WCE

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MEMORANDUM

TO:	City of Spokane M. Nilsson, J. Taylor and J. Saywers		
FROM:	Todd R. Whipple, P. E.		
DATE:	September 7, 2022		
PROJECT NO:	21-3130	**NAME:**	Westridge PUD, Phase 1 Construction 21st Avenue, Grandview to Westwood Hills, 1st Addition
REGARDING:	Review of the Previously Approved Storm Drainage Report, Prepared by Mike Yake, PE with Inland Pacific Engineering, Inc., dated 9-03-1997		

This report has been prepared by Todd R. Whipple, PE and reviewed by the WCE Staff under the direction of the professional engineer whose seal and signature appears hereon:

INTRODUCTION:

The purpose of the drainage review of the previously approved Drainage Report is to compare results presented in 1997, as prepared under the 1995 Guidelines for Stormwater Management (GSM) as they relate to the current areawide storm water standards as found in the 2008 Spokane Regional Stormwater Manual (SRSM).

This submittal will review two elements and recommend changes if required.

1. Review the Phase 1 requirements which include the construction of 21st Avenue from Grandview to the westerly boundary of the Westwood Hills 1st Addition. This review focused on the approved plans that were approved for construction on 5/19/1998 by the City of Spokane as a part of the final plat of Westridge Addition PUD (Phase 1). A vicinity map is attached for ease of reference on the next page, see Figure 1.

2. Review the overall drainage for the area that will drain to the large low area / borrow area located south of and adjacent to 21st Avenue. This is to review the issues that were evaluated at the time of final plat as it related to the overall Approved Westridge PUD Preliminary Plat. The notable exception to the plans and original assumptions, is that as proposed in 1998 there was intended to be an overflow to the east through the Westwood Hills First Addition. The omitted easement in the Westwood Hills plat generally prohibits the large catchment area from having an emergency overflow route. As this

route is omitted, the large catchment area and resulting 47 Acres of contributing area, will be evaluated as an evaporation and limited infiltration basin, calculations have been included for development of the entirety of what was the Westridge PUD, now Known as the Beard Addition to West Bluff.

Site / Vicnity Map

This review will confirm or modify the storm elements approved in 1997 that are necessary to control and treat the stormwater runoff from the project site. The results reported will confirm that there are no negative impacts to the adjacent properties with the construction of the approved phase 1 development plans.

The project lies within the Spokane County, in the City of Spokane in Section 26, Township 25 N., Range 42 E., W.M. and is comprised of approximately 27 recorded lots and tracts. While this project lies in soils that are generally defined as Type B with some Type C soils, the SRSM would allow the evaluation by the V= 1133A method provided there are less than 12% fines. However, without the benefit of a geotechnical evaluation the V=1815 method which is consistent with the bowstring method from the GSM was used.

While the SRSM allows for treatment using the Low Impact Development (LID) method as outlined in the Washington State Department of Ecology Stormwater Manual for Eastern Washington (SMMEW), this method for phase one is not being utilized, future phases may incorporate this type of analysis.

NARRATIVE:

Site Information:
Property address: 21st Avenue between Grandview and the Westwood Hills 1st Addition Plat

Parcel #'s: Per the Basin Map, See Scout for more information
Lot size: The platted area encompasses approximately 15.9 acres
SW 1/4 of Section 26, T 25 N., R 42 E., W.M.

Geotechnical Information:

A geotechnical evaluation including infiltration testing and calculations have been requested by Budinger and should be provided and prepared within weeks following the submittal of this evaluation. It should be noted that at the time of original design, no geotechnical evaluations were found, yet indicated on the original Basin maps, and only a listing of soil types from what was then the USDA, Spokane County Soil Survey (SCS) provided the following:

> **SOILS DESCRIPTION**
>
> Sheet 73 of the Spokane County Soil Survey indicates that the proposed site primarily consists of Hesseltine soils with some small outcrops of Cheny & Uhlig, and Cocolalla soils. The Hesseltine (HvC, HsB, Hob) and Cheney & Uhlig (CnB) soils belong to soil group B. The small outcrop of Cocolalla (Cy) soil belongs to soil group C. The soil survey map can be seen in the appendix.

The presence of Type B soils would indicate that infiltration, even to a limited degree would be acceptable, the current USDA Soil Survey indicates the following soil types.

> Approximately 10% Cocolalla-Hardesty (1021) complex 0 to 3 percent slopes, a Type B/D soil group; 80% NorthStar-Rock outcrop (3115) complex, 0 to 15 percent slopes, a Type C soil; and 10% Rock Outcrop-NorthStar (3126) complex 15 to 30 percent slopes, a Type C soil.

Proposed Pond C is in Soil Type 3126, a Type C soils. Based on recent infiltration testing provided by Budinger on sites to the north in similar soils, acceptable infiltration rates of 0.3 cfs for a Type 1 drywell were encountered, so the results of the infiltration testing may modify the results of this evaluation. Pond B, a temporary pond is in Soil Type 1021, a the type B/D soil, for the temporary pond an outflow of 0.3 cfs was use, however, additional testing as well will validate the ability to infiltrate water. Within the evaporation analysis of the entire 47 Acre site, an infiltration rate of 1.5x10-7 cfs/sf was used for the evaporation pond, which is the same rate that we use for infiltration into competent basalt rock nearby.

Storage calculations from the original study were for the 100-year event and those were used here. Additionally, the original study used an older version of Pond Pack, that was used here to some extent, however, updated bowstring analysis using the rational method for Basin C and, original Basin B was also used for treatment and total volume based on outflow, a HydroCAD analysis for the entire basin undeveloped (pre) and develop (post) was also evaluated and is attached for reference only as we believe that for Phase 1, the 100-year bowstring evaluation is more conservative. See the Appendix for more information.

Basin C

Basin C as shown in the Basin map, located at the west end of 21st Avenue and includes Beard Avenue, Slopes toward Grandview Avenue. As can be seen from Table 1, the 100-year Pond Pack volume of 5,544 cf from 1998 was conservative because of the way it was run, the SRSM 100-year bowstring maximum storage volume of 5,094 cf while not as conservative is still contained within the total pond volume proposed of 11,846 cf. Pond C was approved to have a Discharge pipe to the ditch on the northside of Grandview Avenue. We propose to eliminate the need for the approved offsite discharge once a full-scale drywell test is performed in Pond C during construction. Thus also eliminating potential impact to downstream properties. See the Appendix for more information.

Table 1 –Basin C Summary (Original Basin C, pg. 4 Summary Table)

Item No.	Description	Volume
1998 Analysis Basin C	Required 100-year volume, offsite discharge was 0.9 cfs	5,544 cf (Pond Pack)
1998 Analysis Basin C	Required Treatment volume, offsite discharge was 0.9 cfs	Not Provided
2022 Analysis Basin C	Required 100-year maximum volume, offsite discharge eliminated and 0.3 cfs gallery installed	5,094 cf (Bowstring) 11,846 cf Provided/Proposed
2022 Analysis Basin C	Required Treatment volume, offsite discharge eliminated and 0.3 cfs gallery installed	2,172 cf (Bowstring) 2,174 cf Provided/Proposed

Basins B1 & B2

Basins B1 & B2 are located at the East end of 21st Avenue and include the bluff to the north, slope to the large catchment/barrow area south of 21st Avenue. As can be seen in Table 2 as well in the Stormwater Summary Table from the 1998 Storm Report, the previous project did not require any storage volume for Basin B, the reasoning we believe, is that it ultimately was covered or would be covered in the storage of the large Catchment/ barrow area known as Pond A, where the full storm was to be stored.

Regardless, we have evaluated Basin B1 using the 100-year Bowstring method for stormwater per the SRSM the runoff from Basin B and the easterly 2/3rds of 21st Avenue would result, for the 100-year storm, a maximum volume of 8,388 cf and a treatment volume of 2,097 cf. For this basin we are proposing a temporary Pond A, that will meet these treatment requirements as noted within Table 2. The outflow rate for Basin B1 was found via calculations which can be found in the Appendix. Basin B2 was not evaluated using the 100-year Bowstring method given that the

bio-filtration channel within Basin B2 has its own separate design sheet. See appendix for Bio-filtration Channel Design sheet.

Biofiltration Channel:
The stormwater generated within Basin B2 of this site will sheet flow across the pavement to the gutter where it will then be collected by the proposed storm drainage system and conveyed into the proposed Bio-filtration channel per section 6.7.2 of the S.R.S.M. Once in the Bio-filtration channel the stormwater will flow down through the channel media and continue to be treated. The treated stormwater will then discharge be discharge to a wetland as clean treated stormwater per the Spokane Regional Stormwater Manual.

Table 2 –Phase 1 - Basin B Summary, 21st Avenue Development and upslope undeveloped properties only.

Item No.	Description	Volume
1998 Analysis Basin B	Required 100-year volume, offsite discharge was 2.3 cfs(pg. 4 Summary Table)	0,000 cf (Pond Pack)
1998 Analysis Basin B	Required Treatment volume, offsite discharge was 2.3 cfs(pg. 4 Summary Table)	Not Provided
2022 Analysis Basin B	Required 100-year maximum volume, offsite discharge eliminated and 0.3 cfs gallery installed	8,388 cf (Bowstring) 22,523 cf Provided/Proposed
2022 Analysis Basin B	Required Treatment volume, offsite discharge eliminated and 0.3 cfs gallery installed	2,097 cf (Bowstring) 4,479 cf Provided/Proposed

Post-Development Pond Information

For Ponds C and A we are proposing to upgrade these two ponds to Bio-Retention ponds, with underdrains and rock galleries, the final disposition of the outlet will occur at the completion of the geotechnical infiltration testing. See Table 3 below for more information.

With regards to an emergency overflow path, per the initial approved plans, a pipe was to be built that would allow the emergency overflow to flow into the neighboring Westwood Hills 2nd Addition. However, when the Westwood Hills 2nd Addition was built, this pipe was not included, and a berm was installed along the west side of the project, meaning that emergency overflow would not be able to flow into the addition. At this time, there is no emergency overflow path for the stormwater. However, overall Pond A has 4.19 acres of gross pond area that is several feet lower than the proposed road, and collected survey data states that the 4.19 acre basin will hold about 8 to 10 acre feet of water, or 456,000 cf of water or more. The entire basin has been analyzed for evaporation due to the loss of the discharge route due to the development of the Westwood Hills 2nd Addition, and this basin is oversized for the entire drainage basin by a factor of more than 2. Therefore, for the road improvements for this area, we surmise that no overflow route would technically ever be required. Should the need for an overflow route arise, a pump to

the onsite sewer system may be necessary, but we do not believe that will ever be necessary. As the full Beard subdivision to the south develops, final calculations can be provided, including limited site infiltration, but for this 21st Avenue project, we do not believe this is necessary.

Table 3 – Post-Development Project Site Pond Summary

Basins	Ponds	(Method 1815A (ac)) Treatment Area/Volume (square feet/cubic feet)				
		Required		Provided		
		Pond area	Treatment vol./length	Pond area/length	Treatment vol./length	Pond vol.
POST B1	Temp Pond A	-	2015.17 cf	4,095 sf	4,479 cf	11,846 cf
POST B2	Bio-filtration Channel	-	122.26 lf	N/A	172 lf	N/A
POST C	Pond C	-	2171.58 cf	1,912 sf	2,174 cf	22,523 cf

Refer to basin calculations in Appendix for areas and peak flows for all basins.

OVERALL DEVELOPED PROPERTY – Basins A and B

In the original Drainage Report from 1998, the Author included an analysis for the proposed entirety of the Westridge PUD site being developed, this sized the pond in the large catchment/ borrow area as well as an overflow through Westwood Hills. As the Westwood plats did not include the overflow depicted on the Approved Plans, an analysis to evaluate as an evaporation scenario for these two basins was performed. The area is approximately 47 acres, this analysis used HydroCAD while the original analysis used Pond Pack, circa 1998. The results are included in Table 4 and the Appendix.

Basin A+B in this Analysis for the big pond is a 47-acre area that includes Basin A and B, this is the same for the 1998 Drainage Report with a slight adjustment in area. The results are as follows.

Table 4 –Buildout Preliminary Basin A+B Summary

Item No.	Description	Volume
1998 Analysis Basin A+B	Required 100-year volume, Total Basin size 37.61 + 10.36 = 47.97 Ac (Pond Pack)	100 Year Runoff Basin A = 97,146 cf Basin B = 12,348 cf Total = 109,494 cf / 2.52 ac/ft
1998 Analysis Basin A+B	Storage Volume Provided (est)	Evaporation Pond Storage Volume Provided = 616,884 cf / 14.16 ac/ft
2022 Analysis Basin A+B	Required 100-year volume, 47 acres (HydroCAD)	Runoff Volume = 143,704 cf / 3.299 ac/ft
2022 Analysis Basin A+B	Storage Volume Provided	Bottom Area = 187,308 sf Storage = 559,386 cf / 13.76 ac/ft

As shown within Table 4 the runoff volume of the 2022 analysis is larger than the 1998 analysis, and the estimated storage volume of the large catchment/barrow area is smaller in the 2022 analysis, than in the 1998 analysis. However, within both analysis years, the large catchment area is sufficient to store the runoff of both basins A & B.

Soil infiltration Comparison (SRSM Evaporation Worksheets attached)

Overall Basin Evaporation Results with and without any infiltration show that the proposed large catchment/ barrow (Pond A) area is adequate whether there is infiltration or not. The large pond without infiltration is empty or should be expected to have no standing water between August and September, prior to the beginning of the wet season. Should some infiltration occur, the dry period in the pond would extend to include the month of July.

Critical Areas:

Based on the Critical Area Maps provided by the City of Spokane GIS as well as a review of DNR Streams mapping website, US Fish and Wildlife, National wetlands mapper and other maps as available, there does appear to be critical areas on site. There are inventoried wetlands present within the project site. See attached wetland mitigation report for more information.

CONCLUSION:

As required for the construction of 21st Avenue between Grandview Road and the Westwood Hills subdivision, the previously approved storm drainage report prepared in 1998 by Inland Pacific Engineering and stamped by Mike Yake, PE appears to meet the current standards of the Spokane Regional Stormwater Manual. To be conservative, a couple of changes are being proposed, they are shown on the Amended Construction plans and described as follows:

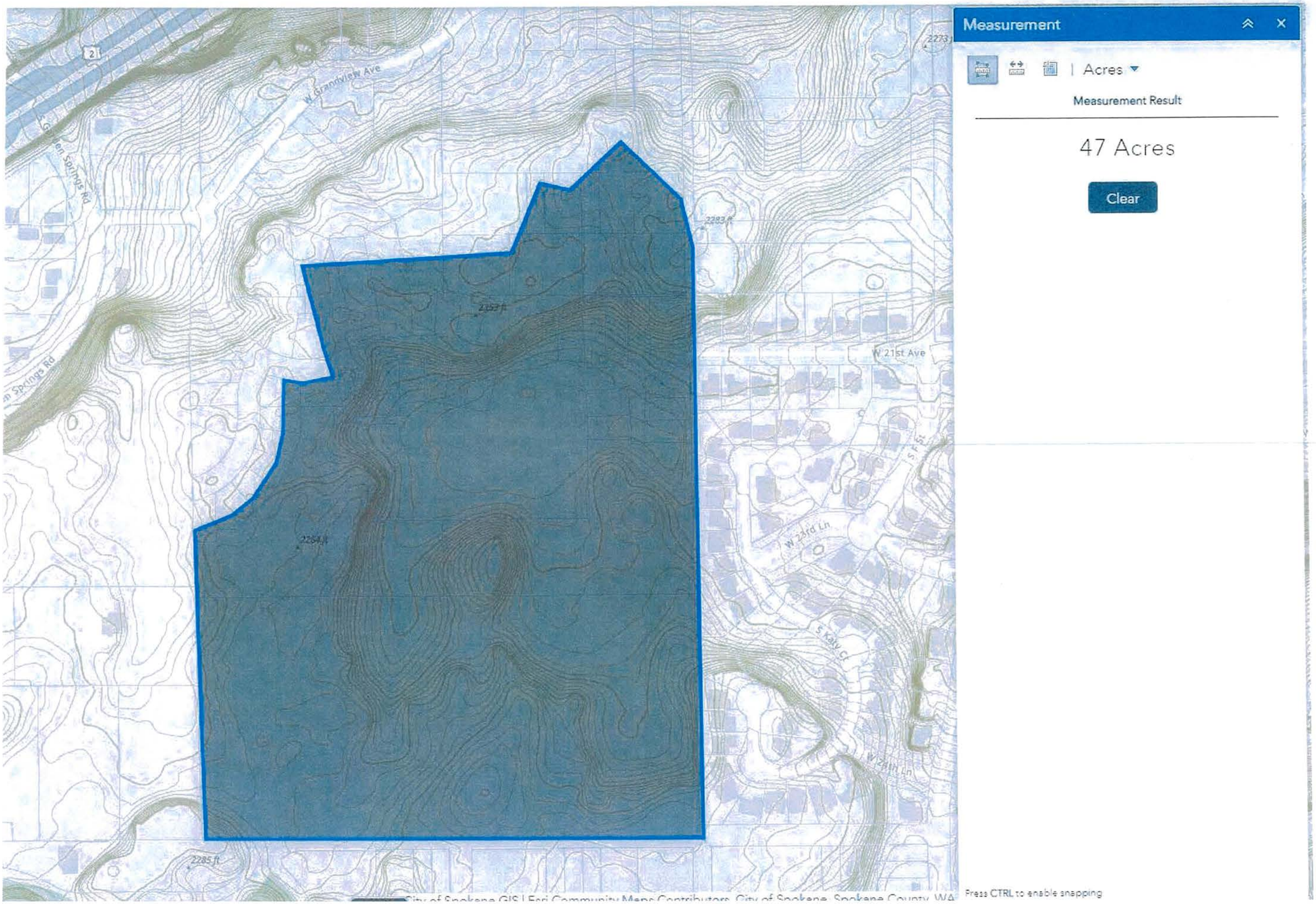
1. A geotechnical evaluation along with infiltration test at Pond C and the large Pond A evaporation impoundment is to be conducted, as no geotechnical evaluation or testing was found in the original application file.
2. All storm calculations were based on the 100-year storm whether the calculations were via bowstring or the CN method using HydroCAD.
3. Pond C is proposed to be modified by decreasing the pond bottom area from 1,988 sf to 1,912 sf, a decrease of 76 sf, also the pond depth will be increased to 1.0 feet, per LID Standards, and at this time some infiltration is assumed to occur. While the overflow pipe will be maintained as an emergency overflow route, it is not anticipated that it will be the primary source of out flow.
4. Basin B, 21st Avenue development, we are recommending that a temporary pond be constructed at the pipe outfall, within the large catchment/Pond A. This temporary pond A will be removed at the time of further design and construction of the remainder of the plat, or it will remain in place as a filtration basin so that clean up and maintenance in the future may be made easier. This temporary Pond A is proposed to be 4,095 sf and again have a depth of 1.0 feet with a berm at 1.5 feet above pond bottom.

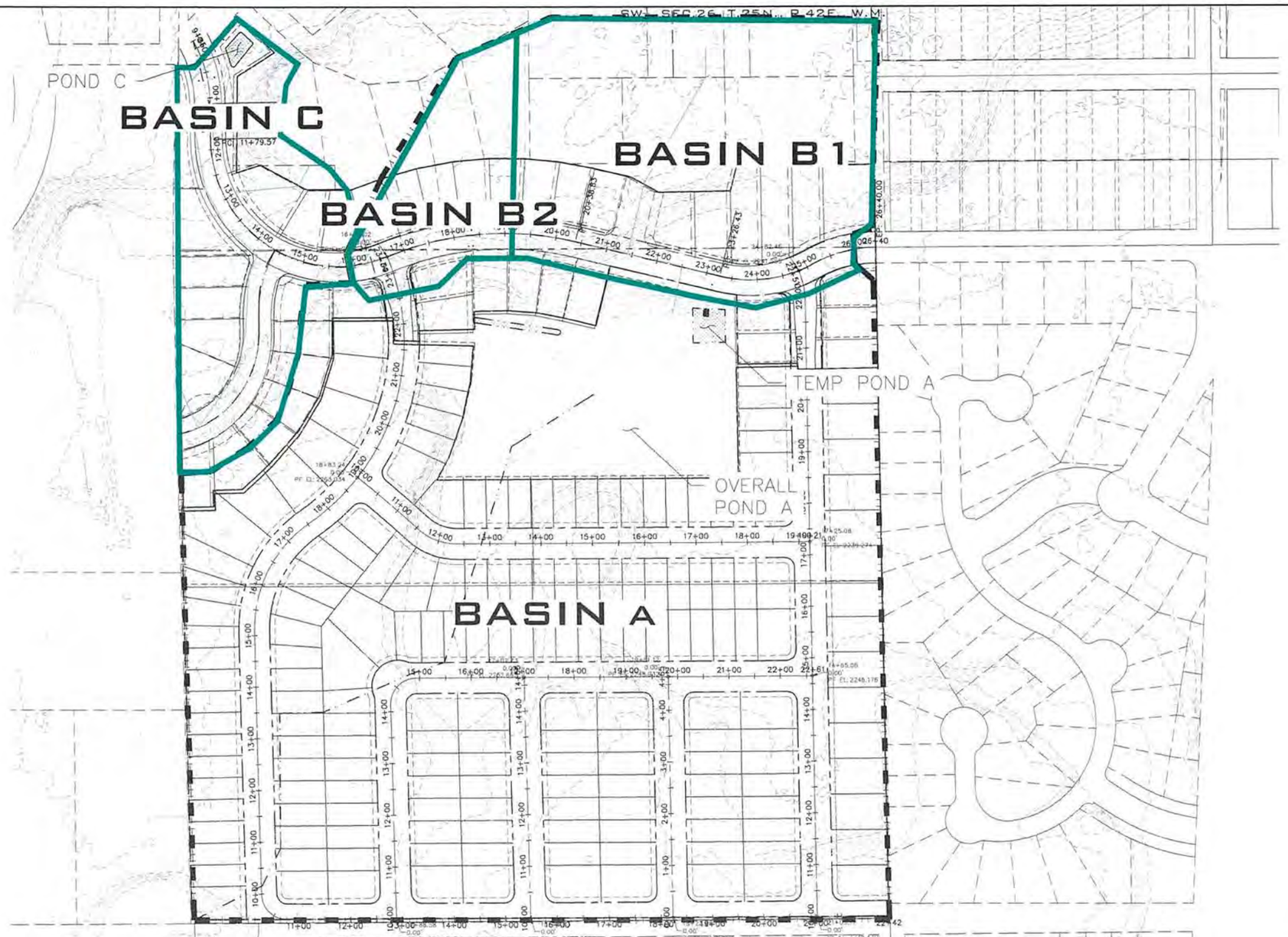
Based on this review of the previously approved storm drainage report, we believe that the final construction of 21st Avenue as noted will adequately collect, treat and discharge stormwater runoff generated by the site during the 100-year storm event. Also, the storm drainage facilities will contain and discharge the 100-year storm under non frozen conditions. Therefore, this project will have no adverse impact to adjacent and/or downstream properties.

APPENDIX

1. Basin Maps
2. Basin Calculation Worksheet
3. Pond Volume Work Sheet
4. Pond Outflow Calc Sheets
5. SRSM Bowstrings
    a. 25 year
    b. 50 year
    c. 100 year
6. Bio-filtration Channel Design Sheet
7. Evaporation Calculations
    a. Without Infiltration
    b. With Infiltration
8. HydroCAD Calculations
9. Geotechnical Report
10. Gutter Spread Calculations
11. Wetland Mitigation Report

Basin Maps


Measurement
Acres
Measurement Result
47 Acres
Clear
W Grandview Ave
Green Springs Rd
W 21st Ave
W 23rd Ln
S Kay Ct
W 24th Ln
2273 ft
2283 ft
2257 ft
2284 ft
2285 ft
Press CTRL to enable snapping



UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

SITE DATA TABLE		
PARCEL NUMBERS	25263.0052 25263.0051 25263.0048	
PROJECT AREA	1,098,005.58	25.21
ZONE	RSF	
	MIN (4)	MAX (10)
ALLOWED DENSITY	100	252
PROPOSED LOTS	180	
PROPOSED DENSITY (u/ac)	7.14	
TOTAL LOT AREA	981,235.69	22.53
RIGHT OF WAY AREA	116,769.89	2.68
MIN. LOT AREA	4,350.24	0.10
MAX. LOT AREA	12,849.17	0.29

N
W E
S

GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
1 inch = 100 ft.

NAVD - 88
XXX

TODD R. WHIPPLE
STATE OF WASHINGTON
25462
REGISTERED
PROFESSIONAL ENGINEER

NO.	DATE	BY	REVISIONS

SCALE:	
HORIZONTAL:	1"= _'
VERTICAL:	1"= _'

PROJ #:	21-3109
DATE:	12/01/21
DRAWN:	XXX
REVIEWED:	XXX

X CIVIL
STRUCTURAL
SURVEYING
TRAFFIC
PLANNING
LANDSCAPE
OTHER

WCE
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BEARD ADDITION TO WEST BLUFF
LOT LAYOUT
CUMBERLAND LN. & 21ST AVE
SPOKANE, WA

SHEET
1 OF 1

JOB NUMBER
21-3109

SW¼, SEC.26, T.25N., R.42E., W.M.

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
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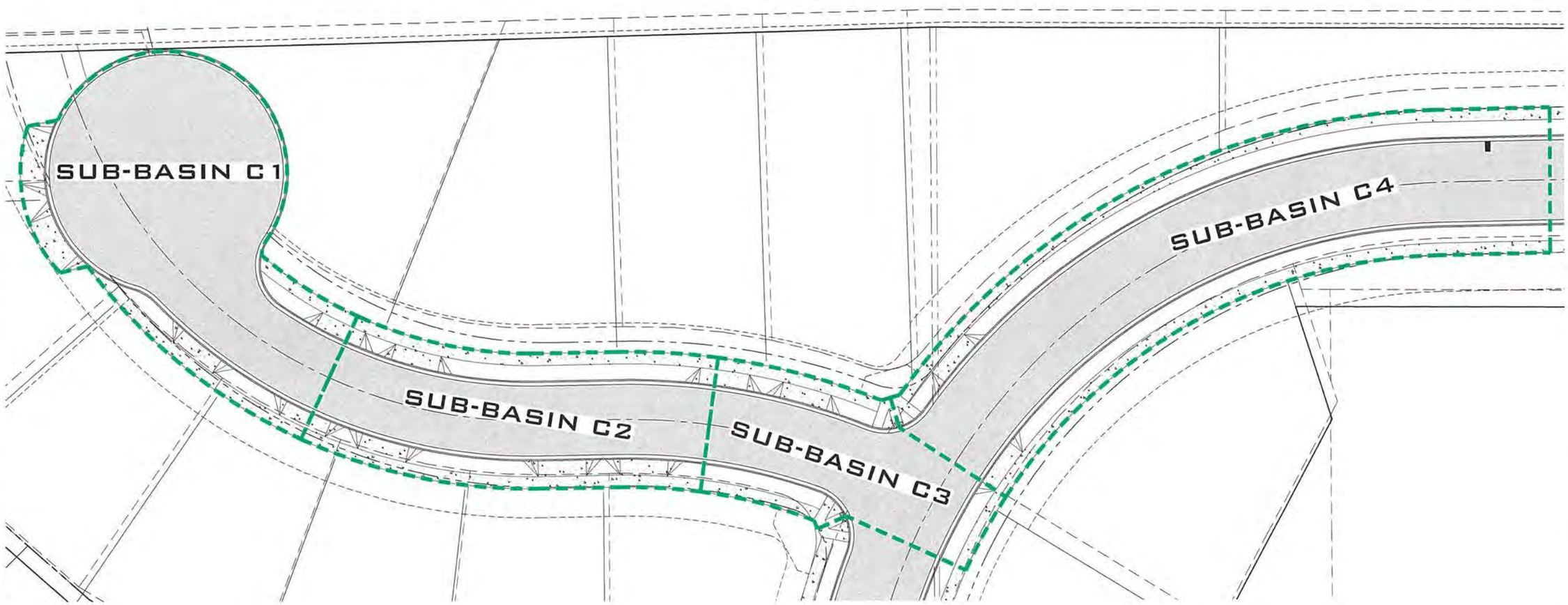

W
S E N

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

TODD R. WHIPPLE
STATE OF WASHINGTON
25482
REGISTERED
PROFESSIONAL ENGINEER

NAVD - 88
XXX

P:\WCE_WORK\2021 WCE PROJECTS\2021-3109 LENMAR - BEARD ADDITION TO WEST BLUFF\DWG\3109-STORM PAVING PLOT DATE: 08/17/22

NO.	DATE	BY	REVISIONS

SCALE:	
HORIZONTAL:	1"=20'
VERTICAL:	N/A
PROJ #:	21-3109
DATE:	12/01/21
DRAWN:	DJW
REVIEWED:	XXX

X CIVIL
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BEARD ADDITION TO WEST BLUFF
POST SUB-BASINS
CUMBERLAND LN. & 21ST AVE
SPOKANE, WA

SHEET
1 OF 1

JOB NUMBER
21-3109

Basin Calculation Worksheet

Whipple Consulting Engineers
Basin Calculation Worksheet

WCE No. 21-3130
8/17/2022 Lennar - 21st Avenue
TRW

Imp 0.9
Per 0.15

Intensities from SRSM eqn. 5-13, per Table 5-7, Assumes Tc = 5 min
I (2 yr) = 1.418 inches I (10 yr)= 2.619 inches NOTE:
I (25 yr) = 3.319 inches I (50 yr)= 3.843 inches
I (100 yr) = 4.381 inches

SPOKANE COUNTY - SRSM - GRASSED PERCOLATION METHOD

												1815 A		Q=CIA (cfs)				
Basin	Total sf	Access/Parking /Street (sf)	Sidewalk (NPGIS) sf	Sidewalk sf	Dvwy SF	Building to Drywell	Buildings to Pond sf	Total Impervious	Total Pervious	Weighted "C"	PGIS sf	POND Area (sf)	Pond Vol (cf)	2 yr	10 yr	25 yr	50 yr	100 yr
Post Onsite Flow																		
POST A (SITE) LESS BASIN C	2,047,320	253,280	79,150	0	79,200	0	168,750	580,380.00	1,466,940.00	0.36	501,230.00	41,769.17	20,884.58	24.17	44.64	56.56	65.50	74.66
POST C - POND C	200,850	37,440	10,400	0	4,928	0	9,750	62,518.00	138,332.00	0.38	52,118.00	4,343.17	2,171.58	2.51	4.63	5.87	6.79	7.75
POST B1 - TEMP POND A	352,862	38,446	5,985	0	3,168	0	6,750	54,349.00	298,513.00	0.27	48,364.00	4,030.33	2,015.17	3.05	5.63	7.14	8.27	9.42
POST B2 - BIO-FILTRATION CHANNEL	99,303	18,760	2,578		2,464	0	5,250	29,052.00	70,251.00	0.37	26,474.00	2,206.17	1,103.08	1.19	2.21	2.80	3.24	3.69
Total	**653,015**	**75,886**	**16,385**	**0**	**8,096**	**0**	**16,500**	**100,482.00**	**552,533.00**	**0.27**	**100,482.00**	**8,373.50**	**4,186.75**	**5.64**	**10.42**	**13.21**	**15.29**	**17.43**
Gutter Sub-Basin Analysis																		
POST C1	12,503	10,105	763	0	1,408	0	0	12,276.00	227.00	0.89	11,513.00	959.42	479.71	0.36	0.67	0.84	0.98	1.11
POST C2	8,960	5,120	1,600	0	1,936	0	0	8,656.00	304.00	0.87	7,056.00	588.00	294.00	0.26	0.47	0.60	0.69	0.79
POST C3	5,982	3,925	953	0	528	0	0	5,406.00	576.00	0.83	4,453.00	371.08	185.54	0.16	0.30	0.38	0.44	0.50
POST C4	17,372	10,449	2,919	0	704	0	0	14,072.00	3,300.00	0.76	11,153.00	929.42	464.71	0.43	0.79	1.00	1.16	1.32
Total	**44,817**	**29,599**	**2,553**	**0**	**2,464**	**0**	**0**	**32,063.00**	**12,754.00**	**0.69**	**32,063.00**	**2,671.92**	**1,335.96**	**1.00**	**1.85**	**2.34**	**2.71**	**3.09**

Pond Volume Worksheet

WHIPPLE CONSULTING ENGINEERS **Date: 8/17/2022**

POND VOLUME CALC SHEET

Project: 21-3130 LENNAR - WESTRIDGE - 21ST AVENUE

Designer: TRW

								Treatment				*Storage*	
Basins	Ponds/ Swales	Bottom Area sf	Treatment Area (w/ Side Slopes)	Squared Side lf	Pond Bottom Elevation at Drywell	Pond Drywell Elevation	Top of Berm Elevation (avg)	Conic Volume to Rim cf	Side * Slope Volume cf	Total Volume to to Rim cf	Conic Volume to Inlet cf	Side Slope Volume cf	Total Volume to Inlet cf
POST C	**C**	1,912	4,349	43.73	1000.00	1001.00	1005.00	1,912	262	**2,174**	9,560	6,559	16,119
POST B	**Temp Pond A**	4,095	8,958	63.99	1000.00	1001.00	1006.00	4,095	384	**4,479**	24,570	13,822	38,392
Totals		**6,007**	**13,307**	**x**	**x**	**x**	**x**	**6,007**	**646**	**6,653**	**34,130**	**20,381**	**54,511**

* LID ponds do not calculate side slopes.

Pond Outflow Calc Sheets

Temp. Pond A Outflow Calcs

Design Infiltration Rate = 1.7×10^{-7} cfs/sf

Pond Bottom Area = 4,095 sf

Outflow Rate = Design Infiltration Rate • Pond Bottom Area

$= 1.7 \times 10^{-7}$ cfs/sf • 4,095 sf

$= 0.000696$ cfs $= 6.96 \times 10^{-4}$ cfs

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Traffic ☐ Planning ☐ Survey ☐ Structural ☐ Landscape ☐ Civil ☐

NAME OF PROJECT			SHEET NUMBER
Westridge PUD			OF
COMPUTED BY	CHECKED BY	JOB NUMBER 21-3130	DATE

Pond C Outflow Calcs

Design Infiltration Rate = 1.7×10^{-7} cfs/sf

Pond Bottom Area = 1,912 sf

Outflow Rate = Design Infiltration Rate · Pond Bottom Area

$= 1.7 \times 10^{-7}$ cfs/sf · 1,912 sf

$= 0.000325$ cfs $= 3.25 \times 10^{-4}$ cfs

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NAME OF PROJECT			SHEET NUMBER
Westridge PUD			OF
COMPUTED BY	CHECKED BY	JOB NUMBER	DATE
		21-3130	

SRSM 25-Year Bowstring

PEAK FLOW CALCULATION PROJECT: 3130

25-Year Design Storm **Lennar - 21st Avenue**

BASIN: B1

Tot. Area	352,862 SF	8.10 Acres	
Imp. Area	54,349 SF	C=	0.9
Perv. Area	298,513 SF	C=	0.15
Wt. C =	0.27	PGIS Area =	48,364

WCE Applicable Travel Time Ground Cover Coefficients

Per Table 5-6 SRSM	
Type of Cover	K (ft/min)
Short Pasture	420
Nearly Bare Ground	600
Small Roadside Ditch/ Grass	900
Paved Area (use for parking lots)	1200
Gutter - 4 inches deep	1500
Gutter - 6 inches deep	2400
Pipe - 12-inch PVC/DI	3000
Pipe - 15/18-inch PVC/DI	3900
Pipe - 24-inch PVC/DI	4700

Reaches

Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	250.00	
K	420.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	4.21	Minutes
Reach 2	Finished Lot from House to Street	
Length	85.00	
K	420.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	1.43	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	300.00	
K	2400.00	
Slope (ft/ft)	0.0300	be sure this is decimal equivalent slope 0.0000
Travel Time	0.72	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	650.00	
K	3000.00	12-inch Pipe minimum
Slope (ft/ft)	0.0500	Average Slope for total pipe run
Travel Time	0.97	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	3900.00	15/18-inch Pipe
Slope (ft/ft)	0.0050	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	7.33	Minutes
Tc for Analysis	7.33	Minutes

BOWSTRING METHOD PROJECT: 0

DETENTION BASIN DESIGN BASIN: B1

DESIGNER: TRW

DATE: 15-Jul-22

Time Increment (min)	10
Time of Conc. (min)	7.33
Outflow (cfs)	0.0007
Design Year Flow	25
Area (acres)	8.10
Impervious Area (sq ft)	54349
'C' Factor	0.27
Area * C	2.151
PGIS Area	48,364

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel. (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)
7.33	440	2.61	5.62	3311	0	3311
15	900	1.67	3.59	3767	1	3766
25	1500	1.21	2.61	4300	1	4299
35	2100	0.98	2.11	4750	1	4748
45	2700	0.84	1.80	5141	2	5139
55	3300	0.74	1.59	5489	2	5486
65	3900	0.67	1.43	5804	3	5801
75	4500	0.61	1.31	6093	3	6089
85	5100	0.56	1.21	6360	4	6357
95	5700	0.53	1.13	6611	4	6607
105	6300	0.49	1.06	6846	4	6842
115	6900	0.47	1.00	7069	5	7064
125	7500	0.44	0.95	7280	5	7275
135	8100	0.42	0.91	7482	6	7476
145	8700	0.40	0.87	7675	6	7669
155	9300	0.39	0.83	7860	6	7854
165	9900	0.37	0.80	8039	7	8032
175	10500	0.36	0.77	8210	7	8203
185	11100	0.35	0.74	8376	8	8369
195	11700	0.33	0.72	8537	8	8529
205	12300	0.32	0.70	8693	9	8684
215	12900	0.32	0.68	8844	9	8835
225	13500	0.31	0.66	8991	9	8982
235	14100	0.30	0.64	9135	10	9125
245	14700	0.29	0.62	9274	10	9264
255	15300	0.28	0.61	9410	11	9399
265	15900	0.28	0.59	9543	11	9532
275	16500	0.27	0.58	9673	11	9661
285	17100	0.26	0.57	9800	12	9788
295	17700	0.26	0.56	9924	12	9912
305	18300	0.25	0.54	10046	13	10033
315	18900	0.25	0.53	10165	13	10152
325	19500	0.24	0.52	10282	14	10269
335	20100	0.24	0.51	10397	14	10383
345	20700	0.23	0.50	10510	14	10495
355	21300	0.23	0.49	10552	15	10537
365	21900	0.22	0.48	10640	15	10625
375	22500	0.22	0.47	10655	16	10639
385	23100	0.22	0.47	10937	16	10921

Rainfall Intensity Coefficients for ***Spokane***

taken from Table 5-7 SRSM

M_{25} = 9.09

N_{25} = 0.626

Flow (weighted c)

Qwc= 7.14 cfs

Flow (time of concentration)

Qtc= 5.62 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
385							
395	23700	0.21	0.45	10707	16	10690	
405	24300	0.21	0.45	10976	17	10959	<==
415	24900	0.20	0.43	10707	17	10689	
425	25500	0.20	0.43	10963	18	10945	
435	26100	0.19	0.41	10655	18	10637	
445	26700	0.19	0.41	10898	19	10880	
455	27300	0.18	0.38	10552	19	10533	
465	27900	0.18	0.38	10782	19	10763	
475	28500	0.17	0.36	10397	20	10377	
485	29100	0.17	0.36	10614	20	10594	
495	29700	0.16	0.34	10190	21	10169	
505	30300	0.16	0.34	10395	21	10374	
515	30900	0.15	0.32	9932	22	9910	
525	31500	0.15	0.32	10124	22	10102	
535	32100	0.14	0.30	9622	22	9600	
545	32700	0.14	0.30	9801	23	9778	
555	33300	0.13	0.28	9261	23	9237	
565	33900	0.13	0.28	9427	24	9403	
575	34500	0.12	0.26	8848	24	8824	
585	35100	0.12	0.26	9001	24	8976	
595	35700	0.11	0.23	8383	25	8358	
605	36300	0.11	0.23	8523	25	8498	
615	36900	0.10	0.21	7867	26	7841	
625	37500	0.10	0.21	7994	26	7968	
635	38100	0.09	0.19	7299	27	7272	
645	38700	0.09	0.19	7413	27	7386	
655	39300	0.08	0.17	6679	27	6652	
665	39900	0.08	0.17	6781	28	6753	
675	40500	0.07	0.15	6008	28	5980	
685	41100	0.07	0.15	6097	29	6068	
695	41700	0.06	0.13	5285	29	5256	
705	42300	0.06	0.13	5361	29	5332	
715	42900	0.05	0.10	4511	30	4481	
725	43500	0.05	0.10	4574	30	4544	
735	44100	0.04	0.08	3685	31	3654	
745	44700	0.04	0.08	3735	31	3704	

"1815A" TREATMENT REQUIREMENTS	
Minimum "1815A" Volume Required	2,015 cu ft
Provided Treatment Volume - Min.	4,479 cu ft

STORAGE REQ. - 25 YEAR DESIGN STORM	
Maximum Storage Required by Bowstring	10,959 cu ft
Provided Pond Storage Volume to Inlet - Min.	22,523 cu ft
Provided Drywell/Gallery Storage Volume	1,200 cu ft
Total Provided Volume	**23,723 cu ft**

PEAK FLOW CALCULATION PROJECT: 3130

25-Year Design Storm **Lennar - 21st Avenue**

BASIN: C

Tot. Area	200,850	SF	4.61	Acres
Imp. Area	62,518	SF	C=	0.9
Perv. Area	138,332	SF	C=	0.15
Wt. C =	0.38	PGIS Area =	52,118	

WCE Applicable Travel Time Ground Cover Coefficients

Per Table 5-6 SRSM	
Type of Cover	K (ft/min)
Short Pasture	420
Nearly Bare Ground	600
Small Roadside Ditch/ Grass	900
Paved Area (use for parking lots)	1200
Gutter - 4 inches deep	1500
Gutter - 6 inches deep	2400
Pipe - 12-inch PVC/DI	3000
Pipe - 15/18-inch PVC/DI	3900
Pipe - 24-inch PVC/DI	4700

Reaches

Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	170.00	
K	1200.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	1.00	Minutes
Reach 2	Finished Lot from House to Street	
Length	85.00	
K	2400.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	0.25	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	150.00	
K	3000.00	
Slope (ft/ft)	0.0600	be sure this is decimal equivalent slope 0.0000
Travel Time	0.20	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	600.00	
K	3900.00	12-inch Pipe minimum
Slope (ft/ft)	0.0600	Average Slope for total pipe run
Travel Time	0.63	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	4700.00	15/18-inch Pipe
Slope (ft/ft)	0.0050	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	2.08	Minutes
Tc for Analysis	5.00	Minutes

Whipple Consulting Engineers

BOWSTRING METHOD PROJECT: 0

DETENTION BASIN DESIGN BASIN: C

DESIGNER: TRW

DATE: 15-Jul-22

Time Increment (min)	10
Time of Conc. (min)	5.00
Outflow (cfs)	0.0003
Design Year Flow	25
Area (acres)	4.61
Impervious Area (sq ft)	62,518
'C' Factor	0.38
Area * C	1.768
PGIS Area	52,118

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel. (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)
5.00	300	3.32	5.87	2359	0	2359
15	900	1.67	2.95	2956	0	2956
25	1500	1.21	2.14	3432	0	3432
35	2100	0.98	1.74	3822	1	3821
45	2700	0.84	1.48	4155	1	4155
55	3300	0.74	1.31	4450	1	4449
65	3900	0.67	1.18	4715	1	4713
75	4500	0.61	1.08	4957	1	4955
85	5100	0.56	1.00	5181	2	5179
95	5700	0.53	0.93	5390	2	5388
105	6300	0.49	0.87	5586	2	5584
115	6900	0.47	0.82	5771	2	5769
125	7500	0.44	0.78	5947	2	5945
135	8100	0.42	0.75	6115	3	6112
145	8700	0.40	0.71	6275	3	6272
155	9300	0.39	0.68	6429	3	6426
165	9900	0.37	0.66	6577	3	6573
175	10500	0.36	0.63	6719	3	6716
185	11100	0.35	0.61	6857	4	6853
195	11700	0.33	0.59	6990	4	6986
205	12300	0.32	0.57	7119	4	7115
215	12900	0.32	0.56	7244	4	7240
225	13500	0.31	0.54	7365	4	7361
235	14100	0.30	0.53	7484	5	7479
245	14700	0.29	0.51	7599	5	7594
255	15300	0.28	0.50	7712	5	7707
265	15900	0.28	0.49	7821	5	7816
275	16500	0.27	0.48	7929	5	7923
285	17100	0.26	0.47	8033	6	8028
295	17700	0.26	0.46	8136	6	8130
305	18300	0.25	0.45	8237	6	8231
315	18900	0.25	0.44	8335	6	8329
325	19500	0.24	0.43	8432	6	8425
335	20100	0.24	0.42	8527	7	8520
345	20700	0.23	0.41	8620	7	8613
355	21300	0.23	0.40	8655	7	8648
365	21900	0.22	0.40	8728	7	8721
375	22500	0.22	0.39	8740	7	8733
385	23100	0.22	0.39	8972	8	8965

Rainfall Intensity Coefficients for ***Spokane***

taken from Table 5-7 SRSM

M_{25} = 9.09

N_{25} = 0.626

Flow (weighted c)

Qwc= 5.87 cfs

Flow (time of concentration)

Qtc= 5.87 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
385							
395	23700	0.21	0.37	8783	8	8776	
405	24300	0.21	0.37	9005	8	8997	<==
415	24900	0.20	0.35	8784	8	8776	
425	25500	0.20	0.35	8995	8	8987	
435	26100	0.19	0.33	8743	8	8734	
445	26700	0.19	0.33	8943	9	8934	
455	27300	0.18	0.32	8659	9	8650	
465	27900	0.18	0.32	8848	9	8839	
475	28500	0.17	0.30	8532	9	8523	
485	29100	0.17	0.30	8711	9	8702	
495	29700	0.16	0.28	8363	10	8353	
505	30300	0.16	0.28	8531	10	8522	
515	30900	0.15	0.26	8152	10	8142	
525	31500	0.15	0.26	8309	10	8299	
535	32100	0.14	0.25	7898	10	7887	
545	32700	0.14	0.25	8045	11	8034	
555	33300	0.13	0.23	7602	11	7591	
565	33900	0.13	0.23	7738	11	7727	
575	34500	0.12	0.21	7263	11	7252	
585	35100	0.12	0.21	7389	11	7377	
595	35700	0.11	0.19	6882	12	6870	
605	36300	0.11	0.19	6997	12	6985	
615	36900	0.10	0.17	6458	12	6446	
625	37500	0.10	0.17	6563	12	6551	
635	38100	0.09	0.16	5992	12	5980	
645	38700	0.09	0.16	6086	13	6074	
655	39300	0.08	0.14	5484	13	5471	
665	39900	0.08	0.14	5567	13	5554	
675	40500	0.07	0.12	4933	13	4920	
685	41100	0.07	0.12	5006	13	4993	
695	41700	0.06	0.10	4340	14	4326	
705	42300	0.06	0.10	4402	14	4388	
715	42900	0.05	0.09	3704	14	3690	
725	43500	0.05	0.09	3756	14	3742	
735	44100	0.04	0.07	3026	14	3012	
745	44700	0.04	0.07	3067	15	3052	

"1815A" TREATMENT REQUIREMENTS		
Minimum "1815A" Volume Required	2,172	cu ft
Provided Treatment Volume - Min.	2,174	cu ft
STORAGE REQ. - 25 YEAR DESIGN STORM		
Maximum Storage Required by Bowstring	8,997	cu ft
Provided Pond Storage Volume to Inlet - Min.	11,846	cu ft
Provided Drywell/Gallery Storage Volume	1,200	cu ft
Total Provided Volume	**13,046**	**cu ft**

SRSM 50-Year Bowstring

PEAK FLOW CALCULATION PROJECT: 3130

50-Year Design Storm **Lennar - 21st Avenue**

BASIN: B1

Tot. Area	352,862 SF	8.10 Acres	
Imp. Area	54,349 SF	C=	0.9
Perv. Area	298,513 SF	C=	0.15
Wt. C =	0.27	PGIS Area =	48,364

WCE Applicable Travel Time Ground Cover Coefficients		
Per Table 5-6 SRSM		
Type of Cover	K (ft/min)	
Short Pasture	420	
Nearly Bare Ground	600	
Small Roadside Ditch/ Grass	900	
Paved Area (use for parking lots)	1200	
Gutter - 4 inches deep	1500	
Gutter - 6 inches deep	2400	
Pipe - 12-inch PVC/DI	3000	
Pipe - 15/18-inch PVC/DI	3900	
Pipe - 24-inch PVC/DI	4700	

Reaches		
Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	250.00	
K	420.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	4.21	Minutes
Reach 2	Finished Lot from House to Street	
Length	85.00	
K	420.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	1.43	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	300.00	
K	2400.00	
Slope (ft/ft)	0.0300	be sure this is decimal equivalent slope 0.0000
Travel Time	0.72	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	650.00	
K	3000.00	12-inch Pipe minimum
Slope (ft/ft)	0.0500	Average Slope for total pipe run
Travel Time	0.97	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	3900.00	15/18-inch Pipe
Slope (ft/ft)	0.0050	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	7.33	Minutes
Tc for Analysis	7.33	Minutes

BOWSTRING METHOD PROJECT: 0

DETENTION BASIN DESIGN BASIN: B1

DESIGNER: BNG

DATE: 15-Jul-22

Time Increment (min)	10
Time of Conc. (min)	7.33
Outflow (cfs)	0.0007
Design Year Flow	50
Area (acres)	8.10
Impervious Area (sq ft)	54349
'C' Factor	0.27
Area * C	2.151
PGIS Area	48,364

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
7.33	440	3.01	6.48	3821	0	3821	
15	900	1.91	4.11	4319	1	4318	
25	1500	1.38	2.98	4907	1	4906	
35	2100	1.12	2.40	5405	1	5404	
45	2700	0.95	2.05	5837	2	5835	
55	3300	0.84	1.80	6220	2	6218	
65	3900	0.75	1.62	6567	3	6565	
75	4500	0.69	1.48	6885	3	6882	
85	5100	0.64	1.37	7180	4	7176	
95	5700	0.59	1.27	7455	4	7451	
105	6300	0.56	1.20	7714	4	7709	
115	6900	0.52	1.13	7958	5	7953	
125	7500	0.50	1.07	8190	5	8185	
135	8100	0.47	1.02	8411	6	8405	
145	8700	0.45	0.97	8623	6	8616	
155	9300	0.43	0.93	8825	6	8819	
165	9900	0.42	0.90	9020	7	9014	
175	10500	0.40	0.86	9208	7	9201	
185	11100	0.39	0.83	9390	8	9382	
195	11700	0.38	0.81	9566	8	9557	
205	12300	0.36	0.78	9736	9	9727	
215	12900	0.35	0.76	9901	9	9892	
225	13500	0.34	0.74	10062	9	10052	
235	14100	0.33	0.72	10218	10	10208	
245	14700	0.32	0.70	10370	10	10360	
255	15300	0.32	0.68	10518	11	10508	
265	15900	0.31	0.66	10663	11	10652	
275	16500	0.30	0.65	10805	11	10793	
285	17100	0.29	0.63	10943	12	10931	
295	17700	0.29	0.62	11078	12	11066	
305	18300	0.28	0.61	11211	13	11198	
315	18900	0.28	0.60	11341	13	11328	
325	19500	0.27	0.58	11468	14	11454	
335	20100	0.27	0.57	11593	14	11579	
345	20700	0.26	0.56	11716	14	11701	
355	21300	0.26	0.55	11819	15	11804	
365	21900	0.25	0.54	11916	15	11900	
375	22500	0.25	0.53	11993	16	11977	
385	23100	0.25	0.53	12310	16	12294	

Rainfall Intensity Coefficients for ***Spokane***

taken from Table 5-7 SRSM

M_{50} = 10.68

N_{50} = 0.635

Flow (weighted c)

Qwc= 8.27 cfs

Flow (time of concentration)

Qtc= 6.48 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
385							
395	23700	0.24	0.51	12115	16	12099	
405	24300	0.24	0.51	12420	17	12403	
415	24900	0.23	0.49	12186	17	12169	
425	25500	0.23	0.49	12478	18	12460	
435	26100	0.22	0.46	12205	18	12187	
445	26700	0.22	0.46	12484	19	12465	<==
455	27300	0.21	0.44	12173	19	12154	
465	27900	0.21	0.44	12439	19	12419	
475	28500	0.20	0.42	12088	20	12069	
485	29100	0.20	0.42	12342	20	12321	
495	29700	0.19	0.40	11953	21	11932	
505	30300	0.19	0.40	12193	21	12172	
515	30900	0.18	0.38	11766	22	11744	
525	31500	0.18	0.38	11993	22	11971	
535	32100	0.17	0.36	11527	22	11504	
545	32700	0.17	0.36	11741	23	11718	
555	33300	0.16	0.34	11236	23	11213	
565	33900	0.16	0.34	11438	24	11414	
575	34500	0.15	0.31	10894	24	10870	
585	35100	0.15	0.31	11083	24	11058	
595	35700	0.14	0.29	10500	25	10475	
605	36300	0.14	0.29	10676	25	10651	
615	36900	0.13	0.27	10055	26	10029	
625	37500	0.13	0.27	10217	26	10191	
635	38100	0.12	0.25	9558	27	9531	
645	38700	0.12	0.25	9708	27	9681	
655	39300	0.11	0.23	9009	27	8982	
665	39900	0.11	0.23	9146	28	9118	
675	40500	0.10	0.21	8409	28	8381	
685	41100	0.10	0.21	8533	29	8504	
695	41700	0.09	0.19	7757	29	7728	
705	42300	0.09	0.19	7868	29	7839	
715	42900	0.08	0.16	7053	30	7023	
725	43500	0.08	0.16	7152	30	7121	
735	44100	0.07	0.14	6298	31	6267	
745	44700	0.07	0.14	6384	31	6352	

"1815A" TREATMENT REQUIREMENTS		
Minimum "1815A" Volume Required	2,015	cu ft
Provided Treatment Volume - Min.	4,479	cu ft
STORAGE REQ. - 50 YEAR DESIGN STORM		
Maximum Storage Required by Bowstring	12,465	cu ft
Provided Pond Storage Volume to Inlet - Min.	22,523	cu ft
Provided Drywell/Gallery Storage Volume	1,200	cu ft
Total Provided Volume	**23,723**	**cu ft**

PEAK FLOW CALCULATION PROJECT: 3130

50-Year Design Storm **Lennar - 21st Avenue**

BASIN: C

Tot. Area	200,850 SF	4.61 Acres	
Imp. Area	62,518 SF	C=	0.9
Perv. Area	138,332 SF	C=	0.15
Wt. C =	0.38	PGIS Area =	52,118

WCE Applicable Travel Time Ground Cover Coefficients

Per Table 5-6 SRSM	
Type of Cover	K (ft/min)
Short Pasture	420
Nearly Bare Ground	600
Small Roadside Ditch/ Grass	900
Paved Area (use for parking lots)	1200
Gutter - 4 inches deep	1500
Gutter - 6 inches deep	2400
Pipe - 12-inch PVC/DI	3000
Pipe - 15/18-inch PVC/DI	3900
Pipe - 24-inch PVC/DI	4700

Reaches

Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	170.00	
K	1200.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	1.00	Minutes
Reach 2	Finished Lot from House to Street	
Length	85.00	
K	2400.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	0.25	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	150.00	
K	3000.00	
Slope (ft/ft)	0.0600	be sure this is decimal equivalent slope 0.0000
Travel Time	0.20	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	600.00	
K	3900.00	12-inch Pipe minimum
Slope (ft/ft)	0.0600	Average Slope for total pipe run
Travel Time	0.63	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	4700.00	15/18-inch Pipe
Slope (ft/ft)	0.0050	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	2.08	Minutes
Tc for Analysis	5.00	Minutes

BOWSTRING METHOD PROJECT: 0

DETENTION BASIN BASIN: C

DESIGN DESIGNER: BNG

DATE: 15-Jul-22

Time Increment (min)	10
Time of Conc. (min)	5.00
Outflow (cfs)	0.0003
Design Year Flow	50
Area (acres)	4.61
Impervious Area (sq ft)	62518
'C' Factor	0.38
Area * C	1.768
PGIS Area	52,118

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
5.00	300	3.84	6.80	2732	0	2732	
15	900	1.91	3.38	3389	0	3389	
25	1500	1.38	2.45	3918	0	3917	
35	2100	1.12	1.98	4349	1	4348	
45	2700	0.95	1.68	4718	1	4717	
55	3300	0.84	1.48	5043	1	5042	
65	3900	0.75	1.33	5335	1	5334	
75	4500	0.69	1.22	5602	1	5601	
85	5100	0.64	1.12	5849	2	5847	
95	5700	0.59	1.05	6078	2	6077	
105	6300	0.56	0.98	6294	2	6292	
115	6900	0.52	0.93	6497	2	6495	
125	7500	0.50	0.88	6690	2	6688	
135	8100	0.47	0.84	6874	3	6872	
145	8700	0.45	0.80	7050	3	7047	
155	9300	0.43	0.77	7218	3	7215	
165	9900	0.42	0.74	7380	3	7377	
175	10500	0.40	0.71	7536	3	7532	
185	11100	0.39	0.69	7686	4	7682	
195	11700	0.38	0.66	7832	4	7828	
205	12300	0.36	0.64	7972	4	7968	
215	12900	0.35	0.62	8109	4	8105	
225	13500	0.34	0.61	8242	4	8238	
235	14100	0.33	0.59	8371	5	8367	
245	14700	0.32	0.57	8497	5	8492	
255	15300	0.32	0.56	8620	5	8615	
265	15900	0.31	0.55	8739	5	8734	
275	16500	0.30	0.53	8856	5	8851	
285	17100	0.29	0.52	8971	6	8965	
295	17700	0.29	0.51	9082	6	9077	
305	18300	0.28	0.50	9192	6	9186	
315	18900	0.28	0.49	9299	6	9293	
325	19500	0.27	0.48	9404	6	9398	
335	20100	0.27	0.47	9507	7	9501	
345	20700	0.26	0.46	9608	7	9602	
355	21300	0.26	0.45	9694	7	9687	
365	21900	0.25	0.44	9774	7	9767	
375	22500	0.25	0.44	9837	7	9830	
385	23100	0.25	0.44	10099	8	10091	

Rainfall Intensity Coefficients for *Spokane*

taken from Table 5-7 SRSM

M_{50} = 10.68

N_{50} = 0.635

Flow (weighted c)

Qwc= 6.80 cfs

Flow (time of concentration)

Qtc= 6.80 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
385							
395	23700	0.24	0.42	9939	8	9931	
405	24300	0.24	0.42	10190	8	10182	
415	24900	0.23	0.40	9998	8	9990	
425	25500	0.23	0.40	10238	8	10230	
435	26100	0.22	0.38	10015	8	10006	
445	26700	0.22	0.38	10244	9	10235	<==
455	27300	0.21	0.36	9989	9	9980	
465	27900	0.21	0.36	10207	9	10198	
475	28500	0.20	0.35	9921	9	9911	
485	29100	0.20	0.35	10129	9	10119	
495	29700	0.19	0.33	9810	10	9800	
505	30300	0.19	0.33	10007	10	9997	
515	30900	0.18	0.31	9657	10	9647	
525	31500	0.18	0.31	9844	10	9833	
535	32100	0.17	0.29	9461	10	9451	
545	32700	0.17	0.29	9637	11	9627	
555	33300	0.16	0.28	9223	11	9212	
565	33900	0.16	0.28	9389	11	9378	
575	34500	0.15	0.26	8943	11	8931	
585	35100	0.15	0.26	9098	11	9086	
595	35700	0.14	0.24	8620	12	8608	
605	36300	0.14	0.24	8764	12	8752	
615	36900	0.13	0.22	8255	12	8243	
625	37500	0.13	0.22	8388	12	8376	
635	38100	0.12	0.21	7847	12	7834	
645	38700	0.12	0.21	7970	13	7957	
655	39300	0.11	0.19	7397	13	7384	
665	39900	0.11	0.19	7509	13	7496	
675	40500	0.10	0.17	6904	13	6891	
685	41100	0.10	0.17	7006	13	6993	
695	41700	0.09	0.15	6369	14	6355	
705	42300	0.09	0.15	6460	14	6447	
715	42900	0.08	0.13	5792	14	5778	
725	43500	0.08	0.13	5872	14	5858	
735	44100	0.07	0.12	5172	14	5157	
745	44700	0.07	0.12	5242	15	5227	

"1815A" TREATMENT REQUIREMENTS	
Minimum "1815A" Volume Required	2,172 cu ft
Provided Treatment Volume - Min.	2,174 cu ft

STORAGE REQ. - 50 YEAR DESIGN STORM	
Maximum Storage Required by Bowstring	10,235 cu ft
Provided Pond Storage Volume to Inlet - Min.	11,846 cu ft
Provided Drywell/Gallery Storage Volume	1,200 cu ft
Total Provided Volume	**13,046 cu ft**

SRSM 100-Year Bowstring

PEAK FLOW CALCULATION PROJECT: 3130

100-Year Design Storm **Lennar - 21st Avenue**

BASIN: B1

Tot. Area	352,862 SF	8.10 Acres	
Imp. Area	54,349 SF	C=	0.9
Perv. Area	298,513 SF	C=	0.15
Wt. C =	0.27	PGIS Area =	48,364

WCE Applicable Travel Time Ground Cover Coefficients	
Per Table 5-6 SRSM	
Type of Cover	K (ft/min)
Short Pasture	420
Nearly Bare Ground	600
Small Roadside Ditch/ Grass	900
Paved Area (use for parking lots)	1200
Gutter - 4 inches deep	1500
Gutter - 6 inches deep	2400
Pipe - 12-inch PVC/DI	3000
Pipe - 15/18-inch PVC/DI	3900
Pipe - 24-inch PVC/DI	4700

Reaches		
Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	250.00	
K	420.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	4.21	Minutes
Reach 2	Finished Lot from House to Street	
Length	85.00	
K	420.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	1.43	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	300.00	
K	2400.00	
Slope (ft/ft)	0.0300	be sure this is decimal equivalent slope 0.0000
Travel Time	0.72	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	650.00	
K	3000.00	12-inch Pipe minimum
Slope (ft/ft)	0.0500	Average Slope for total pipe run
Travel Time	0.97	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	3900.00	15/18-inch Pipe
Slope (ft/ft)	0.0050	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	7.33	Minutes
Tc for Analysis	7.33	Minutes

BOWSTRING METHOD PROJECT: 0

DETENTION BASIN DESIGN BASIN: B1

DESIGNER: BNG

DATE: 15-Jul-22

Time Increment (min)	10
Time of Conc. (min)	7.33
Outflow (cfs)	0.0007
Design Year Flow	50
Area (acres)	8.10
Impervious Area (sq ft)	54349
'C' Factor	0.27
Area * C	2.151
PGIS Area	48,364

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel. (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)
7.33	440	3.43	7.37	4342	0	4342
15	900	2.16	4.65	4879	1	4879
25	1500	1.56	3.35	5522	1	5521
35	2100	1.25	2.70	6065	1	6064
45	2700	1.07	2.29	6536	2	6534
55	3300	0.94	2.02	6955	2	6952
65	3900	0.84	1.81	7333	3	7330
75	4500	0.77	1.65	7679	3	7676
85	5100	0.71	1.52	8000	4	7996
95	5700	0.66	1.42	8299	4	8295
105	6300	0.62	1.33	8580	4	8575
115	6900	0.58	1.25	8845	5	8840
125	7500	0.55	1.19	9097	5	9092
135	8100	0.53	1.13	9337	6	9331
145	8700	0.50	1.08	9566	6	9560
155	9300	0.48	1.04	9786	6	9779
165	9900	0.46	0.99	9997	7	9990
175	10500	0.45	0.96	10201	7	10193
185	11100	0.43	0.92	10397	8	10389
195	11700	0.42	0.89	10587	8	10579
205	12300	0.40	0.87	10771	9	10763
215	12900	0.39	0.84	10950	9	10941
225	13500	0.38	0.81	11123	9	11114
235	14100	0.37	0.79	11292	10	11282
245	14700	0.36	0.77	11457	10	11446
255	15300	0.35	0.75	11617	11	11606
265	15900	0.34	0.73	11773	11	11762
275	16500	0.33	0.72	11926	11	11914
285	17100	0.33	0.70	12075	12	12063
295	17700	0.32	0.68	12221	12	12209
305	18300	0.31	0.67	12364	13	12351
315	18900	0.31	0.66	12504	13	12491
325	19500	0.30	0.64	12641	14	12628
335	20100	0.29	0.63	12776	14	12762
345	20700	0.29	0.62	12908	14	12893
355	21300	0.28	0.61	13071	15	13057
365	21900	0.28	0.60	13176	15	13161
375	22500	0.27	0.59	13316	16	13300
385	23100	0.27	0.59	13668	16	13652

Rainfall Intensity Coefficients for ***Spokane***

taken from Table 5-7 SRSM

M_{100} = 12.33

N_{100} = 0.643

Flow (weighted c)

Qwc= 9.42 cfs

Flow (time of concentration)

Qtc= 7.37 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
385							
395	23700	0.26	0.57	13508	16	13492	
405	24300	0.26	0.57	13848	17	13831	
415	24900	0.25	0.54	13649	17	13632	
425	25500	0.25	0.54	13976	18	13958	
435	26100	0.24	0.52	13738	18	13720	
445	26700	0.24	0.52	14052	19	14034	
455	27300	0.23	0.50	13776	19	13757	
465	27900	0.23	0.50	14077	19	14058	<==
475	28500	0.22	0.48	13762	20	13742	
485	29100	0.22	0.48	14050	20	14030	
495	29700	0.21	0.46	13696	21	13676	
505	30300	0.21	0.46	13972	21	13951	
515	30900	0.20	0.44	13579	22	13558	
525	31500	0.20	0.44	13842	22	13820	
535	32100	0.19	0.42	13410	22	13388	
545	32700	0.19	0.42	13660	23	13637	
555	33300	0.18	0.39	13190	23	13167	
565	33900	0.18	0.39	13426	24	13403	
575	34500	0.17	0.37	12918	24	12894	
585	35100	0.17	0.37	13141	24	13117	
595	35700	0.16	0.35	12594	25	12569	
605	36300	0.16	0.35	12805	25	12780	
615	36900	0.15	0.33	12219	26	12193	
625	37500	0.15	0.33	12417	26	12390	
635	38100	0.14	0.31	11792	27	11765	
645	38700	0.14	0.31	11977	27	11950	
655	39300	0.13	0.29	11313	27	11286	
665	39900	0.13	0.29	11485	28	11458	
675	40500	0.12	0.27	10783	28	10755	
685	41100	0.12	0.27	10942	29	10914	
695	41700	0.11	0.24	10201	29	10172	
705	42300	0.11	0.24	10347	29	10318	
715	42900	0.10	0.22	9568	30	9538	
725	43500	0.10	0.22	9701	30	9671	
735	44100	0.09	0.20	8883	31	8852	
745	44700	0.09	0.20	9003	31	8972	

"1815A" TREATMENT REQUIREMENTS		
Minimum "1815A" Volume Required	2,015	cu ft
Provided Treatment Volume - Min.	4,479	cu ft
STORAGE REQ. - 100 YEAR DESIGN STORM		
Maximum Storage Required by Bowstring	14,058	cu ft
Provided Pond Storage Volume to Inlet - Min.	22,523	cu ft
Provided Drywell/Gallery Storage Volume	1,200	cu ft
Total Provided Volume	**23,723**	**cu ft**

PEAK FLOW CALCULATION PROJECT: 3130

100-Year Design Storm **Lennar - 21st Avenue**

BASIN: C

Tot. Area	200,850 SF	4.61	Acres
Imp. Area	62,518 SF	C=	0.9
Perv. Area	138,332 SF	C=	0.15
Wt. C =	0.38	PGIS Area =	52,118

WCE Applicable Travel Time Ground Cover Coefficients

Per Table 5-6 SRSM	
Type of Cover	K (ft/min)
Short Pasture	420
Nearly Bare Ground	600
Small Roadside Ditch/ Grass	900
Paved Area (use for parking lots)	1200
Gutter - 4 inches deep	1500
Gutter - 6 inches deep	2400
Pipe - 12-inch PVC/DI	3000
Pipe - 15/18-inch PVC/DI	3900
Pipe - 24-inch PVC/DI	4700

Reaches

Reach 1	Offsite	also applicable for Pre-Developed Tc
Length	170.00	
K	1200.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	1.00	Minutes
Reach 2	Finished Lot from House to Street	
Length	85.00	
K	2400.00	
Slope (ft/ft)	0.0200	be sure this is decimal equivalent slope 0.0000
Travel Time	0.25	Minutes
Reach 3	Gutter Flow to Inlet/Catch Basin	
Length	150.00	
K	3000.00	
Slope (ft/ft)	0.0600	be sure this is decimal equivalent slope 0.0000
Travel Time	0.20	Minutes
Reach 4	Pipe Flow	Pipe Reach One (only need one if no Dia change)
Length	600.00	
K	3900.00	12-inch Pipe minimum
Slope (ft/ft)	0.0600	Average Slope for total pipe run
Travel Time	0.63	Minutes
Reach 5	Pipe Flow	Add additional pipe reacheds for other Dia
Length	0.00	
K	4700.00	15/18-inch Pipe
Slope (ft/ft)	0.0050	Average Slope for total pipe run
Travel Time	0.00	Minutes
Sum of Tc	2.08	Minutes
Tc for Analysis	5.00	Minutes

Whipple Consulting Engineers

BOWSTRING METHOD PROJECT: 0

DETENTION BASIN DESIGN BASIN: C

DESIGNER: BNG

DATE: 15-Jul-22

Time Increment (min)	10
Time of Conc. (min)	5.00
Outflow (cfs)	0.0003
Design Year Flow	50
Area (acres)	4.61
Impervious Area (sq ft)	62518
'C' Factor	0.38
Area * C	1.768
PGIS Area	52,118

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel. (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)
5.00	300	4.38	7.74	3113	0	3113
15	900	2.16	3.82	3829	0	3829
25	1500	1.56	2.75	4408	0	4408
35	2100	1.25	2.22	4880	1	4880
45	2700	1.07	1.89	5283	1	5282
55	3300	0.94	1.66	5638	1	5637
65	3900	0.84	1.49	5957	1	5956
75	4500	0.77	1.36	6248	1	6246
85	5100	0.71	1.25	6516	2	6515
95	5700	0.66	1.17	6766	2	6765
105	6300	0.62	1.09	7001	2	6999
115	6900	0.58	1.03	7222	2	7220
125	7500	0.55	0.98	7431	2	7429
135	8100	0.53	0.93	7631	3	7628
145	8700	0.50	0.89	7821	3	7818
155	9300	0.48	0.85	8004	3	8001
165	9900	0.46	0.82	8179	3	8176
175	10500	0.45	0.79	8348	3	8344
185	11100	0.43	0.76	8511	4	8507
195	11700	0.42	0.73	8668	4	8664
205	12300	0.40	0.71	8820	4	8816
215	12900	0.39	0.69	8968	4	8964
225	13500	0.38	0.67	9112	4	9107
235	14100	0.37	0.65	9251	5	9247
245	14700	0.36	0.63	9387	5	9383
255	15300	0.35	0.62	9520	5	9515
265	15900	0.34	0.60	9649	5	9644
275	16500	0.33	0.59	9775	5	9770
285	17100	0.33	0.58	9899	6	9893
295	17700	0.32	0.56	10019	6	10013
305	18300	0.31	0.55	10137	6	10131
315	18900	0.31	0.54	10253	6	10247
325	19500	0.30	0.53	10366	6	10360
335	20100	0.29	0.52	10477	7	10471
345	20700	0.29	0.51	10586	7	10580
355	21300	0.28	0.50	10721	7	10714
365	21900	0.28	0.49	10808	7	10801
375	22500	0.27	0.48	10923	7	10915
385	23100	0.27	0.48	11213	8	11205

Rainfall Intensity Coefficients for ***Spokane***

taken from Table 5-7 SRSM

M_{100} = 12.33

N_{100} = 0.643

Flow (weighted c)

Qwc= 7.74 cfs

Flow (time of concentration)

Qtc= 7.74 cfs

Time (min)	Time Inc. (sec)	Intens. (in/hr)	Q Devel (cfs)	Vol.In (cu ft)	Vol.Out (cu ft)	Storage (cu ft)	
385							
395	23700	0.26	0.47	11082	8	11074	
405	24300	0.26	0.47	11361	8	11353	
415	24900	0.25	0.45	11198	8	11190	
425	25500	0.25	0.45	11467	8	11459	
435	26100	0.24	0.43	11273	8	11264	
445	26700	0.24	0.43	11531	9	11522	
455	27300	0.23	0.41	11304	9	11296	
465	27900	0.23	0.41	11552	9	11543	<==
475	28500	0.22	0.39	11294	9	11285	
485	29100	0.22	0.39	11531	9	11521	
495	29700	0.21	0.38	11241	10	11231	
505	30300	0.21	0.38	11467	10	11457	
515	30900	0.20	0.36	11145	10	11135	
525	31500	0.20	0.36	11361	10	11351	
535	32100	0.19	0.34	11007	10	10997	
545	32700	0.19	0.34	11212	11	11202	
555	33300	0.18	0.32	10827	11	10816	
565	33900	0.18	0.32	11021	11	11010	
575	34500	0.17	0.31	10604	11	10593	
585	35100	0.17	0.31	10788	11	10777	
595	35700	0.16	0.29	10339	12	10327	
605	36300	0.16	0.29	10512	12	10500	
615	36900	0.15	0.27	10031	12	10019	
625	37500	0.15	0.27	10194	12	10182	
635	38100	0.14	0.25	9681	12	9669	
645	38700	0.14	0.25	9833	13	9821	
655	39300	0.13	0.24	9288	13	9276	
665	39900	0.13	0.24	9430	13	9417	
675	40500	0.12	0.22	8854	13	8840	
685	41100	0.12	0.22	8984	13	8971	
695	41700	0.11	0.20	8376	14	8363	
705	42300	0.11	0.20	8496	14	8483	
715	42900	0.10	0.18	7856	14	7842	
725	43500	0.10	0.18	7966	14	7952	
735	44100	0.09	0.17	7294	14	7280	
745	44700	0.09	0.17	7393	15	7378	

"1815A" TREATMENT REQUIREMENTS	
Minimum "1815A" Volume Required	2,172 cu ft
Provided Treatment Volume - Min.	2,174 cu ft

STORAGE REQ. - 100 YEAR DESIGN STORM	
Maximum Storage Required by Bowstring	11,543 cu ft
Provided Pond Storage Volume to Inlet - Min.	11,846 cu ft
Provided Drywell/Gallery Storage Volume	1,200 cu ft
Total Provided Volume	**13,046 cu ft**

Bio-Infiltration Swale Design Sheet

WCE PROJECT NO.: 21-2808
PROJECT NAME: Westridge Add.
DATE: 7/15/2022

SRSM 6.7.2 Bio-filtration Swale Design

Basin B2

Calculation of Design Flow:

Q_{wq} = 0.69 * (2-yr peak flow rate)

$Q_{peak,2}$ = **1.19** cfs

Q_{wq} = 0.82 cfs

THIS SPREADSHEET SOLVES FOR **WIDTH, LENGTH** AND **VELOCITY** INSERT **Q, S, Z AND Y**

Calculation of swale bottom width:

$Q = 1.49\ A\ R^{0.67} S^{0.5}\ n^{-1}$ Manning's equation

OR

$b = Q_{wq}\ n_{wq}\ (1.49 * y^{1.67} S^{0.5})^{-1}$ where

OR

$y = [Q_{wq}\ n_{wq}\ (1.49 * b * S^{0.5})^{-1}]^{0.6}$, b = 2 ft

width known: b = **10** ft

S = **0.020** ft/ft

y = 0.33 ft

- b = bottom width of swale (ft)...minimum 2 ft width required, maximum 10 ft
- Q_{wq} = water quality design flow (cfs)
- n_{wq} = Manning's roughness coefficient for shallow flow conditions = 0.20 (unitless)
- y = design flow depth (0.25' for dryland or 0.33' for sod)
- S = longitudinal slope (along direction of flow) (ft/ft), slope shall be between 1%-6%. If less than 1.5%, underdrains must be provided. Slope less than 1% is considered a "wet biofiltration swale" and must be designed under those guidelines. Slope greater than 6% requires check dams with vertical drops of 12-inches

Determining design flow velocity:

$V_{wq} = Q_{wq} / A_{wq}$, max 1.0 fps

$A_{wq} = b*y + Z*y^2$

where

- V_{wq} = design flow velocity (fps)
- A_{wq} = cross-sectional area of flow at design depth (sf)
- Z = side slope length per unit height (e.g. for 3:1, Z = 3)

Z = 3

A_{wq} = 3.63 sf

V_{wq} = 0.23 fps

Calculate swale length to achieve a minimum hydraulic residence time of 9 minutes (540 seconds):

$L = 540 * V_{wq}$, minimum swale length is 100 ft

L = 122.26 ft

Conveyance of larger storms using previous steps, Velocity must not exceed 3 fps:

$Q_{peak,2}$ =	1.19	cfs	b=	**10.00**	ft	A_2 =	3.63	sf	V_2 =	0.33	fps
$Q_{peak,10}$ =	2.21	cfs	b=	**10.00**	ft	A_{10} =	3.63	sf	V_{10} =	0.61	fps
$Q_{peak,25}$ =	2.80	cfs	b=	**10.00**	ft	A_{25} =	3.63	sf	V_{25} =	0.77	fps
$Q_{peak,100}$ =	3.69	cfs	b=	**10.00**	ft	A_{100} =	3.63	sf	V_{100} =	1.02	fps

Evaporation Calculations – Without Infiltration

OVERALL POND A - W/O INFILTRATION

Notes: User to fill in the shaded areas
Spokane County Water Budget Calculation Sheet

Project:	Lennar - 21st - Grandview to Westwood and Overall Beard
Job No.	2021-3130 and 3109
Basin:	Pond Sizing / Adequacy Calculations
Date:	31-Jan-22
Reviewer:	TRW

Basin Data		
Total Basin Area (acres) =	47.00	acres
Developed Conditions:		
Pervious Area (acres) =	33.43	acres
Impervious Area (acres) =	13.57	acres

Precipitation Adjustment Factor = 17 /16.13 = 1.051

	Curve Numbers (CN) AMC II Apr - Oct	AMC III Nov, Mar	Winter Dec - Feb
Pre-Developed Conditions	70.0	91.0	95.0
Post-Developed Conditions			
Pervious Area	85.0	95.0	95.0
Impervious Area	98.0	98.0	98.0

100 - YEAR STORM CALCULATION FOR PRE-EVENT	
100 YEAR RAINFALL	2.80
PERVIOUS S	1.76
PERVIOUS I	0.35
PERVIOUS Q (IN)	1.42
100 YEAR RAINFALL	2.80
IMPERVIOUS S	0.20
IMPERVIOUS I	0.04
IMPERVOUS Q (IN)	2.57

Month	Precipitation (inches)	Adjusted Precipitation (inches)	Pre-Developed Conditions CN	S	Runoff (inches)	Runoff (cubic ft.)	Post-Developed, Pervious Area CN	S	Runoff (inches)	Runoff (cubic ft.)	Post-Developed, Impervious Area CN	S	Runoff (inches)	Runoff (cubic ft.)	Post-Developed, SUMMARY MONTHLY TOTAL RUNOFF	(cubic ft.)	MONTHLY TOTAL INCREASE (cubic ft.)
Jan.	2.05	2.15	95.0	0.53	1.63	277,965	95.0	0.53	1.63	197,729	98.0	0.20	1.93	94,860	292,589		14,624
Feb.	1.57	1.65	95.0	0.53	1.15	196,425	95.0	0.53	1.15	139,726	98.0	0.20	1.43	70,280	210,005		13,581
Mar.	1.38	1.45	91.0	0.99	0.70	119,306	95.0	0.53	0.97	117,239	98.0	0.20	1.23	60,592	177,832		58,526
Apr.	1.11	1.17	70.0	4.29	0.02	3,546	85.0	1.76	0.26	31,127	98.0	0.20	0.95	46,899	78,026		74,479
May	1.37	1.44	70.0	4.29	0.07	11,878	85.0	1.76	0.41	50,227	98.0	0.20	1.22	60,084	110,310		98,432
June	1.27	1.33	70.0	4.29	0.05	8,154	85.0	1.76	0.35	42,550	98.0	0.20	1.12	55,001	97,551		89,397
July	0.50	0.53	70.0	4.29	0.00	0	85.0	1.76	0.02	1,861	98.0	0.20	0.34	16,783	18,644		18,644
Aug.	0.60	0.63	70.0	4.29	0.00	0	85.0	1.76	0.04	4,573	98.0	0.20	0.44	21,561	26,135		26,135
Sept.	0.80	0.84	70.0	4.29	0.00	0	85.0	1.76	0.11	12,806	98.0	0.20	0.64	31,365	44,171		44,171
Oct.	1.22	1.28	70.0	4.29	0.04	6,530	85.0	1.76	0.32	36,860	98.0	0.20	1.07	52,465	91,325		84,795
Nov.	2.02	2.12	91.0	0.99	1.27	216,806	95.0	0.53	1.60	194,067	98.0	0.20	1.90	93,321	287,388		70,582
Dec.	2.22	2.33	95.0	0.53	1.80	307,236	95.0	0.53	1.80	218,551	98.0	0.20	2.10	103,590	322,141		14,905
					6.73												
Annual Total =	16.11	16.93				1,147,847 c.f.				1,049,317 c.f.				706,800	1,756,117		608,270

Increase in Runoff Volume/year = ((Post Impervious) + (Post Pervious)] - PreDeveloped

Increase in Runoff Volume/year = 608,270 **cubic ft.** Mean Annual Increase in Runoff Volume

CN = Curve Number
S = 1000/CN-10
I = 0.25
Q = ((P-I)^2)/((P-I)+S)

Q = Runoff (in)
P = Rainfall (in)
S = Potential Maximum Retention after Runoff
I = Initial Abstraction

N/a

Project: **Lennar - 21st - Grandview to Westwood and Overall Beard**
Job No. **2021-3130 and 3109**
Basin: **Pond Sizing / Adequacy Calculations**
Date: **31-Jan-22**
Reviewer: **TRW**

Design Infiltration Rate (Evap. Pond) =	0.00E+00	cfs/sf of Pond Bottom	
Available Bottom Area (Evap. Pond) =	187,308	sq. ft.	
Outlet Weir Elevation (Evap. Pond) =	3.20	ft	
Design Infiltration Rate (Infil. Pond) =	0.00E+00	cfs/sf of Pond Bottom	
Available Bottom Area (Infil. Pond) =	187,308	sq. ft.	
Surf. Area =	187957.7	s.f. @ 3" depth	0.25 Pond Volume — 46989.4 CF @ 3" depth
Surf. Area =	188608.6	s.f. @ 6" depth	0.5 Pond Volume — 94304.3 CF @ 6" depth
Surf. Area =	189913.7	s.f. @ 1' depth	1 Pond Volume — 189913.7 CF @ 1' depth
Surf. Area =	192537.5	s.f. @ 2' depth	2 Pond Volume — 385075.0 CF @ 2' depth
Surf. Area =	195179.2	s.f. @ 3' depth	3 Pond Volume — 585537.7 CF @ 3' depth

MONTH	INITIAL STORM EVENT (CF) (INFIL FACTOR)	TOTAL RUNOFF (CF)	ALLOWABLE RUNOFF OFFSITE (CF)	RUNOFF TO POND VOLUME (CF)	END OF MONTH RUNOFF VOLUME (CF)	POND BOTTOM INFILT. VOLUME (CF)	POND VOLUME BEFORE EVAP (CF)	POND SURFACE ELEVATION BEFORE EVAP	INITIAL POND SURFACE AREA	PAN EVAP (IN)	ADJ EVAP (IN)	EVAP VOLUME (CF)	FINAL POND VOLUME (CF)	FINAL POND ELEVATION
INITIAL ELEV	2236													
PRE EVENT	November storm	287,387.66	216,806.05	70,581.62										
DECEMBER	0.20	322,140.79	307,236.14	14,904.65	85,486.26	0.00	85,486.26	2236.4	188,348.14	0.51	0.37	5,763	79,722.81	2236.4
JANUARY	0.40	292,589.27	277,964.82	14,624.45	94,347.26	0.00	94,347.26	2236.5	188,608.62	0.61	0.44	6,903	87,444.18	2236.4
FEBRUARY	0.60	210,005.41	196,424.67	13,580.74	101,024.92	0.00	101,024.92	2236.5	188,695.62	1.11	0.80	12,561	88,463.58	2236.4
MARCH	0.80	177,831.89	119,306.30	58,525.58	146,989.17	0.00	146,989.17	2236.7	189,130.13	2.28	1.64	25,873	121,116.17	2236.6
APRIL	1.00	78,025.73	3,546.44	74,479.29	195,595.46	0.00	195,595.46	2237	189,913.75	4.45	3.20	50,707	144,888.49	2236.7
MAY	1.00	110,310.32	11,878.36	98,431.96	243,320.45	0.00	243,320.45	2237.2	190,437.05	6.69	4.82	76,441	166,879.01	2236.8
JUNE	1.00	97,551.24	8,154.44	89,396.79	256,275.81	0.00	256,275.81	2237.3	190,698.98	8.14	5.86	93,137	163,138.42	2236.8
JULY	1.00	18,644.36	0.00	18,644.36	181,782.78	0.00	181,782.78	2236.9	189,652.36	10.70	7.70	121,757	60,025.96	2236.3
AUGUST	1.00	26,134.53	0.00	26,134.53	86,160.49	0.00	86,160.49	2236.4	188,348.14	9.42	6.78	106,454	0.00	2236
SEPTEMBER	1.00	44,170.91	0.00	44,170.91	44,170.91	0.00	44,170.91	2236.2	187,827.71	5.90	4.25	66,491	0.00	2236
OCTOBER	1.00	91,324.90	6,529.95	84,794.95	84,794.95	0.00	84,794.95	2236.4	188,348.14	2.58	1.86	29,156	55,638.66	2236.2
NOVEMBER	0.60	287,387.66	216,806.05	70,581.62	126,220.28	0.00	126,220.28	2236.6	188,869.29	0.92	0.66	10,426	115,794.69	2236.6
DECEMBER	0.20	322,140.79	307,236.14	14,904.65	130,699.34	0.00	130,699.34	2236.6	188,869.29	0.51	0.37	5,779	124,919.94	2236.6
JANUARY	0.40	292,589.27	277,964.82	14,624.45	139,544.39	0.00	139,544.39	2236.7	189,130.13	0.61	0.44	6,922	132,622.22	2236.7
FEBRUARY	0.60	210,005.41	196,424.67	13,580.74	146,202.96	0.00	146,202.96	2236.7	189,130.13	1.11	0.80	12,596	133,606.89	2236.7
MARCH	0.80	177,831.89	119,306.30	58,525.58	192,132.48	0.00	192,132.48	2237	189,913.75	2.28	1.64	25,980	166,152.28	2236.8
APRIL	1.00	78,025.73	3,546.44	74,479.29	240,631.57	0.00	240,631.57	2237.2	190,437.05	4.45	3.20	50,847	189,784.88	2236.9
MAY	1.00	110,310.32	11,878.36	98,431.96	288,216.83	0.00	288,216.83	2237.5	191,223.37	6.69	4.82	76,757	211,459.77	2237.1
JUNE	1.00	97,551.24	8,154.44	89,396.79	300,856.57	0.00	300,856.57	2237.5	191,223.37	8.14	5.86	93,393	207,463.07	2237
JULY	1.00	18,644.36	0.00	18,644.36	226,107.43	0.00	226,107.43	2237.1	190,175.31	10.70	7.70	122,093	104,014.88	2236.5
AUGUST	1.00	26,134.53	0.00	26,134.53	130,149.41	0.00	130,149.41	2236.6	188,869.29	9.42	6.78	106,749	23,400.49	2236.1
SEPTEMBER	1.00	44,170.91	0.00	44,170.91	67,571.40	0.00	67,571.40	2236.3	188,087.83	5.90	4.25	66,583	983.30	2236
OCTOBER	1.00	91,324.90	6,529.95	84,794.95	85,783.26	0.00	85,783.26	2236.4	188,348.14	2.58	1.86	29,156	56,626.96	2236.3
NOVEMBER	0.60	287,387.66	216,806.05	70,581.62	127,208.58	0.00	127,208.58	2236.6	188,869.29	0.92	0.66	10,426	116,782.99	2236.6
TOTALS	**November storm**	**3,512,234.00**	**2,295,694.36**	**1,216,539.64**	**3,721,272.93**	**0.00**	**3,721,272.93**		**4,543,067.88**	**106.62**	**76.77**	**1,212,952.24**	**2,550,934.67**	

Note: Assumes and infiltration rate shown in cfs/sf of pond bottom area for 24 hrs after the event for 3 events per month. This is not a 24/7/365 calculation
Note: Assumes a November 100 year storm event prior to beginning Yearly Rainfall Events - Assumes that the pond is empty prior to the initial 100 year storm event

Annual Evaporation Volume (cf/yr): 606,476.12

RUNOFF = RAINFALL X AREA X FACTORS
POND VOLUME = RUNOFF - ALLOWABLE DISCHARGE
POND ELEVATIONS = POND VOLUME - EVAPORATION - INFILTRATION

Project:	Project: **Lennar - 21st - Grandview to Westwood and Overall Beard**
Job No.	Job No. **2021-3130 and 3109**
Basin	Basin: **Pond Sizing / Adequacy Calculations**
Date	Date: **31-Jan-22**
Reviewer:	Reviewer: **TRW**

MONTH	INITIAL STORM EVENT (CF) (INFIL. FACTOR)	OUTFLOW FROM INFIL. POND (CF/MONTH)
JANUARY	0.40	0
FEBUARY	0.60	0
MARCH	0.80	0
APRIL	1.00	0
MAY	1.00	0
JUNE	1.00	0
JULY	1.00	0
AUGUST	1.00	0
SEPTEMBER	1.00	0
OCTOBER	1.00	0
NOVEMBER	0.60	0
DECEMBER	0.20	0
TOTAL		0

Volume infiltrated per year = 0 cubic ft. Mean Annual Maximum Infiltration

Note: Assumes a November 100 year storm event prior to beginning Yearly Rainfall Events - Assumes that the pond is empty prior to the initial 100 year storm event

Evaporation Calculations – With Infiltration

OVERALL POND A - W/ INFILTRATION

Notes: User to fill in the shaded areas
Spokane County Water Budget Calculation Sheet

Project: Lennar - 21st - Grandview to Westwood and Overall Beard
Job No. 2021-3130 and 3109 w/ Pond Bottom Infiltration
Basin: Pond Sizing / Adequacy Calculations
Date: 31-Jan-22
Reviewer: TRW

Basin Data

Total Basin Area (acres) =	47.00	acres
Developed Conditions:		
Pervious Area (acres) =	33.43	acres
Impervious Area (acres) =	13.57	acres

Precipitation Adjustment Factor = 17 /16.18 = 1.051

Curve Numbers (CN)	AMC II Apr - Oct	AMC III Nov. Mar	Winter Dec - Feb
Pre-Developed Conditions	70.0	91.0	95.0
Post-Developed Conditions			
Pervious Area	85.0	95.0	95.0
Impervious Area	98.0	98.0	98.0

100 - YEAR STORM CALCULATION FOR PRE-EVENT	
100 YEAR RAINFALL	2.80
PERVIOUS S	1.76
PERVIOUS I	0.35
PERVIOUS Q (IN)	1.42
100 YEAR RAINFALL	2.80
IMPERVIOUS S	0.20
IMPERVIOUS I	0.04
IMPERVOUS Q (IN)	2.57

Month	Precipitation (inches)	Adjusted Precipitation (inches)	Pre-Developed Conditions CN	S	Runoff (inches)	Runoff (cubic ft.)	Post-Developed, Pervious Area CN	S	Runoff (inches)	Runoff (cubic ft.)	Post-Developed, Impervious Area CN	S	Runoff (inches)	Runoff (cubic ft.)	Post-Developed, SUMMARY MONTHLY TOTAL RUNOFF (cubic ft.)	MONTHLY TOTAL INCREASE (cubic ft.)
Jan.	2.05	2.15	95.0	0.53	1.63	277,965	95.0	0.53	1.63	197,729	98.0	0.20	1.93	94,860	292,589	14,624
Feb.	1.57	1.65	95.0	0.53	1.15	196,425	95.0	0.53	1.15	139,726	98.0	0.20	1.43	70,280	210,005	13,581
Mar.	1.38	1.45	91.0	0.99	0.70	119,306	95.0	0.53	0.97	117,239	98.0	0.20	1.23	60,592	177,832	58,526
Apr.	1.11	1.17	70.0	4.29	0.02	3,546	85.0	1.76	0.26	31,127	98.0	0.20	0.95	46,899	78,026	74,479
May	1.37	1.44	70.0	4.29	0.07	11,878	85.0	1.76	0.41	50,227	98.0	0.20	1.22	60,084	110,310	98,432
June	1.27	1.33	70.0	4.29	0.05	8,154	85.0	1.76	0.35	42,550	98.0	0.20	1.12	55,001	97,551	89,397
July	0.58	0.53	70.0	4.29	0.00	0	85.0	1.76	0.02	1,861	98.0	0.20	0.34	16,783	18,644	18,644
Aug.	0.60	0.63	70.0	4.29	0.00	0	85.0	1.76	0.04	4,573	98.0	0.20	0.44	21,561	26,135	26,135
Sept.	0.80	0.84	70.0	4.29	0.00	0	85.0	1.76	0.11	12,806	98.0	0.20	0.64	31,365	44,171	44,171
Oct.	1.22	1.28	70.0	4.29	0.04	6,530	85.0	1.76	0.32	38,860	98.0	0.20	1.07	52,465	91,325	84,795
Nov.	2.02	2.12	91.0	0.99	1.27	216,806	95.0	0.53	1.60	194,067	98.0	0.20	1.90	93,321	287,388	70,582
Dec.	2.22	2.33	95.0	0.53	1.80	307,236	95.0	0.53	1.80	218,551	98.0	0.20	2.10	103,590	322,141	14,905
					6.73											
Annual Total =	16.11	16.93				1,147,847 c.f.				1,049,317 c.f.				706,800	1,758,117	608,270

Increase in Runoff Volume/year = [(Post Impervious) + (Post Pervious)] - PreDeveloped

Increase in Runoff Volume/year = 608,270 cubic ft. Mean Annual Increase in Runoff Volume

CN = Curve Number
S = 1000/CN-10
I = 0.25
Q = ((P-I)^2)/((P-I)+S)

Q = Runoff (in)
P = Rainfall (in)
S = Potential Maximum Retention after Runoff
I = Initial Abstraction

Project: **Lennar - 21st - Grandview to Westwood and Overall Beard**
Job No. **2021-3130 and 3109 w/ Pond Bottom Infiltration**
Basin: **Pond Sizing / Adequacy Calculations**
Date: **31-Jan-22**
Reviewer: **TRW**

Design Infiltration Rate (Evap. Pond) =	1.70E-07	cfs/sf of Pond Bottom	
Available Bottom Area (Evap. Pond) =	187,308	sq. ft.	
Outlet Weir Elevation (Evap. Pond) =	3.20	ft.	
Design Infiltration Rate (Infil. Pond) =	1.70E-07	cfs/sf of Pond Bottom	
Available Bottom Area (Infil. Pond) =	187,308	sq. ft.	
Surf. Area =	187957.7	s.f. @ 3" depth	0.25 Pond Volume = 46989.4 CF @ 3" depth
Surf. Area =	188608.6	s.f. @ 6" depth	0.5 Pond Volume = 94304.3 CF @ 6" depth
Surf. Area =	189913.7	s.f. @ 1' depth	1 Pond Volume = 189913.7 CF @ 1' depth
Surf. Area =	192537.5	s.f. @ 2' depth	2 Pond Volume = 385075.0 CF @ 2' depth
Surf. Area =	195179.2	s.f. @ 3' depth	3 Pond Volume = 585537.7 CF @ 3' depth

MONTH	INITIAL STORM EVENT (CF) (INFIL FACTOR)	TOTAL RUNOFF (CF)	ALLOWABLE RUNOFF OFFSITE (CF)	RUNOFF TO POND VOLUME (CF)	END OF MONTH RUNOFF VOLUME (CF)	POND BOTTOM INFILT. VOLUME (CF)	POND VOLUME BEFORE EVAP (CF)	POND SURFACE ELEVATION BEFORE EVAP	INITIAL POND SURFACE AREA	PAN EVAP (IN)	ADJ EVAP (IN)	EVAP VOLUME (CF)	FINAL POND VOLUME (CF)	FINAL POND ELEVATION
INITIAL ELEV	2236													
PRE EVENT	November storm	287,387.66	216,806.05	70,581.62										
DECEMBER	0.20	322,140.79	307,236.14	14,904.65	85,486.26	1,064.97	84,421.29	2236.4	188,348.14	0.51	0.37	5,763	78,657.84	2236.4
JANUARY	0.40	292,589.27	277,964.82	14,624.45	93,282.29	0.00	93,282.29	2236.4	188,348.14	0.61	0.44	6,894	86,388.74	2236.4
FEBRUARY	0.60	210,005.41	196,424.67	13,580.74	99,969.48	3,537.23	96,432.25	2236.5	188,608.62	1.11	0.80	12,561	83,870.91	2236.4
MARCH	0.80	177,831.89	119,306.30	58,525.58	142,396.50	12,779.67	129,616.82	2236.6	188,869.29	2.28	1.64	25,837	103,779.50	2236.5
APRIL	1.00	78,025.73	3,546.44	74,479.29	178,258.80	33,014.16	145,244.64	2236.7	189,130.13	4.45	3.20	50,498	94,746.89	2236.5
MAY	1.00	110,310.32	11,878.36	98,431.96	193,178.85	33,014.16	160,164.69	2236.8	189,391.16	6.69	4.82	76,022	84,143.08	2236.4
JUNE	1.00	97,551.24	8,154.44	89,396.79	173,539.87	33,014.16	140,525.72	2236.7	189,130.13	8.14	5.86	92,371	48,154.56	2236.2
JULY	1.00	18,644.36	0.00	18,644.36	66,798.92	8,253.54	58,545.38	2236.3	188,087.83	10.70	7.70	120,752	0.00	2236
AUGUST	1.00	26,134.53	0.00	26,134.53	26,134.53	8,253.54	17,880.99	2236	187,308.00	9.42	6.78	105,866	0.00	2236
SEPTEMBER	1.00	44,170.91	0.00	44,170.91	44,170.91	8,253.54	35,917.37	2236.1	187,567.76	5.90	4.25	66,399	0.00	2236
OCTOBER	1.00	91,324.90	6,529.95	84,794.95	84,794.95	33,014.16	51,780.79	2236.2	187,827.71	2.58	1.86	29,076	22,705.06	2236.1
NOVEMBER	0.60	287,387.66	216,806.05	70,581.62	93,286.68	19,808.50	73,478.18	2236.3	188,087.83	0.92	0.66	10,382	63,095.74	2236.3
DECEMBER	0.20	322,140.79	307,236.14	14,904.65	78,000.38	1,064.97	76,935.41	2236.4	188,348.14	0.51	0.37	5,763	71,171.96	2236.3
JANUARY	0.40	292,589.27	277,964.82	14,624.45	85,796.41	0.00	85,796.41	2236.4	188,348.14	0.61	0.44	6,894	78,902.86	2236.4
FEBRUARY	0.60	210,005.41	196,424.67	13,580.74	92,483.60	3,537.23	88,946.37	2236.4	188,348.14	1.11	0.80	12,544	76,402.38	2236.4
MARCH	0.80	177,831.89	119,306.30	58,525.58	134,927.97	12,779.67	122,148.29	2236.6	188,869.29	2.28	1.64	25,837	96,310.97	2236.5
APRIL	1.00	78,025.73	3,546.44	74,479.29	170,790.27	33,014.16	137,776.11	2236.7	189,130.13	4.45	3.20	50,498	87,278.36	2236.4
MAY	1.00	110,310.32	11,878.36	98,431.96	185,710.32	33,014.16	152,696.16	2236.8	189,391.16	6.69	4.82	76,022	76,674.55	2236.4
JUNE	1.00	97,551.24	8,154.44	89,396.79	166,071.34	33,014.16	133,057.18	2236.7	189,130.13	8.14	5.86	92,371	40,686.03	2236.2
JULY	1.00	18,644.36	0.00	18,644.36	59,330.38	8,253.54	51,076.84	2236.2	187,827.71	10.70	7.70	120,585	0.00	2236
AUGUST	1.00	26,134.53	0.00	26,134.53	26,134.53	8,253.54	17,880.99	2236	187,308.00	9.42	6.78	105,866	0.00	2236
SEPTEMBER	1.00	44,170.91	0.00	44,170.91	44,170.91	8,253.54	35,917.37	2236.1	187,567.76	5.90	4.25	66,399	0.00	2236
OCTOBER	1.00	91,324.90	6,529.95	84,794.95	84,794.95	33,014.16	51,780.79	2236.2	187,827.71	2.58	1.86	29,076	22,705.06	2236.1
NOVEMBER	0.60	287,387.66	216,806.05	70,581.62	93,286.68	19,808.50	73,478.18	2236.3	188,087.83	0.92	0.66	10,382	63,095.74	2236.3
TOTALS	**November storm**	**3,512,234.00**	**2,295,694.36**	**1,216,539.64**	**2,502,795.77**	**388,015.26**	**2,114,780.52**		**4,520,888.89**	**106.62**	**76.77**	**1,204,660.05**	**1,278,770.25**	

Note: Assumes and infiltration rate shown in cfs/sf of pond bottom area for 24 hrs after the event for 3 events per month. This is not a 24/7/365 calculation.
Note: Assumes a November 100 year storm event prior to beginning Yearly Rainfall Events - Assumes that the pond is empty prior to the initial 100 year storm event

Annual Evaporation Volume (cf/yr): 602,330.02

RUNOFF = RAINFALL X AREA X FACTORS
POND VOLUME = RUNOFF - ALLOWABLE DISCHARGE
POND ELEVATIONS = POND VOLUME - EVAPORATION - INFILTRATION

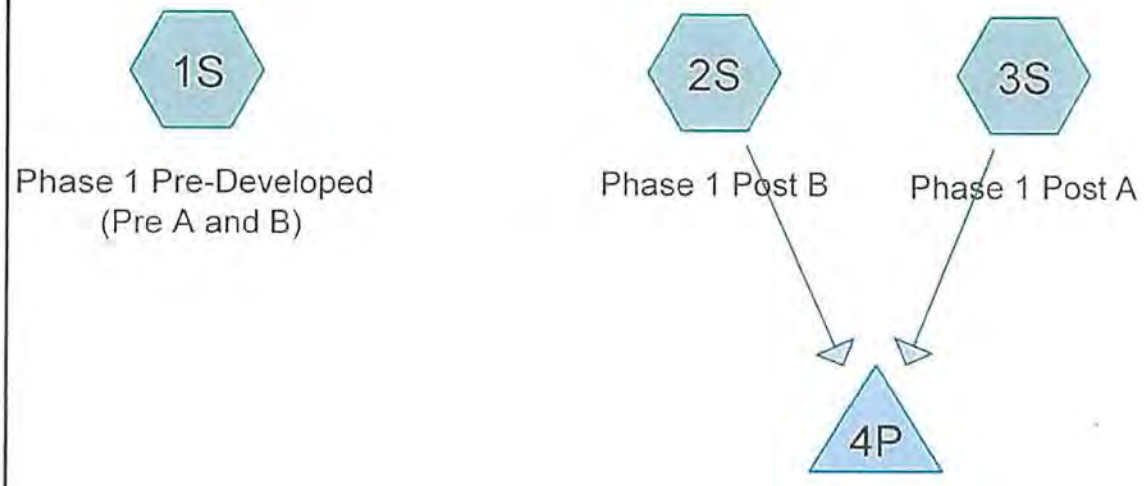
Project:	Project: **Lennar - 21st - Grandview to Westwood and Overall Beard**
Job No.	Job No. **2021-3130 and 3109 w/ Pond Bottom Infiltration**
Basin:	Basin: **Pond Sizing / Adequacy Calculations**
Date:	Date: **31-Jan-22**
Reviewer:	Reviewer: **TRW**

MONTH	INITIAL STORM EVENT (CF) (INFIL. FACTOR)	OUTFLOW FROM INFIL. POND (CF/MONTH)
JANUARY	0.40	7,483
FEBUARY	0.60	11,225
MARCH	0.80	14,966
APRIL	1.00	18,708
MAY	1.00	18,708
JUNE	1.00	18,708
JULY	1.00	18,708
AUGUST	1.00	18,708
SEPTEMBER	1.00	18,708
OCTOBER	1.00	18,708
NOVEMBER	0.60	11,225
DECEMBER	0.20	3,742
TOTAL		179597

Volume infiltrated per year = 179,597 **cubic ft.** Mean Annual Maximum Infiltration

Note: Assumes a November 100 year storm event prior to beginning Yearly Rainfall Events - Assumes that the pond is empty prior to the initial 100 year storm event

HydroCAD Calculations



Subcat Reach Pond Link

Routing Diagram for 21-3130 Westridge 21st Avenue - Phase 1 Storm Update
Prepared by {enter your company name here}, Printed 2/16/2022
HydroCAD® 10.10-6a s/n 10129 © 2020 HydroCAD Software Solutions LLC

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25 year	Type II 24-hr		Default	24.00	1	2.00	2
2	50 year	Type II 24-hr		Default	24.00	1	2.20	2
3	100 year	Type II 24-hr		Default	24.00	1	2.40	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
17.490	70	1/2 acre lots, 25% imp, HSG B (2S)
29.510	85	1/8 acre lots, 65% imp, HSG B (3S)
47.000	65	Woods/grass comb., Fair, HSG B (1S)
94.000	**72**	**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	3S	0.00	0.00	1,500.0	0.0300	0.010	0.0	18.0	0.0

Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Phase 1 Pre-Developed Runoff Area=47.000 ac 0.00% Impervious Runoff Depth>0.14"
Flow Length=1,300' Tc=468.7 min CN=65 Runoff=0.52 cfs 0.529 af

Subcatchment2S: Phase 1 Post B Runoff Area=17.490 ac 25.00% Impervious Runoff Depth>0.24"
Flow Length=613' Tc=457.6 min CN=70 Runoff=0.37 cfs 0.351 af

Subcatchment3S: Phase 1 Post A Runoff Area=29.510 ac 65.00% Impervious Runoff Depth=0.80"
Flow Length=2,200' Slope=0.0300 '/' Tc=79.2 min CN=85 Runoff=9.75 cfs 1.955 af

Pond 4P: Central Pond Peak Elev=2,236.52' Storage=2.306 af Inflow=9.76 cfs 2.306 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 94.000 ac Runoff Volume = 2.835 af Average Runoff Depth = 0.36"
74.94% Pervious = 70.446 ac 25.06% Impervious = 23.554 ac

Summary for Subcatchment 1S: Phase 1 Pre-Developed (Pre A and B)

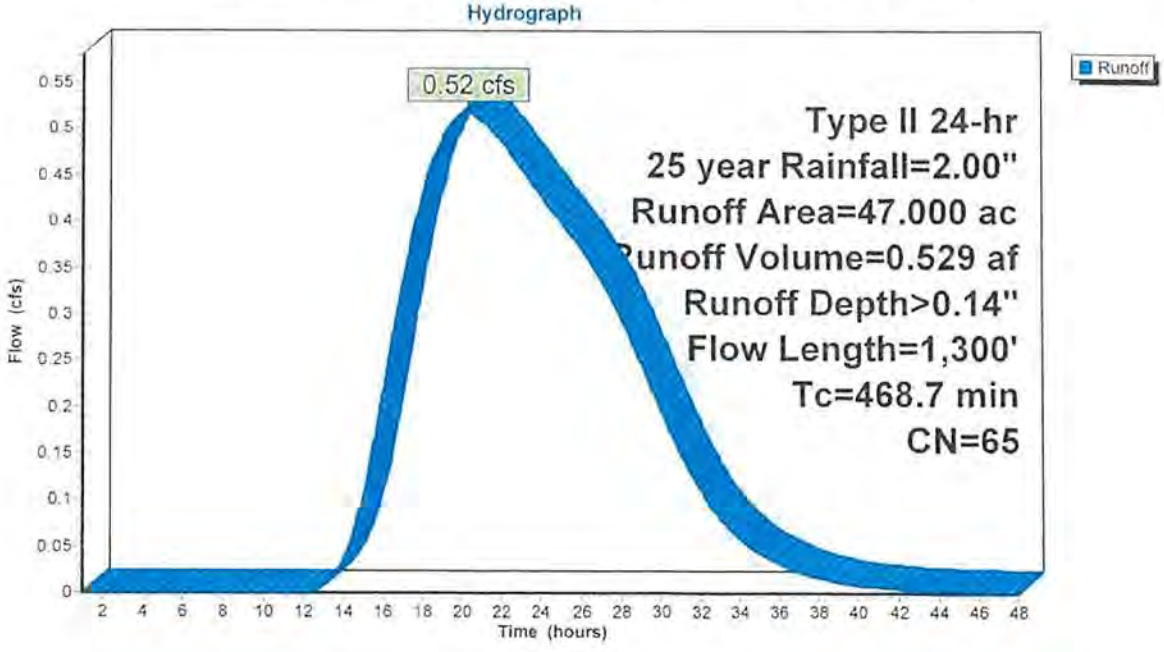
Runoff = 0.52 cfs @ 20.30 hrs, Volume= 0.529 af, Depth> 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 year Rainfall=2.00"

Area (ac)	CN	Description
47.000	65	Woods/grass comb., Fair, HSG B
47.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
456.2	300	0.0207	0.01		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 0.04"
9.3	400	0.0207	0.72		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
3.2	600	0.0050	3.10	310.17	**Channel Flow, Bottom of Pond Area** Area= 100.0 sf Perim= 120.0' r= 0.83' n= 0.030 Earth, grassed & winding
468.7	1,300	Total			

Subcatchment 1S: Phase 1 Pre-Developed (Pre A and B)



Summary for Subcatchment 2S: Phase 1 Post B

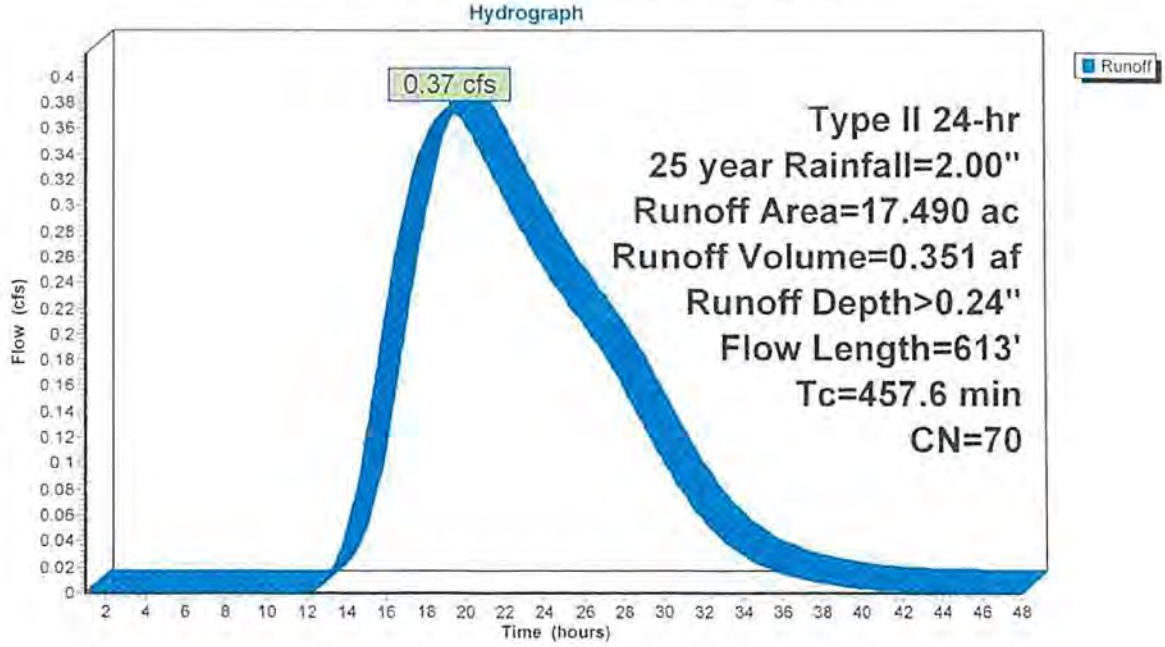
Runoff = 0.37 cfs @ 19.30 hrs, Volume= 0.351 af, Depth> 0.24"
Routed to Pond 4P : Central Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 year Rainfall=2.00"

Area (ac)	CN	Description
17.490	70	1/2 acre lots, 25% imp, HSG B
13.118		75.00% Pervious Area
4.372		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
456.2	300	0.0207	0.01		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 0.04"
1.0	138	0.0207	2.32		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.4	175	0.0200	7.36	22.80	**Channel Flow, Bottom of Pond Area** Area= 3.1 sf Perim= 10.1' r= 0.31' n= 0.013 Concrete, trowel finish
457.6	613	Total			

Subcatchment 2S: Phase 1 Post B



Summary for Subcatchment 3S: Phase 1 Post A

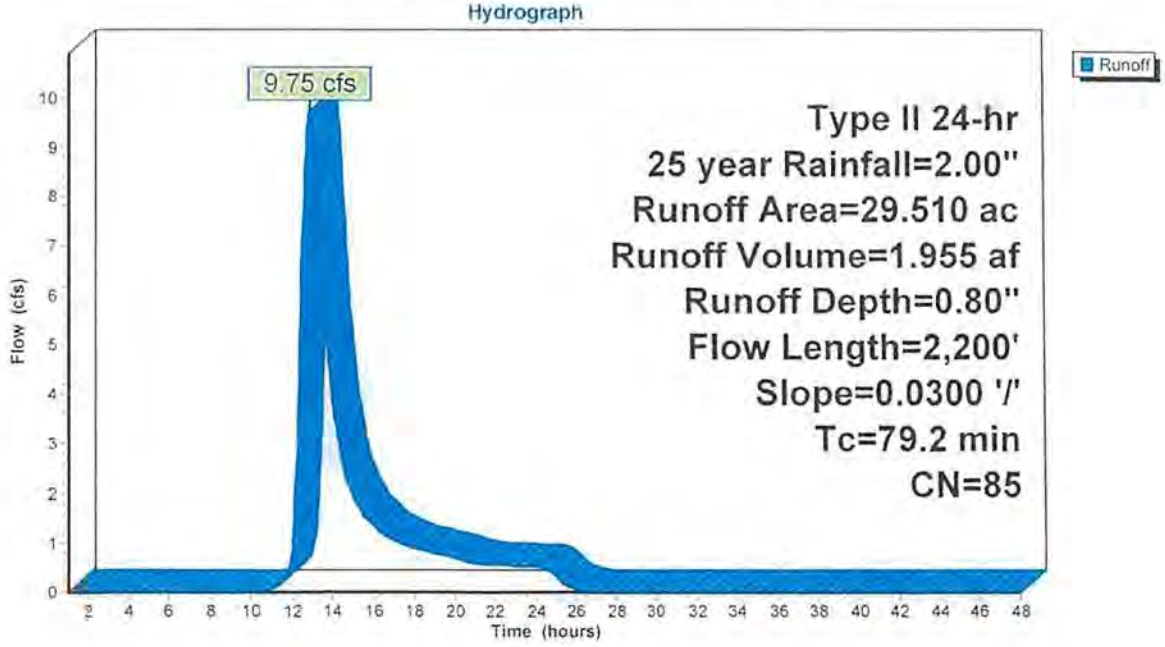
Runoff = 9.75 cfs @ 12.92 hrs, Volume= 1.955 af, Depth= 0.80"
Routed to Pond 4P : Central Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 year Rainfall=2.00"

Area (ac)	CN	Description
29.510	85	1/8 acre lots, 65% imp, HSG B
10.328		35.00% Pervious Area
19.182		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
74.5	100	0.0300	0.02		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 0.04"
2.8	600	0.0300	3.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
1.9	1,500	0.0300	13.38	23.65	**Pipe Channel, Pipe Flow to Pond** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
79.2	2,200	Total			

Subcatchment 3S: Phase 1 Post A



Summary for Pond 4P: Central Pond

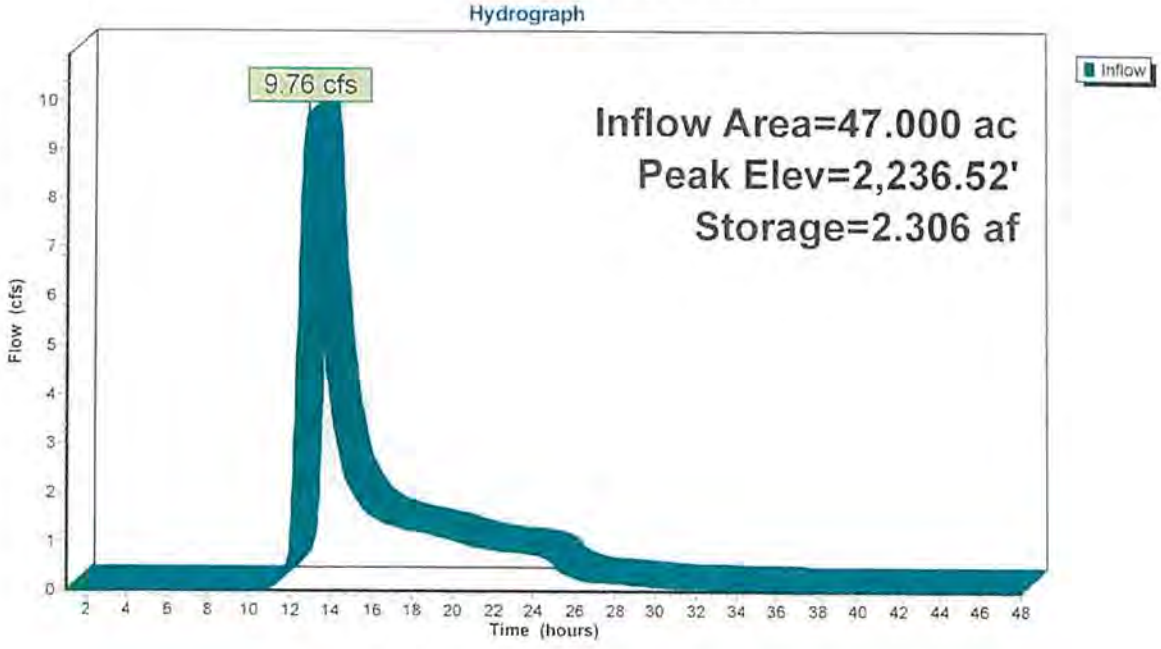
Inflow Area = 47.000 ac, 50.11% Impervious, Inflow Depth = 0.59" for 25 year event
Inflow = 9.76 cfs @ 12.92 hrs, Volume= 2.306 af
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 2,236.52' @ 48.00 hrs Surf.Area= 4.951 ac Storage= 2.306 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,236.00'	23.054 af	**515.00'W x 415.00'L x 5.00'H Prismatoid Z=2.0** 25.615 af Overall x 90.0% Voids

Pond 4P: Central Pond



Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Phase 1 Pre-Developed Runoff Area=47.000 ac 0.00% Impervious Runoff Depth>0.19"
Flow Length=1,300' Tc=468.7 min CN=65 Runoff=0.77 cfs 0.759 af

Subcatchment2S: Phase 1 Post B Runoff Area=17.490 ac 25.00% Impervious Runoff Depth>0.32"
Flow Length=613' Tc=457.6 min CN=70 Runoff=0.51 cfs 0.467 af

Subcatchment3S: Phase 1 Post A Runoff Area=29.510 ac 65.00% Impervious Runoff Depth=0.94"
Flow Length=2,200' Slope=0.0300 '/' Tc=79.2 min CN=85 Runoff=11.74 cfs 2.323 af

Pond 4P: Central Pond Peak Elev=2,236.63' Storage=2.790 af Inflow=11.75 cfs 2.790 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 94.000 ac Runoff Volume = 3.549 af Average Runoff Depth = 0.45"
74.94% Pervious = 70.446 ac 25.06% Impervious = 23.554 ac

Summary for Subcatchment 1S: Phase 1 Pre-Developed (Pre A and B)

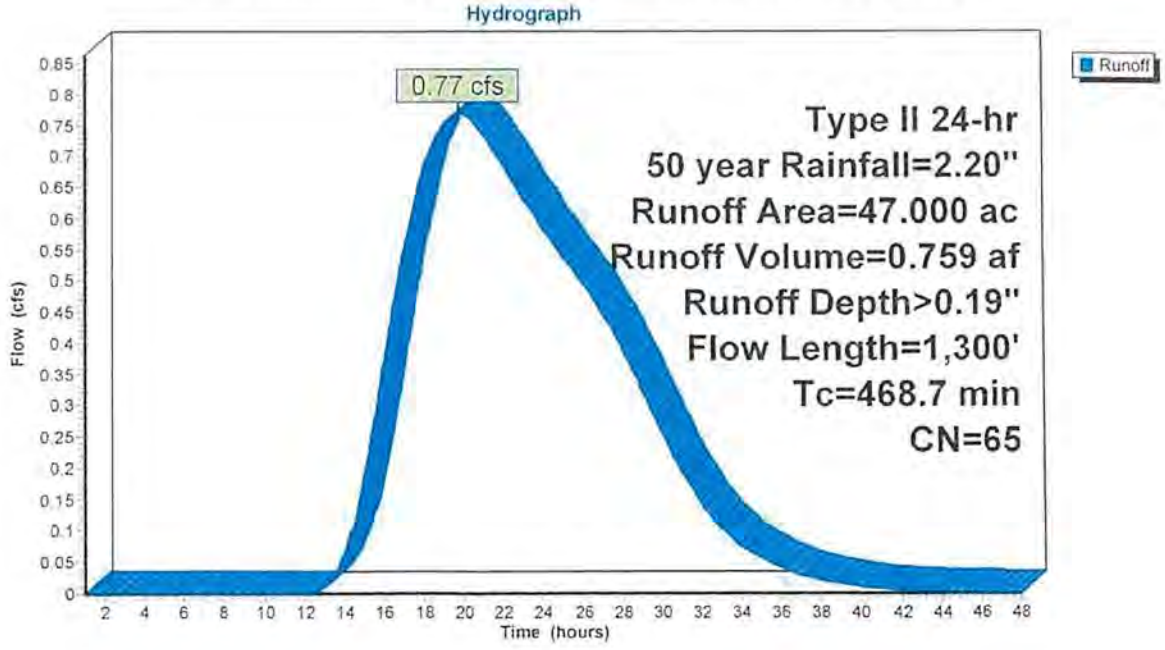
Runoff = 0.77 cfs @ 19.80 hrs, Volume= 0.759 af, Depth> 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 year Rainfall=2.20"

Area (ac)	CN	Description
47.000	65	Woods/grass comb., Fair, HSG B
47.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
456.2	300	0.0207	0.01		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 0.04"
9.3	400	0.0207	0.72		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
3.2	600	0.0050	3.10	310.17	**Channel Flow, Bottom of Pond Area** Area= 100.0 sf Perim= 120.0' r= 0.83' n= 0.030 Earth, grassed & winding
468.7	1,300	Total			

Subcatchment 1S: Phase 1 Pre-Developed (Pre A and B)



Summary for Subcatchment 2S: Phase 1 Post B

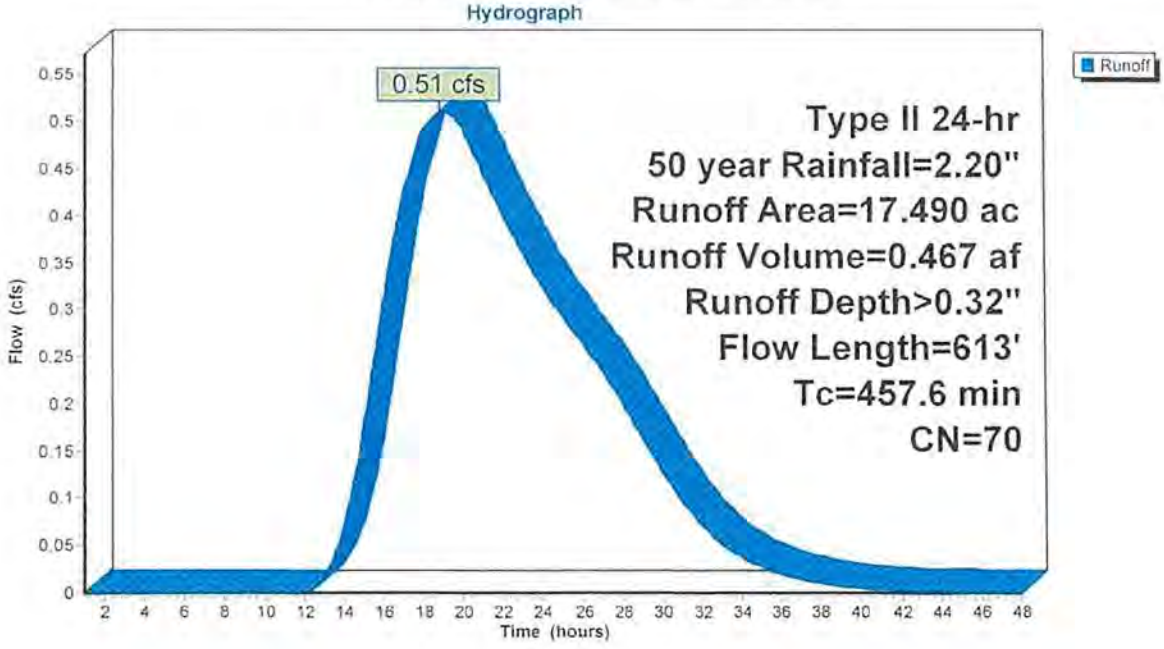
Runoff = 0.51 cfs @ 18.85 hrs, Volume= 0.467 af, Depth> 0.32"
Routed to Pond 4P : Central Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 year Rainfall=2.20"

Area (ac)	CN	Description
17.490	70	1/2 acre lots, 25% imp, HSG B
13.118		75.00% Pervious Area
4.372		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
456.2	300	0.0207	0.01		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 0.04"
1.0	138	0.0207	2.32		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.4	175	0.0200	7.36	22.80	**Channel Flow, Bottom of Pond Area** Area= 3.1 sf Perim= 10.1' r= 0.31' n= 0.013 Concrete, trowel finish
457.6	613	Total			

Subcatchment 2S: Phase 1 Post B



Summary for Subcatchment 3S: Phase 1 Post A

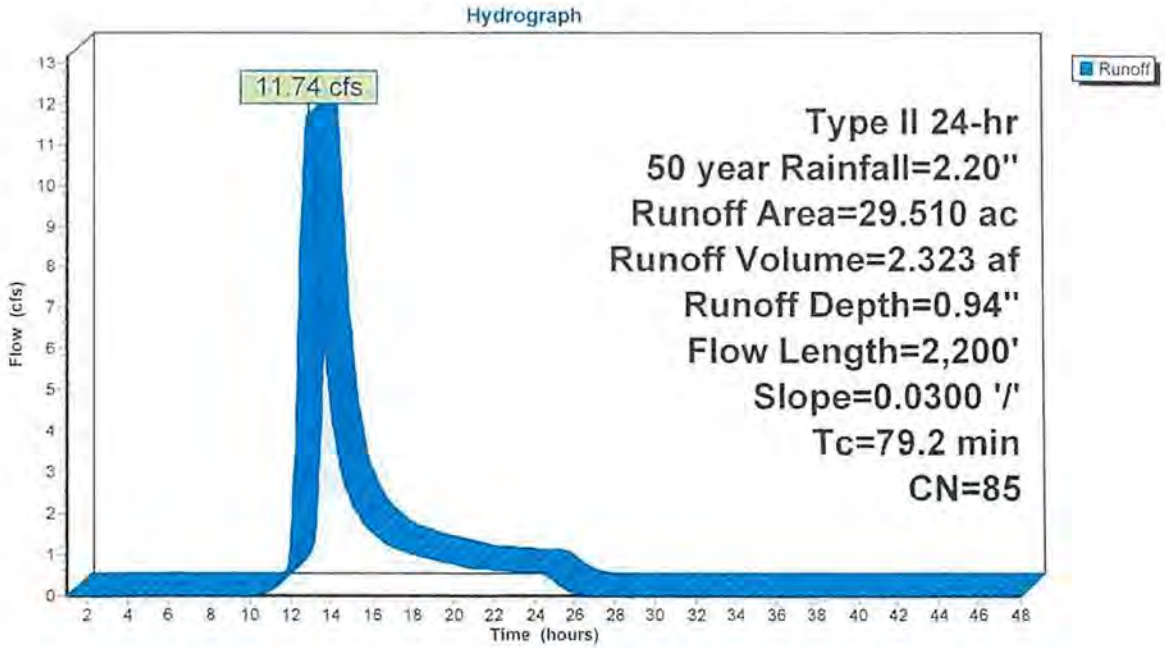
Runoff = 11.74 cfs @ 12.91 hrs, Volume= 2.323 af, Depth= 0.94"
Routed to Pond 4P : Central Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 50 year Rainfall=2.20"

Area (ac)	CN	Description
29.510	85	1/8 acre lots, 65% imp, HSG B
10.328		35.00% Pervious Area
19.182		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
74.5	100	0.0300	0.02		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 0.04"
2.8	600	0.0300	3.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
1.9	1,500	0.0300	13.38	23.65	**Pipe Channel, Pipe Flow to Pond** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
79.2	2,200	Total			

Subcatchment 3S: Phase 1 Post A



Summary for Pond 4P: Central Pond

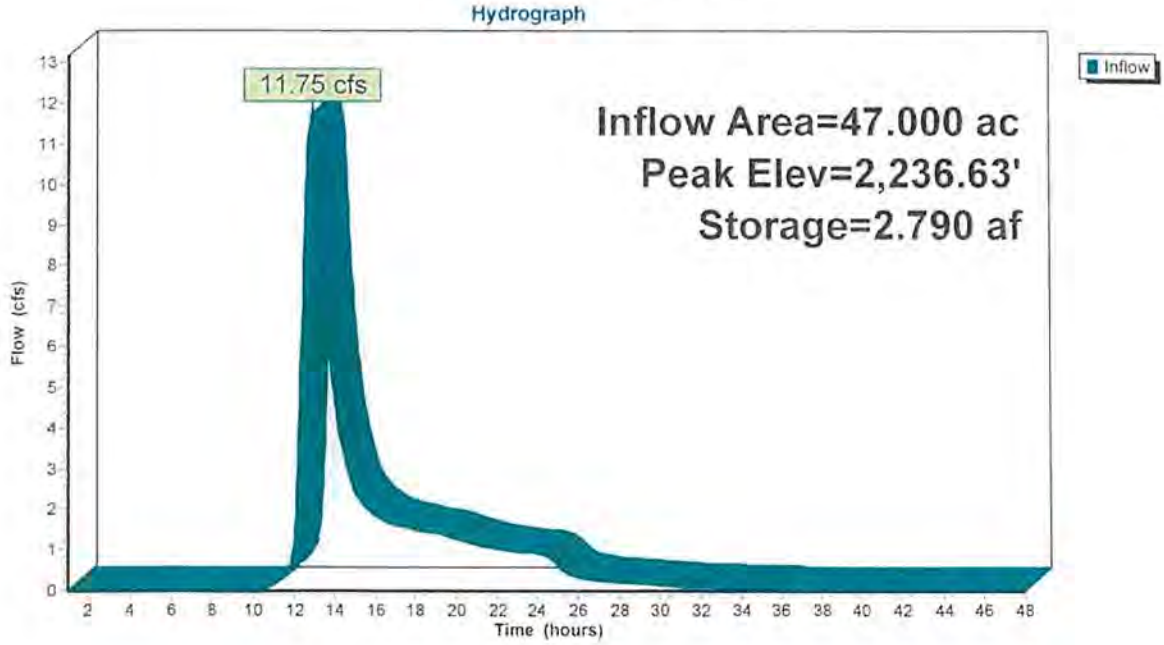
Inflow Area = 47.000 ac, 50.11% Impervious, Inflow Depth = 0.71" for 50 year event
Inflow = 11.75 cfs @ 12.91 hrs, Volume= 2.790 af
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 2,236.63' @ 48.00 hrs Surf.Area= 4.960 ac Storage= 2.790 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,236.00'	23.054 af	**515.00'W x 415.00'L x 5.00'H Prismatoid Z=2.0** 25.615 af Overall x 90.0% Voids

Pond 4P: Central Pond



Time span=1.00-48.00 hrs, dt=0.05 hrs, 941 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Phase 1 Pre-Developed Runoff Area=47.000 ac 0.00% Impervious Runoff Depth>0.26"
Flow Length=1,300' Tc=468.7 min CN=65 Runoff=1.07 cfs 1.022 af

Subcatchment2S: Phase 1 Post B Runoff Area=17.490 ac 25.00% Impervious Runoff Depth>0.41"
Flow Length=613' Tc=457.6 min CN=70 Runoff=0.67 cfs 0.595 af

Subcatchment3S: Phase 1 Post A Runoff Area=29.510 ac 65.00% Impervious Runoff Depth=1.10"
Flow Length=2,200' Slope=0.0300 '/' Tc=79.2 min CN=85 Runoff=13.79 cfs 2.703 af

Pond 4P: Central Pond Peak Elev=2,236.74' Storage=3.299 af Inflow=13.81 cfs 3.299 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 94.000 ac Runoff Volume = 4.321 af Average Runoff Depth = 0.55"
74.94% Pervious = 70.446 ac 25.06% Impervious = 23.554 ac

Summary for Subcatchment 1S: Phase 1 Pre-Developed (Pre A and B)

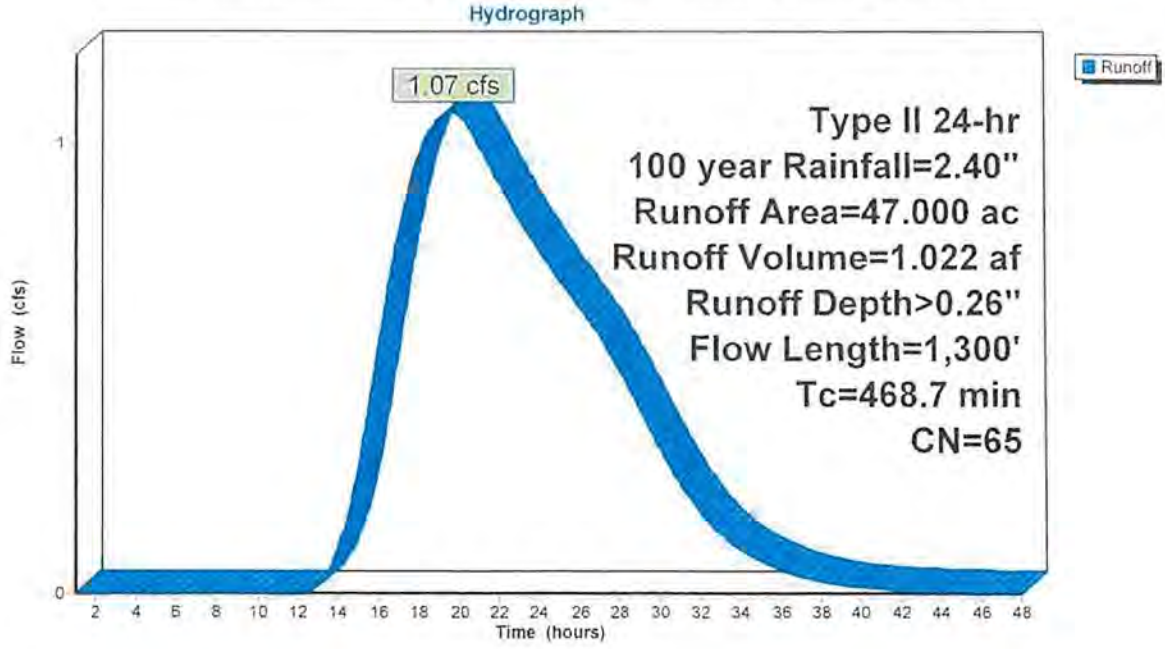
Runoff = 1.07 cfs @ 19.74 hrs, Volume= 1.022 af, Depth> 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 year Rainfall=2.40"

Area (ac)	CN	Description
47.000	65	Woods/grass comb., Fair, HSG B
47.000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
456.2	300	0.0207	0.01		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 0.04"
9.3	400	0.0207	0.72		**Shallow Concentrated Flow, Shallow Concentrated Flow** Woodland Kv= 5.0 fps
3.2	600	0.0050	3.10	310.17	**Channel Flow, Bottom of Pond Area** Area= 100.0 sf Perim= 120.0' r= 0.83' n= 0.030 Earth, grassed & winding
468.7	1,300	Total			

Subcatchment 1S: Phase 1 Pre-Developed (Pre A and B)



Summary for Subcatchment 2S: Phase 1 Post B

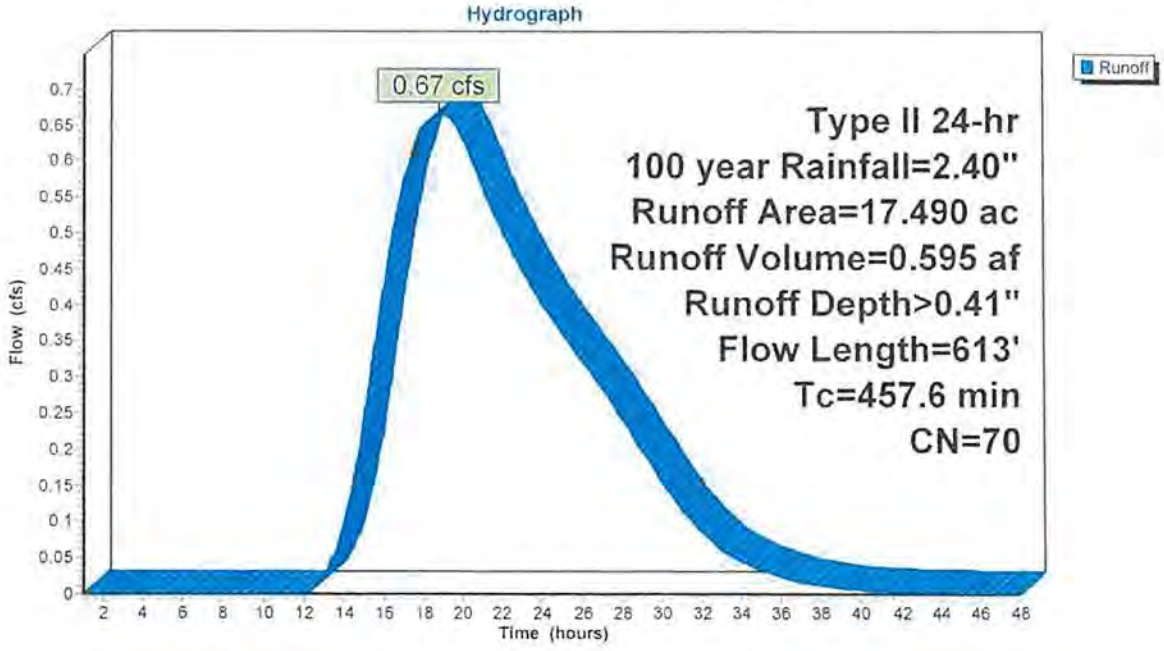
Runoff = 0.67 cfs @ 18.82 hrs, Volume= 0.595 af, Depth> 0.41"
Routed to Pond 4P : Central Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 year Rainfall=2.40"

Area (ac)	CN	Description
17.490	70	1/2 acre lots, 25% imp, HSG B
13.118		75.00% Pervious Area
4.372		25.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
456.2	300	0.0207	0.01		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 0.04"
1.0	138	0.0207	2.32		**Shallow Concentrated Flow, Shallow Concentrated Flow** Unpaved Kv= 16.1 fps
0.4	175	0.0200	7.36	22.80	**Channel Flow, Bottom of Pond Area** Area= 3.1 sf Perim= 10.1' r= 0.31' n= 0.013 Concrete, trowel finish
457.6	613	Total			

Subcatchment 2S: Phase 1 Post B



Summary for Subcatchment 3S: Phase 1 Post A

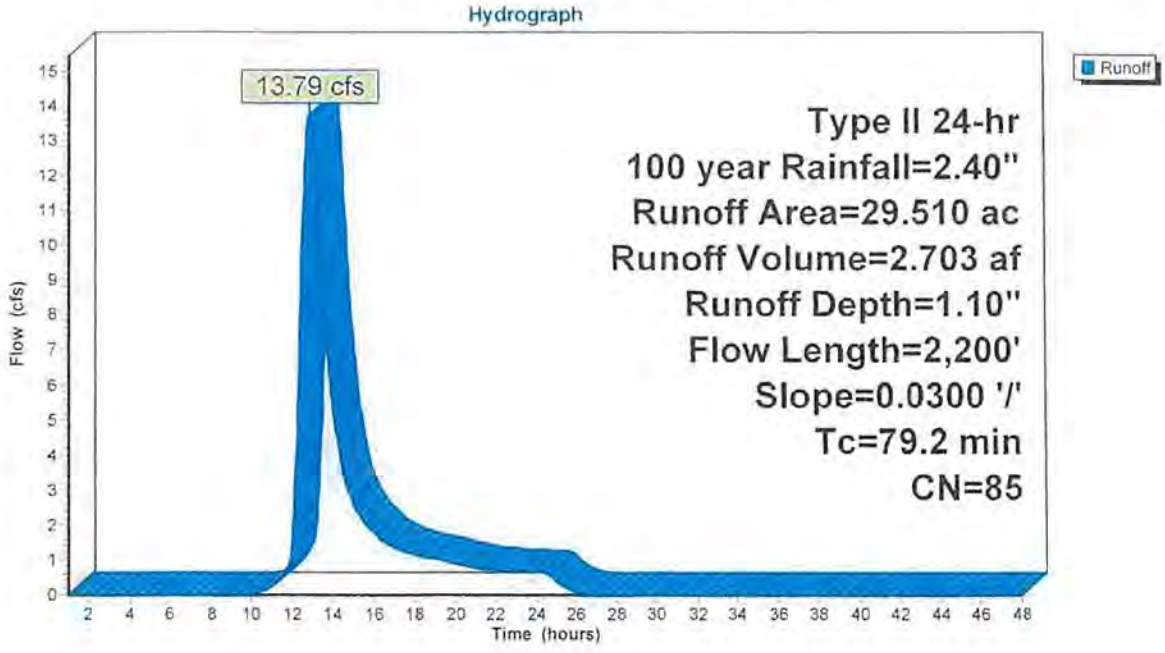
Runoff = 13.79 cfs @ 12.90 hrs, Volume= 2.703 af, Depth= 1.10"
Routed to Pond 4P : Central Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 year Rainfall=2.40"

Area (ac)	CN	Description
29.510	85	1/8 acre lots, 65% imp, HSG B
10.328		35.00% Pervious Area
19.182		65.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
74.5	100	0.0300	0.02		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 0.04"
2.8	600	0.0300	3.52		**Shallow Concentrated Flow, Shallow Concentrated Flow** Paved Kv= 20.3 fps
1.9	1,500	0.0300	13.38	23.65	**Pipe Channel, Pipe Flow to Pond** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.010 PVC, smooth interior
79.2	2,200	Total			

Subcatchment 3S: Phase 1 Post A



Summary for Pond 4P: Central Pond

Inflow Area = 47.000 ac, 50.11% Impervious, Inflow Depth = 0.84" for 100 year event
Inflow = 13.81 cfs @ 12.90 hrs, Volume= 3.299 af
Outflow = 0.00 cfs @ 1.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 1.00-48.00 hrs, dt= 0.05 hrs
Peak Elev= 2,236.74' @ 48.00 hrs Surf.Area= 4.970 ac Storage= 3.299 af

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,236.00'	23.054 af	**515.00'W x 415.00'L x 5.00'H Prismatoid Z=2.0** 25.615 af Overall x 90.0% Voids

Pond 4P: Central Pond

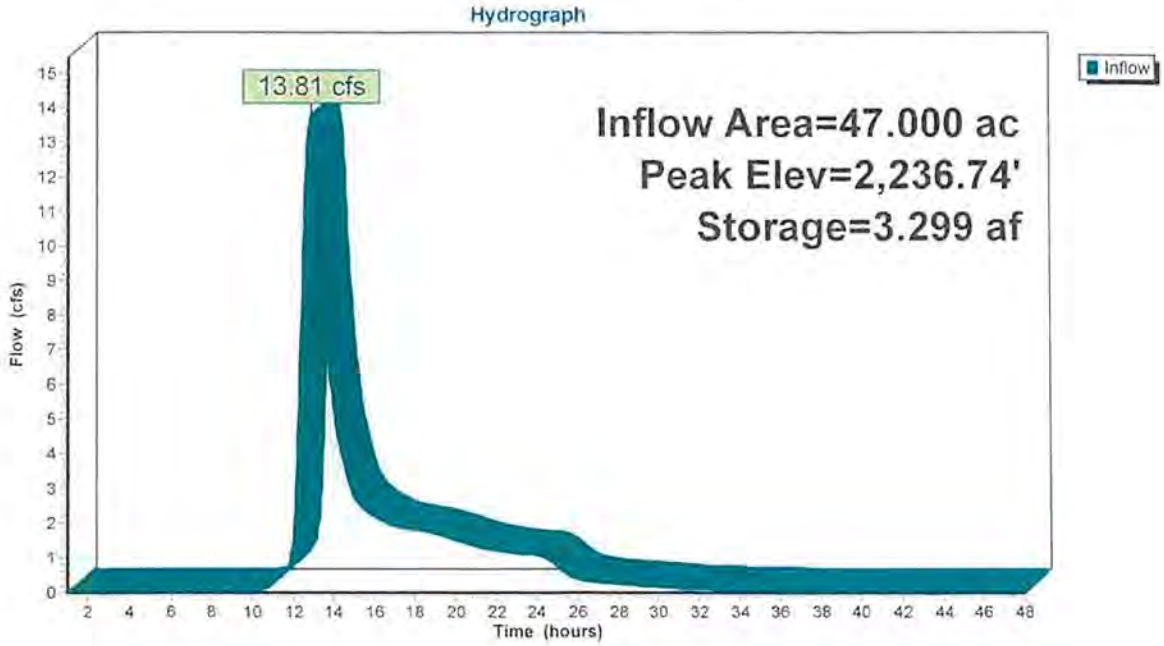


TABLE OF CONTENTS

Geotechnical Report

Geotechnical Engineering Report
21st Avenue – Westridge to Grandview
Spokane County, WA

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4/21/2022

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BAI Project Number: S22083

April 21, 2022

CONTENTS

EMBEDDED TABLES

ATTACHED FIGURES

CONTEXT

This geotechnical engineering report (GER) presents the results of geotechnical exploration and analysis for the proposed housing development. These services were contracted and coordinated with Whipple Consulting Engineers.

Project Considerations

Approximately 17 acres are planned for residential development in Spokane, WA. The development will consist of 41 lots with single-family homes. New streets are proposed and 21st Avenue will be extended to the west and connect with Grandview Avenue. Cuts and fills up to 5 and 10 feet, respectively, are proposed. Stormwater runoff will be directed to ponds in the northwestern and southeastern portions of the site.

Location

The site is in the NE ¼ of the SW ¼ of Section 26, Township 25N, Range 42E, Willamette Meridian. It is located between the west end of 21st Avenue and on the south side of Grandview Aveune. The physical address is 3604 W. 21st Ave. The location is illustrated in the attached *Vicinity Map* and *Site Plan*.

Scope

This geotechnical study involved interpretation of subsurface soil conditions to provide conclusions addressing the suitability of the site to support proposed structures and provide geotechnical parameters required for others to design and construct. We endeavored to conduct these services in accordance with generally accepted geotechnical engineering practices as outlined in proposal S22214, dated February 1, 2022.

The following scope was completed:

- Excavated 12 test pits to a maximum depth of 12 feet;
- Advanced dynamic cone penetrometer (DCP) soundings adjacent to test pit locations;
- Characterized the encountered subsurface conditions;
- Performed laboratory tests on representative samples of the encountered soils;
- Performed test pit infiltration tests at 2 locations; and,
- Prepared this report presenting the exploration results along with conclusions and recommendations.

The scope of this study does not include foundation evaluation for homes or outbuildings. Additional information including architectural drawings, lot grading plans, and anticipated foundation loading are required to provide foundation recommendations.

ENCOUNTERED CONDITIONS

Physical Setting

The site is located near the eastern margin of a broad plain characterized by relatively level topography with intermittent wetlands and outcroppings of igneous and metasedimentary rock. During the last ice age, repeated catastrophic flood events resulting from rupturing of the ice dams that retained Glacial Lake Missoula, inundated much of the Spokane area, and scoured pre-existing

rock and sedimentary formations. The floods deposited sediment on top of pre-existing formations and in consequentially developed channels and basins. Some basins became subsequently infilled with sediment resulting from erosion of surrounding areas. Geologic mapping of the area shows Miocene basalt (~~*M*~~*wp*) underlies the site (WSDNR, 2004). ~~*M*~~*wp* is described as *"Dark gray to black, fine-grained, dense basalt."*

Surface Conditions

We observed the site on March 17, 2022. The site topography consisted of a northeast-southwest trending ridge across the center of the site sloping down to lower points at the northwest corner and southeast third of the site. Total relief across the site was approximately 30 feet ranging from a high of 2,262 feet to a low of 2,232 feet (NAVD 88). The northern and western portions were characterized by outcroppings of basalt and piled fill consisting chiefly of excavated basalt. Various sized piles of fill including lawn and plant debris, soil, wood piles, and trash were observed across the site. The site was moderately populated with mature conifers with the exception of the proposed road alignments and the lowest part of the site in the southeast corner.

A primitive road was observed along the proposed alignment of 21st Avenue from Grandview to Westridge Drive. Several new residential structures were observed under construction north of the proposed intersection of Cumberland Lane and 21st Avenue. Basalt rubble piles were observed on the proposed alignment of Beard Drive as a result of previous blasting efforts. An east-west trending, approximately 4 to 5-foot-high ridge of fill was observed on the at the northern edge of "Tract A". The lowest area of the site, including most of "Tract A" was classified as *PEM1C, Seasonally Flooded* (USFWS-NWI).

Subsurface Conditions

Test pit excavations were performed concurrently with site observations. Conditions encountered in the explorations are described in the *Logs* in accordance with methods described in *Field Exploration*. The subsurface materials were differentiated based on characteristics relevant to this project.

topsoil
Log symbol:

Topsoil consisting of silt and sand with organics was encountered in Test Pit 1 (TP-1) TP-2, TP-3, TP-8, TP-9, and TP-12 beginning at the ground surface and extending to a maximum depth of approximately 1.5 feet below ground surface (BGS). Gravel and cobbles were observed in minor amounts.

existing fill
Log symbols:

Existing fill consisting primarily of basalt shot-rock was encountered in TP-4, TP-6, TP-7, TP-10, and TP-11 beginning at the ground surface and extending to depths ranging from 2.5 to greater than 10 feet BGS. Existing fill in TP-6 appeared to consist of imported material and included wood and metal debris. The condition varied widely, and the presence of coarse particles (cobbles and

boulders) tended to interfere with DCP probes resulting in artificially high blow counts.

silt
Log symbol:

Silt was encountered in TP-2, TP-3, and TP-12 beginning beneath *topsoil* and extended to depths ranging from 4 to greater than 12 feet BGS. The condition varied and correlated N-values from DCP tests ranged from 1 to 14. Moisture contents for two representative samples were at the liquid limit. The fines content (percent, by weight, passing the U.S. #200 sieve) ranged from 78 to 99 percent.

silty sand
Log symbol:

Silty sand was encountered in TP-1, TP-4, TP-9, and TP-12 beginning beneath *topsoil*, *existing fill*, and *silt*. Silty sand was deposited over *basalt* in TP-1, TP-4, and TP-9 and thickness ranged from approximately 1 to 4 feet. Silty sand was observed beginning at 5 feet BGS in TP-12 and extended to depths greater than 11.5 feet BGS. The fines content was 34 and 44 percent for two representative samples tested.

basalt
Log symbol:

Basalt was encountered in the excavations, with the exception of TP-3, TP-10, and TP-12, beginning at depths ranging from 0.5 to 7 feet BGS. It consisted of slightly to moderately weathered and highly fractured, fine-grained rock. The relative rock strength was strong to very strong (R4 to R5).

N-value correlation. Triggs Wildcat® DCP tests were advanced at test pit locations to estimate relative densities of the encountered soils. The tests were initiated beginning at the ground surface and advanced to the point of refusal.

Pavement subgrade strength. Kessler® DCP tests were also initiated beginning at the ground surface and advanced to a maximum depth of 30 inches BGS. These DCP tests were used to evaluate pavement subgrade support conditions within the site.

Results of the DCP tests are presented in *Figures*.

Surface and Groundwater Hydrology

Surface water was not observed on site. Surface water was observed in several wetland areas within approximately 1 mile to the south and west. The wetlands result from perched water atop impermeable soil and basalt rock.

Groundwater was encountered in TP-3 and TP-12 beginning at depths of 7.5 and 10.5 feet BGS,

respectively. Although *basalt* was not encountered in these test pits, the groundwater likely results from being perched atop *basalt*. Mottled soil textures indicate the groundwater levels fluctuate seasonally. Local groundwater, other than that which is perched atop impermeable stratum near the ground surface, is primarily encountered as confined aquifers of basalt flow interbeds within a sequence of rock that extends to depths greater than 250 feet BGS in the vicinity of the site.

CONCLUSIONS

Based on the encountered conditions described above, we conclude the site offers challenging conditions with respect to the proposed development. However, development is considered feasible provided that the recommendations in this report are implemented.

Existing fill may pose settlement risks and should be removed from beneath roads and building foundations. *Existing fill* consisted primarily of blasted *basalt* rock fragments (shot rock) and may be suitable for reuse as subgrade structural fill if screened as necessary to a maximum particle size depending on the application.

The saturated *silt* layer encountered in the southeast portion of the site in test pits TP-2, TP-3 and TP-12 poses settlement risks. Fill placement to raise the grade in this area should be expected to induce time dependent consolidation settlement. Failure to postpone construction of structures, pavements and slabs until after consolidation settlement has been allowed to occur can result in construction difficulties, damage structures, and decrease performance of paved surfaces. Potential options to mitigate settlement include removal and replacement, preloading the site and waiting for settlement to reach substantial completion, or ground improvement. Depending on the timeline for constructing the grading plan for the project, preloading may be the simplest and mostcost-effective alternative for settlement mitigation.

The encountered *silty sand* and *silt* are not suitable for use as structural fill. They are considered moisture-sensitive due to the high fines content; specifically, adjusting the moisture content to a range suitable for compaction will be more difficult, particularly in wet weather. Typically, structural fill should not include more than 15 percent fines.

In situ *basalt* was encountered throughout the majority of the site and will likely require heavy ripping and/or blasting in order to meet the proposed subgrade elevations in areas of cut.

Geotechnical site characterization criteria for use of rapid infiltration structures, such as drywells, requires the presence of a suitable target soil with high permeability, wide horizontal extent, and suitable thickness above limiting layers such as fine-grained soils, rock, or groundwater. These conditions were not encountered in explorations. *Silty sand* and *silt* exhibit low permeability due to high fines content. Shallow *basalt* and groundwater constitute limiting layers. Drywells and infiltration trenches are not considered feasible due to the absence of permeable soil and inadequate separation between the base of infiltration structures and limiting layers. Detention/evaporation ponds with limited subsurface drainage may be a viable alternative for stormwater management.

RECOMMENDATIONS

The recommendations presented throughout this chapter are intended to provide economically feasible criteria at normally accepted risk levels. More conservative design parameters can be used if lower risks are preferred. Specifically, the design should incorporate the following recommendations concerning earthwork, flexible pavement, and stormwater drainage.

Seismic Considerations

The recommended seismic site class designation is Site Class C "very dense soil and soft rock." Spectral response acceleration parameters, adjusted for Site Class C*, were calculated using USGS, U.S. Seismic Design Web Services through the Applied Technology Council (ATC) website. The values of predicted earthquake ground motion for short period structural elements (0.2 second spectral response acceleration, Ss) and for long period structural elements (1.0 second spectral response acceleration, S_1) are provided in the table below. The design parameters (S_{DS} and S_{D1}) are equal to ⅔ of the maximum earthquake spectral response accelerations (S_{MS} and S_{M1}).

Table 1. Seismic design parameters

Site Class	Latitude	Longitude	PGA	Ss	S_1	S_{DS}	S_{D1}
C	47.635 N	-117.467 W	0.137g	0.305g	0.112g	0.265g	0.112g

*Code Reference: International Building Code (ASCE 7-16)

Although shallow groundwater is present, due to the low potential for high ground acceleration, consistency, fines contents, and plasticity of encountered saturated soils, the liquefaction potential is considered low.

Earthwork

Site preparation. Select an earthwork contractor with successful experience working with fine-grained soils and discuss wet weather contingencies prior to beginning work. Strip *topsoil* so that mineral soil lacking concentrated organics is exposed. Scarify and moisture-condition soils, as necessary. Compact the upper 12 inches minimum to at least 92 percent of the maximum dry unit weight (MDUW) but do not compact past the onset of pumping. Additional subgrade evaluation will be needed if compaction produces instability. Solutions may require stabilization with strong geosynthetic such as Mirafi RS380i. Determine MDUW and optimum moisture contents for fill material in accordance with the modified Proctor method ASTM D-1557.

Temporary slopes. Due to varying construction methods and conditions, temporary cuts should be the responsibility of the contractor. The encountered soils are consistent with Type C materials per WISHA excavation criteria. WISHA specifies a maximum inclination of 1½ horizontal to 1 vertical (1½ H:1V) in the temporary condition for Type C.

Permanent slopes. Maximum permanent soil cut and fill slope angles of 2H:1V are recommended except where potentially submerged in drainage basins, where the slopes should be no steeper than 3H:1V. Protect completed surfaces as soon as possible with mechanical or bio-technical erosion control.

Protection of subgrade. Following compaction of subgrade, protect surfaces from degradation during inclement weather. Protection measures include erosion control maintenance, preventing tracking soil and rock offsite, and preventing driving on wet subgrade soil. Reduce frost penetration in freezing weather by leaving surfaces of soil un-compacted if left for an extended duration. Prevent frost penetration in freezing weather by covering soils, such as placing a temporary loose, insulating layer of soil on top.

Fill material. The *existing fill* is generally suitable for re-use as structural fill provided that deleterious items (anthropogenic debris, organics, over-sized materials, etc.), if encountered, are

removed prior to re-use. Soils exhibiting high fines percentages, including *topsoil, silty sand, and silt*, should not be used for structural fill as they are considered moisture sensitive and may be difficult to compact in wet conditions. The generally recommended import fill materials and uses are illustrated in the following table:

Table 2. Fill Materials

Soil Fill Product	Allowable Use
Non-Structural Fill	• Areas not supporting structures (typically landscaped areas) • Soils should not contain particles larger than 12 inches median diameter and be reasonably free of deleterious items (wood, metal, plastic, trash, etc.)
Granular Structural Fill	
Select Borrow: WSDOT SS Section 9-03.14(2)[1]	• Fills within building footprints and paved areas to meet subgrade elevations • Over-excavations • Utility trench backfill above bedding course
Class B Gravel Backfill for Foundations: WSDOT SS 9-03.12(1)B	• Slab-on-grade aggregate • Structural fill below foundations, where required.
Gravel Backfill for Walls: WSDOT SS 9-03.12(2)	• Foundation and retaining wall backfill
Bedding Course: WSDOT SS 9-03.12(3)	• Backfill for utility and pipe zone bedding

Contact us to review alternative material selections. Structural fill should extend beyond footings a minimum distance equal to the fill depth.

Fill Placement. Place fill in lifts of thickness suited to the compaction equipment but no more than 12 inches. Compact structural fill to at least 92 percent of MDUW below footings and embankment fill below slab and pavement, except within the top 12 inches of final grade where compaction should be increased to 95 percent. Do not place fill in a frozen condition or on un-compacted frozen subgrade.

We do not recommend placing fill over the *silt* encountered in the southeast portion of the site. The *silt* should either be removed and replaced or treated to mitigate time dependent consolidation settlement prior to construction of structures, pavements, and slabs. We recommend preloading based on the amount of fill required in this area per the grading plan. Preloading involves placing a surcharge fill (beyond what's required in the grading plan) over the top of the compressible stratum. The height of the surcharge fill is equivalent to the final project loading conditions. Time is then allowed to for the ground to settle as consolidation occurs under the added surcharge. Once sufficient consolidation has occurred, the surcharge fill can be removed, and construction can commence over the improved area. Settlement monitoring is typically accomplished by installing simple and inexpensive settlement plates within the fill. The settlement plate is connected to a riser pipe extending upward through the fill inside of a plastic sleeve.

[1] Washington State Department of Transportation, 2022, Standard Specifications, M 41-10 (WSDOT SS).

The time for substantial completion of consolidation settlement can range from several weeks to several months depending on the permeability and in situ void ratio of the native *silt*. The rate of settlement imposed by the preload can be accelerated by installation of prefabricated vertical drains to shorten the drainage path. If a better estimate of time vs settlement is desired, we recommend performing additional subsurface explorations with undisturbed sampling and laboratory consolidation testing.

Verification and application. These earthwork recommendations apply to structural fill, backfill against footings, and backfill of utility trenches. Retain a qualified earthwork technician present during fill and backfill operations to observe and test each lift of fill. A representative of the Geotechnical Engineer is best suited to provide such testing.

We recommend that in-place density testing be completed in accordance with ASTM D-6938 (nuclear density methods) on site soil and compacted structural fill at the following minimum frequencies:

- Subgrade and base course materials for footings and slabs – At least two tests per 2,000 square feet or fraction thereof, per fill lift;
- Subgrade and base course materials for roads – At least one in-place density test per 100 lineal feet per lane, per fill lift;
- Subgrade and base course materials for curbs and sidewalks – At least one in-place density test per 100 lineal feet, per fill lift; and,
- Utility trench backfill – At least one in-place density test per 5 feet of depth per 100 lineal feet of trench.

Flexible Pavement

A resilient modulus of approximately 6,000 pounds per square inch (psi) appears to be suitable for pavement design.

Information regarding the estimation of average daily traffic (ADT) was provided by Whipple Consulting Engineers. The ADT includes 10 trips per day per lot for light passenger vehicles with 4 percent heavy vehicles added (concrete trucks, construction equipment haulers, garbage trucks, moving and delivery vans, etc.). If traffic information is updated, we need to be contacted to re-evaluate pavement sections.

Factors considered in the recommended pavement section include the following:

- Estimated average daily traffic (ADT): 420 (residents coming and going, visitors, heavy vehicles, etc.);
- Future traffic growth rate of 5 percent;
- City of Spokane and Spokane County design standards; and,
- Total design equivalent single-axle loads (ESALs) equals 77,000.

The recommended minimum flexible pavement section 3 inches hot mix asphalt (HMA) over 6 inches crushed surfacing top course (CSTC) over compacted subgrade. The use of a stabilization geotextile is recommended between CSTC and subgrade materials. Where the subgrade is tested to be granular material consisting of no more than 15 percent passing the U.S. # 200 sieve, the filter fabric may be omitted.

Table 3: Pavement Compaction and Recommended Materials Summary

Layer	Compaction	Specification
3 inches Asphalt Surfacing – *HMA*	92% TM	*WSDOT SSs Section 9-03.8(6).*
6 inches Base Course - *CSTC*	95% MP	*WSDOT SSs Section 9-03.9(3)*
Separation and stabilization geotextile		*WSDOT SS 9-33.2(1), Table 3*

TM = Theoretical Maximum Unit Weight
MP = Modified Proctor *(AASHTO T-180)*

Stormwater Drainage

We recommend grading surfaces to allow positive drainage away from structures and pavements. Roof and parking lot runoff should be collected and disposed of such that water is not allowed to accumulate near the structure or pavements.

As previously stated, the use of rapid subsurface infiltration structures is not considered feasible. An alternative method to subsurface infiltration may include the use of evaporative/detention ponds with limited infiltration to the subsurface. In the event this method for stormwater treatment becomes desirable, we recommend following procedures described in the SRSM, Chapter 5, for designing such facilities. The estimated hydraulic conductivity rates of the soils at TP-3 and TP-9 locations were approximately 1.4 and 10.6 inches per hour, respectively, as determined from infiltration testing.

Additional Services

Effective geotechnical services involve cooperation with the owner, designer, and constructor as follows:

1. Preliminary study to assist in planning and to economically adapt the project to its geologic environment;
2. Soil exploration and analysis to characterize subsurface conditions and recommend design criteria;
3. Consultation with the designer to adapt the specific design to the site in accordance with the recommendations;
4. Construction observation to verify the conditions encountered and to make recommendations for modifications, as necessary; and,
5. Construction material testing, quality control, and special inspection.

This report satisfies Item 2 of the 5-phase endeavor. We are eager to provide assistance with design and construction as appropriate to assist in completing a safe and economical project.

FIELD EXPLORATION

The fieldwork was conducted by staff engineer Greyson Charon, EIT, staff geologist Jack Pappas, GIT, and supervised by geotechnical engineer John Finnegan, PE, beginning March 17 and concluding March 22, 2022. The field activities generally consisted of the following:

- Reconnaissance of the site and surrounding area;
- Logging subsurface conditions in 12 test pits;
- Conducting DCP soundings;
- Performing infiltration tests; and,
- Obtaining bulk samples of the soils.

Results are presented in *Figures*.

Excavations

Test pits were excavated by Vietzke with a CAT 308 track-mounted excavator using a 24-inch-wide, toothed bucket. Criteria governing the depth to which test pits were excavated included limits of equipment reach and digging refusal on *basalt* with a 10-ton, 70-horsepower excavator.

Soil Samples

Samples were obtained by capturing representative material from the bucket of the excavator or from within the excavation while less than 4 feet BGS.

DCP Testing

DCP Testing – ASTM D6951/ASTM STP 399. Soil strength was estimated with a series of DCP tests using two methods. Method 1 involves the use of a Kessler® DCP which consists of a 10.1-pound slide hammer and rods with 2-inch graduations. Method 2 involves the use of a Triggs Wildcat® DCP system which consists of a 35-pound slide hammer and rods with 4-inch graduations. In both methods the hammer is manually lifted and allowed to fall from a fixed height. Kessler® DCP test results can be correlated to CBR values for estimating relative soil strength for pavement design. Wildcat® DCP results can be corelated to N-values for estimating relative soil density. The results of DCP penetration per 1-inch and 4-inch intervals are presented in *Figures*.

Infiltration Testing

Infiltration tests were conducted at TP-3 and TP-9 locations. The tests were performed in accordance with the *Spokane Regional Stormwater Manual, Appendix 4C – Test Pit Method.* The results of infiltration testing are presented in *Figures*.

Soil and Rock Classification

Field descriptions of soils and rock were completed in accordance with the current version of the Washington State Department of Transportation, *Geotechnical Design Manual* (GDM), M 46-03, except that fines (silt and clay) were described in accordance with ASTM D 2487. *Whereas, the GDM uses the terms 'silty' and 'clayey' to describe a very broad range of fines from 10 to 49 percent; ASTM D 2487 uses those terms for percentages greater than 12 and the term 'with' for fines ranging from 5 to 12 percent, which is typically necessary to describe variations relevant to soil permeability per the SRSM.* A key to the descriptions is provided in *Guide to Soil and Rock Descriptions.*

Location

Horizontal & vertical control. The *Site Plan* was reproduced from a preliminary plan provided by the client from Inland Pacific Engineering (dated September 3, 1997) and is based on measured offsets from existing site features at the time of exploration.

Elevations presented in the *Logs* were correlated from contour intervals illustrated on the provided plans. Horizontal and vertical locations can be considered accurate to within 5-foot and 1-foot respectively, relative to the information provided.

LABORATORY ANALYSIS

Laboratory testing was performed on representative samples of the soils encountered to provide data used in our assessment of soil characteristics.

Tests were conducted, where practical, in accordance with nationally recognized standards (ASTM, AASHTO, etc.), which are intended to model in-situ soil conditions and behavior. The results are presented in *Figures*.

Index Parameters

Moisture content – ASTM D2216. Moisture contents were determined by direct weight proportion (weight of water/weight of dry soil) determined by drying soil samples in an oven until reaching constant weight.

Gradation – ASTM D6913. Gradation analysis was performed by the mechanical sieve method. The mechanical sieve method is utilized to determine particle size distribution based upon the dry weight of sample passing through sieves of varying mesh sizes. The results of gradation are provided in *Grain Size Distribution Results*.

Atterberg Limits – ASTM D4318. Atterberg limits describe the properties of the fine-grained constituents of soils by relating the water content to the plastic and liquid limits of engineering behavior. As the water content increases, the state of the soil changes from a brittle solid, to a plastic solid, and then to a viscous liquid.

The liquid limit (LL) is the water content above which the soil tends to behave as a viscous liquid. Similarly, the plastic limit (PL) is defined as the water content below which the soil tends to behave as a brittle solid. The plasticity index describes the range of water content over which a soil is plastic and is derived by subtracting the PL from the LL. The soil is classified as "non-plastic" if rolling a 1/8-inch bead is not possible at any water content.

Chemical Parameters

pH – AASHTO T289. The quantified measurement of soil pH (acidity = pH <7) and minimum resistivity are useful variables in determining the potential corrosivity of the soil. Certain clayey soils exhibit excess acidity that attacks concrete, iron, and buried utilities.

LIMITATIONS

The conclusions and recommendations presented herein are based upon the results of field explorations and laboratory testing results. They are predicated upon our understanding of the

project, its design, and its location as defined in by the client. We endeavored to conduct this study in accordance with generally accepted geotechnical engineering practices in this area.

This GER presents our professional interpretation of exploration data developed, which we believe meets the standards of the geotechnical profession in this area; we make no other warranties, express or implied. Attached is a document titled "*Important Information About Your Geotechnical Engineering Report,*" which we recommend you review carefully to better understand the context within which these services were completed.

Unless test locations are specified by others or limited by accessibility, the scope of analysis is intended to develop data from a representative portion of the site. However, the areas tested are discreet. Interpolation between these discreet locations is made for illustrative purposes only but should be expected to vary. If a greater level of detail is desired, the client should request an increased scope of exploration.

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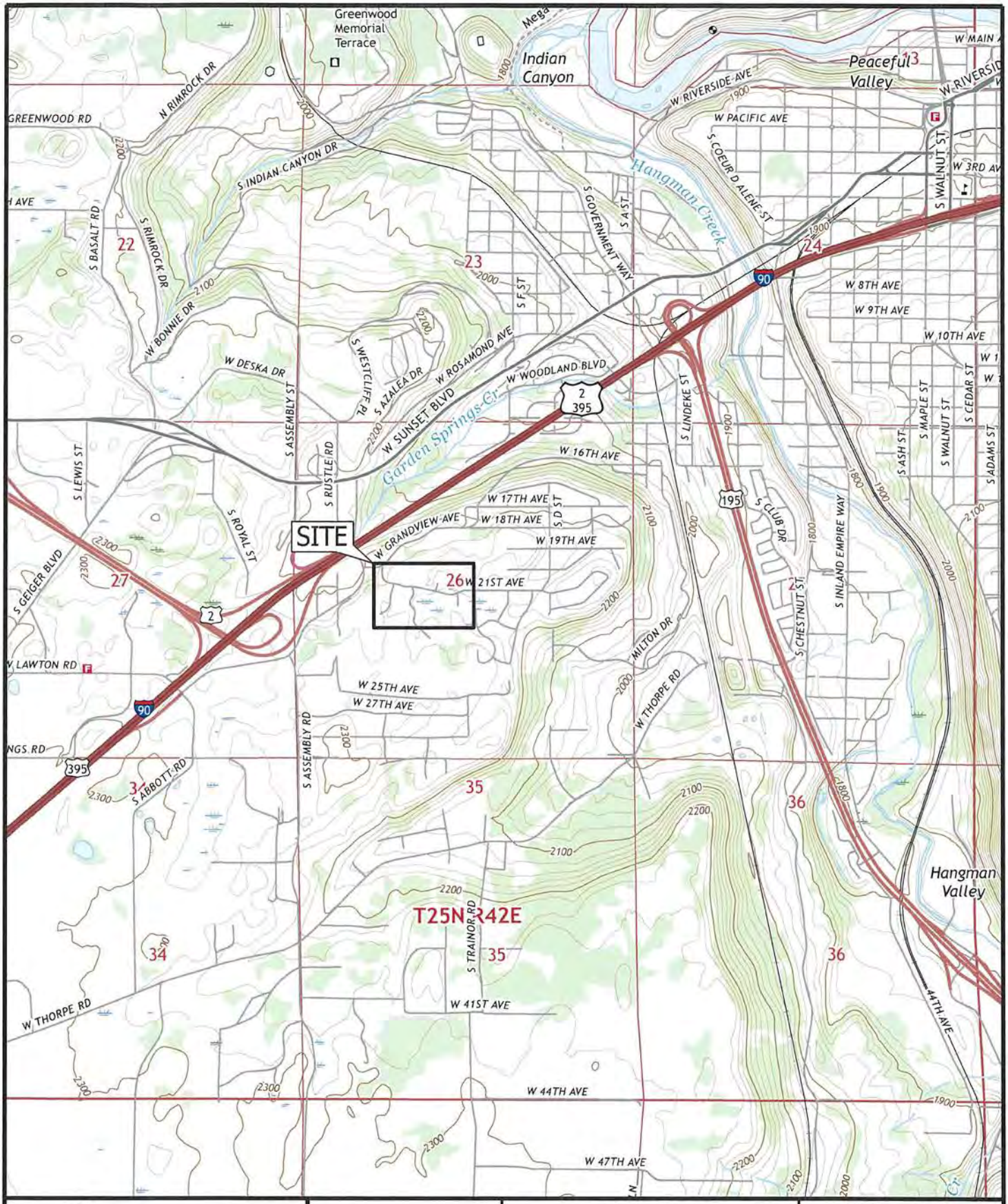

N

SCALE: 1"=2000'
0 1000 2000

SECTION 26
T 25 N R 42 E
USGS 2017

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VICINITY MAP	FIGURE 1
21ST AVE. - WESTRIDGE TO GRANDVIEW SPOKANE, WASHINGTON	PROJECT NUMBER S22083
	DATE: 3/2022

TEST PIT LOCATION (1)

BASE PLAN FROM INLAND PACIFIC ENGINEERING (9/1997)
SATELLITE IMAGERY FROM GOOGLE EARTH (8/2020)

N

SCALE: 1"=200'

0 100 200

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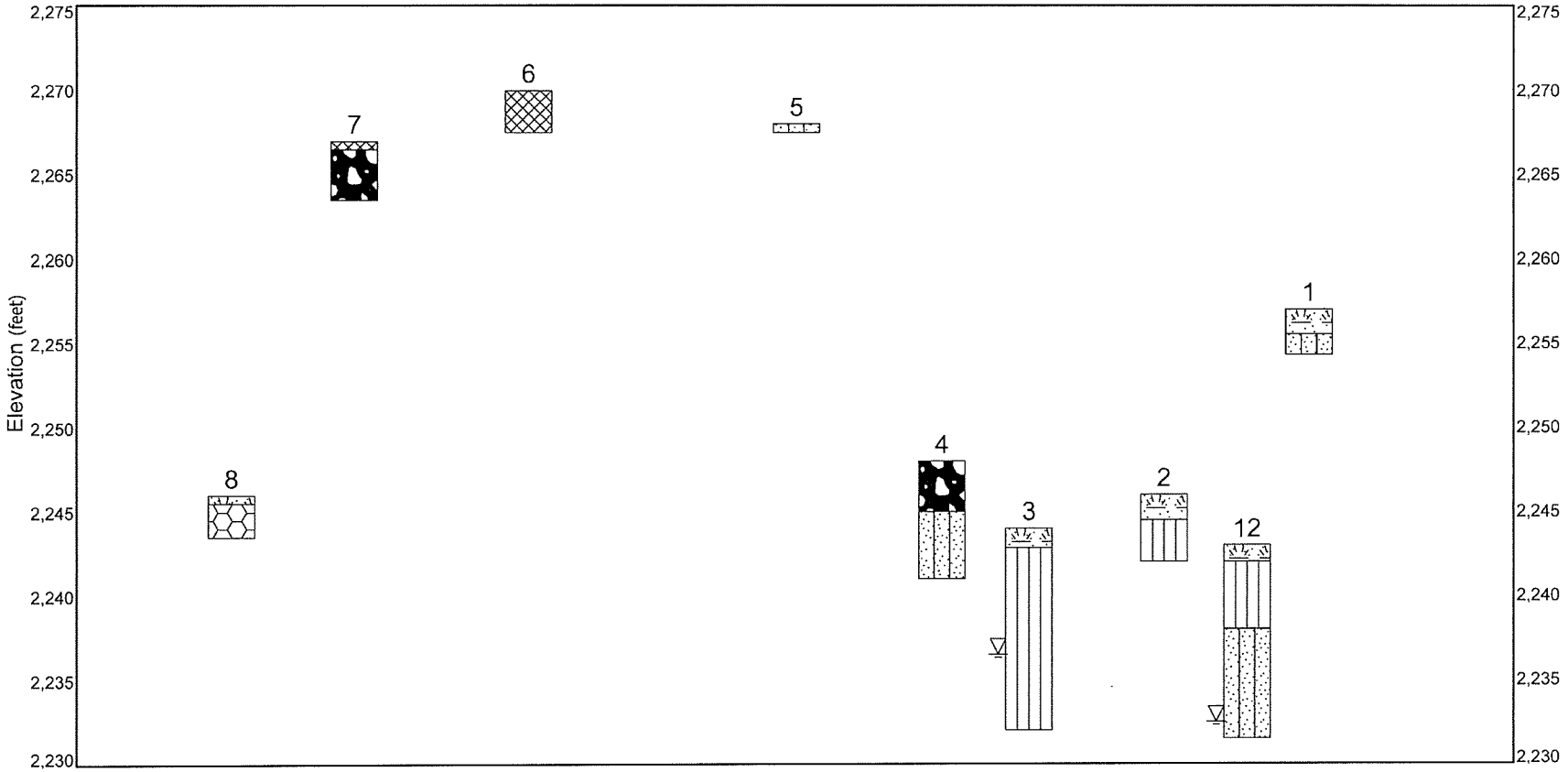
SITE PLAN	FIGURE 2-1
21ST AVE. - WESTRIDGE TO GRANDVIEW SPOKANE, WASHINGTON	PROJECT NUMBER S22083 DATE: 3/2022

VIEW FROM SOUTH TO NORTH



TOPSOIL
EXISTING FILL
SILT
SILTY SAND
BASALT

DISTANCE ALONG BASELINE
SCALE: 1"=200'
0 100 200

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FENCE DIAGRAM

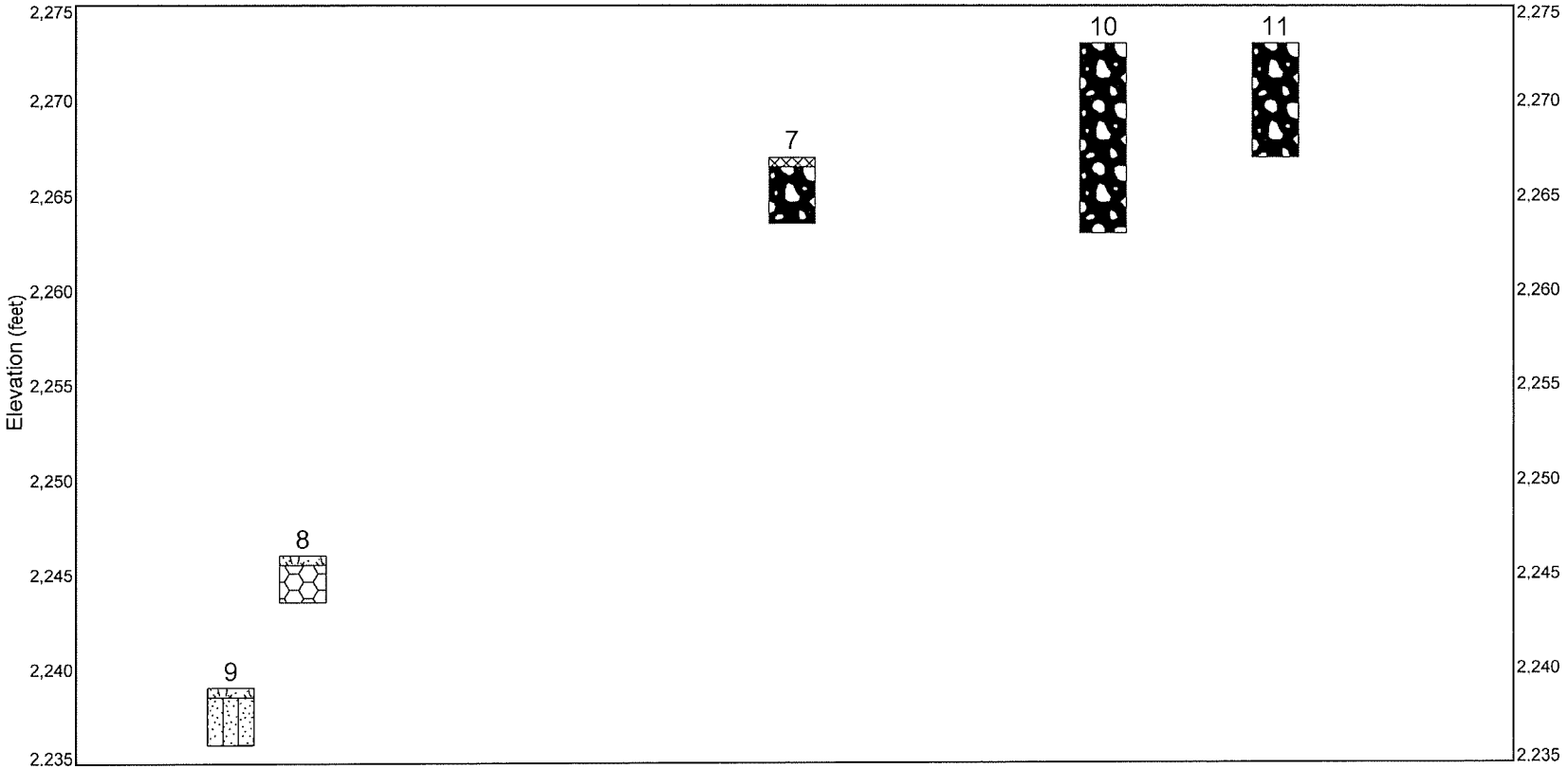
21ST AVE. - WESTRIDGE TO GRANDVIEW
SPOKANE, WASHINGTON

FIGURE 2-2

PROJECT NUMBER S22083

DATE: 4/2022

VIEW FROM WEST TO EAST



TOPSOIL
EXISTING FILL
SILTY SAND
BASALT

DISTANCE ALONG BASELINE
SCALE: 1"=120'
0 60 120

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FENCE DIAGRAM

21ST AVE. - WESTRIDGE TO GRANDVIEW
SPOKANE, WASHINGTON

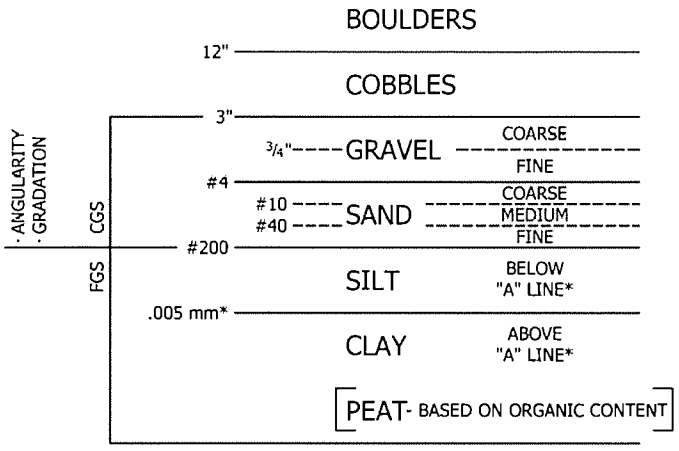
FIGURE 2-3

PROJECT NUMBER S22083

DATE: 4/2022

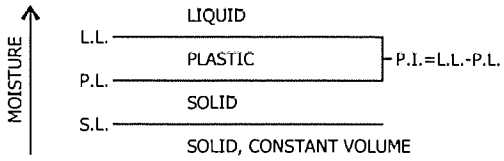
GUIDE TO SOIL & ROCK DESCRIPTIONS

SOIL CLASSIFICATION

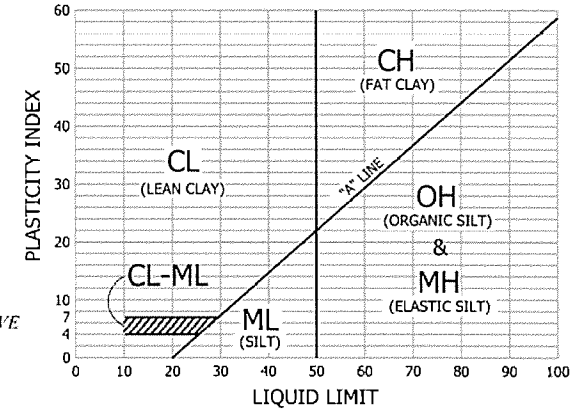


* *SEE PLASTICITY CHART*
CGS - COARSE GRAINED SOIL - MORE THAN 50% RETAINED ON A #200 SIEVE
FGS - FINE GRAINED SOIL - 50% MORE PASSES, #200 SIEVE
FINES - PORTION FINER THAN #200 SIEVE

ATTERBERG LIMITS



PLASTICITY CHART



NOTE - CHART APPLIES TO FGS AND MINUS #40 SIEVE FRACTION OF CGS

GUIDE TO SOIL DESCRIPTION MODIFIERS, MOISTURE, AND CONDITION PRESENTED ON LOGS

MODIFIER	ESTIMATED PERCENTAGE OF MATERIAL
SUFFIX "LY" OR "Y"	30% OR MORE FOR COARSE PARTS IN FGS GREATER THAN 12% FOR FINES IN CGS
WITH	15% - 29% FOR COARSE PARTS IN FGS 5% - 12% FOR FINES IN CGS

NOTE - VISUAL ESTIMATES OF MATERIAL PERCENTAGES TYPICALLY VARY 0 TO 10% FROM THOSE DETERMINED BY LABORATORY TESTING.

MOISTURE

DRY
MOIST
SATURATED OR WET

SOIL CONDITION

CGS:
- VERY LOOSE
- LOOSE
- MEDIUM DENSE
- DENSE
- VERY DENSE

FGS:
- VERY SOFT
- SOFT
- MEDIUM STIFF
- STIFF
- VERY STIFF
- HARD

SAMPLES

- STANDARD 2" PENETRATION TEST SAMPLER WITH BLOWS PER FOOT
- 3" SPLIT SPOON SAMPLER WITH BLOWS PER FOOT
- DRILL CUTTING SAMPLE
- BULK SAMPLE
- THIN-WALLED TUBE SAMPLE
- DIAMOND CORE RUN WITH % RECOVERY & ROCK QUALITY DESIGNATION
- 2.5" SPLIT SPOON SAMPLER WITH BLOWS PER FOOT
- CONTINUOUS SOIL SAMPLE
- R — REFUSAL OF SAMPLE (50+ BLOWS PER 6")

ROCK WEATHERING

FRESH
SLIGHTLY WEATHERED
MODERATELY WEATHERED
HIGHLY WEATHERED
COMPLETELY WEATHERED
RESIDUAL SOIL

ROCK CONDITION

EXTREMELY WEAK
VERY WEAK
MODERATELY WEAK
MODERATELY STRONG
STRONG
VERY STRONG

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FIGURE 3

TEST PIT 1

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed 21st Alignment STA 26+40; 30' Right
Surface: grass and weeds

Elevation: 2257 ft
Logged by: G. Charon
Size of hole: 8 X 3 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, very loose	SANDY SILT with organics and small roots (TOPSOIL)	
		dry, moderate brown, medium dense	SILTY SAND, medium to fine, angular to subrounded	
		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 2.7 ft	
5				
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL ⊢——⊣ LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-1**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 2

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed 21st Alignment STA 24+00
Surface: grass and weeds

Elevation: 2246 ft
Logged by: G. Charon
Size of hole: 4 X 9 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, very loose	SANDY SILT with organics and small roots (TOPSOIL)	
		moist, light brown, medium stiff to stiff	SILT	
5		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 4 ft	
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL ——— LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-2**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 3

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Northeast corner proposed Tract A
Surface: grass and weeds

Elevation: 2244 ft
Logged by: G. Charon
Size of hole: 4 X 12 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION
0		moist, dark brown, very loose	SANDY SILT with organics and small roots (TOPSOIL)
		moist, light brown, medium stiff to stiff	SILT
		very soft	
5		mottled, medium stiff to stiff	
		wet	
		(perched groundwater)	
		moist, bluish gray, stiff	appearance of decaying organics
10			
			End of Excavation @ 12 ft
15			

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-3**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 4

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed 21st Alignment STA 21+60
Surface: cobbles and grass

Elevation: 2248 ft
Logged by: G. Charon
Size of hole: 5 X 10 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark to moderate brown, very loose to medium dense	Cobbles and Boulders with Silt, Sand and Gravel, angular to subangular, shot-rock (FILL)	
		moist, moderate brown, loose	SILTY SAND with Gravel	
5		medium dense	appearance of Basalt Cobbles	
		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 7 ft	
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-4**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 5

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed 21st Alignment STA 19+75
Surface: bare

Elevation: 2268 ft
Logged by: G. Charon
Size of hole: 6 X 4 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, moderate brown	SILTY SAND with Gravel, coarse to fine, angular to subangular, disturbed soil	
		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 0.5 ft	
5				
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-5**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 6

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed 21st Alignment STA 16+65
Surface: bare

Elevation: 2270 ft
Logged by: G. Charon
Size of hole: 6 X 4 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, dense to very dense	SILTY SAND with Gravel and Cobbles, coarse to fine, subangular to subrounded, wood and metal debris (FILL)	
5		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 2.5 ft	
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

TEST PIT LOGS **FIGURE 4-6**

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Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 7

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed 21st Alignment STA 14+40
Surface: bare

Elevation: 2267 ft
Logged by: G. Charon
Size of hole: 4 X 7 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown	SILTY SAND with organics and small roots, coarse to fine, (FILL)	
		moist, dark to moderate brown, very dense	Cobbles and Boulders with Silt, Sand and Gravel, angular to subangular, shot-rock (FILL)	
5		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 3.5 ft	
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL ⊢——⊣ LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-7**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 8

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed 21st Alignment STA 12+50
Surface: bare

Elevation: 2246 ft
Logged by: G. Charon
Size of hole: 6 X 4 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown	SILTY SAND with organics and small roots, coarse to fine, (TOPSOIL)	
		dark brown to dark bluish gray	BASALT, moderately weathered, highly fractured	
5		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 2.5 ft	
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-8**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 9

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: North end of proposed Tract C
Surface: grass and weeds

Elevation: 2239 ft
Logged by: G. Charon
Size of hole: 5 X 7 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown	SILTY SAND with organics and small roots, coarse to fine, (TOPSOIL)	
		moist, dark brown, very loose	SILTY SAND with Cobbles and Boulders	
5		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 3 ft	
10				
15				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-9**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 10

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed Beard Alignment STA 23+25
Surface: cobbles and boulders

Elevation: 2273 ft
Logged by: G. Charon
Size of hole: 10 X 14 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark to moderate brown, dense	Cobbles and Boulders with Silt, Sand and Gravel, angular to subangular, shot-rock (FILL)	
5				
10		no free groundwater observed	(side walls caving excessively) End of Excavation @ 10 ft	
15				

TEST RESULTS

ATTERBERG LIMITS
PL ⊢——⊣ LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-10**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 11

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed Beard Alignment STA 22+65
Surface: cobbles and boulders

Elevation: 2273 ft
Logged by: G. Charon
Size of hole: 7 X 10 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	TEST RESULTS
0		moist, dark to moderate brown, dense	Cobbles and Boulders with Silt, Sand and Gravel, angular to subangular, shot-rock (FILL)		ATTERBERG LIMITS PL LL WATER CONTENT 10 20 30 40 50 60 70 80 90
5					
10		no free groundwater observed	(digging refusal on Basalt) End of Excavation @ 6 ft		
15					

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TEST PIT LOGS **FIGURE 4-11**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

TEST PIT 12

Date: 3-17-22
Excavator: Vietzke
Equipment: CAT 308
Location: Proposed Westridge Alignment STA 24+55
Surface: grass and weeds

Elevation: 2243 ft
Logged by: G. Charon
Size of hole: 7 X 12 feet

DEPTH	SAMPLES	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, very loose	SANDY SILT with organics and small roots (TOPSOIL)	
		moist, light brown, soft to medium stiff	SILT with Sand	
5		mottled, stiff to very stiff		
		moist, mottled, medium dense	SILTY SAND, medium to fine, angular to subangular	
10		wet		
		groundwater encountered beginning at 10.5 feet		
			(side walls caving excessively) End of Excavation @ 11.5 ft	
15				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○

10 20 30 40 50 60 70 80 90

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TEST PIT LOGS **FIGURE 4-12**

Project: 21st Ave. - Westridge to Grandview
Location: Spokane, WA
Number: S22083

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-1
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2257
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 2 ft	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
-	18	79.9	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	20	88.8	••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
- 3 ft	24	106.6	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 1 m	50	222.0	••	25+	VERY DENSE	HARD
-						
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-2
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2246
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 2 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 3 ft	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
- 1 m	9	40.0	••••••••••	11	MEDIUM DENSE	STIFF
-	9	34.7	•••••••••	9	LOOSE	STIFF
- 4 ft	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	50	193.0	••	25+	VERY DENSE	HARD
- 5 ft						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-3
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2244
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 2 ft	8	35.5	••••••••••	10	LOOSE	STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	9	40.0	••••••••••••	11	MEDIUM DENSE	STIFF
- 3 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 m	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	3.9	•	1	VERY LOOSE	VERY SOFT
- 4 ft	1	3.9	•	1	VERY LOOSE	VERY SOFT
-	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 5 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	13	50.2	•••••••••••••	14	MEDIUM DENSE	STIFF
- 6 ft	15	57.9	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	13	50.2	•••••••••••••	14	MEDIUM DENSE	STIFF
- 2 m	12	46.3	••••••••••••	13	MEDIUM DENSE	STIFF
- 7 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	11	37.6	••••••••••	10	LOOSE	STIFF
-	14	47.9	••••••••••••	13	MEDIUM DENSE	STIFF
- 8 ft	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
-	9	30.8	••••••••	8	LOOSE	MEDIUM STIFF
- 9 ft	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
- 3 m 10 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	12	36.7	••••••••••	10	LOOSE	STIFF
-	12	36.7	••••••••••	10	LOOSE	STIFF
-	13	39.8	•••••••••••	11	MEDIUM DENSE	STIFF
- 11 ft	14	42.8	•••••••••••	12	MEDIUM DENSE	STIFF
-	15	45.9	••••••••••••	13	MEDIUM DENSE	STIFF
-	11	33.7	•••••••••	9	LOOSE	STIFF
- 12 ft	16	49.0	••••••••••••••	13	MEDIUM DENSE	STIFF
-	18	55.1	••••••••••••••	15	MEDIUM DENSE	STIFF
-	17	52.0	••••••••••••••	14	MEDIUM DENSE	STIFF
- 4 m 13 ft	21	64.3	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF

HOLE #: DCP @ TP-3 **WILDCAT DYNAMIC CONE LOG** Page 2 of 2

PROJECT: 21st Ave. - Westridge to Grandview PROJECT NUMBER: S22083

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	25	69.3	••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
	23	63.7	•••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
14 ft	31	85.9	••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
	29	80.3	•••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
	50	138.5	••••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
15 ft						
16 ft						
5 m						
17 ft						
18 ft						
19 ft						
6 m						
20 ft						
21 ft						
22 ft						
7 m 23 ft						
24 ft						
25 ft						
26 ft						
8 m						
27 ft						
28 ft						
29 ft						
9 m						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-4
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2248
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	9	40.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 2 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 3 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 4 ft	9	34.7	•••••••••	9	LOOSE	STIFF
-	9	34.7	•••••••••	9	LOOSE	STIFF
-	14	54.0	••••••••••••••	15	MEDIUM DENSE	STIFF
- 5 ft	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	16	61.8	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 6 ft	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
- 2 m	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
- 7 ft	12	41.0	••••••••••	11	MEDIUM DENSE	STIFF
-	29	99.2	•••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	50	171.0	••	25+	DENSE	HARD
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-6
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2270
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
	10	44.4	••••••••••••	12	MEDIUM DENSE	STIFF
	13	57.7	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
1 ft	28	124.3	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
	50	222.0	••	25+	VERY DENSE	HARD
2 ft						
3 ft						
1 m						
4 ft						
5 ft						
6 ft						
2 m						
7 ft						
8 ft						
9 ft						
3 m 10 ft						
11 ft						
12 ft						
4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-7
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2267
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
	31	137.6	•••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
1 ft	50	222.0	•••	25+	VERY DENSE	HARD
2 ft						
3 ft						
1 m						
4 ft						
5 ft						
6 ft						
2 m						
7 ft						
8 ft						
9 ft						
3 m 10 ft						
11 ft						
12 ft						
4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-8
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2246
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
	12	53.3	••••••••••••••	15	MEDIUM DENSE	STIFF
	12	53.3	••••••••••••••	15	MEDIUM DENSE	STIFF
1 ft	45	199.8	••	25+	VERY DENSE	HARD
	50	222.0	••	25+	VERY DENSE	HARD
2 ft						
3 ft						
1 m						
4 ft						
5 ft						
6 ft						
2 m						
7 ft						
8 ft						
9 ft						
3 m 10 ft						
11 ft						
12 ft						
4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-9
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2239
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 1 ft	3	13.3	•••	3	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 2 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 3 ft	2	8.9	••	2	VERY LOOSE	SOFT
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 4 ft	2	7.7	••	2	VERY LOOSE	SOFT
-	50	193.0	••	25+	VERY DENSE	HARD
- 5 ft						
- 6 ft						
- 2 m						
- 7 ft						
- 8 ft						
- 9 ft						
- 3 m 10 ft						
- 11 ft						
- 12 ft						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

PROJECT NUMBER: S22083
DATE STARTED: 03-22-2022
DATE COMPLETED: 03-22-2022

HOLE #: DCP @ TP-12
CREW: Cameron Andrews
PROJECT: 21st Ave. - Westridge to Grandview
ADDRESS:
LOCATION: Spokane, WA

SURFACE ELEVATION: 2243
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 2 ft	8	35.5	••••••••••	10	LOOSE	STIFF
-	8	35.5	••••••••••	10	LOOSE	STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 3 ft	3	13.3	•••	3	VERY LOOSE	SOFT
- 1 m	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	15.4	••••	4	VERY LOOSE	SOFT
- 4 ft	5	19.3	•••••	5	LOOSE	MEDIUM STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	9	34.7	•••••••••	9	LOOSE	STIFF
- 5 ft	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	17	65.6	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	18	69.5	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 6 ft	19	73.3	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	16	61.8	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 2 m	14	54.0	••••••••••••••	15	MEDIUM DENSE	STIFF
- 7 ft	17	58.1	•••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
-	13	44.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 8 ft	13	44.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
- 9 ft	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	12	41.0	••••••••••••	11	MEDIUM DENSE	STIFF
-	11	37.6	•••••••••••	10	LOOSE	STIFF
- 3 m 10 ft	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
-	15	45.9	•••••••••••••	13	MEDIUM DENSE	STIFF
-	11	33.7	•••••••••	9	LOOSE	STIFF
-	27	82.6	•••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 11 ft	33	101.0	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	41	125.5	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	50	153.0	••	25+	DENSE	HARD
- 12 ft						
-						
-						
- 4 m 13 ft						

DCP TEST DATA

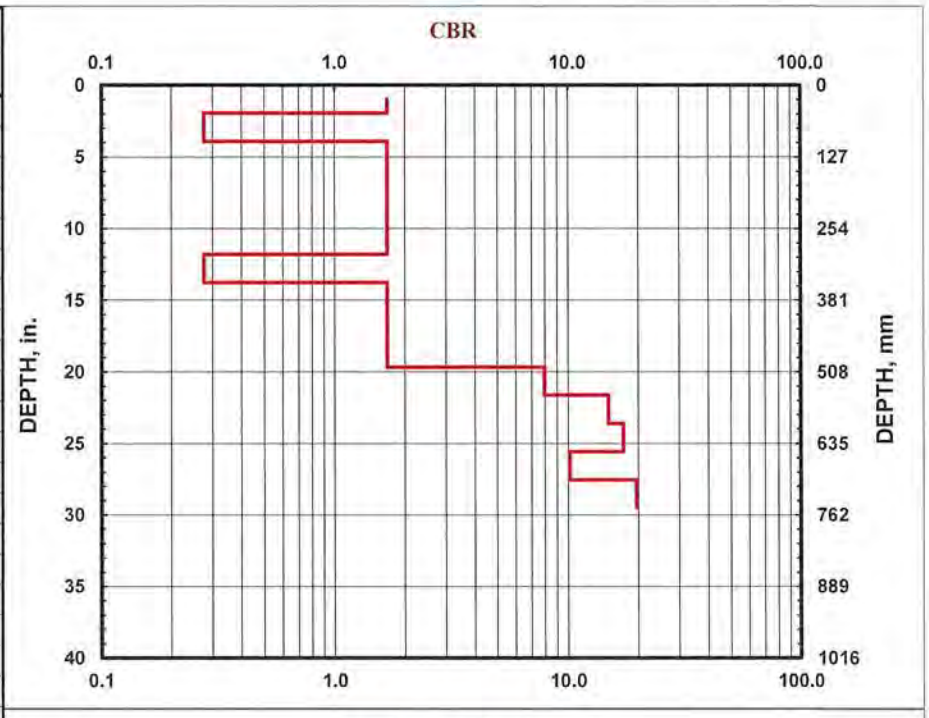
Project: *21st Ave. - Westridge to Grandview* **Date:** 22-Mar-22

Location: TP-1 **Soil Type(s):** Silt & Sand

Hammer
- (●) 10.1 lbs.
- ( ) 17.6 lbs.
- ( ) Both hammers used

Soil Type
- ( ) CH
- ( ) CL
- (●) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0.5	25	2
0.5	50	2
0.1	75	2
0.1	100	2
0.5	125	2
0.5	150	2
0.5	175	2
0.5	200	2
0.5	225	2
0.5	250	2
0.5	275	2
0.5	300	2
0.1	325	2
0.1	350	2
0.5	375	2
0.5	400	2
0.5	425	2
0.5	450	2
0.5	475	2
0.5	500	2
2	525	2
2	550	2
3.5	575	2
3.5	600	2
4	625	2
4	650	2
2.5	675	2
2.5	700	2
4.5	725	2
4.5	750	2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2



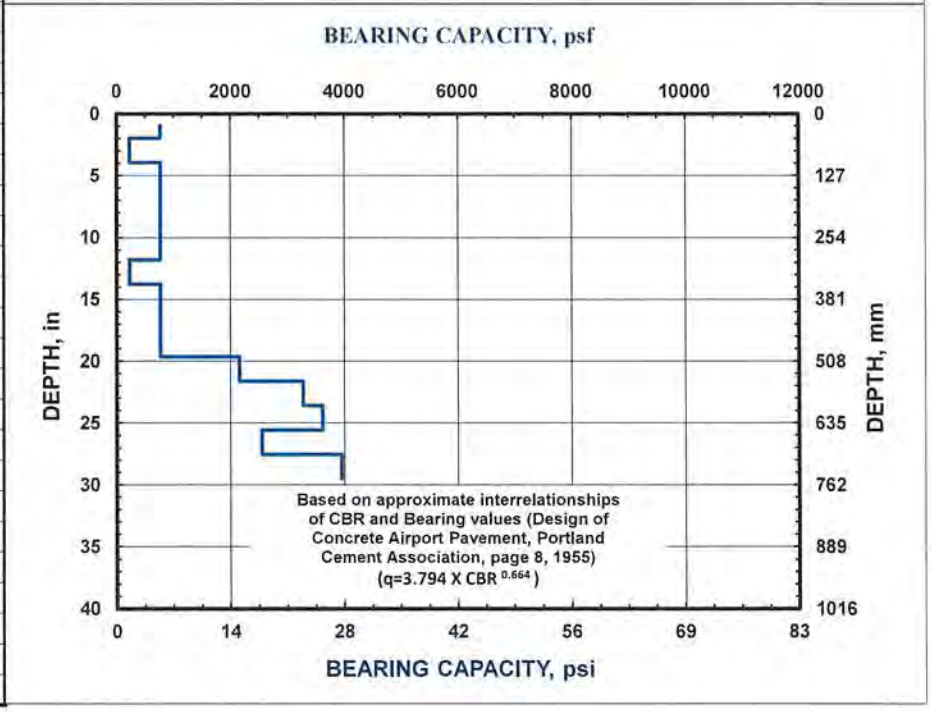


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Figure 5-11

DCP TEST DATA

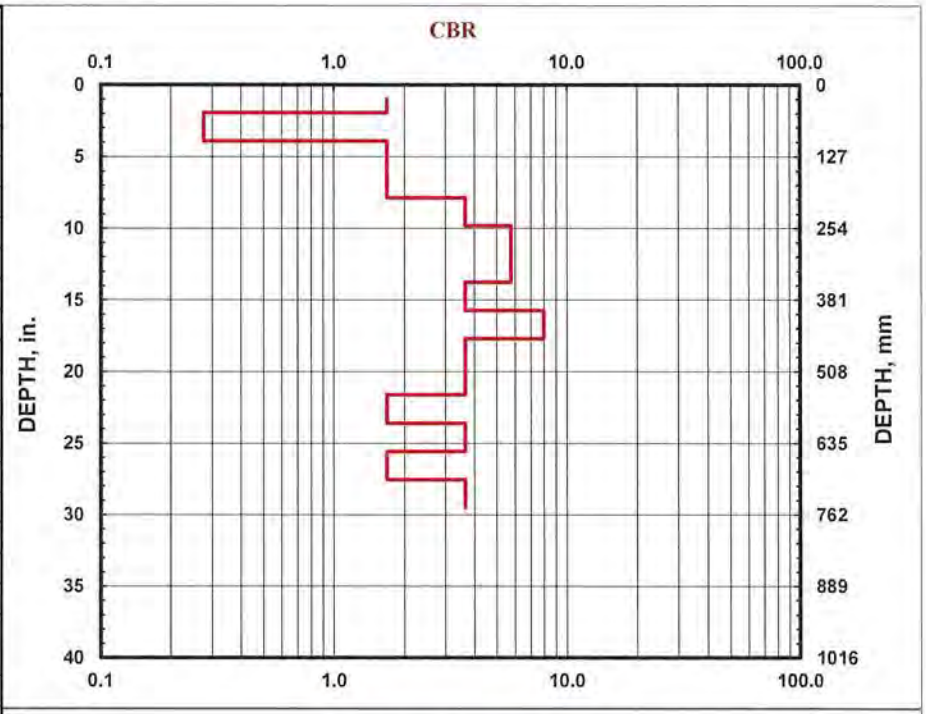
Project: *21st Ave. - Westridge to Grandview* Date: 22-Mar-22

Location: TP-2 Soil Type(s): Silt & Sand

Hammer
- (●) 10.1 lbs.
- ( ) 17.6 lbs.
- ( ) Both hammers used

Soil Type
- ( ) CH
- ( ) CL
- (●) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0.5	25	2
0.5	50	2
0.1	75	2
0.1	100	2
0.5	125	2
0.5	150	2
0.5	175	2
0.5	200	2
1	225	2
1	250	2
1.5	275	2
1.5	300	2
1.5	325	2
1.5	350	2
1	375	2
1	400	2
2	425	2
2	450	2
1	475	2
1	500	2
1	525	2
1	550	2
0.5	575	2
0.5	600	2
1	625	2
1	650	2
0.5	675	2
0.5	700	2
1	725	2
1	750	2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2



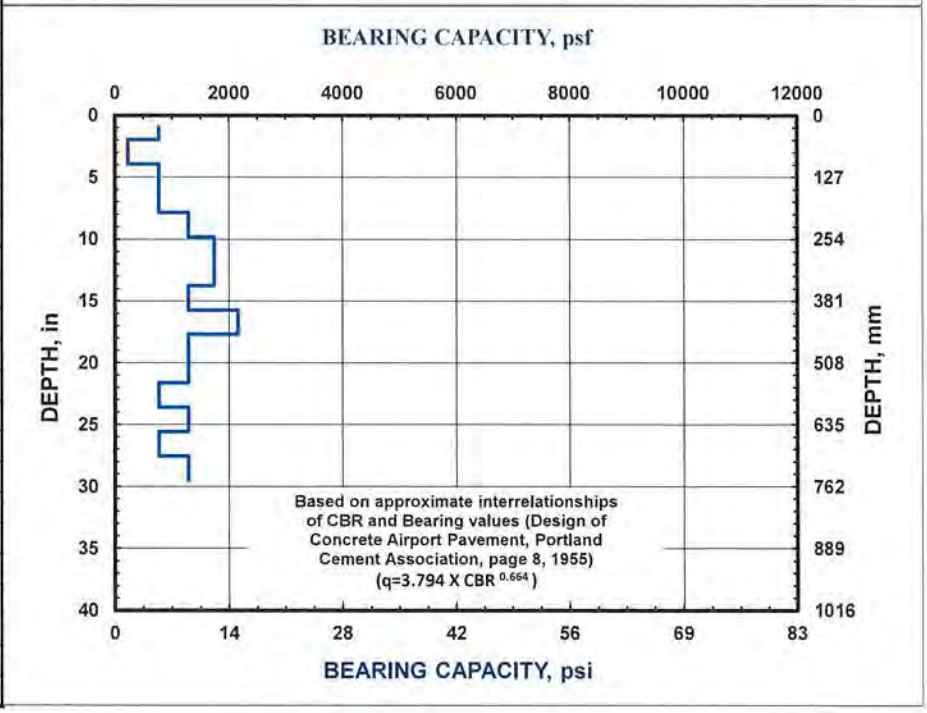


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Figure 5-12

DCP TEST DATA

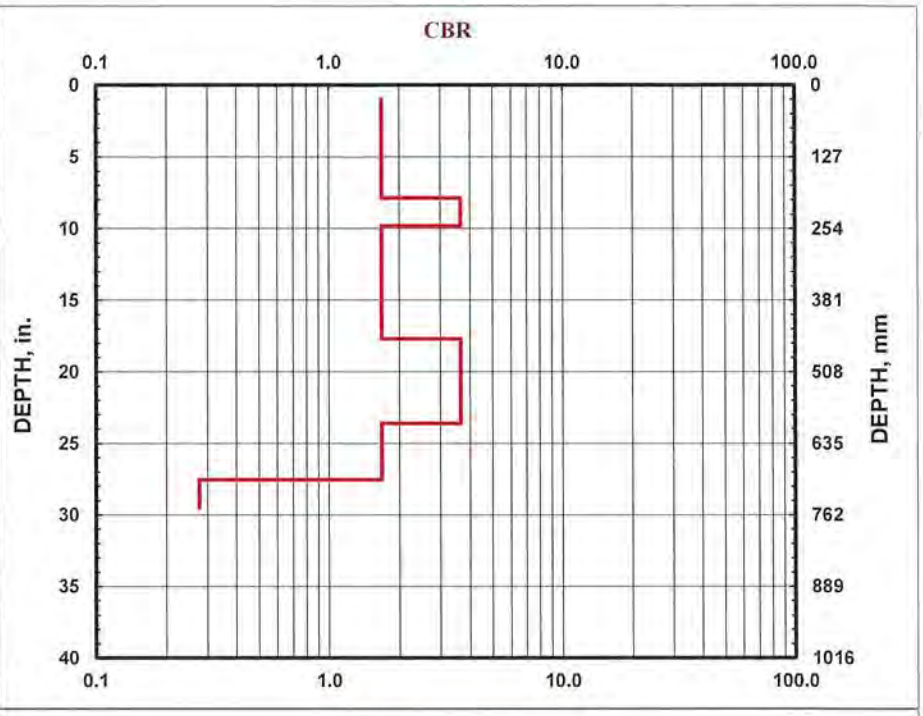
Project: *21st Ave. - Westridge to Grandview* **Date:** 22-Mar-22

Location: TP-4 **Soil Type(s):** Silt & Sand

Hammer
- (●) 10.1 lbs.
- ( ) 17.6 lbs.
- ( ) Both hammers used

Soil Type
- ( ) CH
- ( ) CL
- (●) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0.5	25	2
0.5	50	2
0.5	75	2
0.5	100	2
0.5	125	2
0.5	150	2
0.5	175	2
0.5	200	2
1	225	2
1	250	2
0.5	275	2
0.5	300	2
0.5	325	2
0.5	350	2
0.5	375	2
0.5	400	2
0.5	425	2
0.5	450	2
1	475	2
1	500	2
1	525	2
1	550	2
1	575	2
1	600	2
0.5	625	2
0.5	650	2
0.5	675	2
0.5	700	2
0.1	725	2
0.1	750	2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2



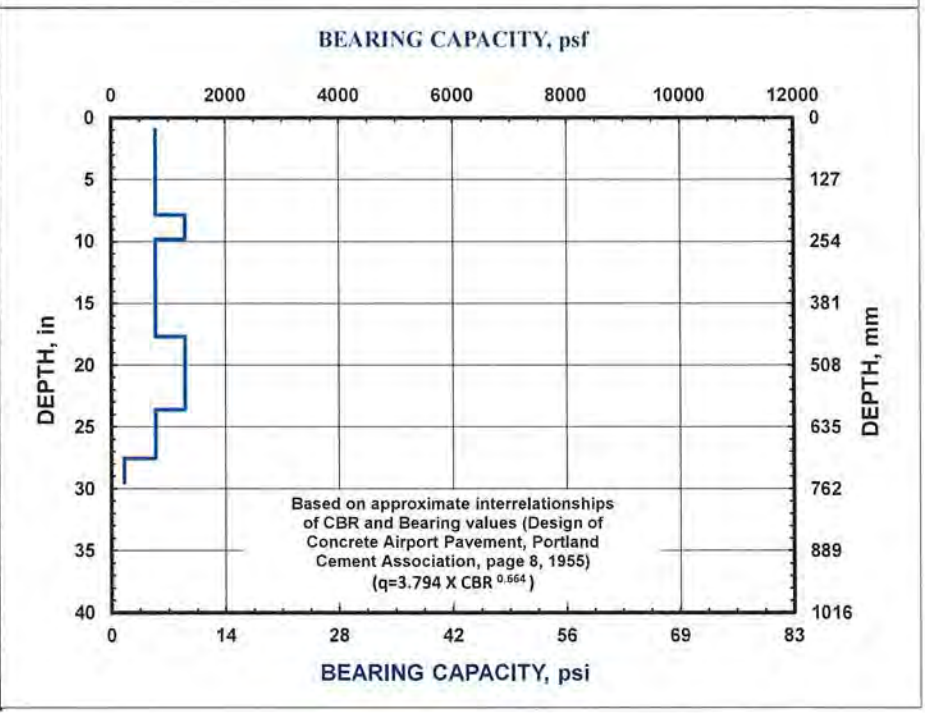


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Figure 5-13

DCP TEST DATA

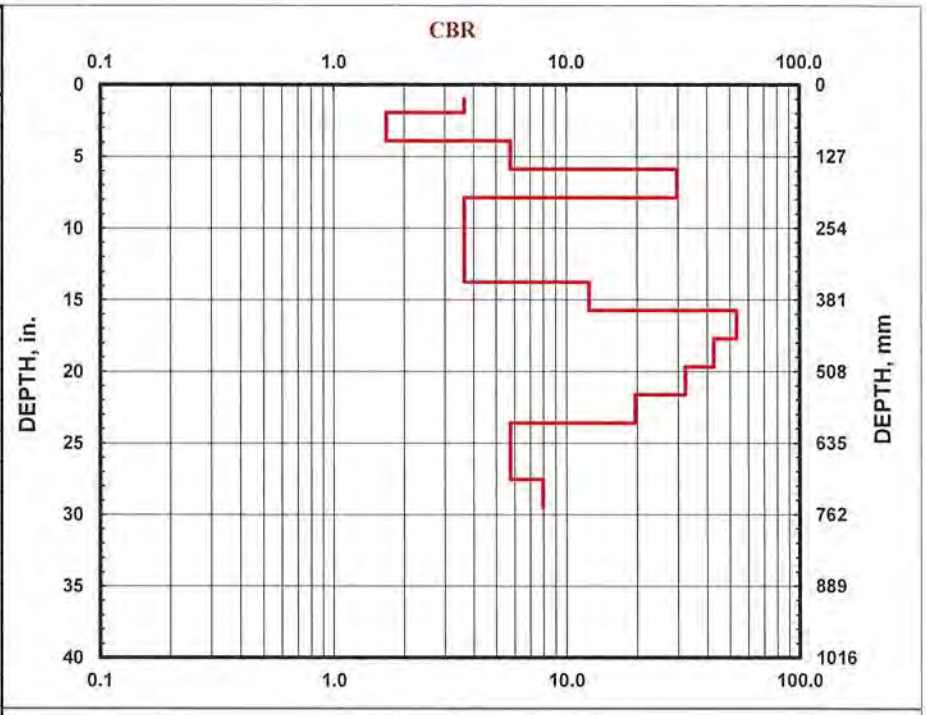
Project: *21st Ave. - Westridge to Grandview* **Date:** 22-Mar-22

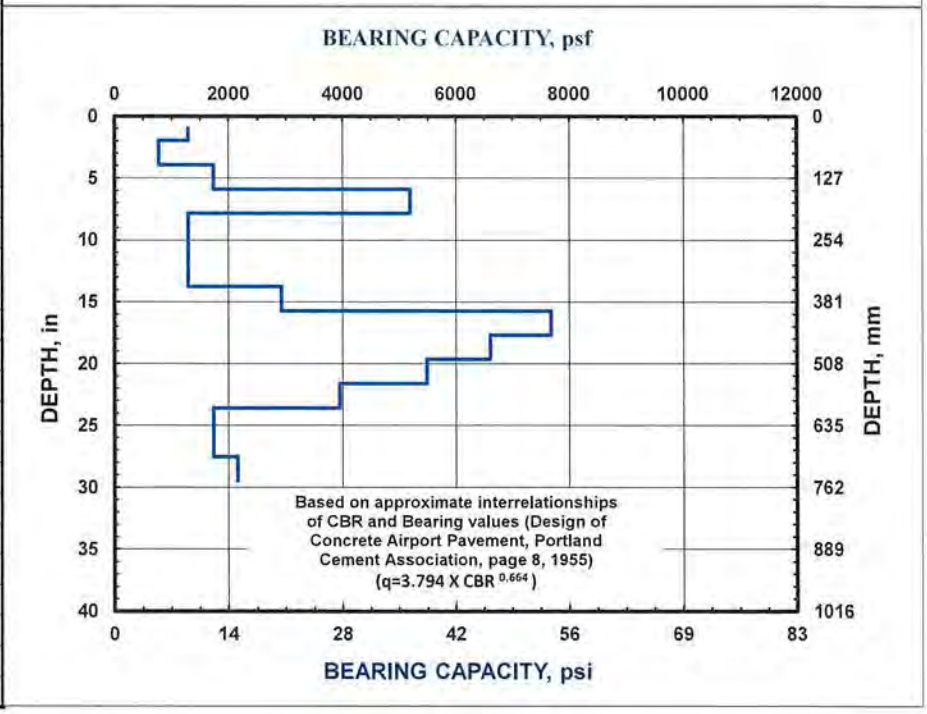
Location: TP-6 **Soil Type(s):** Silt & Sand

Hammer
- (●) 10.1 lbs.
- ( ) 17.6 lbs.
- ( ) Both hammers used

Soil Type
- ( ) CH
- ( ) CL
- (●) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
1	25	2
1	50	2
0.5	75	2
0.5	100	2
1.5	125	2
1.5	150	2
6.5	175	2
6.5	200	2
1	225	2
1	250	2
1	275	2
1	300	2
1	325	2
1	350	2
3	375	2
3	400	2
11	425	2
11	450	2
9	475	2
9	500	2
7	525	2
7	550	2
4.5	575	2
4.5	600	2
1.5	625	2
1.5	650	2
1.5	675	2
1.5	700	2
2	725	2
2	750	2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2
		2





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Geotechnical & Environmental Engineers
Construction Materials Testing & Special Inspection

Figure 5-14

DCP TEST DATA

Project: *21st Ave. - Westridge to Grandview* Date: 22-Mar-22
Location: TP-7 Soil Type(s): Silt & Sand

Hammer: (●) 10.1 lbs. ( ) 17.6 lbs. ( ) Both hammers used

Soil Type: ( ) CH ( ) CL (●) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0.5	25	2
0.5	50	2
1	75	2
1	100	2
3	125	2
3	150	2
2.5	175	2
2.5	200	2
14	225	2
14	250	2
20.5	275	2
20.5	300	2
50	325	2
50	350	2
		2
		2
		2
		2
		2
		2
		2
		2
		2
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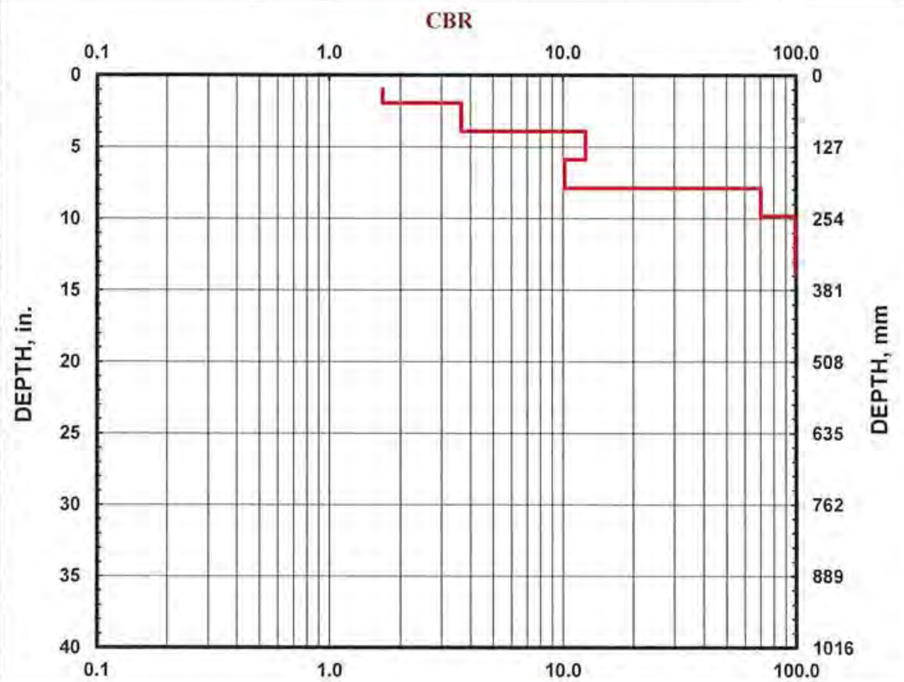

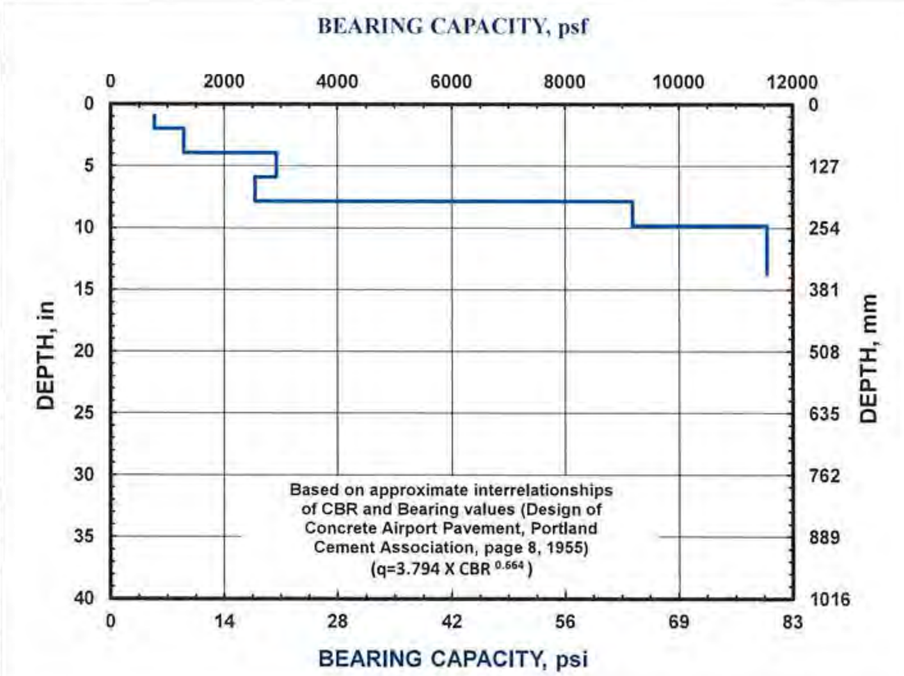

DCP TEST DATA

Project: *21st Ave. - Westridge to Grandview* **Date:** 22-Mar-22

Location: TP-8 **Soil Type(s):** Silt & Sand

Hammer
- (●) 10.1 lbs.
- ( ) 17.6 lbs.
- ( ) Both hammers used

Soil Type
- ( ) CH
- ( ) CL
- (●) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0.5	25	2
0.5	50	2
1	75	2
1	100	2
1	125	2
1	150	2
1.5	175	2
1.5	200	2
2	225	2
2	250	2
2	275	2
2	300	2
5	325	2
5	350	2
8.5	375	2
8.5	400	2
18.5	425	2
18.5	450	2
19.5	475	2
19.5	500	2
50	525	2
50	550	2
		2
		2
		2
		2
		2
		2
		2
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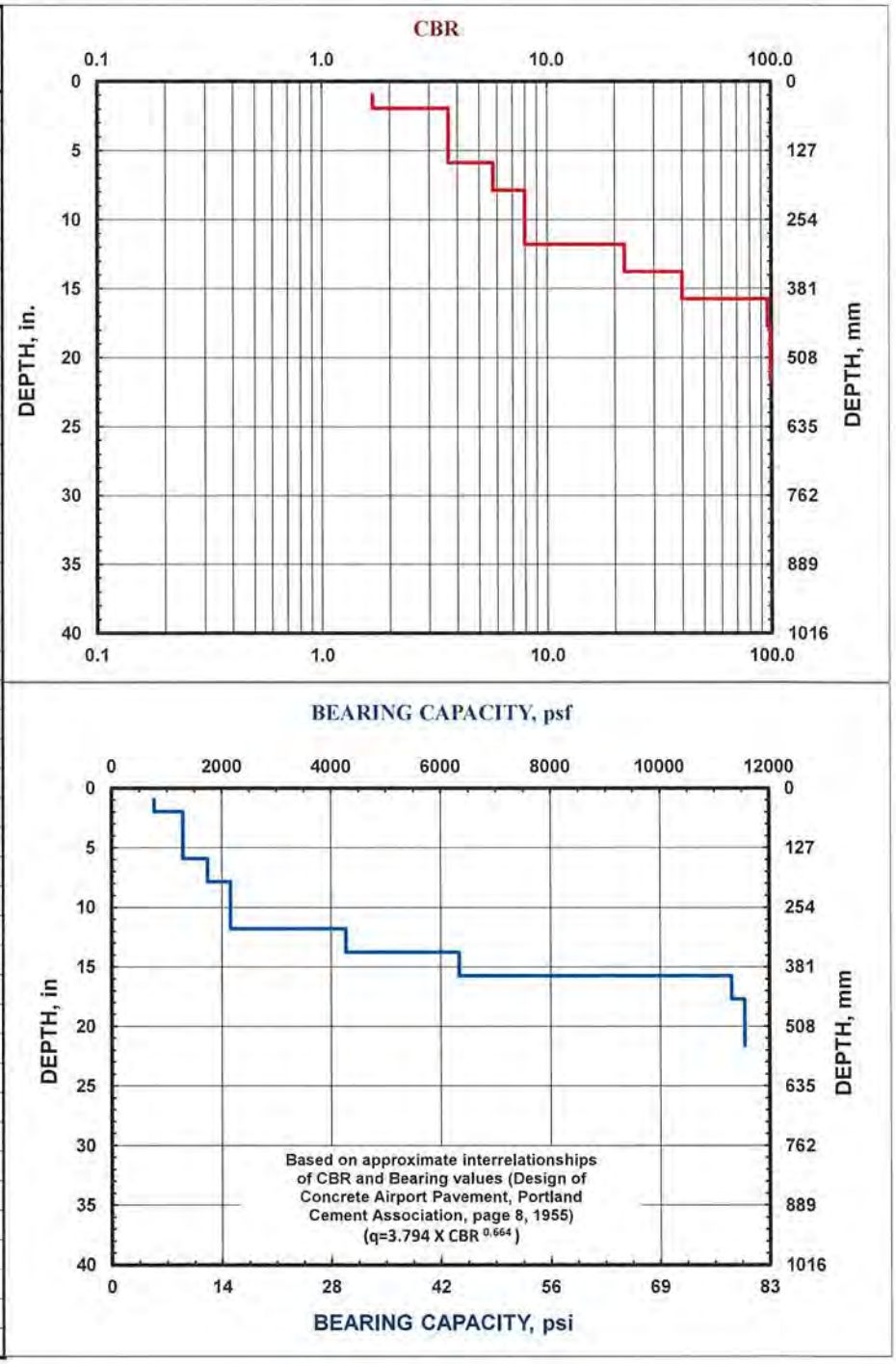

DCP TEST DATA

Project: *21st Ave. - Westridge to Grandview* **Date:** 22-Mar-22
Location: TP-12 **Soil Type(s):** Silt & Sand

Hammer: (●) 10.1 lbs. ( ) 17.6 lbs. ( ) Both hammers used

Soil Type: ( ) CH ( ) CL (●) All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0.5	25	2
0.5	50	2
0.1	75	2
0.1	100	2
0.5	125	2
0.5	150	2
0.5	175	2
0.5	200	2
0.5	225	2
0.5	250	2
0.5	275	2
0.5	300	2
0.1	325	2
0.1	350	2
0.5	375	2
0.5	400	2
1	425	2
1	450	2
1.5	475	2
1.5	500	2
1.5	525	2
1.5	550	2
1.5	575	2
1.5	600	2
1	625	2
1	650	2
1.5	675	2
1.5	700	2
1.5	725	2
1.5	750	2
		2
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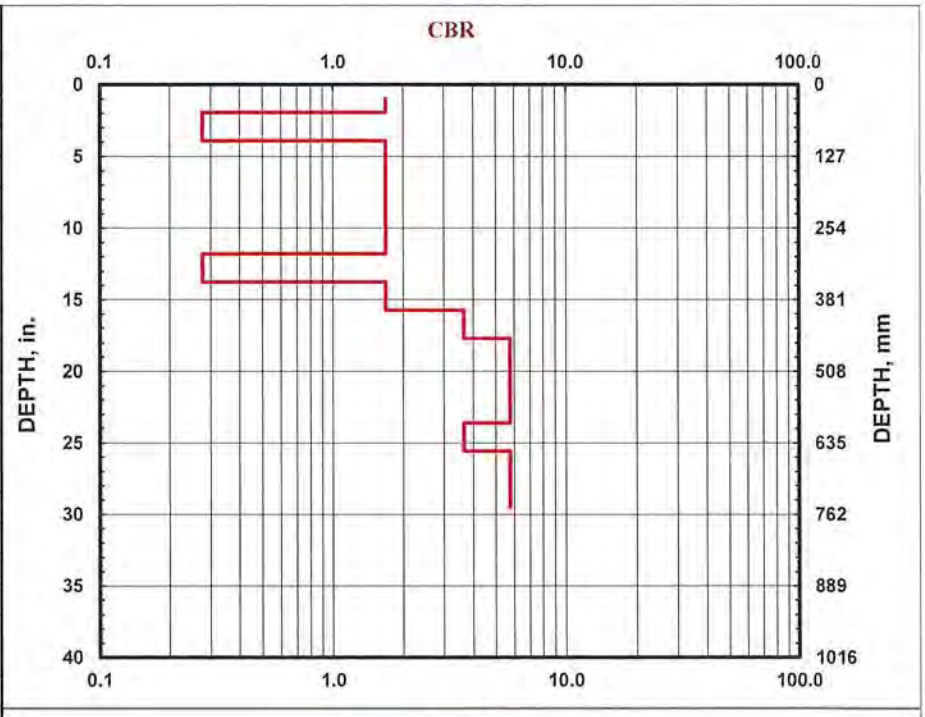
		2



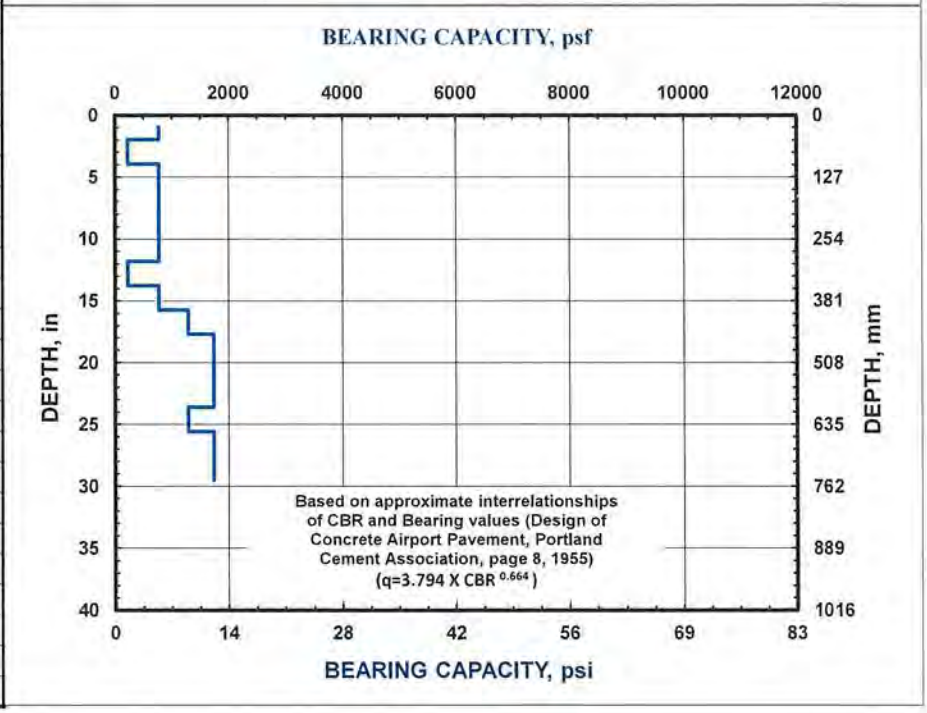


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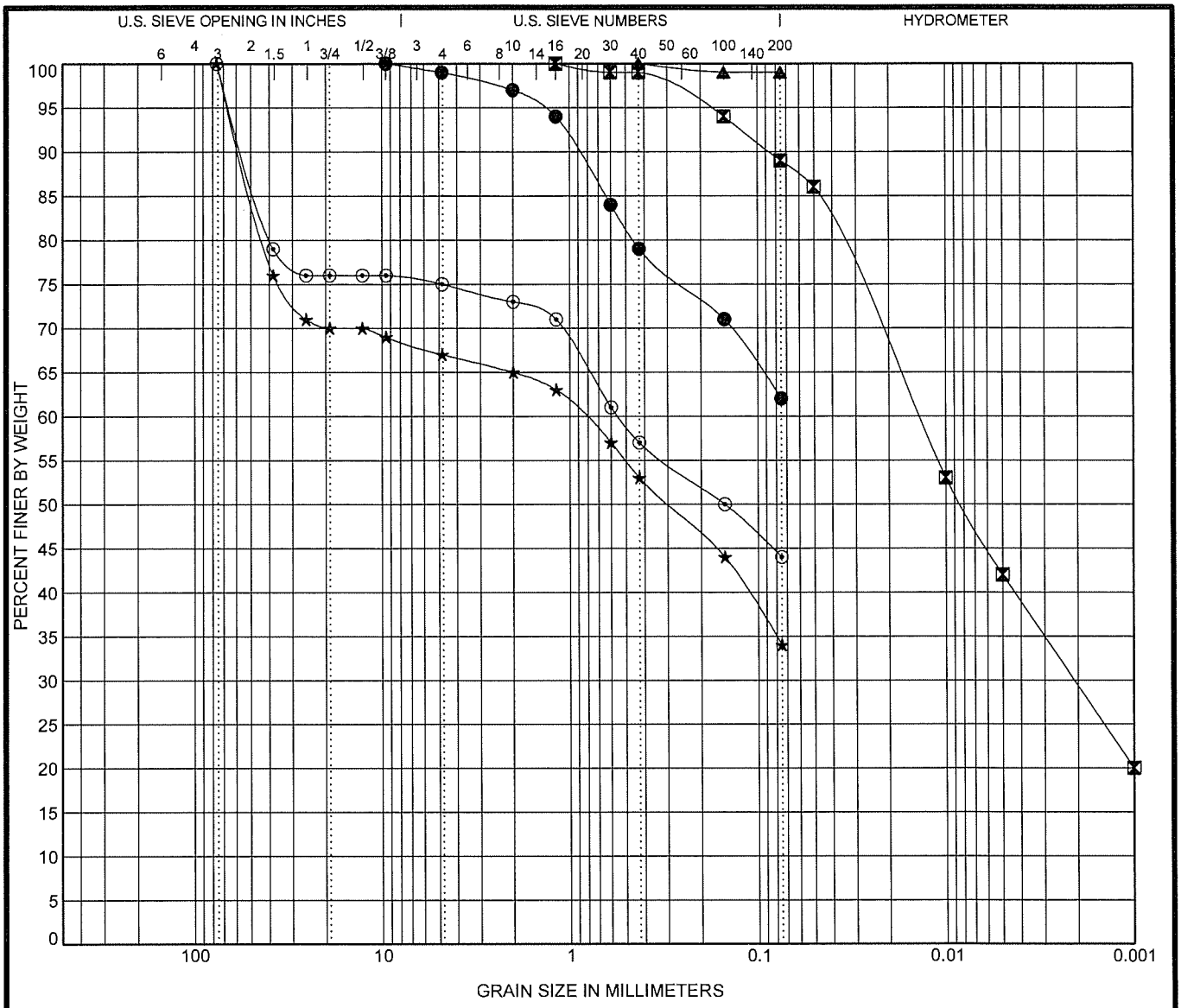
Figure 5-17

SOIL MECHANICS
LABORATORY SUMMARY

		UNITS	METHOD	22-5819	22-5821	22-5822	22-5824	22-5831	22-5830
LABORATORY NUMBER									
SAMPLE SOURCE				**1**	**4**	**9**	**12**	**3**	**3**
STRATUM				*topsoil*	*sand*			*silt*	
DEPTH	TOP	feet		0	4	1	2	2 1/2	8
	BOTTOM	feet		1	5	2	2 1/2	3	9
MOISTURE CONTENT		%	ASTM D2216	25.9	13.8	17.7	65.9	41.6	36.2
pH			AASHTO T289	7.2	7.7	7.4	8.0	8.0	7.9
DRY DENSITY		pcf	ASTM D7263				55		
ATTERBERG LIMITS			ASTM 4318						
	Liquid Limit	%						41	37
	Plastic Limit	%						29	25
	Plasticity Index	%		NP*	NP	NP	NP	12	12
UNIFIED CLASSIFICATION			ASTM D2487	ML	SM	SM	ML	ML	ML
SIEVE ANALYSIS			ASTM D6913						
	3"				100	100			
S	1 1/2"	%			76	79			
I	1"				71	76			
E	3/4"	P			70	76			
V	1/2"	A		100	70	76			
E	3/8"	S		-100	69	76			
	#4	S		99	67	75		100	
S	#10	I		97	65	73	100	-100	100
I	#16	N		94	63	71	-100	-100	-100
Z	#30	G		84	57	61	-100	99	-100
E	#40			79	53	57	-100	99	-100
	#100			71	44	50	95	94	99
	#200			62	34	44	78	89	99
SILT	.05mm		ASTM D422					86	
	.01mm							53	
CLAY	.005mm							42	
	.001mm							20	

NP* = Non Plastic



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	1	0.0	SANDY SILT(ML)	NP	NP	NP		
⊠	3	2.5	SILT(ML)	41	29	12		
▲	3	8.0	SILT(ML)	37	25	12		
★	4	4.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		
⊙	9	1.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	1	0.0	9.5				1.0	37.0	62.0	
⊠	3	2.5	1.18	0.014	0.002		0.0	11.0	89.0	
▲	3	8.0	0.425				0.0	1.0	99.0	
★	4	4.0	76.2	0.841			32.5	33.0	34.0	
⊙	9	1.0	76.2	0.55			24.5	31.0	44.0	

Budinger & Associates
1101 North Fancher Road
Spokane Valley, WA 99212

GRAIN SIZE DISTRIBUTION

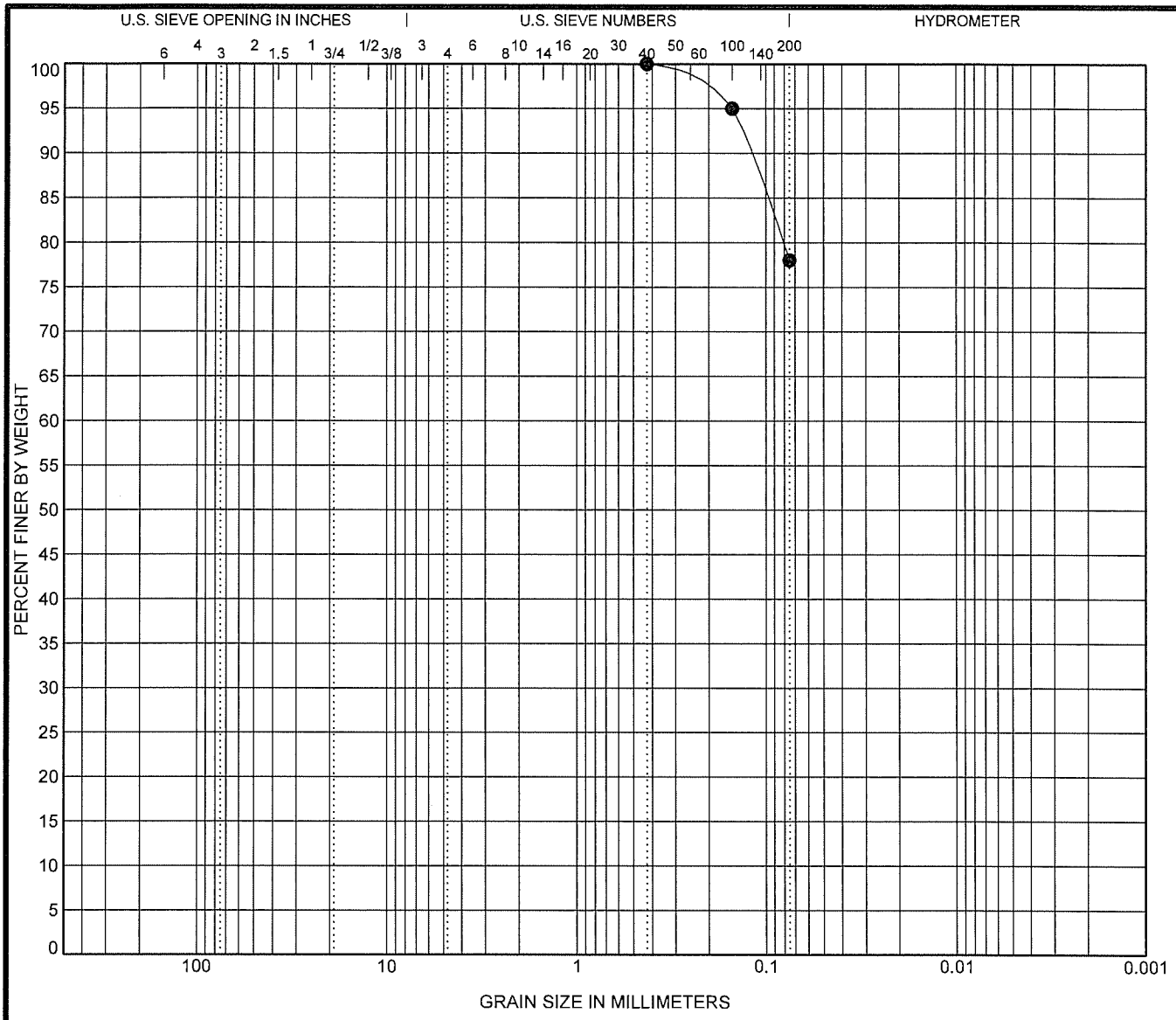
Project: 21st Ave. - Westridge to Grandview

Location: Spokane, WA

Number: S22083

Figure 7-1

GRAINSIZE WO FIGURE # S22083.GPJ GINT STD US.GDT 4/12/22



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	12	2.0	SILT with SAND(ML)	NP	NP	NP		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	12	2.0	0.425				0.0	22.0	78.0	

Budinger & Associates
1101 North Fancher Road
Spokane Valley, WA 99212

GRAIN SIZE DISTRIBUTION

Project: 21st Ave. - Westridge to Grandview

Location: Spokane, WA

Number: S22083

Figure 7-2

GRAINSIZE WO FIGURE # S22083.GPJ GINT STD US.GDT 4/12/22

Infiltration Test Results

Test Pit 3 (NE corner of proposed "Tract A")

		Total Depth (ft)			2.75
Date/Time	**Time (min)**	**meter 1 (gal)**	**Cumulative Volume (gal)**	**Rate (gpm)**	**Head**
3/18/2022 15:12	0	793	0	0	0.00
3/18/2022 15:15	3	870	77	25.7	0.79
3/18/2022 15:20	8	889	96	3.8	0.86
3/18/2022 15:25	13	895	102	1.2	0.92
3/18/2022 15:35	23	900	107	0.5	0.92
3/18/2022 15:45	33	905	112	0.5	0.86
3/18/2022 15:55	43	910	117	0.5	0.86
3/18/2022 16:05	53	915	122	0.5	0.86
3/18/2022 16:15	63	920	127	0.5	0.86
3/18/2022 16:25	73	925	132	0.5	0.86
3/18/2022 16:35	83	930	137	0.5	0.86
3/18/2022 16:45	93	935	142	0.5	0.86
3/18/2022 16:55	103	940	147	0.5	0.86
3/18/2022 17:05	113	945	152	0.5	0.86
3/18/2022 17:15	123	950	157	0.5	0.86
3/18/2022 17:25	133	955	162	0.5	0.86
3/18/2022 17:35	143	965	172	1.0	0.92
3/18/2022 17:45	153	970	177	0.5	0.86
3/18/2022 17:50	158				0.83
3/18/2022 17:55	163				0.81
3/18/2022 18:00	168				0.81
3/18/2022 18:05	173				0.79
3/18/2022 18:10	178				0.77
3/18/2022 18:15	183				0.75
3/18/2022 18:20	188				0.73

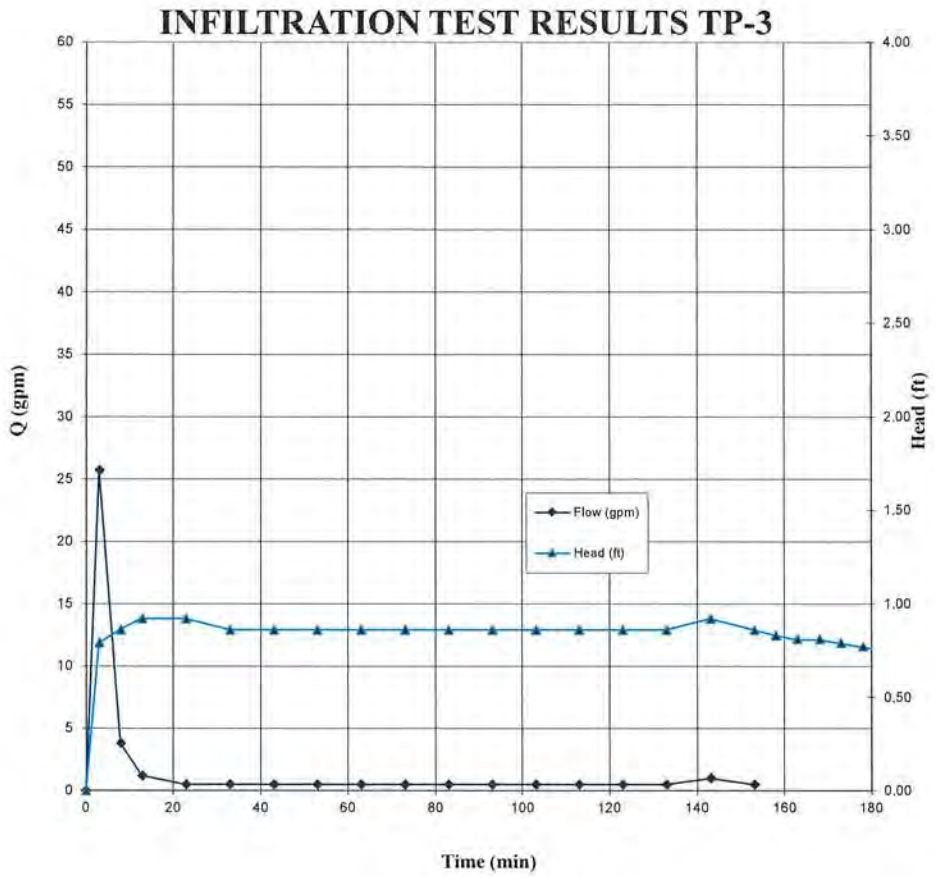

INFILTRATION TEST RESULTS TP-3
Q (gpm)
Head (ft)
Time (min)
Flow (gpm)
Head (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
0
20
40
60
80
100
120
140
160
180

Figure 8-2

Infiltration Test Results

Test Pit 9 (north end of proposed "Tract C")

		Total Depth (ft)			3.58
Date/Time	**Time (min)**	**meter 1 (gal)**	**Cumulative Volume (gal)**	**Rate (gpm)**	**Head**
3/22/2022 9:08	0	20918	0	0	0.00
3/22/2022 9:35	27	22485	1567	58.0	3.25
3/22/2022 9:45	37	22597	1679	11.2	3.25
3/22/2022 9:55	47	22709	1791	11.2	3.25
3/22/2022 10:05	57	22821	1903	11.2	3.25
3/22/2022 10:15	67	22934	2016	11.3	3.25
3/22/2022 10:25	77	23046	2128	11.2	3.21
3/22/2022 10:35	87	23158	2240	11.2	3.21
3/22/2022 10:45	97	23270	2352	11.2	3.21
3/22/2022 10:55	107	23382	2464	11.2	3.21
3/22/2022 11:05	117	23495	2577	11.3	3.21
3/22/2022 11:15	127	23607	2689	11.2	3.17
3/22/2022 11:25	137	23719	2801	11.2	3.17
3/22/2022 11:35	147	23831	2913	11.2	3.13
3/22/2022 11:40	152				3.10
3/22/2022 11:45	157				3.07
3/22/2022 11:50	162				3.05
3/22/2022 11:55	167				3.04
3/22/2022 12:00	172				3.04
3/22/2022 12:05	177				3.03

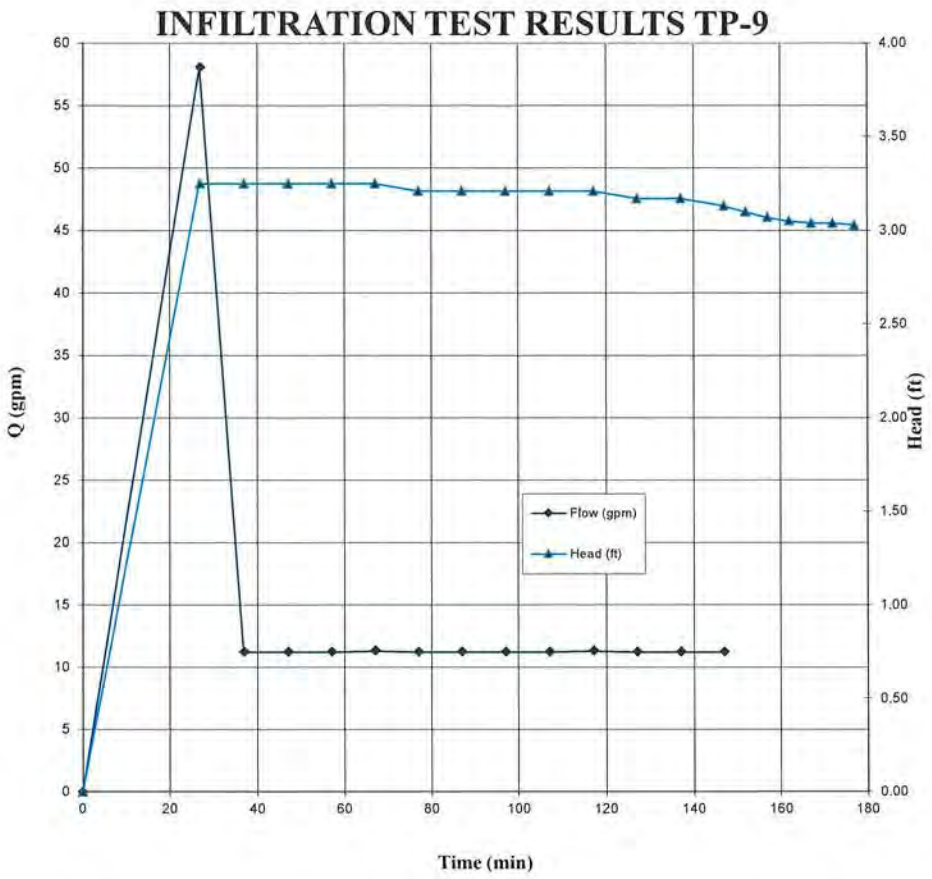

INFILTRATION TEST RESULTS TP-9
Q (gpm)
Head (ft)
Time (min)
Flow (gpm)
Head (ft)
0
5
10
15
20
25
30
35
40
45
50
55
60
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
0
20
40
60
80
100
120
140
160
180

Figure 8-4

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

Gutter Spread Calculations

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 17 2022

Sub Basin C1

Gutter

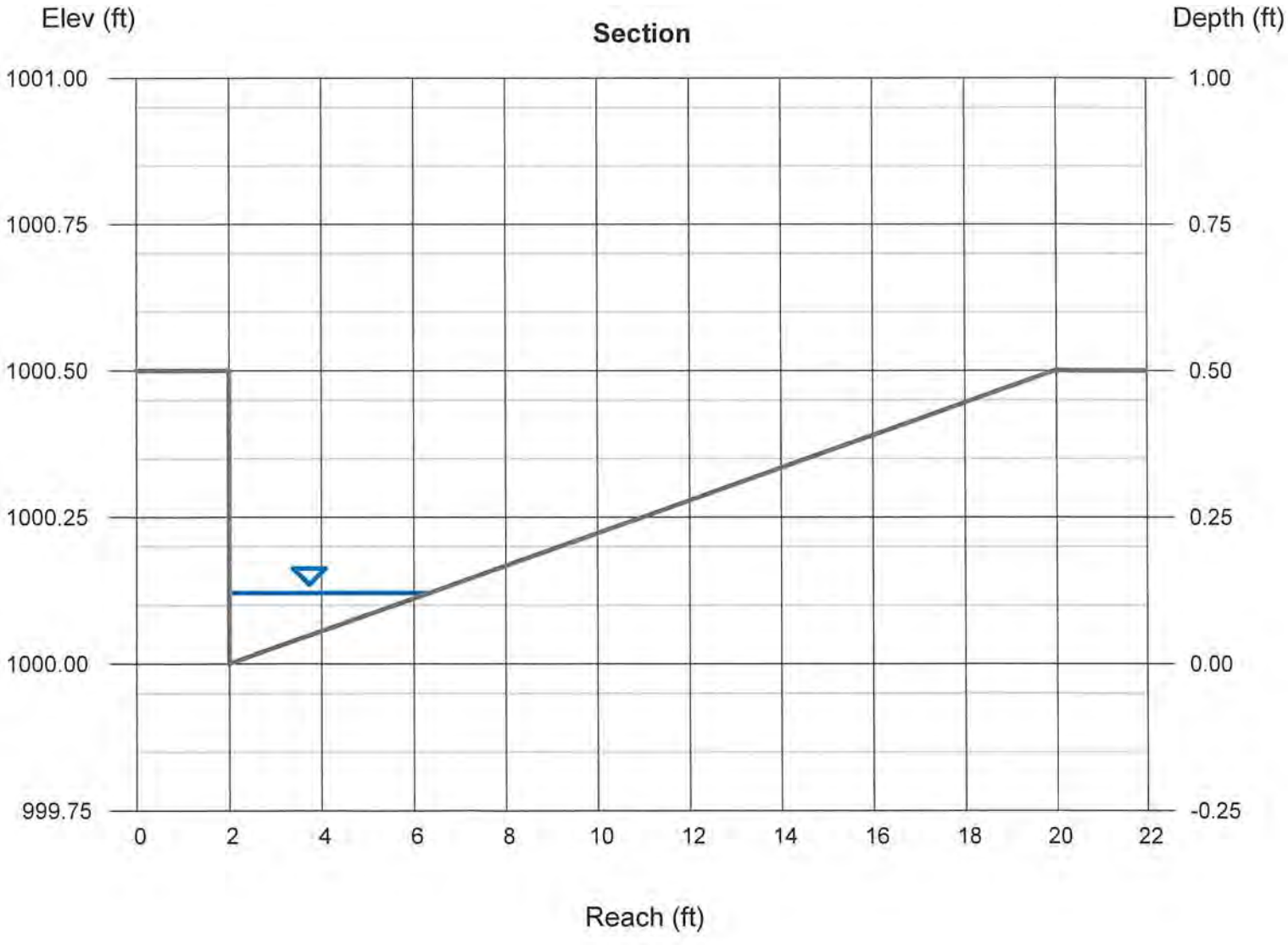
Cross Sl, Sx (ft/ft)	= 0.028
Cross Sl, Sw (ft/ft)	= 0.028
Gutter Width (ft)	= 1.50
Invert Elev (ft)	= 1000.00
Slope (%)	= 2.00
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.84

Highlighted

Depth (ft)	= 0.12
Q (cfs)	= 0.840
Area (sqft)	= 0.26
Velocity (ft/s)	= 3.20
Wetted Perim (ft)	= 4.46
Crit Depth, Yc (ft)	= 0.17
Spread Width (ft)	= 4.34
EGL (ft)	= 0.28



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 17 2022

Sub Basin C2

Gutter

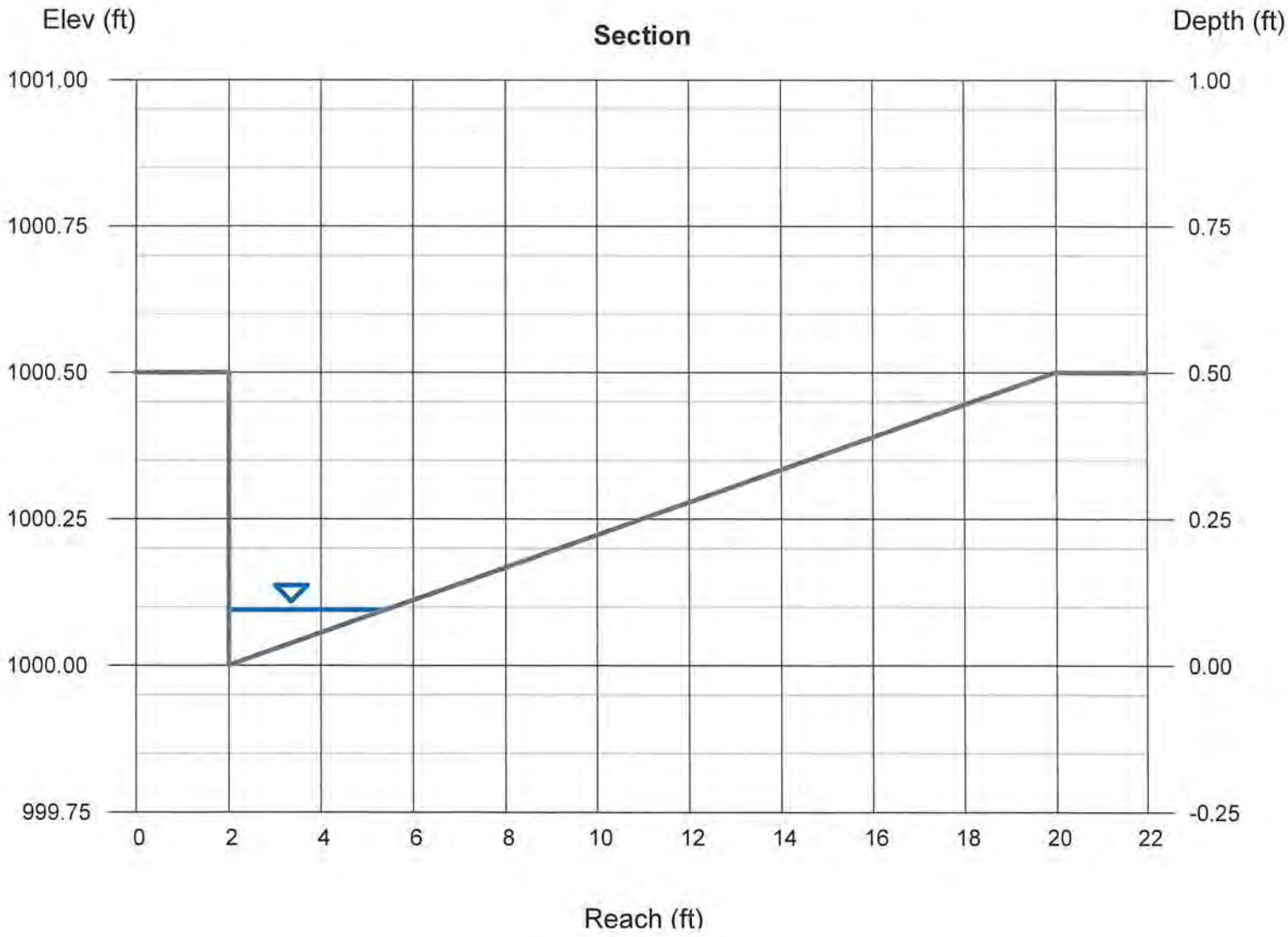
Cross Sl, Sx (ft/ft)	= 0.028
Cross Sl, Sw (ft/ft)	= 0.028
Gutter Width (ft)	= 1.50
Invert Elev (ft)	= 1000.00
Slope (%)	= 3.85
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.60

Highlighted

Depth (ft)	= 0.10
Q (cfs)	= 0.600
Area (sqft)	= 0.16
Velocity (ft/s)	= 3.71
Wetted Perim (ft)	= 3.50
Crit Depth, Yc (ft)	= 0.15
Spread Width (ft)	= 3.41
EGL (ft)	= 0.31



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 17 2022

Sub Basin C3

Gutter

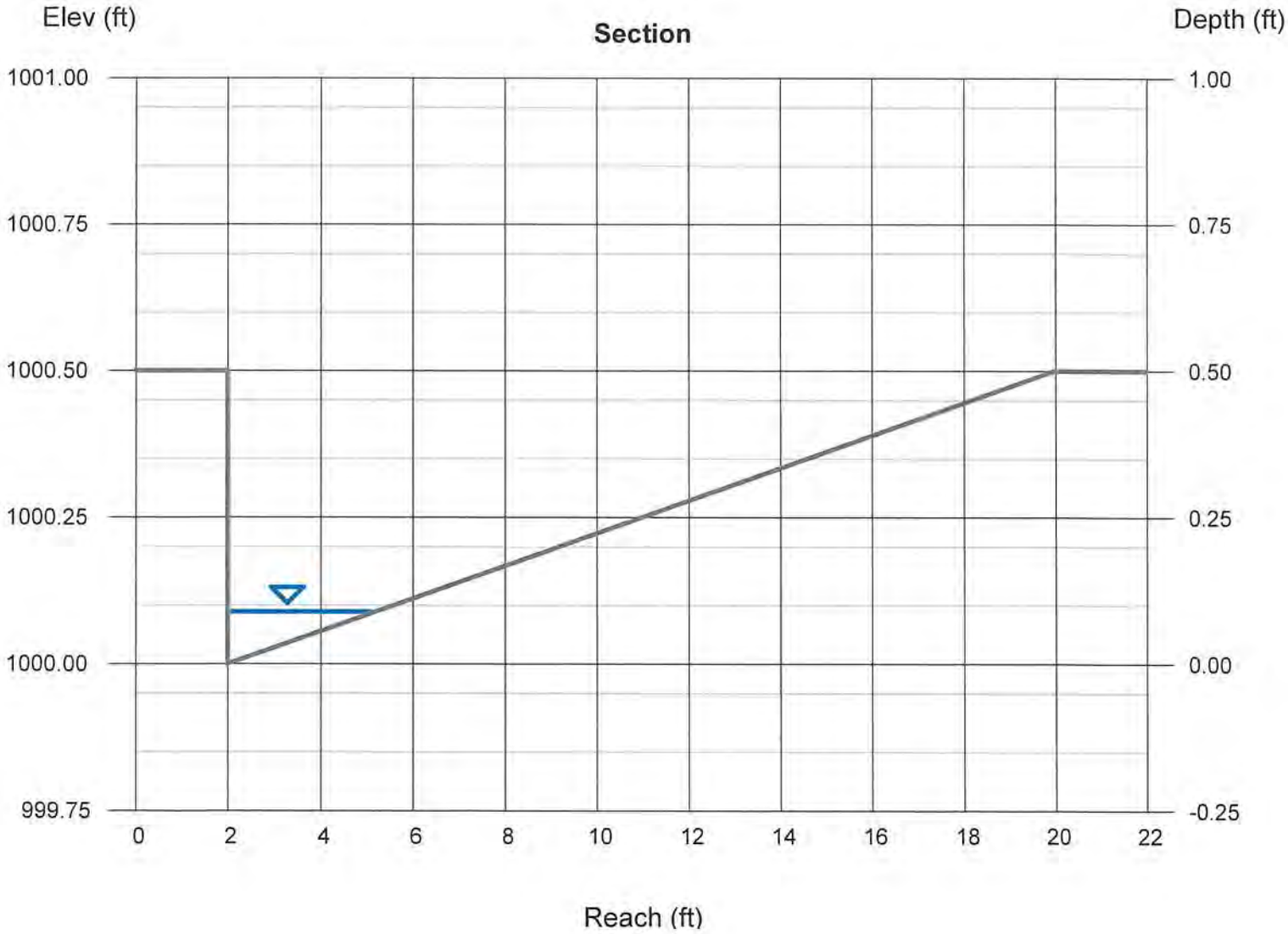
Cross Sl, Sx (ft/ft)	= 0.028
Cross Sl, Sw (ft/ft)	= 0.028
Gutter Width (ft)	= 1.50
Invert Elev (ft)	= 1000.00
Slope (%)	= 2.22
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.38

Highlighted

Depth (ft)	= 0.09
Q (cfs)	= 0.380
Area (sqft)	= 0.14
Velocity (ft/s)	= 2.68
Wetted Perim (ft)	= 3.28
Crit Depth, Yc (ft)	= 0.13
Spread Width (ft)	= 3.19
EGL (ft)	= 0.20



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 17 2022

Sub Basin C4

Gutter

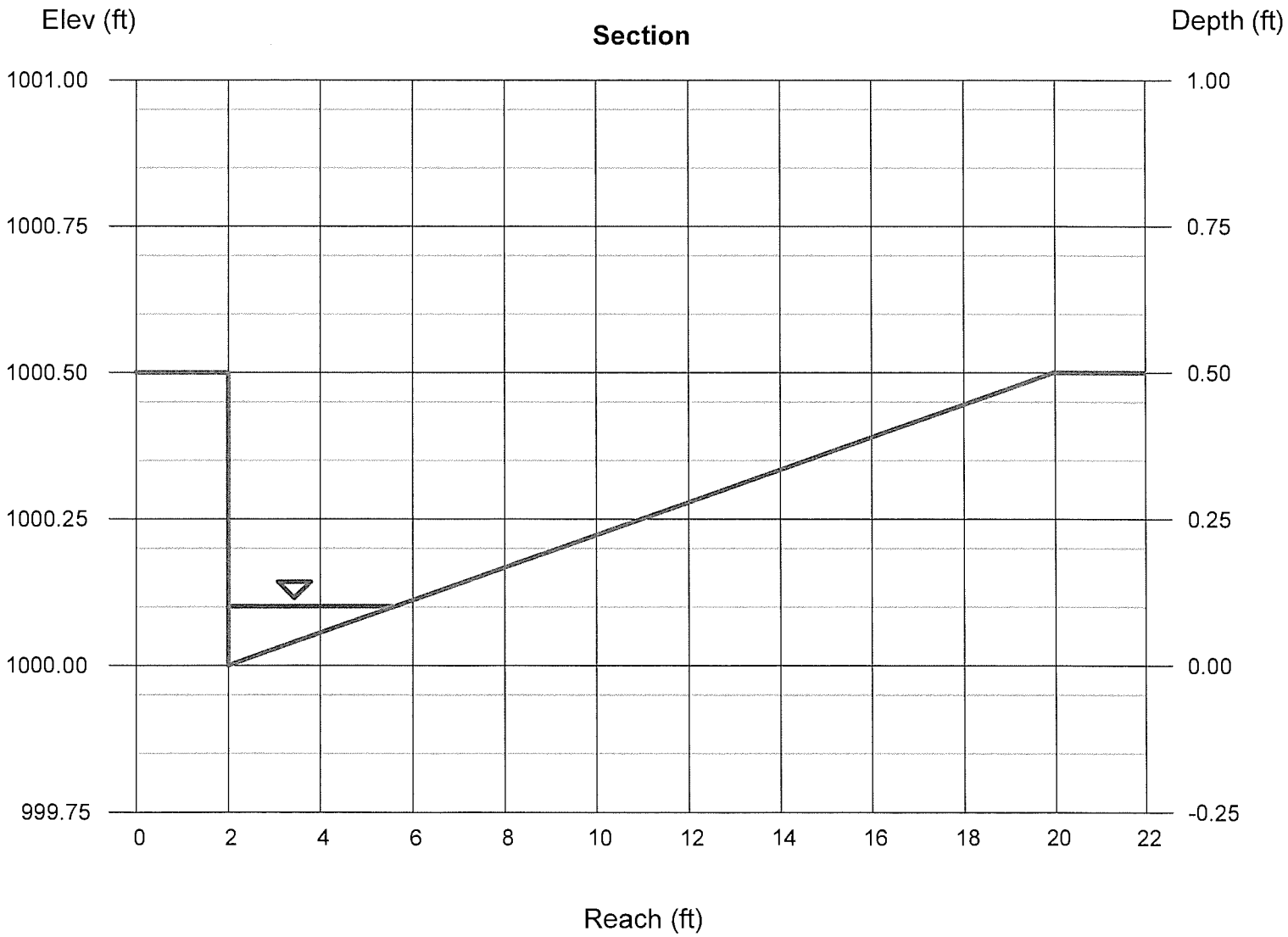
Cross Sl, Sx (ft/ft)	= 0.028
Cross Sl, Sw (ft/ft)	= 0.028
Gutter Width (ft)	= 1.50
Invert Elev (ft)	= 1000.00
Slope (%)	= 7.72
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.00

Highlighted

Depth (ft)	= 0.10
Q (cfs)	= 1.000
Area (sqft)	= 0.18
Velocity (ft/s)	= 5.48
Wetted Perim (ft)	= 3.72
Crit Depth, Yc (ft)	= 0.19
Spread Width (ft)	= 3.62
EGL (ft)	= 0.57



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Aug 17 2022

Sub Basin C1-C4

Gutter

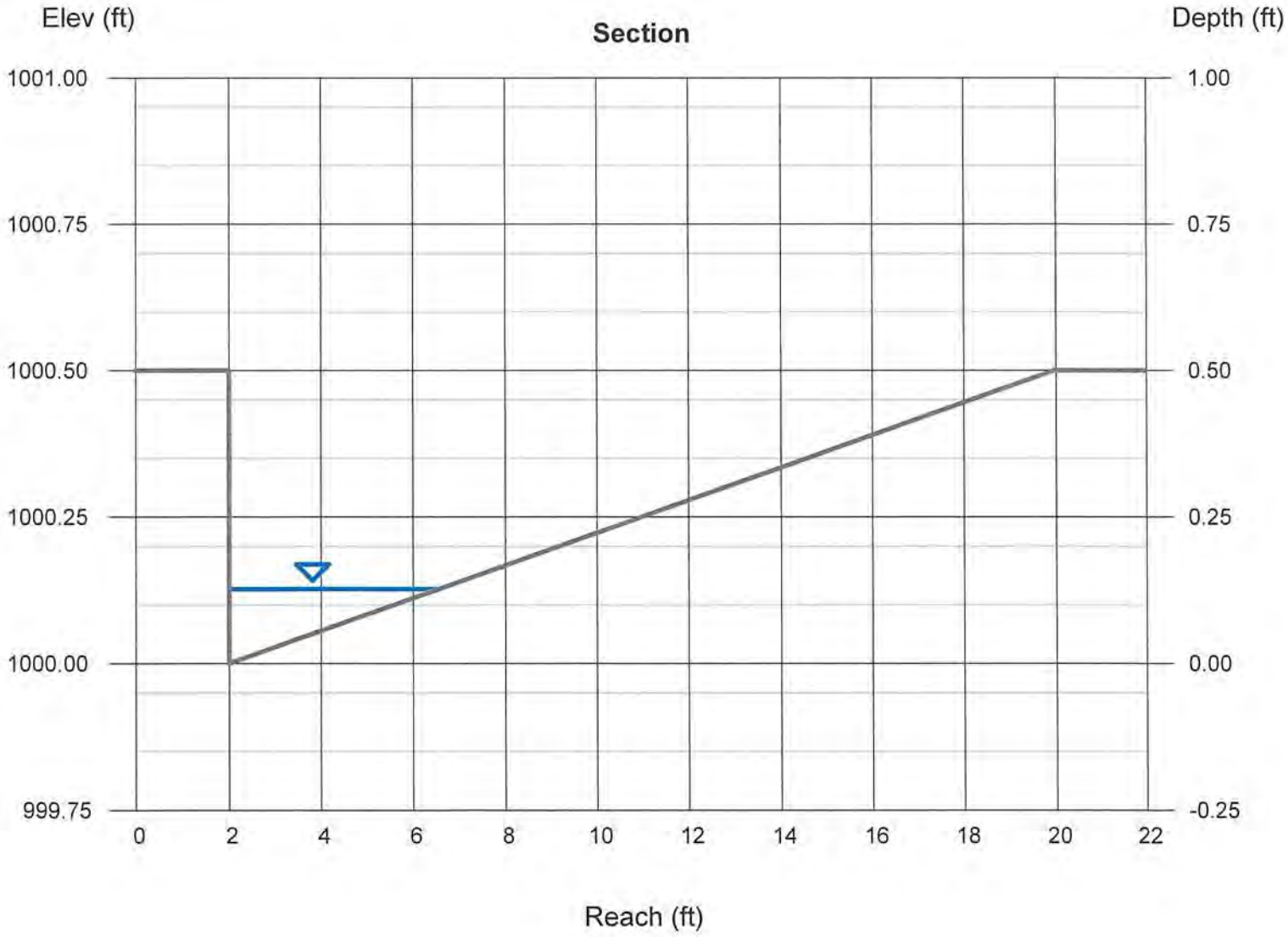
Cross Sl, Sx (ft/ft)	= 0.028
Cross Sl, Sw (ft/ft)	= 0.028
Gutter Width (ft)	= 1.50
Invert Elev (ft)	= 1000.00
Slope (%)	= 7.72
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.85

Highlighted

Depth (ft)	= 0.13
Q (cfs)	= 1.850
Area (sqft)	= 0.29
Velocity (ft/s)	= 6.40
Wetted Perim (ft)	= 4.69
Crit Depth, Yc (ft)	= 0.24
Spread Width (ft)	= 4.56
EGL (ft)	= 0.76



Wetland Mitigation Report

Wetland Assessment and Wetland Mitigation Plan
Westridge Addition
City of Spokane, Washington

August 10, 2022

Prepared for

WCE, Inc.

Prepared by:

Towey Ecological Services
24211 S. Harmony Rd.
Cheney, WA 99004
509-939-5203

Introduction

This assessment was authorized to properly categorize wetlands and their buffers pursuant to the *Spokane Municipal Code Title 17E (Code).* The assessment was performed to provide guidance for the proper design layout for a proposed development. The assessment was performed within parcels 25263.0051, 25263.3103, 25263.3003, 25263.3002, 25263.2907 and 25263.2906. The Code provided guidance on wetland protection (Chapter 17E.070) and wetland mitigation (Section 17E.070.130). A mitigation plan, herein, provides recommendations for the proposed project disturbances to the wetland and wetland buffer.

The investigation was conducted on June 15, 2022. The primary investigator was William T. Towey, a Qualified Wetland Specialist.

Methods

Wetland areas were assessed using criteria and guidance specified in the *Code,* the *U.S. Army Corps of Engineers Wetland Delineation Manual* (USACOE 1987), the National Wetland Inventory Map (attachment 1), the Natural Resources Conservation Service aerial soil surveys (attachment 2) and the *2014 Eastern Washington Wetland Rating and USACOE Arid West Forms* (attachment 3) and Site Plans (attachment 4).

Wetlands identified within the project area were categorized and vegetative communities and general hydrology noted. Pink flagging was used to designate the outer extent of the wetland buffer areas and the soil pits for each wetland. The flagged points were surveyed and transferred to a base site plan to guide layout and mitigation recommendations.

Results and Discussion

The assessment identified three depressional wetlands within the proposed project area. A summary of information (including the designation, category and buffer) of the wetlands is provided in Table 1.

Designation.	Category	Required Buffer
Wetland (Depressional) A	Category 3	150' (high impact)
Wetland (Depressional) B	Category 3	150' (high impact)
Wetland (Depressional) C	Category 3	150' (high impact)

Table 1- Summary of Identified Wetlands

Wetland Assessment

Wetland A- A Category III Depressional Wetland was identified. The wetland is identified on the National Wetland Inventory Map as a PEM1C (Palustrine, Emergent, Persistent, Seasonally Flooded). The wetland scored a total of 16 points (7 points Improving Water Quality, 4 points Hydrologic and 5 points Habitat), utilizing the *2014 Eastern Washington Wetland Rating System.*

Wetland Vegetation- The wetland is characterized by reed canarygrass (*Phalaris arundinacea*), equisetum (*Equisetum hyemale*), and goldenrod (*Solidago* spp.).

Upland Vegetation- The dominant species consists of mullein (*Verbascum thapsus*), wild rose (*Rosa* spp.), upland grasses, hounds-tongue (*Cynoglossum officinale*), yarrow (*Achillea millefolium*), thistle (*Cirsium arvense*), and goldenrod.

Soils- Cocolalla-Hardesty complex (see Arid West data form)

Hydrology- The hydrology is provided by the adjacent topography and suspected high water table. The localized hydrology has likely been affected by surrounding development (reduced quantity and duration of inundation). Evidence of reduced hydrology included the establishment of upland plants in areas that were likely historical wetlands.

Upland/Wetland Transition- The wetland area is defined by a very gradual slope, wetland vegetation and saturated soils. The wetland vegetation transitions to upland vegetation with <50% OBL, FACW or FAC designations. In addition to the plant criteria used to delineate the wetland area, the upland/wetland transition was determined by digging several soil pits to determine the presence/absence of hydric soils.

Wetland B- A Category III Depressional Wetland was identified. The wetland is identified on the National Wetland Inventory Map as a PEM1C (Palustrine, Emergent, Persistent, Seasonally Flooded) The wetland scored a total of 16 points (7 points Improving Water Quality, 4 points Hydrologic and 5 points Habitat), utilizing the *2014 Eastern Washington Wetland Rating System.*

Wetland Vegetation- The wetland is characterized by reed canarygrass, equisetum and goldenrod.

Upland Vegetation- The dominant species consists of mullein, wild rose, upland grasses, hounds tongue, yarrow, thistle and upland grasses.

Soils- Cocolalla-Hardesty complex (see Arid West data form)

Hydrology- The hydrology is provided by the adjacent topography and suspected high water table. The localized hydrology has likely been affected by surrounding development (reduced quantity and duration of inundation). Evidence of reduced hydrology included the establishment of upland plants in areas that were likely historical wetlands.

Upland/Wetland Transition- The wetland area is defined by a very gradual slope, wetland vegetation and saturated soils. The wetland vegetation transitions to upland vegetation with <50% OBL, FACW or FAC designations. In addition to the plant criteria used to delineate the wetland area, the upland/wetland transition was determined by digging several soil pits to determine the presence/absence of hydric soils.

Wetland C- A Category III Depressional Wetland was identified. The wetland is identified on the National Wetland Inventory Map as a PEM1C (Palustrine, Emergent, Persistent, Seasonally Flooded). The wetland scored a total of 16 points (7 points Improving Water Quality, 4 points Hydrologic and 5 points Habitat), utilizing the *2014 Eastern Washington Wetland Rating System.*

Wetland Vegetation- The wetland is characterized by reed canarygrass, sedge (*Carex* spp.), equisetum, goldenrod.

Upland Vegetation- The dominant species consists of mullein, wild rose, upland grasses, hounds tongue, yarrow, thistle and goldenrod.

Soils- Cocolalla-Hardesty complex (See Arid West data form)

Hydrology- The hydrology is provided by the adjacent topography and suspected high water table. The localized hydrology has likely been affected by surrounding development (reduced quantity and duration of inundation). Evidence of reduced hydrology included the establishment of upland plants in areas that were likely historical wetlands.

Upland/Wetland Transition- The wetland area is defined by a very gradual slope, wetland vegetation and saturated soils. The wetland vegetation transitions to upland vegetation with <50% OBL, FACW or FAC designations. In addition to the plant criteria used to delineate the wetland area, the upland/wetland transition was determined by digging several soil pits to determine the presence/absence of hydric soils.

Wetland and Wetland Buffer Mitigation Plan

Introduction-

A wetland assessment was performed within 7 acres of (see attached site plans and attachments) on June 15, 2022. Three wetlands were identified as jurisdictional under the Spokane Municipal Code. The three Category 3 wetlands were labeled A, B and C (see attachment 4). The proposed mitigation wetland is designed at a re-establishment or creation ratio 2:1 (acreage of wetlands requiring replacement:acreage of wetlands altered); whereas the wetland buffer will be established at 150' (Category III wetland-high impact). The wetland mitigation area will be utilized for pretreated storm water detention and has been designed using applicable local and state standards. The recommendations contained herein are consistent with the wetland mitigation provisions of the Spokane Municipal Code.

The current wetlands (A, B and C) and their respective wetland buffers all have low habitat function and values based on a monoculture of grasses and small shrubs. It appears that hydrology has lessened in recent years due to the encroachment of development adjacent to the property. The once historical contiguous wetland area has been transitioning over time to upland area, dominated by upland plants caused by the lack of hydrology. The intent of the proposed wetland cell is to re-establish the contiguous wetland and its associated buffer.

The field assessment included a function analysis that compared existing conditions to the proposed wetland mitigation area to ensure functions and values will be enhanced. The proposed mitigation area was chosen for its suitable soils, topography, and high water table. Increased hydrology will be available to the mitigation area by routing pre-treated stormwater. Storm drainage calculations were completed as necessary components to the wetland mitigation plan.

Mitigation Sequencing-

The mitigation plan utilized guidance of section 17E.070.130 of the Spokane Municipal Code. The plan addresses mitigation sequencing as follows:

1. Avoiding the impact altogether by not taking certain action or parts of an action- The project design recognized that the resulting wetland mitigation measures would improve overall function and value of the project area. The recommended action of increasing the overall contiguous portion of the wetland area and providing increased hydrology (quantity and duration) will ensure higher function and value over current

conditions. The project does not avoid impact by taking no action, rather it is designed to provide improved wetland function and value.

2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts- The project design has reduced impacts by protecting areas that can function as a connected system with native plant enhancements and measures to connect hydrology that has been historically disrupted by development in the surrounding area.

3. Rectifying the impact by repairing, rehabilitating or restoring the affected environment- The mitigation plan rectifies the identified impacts by restoring and enhancing the environment with native plantings and hydrology connectivity.

4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action- The protection of the proposed wetland enhancement areas, including wetland buffers and connection of hydrology, will reduce or eliminate the impact over time.

5. Compensating for the impact by replacing, enhancing, or providing substitute resources or environments- The project recommends enhancement measures to increase habitat diversity, hydrologic connectivity and long-term protection of a contiguous wetland area.

6. Monitoring the impact and the compensation project and taking appropriate corrective measures. Mitigation may include a combination of the above measures- The mitigation plan specifies a long-term monitoring plan to ensure survivability and success of the mitigation measures.

Mitigation Replacement Values-

A total of 19,340 square feet of wetland C has been identified for replacement. The proposed wetland replacement area equals 38,680 square feet (2:1)[1]. The one contiguous wetland cell (replacement for Wetland C, Wetland A and Wetland B) is 52,450 square feet (see attachment 4). The proposed replacement wetland will have a 150' buffer (to include Standard Buffer Width Averaging[2]) to ensure adequate protection of the function and values of the wetland. In addition to the increased wetland and buffer areas and additional hydrology, the proposed wetland and buffer areas will be treated with native plant enhancements that will increase function and value over existing conditions.

---

[1] Utilizing Table 17E.070.130-1 of Section 17E.070.130 of the Spokane Municipal Code (Re-establishment or Creation)

[2] Standard Buffer Width Averaging (*Section 17W.070.110*) will be applied to a portion of the proposed wetland buffer. The proposed buffer width will not be reduced by more than fifty percent of the standard buffer or be less than twenty-five feet.

Identification of Suitable Mitigation Area-

A mitigation site suitability assessment was performed based on: 1) habitat connectivity; 2) source of water; 3) soil conditions; and 4) proposed land use.
The area identified for the creation of the new wetland cell was based on providing a contiguous wetland area associated with the delineated wetlands A, B and C. It is suspected that adjacent development has reduced the overall hydrology to the area and that the wetlands that currently exist have been fragmented. The intent is to return some level of hydrology to support the new wetland cell and proposed vegetative plantings.

The area is currently characterized by a high-water table and the hydrology will be sustained and increased by providing pretreated stormwater runoff from the adjacent topography. Due to the naturally high ground water table and the suitable existing soils, the area is very conducive to re-establishing a vegetative buffer around the constructed wetland area. The recommended contiguous wetland and vegetated buffer areas will improve upon the habitat function and values relative to current conditions.

Recommended Mitigation Actions-

Constructed Wetland Cell- In order to properly mitigate for the replacement of portions of wetland C, one contiguous wetland cell (see attached drawings) was designed based on the available high water table and projected volumes of stormwater drainage from the proposed development.

Vegetation Buffer- In order to establish properly functioning conditions and increased habitat function and values within the identified mitigation area, a native plant design is recommended for the wetland buffer areas (see constructed wetland designs). The buffer areas will consist of thinleaf alder (*Alnus tenuifolia*), quaking aspen (*Populus tremuloides*), serviceberry (*Amelanchier alnifolia*), dogwood (*Cornus stolonifera*), mockorange (*Philadelphus lewisii*), chokecherry (*Prunus virginiana*), golden currant (*Ribes aureum*), rose (*Rosa woodsii*), dune willow (*Salix hookeriana*) and snowberry (*Symphoricarpos albus*). In addition to the native trees and shrubs, the mitigation area will include grass hydroseeding. The grass seed in wetter conditions will utilize a mix of blue wild rye *(Elymus glaucus*), western mannagrass (*Glyceria occidentalis*), meadow barley (*Hordeum brachyantherum*), American sloughgrass (*Beckmannia syzigachne*) and tufted hairgrass (*Deschampsia cespitosa*). Drier site conditions will utilize a mix of smooth brome (*Bromus inermis Leyss*), crested wheatgrass (*Agropyron cristatum*), tall fescue (*Festuca arundinacea*) and Dahurian wildrye (*Elymus dahuricus*).

Species	Quantity
Thinleaf alder	85
Quaking aspen	87
Serviceberry	113
Dogwood	410
Mockorange	52
Chokecherry	112
Golden currant	52
Rose	197
Dune willow	146
Snowberry	294

Detailed prescriptions and specifications for the implementation of the mitigation actions are outlined in the *Landscape Notes* provided in the mitigation design drawings.

Performance Standards- Trees and shrubs shall consist of large, commercially obtained nursery stock per WDFW and USACOE specifications, shall be regularly watered with an installed drip system and maintained until established (including regular weeding to keep plants from being shaded out or out-competed by weeds, and fully replaced as necessary for a period of at least five years). A minimum of eighty percent survival rate by the end of the third growing season will be required (WDFW guidelines).

Long-Term Preservation- Due to the close proximity of human activity, it is necessary to protect the mitigation area post re-vegetation. The planting areas will be protected by fencing. This recommendation will minimize foot traffic and will allow for successful re-vegetation of the area.

As-Built Documentation- Upon completion of the constructed wetland cell and re-vegetation, a qualified wetland biologist will provide an as-built design and photo-documentation to the City of Spokane. This documentation will serve as the basis for ongoing yearly documentation standards.

Monitoring and Evaluation- The mitigation areas will have established photo-documentation reference points. Additionally, an as-built photo will be taken to begin the series of post-implementation documentation. These reference points represent baseline habitat conditions and can be used to monitor the mitigation area through time. It is recommended that the mitigation area be photographed and a status of the performance standards be submitted to the City of Spokane on an annual basis for a minimum of five years. This monitoring will ensure that the mitigation area is being properly maintained and that properly functioning conditions are present within the wetland and wetland buffer areas.

REFERENCES

Washington Department of Ecology (WDOE). 2004. *Guidance on Wetland Mitigation-Part 2*. Publication 04-06-013b.

Washington Department of Fish and Wildlife (WDFW). *General Native Riparian & Shrub Steppe Planting Prescriptions for Shoreline Areas of the Columbia River.* WDFW Region 2 Publication.

U.S. Fish and Wildlife Service

National Wetlands Inventory

Parcel #25263.2907

March 15, 2022

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)

Attachment 1

Soil Map—Spokane County, Washington
(21st Assessment)

Map Scale: 1:2,030 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

USDA **Natural Resources Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

Attachment 2

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: Spokane County, Washington
Survey Area Data: Version 13, Aug 23, 2021

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

Date(s) aerial images were photographed: Jul 12, 2020—Aug 14, 2020

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
1021	Cocolalla-Hardesty complex, 0 to 3 percent slopes	7.0	42.2%
3115	Northstar-Rock outcrop complex, 3 to 15 percent slopes	7.0	42.5%
7131	Urban land-Northstar, disturbed complex, 3 to 8 percent slopes	2.5	15.3%
Totals for Area of Interest		**16.5**	**100.0%**

Attachment 3

Wetland name or number "A"

RATING SUMMARY – Eastern Washington

Name of wetland (or ID #): "A" - 21st Project Date of site visit: 6/15/22

Rated by William T. Towey Trained by Ecology? X Yes ___ No Date of training 04/16/15

HGM Class used for rating Depressional Wetland has multiple HGM classes? ___ Y X N

NOTE: Form is not complete without the figures requested (*figures can be combined*).

Source of base aerial photo/map Google Earth, NWI Map, Soil Map, PHS info HGM Map - 1 Km - Map

OVERALL WETLAND CATEGORY III (based on functions___ or special characteristics___)

1. Category of wetland based on FUNCTIONS

___ **Category I** – Total score = 22-27

X **Category II** – Total score = 19-21

___ **Category III** – Total score = 16-18

___ **Category IV** – Total score = 9-15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	H (M) L	H (M) L	H M (L)	
Landscape Potential	H M (L)	H M (L)	(H) M L	
Value	(H) M L	H M (L)	H M (L)	TOTAL
Score Based on Ratings	7	4	5	16

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY *Circle the appropriate category*
Vernal Pools	II III
Alkali	I
Wetland of High Conservation Value	I
Bog and Calcareous Fens	I
Old Growth or Mature Forest – slow growing	I
Aspen Forest	I
Old Growth or Mature Forest – fast growing	II
Floodplain forest	II
None of the above	

Wetland name or number "A"

DEPRESSIONAL WETLANDS **Water Quality Functions** - Indicators that the site functions to improve water quality	Points (only 1 score per box)
D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland has no surface water outlet — points = 5 Wetland has an intermittently flowing outlet — points = 3 Wetland has a highly constricted permanently flowing outlet — points = 3 Wetland has a permanently flowing, unconstricted, surface outlet — points = 1	5
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions of soils)* YES = 3 NO = 0	0
D 1.3. Characteristics of persistent vegetation (Emergent, Scrub-shrub, and/or Forested Cowardin classes) Wetland has persistent, ungrazed, vegetation for > $^2/_3$ of area — points = 5 Wetland has persistent, ungrazed, vegetation from $^1/_3$ to $^2/_3$ of area — points = 3 Wetland has persistent, ungrazed vegetation from $^1/_{10}$ to < $^1/_3$ of area — points = 1 Wetland has persistent, ungrazed vegetation < $^1/_{10}$ of area — points = 0	5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area of ponding that fluctuates every year. Do not count the area that is permanently ponded.* Area seasonally ponded is > ½ total area of wetland — points = 3 Area seasonally ponded is ¼ - ½ total area of wetland — points = 1 Area seasonally ponded is < ¼ total area of wetland — points = 0	3
Total for D 1 — Add the points in the boxes above	13

Rating of Site Potential If score is: X **12- 16 = H** ___ **6- 11 = M** ___ **0- 5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?		
D 2.1. Does the wetland receive stormwater discharges?	Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants?	Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland?	Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1- D 2.3? Source_____	Yes = 1 No = 0	0
Total for D 2 — Add the points in the boxes above		0

Rating of Landscape Potential If score is: ___ **3 or 4 = H** ___ **1 or 2 = M** X **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?		
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, or lake that is on the 303(d) list?	Yes = 1 No = 0	
D 3.2. Is the wetland in a basin or sub-basin where water quality is an issue in some aquatic resource [303(d) list, eutrophic lakes, problems with nuisance and toxic algae]?	Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality *(answer YES if there is a TMDL for the drainage or basin in which the wetland is found)*?	Yes = 2 No = 0	2
Total for D 3 — Add the points in the boxes above		

Rating of Value If score is: X **2-4 = H** ___ **1 = M** ___ **0 = L** *Record the rating on the first page*

Wetland name or number A

DEPRESSIONAL WETLANDS **Hydrologic Functions** - Indicators that the site functions to reduce flooding and erosion.		Points (only 1 score per box)
D 4.0. Does the site have the potential to reduce flooding and erosion?		
D 4.1. Characteristics of surface water outflows from the wetland:		
Wetland has no surface water outlet	points = 8	8
Wetland has an intermittently flowing outlet	points = 4	
Wetland has a highly constricted permanently flowing outlet	points = 4	
Wetland has a permanently flowing unconstricted surface outlet	points = 0	
(If outlet is a ditch and not permanently flowing treat wetland as "intermittently flowing")		
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or deepest part (if dry).*		
Seasonal ponding: > 3 ft above the lowest point in wetland or the surface of permanent ponding	points = 8	2
Seasonal ponding: 2 ft - < 3 ft above the lowest point in wetland or the surface of permanent ponding	points = 6	
The wetland is a headwater wetland	points = 4	
Seasonal ponding: 1 ft - < 2 ft	points = 4	
Seasonal ponding: 6 in - < 1 ft	points = 2	
Seasonal ponding: < 6 in or wetland has only saturated soils	points = 0	
Total for D 4	Add the points in the boxes above	10

Rating of Site Potential If score is: ___ **12-16 = H** X **6-11 = M** ___ **0-5 = L** *Record the rating on the first page*

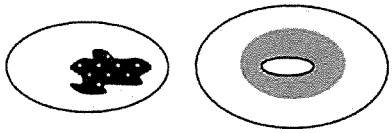
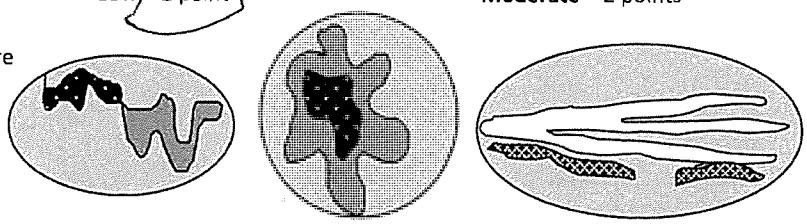
D 5.0. Does the landscape have the potential to support the hydrologic functions of the site?		
D 5.1. Does the wetland receive stormwater discharges?	Yes = 1 No = 0	0
D 5.2. Is > 10% of the area within 150 ft of the wetland in a land use that generates runoff?	Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses?	Yes = 1 No = 0	0
Total for D 5	Add the points in the boxes above	0

Rating of Landscape Potential If score is: ___ **3 = H** ___ **1 or 2 = M** X **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?		
D 6.1. The wetland is in a landscape that has flooding problems. Choose the description that best matches conditions around the wetland being rated. *Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds), AND		
Flooding occurs in sub-basin that is immediately down-gradient of wetland	points = 2	0
Surface flooding problems are in a sub-basin farther down-gradient	points = 1	
The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood.		
Explain why _____	points = 0	
There are no problems with flooding downstream of the wetland	points = 0	
D 6.2. Has the site has been identified as important for flood storage or flood conveyance in a regional flood control plan?	Yes = 2 No = 0	0
Total for D 6	Add the points in the boxes above	0

Rating of Value If score is: ___ **2-4 = H** ___ **1 = M** X **0 = L** *Record the rating on the first page*

Wetland name or number A

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	(only 1 score per box)
H 1.0. Does the wetland have the potential to provide habitat for many species?	
H 1.1. Structure of the plant community: *Check the Cowardin vegetation classes present and categories of emergent plants. Size threshold for each category is >= ¼ ac or >= 10% of the wetland if wetland is < 2.5 ac.* __Aquatic bed X Emergent plants 0-12 in (0-30 cm) high are the highest layer and have > 30% cover __Emergent plants >12-40 in (>30-100 cm) high are the highest layer with >30% cover X Emergent plants > 40 in (> 100 cm) high are the highest layer with >30% cover ____Scrub-shrub (areas where shrubs have >30% cover) ____Forested (areas where trees have >30% cover) 4 or more checks: points = 3 3 checks: points = 2 2 checks: points = 1 1 check: points = 0	1
H 1.2. Is one of the vegetation types Aquatic Bed? Yes = 1 No = 0	
H 1.3. Surface water H 1.3.1. Does the wetland have areas of open water (without emergent or shrub plants) over at least ¼ ac **OR** 10% of its area during the March to early June **OR** in August to the end of September? *Answer YES for Lake Fringe wetlands.* Yes = 3 points & go to H 1.4 No = go to H 1.3.2 H 1.3.2. Does the wetland have an intermittent or permanent, and unvegetated stream within its boundaries, or along one side, over at least ¼ ac or 10% of its area? *Answer yes only if H 1.3.1 is No.* Yes = 3 No = 0	0
H 1.4. Richness of plant species Count the number of plant species in the wetland that cover at least 10 ft^2. *Different patches of the same species can be combined to meet the size threshold. You do not have to name the species.* *Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Russian olive, Phragmites, Canadian thistle, yellow-flag iris, and saltcedar (Tamarisk)* # of species ____ Scoring: > 9 species: points = 2 4-9 species: points = 1 < 4 species: points = 0	0
H 1.5. Interspersion of habitats Decide from the diagrams below whether interspersion among types of plant structures (described in H 1.1), and unvegetated areas (open water or mudflats) is high, moderate, low, or none. *Use map of Cowardin and emergent plant classes prepared for questions H 1.1 and map of open water from H 1.3. If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **High** = 3 points  Riparian braided channels with 2 classes	Figure__ 1

Wetland name or number A

H 1.6. Special habitat features *Check the habitat features that are present in the wetland. The number of checks is the number of points.* ____Loose rocks larger than 4 in OR large, downed, woody debris (> 4 in diameter) within the area of surface ponding or in stream. ____Cattails or bulrushes are present within the wetland. ____Standing snags (diameter at the bottom > 4 in) in the wetland or within 30 m (100 ft) of the edge. ____Emergent or shrub vegetation in areas that are permanently inundated/ponded. ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 45 degree slope) OR signs of recent beaver activity ____ Invasive species cover less than 20% in each stratum of vegetation *(canopy, sub-canopy, shrubs, herbaceous, moss/ground cover)*	0
Total for H 1 — Add the points in the boxes above	2

Rating of Site Potential If score is:___**15-18 = H** ___**7-14 = M** ~~X~~ **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support habitat functions of the site?	
H 2.1. Accessible habitat (only area of habitat abutting wetland). If total accessible habitat is: *Calculate:* % undisturbed habitat _____ + [(% moderate and low intensity land uses)/2] _____ = _____% > 1/3 (33.3%) of 1 km Polygon — points = 3 20-33% of 1km Polygon — ~~points = 2~~ 10-19% of 1km Polygon — points = 1 <10% of 1km Polygon — points = 0	3
H 2.2. Undisturbed habitat in 1 km Polygon around wetland. *Calculate:* % undisturbed habitat _____ + [(% moderate and low intensity land uses)/2] _____ = _____% Undisturbed habitat > 50% of Polygon — ~~points = 3~~ Undisturbed habitat 10 - 50% and in 1-3 patches — points = 2 Undisturbed habitat 10 - 50% and > 3 patches — ~~points = 1~~ Undisturbed habitat < 10% of Polygon — points = 0	2
H 2.3. Land use intensity in 1 km Polygon: > 50% of Polygon is high intensity land use — points = (-2) Does not meet criterion above — points = 0	0
H 2.4. The wetland is in an area where annual rainfall is less than 12 in, and its water regime is not influenced by irrigation practices, dams, or water control structures. *Generally, this means outside boundaries of reclamation areas, irrigation districts, or reservoirs* — Yes = 3 No = 0	0
Total for H 2 — Add the points in the boxes above	5

Rating of Landscape Potential If score is:___**4-9 = H** ___**1-3 = M** ___**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose the highest score that applies to the wetland being rated* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see Appendix B) — It provides habitat for Threatened or Endangered species (any plant or animal on state or federal lists) — It is mapped as a location for an individual WDFW species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats within 100 m (see Appendix B) — ~~points = 1~~ Site does not meet any of the criteria above — points = 0	0

Rating of Value If score is:___**2 = H** ___**1 = M** ~~X~~ **0 = L** *Record the rating on the first page*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: A. 21st City/County: Spokane Sampling Date: 6/15/22

Applicant/Owner: _____ State: Washington Sampling Point: wetland

Investigator(s): Bill Towey (TES) Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _

Subregion (LRR): B – Columbia/Snake River Plateau Lat: _____ Long: _____ Datum: NAVD 88

Soil Map Unit Name: Cocolalla-Hardesty Complex NWI classification: PEMIC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks: The slope wetland has flowing water.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
	_____ = Total Cover		
Herb Stratum (Plot size:)			
1. Phalaris arundinacea	60%	Y	FACW
2. Equisetum hyemale	20%	Y	FACW
3. Solidago spp.	20%	Y	FACU
4.			
5.			
6.			
7.			
8.			
9.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	_____	x 1 =	_____
FACW species	80	x 2 =	160
FAC species	_____	x 3 =	_____
FACU species	20	x 4 =	80
UPL species	_____	x 5 =	_____
Column Totals:	100 (A)		240 (B)

Prevalence Index = B/A = 2.4

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤ 3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

"A"

SOIL Cocollalla - Hardesty Complex

Sampling Point: DP #1 (Wetland)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-21"	10YR 3/1						Silt loam	saturated
21-36"							Silt loam	mottling.

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

* several soil pits dug to identify transition from wetland/upland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: A-21st City/County: Spokane Sampling Date: 6/15/22

Applicant/Owner: _____ State: Washington Sampling Point: Upland

Investigator(s): Bill Towey (TES) Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _

Subregion (LRR): B – Columbia/Snake River Plateau Lat: _____ Long: _____ Datum: NAVD 88

Soil Map Unit Name: Coolall – Hardesty Complex NWI classification: /

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? ND Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? ND (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No _____
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: The slope wetland has flowing water.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
	_____ = Total Cover		
Herb Stratum (Plot size:)			
1. Solidago spp.	20%	Y	FACU
2. Achillea millefolium	25%	Y	FACU
3. Upland grasses	55%	Y	FACU
4.			
5.			
6.			
7.			
8.			
9.			
	100% = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species _____	x 1 =	_____
FACW species _____	x 2 =	_____
FAC species _____	x 3 =	_____
FACU species 100	x 4 =	400
UPL species _____	x 5 =	_____
Column Totals: 100 (A)		400 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

_ Dominance Test is >50%

_ Prevalence Index is ≤ 3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

SOIL Cocoltilla - Hardesty Complex "A" upland

Sampling Point: DP #1 (Wetland)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-36	10YR 2/1	+						Dry - no mottling

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Remarks:

Wetland name or number "B"

RATING SUMMARY – Eastern Washington

Name of wetland (or ID #): "B" - 21st Project Date of site visit: 6/15/22

Rated by William T. Towey Trained by Ecology? X Yes ___ No Date of training 04/16/15

HGM Class used for rating Depressional Wetland has multiple HGM classes? ___ Y X N

NOTE: Form is not complete without the figures requested (*figures can be combined*).

Source of base aerial photo/map Google Earth, NWI Map, Soil Map, PHS info HGM map, 1Km map

OVERALL WETLAND CATEGORY III (based on functions___ or special characteristics___)

1. Category of wetland based on FUNCTIONS

___**Category I** – Total score = 22-27

X **Category II** – Total score = 19-21

___**Category III** – Total score = 16-18

___**Category IV** – Total score = 9-15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	(H) M L	H (M) L	H M (L)	
Landscape Potential	H M (L)	H M (L)	(H) M L	
Value	(H) M L	H M (L)	H M (L)	**TOTAL**
Score Based on Ratings	7	4	5	16

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY *Circle the appropriate category*
Vernal Pools	II III
Alkali	I
Wetland of High Conservation Value	I
Bog and Calcareous Fens	I
Old Growth or Mature Forest – slow growing	I
Aspen Forest	I
Old Growth or Mature Forest – fast growing	II
Floodplain forest	II
None of the above	

Wetland name or number 11 B 4

DEPRESSIONAL WETLANDS **Water Quality Functions** - Indicators that the site functions to improve water quality		Points (only 1 score per box)
D 1.0. Does the site have the potential to improve water quality?		
D 1.1. Characteristics of surface water outflows from the wetland:		
Wetland has no surface water outlet	points = 5	5
Wetland has an intermittently flowing outlet	points = 3	
Wetland has a highly constricted permanently flowing outlet	points = 3	
Wetland has a permanently flowing, unconstricted, surface outlet	points = 1	
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions of soils)*	YES = 3 NO = 0	0
D 1.3. Characteristics of persistent vegetation (Emergent, Scrub-shrub, and/or Forested Cowardin classes)		
Wetland has persistent, ungrazed, vegetation for > $^2/_3$ of area	points = 5	5
Wetland has persistent, ungrazed, vegetation from $^1/_3$ to $^2/_3$ of area	points = 3	
Wetland has persistent, ungrazed vegetation from $^1/_{10}$ to < $^1/_3$ of area	points = 1	
Wetland has persistent, ungrazed vegetation < $^1/_{10}$ of area	points = 0	
D 1.4. Characteristics of seasonal ponding or inundation:		
This is the area of ponding that fluctuates every year. Do not count the area that is permanently ponded.		
Area seasonally ponded is > ½ total area of wetland	points = 3	3
Area seasonally ponded is ¼ - ½ total area of wetland	points = 1	
Area seasonally ponded is < ¼ total area of wetland	points = 0	
Total for D 1	Add the points in the boxes above	13

Rating of Site Potential If score is: X **12- 16 = H** ___ **6- 11 = M** ___ **0- 5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?		
D 2.1. Does the wetland receive stormwater discharges?	Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants?	Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland?	Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1- D 2.3? Source_____	Yes = 1 No = 0	0
Total for D 2	Add the points in the boxes above	0

Rating of Landscape Potential If score is: ___ **3 or 4 = H** ___ **1 or 2 = M** X **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?		
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, or lake that is on the 303(d) list?	Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where water quality is an issue in some aquatic resource [303(d) list, eutrophic lakes, problems with nuisance and toxic algae]?	Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality *(answer YES if there is a TMDL for the drainage or basin in which the wetland is found)*?	Yes = 2 No = 0	2
Total for D 3	Add the points in the boxes above	3

Rating of Value If score is: X **2-4 = H** ___ **1 = M** ___ **0 = L** *Record the rating on the first page*

Wetland name or number 1 B 1

DEPRESSIONAL WETLANDS **Hydrologic Functions** - Indicators that the site functions to reduce flooding and erosion.	Points (only 1 score per box)
D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland has no surface water outlet — points = 8 Wetland has an intermittently flowing outlet — points = 4 Wetland has a highly constricted permanently flowing outlet — points = 4 Wetland has a permanently flowing unconstricted surface outlet — points = 0 *(If outlet is a ditch and not permanently flowing treat wetland os "intermittently flowing")*	8
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or deepest part (if dry).* Seasonal ponding: > 3 ft above the lowest point in wetland or the surface of permanent ponding — points = 8 Seasonal ponding: 2 ft - < 3 ft above the lowest point in wetland or the surface of permanent ponding — points = 6 The wetland is a headwater wetland — points = 4 Seasonal ponding: 1 ft - < 2 ft — points = 4 Seasonal ponding: 6 in - < 1 ft — points = 2 Seasonal ponding: < 6 in or wetland has only saturated soils — points = 0	2
Total for D 4 — Add the points in the boxes above	10

Rating of Site Potential If score is: ___**12-16 = H** X **6-11 = M** ___**0-5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? — Yes = 1 No = 0	0
D 5.2. Is > 10% of the area within 150 ft of the wetland in a land use that generates runoff? — Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses? — Yes = 1 No = 0	0
Total for D 5 — Add the points in the boxes above	0

Rating of Landscape Potential If score is: ___**3 = H** ___**1 or 2 = M** X **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The wetland is in a landscape that has flooding problems. Choose the description that best matches conditions around the wetland being rated. *Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds), AND Flooding occurs in sub-basin that is immediately down-gradient of wetland — points = 2 Surface flooding problems are in a sub-basin farther down-gradient — points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ — points = 0 There are no problems with flooding downstream of the wetland — points = 0	0
D 6.2. Has the site has been identified as important for flood storage or flood conveyance in a regional flood control plan? — Yes = 2 No = 0	0
Total for D 6 — Add the points in the boxes above	0

Rating of Value If score is: ___**2-4 = H** ___**1 = M** X **0 = L** *Record the rating on the first page*

Wetland name or number B

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	(only 1 score per box)
H 1.0. Does the wetland have the potential to provide habitat for many species?	
H 1.1. Structure of the plant community: *Check the Cowardin vegetation classes present and categories of emergent plants. Size threshold for each category is >= ¼ ac or >= 10% of the wetland if wetland is < 2.5 ac.* ___Aquatic bed X Emergent plants 0-12 in (0-30 cm) high are the highest layer and have > 30% cover ___Emergent plants >12-40 in (>30-100 cm) high are the highest layer with >30% cover X Emergent plants > 40 in (> 100 cm) high are the highest layer with >30% cover ___Scrub-shrub (areas where shrubs have >30% cover) 4 or more checks: points = 3 ___Forested (areas where trees have >30% cover) 3 checks: points = 2 2 checks: points = 1 1 check: points = 0	1
H 1.2. Is one of the vegetation types Aquatic Bed? Yes = 1 No = 0	0
H 1.3. Surface water H 1.3.1. Does the wetland have areas of open water (without emergent or shrub plants) over at least ¼ ac **OR** 10% of its area during the March to early June **OR** in August to the end of September? *Answer YES for Lake Fringe wetlands.* Yes = 3 points & go to H 1.4 No = go to H 1.3.2 H 1.3.2. Does the wetland have an intermittent or permanent, and unvegetated stream within its boundaries, or along one side, over at least ¼ ac or 10% of its area? *Answer yes only if H 1.3.1 is No.* Yes = 3 No = 0	0
H 1.4. Richness of plant species Count the number of plant species in the wetland that cover at least 10 ft^2. *Different patches of the same species can be combined to meet the size threshold. You do not have to name the species.* *Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Russian olive, Phragmites, Canadian thistle, yellow-flag iris, and saltcedar (Tamarisk)* # of species ____ Scoring: > 9 species: points = 2 4-9 species: points = 1 < 4 species: points = 0	0
H 1.5. Interspersion of habitats Decide from the diagrams below whether interspersion among types of plant structures (described in H 1.1), and unvegetated areas (open water or mudflats) is high, moderate, low, or none. *Use map of Cowardin and emergent plant classes prepared for questions H 1.1 and map of open water from H 1.3. If you have four or more plant classes or three classes and open water, the rating is always high.* **None** = 0 points **Low** = 1 point **Moderate** = 2 points All three diagrams in this row are **High** = 3 points Riparian braided channels with 2 classes	Figure__ 1

Wetland name or number B

H 1.6. Special habitat features *Check the habitat features that are present in the wetland. The number of checks is the number of points.* ____Loose rocks larger than 4 in OR large, downed, woody debris (> 4 in diameter) within the area of surface ponding or in stream. ____Cattails or bulrushes are present within the wetland. ____Standing snags (diameter at the bottom > 4 in) in the wetland or within 30 m (100 ft) of the edge. ____Emergent or shrub vegetation in areas that are permanently inundated/ponded. ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 45 degree slope) OR signs of recent beaver activity ____ Invasive species cover less than 20% in each stratum of vegetation *(canopy, sub-canopy, shrubs, herbaceous, moss/ground cover)*	0
Total for H 1 — Add the points in the boxes above	2

Rating of Site Potential If score is:___**15-18 = H** ___**7-14 = M** X **0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support habitat functions of the site?	
H 2.1. Accessible habitat (only area of habitat abutting wetland). If total accessible habitat is: *Calculate:* % undisturbed habitat _____ + [(% moderate and low intensity land uses)/2] _____ = _____% > 1/3 (33.3%) of 1 km Polygon — points = 3 20-33% of 1km Polygon — points = 2 10-19% of 1km Polygon — points = 1 <10% of 1km Polygon — points = 0	3
H 2.2. Undisturbed habitat in 1 km Polygon around wetland. *Calculate:* % undisturbed habitat _____ + [(% moderate and low intensity land uses)/2] _____ = _____% Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10 - 50% and in 1-3 patches — points = 2 Undisturbed habitat 10 - 50% and > 3 patches — points = 1 Undisturbed habitat < 10% of Polygon — points = 0	2
H 2.3. Land use intensity in 1 km Polygon: > 50% of Polygon is high intensity land use — points = (-2) Does not meet criterion above — points = 0	0
H 2.4. The wetland is in an area where annual rainfall is less than 12 in, and its water regime is not influenced by irrigation practices, dams, or water control structures. *Generally, this means outside boundaries of reclamation areas, irrigation districts, or reservoirs* — Yes = 3 No = 0	0
Total for H 2 — Add the points in the boxes above	5

Rating of Landscape Potential If score is:X **4-9 = H** ___**1-3 = M** ___**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose the highest score that applies to the wetland being rated* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see Appendix B) — It provides habitat for Threatened or Endangered species (any plant or animal on state or federal lists) — It is mapped as a location for an individual WDFW species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats within 100 m (see Appendix B) — points = 1 Site does not meet any of the criteria above — points = 0	0

Rating of Value If score is:___**2 = H** ___**1 = M** X **0 = L** *Record the rating on the first page*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: 1st B-21 Project City/County: Spokane Sampling Date: 6/15/22

Applicant/Owner: _____ State: Washington Sampling Point: Wetland

Investigator(s): Bill Towey (TES) Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _

Subregion (LRR): B – Columbia/Snake River Plateau Lat: _____ Long: _____ Datum: NAVD 88

Soil Map Unit Name: Coccolla-Hardesty Complex NWI classification: PEMK*

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks: The slope wetland has flowing water.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
	_____ = Total Cover		
Herb Stratum (Plot size:)			
1. Phalaris arundinacea	65%	Y	FACW
2. Equisetum hyemale	25%	Y	FACW
3. Solidago spp.	10%	N	FACU
4.			
5.			
6.			
7.			
8.			
9.			
	100% = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species	x 1 =	
FACW species 90	x 2 =	180
FAC species	x 3 =	
FACU species 10	x 4 =	40
UPL species	x 5 =	
Column Totals: 100 (A)		220 (B)

Prevalence Index = B/A = 2.2

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤ 3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks:

SOIL Cocollalla-Hardesty Complex

Sampling Point: DP #1 (Wetland)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-21	10YR 2/1						silt loam	saturated
21-36							silt loam	mottling

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: Several soil pits dug to identify wetland/upland transition

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 10"

Wetland Hydrology Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: B-21 (1" CT) City/County: Spokane Sampling Date: 6/15/22

Applicant/Owner: _____ State: Washington Sampling Point: Upland

Investigator(s): Bill Towey (TES) Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _

Subregion (LRR): B – Columbia/Snake River Plateau Lat: _____ Long: _____ Datum: NAVD 88

Soil Map Unit Name: Coolulla-Hardesh Complex NWI classification: /

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: The slope wetland has flowing water.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
	= Total Cover		
Herb Stratum (Plot size:)			
1. Achillea millefolium	15%	N	FACU
2. Cynoglossum officinale	10%	N	FACU
3. Verbascum thapsus	20%	Y	FACU
4. Solidago spp.	55%	Y	FACU
5.			
6.			
7.			
8.			
9.			
	= Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species _____	x 1 =	_____
FACW species _____	x 2 =	_____
FAC species _____	x 3 =	_____
FACU species 100	x 4 =	400
UPL species _____	x 5 =	_____
Column Totals: 100 (A)		400 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

_ Dominance Test is >50%

_ Prevalence Index is ≤ 3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Cocolalla Hardesty Complex

SOIL

Upland

Sampling Point: DP #1 (Wetland)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-36	10YR 2/1						silty loam	dry, no mottling

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Remarks:

Wetland name or number "C" 1

RATING SUMMARY – Eastern Washington

Name of wetland (or ID #): "C" - 21st Project Date of site visit: 6/15/22

Rated by William T. Towey Trained by Ecology? X Yes ___ No Date of training 04/16/15

HGM Class used for rating Depressional Wetland has multiple HGM classes? ___ Y X N

NOTE: Form is not complete without the figures requested (*figures can be combined*).

Source of base aerial photo/map Google Earth, NWI Map, Soil Map, PHS Info HGM Map, 1 Km - Map

OVERALL WETLAND CATEGORY III (based on functions___ or special characteristics___)

1. Category of wetland based on FUNCTIONS

___**Category I** – Total score = 22-27

X **Category II** – Total score = 19-21

___**Category III** – Total score = 16-18

___**Category IV** – Total score = 9-15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
	Circle the appropriate ratings			
Site Potential	(H) M L	H (M) L	H M (L)	
Landscape Potential	H M (L)	H M (L)	(H) M L	
Value	(H) M L	H M (L)	H M (L)	TOTAL
Score Based on Ratings	7	4	5	16

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY *Circle the appropriate category*
Vernal Pools	II III
Alkali	I
Wetland of High Conservation Value	I
Bog and Calcareous Fens	I
Old Growth or Mature Forest – slow growing	I
Aspen Forest	I
Old Growth or Mature Forest – fast growing	II
Floodplain forest	II
None of the above	

Wetland name or number "C"

DEPRESSIONAL WETLANDS **Water Quality Functions** - Indicators that the site functions to improve water quality		Points (only 1 score per box)
D 1.0. Does the site have the potential to improve water quality?		
D 1.1. Characteristics of surface water outflows from the wetland: Wetland has no surface water outlet Wetland has an intermittently flowing outlet Wetland has a highly constricted permanently flowing outlet Wetland has a permanently flowing, unconstricted, surface outlet	points = 5 ~~points = 3~~ points = 3 points = 1	5
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions of soils)*	YES = 3 NO = 0	0
D 1.3. Characteristics of persistent vegetation (Emergent, Scrub-shrub, and/or Forested Cowardin classes) Wetland has persistent, ungrazed, vegetation for > 2/3 of area Wetland has persistent, ungrazed, vegetation from 1/3 to 2/3 of area Wetland has persistent, ungrazed vegetation from 1/10 to < 1/3 of area Wetland has persistent, ungrazed vegetation < 1/10 of area	points = 5 ~~points = 3~~ points = 1 points = 0	5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area of ponding that fluctuates every year. Do not count the area that is permanently ponded.* Area seasonally ponded is > ½ total area of wetland Area seasonally ponded is ¼ - ½ total area of wetland Area seasonally ponded is < ¼ total area of wetland	points = 3 points = 1 points = 0	3
Total for D 1	Add the points in the boxes above	13

Rating of Site Potential If score is: X **12- 16 = H** ___ **6- 11 = M** ___ **0- 5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?		
D 2.1. Does the wetland receive stormwater discharges?	Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants?	Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland? City hook up	Yes = 1 No = 0	0
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1- D 2.3? Source_____	Yes = 1 No = 0	0
Total for D 2	Add the points in the boxes above	0

Rating of Landscape Potential If score is: ___ **3 or 4 = H** ___ **1 or 2 = M** X **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?		
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, or lake that is on the 303(d) list?	Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where water quality is an issue in some aquatic resource [~~303(d)~~ list, eutrophic lakes, problems with nuisance and toxic algae]?	Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality *(answer YES if there is a TMDL for the drainage or basin in which the wetland is found)*?	Yes = 2 No = 0	2
Total for D 3	Add the points in the boxes above	3

Rating of Value If score is: X **2-4 = H** ___ **1 = M** ___ **0 = L** *Record the rating on the first page*

Wetland name or number C

DEPRESSIONAL WETLANDS **Hydrologic Functions** - Indicators that the site functions to reduce flooding and erosion.		Points (only 1 score per box)
D 4.0. Does the site have the potential to reduce flooding and erosion?		
D 4.1. Characteristics of surface water outflows from the wetland: Wetland has no surface water outlet Wetland has an intermittently flowing outlet Wetland has a highly constricted permanently flowing outlet Wetland has a permanently flowing unconstricted surface outlet *(If outlet is a ditch and not permanently flowing treat wetland as "intermittently flowing")*	points = 8 points = 4 points = 4 points = 0	8
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or deepest part (if dry).* Seasonal ponding: > 3 ft above the lowest point in wetland or the surface of permanent ponding Seasonal ponding: 2 ft - < 3 ft above the lowest point in wetland or the surface of permanent ponding The wetland is a headwater wetland Seasonal ponding: 1 ft - < 2 ft Seasonal ponding: 6 in - < 1 ft Seasonal ponding: < 6 in or wetland has only saturated soils	points = 8 points = 6 points = 4 points = 4 points = 2 points = 0	2
Total for D 4	Add the points in the boxes above	10

Rating of Site Potential If score is: ___**12-16 = H** ___**6-11 = M** ___**0-5 = L** *Record the rating on the first page*

D 5.0. Does the landscape have the potential to support the hydrologic functions of the site?		
D 5.1. Does the wetland receive stormwater discharges?	Yes = 1 No = 0	0
D 5.2. Is > 10% of the area within 150 ft of the wetland in a land use that generates runoff?	Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses?	Yes = 1 No = 0	0
Total for D 5	Add the points in the boxes above	0

Rating of Landscape Potential If score is: ___**3 = H** ___**1 or 2 = M** ___**0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?		
D 6.1. The wetland is in a landscape that has flooding problems. Choose the description that best matches conditions around the wetland being rated. *Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds), AND Flooding occurs in sub-basin that is immediately down-gradient of wetland Surface flooding problems are in a sub-basin farther down-gradient The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ There are no problems with flooding downstream of the wetland	points = 2 points = 1 points = 0 points = 0	0
D 6.2. Has the site has been identified as important for flood storage or flood conveyance in a regional flood control plan?	Yes = 2 No = 0	0
Total for D 6	Add the points in the boxes above	0

Rating of Value If score is: ___**2-4 = H** ___**1 = M** ___**0 = L** *Record the rating on the first page*

Wetland name or number C

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	(only 1 score per box)
H 1.0. Does the wetland have the potential to provide habitat for many species?	
H 1.1. Structure of the plant community: *Check the Cowardin vegetation classes present and categories of emergent plants. Size threshold for each category is >= ¼ ac or >= 10% of the wetland if wetland is < 2.5 ac.* ___Aquatic bed X Emergent plants 0-12 in (0-30 cm) high are the highest layer and have > 30% cover ___Emergent plants >12-40 in (>30-100 cm) high are the highest layer with >30% cover X Emergent plants > 40 in (> 100 cm) high are the highest layer with >30% cover ___Scrub-shrub (areas where shrubs have >30% cover) ___Forested (areas where trees have >30% cover) 4 or more checks: points = 3 3 checks: points = 2 2 checks: points = 1 1 check: points = 0	1
H 1.2. Is one of the vegetation types Aquatic Bed? Yes = 1 No = 0	0
H 1.3. Surface water H 1.3.1. Does the wetland have areas of open water (without emergent or shrub plants) over at least ¼ ac **OR** 10% of its area during the March to early June **OR** in August to the end of September? *Answer YES for Lake Fringe wetlands.* Yes = 3 points & go to H 1.4 No = go to H 1.3.2 H 1.3.2. Does the wetland have an intermittent or permanent, and unvegetated stream within its boundaries, or along one side, over at least ¼ ac or 10% of its area? *Answer yes only if H 1.3.1 is No.* Yes = 3 No = 0	0
H 1.4. Richness of plant species Count the number of plant species in the wetland that cover at least 10 ft^2. *Different patches of the same species can be combined to meet the size threshold. You do not have to name the species.* *Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Russian olive, Phragmites, Canadian thistle, yellow-flag iris, and saltcedar (Tamarisk)* # of species ____ Scoring: > 9 species: points = 2 4-9 species: points = 1 < 4 species: points = 0	0
H 1.5. Interspersion of habitats Decide from the diagrams below whether interspersion among types of plant structures (described in H 1.1), and unvegetated areas (open water or mudflats) is high, moderate, low, or none. *Use map of Cowardin and emergent plant classes prepared for questions H 1.1 and map of open water from H 1.3. If you have four or more plant classes or three classes and open water, the rating is always high.* **None** = 0 points **Low** = 1 point **Moderate** = 2 points All three diagrams in this row are **High** = 3 points Riparian braided channels with 2 classes	Figure 1

Wetland name or number C

H 1.6. Special habitat features *Check the habitat features that are present in the wetland. The number of checks is the number of points.* ____Loose rocks larger than 4 in OR large, downed, woody debris (> 4 in diameter) within the area of surface ponding or in stream. ____Cattails or bulrushes are present within the wetland. ____Standing snags (diameter at the bottom > 4 in) in the wetland or within 30 m (100 ft) of the edge. ____Emergent or shrub vegetation in areas that are permanently inundated/ponded. ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 45 degree slope) OR signs of recent beaver activity ____ Invasive species cover less than 20% in each stratum of vegetation *(canopy, sub-canopy, shrubs, herbaceous, moss/ground cover)*	0
Total for H 1 — Add the points in the boxes above	2

Rating of Site Potential If score is:___**15-18 = H** ___**7-14 = M** X**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support habitat functions of the site?	
H 2.1. Accessible habitat (only area of habitat abutting wetland). If total accessible habitat is: *Calculate:* % undisturbed habitat _____ + [(% moderate and low intensity land uses)/2] _____ = _____% > 1/3 (33.3%) of 1 km Polygon — 37% — points = 3 20-33% of 1km Polygon — points = 2 10-19% of 1km Polygon — points = 1 <10% of 1km Polygon — points = 0	3
H 2.2. Undisturbed habitat in 1 km Polygon around wetland. *Calculate:* % undisturbed habitat _____ + [(% moderate and low intensity land uses)/2] _____ = _____% Undisturbed habitat > 50% of Polygon — points = 3 Undisturbed habitat 10 - 50% and in 1-3 patches — 47% — points = 2 Undisturbed habitat 10 - 50% and > 3 patches — points = 1 Undisturbed habitat < 10% of Polygon — points = 0	2
H 2.3. Land use intensity in 1 km Polygon: > 50% of Polygon is high intensity land use — points = (2) Does not meet criterion above — points = 0	0
H 2.4. The wetland is in an area where annual rainfall is less than 12 in, and its water regime is not influenced by irrigation practices, dams, or water control structures. *Generally, this means outside boundaries of reclamation areas, irrigation districts, or reservoirs* — Yes = 3 (No = 0)	0
Total for H 2 — Add the points in the boxes above	5

Rating of Landscape Potential If score is:X**4-9 = H** ___**1-3 = M** ___**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose the highest score that applies to the wetland being rated* Site meets ANY of the following criteria: — points = 2 — It has 3 or more priority habitats within 100 m (see Appendix B) — It provides habitat for Threatened or Endangered species (any plant or animal on state or federal lists) — It is mapped as a location for an individual WDFW species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan Site has 1 or 2 priority habitats within 100 m (see Appendix B) — points = 1 Site does not meet any of the criteria above — points = 0	0

Rating of Value If score is:___**2 = H** ___**1 = M** X**0 = L** *Record the rating on the first page*

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: "C" 3rd C-21 City/County: Spokane Sampling Date: 6/15/22

Applicant/Owner: _____ State: Washington Sampling Point: "C" SP Wetland

Investigator(s): Bill Towey (TES) Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _

Subregion (LRR): B – Columbia/Snake River Plateau Lat: _____ Long: _____ Datum: NAVD 88

Soil Map Unit Name: Cocolalla-Haydesty Complex NWI classification: PEMIC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? NO Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? NO (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks: ~~The slope wetland has flowing water.~~ all three wetland criteria met

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
	_____ = Total Cover		
Herb Stratum (Plot size:)			
1. Phalaris arundinacea	65%	Y	FACW
2. Equisetum hyemale	20%	Y	FACW
3. Solidago spp.	15%	N	FACU
4.			
5.			
6.			
7.			
8.			
9.			
	100% = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	_____	x 1 =	_____
FACW species	85	x 2 =	170
FAC species	_____	x 3 =	_____
FACU species	15	x 4 =	60
UPL species	_____	x 5 =	_____
Column Totals:	100 (A)		230 (B)

Prevalence Index = B/A = 2.3

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤ 3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? X Yes _____ No _____

Remarks:

"C"

SOIL Cocolalla - Hardesty Complex

Sampling Point: DP #1 (Wetland)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1						silt loam	mottling/Saturated
24-36"	10YR/2/1 (wet)						"	mottling
	2.5Y 6/1 (dry)							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: Poorly drained. Several soil pits dug to determine upland/wetland boundary.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 12"

Wetland Hydrology Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: C-21 1st City/County: Spokane Sampling Date: 6/15/22

Applicant/Owner: _____ State: Washington Sampling Point: Upland

Investigator(s): Bill Towey (TES) Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _

Subregion (LRR): B – Columbia/Snake River Plateau Lat: _____ Long: _____ Datum: NAVD 88

Soil Map Unit Name: Cocaillalla-Haddsky Complex NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? No Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: The slope wetland has flowing water.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
	_____ = Total Cover		
Herb Stratum (Plot size:)			
1. Verbascum thapsus	5%	N	FACU
2. Rosa spp.	20%	Y	FACU
3. Cynoglossum officinale	5%	N	FACU
4. Achillea millefolium	10%	N	FACU
5.			
6. Cirsium arvense	10%	N	FACU
7. Solidago spp.	50%	Y	FACU
8.			
9.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:	
OBL species _____	x 1 =	_____
FACW species _____	x 2 =	_____
FAC species _____	x 3 =	_____
FACU species 100	x 4 =	400
UPL species _____	x 5 =	_____
Column Totals: 100 (A)		400 (B)

Prevalence Index = B/A = 4.0

Hydrophytic Vegetation Indicators:

_ Dominance Test is >50%

_ Prevalence Index is ≤ 3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

SOIL Cocolalla - Hanford Complex Upland

Sampling Point: DP #1 (Wetland)

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12"	10YR 2/1						silt loam	No Mottling
12-36	10YR 2/1						silt loam	dry No mottling

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

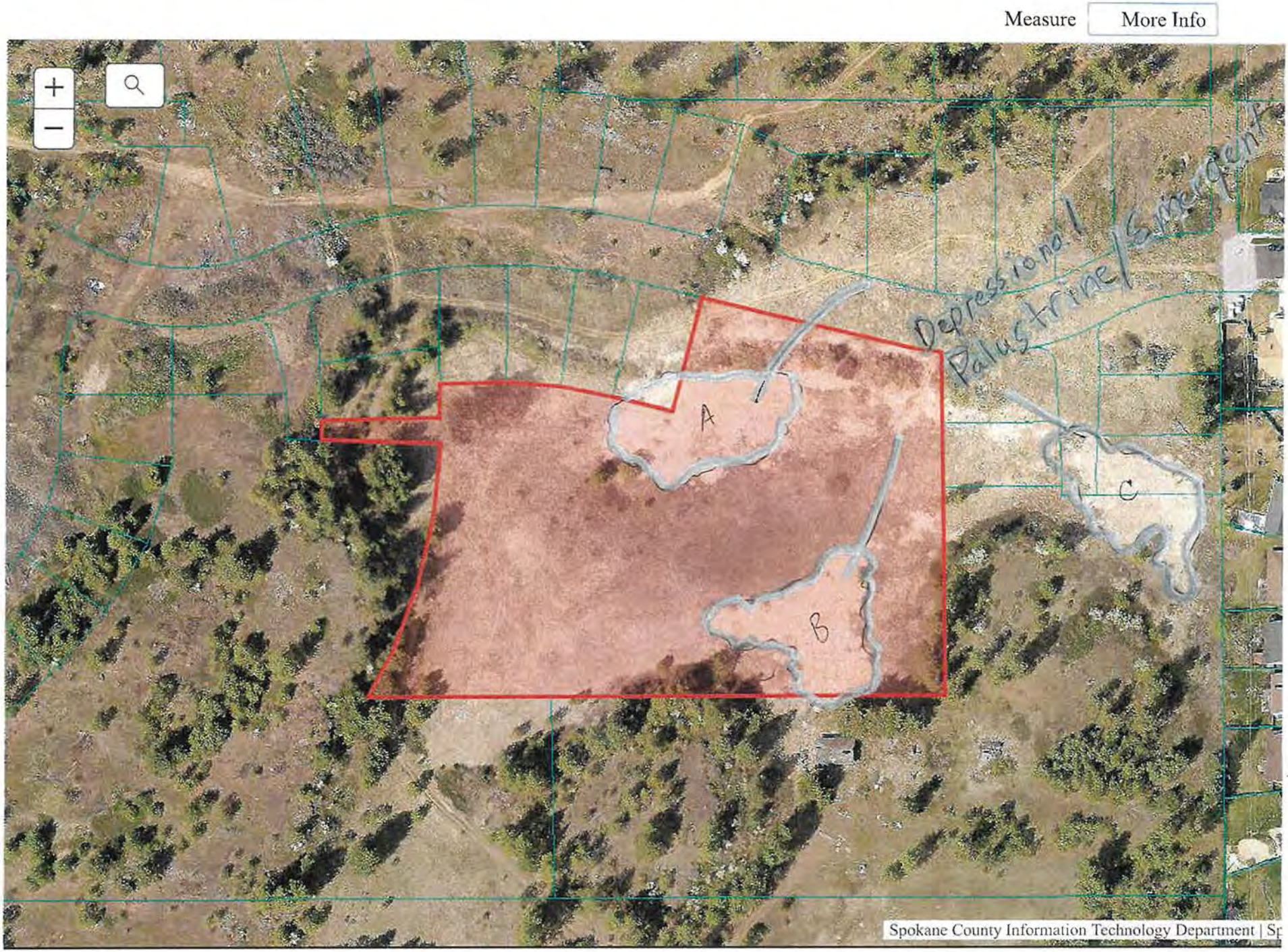
Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

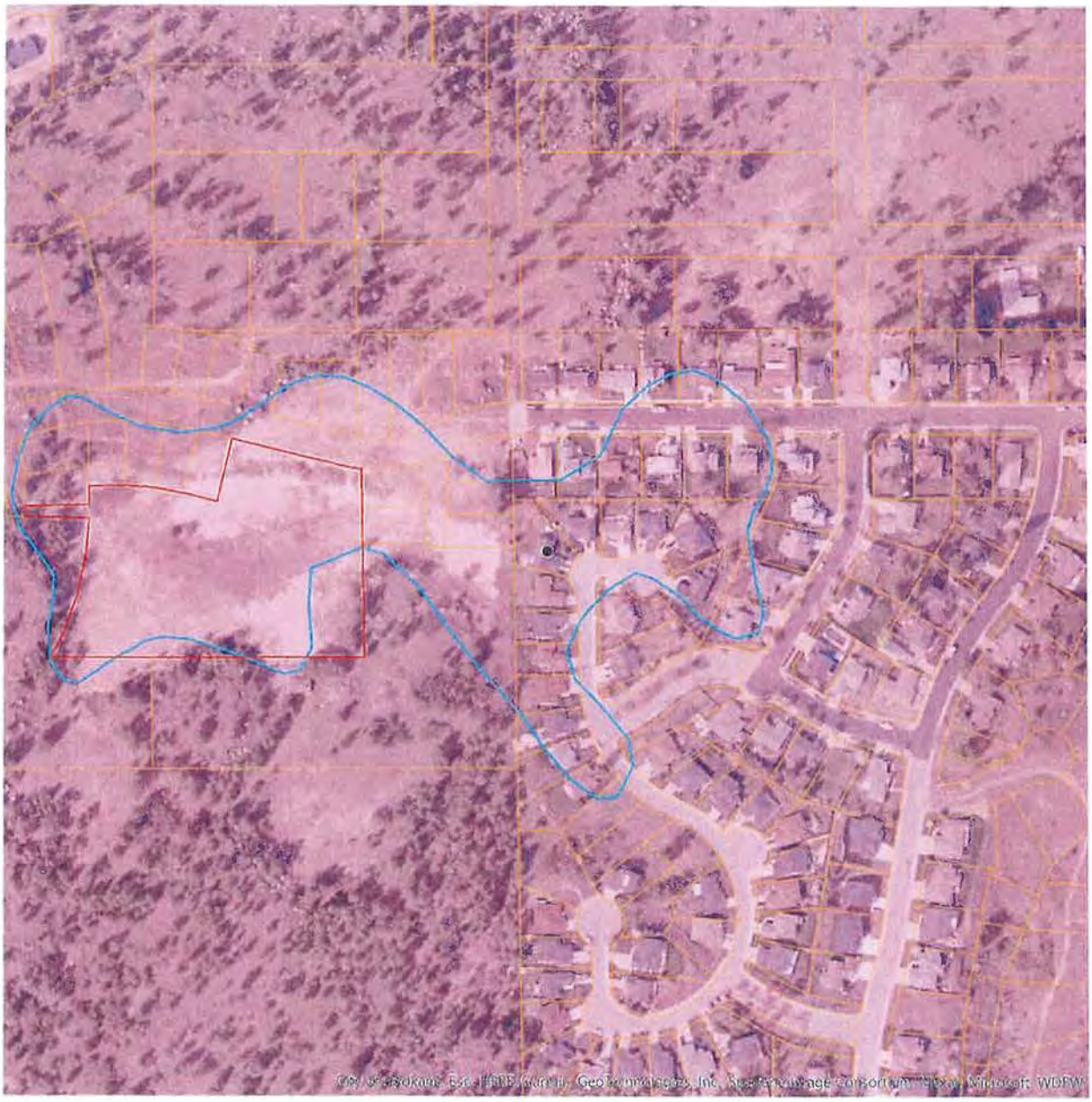
Remarks:

1Km – Map



HGM Class/Courdin

Priority Habitats and Species on the Web



Report Date: 03/15/2022, Parcel ID: 25263.2907

PHS Species/Habitats Overview:

Occurence Name	Federal Status	State Status	Sensitive Location
Mule deer	N/A	N/A	No
Freshwater Emergent Wetland	N/A	N/A	No
Big brown bat	N/A	N/A	Yes
Townsend's Big-eared Bat	N/A	Candidate	Yes

PHS Species/Habitats Details:

Mule deer	
Scientific Name	*Odocoileus hemionus hemionus*
Priority Area	Regular Concentration
Site Name	LINCOLN-SPOKANE MULE DEER HERD
Accuracy	1/4 mile (Quarter Section)
Notes	REGULAR CONCENTRATION IN WINTER TIME IN AREAS OF SHRUB. DEER ARE CONCENTRATEDON THE EDGE OF AG IN SHRUBS AND SPARCER TREED HABITAT. SOUTHERN EDGE OF LAKEROOSEVELT AND LAKE SPOKANE. MORE COMMONLY UTILIZING WINTER WHEAT AREAS.
Source Record	920012
Source Dataset	PHSREGION
Source Name	ATAMIAN, MIKE
Source Entity	WA Dept. of Fish and Wildlife
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS LISTED OCCURRENCE
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00612
Geometry Type	Polygons

Freshwater Emergent Wetland	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Freshwater Emergent Wetland - NWI Code: PEM1C
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

Big brown bat	
Scientific Name	*Eptesicus fuscus*
Notes	This polygon mask represents one or more records of the above species or habitat occurrence. Contact PHS Data Release (360-902-2543) for obtaining information about masked sensitive species and habitats.
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	Y
SGCN	N
Display Resolution	TOWNSHIP
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00605

Townsend's Big-eared Bat	
Scientific Name	*Corynorhinus townsendii*
Notes	This polygon mask represents one or more records of the above species or habitat occurrence. Contact PHS Data Release (360-902-2543) for obtaining information about masked sensitive species and habitats.
Federal Status	N/A
State Status	Candidate
PHS Listing Status	PHS Listed Occurrence
Sensitive	Y
SGCN	Y
Display Resolution	TOWNSHIP
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00027

NW¼, SEC.26, T.25N., R.42E., W.M.

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

WETLAND LEGEND

DESCRIPTION	WETLAND A	WETLAND B	WETLAND C	PROPOSED	TOTALS
EX. WETLAND AREA TO REMAIN	4,650 SF	9,120 SF	–	–	13,860 SF
WETLAND IMPACT (TO BE REMOVED)	–	–	19,340 SF	–	-19,340 SF
WETLAND REPLACEMENT @ 2:1 FROM WETLAND C	–	–	–	38,680 SF	+38,680 SF =33,200 SF REQ
EX. BUFFER AREA				367,826 SF	

EXISTING 150' BUFFER
EX. WETLAND 'A' 4,650-SF TO REMAIN
TRACT "A" 4.3 AC 185635.03 SF
150' BUFFER (TYP.)
EX. WETLAND 'B' 9,120-SF TO REMAIN
EXISTING 150' BUFFER
EX. WETLAND 'C' 19,340-SF TO BE REMOVED
NOT A PARK SUBDIVISION
PP N-S
PP E-W
RIM 2241.84
B1 L1 B1 L2 B1 L3 B1 L4 B1 L5 B1 L6 B1 L7 B1 L8
B2 L1 B2 L2 B2 L3 B2 L4 B2 L5 B2 L6 B2 L7 B2 L8
B8 L1 B8 L2 B8 L3 B8 L4 B8 L5 B8 L6 B8 L7 B8 L8 B8 L9 B8 L10 B8 L11 B8 L12 B8 L13 B8 L14 B8 L15 B8 L16 B8 L17 B8 L18 B8 L19
B7 L1 B7 L2 B7 L3 B7 L4 B7 L5 B7 L6 B7 L7 B7 L8 B7 L9 B7 L10 B7 L11 B7 L12 B7 L13
L1 L2 L3 L4 L5 L6 L7 L8 L9 L10 L11 L12 L13 L14 L15 L16 L17 L18 L19 L20 L21 L22 L23 L24 L25 L26 L27

N
W E
S
GRAPHIC SCALE
50 0 25 50 100
(IN FEET)
1 inch = 50 ft.

NAVD - 88
NAVD 88.

NO.	DATE	BY	REVISIONS
A	07/27/22	WCE	ORIGINAL PREPARATION

SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROJ #: 21-3130
DATE: 08/10/22
DRAWN: RMA
REVIEWED:

CIVIL
STRUCTURAL
SURVEYING
TRAFFIC
X PLANNING
LANDSCAPE
OTHER

WCE
WHIPPLE CONSULTING ENGINEERS
21 S PINES ROAD
SPOKANE VALLEY, WA 99206
PH: 509-893-2617 FAX: 509-926-0227

WESTRIDGE ADDITION
EXISTING WETLAND EXHIBIT
21ST AVENUE & BEARD DRIVE
SPOKANE, WA

SHEET 1 OF 4

JOB NUMBER 21-3130

P:\WCE_WORK\2021 WCE PROJECTS\2021-3130 Lemax- Westridge 21st Avenue Construction Staking (ref 21-3109)\DWG\3130-MAP MAP.dwg, EX WETLAND EXHIBIT, 8/10/2022 3:07:16 PM, vs. SMart

NW¼, SEC.26, T.25N., R.42E., W.M.

WETLAND LEGEND

DESCRIPTION	WETLAND A	WETLAND B	WETLAND C	PROPOSED	TOTALS
EX. WETLAND (A & B) AREA TO REMAIN	4,650 SF	9,120 SF	–	–	13,770 SF
EX. WETLAND C			19,340 SF		
WETLAND REPLACEMENT @ 2:1 FROM WETLAND C	–	–	–	38,680 SF REQ	+38,680 SF =52,450 SF PROVIDED
150' BUFFER AREA FOR A, B & C				219,973 SF	219,973 SF PROVIDED

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

WETLAND 'A' TO REMAIN 4,650 SF

150' BUFFER (TYP)

REPLACEMENT WETLAND FOR WETLAND C 38,680 SF

TRACT A

WETLAND 'B' TO REMAIN 9,120 SF

150' BUFFER (TYP)

BUFFER PRIOR TO MODIFICATIONS, SEE SHEET 3 OF 3

PP N-S

MW

ISSAH DIP 2241.16 E N-S
RIM 2241.84

PP N-S

PP E-S

NOT A PARK SUBDIVISION

N
W E
S

GRAPHIC SCALE
50 0 25 50 100
(IN FEET)
1 inch = 50 ft.

NAVD - 88
NAVD 88.

NO.	DATE	BY	REVISIONS
A	07/27/22	WCE	ORIGINAL PREPARATION

SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROJ #: 21-3130
DATE: 08/10/22
DRAWN: RMA
REVIEWED:

- CIVIL
- STRUCTURAL
- SURVEYING
- TRAFFIC
- X PLANNING
- LANDSCAPE
- OTHER

WCE
WHIPPLE CONSULTING ENGINEERS
21 S PINES ROAD
SPOKANE VALLEY, WA 99206
PH: 509-893-2617 FAX: 509-926-0227

WESTRIDGE ADDITION
WETLAND BUFFER EXHIBIT
21ST AVENUE & BEARD DRIVE
SPOKANE, WA

SHEET 2 OF 4

JOB NUMBER 21-3130

NW¼, SEC.26, T.25N., R.42E., W.M.

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

WETLAND LEGEND

DESCRIPTION	WETLAND A	WETLAND B	WETLAND C	PROPOSED	TOTALS
EX. WETLAND AREA TO REMAIN	4,650 SF	9,120 SF	–	–	13,770 SF
WETLAND REPLACEMENT @ 2:1 FROM WETLAND C	–	–	–	38,680 SF	±38,680 SF = 52,450 SF PROVIDED
BUFFER TO REMAIN				161,342 SF	161,342 SF
REDUCED WETLAND BUFFER				−58,631 SF	−58,631 SF
REPLACEMENT WETLAND BUFFER				58,631 SF	58,631 SF 219,973 SF PROVIDED

REDUCED WETLAND BUFFER AREA FROM 150' TO 75'
= 31,961−SF

MODIFIED 150' BUFFER

PROPOSED BUFFER

BUFFER AREA TO REMAIN 161,342−SF

TOTAL WETLAND AREA 52,450 SF

TRACT A

MODIFIED 150' BUFFER

PROPOSED BUFFER

REDUCED WETLAND BUFFER AREA FROM 150' TO 75'
= 26,650−SF

REPLACEMENT WETLAND BUFFER AREA 58,611 SF

MODIFIED 150' BUFFER

PROPOSED BUFFER

PP N-S

SSMH DIP 3-241E N-S
RIM 2241.84

NOT A PARK SUBDIVISION

N
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GRAPHIC SCALE
50 0 25 50 100
(IN FEET)
1 inch = 50 ft.

NAVD - 88
NAVD 88.

NO.	DATE	BY	REVISIONS
A	07/27/22	WCE	ORIGINAL PREPARATION

SCALE:		PROJ #:	21-3130
HORIZONTAL:	1" = 50'	DATE:	08/10/22
VERTICAL:	N/A	DRAWN:	RMA
		REVIEWED:	

- CIVIL
- STRUCTURAL
- SURVEYING
- TRAFFIC
- [X] PLANNING
- LANDSCAPE
- OTHER

WCE
WHIPPLE CONSULTING ENGINEERS
21 S PINES ROAD
SPOKANE VALLEY, WA 99206
PH 509-893-2617 FAX 509-926-0227

WESTRIDGE ADDITION
MODIFIED BUFFER EXHIBIT
21ST AVENUE & BEARD DRIVE
SPOKANE, WA

SHEET 3 OF 4

JOB NUMBER 21-3130

I:\CIVIL_WORK\2021 WCE PROJECTS\2021-3130 Lennar- Westridge 21st Avenue Construction Staking (ref 21-3109)\DWG\3130-MIT MAP.dwg, WETLAND BUFFER EXHIBIT, 8/10/2022 3:07:56 PM, rk, SMM

NW¼, SEC.26, T.25N., R.42E., W.M.

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

NOTES:
* USE TRUNK FLARE TO DETERMINE THE REAL TOP OF THE ROOTBALL, THEN PLANT TRUNK FLARE AND TOP OF ROOTBALL AT GRADE.

1 DECIDUOUS TREE DETAIL

NOT TO SCALE M-SPV-03

2 SHRUB DETAIL

NOT TO SCALE M-SPV-05

PLANTING GUIDELINES

1. TREES– 12 FEET MIN. ON CENTER
   SHRUBS– 8 FEET MIN. ON CENTER
2. PLANT IN A NATURAL PATTERN WITH LIKE PLANTS BLENDING INTO THE REST OF THE PLANT MATERIAL IN THE MIX.
3. SPACING SHOULD NOT BE SYMMETRICAL.

PLANTING LEGEND

SYMBOL	DESCRIPTION
	MIX 1
	MIX 2
	MIX 3
	MIX 4
	MIX 5
	MIX 6

PLANT COUNTS

MIX 1:

QA	QUAKING ASPEN	@ 20%	87
TA	THINLEAF ALDER	@ 20%	85
DW	DOGWOOD	@ 60%	262

MIX 2:

SS	SERVICEBERRY	@ 20%	113
WW	DUNE WILLOW	@ 26%	146
SB	SNOWBERRY	@ 27%	149
DW	DOGWOOD	@ 27%	148

MIX 3:

CC	CHOKECHERRY	@ 20%	73
RR	ROSE	@ 40%	145
SB	SNOWBERRY	@ 40%	145

MIX 4:

CC	CHOKECHERRY	@ 20%	39
GC	GOLDEN CURRANT	@ 26%	52
MO	MOCKORANGE	@ 27%	52
RR	ROSE	@ 27%	52

MIX 5:
WETLAND GRASS MIX: 52,450 SF
BLUE WILD RYE
WESTERN MANNAGRASS
MEADOW BARLEY
AMERICAN SLOUGHGRASS
TUFTED HAIRGRASS

2–3 POUNDS PER 1,000 SF

MIX 6:
UPLAND GRASS MIX: 60,705 SF
BROME
CRESTED WHEAT GRASS
FESCUE
WILDRYE GRASS

2–3 POUNDS PER 1,000 SF

TOTAL COUNTS

	NAME	SIZE	NUMBER
QA	QUAKING ASPEN POPULUS TREMULOIDES	1 GAL	87
TA	THINLEAF ALDER ALNUS TENUIFOLIA	1 GAL	85
DW	DOGWOOD CORNUS STOLONIFERA	1 GAL	410
SS	SERVICEBERRY AMELANCHIER ALNIFOLIA	1 GAL	113
WW	DUNE WILLOW SALIX HOOKERIANA	1 GAL	146
SB	SNOWBERRY SYMPHORICARPOS ALBUS	I GAL	294
CC	CHOKECHERRY PRUNUS VIRGINIANA	1 GAL	112
RR	ROSE ROSA WOODSII	1 GAL	197
GC	GOLDEN CURRANT RIBES AUREUM	1 GAL	52
MO	MOCKORANGE PHILADELPHUS LEWISII	1 GAL	52

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W E
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	LANDSCAPE
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WESTRIDGE ADDITION
MITIGATION PLAN
21ST AVENUE & BEARD DRIVE
SPOKANE, WA

SHEET 4 OF 4

JOB NUMBER 21-3130