
20	0.0388	0.0601
21	0.0383	0.0597
22	0.0368	0.0592
23	0.0368	0.0588
24	0.0358	0.0573
25	0.0337	0.0545
26	0.0335	0.0541
27	0.0322	0.0539
28	0.0318	0.0530
29	0.0313	0.0499
30	0.0305	0.0486
31	0.0300	0.0485
32	0.0297	0.0461
33	0.0281	0.0460
34	0.0281	0.0459
35	0.0273	0.0458
36	0.0263	0.0456
37	0.0263	0.0456
38	0.0262	0.0448
39	0.0258	0.0448
40	0.0250	0.0439
41	0.0246	0.0430
42	0.0242	0.0416
43	0.0240	0.0413
44	0.0223	0.0412
45	0.0203	0.0410
46	0.0200	0.0398
47	0.0198	0.0398
48	0.0167	0.0394
49	0.0165	0.0391
50	0.0160	0.0371
51	0.0156	0.0367
52	0.0152	0.0350
53	0.0135	0.0346
54	0.0108	0.0345
55	0.0080	0.0345
56	0.0041	0.0316

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Channel 1 POC	☐	22.75			☐	5.34			
Total Volume Infiltrated		22.75	0.00	0.00		5.34	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

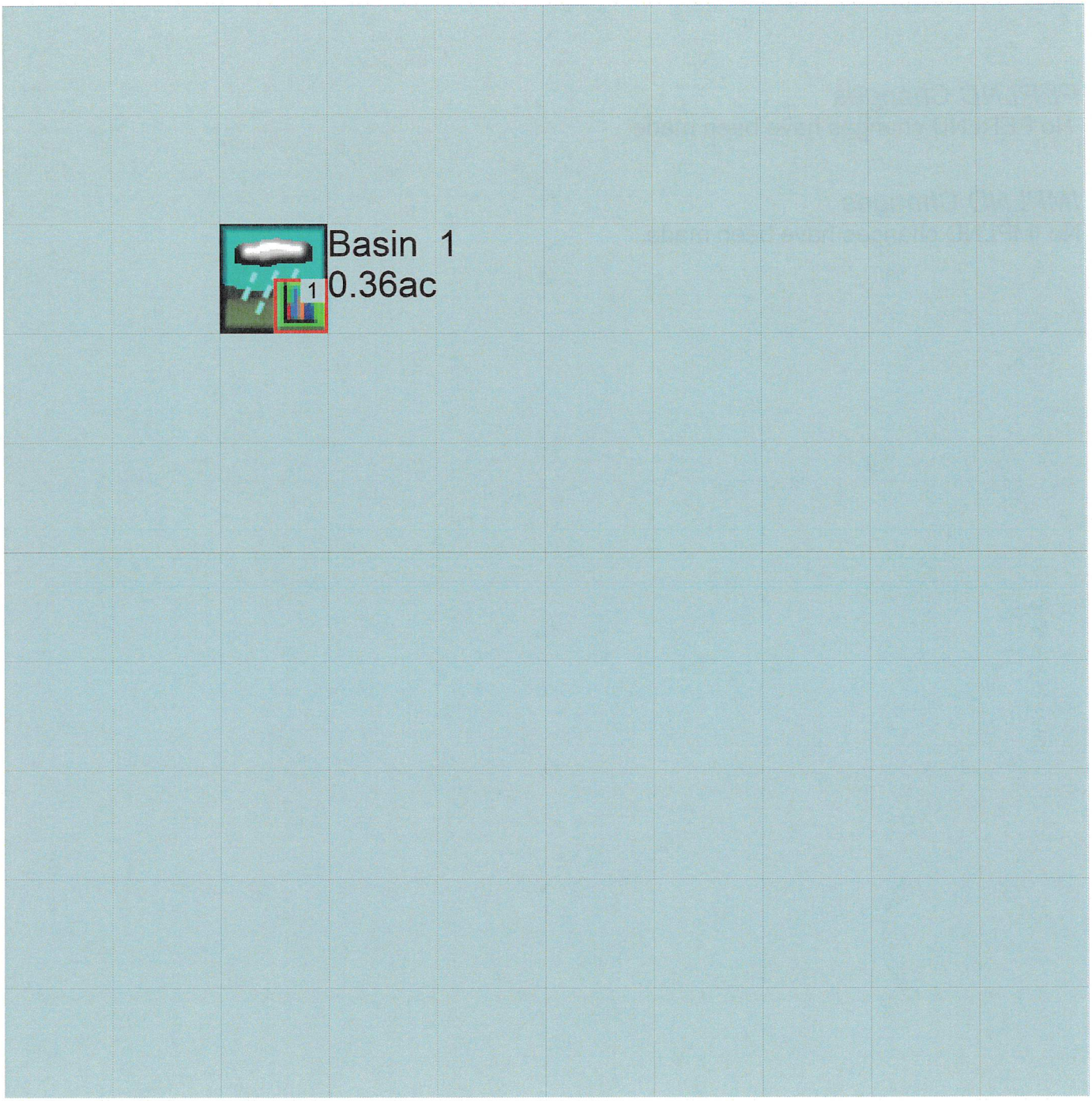
PERLND Changes

No PERLND changes have been made.

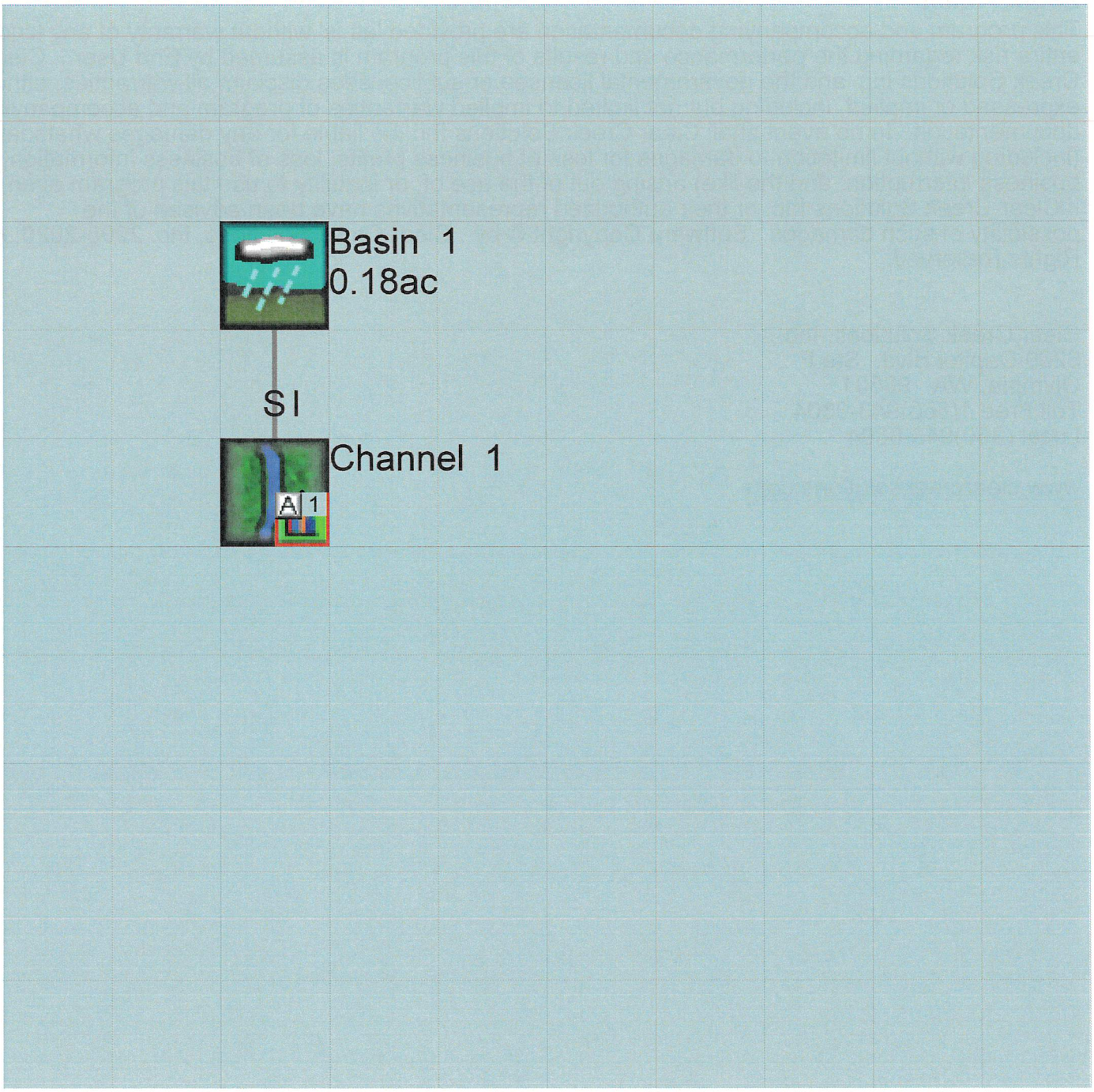
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Disclaimer

Legal Notice

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Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

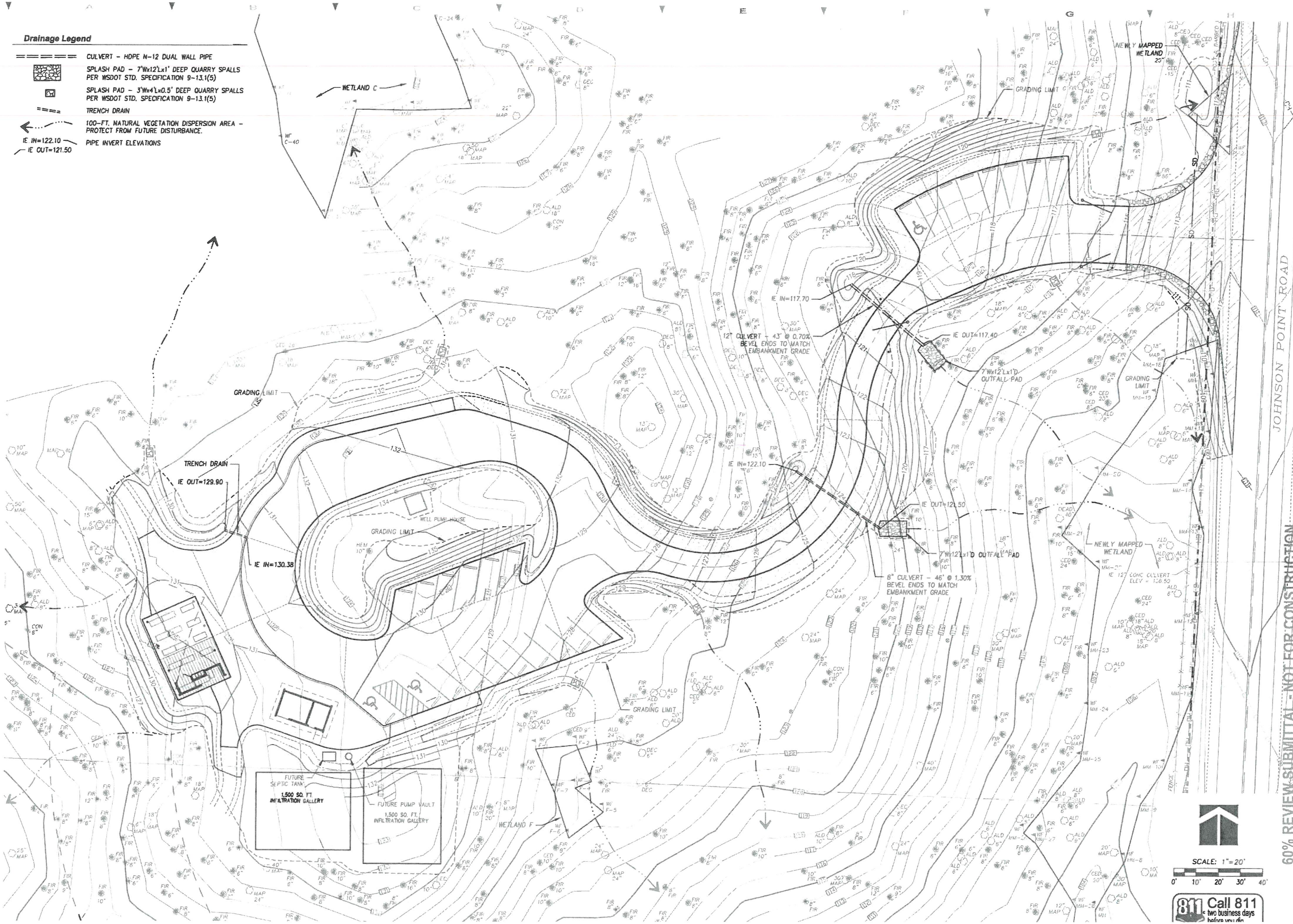
www.clearcreeksolutions.com

APPENDIX E

Stormwater Plans

Drainage Legend

======	CULVERT - HDPE N-12 DUAL WALL PIPE
	SPLASH PAD - 7'Wx12'Lx1' DEEP QUARRY SPALLS PER WSDOT STD. SPECIFICATION 9-13.1(5)
	SPLASH PAD - 3'Wx4'Lx0.5' DEEP QUARRY SPALLS PER WSDOT STD. SPECIFICATION 9-13.1(5)
====	TRENCH DRAIN
←-------	100-FT. NATURAL VEGETATION DISPERSION AREA - PROTECT FROM FUTURE DISTURBANCE.
IE IN=122.10 / IE OUT=121.50	PIPE INVERT ELEVATIONS



60% REVIEW SUBMITTAL - NOT FOR CONSTRUCTION

Call 811 two business days before you dig

Inspiring K Preserve

Capitol Land Trust
Lacey, WA

Robert W. Dr
Landscape Architect,
4405 7th Avenue SE, Ste.
Lacey, WA 9
(360) 456-
FAX (360) 493-
E-MAIL bob@rwdroll.
Landscape Architec
Site Plan
Athletic Facility D
Urban D
Land Plan
Project Managem

STATE OF WASHINGTON
ROBERT W. DROLL
LANDSCAPE ARCHITECT

PROJECT NO. _____
DRAWING _____
DESIGNED BY _____
DRAWN BY _____
CHECKED BY _____

REVISION

DATE	CHANGE

DATE: MAY 22,

Drainage Pl

L4.0

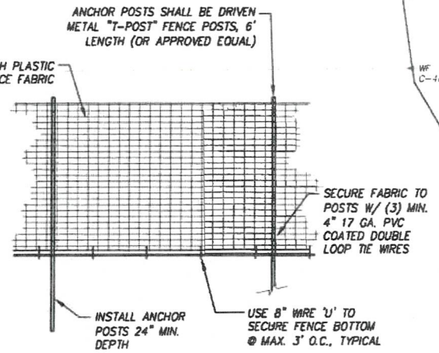
Sheet - of

APPENDIX F

SWPPP

The Construction SWPPP will be prepared and submitted with the final drainage report.

LOCATE CONSTRUCTION FENCE AS SHOWN. FENCE FABRIC SHALL BE HIGH-DENSITY POLYETHYLENE PLASTIC, RECTANGULAR PATTERN, COLOR IS SAFETY ORANGE AND SUPPORTED BY T-POST STEEL FENCE POSTS SPACED A MAXIMUM OF 8-FEET APART. CONSTRUCTION FENCING SHALL BE APPROVED BY ENGINEER.



1 / L1.1 **Temporary Construction Fencing**
NOT TO SCALE

Legend

- GEOLOGICAL TEST PIT LOCATION AND DESIGNATION
- TEMPORARY CONSTRUCTION FENCING PER DETAIL 1 OF THIS SHEET
- 25' NATIVE VEGETATION STRIP - DOWNSLOPE EDGE

WETLAND C

WETLAND F

NEWLY MAPPED WETLAND

REFER TO FRONTAGE IMPROVEMENT SHEETS FOR TEMPORARY CONSTRUCTION ENTRANCE

TEMPORARY CONSTRUCTION FENCING 1 / L1.1

GRADING LIMIT

25' MIN. TYPICAL

JOHNSON POINT ROAD

TP-1 TP-2 TP-3 TP-4

FUTURE PTIC TANK 1,500 SQ. FT. INFILTRATION GALLERY

FUTURE PUMP VAULT 1,500 SQ. FT. INFILTRATION GALLERY

CONC CULVERT ELEV = 106.58

SCALE: 1"=20'
0' 10' 20' 30' 40'

811 Call 811 two business days before you dig

60% REVIEW SUBMITTAL - NOT FOR CONSTRUCTION

Inspiring K Preserve

Capitol Land Trust
Lacey, WA

Robert W. Dr
Landscape Architects,
4405 7th Avenue SE, Ste.
Lacey, WA 98
(360) 456-
FAX (360) 493-
E-MAIL bob@rwdroll.
Landscape Architec
Site Plan
Athletic Facility De
Urban De
Land Plan
Project Managem

STATE OF WASHINGTON ROBERT W. DROLL NO. 536 EXP. 6/5/2020 LANDSCAPE ARCHITECT

PROJECT NO. _____
DRAWING _____
DESIGNED BY _____
DRAWN BY _____
CHECKED BY _____

REVISION

DATE	CHANGE

DATE: MAY 22,

TESC Plan

L1.1

Sheet ___ of ___

O:\2018\18054 Inspiring Kids Preserve - CLT\Drawings\SHEETS\18054-IKP_L1.1 - TESC Plan.dwg
Jun-22-20 9:51pm

APPENDIX G

Source Control Plan

The Pollution Source Control Plan will be prepared and submitted with the final drainage report.

Activity Code	Type of Activity	Check if You Are Involved in This	
		Indoor	Outdoor
A1.1	Cleaning or Washing of Tools, Engines, and Manufacturing Equipment • Includes parts washers and all types of manufactured equipment components.		
A1.2	Cleaning or Washing of Cooking Equipment • Includes vents, filters, pots and pans, grills, and related items.		
A1.3	Washing, Pressure Washing, and Steam Cleaning of Vehicles/Equipment/Building Structures • Includes cleaning and washing at all types of establishments, including fleet vehicle yards, car dealerships, car washes, and maintenance facilities.		
A1.4	Collection and Disposal of Wastewater from Mobile Interior Washing Operations • Includes carpet cleaners, upholstery cleaners, and drapery cleaners.		
A2.1	Loading and Unloading Areas for Liquid or Solid Material • Includes raw materials, intermediate products, finished products, waste, or fuel.		
A2.2	Fueling at Dedicated Stations • Includes gas stations, pumps at fleet vehicle yards or shops, and other privately owned pumps.		
A2.3	Engine Repair and Maintenance • This covers oil changes and other engine fluids.		
A2.4	Mobile Fueling of Vehicles and Heavy Equipment • Includes fleet fueling, wet fueling, and wet hosing.		
A3.1	Concrete and Asphalt Mixing and Production at Stationary Sites • Applies to mixing of raw materials on site to produce concrete or asphalt.		
A3.2	Concrete Pouring, Concrete Cutting, and Asphalt Application at Temporary Sites • Includes construction sites, and driveway and parking lot resurfacing.		X
A3.3	Manufacturing and Postprocessing of Metal Products • Includes machining, grinding, soldering, cutting, welding, quenching, rinsing, etc.		
A3.4	Wood Treatment Areas • Includes wood treatment using pressure processes or by dipping or spraying.		
A3.5	Commercial Composting • Includes commercial composting facilities operating outside.		
A3.6	Landscaping and Vegetation Management Activities, Including Vegetation Removal, Herbicide and Insecticide Application, Fertilizer Application, Irrigation, Watering, Gardening, and Lawn Care • Includes businesses involved in landscaping, applying pesticides and managing vegetation.		X

Activity Code	Type of Activity	Check if You Are Involved in This	
		Indoor	Outdoor
A3.7	Painting, Finishing, and Coating of Vehicles, Boats, Buildings, and Equipment • Includes surface preparation and the applications of paints, finishes, and/or coatings.		
A3.8	Commercial Printing Operations • Includes materials used in the printing process.		
A3.9	Manufacturing Activities – Outside • Includes outdoor manufacturing areas.		
A3.10	Agricultural Crop Production • Includes commercial scale farming.		
A3.11	Application of Pesticides, Herbicides, Fungicides and Rodenticides for purposes other than landscaping • Includes moss removal and outdoor insect extermination.		
A4.1	Storage or Transfer (Outside) of Solid Raw Materials, By-products, or Finished Products		
A4.2	Storage and Treatment of Contaminated Soils • This applies to contaminated soils that are excavated and left on site.		
A4.3	Temporary Storage or Processing of Fruits or Vegetables • Includes processing activities at wineries, fresh and frozen juice makers, and other food and beverage processing operations.		
A4.4	Storage of Solid Wastes and Food Wastes • Includes regular garbage and all other discarded non-liquid items.		
A4.5	Recyclers and Scrap Yards • Includes scrapped equipment, vehicles, empty metal drums, and assorted recyclables.		
A4.6	Treatment, Storage, or Disposal of Dangerous Wastes • Refer to Ecology and the Thurston County Health Department for more information, see Chapter 7.		
A4.7	Storage of Liquid, Food Waste, or Dangerous Waste Containers • Includes containers located outside a building and used for temporary storage.		X
A4.8	Storage of Liquids in Permanent Aboveground Tanks • Includes all liquids in aboveground tanks.		
A4.9	Parking and Storage for Vehicles and Equipment • Includes public and commercial parking lots		X
A4.10	Storage of Pesticides, Fertilizers, or other products that can leach pollutants		
A5.1	Demolition of Buildings • Applies to removal of existing buildings and subsequent clearing of the rubble.		X
A5.2	Building Repair, Remodeling, and Construction • Applies to construction of buildings, general exterior building repair work and remodeling of buildings.		X

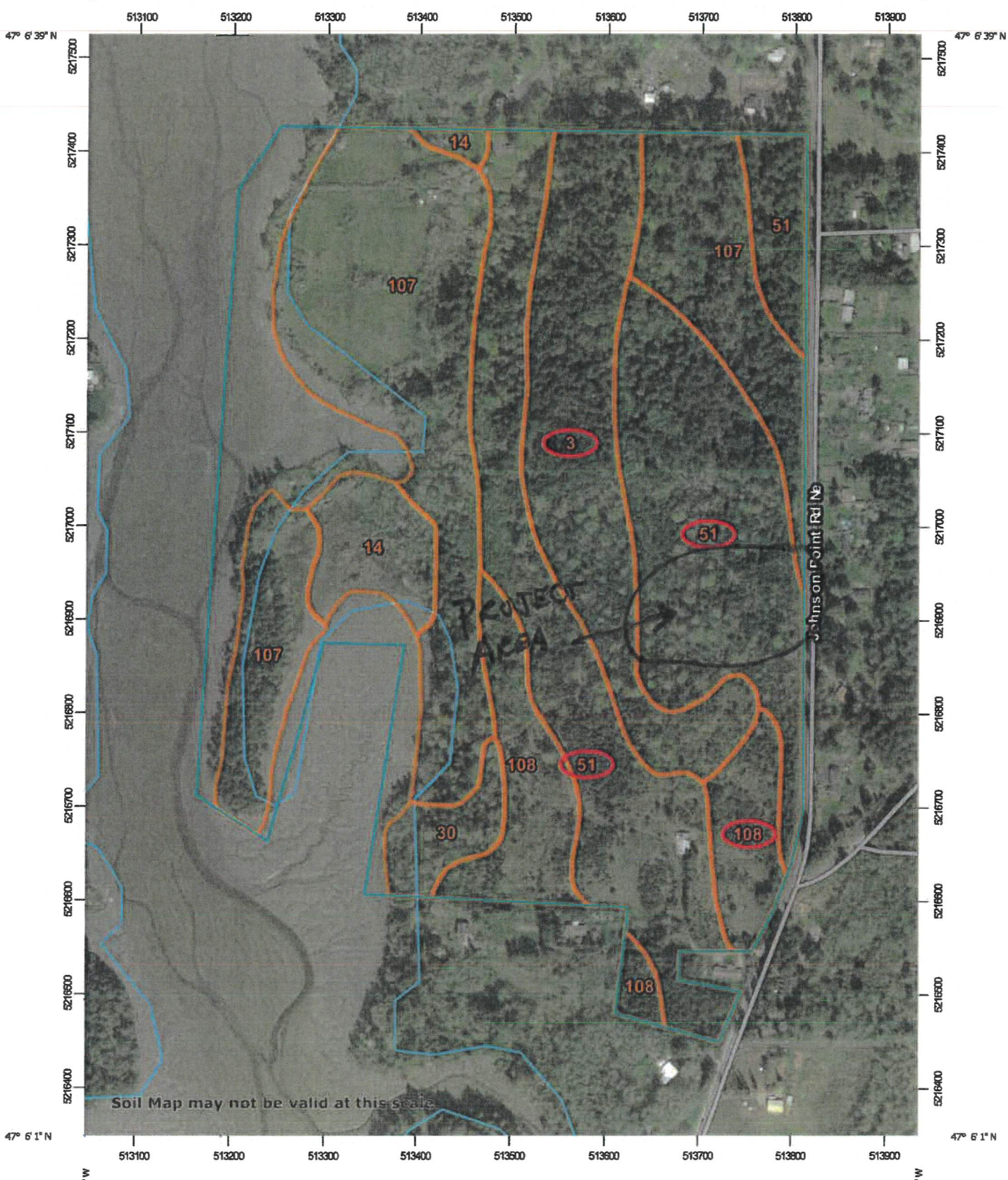
Activity Code	Type of Activity	Check if You Are Involved in This	
		Indoor	Outdoor
A6.1	Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots		X
A6.2	Dust Control at Manufacturing Sites • Includes grain dust, sawdust, coal, gravel, crushed rock, cement, and boiler fly ash.		
A6.3	Soil Erosion and Sediment Control (ESC) at Industrial Sites • Includes industrial activities that take place on soil.		
A7.1	Commercial Animal Handling Areas • Includes kennels, fenced pens, veterinarians, and businesses that board animals.		
A7.2	Keeping Livestock in Stables, Pens, Pastures or Fields • Applies to all types of livestock.		
A7.3	Log Sorting and Handling • Applies to log yards typically located at sawmills, ports, and pulp mills.		
A7.4	Boat Building, Mooring, Maintenance, and Repair • Includes all types of maintenance, repair, and building operations.		
A7.5	Logging • Applies to logging activities that fall under Class IV general forest practices.		
A7.6	Mining and Quarrying of Sand, Gravel, Rock, Minerals, Peat, Clay, and Other Materials • This does not include excavation at construction sites.		
A7.7	Swimming Pool and Spa Cleaning and Maintenance • Includes every swimming pool and spa not at a single family residence. Commercial pool cleaners are included here for all pools.		
A7.8	De-icing and Anti-icing Operations for Airports and Streets • Includes aircraft, runways/taxiways, streets and highways.		
A7.9	Roof and Building Drains at Manufacturing and Commercial Buildings • These sites will be referred to ORCAA.		
A7.10	Urban Streets • BMPs for addressing pollutants found on paved surfaces, including street sweeping.		
A7.11	Railroad Yards		
A7.12	Maintenance of Public and Private Utility Corridors and Facilities • Includes public and private utility maintenance activities.		
A7.13	Maintenance of Roadside Ditches		X
A7.14	Maintenance of Stormwater Drainage and Treatment Facilities		X
A7.15	Spills of Oil and Hazardous Substances		

APPENDIX H

NRCS Mapping

NRCS SOILS MAP

Soil Map—Thurston County Area, Washington
(Inspiring Kids Preserve)



Map Scale: 1:5,720 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 12, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 1, 2016—Sep 27, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
3	Alderwood gravelly sandy loam, 15 to 30 percent slopes	16.1	13.0%
14	Bellingham silty clay loam	4.7	3.8%
30	Dystric Xerochrepts, 60 to 90 percent slopes	2.7	2.2%
51	Kapowsin silt loam, 3 to 15 percent slopes	38.8	31.5%
107	Skipopa silt loam, 0 to 3 percent slopes	35.8	29.1%
108	Skipopa silt loam, 3 to 15 percent slopes	10.5	8.5%
Totals for Area of Interest		**123.1**	**100.0%**

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named, soils that are similar to the named components, and some minor components that differ in use and management from the major soils.

Most of the soils similar to the major components have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Some minor components, however, have properties and behavior characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Thurston County Area, Washington

3—Alderwood gravelly sandy loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2t627
Elevation: 0 to 1,000 feet

Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Alderwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Alderwood

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)
Hydric soil rating: No

Minor Components

Everett

Percent of map unit: 5 percent

Landform: Moraines, eskers, kames
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Indianola

Percent of map unit: 5 percent
Landform: Kames, eskers, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Shalcar

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma

Percent of map unit: 2 percent
Landform: Drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

14—Bellingham silty clay loam

Map Unit Setting

National map unit symbol: 2ndbg
Elevation: 20 to 600 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Bellingham and similar soils: 85 percent
Minor components: 12 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bellingham

Setting

Landform: Depressions
Parent material: Alluvium and lacustrine deposits

Typical profile

H1 - 0 to 5 inches: silty clay loam
H2 - 5 to 60 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Forage suitability group: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: Yes

Minor Components

Mckenna

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Mukilteo

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Norma

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Skipopa

Percent of map unit: 3 percent
Hydric soil rating: No

30—Dystric Xerochrepts, 60 to 90 percent slopes

Map Unit Setting

National map unit symbol: 2nd8r
Elevation: 0 to 3,280 feet
Mean annual precipitation: 50 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Dystric xerochrepts and similar soils: 85 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dystric Xerochrepts

Setting

Landform: Escarpments
Parent material: Colluvium and glacial till

Typical profile

H1 - 0 to 4 inches: very gravelly sandy loam
H2 - 4 to 30 inches: very gravelly sandy loam
H3 - 30 to 34 inches: very gravelly sandy loam

Properties and qualities

Slope: 60 to 90 percent
Depth to restrictive feature: 20 to 72 inches to densic material
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Skipopa

Percent of map unit: 5 percent
Hydric soil rating: No

51—Kapowsin silt loam, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2ndbx
Elevation: 50 to 900 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Kapowsin and similar soils: 85 percent

Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kapowsin

Setting
Landform: Till plains
Parent material: Compact basal till

Typical profile
H1 - 0 to 4 inches: silt loam
H2 - 4 to 22 inches: silt loam
H3 - 22 to 30 inches: gravelly loam
H4 - 30 to 34 inches: gravelly loam

Properties and qualities
Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Forage suitability group: Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

Norma
Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Skipopa
Percent of map unit: 3 percent
Hydric soil rating: No

107—Skipopa silt loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2nd7v
Elevation: 490 to 980 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Skipopa and similar soils: 85 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skipopa

Setting

Landform: Terraces
Parent material: Volcanic ash over glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 18 inches: silt loam
H3 - 18 to 60 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 10 to 20 inches to abrupt textural change
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Forage suitability group: Seasonally Wet Soils (G002XN202WA)
Hydric soil rating: No

Minor Components

Bellingham

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Mukilteo

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Yelm

Percent of map unit: 2 percent
Hydric soil rating: No

108—Skipopa silt loam, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2nd7w
Elevation: 490 to 980 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Skipopa and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skipopa

Setting

Landform: Terraces
Parent material: Volcanic ash over glaciolacustrine deposits

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 18 inches: silt loam
H3 - 18 to 60 inches: clay

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 10 to 20 inches to abrupt textural change
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Forage suitability group: Soils with Moderate Limitations (G002XN602WA)
Hydric soil rating: No

Minor Components

Yelm

Percent of map unit: 2 percent

Hydric soil rating: No

Data Source Information

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 12, Sep 10, 2018

ECOLOGY WELL LOG

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Water Right Permit No. _____

(1) OWNER: Name STILLMAN Address 4844 Johnson Pt RD NE

(2) LOCATION OF WELL: County THURSTON NW¼ SW¼ Sec 28 T. 19 N., R. 1W W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) same

(3) PROPOSED USE: [X] Domestic [ ] Industrial [ ] Municipal [ ] Irrigation [ ] Test Well [ ] Other [ ] DeWater

(4) TYPE OF WORK: Owner's number of well (if more than one) 1
Abandoned [ ] New well [X] Method: Dug [ ] Bored [ ] Deepened [ ] Cable [X] Driven [ ] Reconditioned [ ] Rotary [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 6 inches. Drilled 91 feet. Depth of completed well 86 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6 " Diam. from 81 ft. to 81 ft.
Welded [X] Liner installed [ ] Threaded [ ] _____ " Diam. from _____ ft. to _____ ft.
_____ " Diam. from _____ ft. to _____ ft.

Perforations: Yes [ ] No [X]
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes [X] No [ ]
Manufacturer's Name WESCO
Type WIRE Model No. _____
Diam. 6 Slot size 10 from 81 ft. to 86 ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes [ ] No [X] Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes [X] No [ ] To what depth? 18 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name _____
Type: _____ H.P. _____

(8) WATER LEVELS: Land-surface elevation above mean sea level 100 ft.
Static level 36 ft. below top of well Date 1-90
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [ ] No [X] If yes, by whom? _____
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test 1-90
Bailer test 19 gal./min. with 19 ft. drawdown after 1 hrs.
Airtest _____ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Clay - open hole	0	24
Clay w/ sand	24	29
Silty sand	29	52
Silty Sand - seepage	52	60
Sand - Fine	60	70
Sand - Fine Active	71	86
Sand w/clay.		

RECEIVED
MAY 10 '90
DEPT. OF ECOLOGY
WATER RESOURCES
SW REGIONAL OFFICE

Work started 1, 90 Completed 1, 1990

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME TIMS WELL DRILLING (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)
Address 6246 Libby Rd NE
(Signed) _____ (WELL DRILLER) License No. 832
Contractor's Registration No. TIMSWDI81RE Date 2-10, 1990

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329- 3

APPENDIX I

Geotechnical Report

Draft Technical Memorandum

TO: Mr. Bob Droll, President, Robert W. Droll, Landscape Architect, PS

FROM: Lance Levine, PE, and Calvin McCaughan, PE

DATE: March 18, 2020

RE: **Summary of Geotechnical Engineering Services**
Inspiring Kids Preserve
Olympia, Washington
Project No. 1444012.010.011

Introduction

This memorandum summarizes the results of geotechnical engineering services provided by Landau Associates, Inc. (LAI) in support of the Inspiring Kids Preserve project, located at 4849 Johnson Point Road Northeast near Olympia, Washington (site; Figure 1). Geotechnical services were provided in accordance with the scope outlined in LAI's December 6, 2019 proposal.

This memorandum was prepared with information provided by representatives of Robert W. Droll, Landscape Architect, PS, and with data collected during LAI's geologic review, field investigation, and geotechnical laboratory testing. The site plan (Figure 2) was developed with information provided by KPFF Consulting Engineers (project civil engineer).

Project Understanding

The 108-acre site consists of eight undeveloped parcels. Capitol Land Trust (CLT, project owner) proposes to develop a portion of the site along Johnson Point Road Northeast with a shelter, a restroom, trails, paved parking and roads, and one or more stormwater facilities.

Geologic Setting

Geologic information for the site and the surrounding area was obtained from the *Geologic Map of the Lacey 7.5-minute Quadrangle, Thurston County, Washington* (Logan 2003). Subsurface conditions at the site are mapped as Vashon till deposits (Qgt), a highly compact mixture of low-permeability clay, silt, sand, and gravel deposited directly by the glacier. During LAI's February 2020 field investigation, surficial site soils were observed to consist of silt with variable sand content. These soil conditions are consistent with the Vashon recessional outwash and minor silt (Qgos) mapped to the west of the site.

Subsurface Explorations

Site subsurface conditions were explored on February 25, 2020 by excavating five test pits (TP-1 through TP-5) at the approximate locations shown on Figure 2. Howard's Construction and Excavating, subcontracted by LAI, advanced the test pits 12.0 to 15.0 feet (ft) below ground surface (bgs).

LAI personnel monitored the explorations, collected representative soil samples, and maintained a detailed record of the subsurface soil and groundwater conditions observed. Each representative soil type was described using the soil classification system shown on Figure 3. Summary logs of the subsurface soil and groundwater conditions are provided on Figures 4 through 6.

Samples were transported to LAI's soils laboratory for further examination and testing. To evaluate the composition of fine-grained site soils, select samples were analyzed in accordance with ASTM International (ASTM) standard test method D4318, *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.* Test results are presented on Figure 7.

Soil Conditions

Soils underlying existing surface conditions (i.e., 6 to 10 inches of topsoil) can be categorized into two units:

- **Recessional lacustrine:** Recessional lacustrine deposits were observed in all five test pits, and consisted of soft, brown or mottled brown silt with variable sand content. The deposits exhibited a low bearing capacity and very low infiltration rates.
- **Glacial till:** Glacial till was observed beneath the lacustrine deposits in test pits TP-4 and TP-5. The till varied from dense, brown to gray sand with variable silt and gravel content to very stiff, brown silt.

Cobbles were observed in test pit TP-4, and are often found in glacial till deposits. Cobbles and boulders could be present throughout the site. The contractor should be prepared to manage such oversized material.

Groundwater Conditions

During LAI's February 2020 field investigation, perched groundwater was observed at 6 ft bgs in test pit TP-4. The wetland areas mapped at the site likely store groundwater on top of silt or glacial till layers. A true groundwater table was not observed in LAI's explorations.

The groundwater conditions reported herein are for the specific locations and date indicated, and may not be representative of other locations and/or times. Groundwater conditions will vary with local subsurface conditions, weather conditions, and other factors. Furthermore, groundwater levels are expected to fluctuate seasonally, with maximum groundwater levels occurring during late winter and early spring.

Seismic Design

LAI understands that seismic design will be performed using 2018 International Building Code standards (ICC 2017). The parameters in Table 1 can be used to compute seismic base shear forces.

Table 1. 2018 International Building Code Seismic Design Parameters

Peak ground acceleration = 0.604
Spectral response acceleration at short periods (S_S) = 1.42g
Spectral response acceleration at 1-second periods (S_1) = 0.515g
Site class = D
Site coefficient (F_a) = 1.0
Site coefficient (F_v) = 1.785[(a)]

(a) The structural engineer must calculate the seismic response coefficient (C_S) in accordance with Section 11.4.8, Exception 2 of the American Society of Civil Engineers' *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (2017).
F_a, F_v = acceleration (0.2-second period) and velocity (1.0-second period) site coefficients, respectively
g = force of gravity
S_s, S_1 = 0.2-second and 1.0-second period spectral accelerations, respectively

Based on the subsurface conditions observed in LAI's February 2020 explorations, seismically induced soil liquefaction and lateral spreading are not likely to occur at the site. Given the distance between the site and the nearest known active crustal fault, the risk of ground rupture due to surface faulting is low.

Conclusions and Recommendations

Shallow site soils are soft, but will provide adequate support for shallow foundations and anticipated structural loads. Because they are fine grained and moisture sensitive, site soils are not suitable for reuse as structural fill. Earthwork should be avoided during heavy and/or extended precipitation events. A 1-ft-thick layer of import structural fill should be placed across structural footprints to limit soil disturbance and increase soil bearing capacity.

Foundation Support

In areas that will be developed with foundations and slabs-on-grade, at least 12 inches of fine-grained, moisture-sensitive soil should be overexcavated and replaced with Gravel Borrow. Gravel Borrow should meet the requirements in Section 9-03.14(1) of the Washington State Department of Transportation's *2020 Standard Specifications for Road, Bridge, and Municipal Construction* (*2020 WSDOT Standard Specifications*). Following overexcavation, the exposed subgrade should be sloped to allow runoff to drain away from the proposed structures. Gravel Borrow should be compacted to 95 percent of the maximum dry density, in accordance with ASTM standard test method D1557, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))*.

The design parameters in Table 2 should be used in conjunction with the complete recommendations in this memorandum.

Table 2. Summary of Design Parameters for Shallow Foundations

Allowable soil bearing pressure = 2,000 psf
Friction coefficient (factored) = 0.35
Passive earth pressure = 250 pcf
Minimum foundation width = 18 inches (continuous), 24 inches (isolated)
Maximum foundation width (for settlement considerations) = 5 ft (continuous), 10 ft (isolated)

ft = feet
pcf = pounds per cubic foot
psf = pounds per square foot

When calculating design parameters, LAI assumed that shallow foundations would be constructed on 1 ft of Gravel Borrow extending to uniformly firm, unyielding, unsaturated silt. The allowable soil bearing pressure in Table 2 applies to long-term dead and live loads, exclusive of the weight of the footing and any overlying backfill. The allowable soil bearing pressure includes a factor of safety of at least 3 on the calculated ultimate bearing capacity. The allowable soil bearing pressure can be increased by one-third for total loads, including transient loads, such as those induced by wind and seismic forces.

LAI recommends a minimum width of 18 inches for continuous wall footings and 24 inches for isolated column footings. For frost protection, perimeter footings should be embedded at least 12 inches below the lowest adjacent grade, where the ground is flat. If used, interior footings should be embedded at least 6 inches below the nearest adjacent grade. If construction is performed as recommended, settlement of continuous or isolated foundations is estimated to be on the order of 1 inch or less. Differential settlement between similarly loaded foundation elements is estimated to be on the order of ½ inch or less. Settlement is likely to occur as building loads are applied during construction.

An allowable coefficient of sliding resistance of 0.35, applied to vertical dead loads only, can be used to compute frictional resistance acting on the base of footings. The allowable coefficient of sliding resistance includes a factor of safety of 1.5 on the calculated ultimate value.

The passive resistance of properly compacted structural fill placed against the sides of foundations can be considered equivalent to a fluid with a density of 250 pounds per cubic foot (pcf). The foundation passive earth pressure value has been reduced by a factor of 1.5 to limit deflections to less than 2 percent of the embedded depth. The passive earth pressure and friction components can be combined, provided the passive component does not exceed two-thirds of the total. The top foot of soil should be excluded from the calculation, unless the foundation perimeter will be covered by a slab-on-grade or pavement.

Slabs-On-Grade

A modulus of vertical subgrade reaction (subgrade modulus) can be used to design slabs-on-grade. The subgrade modulus will vary based on the dimensions of the slab and the magnitude of applied loads on the slab surface; slabs with larger dimensions and loads are influenced by soils at a greater depth. LAI recommends using a subgrade modulus of 125 pounds per cubic inch to design on-grade floor slabs. This subgrade modulus is for a 1-ft by 1-ft square plate, and is not the overall modulus of a larger area. When calculating the subgrade modulus, LAI assumed that on-grade slabs would be placed on a 1-ft-thick layer of Gravel Borrow.

Interior slabs-on-grade should include a vapor barrier and a capillary break layer, consistent with industry standards. The 1-ft-thick layer of Gravel Borrow placed beneath slabs to limit subgrade disturbance could double as a capillary break material, provided it is not contaminated with silty soils during construction.

Pavement Design

Pavement sections should be constructed on a uniformly firm, unyielding subgrade that consists of 1 ft of recompacted native soil or import structural fill. Native soils will not provide a suitable subbase for pavements constructed during the wet season. If wet weather construction is unavoidable, one foot of import structural fill should be placed beneath the pavement section.

When calculating the parameters in Table 3, LAI assumed a 20-year design life and maximum equivalent single-axle loads of 100,000 for the standard-duty pavement section and 1,000,000 for the heavy-duty section. For new pavement installed within public rights-of-way, local standards will supersede the recommendations provided herein.

Table 3. Recommended Asphalt Pavement Design Section

Pavement Section Type	Asphalt Pavement Thickness (inches)	Crushed Surfacing Thickness (inches)
Standard duty	2	4
Heavy duty	3	6

Base course material should be compacted to at least 95 percent of the maximum dry density (ASTM standard test method D1557), and should meet the requirements for Crushed Surfacing Base Course in Section 9-03.9(3) of the *2020 WSDOT Standard Specifications.* To facilitate fine grading of the surface, the upper 2 inches of crushed surfacing could consist of Crushed Surfacing Top Course. Prevention of road base saturation is essential for pavement durability, and efforts should be made to limit the amount of water entering the base course.

Asphalt concrete should be Class B aggregate material or hot-mix asphalt class ½ inch and PG58H-22 binder conforming to the requirements in Section 5-04 of the *2020 WSDOT Standard Specifications.* Asphalt should be compacted to at least 91 percent of the Rice density.

Stormwater Infiltration

The site is underlain by silt with variable sand content and by impermeable glacial till. These soils have a low infiltration rate, and wetlands have formed in areas of the site with water ponding. Based on the subsurface conditions observed in LAI's February 2020 explorations, onsite stormwater infiltration may not be feasible. Fine-grained site soils are likely to have a limited infiltration rate of 0.05 inches per hour.

Site Work

The following key points should be reviewed during development of design specifications:

- **Stripping:** Organic-rich topsoil is present throughout the site, and extends approximately 1 ft bgs. LAI recommends stripping the sod/topsoil from beneath all structural areas (i.e., footings, slabs-on-grade, and pavement sections). An average stripping depth of 1 ft should be assumed. Stripped material is not suitable for reuse as structural fill, but can be stockpiled and used in landscaped areas.
- **Subgrade preparation:** Before structural fill or formwork is placed, the subgrade should be evaluated by the geotechnical engineer. Accessible subgrades should be proof-rolled; areas of limited access can be evaluated using a steel T-probe. If probing or proof-rolling reveals loose and/or disturbed subgrades, the upper 1 ft of subgrade should be scarified, moisture conditioned, and compacted to a firm, unyielding condition, or overexcavated and replaced with compacted structural fill.
- **Site utilities:** Site soils are anticipated to provide adequate foundation support for new utility lines. Unsuitable soil should be overexcavated and replaced with crushed, processed, or naturally occurring granular material. The material should meet the gradation requirements for Gravel Backfill for Pipe Zone Bedding in Section 9-03.12(3) of the *2020 WSDOT Standard Specifications.* Foundation material should be placed in 6-inch lifts and mechanically compacted to provide a firm trench bottom.
- **Site soils:** Nearly all site soils are fine grained and moisture sensitive. Earthwork should be avoided during heavy and/or extended precipitation events. Native soils will require moisture conditioning, even in dry summer months. If reused as structural fill, native soils should be moisture conditioned and screened for constituents greater than 6 inches in diameter. In LAI's opinion, large-scale reuse of native soils is impractical, as preparation could delay the project schedule.
- **Import structural fill:** Gravel Borrow, as described in Section 9-03.14(1) of the *2020 WSDOT Standard Specifications,* is a suitable source of import structural fill. During periods of wet weather, the fines content should not exceed 5 percent, based on the minus ¾-inch fraction.

- **Fill placement and compaction:** Structural fill should be placed on an approved subgrade that consists of uniformly firm, unyielding, inorganic native soil, or on compacted structural fill extending to such soils. Structural fill should be placed and compacted in accordance with Section 2-03.3(14)C, Method C of the *2020 WSDOT Standard Specifications.* Method A is appropriate for non-structural areas, such as landscaping. Each layer of structural fill should be compacted to at least 95 percent of the maximum dry density, as determined using the compaction control tests described in Section 2-03.3(14)D of the *2020 WSDOT Standard Specifications.* Alternatively, maximum density can be determined using ASTM standard test method D1557.
- **Construction dewatering:** Perched groundwater zones may be encountered during the wet season, and the need for construction dewatering should be anticipated. LAI recommends dewatering temporary excavations to allow construction to be completed in the dry. Where groundwater seepage is encountered, conventional sumps and pumps should be sufficient. The contractor should be responsible for the design, monitoring, and maintenance of any dewatering system(s).
- **Temporary slopes:** Temporary excavations should be completed in accordance with Section 2-09 of the *2020 WSDOT Standard Specifications.* The contractor should be responsible for actual excavation configurations and the maintenance of safe working conditions, including temporary excavation stability. Temporary excavations in excess of 4 ft should be shored or sloped in accordance with the requirements outlined in Safety Standards for Construction Work, Part N (Washington Administrative Code Chapter 296-155). The soil likely to be exposed in the excavations should be considered Type C with a maximum allowable excavation inclination of 1½ horizontal to 1 vertical (1½H:1V). All applicable local, state, and federal safety codes should be followed.
- **Permanent slopes:** Permanent cut-or-fill slopes should be no steeper than 2H:1V. This design recommendation does not apply to stormwater pond slopes, which are typically 3H:1V or flatter. Stormwater pond slopes should be designed in accordance with local stormwater codes. Permanent and temporary slopes should be protected from erosion and reseeded or revegetated as soon as practical.
- **Obstructions:** During LAI's February 2020 field investigation, cobbles were observed in site soils. The contractor should be prepared to encounter cobbles and boulders in the excavations.

Construction Support Services

LAI should review the project plans and specifications to verify that geotechnical recommendations have been properly interpreted and implemented.

Monitoring, testing, and consultation should be provided during construction to confirm that site conditions are consistent with those observed in LAI's explorations, and to provide expedient recommendations should conditions differ from those anticipated. Construction monitoring activities would include compaction testing of structural fill and observation of slab, pavement, and structural foundation subgrade preparation. LAI would be pleased to provide construction monitoring services.

Use of This Technical Memorandum

Landau Associates, Inc. (LAI) has prepared this technical memorandum for the exclusive use of Capitol Land Trust; Robert W. Droll, Landscape Architect, PS; and the project design team for specific application to the Inspiring Kids Preserve project in Olympia, Washington. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of LAI. Reuse of the information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by LAI, shall be at the user's sole risk. LAI warrants that, within the limitations of scope, schedule, and budget, its services have been provided in a manner consistent with that level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. LAI makes no other warranty, either express or implied.

Closing

We trust that this memorandum provides you with sufficient information to proceed with the project. If you have questions or comments, please contact the undersigned at (360) 791-3178.

LANDAU ASSOCIATES, INC.

Lance Levine, PE
Senior Project Engineer

Calvin McCaughan, PE
Principal

LGL/CAM/mcs
[O:\1444\012.010\R\INSPIRING KIDS PRESERVE DRAFT TECHNICAL MEMORANDUM 3.18.2020.DOCX]

Attachments: Figure 1. Vicinity Map
Figure 2. Site and Exploration Location Plan
Figure 3. Soil Classification System and Key
Figures 4–6. Logs of Test Pits
Figure 7. Plasticity Chart

References

ASCE. 2017. *Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-16).* American Society of Civil Engineers/Structural Engineering Institute.

ASTM. 2017. Annual Book of ASTM Standards. In: *Soil and Rock (I).* West Conshohocken, PA: ASTM International.

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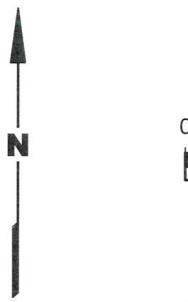
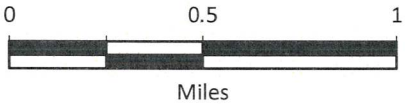
Washington State Department of Labor and Industries. 2016. Construction Work. Chapter 296-155 WAC; Part N. Excavation, Trenching, and Shoring. Washington State Department of Labor and Industries. May 20.

WSDOT. 2019. *M41-10: Standard Specifications for Road, Bridge, and Municipal Construction 2020.* Washington State Department of Transportation.





Data Source: Esri 2012

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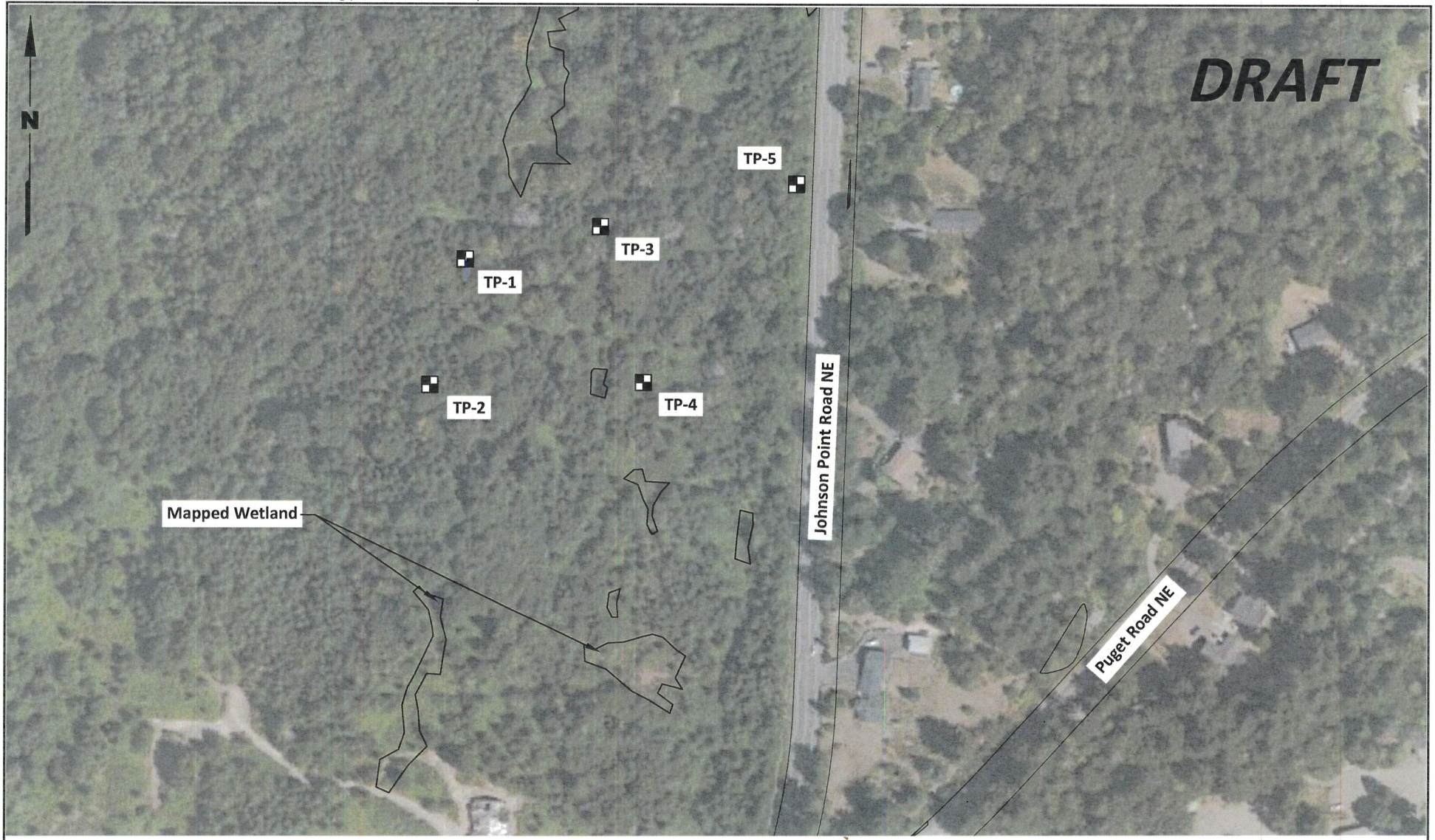
LANDAU ASSOCIATES

Inspiring Kids Preserve Olympia, Washington	**Vicinity Map**	Figure 1

Landau Associates | Y:\CAD\1444\012.010\1444012.010.dwg | 3/13/2020 10:41 AM | caduser



Legend

TP-1 Approximate Test Pit Location and Designation

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Source: Digital Globe 2020; KPFF 2020

0 200 400

Scale in Feet

LANDAU ASSOCIATES

Inspiring Kids Preserve
Olympia, Washington

Site and Exploration Location Plan

Figure
2

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL[1]	TYPICAL DESCRIPTIONS [2][3]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes:
1. USCS letter symbols correspond to symbols used by the Unified Soil Classification System and ASTM classification methods. Dual letter symbols (e.g., SP-SM for sand or gravel) indicate soil with an estimated 5-15% fines. Multiple letter symbols (e.g., ML/CL) indicate borderline or multiple soil classifications.
2. Soil descriptions are based on the general approach presented in the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the Standard Test Method for Classification of Soils for Engineering Purposes, as outlined in ASTM D 2487.
3. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:		> 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	- "very gravelly," "very sandy," "very silty," etc.
	> 15% and ≤ 30%	- "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 15%	- "with gravel," "with sand," "with silt," etc.
	≤ 5%	- "with trace gravel," "with trace sand," "with trace silt," etc., or not noted.

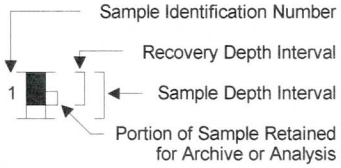
4. Soil density or consistency descriptions are based on judgement using a combination of sampler penetration blow counts, drilling or excavating conditions, field tests, and laboratory tests, as appropriate.

Drilling and Sampling Key

SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Single-Tube Core Barrel
f	Double-Tube Core Barrel
g	2.50-inch O.D., 2.00-inch I.D. WSDOT
h	3.00-inch O.D., 2.375-inch I.D. Mod. California
i	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Vibrocore (Rotosonic/Geoprobe)
5	Other - See text if applicable

SAMPLE NUMBER & INTERVAL



Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

Groundwater

▽ Approximate water level at time of drilling (ATD)

▼ Approximate water level at time after drilling/excavation/well

LANDAU ASSOCIATES

Inspiring Kids Preserve
Olympia, Washington

Soil Classification System and Key

Figure 3

TP-1

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not measured Excavated By: Howard's Construction and Excav. Logged By: DAR	
0	S-1	d	W = 28 AL		ML ML	3 inches of duff over 7 inches of dark brown SILT with sand and organics (soft, moist) **(TOPSOIL)** Brown SILT with sand (soft, moist) **(RECESSIONAL LACUSTRINE)**	Groundwater not encountered.
10	S-2	d			SM	Brown, silty, fine SAND (medium dense, moist)	

Test Pit Completed 02/25/20
Total Depth of Test Pit = 12.0 ft.

TP-2

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not measured Excavated By: Howard's Construction and Excav. Logged By: DAR	
0	S-1	d	W = 37 AL		ML ML	3 inches of duff over 6 inches of dark brown SILT with sand and organics (soft, moist) **(TOPSOIL)** Mottled orange/brown/gray SILT with sand (soft, moist to wet) **(RECESSIONAL LACUSTRINE)**	Groundwater not encountered.
10	S-2	d			SM	Brown, very silty, fine SAND (medium dense, moist)	

Test Pit Completed 02/25/20
Total Depth of Test Pit = 12.0 ft.

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

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Inspiring Kids Preserve
Olympia, Washington

Log of Test Pits

Figure 4

TP-3

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft) / Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not measured Excavated By: Howard's Construction and Excav. Logged By: DAR	
0					ML	3 inches of duff over 7 inches of dark brown SILT with sand and organics (soft, moist)	Groundwater not encountered.
	S-1	d	W = 33 AL		ML	**(TOPSOIL)**	
5						Brown SILT with sand (soft, moist) **(RECESSIONAL LACUSTRINE)**	
	S-2	d			SM	Brown, very silty, fine SAND (loose, moist)	
10					ML	Brown SILT (soft, moist)	
	S-3	d					
15							
20							

Test Pit Completed 02/25/20
Total Depth of Test Pit = 12.0 ft.

TP-4

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft) / Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not measured Excavated By: Howard's Construction and Excav. Logged By: DAR	
0					ML	3 inches of duff over 7 inches of dark brown SILT with sand and organics (soft, moist)	
	S-1	d	W = 33 AL		ML	**(TOPSOIL)**	
	S-2	d			SM	Mottled orange/brown/gray SILT (soft, moist) **(RECESSIONAL LACUSTRINE)**	▽ Perched at 6 feet
5					ML	Brown, silty, fine to coarse SAND with gravel (dense, moist) **(GLACIAL TILL)**	
10	S-3	d				Brown SILT (very stiff, moist)	
					SM	Brown, silty, fine to coarse SAND with gravel and cobbles (dense, moist)	
15	S-4	d					
20							

Test Pit Completed 02/25/20
Total Depth of Test Pit = 15.0 ft.

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

LANDAU ASSOCIATES

Inspiring Kids Preserve
Olympia, Washington

Log of Test Pits

Figure 5

TP-5

SAMPLE DATA				SOIL PROFILE			GROUNDWATER
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): Not measured Excavated By: Howard's Construction and Excav. Logged By: DAR	
0		S-1	d	W = 30 AL		ML	4 inches of duff over 10 inches of dark brown SILT with sand and organics (soft, moist)	Groundwater not encountered.
						ML	**(TOPSOIL)**	
5		S-2	d			SM	Mottled orange/brown/gray SILT with sand (soft, moist)	
		S-3	d				**(RECESSIONAL LACUSTRINE)**	
10		S-4	d				Brown, silty, fine to coarse SAND with gravel (dense, moist)	
							(GLACIAL TILL)	
15							Grades to gray at 6 feet	
20								

Test Pit Completed 02/25/20
Total Depth of Test Pit = 12.5 ft.

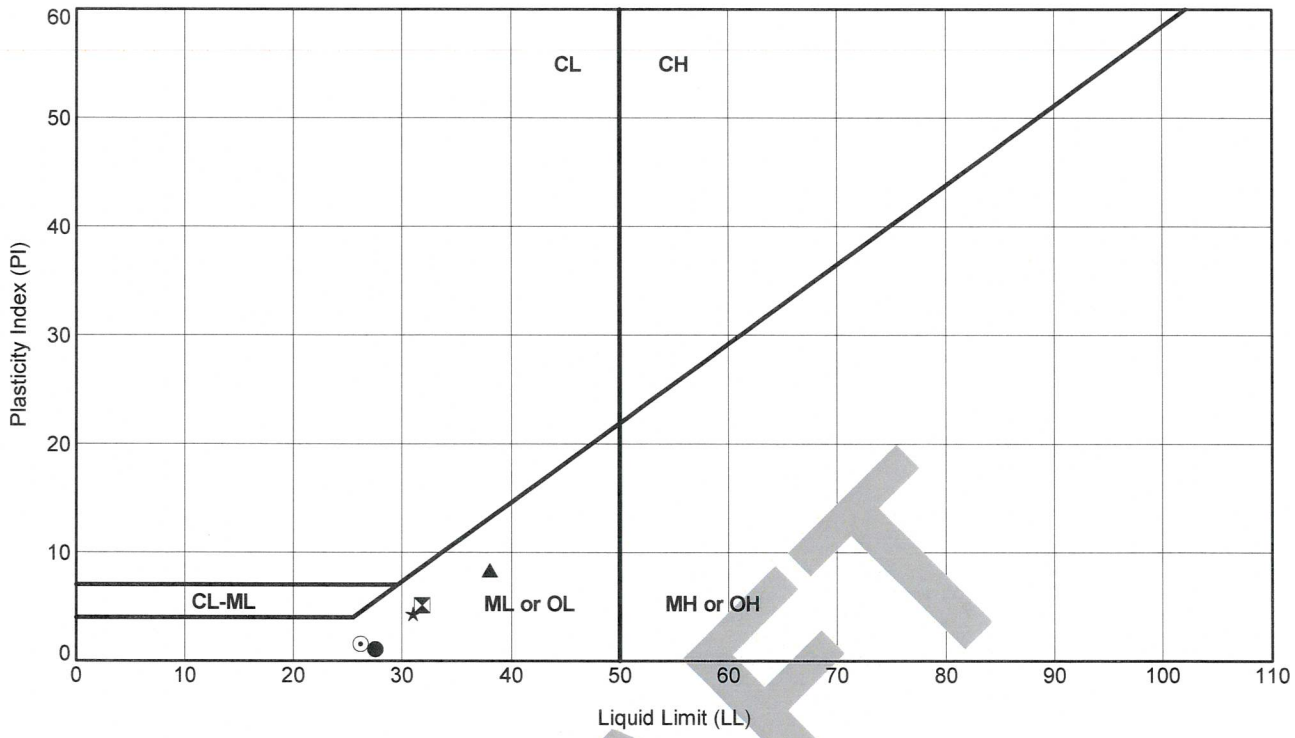
Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

LANDAU ASSOCIATES

Inspiring Kids Preserve
Olympia, Washington

Log of Test Pits

Figure 6



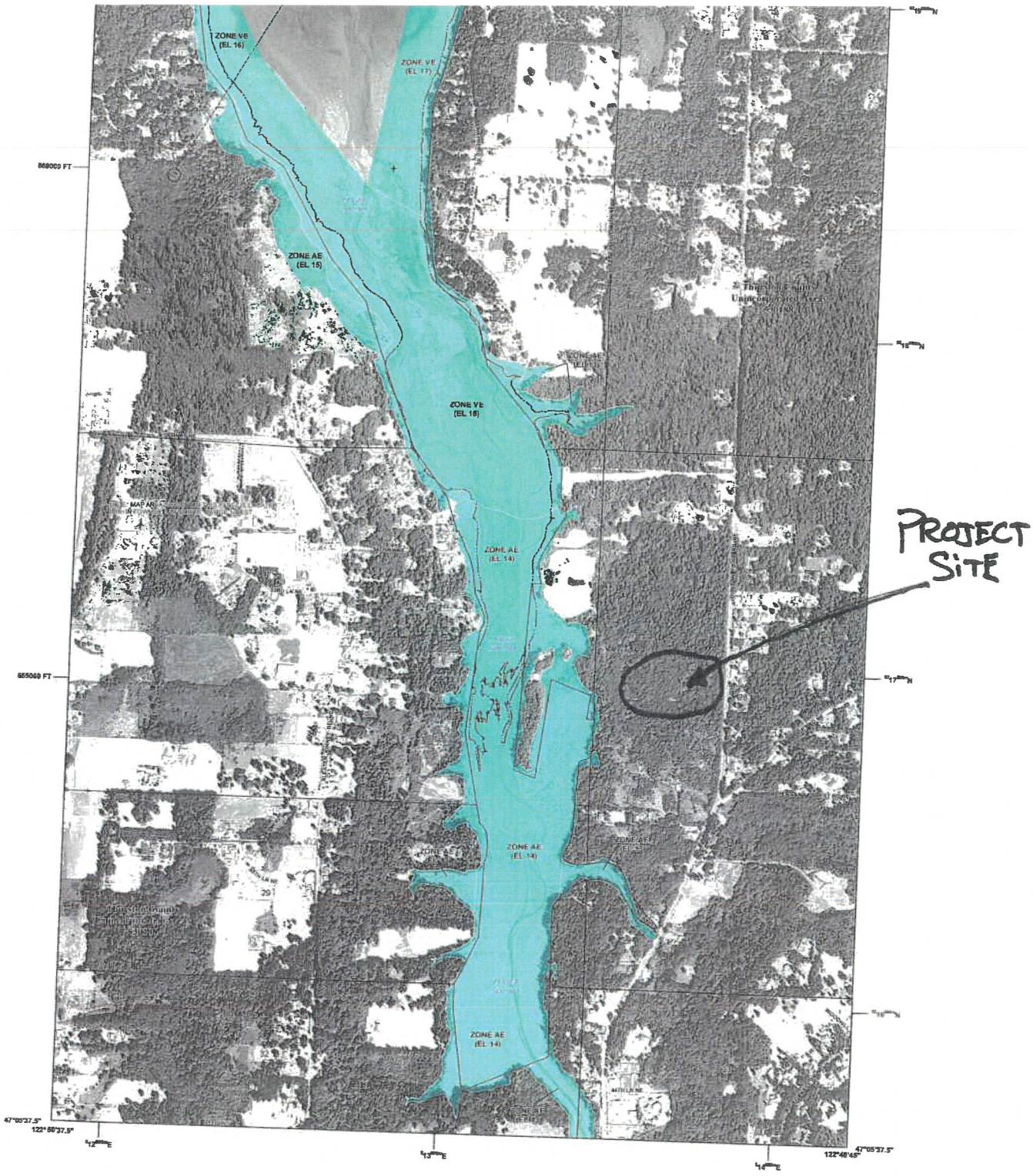
ATTERBERG LIMIT TEST RESULTS

Symbol	Exploration Number	Sample Number	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Natural Moisture (%)	Soil Description	Unified Soil Classification
●	TP-1	S-1	2.0	28	26	2	28	SILT with sand	ML
⧓	TP-2	S-1	2.0	32	27	5	37	SILT	ML
▲	TP-3	S-1	2.0	38	30	8	33	SILT with sand	ML
★	TP-4	S-1	2.0	31	27	4	33	SILT	ML
⊙	TP-5	S-1	2.0	26	25	1	30	SILT with sand	ML

ASTM D 4318 Test Method

APPENDIX J

FEMA Mapping



FLOOD HAZARD INFORMATION

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

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://MSC.FEMA.GOV

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

OTHER AREAS OF FLOOD HAZARD
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*

OTHER AREAS
- Areas of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert or Storm Sewer
- Accredited or Provisionally Accredited Levee, Dike, or Floodwall
- Non-accredited Levee, Dike or Floodwall
- (E) 16.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevations (BFE)

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of the map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the Thurston GeoData Center, Thurston County, WA. This information was derived from digital orthophotography photography dated 2015.

SCALE

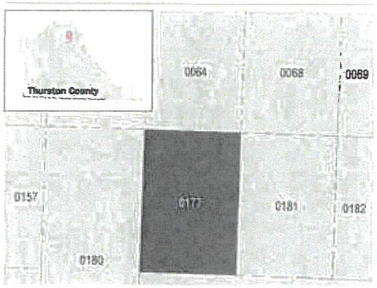
Map Projection:
NAD 1983 State Plane Washington South FIPS 4602 Feet
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

THURSTON COUNTY, WA
And Incorporated Areas

PANEL 177 OF 625

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
THURSTON COUNTY	530183	0177	F

APPENDIX K

Stormwater Scoping Response

Scoping Report Response is on-file with Thurston County

DDECM FIGURE 2-1

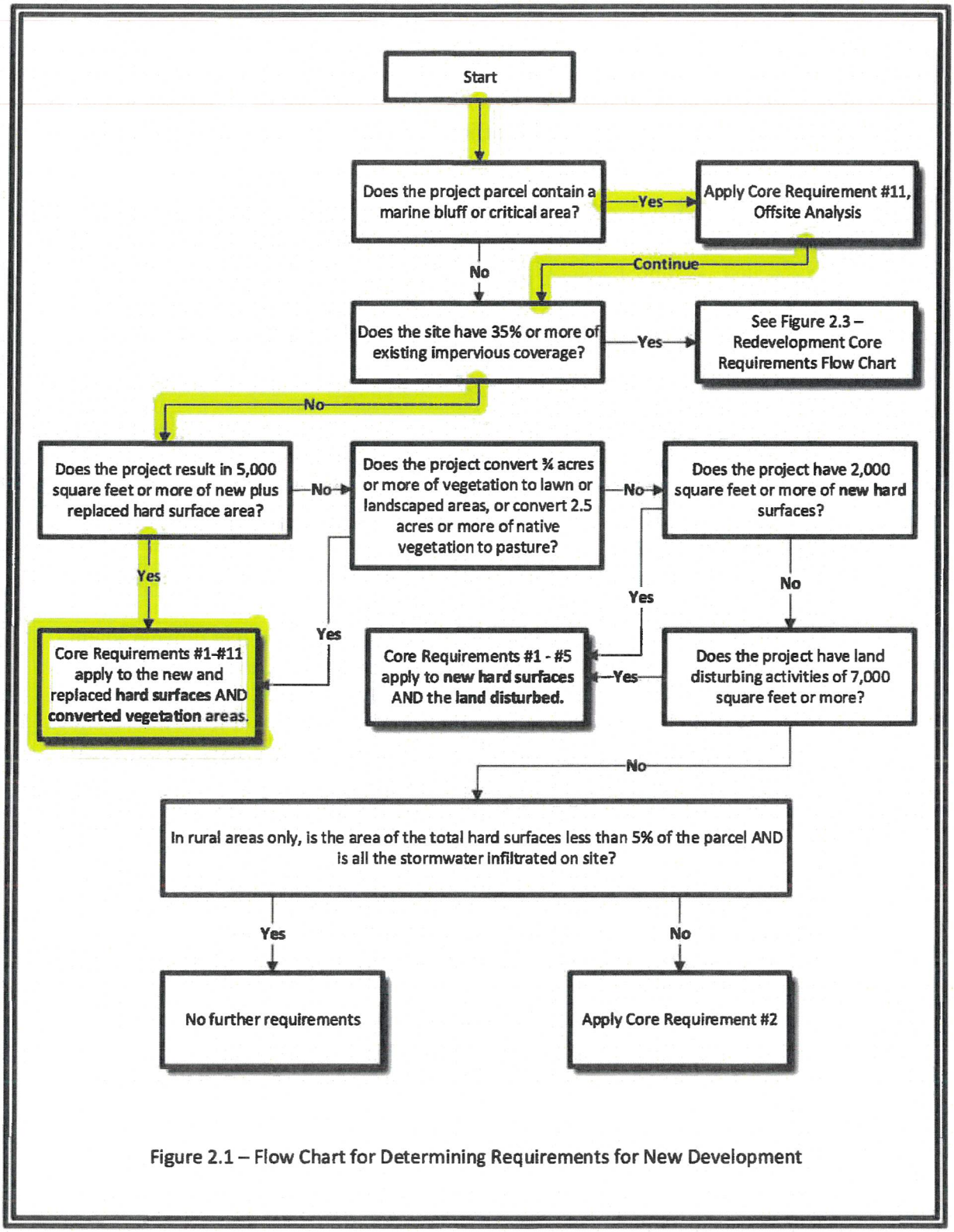


Figure 2.1 – Flow Chart for Determining Requirements for New Development

Figure 2-1 Flow Chart for Determining Requirements for New Development.

Checklist LID.11
Full Dispersion

This checklist reflects most, but not necessarily all of the items that will be reviewed by the Development Engineering Section. It is intended to be used as an aid by us to provide a consistent review of development work in Pierce County. All items may not be applicable in the review of each project and all items of concern to this office may not be covered on this checklist.

Y	N	
		MODELING AND SIZING
Y		Areas that are fully dispersed in accordance with 65/10 Dispersion have fully met Minimum Requirements #5, #6, and #7, and do not need to perform continuous runoff modeling to demonstrate compliance these minimum requirements.
		DESIGN CRITERIA
		Setbacks and Site Constraints
Y		The dispersion of runoff does not create flooding or erosion impacts.
Y		The discharge point is not located within 300 feet of erosion hazard, or landslide hazard area.
Y		The discharge point is not located within 50 feet from the top of slopes steeper than 20% and greater than 10 feet high.
Y		The discharge point is a minimum 30 feet upgradient/ 10 feet downgradient of the drainfield primary and reserve areas. In addition, the flowpath does not intersect with the drainfield primary and reserve area. These requirements can be waived if site topography will clearly prohibit flows from intersecting the drainfield or where site conditions (soil permeability, distance between systems, etc.) indicate that this is unnecessary.
		General 65/10 Design Criteria
Y		Project retains 65% of the site (or a threshold discharge area on the site) in a forested or native condition and impervious developed areas draining to the native vegetation do not exceed 10% of the entire site, or the ratio of the native vegetation area to the impervious area is not less than 65 to 10.
Y		The preserved area is placed in a separate tract or protected through recorded easements for individual lots.
Y		All trees within the preserved area at the time of permit application are retained, aside from the removal of dangerous or diseased trees.
Y		Passive recreation and related facilities do not exceed 8% of the preserved area.
Y		The preserved area does not include septic systems.
Y		Preserved areas are preserved or replanted in accordance with **Checklist LID.01 Native Vegetation Protection, Reforestation, and Maintenance.**
Y		Site meets the requirements for: • 65/10 Residential, Commercial, and Industrial Design Criteria (see details below), or • 65/10 Roadway Design Criteria (see details below)
		65/10 Residential, Commerical, Industrial Design Criteria

Checklist LID.11
Full Dispersion

Y	N	
		Applies to site development and roadways planned for urban density development.
na		Meets all Design Criteria listed above.
		Lawn and landscaping areas (associated with the development areas) that are dispersed into the native vegetation area meet Volume III, Section 3.1 Soil Preservation and Amendment BMP requirements.
		Any additional impervious areas above the 10% do not drain to the native vegetation area.
		The native vegetation f Not Applicable to this project. eet in length (25 feet for sheet flow from a non-native
		The flowpath is locate offsite tract or easement area.
		The slope of the flowpath or dispersal area is no steeper than 15% for any 20-foot reach of the flowpath. If a level spreader is used upstream and vegetation is established, the slope of the flowpath is no steeper than 33%.
		The flowpaths for adjacent dispersion devices are sufficiently spaced to prevent overlap of flows in the flowpath areas.
		Runoff from contributing impervious areas is dispersed into the native vegetation area using the dispersion approaches outlined in the following sections (i.e., Roof Downspout Dispersion, Driveway Dispersion, Roadway Dispersion, or Cleared Area Dispersion).
		Roof Downspout Dispersion
na		Roof surfaces discharge to an area that consists of forested or native vegetative cover and that is more than 65% of the development site area (with less than 10% impervious total).
na		Roof downspouts are dispersed in accordance with Downspout Dispersion and have flowpaths of 100 feet or more through native vegetation.
		Driveway Dispersion
na		Driveway surfaces are within a threshold discharge area that is more than 65% forested or native vegetative cover and less than 10% impervious (total).
na		Driveway surfaces are dispersed in accordance with Concentrated Flow Dispersion and have flowpaths of 100 feet or more through native vegetation, OR driveway surfaces are dispersed along with the road runoff in accordance with the roadway dispersion design requirements below.
		Roadway Dispersion
Y		Roadway surfaces are within a threshold discharge area that is more than 65% forested or native vegetative cover and less than 10% impervious (total).
		The road section is designed to minimize collection and concentration of roadway runoff.
		Concentrated flows are incrementally discharged from the ditch via cross culverts or at the ends of cut cross-sections at a maximum rate of 0.5 cfs for the peak 100-year flow.
		For discharge locations with up to 0.2 cfs for the peak 100-year flow, rock pads or dispersion trenches are used to disperse flows.
		For discharge locations with between 0.2 and 0.5 cfs discharge for the 100-year peak flow, dispersion trenches are used to disperse flows.

Not Applicable to this project.

ID.11
sion

Y	N	
n/a		If included, dispersion trenches meet the following design criteria: • Designed to accept surface flows (free discharge) from a pipe, culvert, or ditch end and aligned perpendicular to the flowpath • Minimum of 2 feet wide by 2 feet deep • Minimum of 50 feet in length • Filled with 0.75-inch to 1.5-inch washed rock • Minimum spacing of 50 feet between centerlines
Y		Flowpaths from adjacent discharge points do not intersect within the 100-foot flowpath lengths, and dispersed flow from a discharge point is not intercepted by another discharge point.
Y		There is no county-determined potential for significant downstream impacts.
		Cleared Area Dispersion
na		Cleared areas draining to the dispersion areas consist of bare soil, non-native landscaping, lawn, or pasture.
		Runoff from the cleared area is dispersed through at least 25 feet of native vegetation.
		No more than 25 feet in contribu Not Applicable to this project. :., through the cleared area). The dispersal flov 1 foot for every 3 feet of contributing flowpath be yond 25 feet (up to a maximum contributing flowpath of 250 feet).
		The topography of the non-native pervious surface does not allow runoff to concentrate prior to discharge to the dispersal area.
		65/10 Roadway Project Design Criteria Applies to public and private roads, typically on roads outside of the urban growth areas.
		Uncollected or Natural Dispersion into Adjacent Vegetated Areas (i.e., sheet flow into the dispersion area)
Y		Depth to the average annual maximum groundwater elevation is at least 3 feet.
		The contributing impervious surface flowpath length is less than 75 feet.
		The contributing pervious flowpath length is less than 150 feet.
		The lateral slope of contributing impervious drainage area is less than 8%.
		The longitudinal slope of road is less than 5%.
		Road side slopes (not part of the dispersion area) are less than 25%.
		Dispersion area does not include road side slopes unless native vegetation is re-established and slopes are less than 15%.
		Road shoulders that are paved or graveled are counted as impervious surface. (Permeable pavement shoulders are considered a hard surface, not an impervious surface.)
		The length of the dispersion area is equivalent to length of road.
		The average longitudinal (parallel to road) slope of the dispersion area is less than 15%.
		The average lateral slope of the dispersion area is less than 15%.

Checklist LID.11
Full Dispersion

Y	N	
na		For sites with outwash soils with initial hydraulic conductivity of 4 inches per hour or greater, the following criteria are met: • 10 feet of dispersion area flowpath is provided for up to 20 feet of contributing impervious width (i.e., perpendicular to the direction of roadway travel). • Each additional foot of contributing impervious width includes an additional 0.25 feet of dispersion area flowpath.
Y		For sites with soils not meeting the above criteria (Types C and D, and some Type B), the following criteria are met: • 6.5 feet of flowpath is included for every 1 foot of contributing impervious width draining to it. • A minimum flow path distance of 100 feet is provided.
		Channelized Stormwater Into Areas With a) Native Vegetation or b) Cleared Land in Areas Outside of the UGA
Y		Depth to the average annual maximum groundwater elevation is at least 3 feet.
Y		Channelized flow is re-dispersed to produce the longest possible flowpath.
Y		Flows are evenly dispersed across the dispersion area.
Y		The length of dispersion area is equivalent to length of the road.
		The average longitudinal and lateral slopes of the dispersion area are less than 8%.
		The slope of any flowpath segment is no steeper than 15% for any 20-foot reach of the flowpath segment.
		Flows are dispersed using rock pads and dispersion techniques as specified under **Roadway Dispersion** (see above).
		For sites with outwash soils with initial hydraulic conductivity of 4 inches per hour or greater, the dispersion area flowpath is at least half the width of the contributing impervious drainage area.
		For sites with soils not meeting the above criteria (Types C and D, and some Type B), the following criteria are met: • 6.5 feet of flowpath is included for every 1 foot of contributing impervious width draining to it. • A minimum flow path distance of 100 feet is provided.
		Engineered Dispersion of Stormwater Runoff into Areas with Engineered Soils
		Depth to the average annual maximum groundwater elevation is at least 3 feet.
		Average longitudina of dispersion area is less than 15%.
		Average lateral slop ss than 15%.
		The dispersion area is planted with native trees and shrubs.

Not Applicable to this project.

Checklist LID.11
Full Dispersion

Y	N	
		Stormwater is dispersed via sheet flow or via collection and re-dispersion in accordance with the techniques specified under **Roadway Dispersion** (see above).
		For sites with outwash soils with initial hydraulic conductivity of 4 inches per hour or greater, the following criteria are met: • Soil are amended to meet Volume III, Section 3.1 Soil Preservation and Amendment BMP requirements. • 10 feet of dispersion area flowpath is provided for up to 20 feet of impervious width. • An additional 0.25 feet of dispersion area flowpath is provided for each additional foot of impervious width beyond 20 feet.
		For sites with soils not meeting the above criteria (Types C and D, and some Type B), the following criteria are met: • Soil are amended to meet Volume III, Section 3.1 Soil Preservation and Amendment BMP requirements. • The dispersion area must meet the 65/10 ratio.
		CONSTRUCTION CRITERIA INCLUDED IN THE SWPPP
		The preserved area is shown on all property maps.
		The dispersion area is clearly identified (e.g., using flagging or high visibility fencing) and protected prior to and during construction.
		A soil and vegetation management plan is provided showing areas to be protected and restored areas.
		Construction SWPPP sequencing that will protect the dispersion area
		Construction SWPPP BMPs and protection techniques are implemented as applicable. The upslope of construction areas are stabilized and overland flow distances are minimized.
		Operate machinery outside of dispersion area during construction.
		Refer to construction requirements in **Checklist 42:** ***Preserving Native Vegetation and Restoring Site Vegetation***.
		INSPECTION CRITERIA
		The dispersion facility meets applicable design and construction criteria (see * in Design Criteria above).

SWPPP Not Submitted for Preliminary