



INSIGHT ENGINEERING CO.

**STORMWATER SITE PLAN**  
**For**  
**Kendall Auto Group**

**Prepared for**  
City of Marysville  
80 Columbia Ave.  
Marysville, WA 98270

**Project Site Location:**  
XXXXX Smokey Point Blvd  
Marysville, WA 98271

**Applicant:**  
Kendall Auto Group  
8854 W. Emerald St, Ste. 260  
Boise, ID 83704

**Contact:**  
IECO  
P.O. Box 1478  
Everett, WA 98206  
425-303-9363

**Tax Id:** 31052800301200, 31052800300600  
**IECO Project:** 20-1092

**Certified Erosion and Sedimentation Control Lead:**  
To be named by contractor

Stormwater Site Plan Prepared By:  
Shilpa Xavier

Stormwater Site Plan Preparation Date:  
June 23, 2022

**Date Revised:**  
**October 19<sup>th</sup>, 2022**

Approximate Construction Date:  
May 1<sup>st</sup>, 2023



10/25/2022

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## Acronyms and Abbreviations

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BMP	Best Management Practices
DOE	Department of Ecology
ESC	Erosion and Sediment Control
IECO	Insight Engineering Company
MR	Minimum Requirement
SWPPP	Stormwater Pollution Prevention Plan
SWMMWW	Stormwater Management Manual for Western Washington
TESC	Temporary Erosion and Sediment Control
WWHM	Western Washington Hydrology Model

## 1.0 Executive Summary

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The proposed project *Kendall Auto Group* is located at XXXXX Smokey Point BLVD in City of Marysville, Washington. More generally, the site is located within the SW ¼ of Section 28, Township 31 North, and Range 5 East of the Willamette Meridian. Please refer to the Vicinity Map attached later in the section. This report follows City of Marysville Drainage and Erosion Control Design Standards (April 1999, revised June 2016) and the 2019 SWMMWW.

The site contains 11.62 acres after BLA. The existing site is undeveloped. Based on the topography the site is flat and contains one drainage basin that drains to the south. Per NRCS survey of Snohomish County, the project site contains Custer and Norma soils that have a hydrologic classification of Type “D”. Please refer to the soils map and descriptions attached later in this report for more details. Refer to section 4 of this report for the existing basin summary.

The project proposal is to develop the site by constructing a car dealership building and parking with associated utilities. The total clearing area for the project is 12.48 acres. The new impervious area onsite is 460,644 SF.

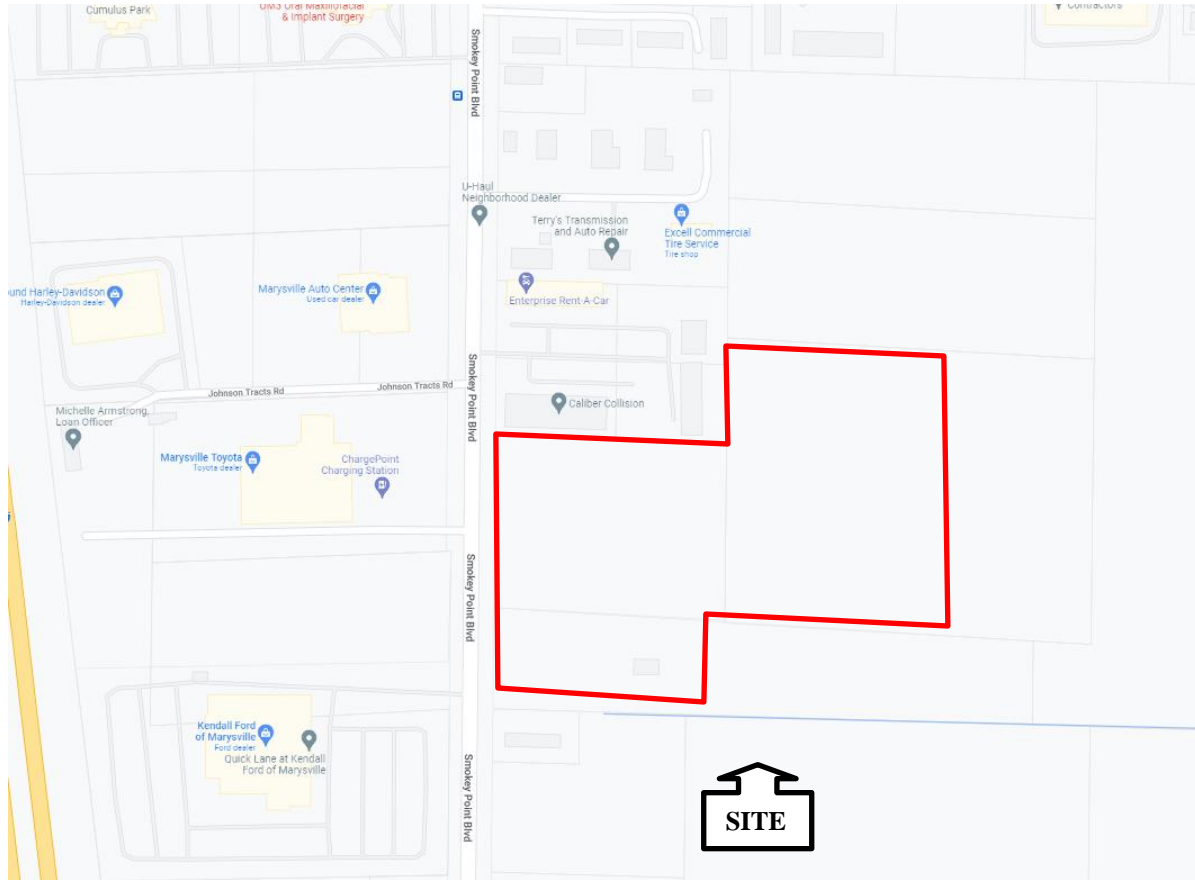
Per conversation with the City minimum requirements #1-5 shall apply for this project. Minimum Requirements #6-9 are taken care of through the existing storm system on site that flows to a regional detention pond that will provide the site flow control and water quality. See Section 1.2 for Minimum Requirements Summary included later in this report.

Onsite stormwater management was evaluated using List #1 per section 2.5.5 of the SWMMWW. Full dispersion was considered infeasible due to a lack of native vegetation, Permeable pavement, rain gardens, and bioretention have been deemed infeasible due to high groundwater levels. Seasonal groundwater levels have been observed as shallow as 2-feet below grade. Please refer to the geotechnical report in section 5B for more details. Sheet flow dispersion is also infeasible as the required vegetated flow paths could not be met due to the large impervious footprint of the project. BMP T5.13 will be used for all pervious areas. Pervious areas will infiltrate

into the underlying soils. Impervious areas will be conveyed to the existing stormwater system which will provide flow control and water quality. The downstream public channel should not experience any future flooding problems as the system has been designed to handle the impervious development area.

Please refer to the Operation and Maintenance Manual in Section 5 Appendix C.

**VICINITY MAP**



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**Figure 1 -Vicinity Map**  
 Kendall Auto Group  
 Marysville, Washington

<b>SCALE:</b> NTS	<b>DATE:</b> 10/25/22	<b>JOB #:</b> 20-1092
<b>BY:</b> SX	<b>FILE NAME:</b> 20-1092/doc/drainage report	

## 1.2 Minimum Requirements Summary

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**MR : Minimum Requirement**

**SWPPP : Stormwater Pollution Prevention Plan**

**MR #1 Stormwater Site Plan Narrative:** This report follows City of Marysville Drainage and Erosion Control Design Standards (April 1999, revised June 2016) and the 2019 SWMMWW.

**MR #2 SWPPP Narrative:** A SWPPP has been included in section 5 of this report.

**MR #3 Water Pollution Source Control for New Development:** A covered car wash section is proposed within the building. Any runoff from this area will be directed to the sewer system through a coalescing plate oil/water separator.

**MR #4 Preservation of Natural Drainage Systems and Outfalls:** The runoff from the storage lot will be connected to the existing drainage system on-site to continue following the natural drainage flow path.

**MR #5 Onsite Stormwater Management:** Onsite stormwater management was evaluated using List #1 per section 2.5.5 of the SWMMWW. Full dispersion was considered infeasible due to a lack of native vegetation, Permeable pavement, rain gardens, and bioretention have been deemed infeasible due to high groundwater levels. Seasonal groundwater levels have been observed as shallow as 2-feet below grade. Please refer to the geotechnical report in section 5B for more details. Sheet flow dispersion is also infeasible as the required vegetated flow paths could not be met due to the large impervious footprint of the project. BMP T5.13 will be used for all pervious areas. Pervious areas will infiltrate into the underlying soils.

## 2.0 Existing Conditions

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The proposed project *Kendall Auto Group* is located at XXXXX Smokey Point BLVD in City of Marysville, Washington. More generally, the site is located within the SW ¼ of Section 28, Township 31 North, and Range 5 East of the Willamette Meridian. Please refer to the Vicinity Map attached later in the section.

The existing site is undeveloped. Based on the topography the site is flat and contains one drainage basin that drains to the south. Per NRCS survey of Snohomish County, the project site contains Custer and Norma soils that have a hydrologic classification of Type “D”. Please refer to the soils map and descriptions attached later in this report for more details. Refer to section 4 of this report for the existing basin summary.



## *SOIL MAP*



### SOILS LEGEND

**13- Custer fine sandy loam**

**39-Norma loam**



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**Figure 2 - Soil Map**  
Kendall Auto Group  
Marysville, Washington

**SCALE:**  
NONE

**DATE:** 10/25/22

**JOB #:** 20-1092

**BY:** SX

**FILE NAME:**  
20-1092\docs\drainage report

## **Snohomish County Area, Washington**

### **13—Custer fine sandy loam**

#### Map Unit Setting

- *National map unit symbol:* 2hy0
- *Elevation:* 0 to 150 feet
- *Mean annual precipitation:* 32 to 50 inches
- *Mean annual air temperature:* 48 to 50 degrees F
- *Frost-free period:* 150 to 200 days
- *Farmland classification:* Prime farmland if irrigated and drained

#### Map Unit Composition

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

#### Description of Custer, Undrained

##### **Setting**

- *Landform:* Outwash plains
- *Parent material:* Glacial outwash

##### **Typical profile**

- *H1 - 0 to 9 inches:* fine sandy loam
- *H2 - 9 to 35 inches:* sand
- *H3 - 35 to 60 inches:* sand

##### **Properties and qualities**

- *Slope:* 0 to 2 percent
- *Depth to restrictive feature:* 20 to 40 inches to strongly contrasting textural stratification
- *Natural drainage class:* Poorly drained
- *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.57 in/hr)
- *Depth to water table:* About 0 to 12 inches
- *Frequency of flooding:* None
- *Frequency of ponding:* None
- *Salinity, maximum in profile:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
- *Available water storage in profile:* Low (about 3.1 inches)

##### **Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 5w
- *Hydrologic Soil Group:* C/D
- *Forage suitability group:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

#### Minor Components

##### **Norma, undrained**

- *Percent of map unit:* 5 percent
- *Landform:* Depressions

- *Hydric soil rating: Yes*

**Custer, drained**

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

**Indianola**

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

**Snohomish County Area, Washington**

**39—Norma loam**

Map Unit Setting

- *National map unit symbol: 2hyx*
- *Elevation: 0 to 1,000 feet*
- *Mean annual precipitation: 35 to 60 inches*
- *Mean annual air temperature: 48 to 52 degrees F*
- *Frost-free period: 150 to 200 days*
- *Farmland classification: Prime farmland if drained*

Map Unit Composition

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

Description of Norma, Undrained

**Setting**

- *Landform: Drainageways, depressions*
- *Parent material: Alluvium*

**Typical profile**

- *H1 - 0 to 10 inches: ashy loam*
- *H2 - 10 to 28 inches: sandy loam*
- *H3 - 28 to 60 inches: sandy loam*

**Properties and qualities**

- *Slope: 0 to 3 percent*
- *Depth to restrictive feature: More than 80 inches*
- *Drainage class: Poorly drained*
- *Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)*
- *Depth to water table: About 0 inches*
- *Frequency of flooding: None*
- *Frequency of ponding: Frequent*
- *Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)*

### **Interpretive groups**

- *Land capability classification (irrigated):* None specified
- *Land capability classification (nonirrigated):* 5w
- *Hydrologic Soil Group:* B/D
- *Ecological site:* F002XA007WA - Puget Lowlands Wet Forest
- *Forage suitability group:* Wet Soils (G002XN102WA)
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

Minor Components

### **Terric medisaprists, undrained**

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

### **Bellingham, undrained**

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Other vegetative classification:* Wet Soils (G002XN102WA)
- *Hydric soil rating:* Yes

### **Norma, drained**

- *Percent of map unit:* 5 percent
- *Landform:* Depressions
- *Other vegetative classification:* Seasonally Wet Soils (G002XN202WA)
- *Hydric soil rating:* Yes

### **3.0 Offsite Analysis**

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The site contains 11.62 acres after BLA. No visible on-site drainage problems were observed at the time of field investigations.

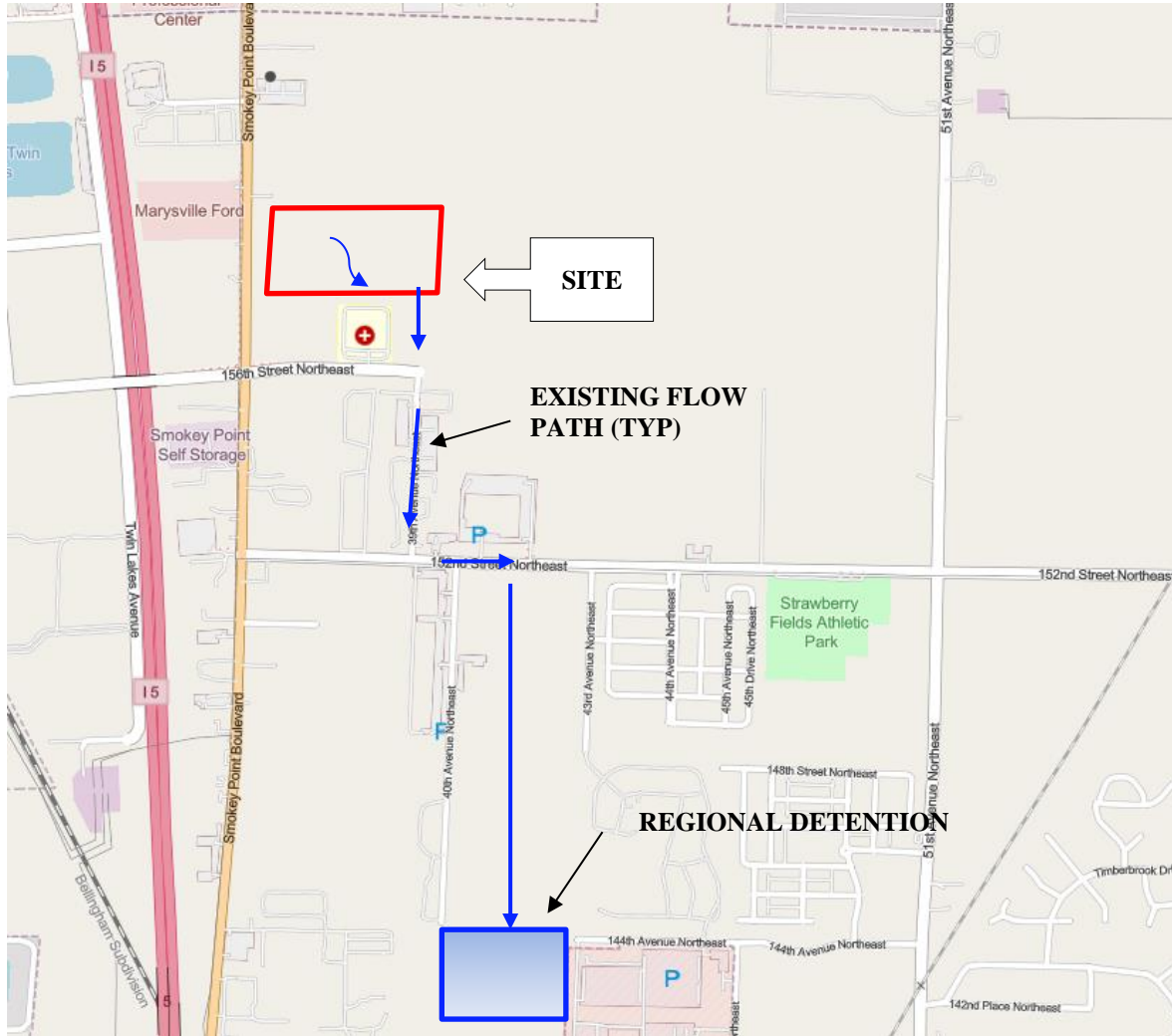
#### **3.1 Upstream Analysis**

Based on the site reconnaissance and the topographic survey of the site, the upstream flows appear to be minimal.

#### **3.2 Downstream Analysis**

The entire site is generally flat and contains one drainage basin that drains to the south property line. The flow travels approximately 150-feet to the south of the southeast corner of the site to enter the existing storm system at 39<sup>th</sup> Ave SE. The flow then follows 39<sup>th</sup> Ave for about 2,700-feet via 42-inch corrugated polyethylene pipe. The flow then turns east along 152<sup>nd</sup> St NE for about 625-feet before crossing and continuing south through an undeveloped parcel for approximately 1,350-feet to the regional detention pond. This is where the downstream analysis was completed. There did not appear to be any restrictions or erosion problems within this distance.

**DOWNSTREAM ANALYSIS MAP**



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**Figure 3 – Downstream Analysis**  
 Kendall Auto Group  
 Marysville, Washington

<b>SCALE:</b> NONE	<b>DATE:</b> 10/25/22	<b>JOB #:</b> 20-1092
<b>BY:</b> SX	<b>FILE NAME:</b> 20-1092\docs\drainage report	

#### 4.0 Permanent Stormwater Control Plan

---

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The project proposal is to develop the site by constructing a car dealership building and parking with associated utilities. The total clearing area for the project is 12.48 acres. The new impervious area onsite is 460,644 SF.

Per conversation with the City minimum requirements #1-5 shall apply for this project. Minimum Requirements #6-9 are taken care of through the existing storm system on site that flows to a regional detention pond that will provide the site flow control and water quality. See Section 1.2 for Minimum Requirements Summary included later in this report.

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#### 4.1 Existing Basin Summary

Site Area (after BLA)	= 11.62 Acres
<u>Clearing Area</u>	= 12.48 Acres
Existing Basin	= 12.48 Acres

#### 4.2 Developed Basin Summary

<u>Clearing Area</u>	= 12.48 Acres
Developed Basin	= 12.48 Acres

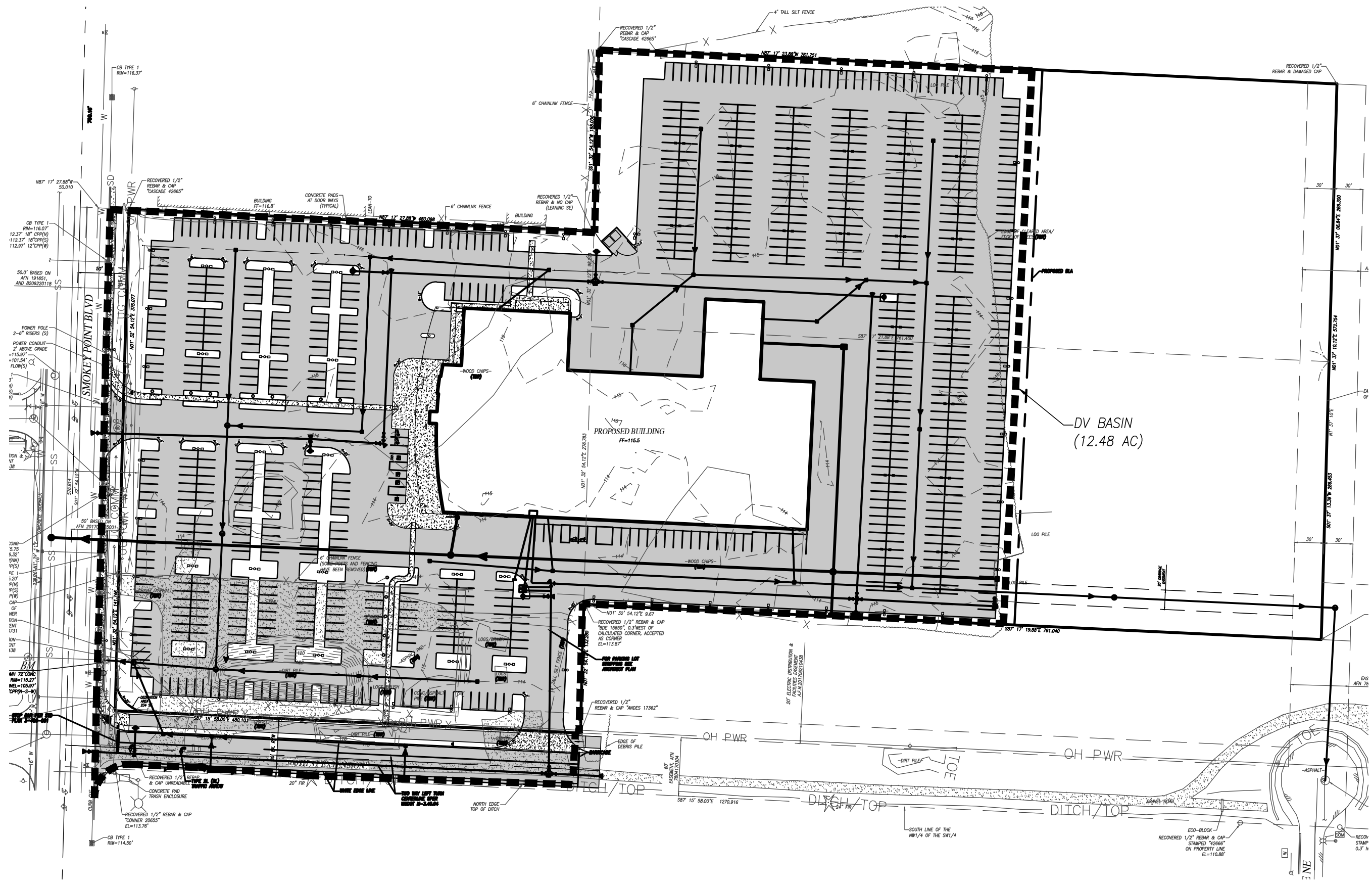
##### **Site Impervious:**

Frontage Road	= 24,015 SF (0.55 Acres)
Frontage SW	= 4,133 SF (0.09 Acres)
Onsite SW	= 7,941 SF (0.18 Acres)
Roof	= 75,577 SF (1.74 Acres)
<u>Parking</u>	= 348,978 SF (8.01 acres)
Total Impervious	= 460,644 SF (10.57 Acres)

**Permeable Area (Lawn):** = 12.48 Acres - 10.57 Acres = 1.91 Acres







SCALE: 1" = 100'

**DEVELOPED BASIN MAP**

### **4.3 Conveyance Analysis and Design**

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An onsite conveyance analysis was performed using “Storm and Sanitary Analysis” software using the “SBUH” method for the onsite conveyance system. A conveyance analysis for 25-yr and backwater analysis for 100-yr storm was also analyzed.

Refer to the following pages for a detailed analysis.

## **Conveyance Layout**



**25-Yr Conveyance Report**

\*\*\*\*\*

Project Description

\*\*\*\*\*

File Name ..... Kendall Auto.SPF

\*\*\*\*\*

Analysis Options

\*\*\*\*\*

Flow Units ..... cfs  
Subbasin Hydrograph Method. Santa Barbara UH  
Time of Concentration..... User-Defined  
Link Routing Method ..... Kinematic Wave  
Storage Node Exfiltration.. None  
Starting Date ..... JUL-27-2022 00:00:00  
Ending Date ..... JUL-28-2022 00:00:00  
Report Time Step ..... 00:00:10

\*\*\*\*\*

Element Count

\*\*\*\*\*

Number of rain gages ..... 2  
Number of subbasins ..... 23  
Number of nodes ..... 28  
Number of links ..... 26

\*\*\*\*\*

Raingage Summary

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Gage ID	Data Source	Data Type	Recording Interval	min
Rain Gage-01	TS-01	INTENSITY	6.00	
Rain Gage-02	TS-02	INTENSITY	6.00	

\*\*\*\*\*

Subbasin Summary

\*\*\*\*\*

Subbasin	Total Area	Imperv. Area	Raingage
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ID	acres	%	
Sub-01	0.73	87.00	Rain Gage-01
Sub-02	0.56	77.00	Rain Gage-01
Sub-03	0.51	90.00	Rain Gage-01
Sub-04	0.37	81.00	Rain Gage-01
Sub-05	0.23	87.00	Rain Gage-01
Sub-06	0.58	84.00	Rain Gage-01
Sub-07	0.67	91.00	Rain Gage-01
Sub-08	0.03	100.00	Rain Gage-01
Sub-09	0.04	50.00	Rain Gage-01
Sub-10	0.13	100.00	Rain Gage-01
Sub-11	0.25	80.00	Rain Gage-01
Sub-12	0.89	100.00	Rain Gage-01
Sub-13	0.40	100.00	Rain Gage-01
Sub-14	0.43	100.00	Rain Gage-01
Sub-15	0.19	100.00	Rain Gage-01
Sub-16	0.46	100.00	Rain Gage-01
Sub-17	0.46	100.00	Rain Gage-01
Sub-18	0.62	100.00	Rain Gage-01
Sub-19	0.71	100.00	Rain Gage-01
Sub-20	0.55	100.00	Rain Gage-01
Sub-21	0.54	100.00	Rain Gage-01
Sub-22	1.10	99.00	Rain Gage-01
Sub-23	0.61	92.00	Rain Gage-01

\*\*\*\*\*

Node Summary

\*\*\*\*\*

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft <sup>2</sup>	External Inflow
CB-01	JUNCTION	109.06	113.50	0.00	
CB-01A	JUNCTION	108.00	114.60	0.00	
CB-02	JUNCTION	110.39	113.50	0.00	
CB-03	JUNCTION	111.00	113.50	0.00	
CB-04	JUNCTION	109.77	115.00	0.00	
CB-05	JUNCTION	110.39	116.20	0.00	
CB-06	JUNCTION	112.75	115.25	0.00	
CB-07	JUNCTION	111.06	114.20	0.00	
CB-08	JUNCTION	112.78	115.50	0.00	
CB-09	JUNCTION	113.00	115.50	0.00	
CB-10	JUNCTION	111.87	115.80	0.00	
CB-11	JUNCTION	112.80	115.30	0.00	
CB-12	JUNCTION	112.53	115.00	0.00	
CB-13	JUNCTION	112.11	114.75	0.00	
CB-14	JUNCTION	112.88	115.40	0.00	
CB-15	JUNCTION	111.20	115.00	0.00	



CB-16	JUNCTION	112.50	115.00	0.00
CB-17	JUNCTION	110.85	114.25	0.00
CB-18	JUNCTION	112.20	114.70	0.00
CB-19	JUNCTION	109.54	114.00	0.00
CB-20	JUNCTION	108.71	113.50	0.00
CB-21	JUNCTION	109.85	114.00	0.00
CB-22	JUNCTION	111.12	113.50	0.00
CB-23E	JUNCTION	107.67	113.30	0.00
CB-24	JUNCTION	106.51	113.53	0.00
CB-F	JUNCTION	108.50	113.50	0.00
EXCB-SE	JUNCTION	105.38	111.71	0.00
EXCBW	JUNCTION	105.97	115.27	0.00

\*\*\*\*\*  
Link Summary  
\*\*\*\*\*

Link Manning's ID Roughness	From Node	To Node	Element Type	Length ft	Slope %
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Link-18 0.0120	CB-16	CB-15	CONDUIT	71.0	1.8732
P-01 0.0120	CB-01	CB-01A	CONDUIT	95.2	1.1137
P-01A 0.0120	CB-01A	EXCBW	CONDUIT	29.0	7.0000
P-02 0.0120	CB-02	CB-01	CONDUIT	137.0	0.5036
P-03 0.0120	CB-03	CB-02	CONDUIT	122.0	0.5000
P-04 0.0120	CB-04	CB-01	CONDUIT	141.0	0.5035
P-05 0.0120	CB-05	CB-04	CONDUIT	123.0	0.5041
P-06 0.0120	CB-06	CB-05	CONDUIT	169.0	0.5030
P-07 0.0120	CB-07	CB-05	CONDUIT	134.0	0.5000
P-08 0.0120	CB-08	CB-07	CONDUIT	108.0	0.5000
P-09 0.0120	CB-09	CB-08	CONDUIT	44.0	0.5000
P-10 0.0120	CB-10	CB-07	CONDUIT	161.0	0.5031
P-11 0.0120	CB-11	CB-10	CONDUIT	185.0	0.5027

P-12 0.0120	CB-12	CB-13	CONDUIT	82.0	0.5122
P-13 0.0120	CB-13	CB-15	CONDUIT	178.0	0.5112
P-14 0.0120	CB-14	CB-13	CONDUIT	151.0	0.5099
P-15 0.0120	CB-15	CB-17	CONDUIT	68.0	0.5147
P-17 0.0120	CB-17	CB-19	CONDUIT	158.0	0.5127
P-18 0.0120	CB-18	CB-17	CONDUIT	139.0	0.5036
P-19 0.0120	CB-19	CB-20	CONDUIT	164.0	0.5061
P-20 0.0120	CB-20	CB-23E	CONDUIT	204.0	0.5098
P-21 0.0120	CB-21	CB-20	CONDUIT	126.0	0.5079
P-22 0.0120	CB-22	CB-21	CONDUIT	249.0	0.5100
P-23 0.0120	CB-23E	CB-24	CONDUIT	228.0	0.5088
P-24 0.0120	CB-24	EXCB-SE	CONDUIT	203.0	0.5567
P-F 0.0120	CB-F	CB-01A	CONDUIT	81.0	0.6173

\*\*\*\*\*

Cross Section Summary

\*\*\*\*\*

Link Full Flow ID Hydraulic Radius ft	Shape Design Flow Capacity cfs	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft <sup>2</sup>
------------------------------------------------------	--------------------------------------------	--------------------------	-------------	-------------------	-----------------------------------------------

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Link-18 0.25	CIRCULAR 5.28	1.00	1.00	1	0.79
P-01 0.25	CIRCULAR 4.07	1.00	1.00	1	0.79
P-01A 0.25	CIRCULAR 10.21	1.00	1.00	1	0.79
P-02 0.25	CIRCULAR 2.74	1.00	1.00	1	0.79

P-03	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-04	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-05	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-06	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-07	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-08	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-09	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-10	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-11	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-12	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-13	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-14	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-15	CIRCULAR	1.00	1.00	1	0.79
0.25	2.77				
P-17	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-18	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-19	CIRCULAR	1.50	1.50	1	1.77
0.38	8.10				
P-20	CIRCULAR	1.50	1.50	1	1.77
0.38	8.13				
P-21	CIRCULAR	1.00	1.00	1	0.79
0.25	2.75				
P-22	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-23	CIRCULAR	1.50	1.50	1	1.77
0.38	8.12				
P-24	CIRCULAR	1.50	1.50	1	1.77
0.38	8.49				
P-F	CIRCULAR	1.00	1.00	1	0.79
0.25	3.03				

\*\*\*\*\*  
Runoff Quantity Continuity  
\*\*\*\*\*  
Total Precipitation .....

Volume  
acre-ft  
-----  
2.389

Depth  
inches  
-----  
2.592

Surface Runoff ..... 2.090 2.268  
 Continuity Error (%) ..... 0.000

\*\*\*\*\*  
 Flow Routing Continuity                    Volume                    Volume  
                                                                                  acre-ft                    Mgallons  
 \*\*\*\*\*  
 External Inflow ..... 0.000 0.000  
 External Outflow ..... 2.082 0.679  
 Initial Stored Volume .... 0.000 0.000  
 Final Stored Volume ..... 0.005 0.002  
 Continuity Error (%) ..... 0.001

\*\*\*\*\*  
 Composite Curve Number Computations Report  
 \*\*\*\*\*

-----  
 Subbasin Sub-01  
 -----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----  
 -----  
 Composite Area & Weighted CN                    0.73  
 95.14

-----  
 Subbasin Sub-02  
 -----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----  
 -----  
 Composite Area & Weighted CN                    0.56  
 92.94

-----  
 Subbasin Sub-03  
 -----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----



96.02

-----  
Subbasin Sub-08  
-----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----  
-----  
Composite Area & Weighted CN                      0.03  
98.00

-----  
Subbasin Sub-09  
-----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----  
-----  
Composite Area & Weighted CN                      0.04  
87.00

-----  
Subbasin Sub-10  
-----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----  
-----  
Composite Area & Weighted CN                      0.13  
98.00

-----  
Subbasin Sub-11  
-----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----  
-----  
Composite Area & Weighted CN                      0.25  
93.60

-----  
Subbasin Sub-12  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.89

-----  
Subbasin Sub-13  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.40

-----  
Subbasin Sub-14  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.43

-----  
Subbasin Sub-15  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.19

-----  
Subbasin Sub-16  
-----





Soil/Surface Description (acres) Group  
CN

-----  
-----  
Composite Area & Weighted CN 0.55  
98.00

-----  
Subbasin Sub-21  
-----

Soil/Surface Description Area Soil  
CN (acres) Group

-----  
-----  
Composite Area & Weighted CN 0.54  
98.00

-----  
Subbasin Sub-22  
-----

Soil/Surface Description Area Soil  
CN (acres) Group

-----  
-----  
Composite Area & Weighted CN 1.10  
97.78

-----  
Subbasin Sub-23  
-----

Soil/Surface Description Area Soil  
CN (acres) Group

-----  
-----  
Composite Area & Weighted CN 0.61  
96.24

\*\*\*\*\*  
Runoff Coefficient Computations Report  
\*\*\*\*\*

-----  
Subbasin Sub-01

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.73	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.73	

Subbasin Sub-02

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.56	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.56	

Subbasin Sub-03

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.51	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.51	

Subbasin Sub-04

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
----------------------------------------------	-----------------	---------------

---

-	0.37	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.37	
0.72		

-----  
Subbasin Sub-05  
-----

	Area	Soil
Runoff	(acres)	Group
Soil/Surface Description		
Coeff.		

---

-	0.23	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.23	
0.72		

-----  
Subbasin Sub-06  
-----

	Area	Soil
Runoff	(acres)	Group
Soil/Surface Description		
Coeff.		

---

-	0.58	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.58	
0.72		

-----  
Subbasin Sub-07  
-----

	Area	Soil
Runoff	(acres)	Group
Soil/Surface Description		
Coeff.		

---

-	0.67	-
0.72		

Composite Area & Weighted Runoff Coeff. 0.67  
0.72

-----  
Subbasin Sub-08  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.03 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.03  
0.72

-----  
Subbasin Sub-09  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.04 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.04  
0.72

-----  
Subbasin Sub-10  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.13 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.13  
0.72

-----  
Subbasin Sub-11  
-----

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.25	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.25	

Subbasin Sub-12

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.89	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.89	

Subbasin Sub-13

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.40	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.40	

Subbasin Sub-14

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
----------------------------------------------	-----------------	---------------

---

-	0.43	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.43	
0.72		

-----  
Subbasin Sub-15  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

---

-	0.19	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.19	
0.72		

-----  
Subbasin Sub-16  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

---

-	0.46	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.46	
0.72		

-----  
Subbasin Sub-17  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

---

-	0.46	-
0.72		

Composite Area & Weighted Runoff Coeff. 0.46  
0.72

-----  
Subbasin Sub-18  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.62 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.62  
0.72

-----  
Subbasin Sub-19  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.71 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.71  
0.72

-----  
Subbasin Sub-20  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.55 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.55  
0.72

-----  
Subbasin Sub-21

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.54	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.54	

Subbasin Sub-22

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	1.10	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	1.10	

Subbasin Sub-23

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.61	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.61	

\*\*\*\*\*  
Subbasin Runoff Summary  
\*\*\*\*\*

Subbasin ID	Total Precip	Total Runoff	Peak Runoff	Weighted Curve	Time of Concentration
----------------	-----------------	-----------------	----------------	-------------------	--------------------------



	in	in	cfs	Number	days	hh:mm:ss
Sub-01	2.59	2.15	0.39	95.140	0	00:06:00
Sub-02	2.59	1.99	0.27	92.940	0	00:06:00
Sub-03	2.59	2.20	0.28	95.800	0	00:06:00
Sub-04	2.59	2.06	0.19	93.820	0	00:06:00
Sub-05	2.59	2.15	0.12	95.140	0	00:06:00
Sub-06	2.59	2.11	0.30	94.480	0	00:06:00
Sub-07	2.59	2.22	0.37	96.020	0	00:06:00
Sub-08	2.59	2.36	0.02	98.000	0	00:06:00
Sub-09	2.59	1.56	0.01	87.000	0	00:06:00
Sub-10	2.59	2.36	0.08	98.000	0	00:06:00
Sub-11	2.59	2.04	0.12	93.600	0	00:06:00
Sub-12	2.59	2.36	0.53	98.000	0	00:06:00
Sub-13	2.59	2.36	0.24	98.000	0	00:06:00
Sub-14	2.59	2.36	0.26	98.000	0	00:06:00
Sub-15	2.59	2.36	0.11	98.000	0	00:06:00
Sub-16	2.59	2.36	0.27	98.000	0	00:06:00
Sub-17	2.59	2.36	0.27	98.000	0	00:06:00
Sub-18	2.59	2.36	0.37	98.000	0	00:06:00
Sub-19	2.59	2.36	0.42	98.000	0	00:06:00
Sub-20	2.59	2.36	0.33	98.000	0	00:06:00
Sub-21	2.59	2.36	0.32	98.000	0	00:06:00
Sub-22	2.59	2.35	0.65	97.780	0	00:06:00
Sub-23	2.59	2.23	0.34	96.240	0	00:06:00

\*\*\*\*\*  
Node Depth Summary  
\*\*\*\*\*

Node Retention ID Time	Average Depth Attained	Maximum Depth Attained	Maximum HGL Attained	Time of Max Occurrence	Total Flooded Volume	Total Time Flooded
hh:mm:ss	ft	ft	ft	days hh:mm	acre-in	minutes
CB-01 0:00:00	0.76	0.94	110.00	0 07:55	0	0
CB-01A 0:00:00	0.19	0.52	108.52	0 07:56	0	0

CB-02	0.12	0.30	110.69	0	07:54	0	0
0:00:00							
CB-03	0.09	0.22	111.22	0	07:54	0	0
0:00:00							
CB-04	0.17	0.47	110.24	0	07:56	0	0
0:00:00							
CB-05	1.60	1.73	112.12	0	07:55	0	0
0:00:00							
CB-06	0.09	0.22	112.97	0	07:54	0	0
0:00:00							
CB-07	1.21	1.26	112.32	0	07:56	0	0
0:00:00							
CB-08	0.03	0.08	112.86	0	07:54	0	0
0:00:00							
CB-09	0.02	0.05	113.05	0	08:00	0	0
0:00:00							
CB-10	0.07	0.18	112.05	0	07:55	0	0
0:00:00							
CB-11	0.06	0.14	112.94	0	07:54	0	0
0:00:00							
CB-12	0.12	0.30	112.83	0	07:54	0	0
0:00:00							
CB-13	0.16	0.42	112.53	0	07:54	0	0
0:00:00							
CB-14	0.08	0.21	113.09	0	07:54	0	0
0:00:00							
CB-15	0.18	0.50	111.70	0	07:55	0	0
0:00:00							
CB-16	0.09	0.18	112.68	0	07:54	0	0
0:00:00							
CB-17	0.75	0.90	111.75	0	07:55	0	0
0:00:00							
CB-18	0.10	0.25	112.45	0	07:54	0	0
0:00:00							
CB-19	0.72	1.14	110.68	0	07:55	0	0
0:00:00							
CB-20	0.65	0.91	109.62	0	07:55	0	0
0:00:00							
CB-21	0.15	0.41	110.26	0	07:55	0	0
0:00:00							
CB-22	0.13	0.33	111.45	0	07:54	0	0
0:00:00							
CB-23E	0.26	0.72	108.39	0	07:56	0	0
0:00:00							
CB-24	0.26	0.72	107.23	0	07:57	0	0
0:00:00							
CB-F	0.09	0.23	108.73	0	07:54	0	0
0:00:00							
EXCB-SE	6.02	6.33	111.71	0	01:11	0	0
0:00:00							

EXCBW  
0:00:00

8.95 9.30 115.27 0 00:54 0 0

\*\*\*\*\*  
Node Flow Summary  
\*\*\*\*\*

Node Peak ID Flooding Occurrence hh:mm	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days hh:mm	Maximum Time of Flooding Overflow cfs days
CB-01	JUNCTION	0.39	2.14	0 07:56	0.00
CB-01A	JUNCTION	0.00	2.48	0 07:56	0.00
CB-02	JUNCTION	0.27	0.55	0 07:54	0.00
CB-03	JUNCTION	0.28	0.28	0 07:54	0.00
CB-04	JUNCTION	0.19	1.21	0 07:56	0.00
CB-05	JUNCTION	0.12	1.02	0 07:55	0.00
CB-06	JUNCTION	0.30	0.30	0 07:54	0.00
CB-07	JUNCTION	0.37	0.60	0 07:55	0.00
CB-08	JUNCTION	0.02	0.03	0 07:54	0.00
CB-09	JUNCTION	0.01	0.01	0 08:00	0.00
CB-10	JUNCTION	0.08	0.20	0 07:55	0.00
CB-11	JUNCTION	0.12	0.12	0 07:54	0.00
CB-12	JUNCTION	0.53	0.53	0 07:54	0.00
CB-13	JUNCTION	0.24	1.02	0 07:54	0.00
CB-14	JUNCTION	0.26	0.26	0 07:54	0.00
CB-15	JUNCTION	0.11	1.41	0 07:55	0.00
CB-16	JUNCTION	0.27	0.27	0 07:54	0.00
CB-17	JUNCTION	0.27	2.05	0 07:55	0.00
CB-18	JUNCTION	0.37	0.37	0 07:54	0.00
CB-19	JUNCTION	0.42	2.47	0 07:55	0.00
CB-20	JUNCTION	0.33	3.76	0 07:56	0.00
CB-21	JUNCTION	0.32	0.97	0 07:55	0.00
CB-22	JUNCTION	0.65	0.65	0 07:54	0.00
CB-23E	JUNCTION	0.00	3.76	0 07:56	0.00
CB-24	JUNCTION	0.00	3.76	0 07:57	0.00
CB-F	JUNCTION	0.34	0.34	0 07:54	0.00
EXCB-SE	JUNCTION	0.00	3.76	0 07:57	0.00
EXCBW	JUNCTION	0.00	2.48	0 07:56	0.00

\*\*\*\*\*  
 Link Flow Summary  
 \*\*\*\*\*

Link ID	Element	Time of	Maximum	Length	Peak Flow
Design Ratio of Flow Capacity	Ratio of Type Flow	Total Reported Peak Flow Occurrence	Velocity Attained	Factor	during Analysis
cfs	Flow Depth	days hh:mm minutes	ft/sec		cfs
Link-18	CONDUIT	0 07:54	3.54	1.00	0.27
5.28	0.05	0.15	0 Calculated		
P-01	CONDUIT	0 07:56	5.25	1.00	2.14
4.07	0.53	0.52	0 Calculated		
P-01A	CONDUIT	0 07:56	10.72	1.00	2.48
10.21	0.24	0.34	0 Calculated		
P-02	CONDUIT	0 07:55	2.73	1.00	0.55
2.74	0.20	0.30	0 Calculated		
P-03	CONDUIT	0 07:55	2.24	1.00	0.28
2.73	0.10	0.22	0 Calculated		
P-04	CONDUIT	0 07:56	3.38	1.00	1.21
2.74	0.44	0.46	0 Calculated		
P-05	CONDUIT	0 07:56	3.23	1.00	1.02
2.74	0.37	0.42	0 Calculated		
P-06	CONDUIT	0 07:55	2.30	1.00	0.30
2.74	0.11	0.22	0 Calculated		
P-07	CONDUIT	0 07:56	2.79	1.00	0.60
2.73	0.22	0.32	0 Calculated		
P-08	CONDUIT	0 07:56	1.17	1.00	0.03
2.73	0.01	0.08	0 Calculated		
P-09	CONDUIT	0 08:00	0.91	1.00	0.01
2.73	0.01	0.05	0 Calculated		
P-10	CONDUIT	0 07:56	2.04	1.00	0.20
2.74	0.07	0.18	0 Calculated		
P-11	CONDUIT	0 07:56	1.78	1.00	0.12
2.74	0.05	0.14	0 Calculated		
P-12	CONDUIT	0 07:54	2.71	1.00	0.53
2.76	0.19	0.30	0 Calculated		
P-13	CONDUIT	0 07:55	3.25	1.00	1.02
2.76	0.37	0.42	0 Calculated		
P-14	CONDUIT	0 07:55	2.20	1.00	0.26
2.76	0.09	0.21	0 Calculated		

P-15		CONDUIT	0 07:55	3.54	1.00	1.41
2.77	0.51	0.50	0 Calculated			
P-17		CONDUIT	0 07:55	3.85	1.00	2.05
2.76	0.74	0.64	0 Calculated			
P-18		CONDUIT	0 07:55	2.43	1.00	0.37
2.74	0.13	0.25	0 Calculated			
P-19		CONDUIT	0 07:56	4.02	1.00	2.47
8.10	0.30	0.38	0 Calculated			
P-20		CONDUIT	0 07:56	4.51	1.00	3.76
8.13	0.46	0.48	0 Calculated			
P-21		CONDUIT	0 07:55	3.19	1.00	0.97
2.75	0.35	0.41	0 Calculated			
P-22		CONDUIT	0 07:55	2.88	1.00	0.65
2.76	0.23	0.33	0 Calculated			
P-23		CONDUIT	0 07:57	4.51	1.00	3.76
8.12	0.46	0.48	0 Calculated			
P-24		CONDUIT	0 07:57	4.66	1.00	3.76
8.49	0.44	0.47	0 Calculated			
P-F		CONDUIT	0 07:54	2.55	1.00	0.34
3.03	0.11	0.23	0 Calculated			

\*\*\*\*\*

Highest Flow Instability Indexes

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All links are stable.

WARNING 107 : Initial water surface elevation defined for Junction CB-01 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-01 is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-01A is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-01A is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-02 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-02 is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-03 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-03 is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-04 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.





WARNING 108 : Surcharge elevation defined for Junction CB-24 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-F is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surcharge elevation defined for Junction CB-F is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction EXCB-SE is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surcharge elevation defined for Junction EXCB-SE is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction EXCBW is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surcharge elevation defined for Junction EXCBW is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

Analysis began on: Tue Aug 2 14:42:30 2022

Analysis ended on: Tue Aug 2 14:42:32 2022

Total elapsed time: 00:00:02



**100-Yr Conveyance Report**

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Project Description

\*\*\*\*\*

File Name ..... Kendall Auto.SPF

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Analysis Options

\*\*\*\*\*

Flow Units ..... cfs  
Subbasin Hydrograph Method. Santa Barbara UH  
Time of Concentration..... User-Defined  
Link Routing Method ..... Kinematic Wave  
Storage Node Exfiltration.. None  
Starting Date ..... JUL-27-2022 00:00:00  
Ending Date ..... JUL-28-2022 00:00:00  
Report Time Step ..... 00:00:10

\*\*\*\*\*

Element Count

\*\*\*\*\*

Number of rain gages ..... 2  
Number of subbasins ..... 23  
Number of nodes ..... 28  
Number of links ..... 26

\*\*\*\*\*

Raingage Summary

\*\*\*\*\*

Gage ID	Data Source	Data Type	Recording Interval	min
Rain Gage-01	TS-01	INTENSITY	6.00	
Rain Gage-02	TS-02	INTENSITY	6.00	

\*\*\*\*\*

Subbasin Summary

\*\*\*\*\*

Subbasin	Total Area	Imperv. Area	Raingage
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ID	acres	%	
Sub-01	0.73	87.00	Rain Gage-02
Sub-02	0.56	77.00	Rain Gage-02
Sub-03	0.51	90.00	Rain Gage-02
Sub-04	0.37	81.00	Rain Gage-02
Sub-05	0.23	87.00	Rain Gage-02
Sub-06	0.58	84.00	Rain Gage-02
Sub-07	0.67	91.00	Rain Gage-02
Sub-08	0.03	100.00	Rain Gage-02
Sub-09	0.04	50.00	Rain Gage-02
Sub-10	0.13	100.00	Rain Gage-02
Sub-11	0.25	80.00	Rain Gage-02
Sub-12	0.89	100.00	Rain Gage-02
Sub-13	0.40	100.00	Rain Gage-02
Sub-14	0.43	100.00	Rain Gage-02
Sub-15	0.19	100.00	Rain Gage-02
Sub-16	0.46	100.00	Rain Gage-02
Sub-17	0.46	100.00	Rain Gage-02
Sub-18	0.62	100.00	Rain Gage-02
Sub-19	0.71	100.00	Rain Gage-02
Sub-20	0.55	100.00	Rain Gage-02
Sub-21	0.54	100.00	Rain Gage-02
Sub-22	1.10	99.00	Rain Gage-02
Sub-23	0.61	92.00	Rain Gage-02

\*\*\*\*\*

Node Summary

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Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft <sup>2</sup>	External Inflow
CB-01	JUNCTION	109.06	113.50	0.00	
CB-01A	JUNCTION	108.00	114.60	0.00	
CB-02	JUNCTION	110.39	113.50	0.00	
CB-03	JUNCTION	111.00	113.50	0.00	
CB-04	JUNCTION	109.77	115.00	0.00	
CB-05	JUNCTION	110.39	116.20	0.00	
CB-06	JUNCTION	112.75	115.25	0.00	
CB-07	JUNCTION	111.06	114.20	0.00	
CB-08	JUNCTION	112.78	115.50	0.00	
CB-09	JUNCTION	113.00	115.50	0.00	
CB-10	JUNCTION	111.87	115.80	0.00	
CB-11	JUNCTION	112.80	115.30	0.00	
CB-12	JUNCTION	112.53	115.00	0.00	
CB-13	JUNCTION	112.11	114.75	0.00	
CB-14	JUNCTION	112.88	115.40	0.00	
CB-15	JUNCTION	111.20	115.00	0.00	

CB-16	JUNCTION	112.50	115.00	0.00
CB-17	JUNCTION	110.85	114.25	0.00
CB-18	JUNCTION	112.20	114.70	0.00
CB-19	JUNCTION	109.54	114.00	0.00
CB-20	JUNCTION	108.71	113.50	0.00
CB-21	JUNCTION	109.85	114.00	0.00
CB-22	JUNCTION	111.12	113.50	0.00
CB-23E	JUNCTION	107.67	113.30	0.00
CB-24	JUNCTION	106.51	113.53	0.00
CB-F	JUNCTION	108.50	113.50	0.00
EXCB-SE	JUNCTION	105.38	111.71	0.00
EXCBW	JUNCTION	105.97	115.27	0.00

\*\*\*\*\*  
Link Summary  
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Link Manning's ID Roughness	From Node	To Node	Element Type	Length ft	Slope %
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Link-18 0.0120	CB-16	CB-15	CONDUIT	71.0	1.8732
P-01 0.0120	CB-01	CB-01A	CONDUIT	95.2	1.1137
P-01A 0.0120	CB-01A	EXCBW	CONDUIT	29.0	7.0000
P-02 0.0120	CB-02	CB-01	CONDUIT	137.0	0.5036
P-03 0.0120	CB-03	CB-02	CONDUIT	122.0	0.5000
P-04 0.0120	CB-04	CB-01	CONDUIT	141.0	0.5035
P-05 0.0120	CB-05	CB-04	CONDUIT	123.0	0.5041
P-06 0.0120	CB-06	CB-05	CONDUIT	169.0	0.5030
P-07 0.0120	CB-07	CB-05	CONDUIT	134.0	0.5000
P-08 0.0120	CB-08	CB-07	CONDUIT	108.0	0.5000
P-09 0.0120	CB-09	CB-08	CONDUIT	44.0	0.5000
P-10 0.0120	CB-10	CB-07	CONDUIT	161.0	0.5031
P-11 0.0120	CB-11	CB-10	CONDUIT	185.0	0.5027

P-12 0.0120	CB-12	CB-13	CONDUIT	82.0	0.5122
P-13 0.0120	CB-13	CB-15	CONDUIT	178.0	0.5112
P-14 0.0120	CB-14	CB-13	CONDUIT	151.0	0.5099
P-15 0.0120	CB-15	CB-17	CONDUIT	68.0	0.5147
P-17 0.0120	CB-17	CB-19	CONDUIT	158.0	0.5127
P-18 0.0120	CB-18	CB-17	CONDUIT	139.0	0.5036
P-19 0.0120	CB-19	CB-20	CONDUIT	164.0	0.5061
P-20 0.0120	CB-20	CB-23E	CONDUIT	204.0	0.5098
P-21 0.0120	CB-21	CB-20	CONDUIT	126.0	0.5079
P-22 0.0120	CB-22	CB-21	CONDUIT	249.0	0.5100
P-23 0.0120	CB-23E	CB-24	CONDUIT	228.0	0.5088
P-24 0.0120	CB-24	EXCB-SE	CONDUIT	203.0	0.5567
P-F 0.0120	CB-F	CB-01A	CONDUIT	81.0	0.6173

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Cross Section Summary

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Link Full Flow ID Hydraulic Radius ft	Shape Design Flow Capacity cfs	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft <sup>2</sup>
------------------------------------------------------	--------------------------------------------	--------------------------	-------------	-------------------	-----------------------------------------------

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Link-18 0.25	CIRCULAR 5.28	1.00	1.00	1	0.79
P-01 0.25	CIRCULAR 4.07	1.00	1.00	1	0.79
P-01A 0.25	CIRCULAR 10.21	1.00	1.00	1	0.79
P-02 0.25	CIRCULAR 2.74	1.00	1.00	1	0.79

P-03	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-04	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-05	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-06	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-07	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-08	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-09	CIRCULAR	1.00	1.00	1	0.79
0.25	2.73				
P-10	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-11	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-12	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-13	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-14	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-15	CIRCULAR	1.00	1.00	1	0.79
0.25	2.77				
P-17	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-18	CIRCULAR	1.00	1.00	1	0.79
0.25	2.74				
P-19	CIRCULAR	1.50	1.50	1	1.77
0.38	8.10				
P-20	CIRCULAR	1.50	1.50	1	1.77
0.38	8.13				
P-21	CIRCULAR	1.00	1.00	1	0.79
0.25	2.75				
P-22	CIRCULAR	1.00	1.00	1	0.79
0.25	2.76				
P-23	CIRCULAR	1.50	1.50	1	1.77
0.38	8.12				
P-24	CIRCULAR	1.50	1.50	1	1.77
0.38	8.49				
P-F	CIRCULAR	1.00	1.00	1	0.79
0.25	3.03				

\*\*\*\*\*  
Runoff Quantity Continuity  
\*\*\*\*\*  
Total Precipitation .....

Volume  
acre-ft  
-----  
2.940

Depth  
inches  
-----  
3.190

Surface Runoff ..... 2.628 2.851  
 Continuity Error (%) ..... 0.000

\*\*\*\*\*  
 Flow Routing Continuity                    Volume                    Volume  
                                                                                  acre-ft                    Mgallons  
 \*\*\*\*\*  
 External Inflow ..... 0.000 0.000  
 External Outflow ..... 2.619 0.853  
 Initial Stored Volume .... 0.000 0.000  
 Final Stored Volume ..... 0.006 0.002  
 Continuity Error (%) ..... 0.001

\*\*\*\*\*  
 Composite Curve Number Computations Report  
 \*\*\*\*\*

-----  
 Subbasin Sub-01  
 -----

Soil/Surface Description CN	Area (acres)	Soil Group
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-----  
 -----  
 Composite Area & Weighted CN                    0.73  
 95.14

-----  
 Subbasin Sub-02  
 -----

Soil/Surface Description CN	Area (acres)	Soil Group
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-----  
 -----  
 Composite Area & Weighted CN                    0.56  
 92.94

-----  
 Subbasin Sub-03  
 -----

Soil/Surface Description CN	Area (acres)	Soil Group
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-----







-----  
Subbasin Sub-12  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.89

-----  
Subbasin Sub-13  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.40

-----  
Subbasin Sub-14  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.43

-----  
Subbasin Sub-15  
-----

Soil/Surface Description  
CN

Area  
(acres)

Soil  
Group

-----  
-----  
Composite Area & Weighted CN  
98.00

0.19

-----  
Subbasin Sub-16  
-----

-----

Soil/Surface Description CN	Area (acres)	Soil Group
--------------------------------	-----------------	---------------

-----

-----

Composite Area & Weighted CN 98.00	0.46	
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Subbasin Sub-17

-----

Soil/Surface Description CN	Area (acres)	Soil Group
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-----

-----

Composite Area & Weighted CN 98.00	0.46	
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Subbasin Sub-18

-----

Soil/Surface Description CN	Area (acres)	Soil Group
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-----

-----

Composite Area & Weighted CN 98.00	0.62	
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Subbasin Sub-19

-----

Soil/Surface Description CN	Area (acres)	Soil Group
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-----

-----

Composite Area & Weighted CN 98.00	0.71	
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Subbasin Sub-20

-----

Area	Soil
------	------

Soil/Surface Description (acres) Group  
CN

-----  
-----  
Composite Area & Weighted CN 0.55  
98.00

-----  
Subbasin Sub-21  
-----

Soil/Surface Description Area Soil  
CN (acres) Group

-----  
-----  
Composite Area & Weighted CN 0.54  
98.00

-----  
Subbasin Sub-22  
-----

Soil/Surface Description Area Soil  
CN (acres) Group

-----  
-----  
Composite Area & Weighted CN 1.10  
97.78

-----  
Subbasin Sub-23  
-----

Soil/Surface Description Area Soil  
CN (acres) Group

-----  
-----  
Composite Area & Weighted CN 0.61  
96.24

\*\*\*\*\*  
Runoff Coefficient Computations Report  
\*\*\*\*\*

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Subbasin Sub-01

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.73	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.73	

Subbasin Sub-02

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.56	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.56	

Subbasin Sub-03

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.51	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.51	

Subbasin Sub-04

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
----------------------------------------------	-----------------	---------------

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-	0.37	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.37	
0.72		

-----  
Subbasin Sub-05  
-----

	Area	Soil
Runoff	(acres)	Group
Soil/Surface Description		
Coeff.		

---

-	0.23	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.23	
0.72		

-----  
Subbasin Sub-06  
-----

	Area	Soil
Runoff	(acres)	Group
Soil/Surface Description		
Coeff.		

---

-	0.58	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.58	
0.72		

-----  
Subbasin Sub-07  
-----

	Area	Soil
Runoff	(acres)	Group
Soil/Surface Description		
Coeff.		

---

-	0.67	-
0.72		

Composite Area & Weighted Runoff Coeff. 0.67  
0.72

-----  
Subbasin Sub-08  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.03 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.03  
0.72

-----  
Subbasin Sub-09  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.04 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.04  
0.72

-----  
Subbasin Sub-10  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.13 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.13  
0.72

-----  
Subbasin Sub-11  
-----

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.25	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.25	

Subbasin Sub-12

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.89	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.89	

Subbasin Sub-13

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.40	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.40	

Subbasin Sub-14

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
----------------------------------------------	-----------------	---------------



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-	0.43	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.43	
0.72		

-----  
Subbasin Sub-15  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

---

-	0.19	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.19	
0.72		

-----  
Subbasin Sub-16  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

---

-	0.46	-
0.72		
Composite Area & Weighted Runoff Coeff.	0.46	
0.72		

-----  
Subbasin Sub-17  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

---

-	0.46	-
0.72		

Composite Area & Weighted Runoff Coeff. 0.46  
0.72

-----  
Subbasin Sub-18  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.62 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.62  
0.72

-----  
Subbasin Sub-19  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.71 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.71  
0.72

-----  
Subbasin Sub-20  
-----

Runoff	Area	Soil
Soil/Surface Description	(acres)	Group
Coeff.		

-----  
-----  
- 0.55 -  
0.72  
Composite Area & Weighted Runoff Coeff. 0.55  
0.72

-----  
Subbasin Sub-21  
-----

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.54	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.54	

Subbasin Sub-22

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	1.10	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	1.10	

Subbasin Sub-23

Runoff Soil/Surface Description Coeff.	Area (acres)	Soil Group
-	0.61	-
0.72 Composite Area & Weighted Runoff Coeff. 0.72	0.61	

\*\*\*\*\*  
Subbasin Runoff Summary  
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Subbasin ID	Total Precip	Total Runoff	Peak Runoff	Weighted Curve	Time of Concentration
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	in	in	cfs	Number	days	hh:mm:ss
Sub-01	3.19	2.72	0.49	95.140	0	00:06:00
Sub-02	3.19	2.54	0.35	92.940	0	00:06:00
Sub-03	3.19	2.78	0.35	95.800	0	00:06:00
Sub-04	3.19	2.61	0.24	93.820	0	00:06:00
Sub-05	3.19	2.72	0.15	95.140	0	00:06:00
Sub-06	3.19	2.67	0.38	94.480	0	00:06:00
Sub-07	3.19	2.80	0.46	96.020	0	00:06:00
Sub-08	3.19	2.96	0.02	98.000	0	00:06:00
Sub-09	3.19	2.05	0.02	87.000	0	00:06:00
Sub-10	3.19	2.96	0.10	98.000	0	00:06:00
Sub-11	3.19	2.60	0.16	93.600	0	00:06:00
Sub-12	3.19	2.96	0.66	98.000	0	00:06:00
Sub-13	3.19	2.96	0.30	98.000	0	00:06:00
Sub-14	3.19	2.96	0.32	98.000	0	00:06:00
Sub-15	3.19	2.96	0.14	98.000	0	00:06:00
Sub-16	3.19	2.96	0.34	98.000	0	00:06:00
Sub-17	3.19	2.96	0.34	98.000	0	00:06:00
Sub-18	3.19	2.96	0.46	98.000	0	00:06:00
Sub-19	3.19	2.96	0.52	98.000	0	00:06:00
Sub-20	3.19	2.96	0.41	98.000	0	00:06:00
Sub-21	3.19	2.96	0.40	98.000	0	00:06:00
Sub-22	3.19	2.94	0.81	97.780	0	00:06:00
Sub-23	3.19	2.81	0.43	96.240	0	00:06:00

\*\*\*\*\*  
Node Depth Summary  
\*\*\*\*\*

Node Retention ID Time	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Total Flooded Volume acre-in	Total Time Flooded minutes
CB-01 0:00:00	0.77	0.98	110.04	0 07:55	0	0
CB-01A 0:00:00	0.21	0.60	108.60	0 07:56	0	0

CB-02 0:00:00	0.13	0.34	110.73	0	07:54	0	0
CB-03 0:00:00	0.10	0.24	111.24	0	07:54	0	0
CB-04 0:00:00	0.20	0.53	110.30	0	07:56	0	0
CB-05 0:00:00	1.61	1.76	112.15	0	07:55	0	0
CB-06 0:00:00	0.10	0.25	113.00	0	07:54	0	0
CB-07 0:00:00	1.22	1.27	112.33	0	07:59	0	0
CB-08 0:00:00	0.04	0.09	112.87	0	07:54	0	0
CB-09 0:00:00	0.03	0.06	113.06	0	08:00	0	0
CB-10 0:00:00	0.08	0.21	112.08	0	07:55	0	0
CB-11 0:00:00	0.07	0.16	112.96	0	07:54	0	0
CB-12 0:00:00	0.13	0.33	112.86	0	07:54	0	0
CB-13 0:00:00	0.18	0.48	112.59	0	07:54	0	0
CB-14 0:00:00	0.09	0.23	113.11	0	07:54	0	0
CB-15 0:00:00	0.21	0.58	111.78	0	07:55	0	0
CB-16 0:00:00	0.10	0.20	112.70	0	07:54	0	0
CB-17 0:00:00	0.76	0.93	111.78	0	07:54	0	0
CB-18 0:00:00	0.11	0.28	112.48	0	07:54	0	0
CB-19 0:00:00	0.75	1.26	110.80	0	07:55	0	0
CB-20 0:00:00	0.67	0.96	109.67	0	07:55	0	0
CB-21 0:00:00	0.17	0.46	110.31	0	07:55	0	0
CB-22 0:00:00	0.14	0.37	111.49	0	07:54	0	0
CB-23E 0:00:00	0.30	0.82	108.49	0	07:56	0	0
CB-24 0:00:00	0.30	0.82	107.33	0	07:57	0	0
CB-F 0:00:00	0.10	0.25	108.75	0	07:54	0	0
EXCB-SE 0:00:00	6.06	6.33	111.71	0	01:01	0	0

EXCBW  
0:00:00

9.01      9.30      115.27      0 00:45      0      0

\*\*\*\*\*  
Node Flow Summary  
\*\*\*\*\*

Node Peak ID Flooding Occurrence hh:mm	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days    hh:mm	Maximum Time of Flooding Overflow cfs    days
CB-01	JUNCTION	0.49	2.71	0 07:56	0.00
CB-01A	JUNCTION	0.00	3.13	0 07:56	0.00
CB-02	JUNCTION	0.35	0.70	0 07:54	0.00
CB-03	JUNCTION	0.35	0.35	0 07:54	0.00
CB-04	JUNCTION	0.24	1.52	0 07:56	0.00
CB-05	JUNCTION	0.15	1.29	0 07:55	0.00
CB-06	JUNCTION	0.38	0.38	0 07:54	0.00
CB-07	JUNCTION	0.46	0.76	0 07:55	0.00
CB-08	JUNCTION	0.02	0.04	0 07:54	0.00
CB-09	JUNCTION	0.02	0.02	0 08:00	0.00
CB-10	JUNCTION	0.10	0.25	0 07:55	0.00
CB-11	JUNCTION	0.16	0.16	0 07:54	0.00
CB-12	JUNCTION	0.66	0.66	0 07:54	0.00
CB-13	JUNCTION	0.30	1.27	0 07:54	0.00
CB-14	JUNCTION	0.32	0.32	0 07:54	0.00
CB-15	JUNCTION	0.14	1.75	0 07:55	0.00
CB-16	JUNCTION	0.34	0.34	0 07:54	0.00
CB-17	JUNCTION	0.34	2.55	0 07:55	0.00
CB-18	JUNCTION	0.46	0.46	0 07:54	0.00
CB-19	JUNCTION	0.52	3.07	0 07:55	0.00
CB-20	JUNCTION	0.41	4.67	0 07:56	0.00
CB-21	JUNCTION	0.40	1.20	0 07:55	0.00
CB-22	JUNCTION	0.81	0.81	0 07:54	0.00
CB-23E	JUNCTION	0.00	4.67	0 07:56	0.00
CB-24	JUNCTION	0.00	4.67	0 07:57	0.00
CB-F	JUNCTION	0.43	0.43	0 07:54	0.00
EXCB-SE	JUNCTION	0.00	4.67	0 07:57	0.00
EXCBW	JUNCTION	0.00	3.13	0 07:56	0.00

\*\*\*\*\*  
 Link Flow Summary  
 \*\*\*\*\*

Link ID	Element	Time of	Maximum	Length	Peak Flow
Design Ratio of Flow Capacity	Ratio of Type Flow	Total Reported Peak Flow Occurrence	Velocity Attained	Factor	during Analysis
cfs	Flow	Depth	minutes	ft/sec	cfs
Link-18	CONDUIT	0 07:54	3.76	1.00	0.34
5.28	0.06	0.17	0 Calculated		
P-01	CONDUIT	0 07:56	5.54	1.00	2.71
4.07	0.66	0.60	0 Calculated		
P-01A	CONDUIT	0 07:56	11.43	1.00	3.13
10.21	0.31	0.38	0 Calculated		
P-02	CONDUIT	0 07:55	2.91	1.00	0.69
2.74	0.25	0.34	0 Calculated		
P-03	CONDUIT	0 07:54	2.39	1.00	0.35
2.73	0.13	0.24	0 Calculated		
P-04	CONDUIT	0 07:56	3.58	1.00	1.52
2.74	0.56	0.53	0 Calculated		
P-05	CONDUIT	0 07:56	3.44	1.00	1.29
2.74	0.47	0.48	0 Calculated		
P-06	CONDUIT	0 07:55	2.46	1.00	0.38
2.74	0.14	0.25	0 Calculated		
P-07	CONDUIT	0 07:56	2.97	1.00	0.76
2.73	0.28	0.36	0 Calculated		
P-08	CONDUIT	0 07:59	1.27	1.00	0.04
2.73	0.02	0.09	0 Calculated		
P-09	CONDUIT	0 08:00	1.00	1.00	0.02
2.73	0.01	0.06	0 Calculated		
P-10	CONDUIT	0 07:56	2.18	1.00	0.25
2.74	0.09	0.21	0 Calculated		
P-11	CONDUIT	0 07:55	1.91	1.00	0.16
2.74	0.06	0.16	0 Calculated		
P-12	CONDUIT	0 07:54	2.88	1.00	0.66
2.76	0.24	0.33	0 Calculated		
P-13	CONDUIT	0 07:55	3.44	1.00	1.27
2.76	0.46	0.48	0 Calculated		
P-14	CONDUIT	0 07:55	2.34	1.00	0.32
2.76	0.12	0.23	0 Calculated		

P-15		CONDUIT	0 07:55	3.73	1.00	1.75
2.77	0.63	0.58	0 Calculated			
P-17		CONDUIT	0 07:55	4.00	1.00	2.54
2.76	0.92	0.76	0 Calculated			
P-18		CONDUIT	0 07:54	2.59	1.00	0.46
2.74	0.17	0.28	0 Calculated			
P-19		CONDUIT	0 07:56	4.26	1.00	3.07
8.10	0.38	0.43	0 Calculated			
P-20		CONDUIT	0 07:56	4.76	1.00	4.67
8.13	0.58	0.54	0 Calculated			
P-21		CONDUIT	0 07:55	3.39	1.00	1.20
2.75	0.44	0.46	0 Calculated			
P-22		CONDUIT	0 07:55	3.05	1.00	0.81
2.76	0.29	0.37	0 Calculated			
P-23		CONDUIT	0 07:57	4.75	1.00	4.67
8.12	0.58	0.54	0 Calculated			
P-24		CONDUIT	0 07:57	4.92	1.00	4.67
8.49	0.55	0.53	0 Calculated			
P-F		CONDUIT	0 07:54	2.72	1.00	0.42
3.03	0.14	0.25	0 Calculated			

\*\*\*\*\*

Highest Flow Instability Indexes

\*\*\*\*\*

All links are stable.

WARNING 107 : Initial water surface elevation defined for Junction CB-01 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-01 is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-01A is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-01A is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-02 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-02 is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-03 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surge elevation defined for Junction CB-03 is below junction maximum elevation. Assumed surge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-04 is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.







WARNING 108 : Surcharge elevation defined for Junction CB-24 is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction CB-F is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surcharge elevation defined for Junction CB-F is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction EXCB-SE is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surcharge elevation defined for Junction EXCB-SE is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

WARNING 107 : Initial water surface elevation defined for Junction EXCBW is below junction invert elevation.

Assumed initial water surface elevation equal to invert elevation.

WARNING 108 : Surcharge elevation defined for Junction EXCBW is below junction maximum elevation. Assumed surcharge elevation equal to maximum elevation.

Analysis began on: Tue Aug 2 14:38:47 2022

Analysis ended on: Tue Aug 2 14:38:50 2022

Total elapsed time: 00:00:03

## 5.0 Special Reports and Studies

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- A. SWPPP
- B. Geotechnical Report
- C. Operation and Maintenance Manual

A. SWPPP

**Construction Stormwater General Permit**  
**Stormwater Pollution Prevention Plan (SWPPP)**  
 for  
**Kendall Auto Group**

Prepared for:  
**The Washington State Department of Ecology**  
**Northwest Regional Office**  
**3190 – 160<sup>th</sup> Avenue SE**  
**Bellevue, WA 98008**

<b>Permittee / Owner</b>	<b>Developer</b>	<b>Operator / Contractor</b>
Kendall Development Group, LLC	Kendall Development Group, LLC	To be determined
3449 E Copper Point Drive Meridian, ID 83642	3449 E Copper Point Drive Meridian, ID 83642	

**Project Site Location**

Marysville, WA 98271  
 Parcel# 31052800301200, 31052800300300, 31052800300600

**Certified Erosion and Sediment Control Lead (CESCL)**

<b>Name</b>	<b>Organization</b>	<b>Contact Phone Number</b>
Brian R. Kalab, P. E.	Insight Engineering	425-303-9363

**SWPPP Prepared By**

<b>Name</b>	<b>Organization</b>	<b>Contact Phone Number</b>
Shilpa Xavier	Insight Engineering	425-303-9363

**SWPPP Preparation Date**

June 24, 2022

**Project Construction Dates**

<b>Activity / Phase</b>	<b>Start Date</b>	<b>End Date</b>
Construction Duration	May 1, 2023	March 1, 2024

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**List of Appendices**

Appendix/Glossary

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- A. Site Map
- B. BMP Detail
- C. Correspondence
- D. Site Inspection Form
- E. Construction Stormwater General Permit (CSWGP)
- F. Contaminated Site Information
- G. Engineering Calculations



## List of Acronyms and Abbreviations

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<b>Acronym / Abbreviation</b>	<b>Explanation</b>
<b>303(d)</b>	Section of the Clean Water Act pertaining to Impaired Waterbodies
<b>BFO</b>	Bellingham Field Office of the Department of Ecology
<b>BMP(s)</b>	Best Management Practice(s)
<b>CESCL</b>	Certified Erosion and Sediment Control Lead
<b>CO<sub>2</sub></b>	Carbon Dioxide
<b>CRO</b>	Central Regional Office of the Department of Ecology
<b>CSWGP</b>	Construction Stormwater General Permit
<b>CWA</b>	Clean Water Act
<b>DMR</b>	Discharge Monitoring Report
<b>DO</b>	Dissolved Oxygen
<b>Ecology</b>	Washington State Department of Ecology
<b>EPA</b>	United States Environmental Protection Agency
<b>ERO</b>	Eastern Regional Office of the Department of Ecology
<b>ERTS</b>	Environmental Report Tracking System
<b>ESC</b>	Erosion and Sediment Control
<b>GULD</b>	General Use Level Designation
<b>NPDES</b>	National Pollutant Discharge Elimination System
<b>NTU</b>	Nephelometric Turbidity Units
<b>NWRO</b>	Northwest Regional Office of the Department of Ecology
<b>pH</b>	Power of Hydrogen
<b>RCW</b>	Revised Code of Washington
<b>SPCC</b>	Spill Prevention, Control, and Countermeasure
<b>su</b>	Standard Units
<b>SWMMEW</b>	Stormwater Management Manual for Eastern Washington
<b>SWMMWW</b>	Stormwater Management Manual for Western Washington
<b>SWPPP</b>	Stormwater Pollution Prevention Plan
<b>TESC</b>	Temporary Erosion and Sediment Control
<b>SWRO</b>	Southwest Regional Office of the Department of Ecology
<b>TMDL</b>	Total Maximum Daily Load
<b>VFO</b>	Vancouver Field Office of the Department of Ecology
<b>WAC</b>	Washington Administrative Code
<b>WSDOT</b>	Washington Department of Transportation
<b>WWHM</b>	Western Washington Hydrology Model

## 1 Project Information

Project/Site Name: Kendall Auto Group  
Street/Location: XXXX  
City: Marysville State: WA Zip code: 98271  
Subdivision:  
Receiving waterbody:  
Hayho Creek

### 1.1 Existing Conditions

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

Total acreage: 11.62 acres  
Disturbed acreage: 11.62 acres  
Existing structures: 0 acres  
Landscape 11.62 acres

topography:

Drainage patterns: Sheet Flow

Existing Vegetation: Typical scrub forest with undergrowth with a mixed stand of trees.

Critical Areas (wetlands, streams, high erosion Buffer area provided from wetland risk, steep or difficult to stabilize slopes): N/A

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody:

N/A

### 1.2 Proposed Construction Activities

Description of site development (example: subdivision):

The project proposal is to develop the site by constructing a car dealership building and parking with associated utilities.

Description of construction activities (example: site preparation, demolition, excavation):

Prepare the site for construction by the installation of the indicated BMP's. Excavate the site for the new car dealership

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:

Per conversation with the City minimum requirements #1-5 shall apply for this project. Minimum Requirements #6-9 are taken care of through the existing storm system on site that flows to a regional detention pond that will provide the site flow control and water quality.

Description of final stabilization (example: extent of revegetation, paving, landscaping):

The access to the site will be from Smokey Point Blvd and Future 160<sup>th</sup> St Extension. Typical commercial landscaping will be around the building and the parking to provide final stabilization.

*Contaminated Site Information:*

Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):

Minimum Requirements #6-9 are taken care of through the existing storm system on site that flows to a regional detention pond that will provide the site flow control and water quality.

## **2 Construction Stormwater Best Management Practices (BMPs)**

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e., hand-written notes and deletions). Update the SWPPP when the CESCL or local agency has noted a deficiency in BMPs or deviation from original design.

### **2.1 The 13 Elements**

#### **2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits**

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. In general, natural vegetation and native topsoil shall be retained in an undisturbed state to the maximum extent possible.

List and describe BMPs: • High Visibility Plastic or Metal Fence (BMP C103)  
Install orange barrier fencing along the clearing limits, according to the approved construction plans, prior to any construction activities. Maintain until all construction activities are completed.

Installation Schedules: The limits of construction will be clearly marked before land-disturbing activities begin.

Inspection and Maintenance plan: Site inspections will be conducted at least once a week and within 24 hours following any rainfall event which causes a discharge of stormwater from the site. For sites with temporary stabilization measures, the site inspection frequency can be reduced to once every month.

Responsible Staff: Permittee shall take immediate action(s) to: stop, contain, and clean up the unauthorized discharges, or otherwise stop the noncompliance; correct the problem(s); implement appropriate Best Management Practices (BMPs), and/or conduct maintenance of existing BMPs; and achieve compliance with all applicable standards and permit conditions. In addition, if the noncompliance causes a threat to human health or the environment, the Permittee shall comply with the Noncompliance Notification requirements in Special Condition S5.F of the permit.

### **2.1.2 Element 2: Establish Construction Access**

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters.

List and describe BMPs: Stabilized Construction Entrance (BMP C105)

Installation Schedules: Install the temporary construction entrance, according to the approved construction plans, prior to any clearing or grading activities

Inspection and Maintenance plan: Maintain until the access road is paved.

Responsible Staff: Contractor.

### 2.1.3 Element 3: Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled. In general, discharge rates of stormwater from the site will be controlled where increases in impervious area or soil compaction during construction could lead to downstream erosion, or where necessary to meet local agency stormwater discharge requirements (e.g. discharge to combined sewer systems).

Will you construct stormwater retention and/or detention facilities?

Yes  No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?

Yes  No

List and describe BMPs: Temporary Sediment Pond (BMP C241),

Installation Schedules: Install temporary sediment pond, according to the approved construction plans, prior to any construction activities.

Inspection and Maintenance plan: Maintain until all construction activities are completed.

Responsible Staff: Contractor

#### **2.1.4 Element 4: Install Sediment Controls**

Whenever possible, sediment laden water shall be discharged into onsite, relatively level, vegetated areas .

In some cases, sediment discharge in concentrated runoff can be controlled using permanent stormwater BMPs (e.g., infiltration swales, ponds, trenches). Sediment loads can limit the effectiveness of some permanent stormwater BMPs, such as those used for infiltration or bio-filtration; however, those BMPs designed to remove solids by settling (wet ponds or detention ponds) can be used during the construction phase. When permanent stormwater BMPs will be used to control sediment discharge during construction, the structure will be protected from excessive sedimentation with adequate erosion and sediment control BMPs. Any accumulated sediment shall be removed after construction is complete and the permanent stormwater BMP will be re-stabilized with vegetation per applicable design requirements once the remainder of the site has been stabilized.

The following BMP will be implemented as end-of-pipe sediment controls as required to meet permitted turbidity limits in the site discharge(s). Prior to the implementation of these technologies, sediment sources and erosion control and soil stabilization BMP efforts will be maximized to reduce the need for end-of-pipe sedimentation controls. In addition, sediment will be removed from paved areas in and adjacent to construction work areas manually or using mechanical sweepers, as needed, to minimize tracking of sediments on vehicle tires away from the site and to minimize wash-off of sediments from adjacent streets in runoff.

List and describe BMPs:

- Silt Fence (BMP C233)

Installation Schedules: Install silt fencing, according to the approved plans, prior to any clearing or grading activities.

Inspection and Maintenance plan: Maintain Silt Fence until all construction activities are completed.

Responsible Staff: Contractor.

**2.1.5 Element 5: Stabilize Soils**

The project site is located west of the Cascade Mountain Crest. As such, no soils shall remain exposed and unworked for more than 7 days during the dry season (May 1 to September 30) and 2 days during the wet season (October 1 to April 30). Regardless of the time of year, all soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on weather forecasts.

In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels.

**West of the Cascade Mountains Crest**

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Start date: May 1, 2022 End date: March 1, 2024

Will you construct during the wet season?

Yes  No

List and describe BMPs:

Exposed and un-worked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. The specific BMPs for soil stabilization that shall be used on this project include:

- Temporary and Permanent Seeding (BMP C120)

Installation Schedules:

Apply temporary hydro-seed to exposed and un-worked soils, according to the approved construction plans, as needed to prevent erosion during site grading.

Inspection and Maintenance plan:

Apply permanent hydro-seed to areas at final grade as site grading is completed.

- Mulching (BMP C121)

Installation Schedules:

Apply mulching to exposed and un-worked soils, according to the approved construction plans, as needed to prevent erosion during site grading.

Inspection and Maintenance plan:

Maintain until site grading is completed and permanent hydro-seed is applied.

- Plastic Covering (BMP C123)



#### Installation Schedules:

Cover stockpiles with plastic sheeting, according to the approved construction plans, as needed to prevent erosion during site grading.

#### Inspection and Maintenance plan:

Maintain until stockpiles are removed from site.

- Dust Control (BMP C140)

#### Installation Schedules and Inspection and Maintenance plan:

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126) added to water at a rate of 0.5 lbs. per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may actually reduce the quantity of water needed for dust control. Use of PAM could be a cost-effective dust control method.

#### Techniques that can be used for unpaved roads and lots include:

- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
- Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
- Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
- Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
- Encourage the use of alternate, paved routes, if available.
- Restrict use of paved roadways by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.

- Pave unpaved permanent roads and other trafficked areas.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Limit dust-causing work on windy days.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.

- Early application of gravel base on areas to be paved  
Place gravel base on roadways, according to the approved construction plans, after roadways are graded to sub-grade. Maintain until roads are paved.

Responsible Staff: Contractor.

### **2.1.6 Element 6: Protect Slopes**

All cut and fill slopes will be designed, constructed, and protected in a manner than minimizes erosion. The following specific BMPs will be used to protect slopes for this project:

Will steep slopes be present at the site during construction?

Yes  No

List and describe BMPs: Temporary and Permanent Seeding (BMP C120)

Installation Schedules: Apply temporary hydro-seed to cut and fill slopes, according to the approved construction plans, as needed to minimize erosion during site grading.

Inspection and Maintenance plan: Apply permanent hydro-seed to cut and fill slopes at final grade as site grading is completed.

Responsible Staff: Contractor

### **2.1.7 Element 7: Protect Drain Inlets**

All storm drain inlets and culverts made operable during construction shall be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep street wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site.

List and describe BMPs: Storm Drian Inlet Protection

Installation Schedules: Install storm drain inlet protection according to the approved construction plans

Inspection and Maintenance plan: Maintain until all construction activities are completed.

Responsible Staff: Contractor

### **2.1.8 Element 8: Stabilize Channels and Outlets**

No site runoff is to be conveyed into channels, or discharged to a stream or some other natural drainage point.— The onsite flowrates will be minimal therefore no BMP's are proposed  
Stabilize Channels and Outlets.

If any BMP's are provided, the project site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10 minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition. Alternatively, the 10-year, 1-hour peak flow rate indicated by an approved continuous runoff simulation model, increased by a factor of 1.6, shall be used. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems.

<p>Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.</p>
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

**2.1.9 Element 9: Control Pollutants**

The following pollutants are anticipated to be present on-site:

**Table 2 – Pollutants**

Pollutant (List pollutants and source, if applicable)
Petroleum products
Solid waste

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris. If required, BMPs to be implemented to control specific sources of pollutants are discussed below.

Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- On-site permanent fueling tanks and petroleum product storage containers shall include secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Chemical storage:

- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. In Western WA, all chemicals shall have cover, containment, and protection provided on site, per BMP C153 for Material Delivery, Storage and Containment in SWMMWW 2005

Excavation and tunneling spoils dewatering waste:

- Dewatering BMPs and BMPs specific to the excavation and tunneling (including handling of contaminated soils) are discussed under Element 10.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).

Process water and slurry resulting from saw-cutting and surfacing operations will be prevented from entering the waters of the State by implementing Saw-cutting and Surfacing Pollution Prevention measures (BMP C152).

Sanitary wastewater:

Portable sanitation facilities will be firmly secured, regularly maintained, and emptied when necessary.

Solid Waste:

Solid waste will be stored in secure, clearly marked containers.

Other:

Other BMPs will be administered as necessary to address any additional pollutant sources on site.

A SPCC plan is required for this site.

As per the Federal regulations of the Clean Water Act (CWA) and according to Final Rule 40 CFR Part 112, as stated in the National Register, a Spill Prevention, Control, and Countermeasure (SPCC) Plan is required for construction activities. A SPCC Plan has been prepared to address an approach to prevent, respond to, and report spills or releases to the environment that could result from construction activities. This Plan must:

Be well thought out in accordance with good engineering;

List and describe BMPs: BMP C151, BMP C152, BMP C153, BMP C140 and BMP C220.  
Installation Schedules:

Inspection and Maintenance plan: All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well organized, and free of debris.

Achieve three objectives - prevent spills, contain a spill that occurs, and clean up the spill;

- Identify the name, location, owner, and type of facility;
- Include the date of initial operation and oil spill history;
- Name the designated person responsible;
- Show evidence of approval and certification by the person in authority; and
- Contain a facility analysis.

Responsible Staff: Contractor.

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?

Yes  No

Will wheel wash or tire bath system BMPs be used during construction?

Yes  No

Will pH-modifying sources be present on-site?

Yes  No

**Table 3 – pH-Modifying Sources**

<input checked="" type="checkbox"/>	None
<input type="checkbox"/>	Bulk cement
<input type="checkbox"/>	Cement kiln dust
<input type="checkbox"/>	Fly ash
<input type="checkbox"/>	Other cementitious materials
<input type="checkbox"/>	New concrete washing or curing waters
<input type="checkbox"/>	Waste streams generated from concrete grinding and sawing
<input type="checkbox"/>	Exposed aggregate processes
<input type="checkbox"/>	Dewatering concrete vaults
<input type="checkbox"/>	Concrete pumping and mixer washout waters
<input type="checkbox"/>	Recycled concrete
<input type="checkbox"/>	Recycled concrete stockpiles
<input type="checkbox"/>	Other (i.e., calcium lignosulfate) [please describe:   ]

Stormwater runoff will be monitored for pH starting on the first day of any activity that includes more than 40 yards of poured or recycled concrete, or after the application of “Engineered Soils” such as, Portland cement treated base, cement kiln dust, or fly ash. This does not include fertilizers. For concrete work, pH monitoring will start the first day concrete is poured and continue until 3 weeks after the last pour. For engineered soils, the pH monitoring period begins when engineered soils are first exposed to precipitation and continue until the area is fully stabilized.

Stormwater samples will be collected daily from all points of discharge from the site and measured for pH using a calibrated pH meter, pH test kit, or wide range pH indicator paper. If the measured pH is 8.5 or greater, the following steps will be conducted:

1. Prevent the high pH water from entering storm drains or surface water.
2. Adjust or neutralize the high pH water if necessary using appropriate technology such as CO<sub>2</sub> sparging (liquid or dry ice).
3. Contact Ecology if chemical treatment other than CO<sub>2</sub> sparging is planned.



Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed. Excess concrete must be returned to the plant for recycling if there are no concrete washout areas with appropriate BMPs installed.

Will uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters?

Yes  No

### 2.1.10 Element 10: Control Dewatering

No dewatering is proposed for the development. If dewatering is needed, Transport. off-site in a vehicle (vacuum truck for legal disposal).

**Table 4 – Dewatering BMPs**

<input type="checkbox"/>	Infiltration
<input type="checkbox"/>	Transport off-site in a vehicle (vacuum truck for legal disposal)
<input type="checkbox"/>	Ecology-approved on-site chemical treatment or other suitable treatment technologies
<input type="checkbox"/>	Sanitary or combined sewer discharge with local sewer district approval (last resort)
<input checked="" type="checkbox"/>	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

### **2.1.11 Element 11: Maintain BMPs**

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

**2.1.12 Element 12: Manage the Project**

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
  - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
  - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
  - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

**Table 5 – Management**

<input checked="" type="checkbox"/>	Design the project to fit the existing topography, soils, and drainage patterns
<input checked="" type="checkbox"/>	Emphasize erosion control rather than sediment control
<input checked="" type="checkbox"/>	Minimize the extent and duration of the area exposed
<input checked="" type="checkbox"/>	Keep runoff velocities low
<input checked="" type="checkbox"/>	Retain sediment on-site
<input checked="" type="checkbox"/>	Thoroughly monitor site and maintain all ESC measures
<input checked="" type="checkbox"/>	Schedule major earthwork during the dry season
<input type="checkbox"/>	Other (please describe)

**Table 6 – BMP Implementation Schedule**

<b>Phase of Construction Project</b>	<b>Stormwater BMPs</b>	<b>Date</b>	<b>Wet/Dry Season</b>
Mark Clearing Limits	High Visibility Plastic or Metal Fence (BMP C103)	05/01/2023	Dry
Mobilize equipment on site	Construction Road/Parking area stabilization (BMP C107)	05/01/2023	Dry
Mobilize and store all ESC and soil stabilization products	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220) Plastic Covering (BMP C123) Surface roughening (BMP C130)	05/01/2023	Dry
Install ESC measures	Silt Fence (BMP C233) Storm Drain Inlet Protection (BMP C220)	05/01/2023	Dry
Install stabilized construction entrance	Stabilized Construction Entrance (BMP C105)	05/01/2023	Dry
Begin clearing and grubbing	Dust Control (BMP C140)	05/15/2023	Dry
Site grading begins	Dust Control (BMP C140)	05/27/2023	Dry
Grade road and stabilize with gravel base	Dust Control (BMP C140)	05/27/2023	Dry
Begin excavation for new utilities and services		07/01/2023	Dry
Soil stabilization on excavated side slopes (in idle, no work areas)	Mulching (BMP C121) Dust Control (BMP C140) Plastic Covering (BMP C123) Nets and Blankets (BMP C122)	08/05/2023	Dry
Temporary erosion control measures (hydro-seeding)	Temporary Seeding (BMP C120)	09/01/2023	Dry
Site grading ends		09/15/2023	Dry
Begin pouring concrete curbs & sidewalks and implement	BMP C151 Concrete Handling (BMP C151) Sawcutting and Surfacing Pollution Prevention (BMP C152)	10/01/2023	Wet

Pave asphalt roads		11/05/2023	Wet
Implement Element #12 BMPs and manage site to minimize soil disturbance during the wet season	Scheduling (BMP C162) CESC Lead (BMP C160)	12/01/2023	Wet
Final landscaping and planting begins		02/1/2024	Wet
Permanent erosion control measures (hydro-seeding)	Permanent Seeding (BMP C120)	03/01/2024	Wet

### **2.1.13 Element 13: Protect Low Impact Development (LID) BMPs**

On-site stormwater management BMPs used for runoff from roofs and other hard surfaces include: full dispersion, roof downspout full infiltration or dispersion systems, perforated stubout connections, rain gardens, bioretention systems, permeable pavement, sheetflow dispersion, and concentrated flow dispersion. The areas on the site to be used for these BMPs shall be protected from siltation and compaction during construction by sequencing the construction in a fashion to install these BMPs at the latter part of the construction grading operations, by excluding equipment from the BMPs and the associated areas, and by using the erosion and sedimentation control BMPs listed below. Additional requirements for protecting these BMPs during the construction process, testing functionality, and restoring functionality are needed at the final stage of the construction process.

#### **Relevant BMPs**

- C103: High Visibility Fence BMP
- C200: Interceptor Dike and Swale BMP
- C201: Grass-lined Channels BMP
- C207: Check Dams BMP
- C208: Triangular Silt Dike BMP
- C233: Silt Fence BMP

### 3 Pollution Prevention Team

Table 7 – Team Information

<b>Title</b>	<b>Name(s)</b>	<b>Phone Number</b>
<b>Certified Erosion and Sediment Control Lead (CESCL)</b>	Brian Kalab	425-303-9363
<b>Resident Engineer</b>	Brian Kalab / Insight Engineering	425-303-9363
<b>Emergency Ecology Contact</b>	Tracy Walters	425-649-7000
<b>Emergency Permittee/ Owner Contact</b>	Todd McFarlane	541-335-4585
<b>Non-Emergency Owner Contact</b>	Todd McFarlane	541-335-4585
<b>Monitoring Personnel</b>	TBD	425-345-9547
<b>Ecology Regional Office</b>	Northwest Regional Office	425-649-7000



## 4 Monitoring and Sampling Requirements

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

The receiving waterbody, Swamp Creek, is impaired for: Bacteria, Bioassessment, DO, pH and Temp. All stormwater and dewatering discharges from the site are subject to an **effluent limit** of 8.5 su for pH and/or 25 NTU for turbidity.

### 4.1 Site Inspection

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

### 4.2 Stormwater Quality Sampling

#### 4.2.1 Turbidity Sampling

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.

Method for sampling turbidity:

**Table 8 – Turbidity Sampling Method**

<input type="checkbox"/>	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
<input checked="" type="checkbox"/>	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The limit for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Stop effluent discharge to receiving waterbody immediately. If discharge continues, this will be a direct violation of the SWPPP and CSWGP. Implement biker tanks to prevent discharge from entering receiving water body. Replace/repair BMP's if not functioning properly. Do not discharge runoff until the turbidity value is 25 nephelometric turbidity units (NTU) or less and a transparency less than 33 centimeters.

2. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the limit.
3. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the limit. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
4. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours.
  - **Central Region** (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490 or [http://www.ecy.wa.gov/programs/spills/forms/nerts\\_online/CRO\\_nerts\\_online.html](http://www.ecy.wa.gov/programs/spills/forms/nerts_online/CRO_nerts_online.html)
  - **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400 or [http://www.ecy.wa.gov/programs/spills/forms/nerts\\_online/ERO\\_nerts\\_online.html](http://www.ecy.wa.gov/programs/spills/forms/nerts_online/ERO_nerts_online.html)
  - **Northwest Region** (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000 or [http://www.ecy.wa.gov/programs/spills/forms/nerts\\_online/NWRO\\_nerts\\_online.html](http://www.ecy.wa.gov/programs/spills/forms/nerts_online/NWRO_nerts_online.html)
  - **Southwest Region** (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300 or [http://www.ecy.wa.gov/programs/spills/forms/nerts\\_online/SWRO\\_nerts\\_online.html](http://www.ecy.wa.gov/programs/spills/forms/nerts_online/SWRO_nerts_online.html)
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the limit. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
  - Turbidity is 25 NTU (or lower).
  - Transparency is 33 cm (or greater).
  - Compliance with the water quality limit for turbidity is achieved.
    - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
    - 1% - 10% over background turbidity, if background is 50 NTU or greater
  - The discharge stops or is eliminated.

#### **4.2.2 pH Sampling**

pH monitoring is required for “Significant concrete work” (i.e., greater than 1000 cubic yards poured concrete over the life of the project). The use of recycled concrete or engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO<sub>2</sub>) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO<sub>2</sub> sparging or dry ice.

Method for sampling pH:

No pH monitoring will be necessary as none of the proposed work includes pH modifying activities.

## **5 Reporting and Record Keeping**

### **5.1 Record Keeping**

#### **5.1.1 Site Log Book**

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

#### **5.1.2 Records Retention**

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

#### **5.1.3 Updating the SWPPP**

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

### **5.2 Reporting**

#### **5.2.1 Discharge Monitoring Reports**

**Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given**

monitoring period the DMR will be submitted as required, reporting “No Discharge”. The DMR due date is fifteen (15) days following the end of each calendar month. DMRs will be reported online through Ecology’s WQWebDMR System.

### 5.2.2 Notification of Noncompliance

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

- **Central Region** at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County
- **Eastern Region** at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County
- **Northwest Region** at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County
- **Southwest Region** at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum

Include the following information:

1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call
6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO<sub>2</sub> sparging is planned for adjustment of high pH water.



## **B. BMP Detail**

### **Element #1 - Mark Clearing Limits**

- High Visibility Plastic or Metal Fence (BMP C103)

### **Element #2 - Establish Construction Access**

- Stabilized Construction Entrance (BMP C105)

### **Element #3 - Control Flow Rates**

- Sediment Pond (BMP C241)

### **Element #4 - Install Sediment Controls**

- Silt Fence (BMP C233)
- Interceptor Dike and Swale (BMP C200)

### **Element #5 - Stabilize Soils**

- Mulching (BMP C121)
- Temporary and Permanent Seeding (BMP C120)

### **Element #6 - Protect Slopes**

- Plastic Covering (BMP C123)

### **Element #8 - Stabilize Channels and Outlets**

- Outlet Protection (BMP C209)
- Element #10 - Control Dewatering
- Additional Advanced BMPs to Control Dewatering:

### **Element #11 – Maintain BMP’s**

- Scheduling (BMP C162)

### **Element #12 – Manage the Project**

- CESC Lead (BMP C160)

### **Element #13 – Protect On-site Stormwater Management BMPs for Runoff from Roofs and Other Hard Surfaces**

- C103: High Visibility Fence BMP
- C200: Interceptor Dike and Swale BMP
- C201: Grass-lined Channels BMP
- C233: Silt Fence BMP

## **C. Correspondence**

Ecology

EPA

Local Government



## D. Site Inspection Form

# Construction Stormwater Site Inspection Form

**Project Name** \_\_\_\_\_ **Permit #** \_\_\_\_\_ **Inspection Date** \_\_\_\_\_ **Time** \_\_\_\_\_

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*

Print Name: \_\_\_\_\_

Approximate rainfall amount since the last inspection (in inches): \_\_\_\_\_

Approximate rainfall amount in the last 24 hours (in inches): \_\_\_\_\_

Current Weather Clear  Cloudy  Mist  Rain  Wind  Fog

**A. Type of inspection:** Weekly  Post Storm Event  Other

**B. Phase of Active Construction (check all that apply):**

Pre Construction/installation of erosion/sediment controls	<input type="checkbox"/>	Clearing/Demo/Grading	<input type="checkbox"/>	Infrastructure/storm/roads	<input type="checkbox"/>
Concrete pours	<input type="checkbox"/>	Vertical Construction/buildings	<input type="checkbox"/>	Utilities	<input type="checkbox"/>
Offsite improvements	<input type="checkbox"/>	Site temporary stabilized	<input type="checkbox"/>	Final stabilization	<input type="checkbox"/>

**C. Questions:**

- |                                                                                                          |     |    |  |
|----------------------------------------------------------------------------------------------------------|-----|----|--|
| 1. Were all areas of construction and discharge points inspected?                                        | Yes | No |  |
| 2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen            | Yes | No |  |
| 3. Was a water quality sample taken during inspection? ( <i>refer to permit conditions S4 &amp; S5</i> ) | Yes | No |  |
| 4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?*                       | Yes | No |  |
| 5. If yes to #4 was it reported to Ecology?                                                              | Yes | No |  |
| 6. Is pH sampling required? pH range required is 6.5 to 8.5.                                             | Yes | No |  |

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: \_\_\_\_\_ Date: \_\_\_\_\_

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

# Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required" details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

## Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

## Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

**E. Check all areas that have been inspected. ✓**

All in place BMPs  All disturbed soils  All concrete wash out area  All material storage areas   
 All discharge locations  All equipment storage areas  All construction entrances/exits

# Construction Stormwater Site Inspection Form

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F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

*Attach additional page if needed*

**Sign the following certification:**

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) \_\_\_\_\_ (Signature) \_\_\_\_\_ Date: \_\_\_\_\_

Title/Qualification of Inspector: \_\_\_\_\_

## **E. Construction Stormwater General Permit (CSWGP)**

## **F. Contaminated Site Information**

There is no contaminated soil onsite.



## G. Engineering Calculations

### TESC Pond sizing calculations

The total contributing area to the proposed sediment pond is approximately 11.62 acres. The sediment pond is sized for the developed 10-year / 24-hour design storm due to the proximity to the wetlands.

#### 1. Discharge rate

$$Q_{10\text{yr}/24\text{hr}} = 9.50 \text{ cfs}$$

Surface Area (SA)

$$SA = 2 \times Q_{10\text{yr}/24\text{hr}} / V_{\text{sed}}$$

$$SA = 2 \times 0.55 / 0.00096$$

Where  $V_{\text{sed}}$  is the settling velocity.

$$= 19,792 \text{ Sqft}$$

#### 2. Sizing the De-watering Mechanism:

Principal Spillway (Riser pipe)

The diameter shall be the minimum necessary to pass the pre-developed 10-yr/24-hr design storm. Use Figure III.2.38 Riser inflow curves (DOE) to determine this diameter ( $h = 1$  foot)

$$Q_{(10\text{yr}/24\text{hr predev})} = 0.76 \text{ cfs}$$

Per figure III.2.38 of the DOE manual, the minimum riser diameter is 12 inches to convey this flow rate.

Emergency Overflow Spillway

The emergency overflow spillway shall convey the 100yr/24hr developed design storm.

$$Q_{100\text{yr}/24\text{hr}} = 15.15 \text{ cfs}$$

$$H = 0.5 \text{ ft}$$

$$\text{Length (L)} = \frac{Q_{100\text{yr}/24\text{hr}}}{3.21 (H)^{3/2}} - 2.4 (H)$$

$$= \frac{15.15}{3.21 (0.5)^{3/2}} - 1.2$$

$$\text{Length (L)} = 12.15 \text{ feet. Use the minimum length of 6.0 feet.}$$

De-Watering Orifice:

Size the de-watering orifice (1" minimum diameter) per the following equation:

$$A_o = \frac{A_s (2H)^{1/2}}{0.6 \times 3600 T g^{1/2}}$$

where  $A_o$  = Orifice area in square feet  
 $A_s$  = Pond surface area in square feet  
 $H$  = Head above the Orifice (height of riser in pipe=2.5-ft)  
 $T$  = De-watering Time (T = 24 hours)  
 $g$  = Acceleration due to gravity

$$A_o = \frac{19,792(2 \times 2.5)^{1/2}}{0.6 \times 3600 (24) (32.2)^{1/2}}$$

$$A_o = 0.15044 \quad \text{Sqft}$$

Convert  $A_o$  to Diameter (D) in inches

$$D = 24 \times (A_o / 3.14)^{1/2}$$

$D = 5.25$  inches. (Use 1" minimum) Per the DOE design standards; the perforated pipe shall be a minimum of two inches larger than the orifice sizes.

Use 4-inch diameter for the perforated pipe.

Refer to the construction plans for more details.

\* Sediment pond shall be a minimum of 3.5-ft deep, which includes 1-ft towards free board, 1-ft towards settling depth and 1.5-ft towards sediment storage. Refer to the construction plans for more details.

B. Geotechnical Report



**NELSON GEOTECHNICAL  
ASSOCIATES. INC.**

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July 27, 2022

2812 Architecture  
ATTN: Adam Clark  
VIA Email: [adam@2812architecture.com](mailto:adam@2812architecture.com)

Geotechnical Engineering Evaluation – **REV2**  
**Kendall Subaru Development**  
**16xxx Smokey Point Boulevard**  
**Marysville, Washington**  
NGA File No. 1378422

## **INTRODUCTION**

This letter presents the results of our geotechnical engineering investigation and evaluation of the planned Kendall Subaru Development project evaluation for the Kendall Subaru Dealership project located at **16xxx Smokey Point Boulevard in Marysville, Washington**, as shown on the Vicinity Map in Figure 1. The parcel numbers for the affected properties are 31052800300600, -1200, and -0300. We have been requested to revise this document so it does not include the seismic site coefficient  $F_a$ , which we understand the project structural engineer will determine without our input.

The purpose of this study is to explore and characterize the site's surface and subsurface conditions and to provide geotechnical recommendations for the planned site development.

The properties consist of three rectangular parcels that are offset to form an irregularly shaped site that covers approximately 15.72 acres. It is currently vacant and undeveloped. Topographically, the site is relatively level. We understand the plans for development include the construction of an auto dealership structure and associated parking lot. We have been informed that the structure will be supported only with isolated foundations, and it will not include any continuous foundations. We have been informed that site stormwater will be directed off-site. We have been requested to prepare this letter to address the City of Marysville code.

For our use in preparing this letter, we were provided with a site plan titled “Kendall Subaru,” dated May 26, 2022, and prepared by 2812 Architecture. We also were provided with a geotechnical report titled “Geotechnical Investigation - CamNel Properties,” dated December 26, 2016, and prepared by Liu and Associates, Inc.

## **SCOPE**

The purpose of this study is to explore and characterize the site surface and subsurface conditions and provide general recommendations for site development.

Specifically, our scope of services included the following:

1. Review available soil and geologic maps of the area, including previous geotechnical documentation.
2. Visit the site to reconnoiter surficial information and evaluate subsurface soil and groundwater conditions within the site with test pits using a mini excavator.
3. Perform laboratory grain-size sieve analysis on soil samples, as necessary.
4. Determine the presence of Geologically Hazardous Areas in accordance with the City of Marysville Municipal Code, as warranted.
5. Provide recommendations for earthwork and foundation support.
6. Provide recommendations for retaining walls.
7. Provide recommendations for temporary and permanent slopes.
8. Provide recommendations for subsurface utilities and pavement subgrade preparation.
9. Provide general recommendations for site drainage and erosion control.
10. Document the results of our findings, conclusions, and recommendations in an updated written geotechnical letter.

## **SITE CONDITIONS**

### **Surface Conditions**

The site consists of three rectangular parcels that are offset to form an irregularly shaped site that covers 15.72 acres. The site is bordered to the west by Smokey Point Boulevard, to the north by undeveloped, wooded land and by an automotive repair business, and to the south and east by undeveloped, wooded land. The site is currently undeveloped and is generally fairly level. A mound of soil up to about 12 feet tall has been placed in a stockpile near the southwest corner of the site. That stockpile has side slopes with inclination close to 3H:1V, and approximate dimensions of 120 feet by 50 feet. The western two-thirds of the site is sparsely vegetated with brush, with areas of exposed soil. The eastern third of the

property is wooded. We did not observe surface water within the site during our site visit on May 20, 2022.

### **Subsurface Conditions**

**Geology:** The geologic units for this area are shown on the [Geologic Map of the Arlington West 7.5 Minute Quadrangle, Snohomish County, Washington](#), by James P. Minard, et al. (USGS, 1985). The site is mapped as Marysville Sand (Qvrm). The Marysville Sand is described as well-drained, stratified to massive outwash sand with some fine gravel. Our explorations encountered topsoil or disturbed ground underlain by fine to medium sand with varying amounts of silt consistent with the description of Marysville Sand.

**Explorations:** The subsurface conditions within the site were explored on June 22, 2022 by excavating four test pits to depths of 6.5 feet below the existing ground surface using a mini excavator. The approximate locations of our explorations are shown on the Site Plan in Figure 2. A geologist from NGA was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the test pits. The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 3. The logs of our test pits are attached to this report and are presented as Figure 4. We present a brief summary of the subsurface conditions in the following paragraph. For a detailed description of the subsurface conditions, the logs of the test pits should be reviewed. The test pits encountered 0.5 to 1 foot of topsoil or fill/disturbed ground at the ground surface. These surficial soils were generally underlain by medium dense sand with silt and varying amounts of roots, which extended to 1.5 to 2.5 feet below the surface. That sand with silt was underlain by medium dense sand, which extended to the maximum explored depths of 6.5 feet. We interpret the sand to be Marysville Sand. Heavy test pit caving was observed below depths of 2 to 3.5 feet in all of the test pits. The conditions observed in our test pits are generally consistent with the subsurface soil conditions described in the provided 2016 geotechnical report for the site.

### **Hydrogeologic Conditions**

We observed groundwater within the test pits at depths of 3 to 4 feet, which we interpret to be associated with the regional groundwater table. We would expect the groundwater elevation to be slightly lower during drier times of the year and slightly higher during wetter periods. The provided 2016 geotechnical report for the site describes 6 test pit explorations that were completed on August 25, 2016. Groundwater was encountered in those test pits at depths of 6 to 7.5 feet. Those explorations were excavated late in the summer, and groundwater was lower than in our recent test pits, excavated early in the summer.

## SENSITIVE AREA EVALUATION

### General

We reviewed the 2012 City of Marysville Critical Areas map and found that the subject site is not mapped as having critical areas.

### Seismic Hazard

We reviewed the 2018 International Building Code (IBC) for seismic site classification for this project. Since competent glacial outwash soils are inferred to underlie the site at depth, the site conditions best fit the IBC description for Site Class D.

Table 1 below provides seismic design parameters for the site that are in conformance with the 2018 IBC, which specifies a design earthquake having a 2% probability of occurrence in 50 years (return interval of 2,475 years), and the 2008 USGS seismic hazard maps.

**Table 1 – 2018 IBC Seismic Design Parameters**

Site Class	Spectral Acceleration at 0.2 sec. (g) $S_s$	Spectral Acceleration at 1.0 sec. (g) $S_1$	Site Coefficients		Design Spectral Response Parameters	
				$F_v$	$S_{DS}$	$S_{D1}$
D	1.072	0.383		null	0.858	null

The spectral response accelerations were obtained from the OSHPD Seismic Design Maps website (ASCE 7-16 data) for the project latitude and longitude.

We reviewed the [Liquefaction Susceptibility Map of Snohomish County, Washington](#) by Stephen Palmer et al. (Washington State Department of Natural Resources, 2004). The site and surrounding vicinity are mapped as having low to moderate liquefaction susceptibility.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the medium dense native Marysville Sand deposits interpreted to underlie the site have a low to moderate potential for liquefaction or amplification of ground motion.

## **Erosion Hazard**

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. The Soil Survey of Snohomish County Area, Washington by the Natural Resources Conservation Service (NRCS), classifies the site as Custer fine sandy loam and Norma loam. These soils are listed as having slight erosion hazard. Based on our experience in the area and our observations in the field, it is our opinion that the site would have a low erosion hazard for areas where the soils are exposed. It is our opinion that the erosion hazard for site soils should be very low in areas where vegetation is not disturbed.

## **CONCLUSIONS AND RECOMMENDATIONS**

### **General**

It is our opinion from a geotechnical standpoint that the planned development is feasible. Our explorations indicated that the site was underlain by medium dense sand with silt or sand at depths of 0.5 to 1 foot below the ground surface. These native soils should provide adequate support for foundation, slab, and pavement loads. We recommend that the new structure be designed utilizing shallow foundations. Footings should extend through any loose soil and be founded on the underlying medium dense native soil, or structural fill extending to these soils. Footing excavations that extend below groundwater should be filled with compacted crushed rock above the water level. Deeper areas of unsuitable soils and/or undocumented fill could be encountered in the unexplored areas of the site. This condition, if encountered, would require deeper excavations in foundation, slab, and pavement areas to remove the unsuitable soils.

The surficial soils encountered on this site are considered moisture-sensitive and may disturb easily when wet. We recommend that construction take place during the drier summer months, if possible. If construction is to take place during wet weather, the soils may disturb and additional expenses and delays should be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls to protect exposed subgrades and construction traffic areas. Some of the native granular on-site soils may be suitable for use as structural fill depending on the moisture content of the soil during construction. NGA should be retained to determine if the on-site soils can be used as structural fill material during construction.



## **Erosion Control**

The erosion hazard for the on-site soils is interpreted to be low for exposed soils, but actual erosion potential will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences and/or straw bales should be erected to prevent muddy water from leaving the site. Disturbed areas should be planted as soon as practical, and the vegetation should be maintained until it is established. The erosion potential of areas not stripped of vegetation should be low.

## **Site Preparation and Grading**

After erosion control measures are implemented, site preparation should consist of removing loose soils, topsoil, and any undocumented fill from foundations, slab, and pavement areas, to expose medium dense native bearing soils. The stripped soil should be removed from the site or stockpiled for later use as a landscaping fill. Based on our observations, we anticipate native, medium dense soil is present at depths of approximately 0.5 to 1 foot at the site. We recommend that if loose soils are encountered at the foundation subgrades, that the subgrade be compacted to a non-yielding condition using a vibratory roller or a heavy plate compactor. Deeper areas of unsuitable soils and/or undocumented fill could be encountered in the unexplored areas of the site. This condition, if encountered, would require deeper excavations in foundation, slab, and pavement areas to remove the unsuitable soils. After site preparation, if the exposed subgrade is deemed loose, it should be compacted to a non-yielding condition and then proof-rolled with a heavy rubber-tired piece of equipment. Areas observed to pump or weave during the proof-roll test should be reworked to structural fill specifications or over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are encountered in foundation areas, the loose soils should be removed and replaced with rock spalls. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed, and the exposed subgrades should be maintained in a semi-dry condition. If wet conditions are encountered, alternative site grading techniques might be necessary. These techniques could include using large excavators equipped with wide tracks and a smooth bucket to complete site grading and covering exposed subgrade with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted, as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from disturbance by machine or foot

traffic during construction. The prepared subgrade should be protected from construction traffic and surface water should be diverted around areas of prepared subgrade.

### **Temporary and Permanent Slopes**

Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations at all times as indicated in OSHA guidelines for cut slopes.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

For planning purposes, we recommend that temporary cuts in the on-site soils be no steeper than 1.5 Horizontal to 1 Vertical (1.5H:1V). If significant groundwater seepage or surface water flow were encountered, flatter inclinations would be necessary. We recommend that cut slopes be protected from erosion. The slope protection measures may include covering cut slopes with plastic sheeting and diverting surface runoff away from the top of cut slopes. We do not recommend vertical slopes for cuts deeper than four feet, if worker access is necessary. We recommend that cut slope heights and inclinations conform to appropriate OSHA/WISHA regulations. Permanent cut and fill slopes should be no steeper than 3H:1V. However, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be vegetated, and the vegetative cover maintained until established.

### **Foundations**

Conventional shallow spread foundations should be placed on medium dense native bearing soils or be supported on structural fill or rock spalls extending to those soils. Medium dense soils should be encountered approximately 0.5 to one foot below ground surface based on our explorations. Where undocumented fill or loose soils are encountered at footing bearing elevation, the subgrade should be over-excavated to expose suitable bearing soil. The over-excavation may be filled with structural fill, or the footing may be extended down to the competent native soils. If footings are supported on structural fill, the fill zone should extend outside the edges of the footing a distance equal to one half of the depth of the over-excavation below the bottom of the footing.

Footings should extend at least 18-inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Foundations should be designed in accordance with the 2018 IBC. Footing widths should be based on the anticipated loads and allowable soil bearing pressure. Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above, we recommend an allowable bearing pressure of not more than 2,000 pounds per square foot (psf) be used for the design of isolated footings with a minimum dimension of at least 4 feet founded on the medium dense or denser native bearing soils or structural fill extending to the competent native bearing material. The foundation bearing soil should be evaluated by a representative of NGA. We should be consulted if higher bearing pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads. Potential foundation settlement using the recommended allowable bearing pressure is estimated to be less than 1-inch total and ½-inch differential between adjacent footings or across a distance of about 20 feet, based on our experience with similar projects.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively. To achieve this value of passive resistance, the foundations should be poured “neat” against the native medium dense soils or compacted fill should be used as backfill against the front of the footing. We recommend that the upper one foot of soil be neglected when calculating the passive resistance.

## Retaining Walls

Should retaining walls be utilized, they should be designed and constructed as outlined hereon. The lateral pressure acting on subsurface retaining walls is dependent on the nature and density of the soil behind the wall, the amount of lateral wall movement which can occur as backfill is placed, wall drainage conditions, and the inclination of the backfill. For walls that are free to yield at the top at least one thousandth of the height of the wall (active condition), soil pressures will be less than if movement is limited by such factors as wall stiffness or bracing (at-rest condition). We recommend that walls supporting horizontal backfill and not subjected to hydrostatic forces, be designed using a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of 35 pcf for yielding (active condition) walls, and 55 pcf for non-yielding (at-rest condition) walls. A seismic design loading of  $8H$  should also be included in the wall design, where “H” represents the total height of the wall.

These recommended lateral earth pressures are for a drained granular backfill and assume of a horizontal ground surface behind the wall for a distance of at least the subsurface height of the wall, and do not account for surcharge loads. Additional lateral earth pressures should be considered for surcharge loads acting adjacent to subsurface walls and within a distance equal to the subsurface height of the wall. This would include the effects of surcharges such as traffic loads, floor slab loads, slopes, or other surface loads. We could consult with the structural engineer regarding additional loads on retaining walls during final design, if needed.

The lateral pressures on walls may be resisted by friction between the foundation and subgrade soil, and by passive resistance acting on the below-grade portion of the foundation. Recommendations for frictional and passive resistance to lateral loads are presented in the **Foundations** subsection of this report.

All wall backfill should be well compacted as outlined in the **Structural Fill** subsection of this report. Care should be taken to prevent the buildup of excess lateral soil pressures due to over-compaction of the wall backfill. This can be accomplished by placing wall backfill in 8-inch loose lifts and compacting the backfill with small, hand-operated compactors within a distance behind the wall equal to at least one-half the height of the wall. The thickness of the loose lifts should be reduced to accommodate the lower compactive energy of the hand-operated equipment. The recommended level of compaction should still be maintained. Permanent drainage systems should be installed for retaining walls. Recommendations for these systems are found in the **Subsurface Drainage** subsection of this report. We recommend that we be retained to evaluate the proposed wall drain backfill material and observe installation of the drainage systems.

## **Structural Fill**

**General:** Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection prior to beginning fill placement. Sloping areas to receive fill should be benched using a minimum 8-foot-wide horizontal benches into competent soils.

**Materials:** Structural fill should consist of a good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). Some of the more granular on-site soils may be suitable for use as structural fill depending on the moisture content of the soil during construction. We should be retained to evaluate all proposed structural fill material prior to placement.

**Fill Placement:** Following subgrade preparation, placement of structural fill may proceed. All filling should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction and should be tested.

## **Slab-on-Grade**

Slabs-on-grade should be supported on subgrade soils prepared as described in the **Site Preparation and Grading** subsection of this report. We recommend that all floor slabs be underlain by at least six inches of free-draining gravel with less than three percent by weight of the material passing Sieve #200 for use as a capillary break. A suitable vapor barrier, such as heavy plastic sheeting (6-mil minimum), should be placed over the capillary break material. An additional 2-inch-thick moist sand layer may be used to cover

the vapor barrier. This sand layer is optional and is intended to be used to protect the vapor barrier membrane and to aid in curing the concrete.

## **Pavements**

Pavement subgrade preparation and structural filling where required, should be completed as recommended in the **Site Preparation and Grading** and **Structural Fill** subsections of this report. The pavement subgrade should be proof-rolled with a heavy, rubber-tired piece of equipment, to identify soft or yielding areas that require repair. The pavement section should be underlain by a minimum of six inches of clean granular pit run or crushed rock. We should be retained to observe the proof-rolling and recommend subgrade repairs prior to placement of the asphalt or hard surfaces.

## **Utilities**

We recommend that underground utilities be bedded with a minimum six inches of pea gravel prior to backfilling the trench with on-site or imported material. Trenches within settlement sensitive areas should be compacted to 95% of the modified proctor as described in the **Structural Fill** subsection of this report. Trenches located in non-structural areas should be compacted to a minimum 90% of the maximum dry density. Trench backfill compaction should be tested.

## **Site Drainage**

**Surface Drainage:** The finished ground surface should be graded such that stormwater is directed to an appropriate stormwater collection system. Water should not be allowed to stand in any areas where footings, slabs, or pavements are to be constructed. Final site grades should allow for drainage away from the proposed structures. We suggest that the finished ground be sloped at a minimum downward gradient of three percent, for a distance of at least 10 feet away from the proposed structures. Surface water should be collected by permanent catch basins and drain lines and be discharged into an approved discharge system.

**Subsurface Drainage:** If groundwater is encountered during construction, we recommend that the contractor slope the bottom of the excavation and collect the water into ditches and small sump pits where the water can be pumped out and routed into a permanent storm drain. We recommend the use of footing drains around the structures. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum 4-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material wrapped in a filter fabric. We recommend that the free-draining material consist of an 18-inch-wide zone of clean (less than three-percent fines), granular material placed along the back of walls. Pea gravel is an acceptable drain material. The free-

draining material should extend up the wall to one foot below the finished surface. The top foot of backfill should consist of impermeable soil placed over plastic sheeting or building paper to minimize surface water or fines migration into the footing drain. Footing drains should discharge into tightlines leading to an approved collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains.

### **CONSTRUCTION MONITORING**

We should be retained to provide construction monitoring services during the earthwork phase of the project to evaluate subgrade conditions, temporary cut conditions, fill compaction, and drainage system installation.

### **USE OF THIS LETTER**

NGA has prepared this letter for **Adam Clark with 2812 Architecture**, and associated agents, for use in the planning and design of the development on this site only. The scope of our work does not include services related to construction safety precautions and our recommendations are not intended to direct the contractors' methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. There are possible variations in subsurface conditions between the explorations and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule.

We recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

o-o-o

It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

**NELSON GEOTECHNICAL ASSOCIATES, INC.**



Thor Christensen, PE  
**Project Engineer**



Khaled M. Shawish, PE  
**Principal Engineer**

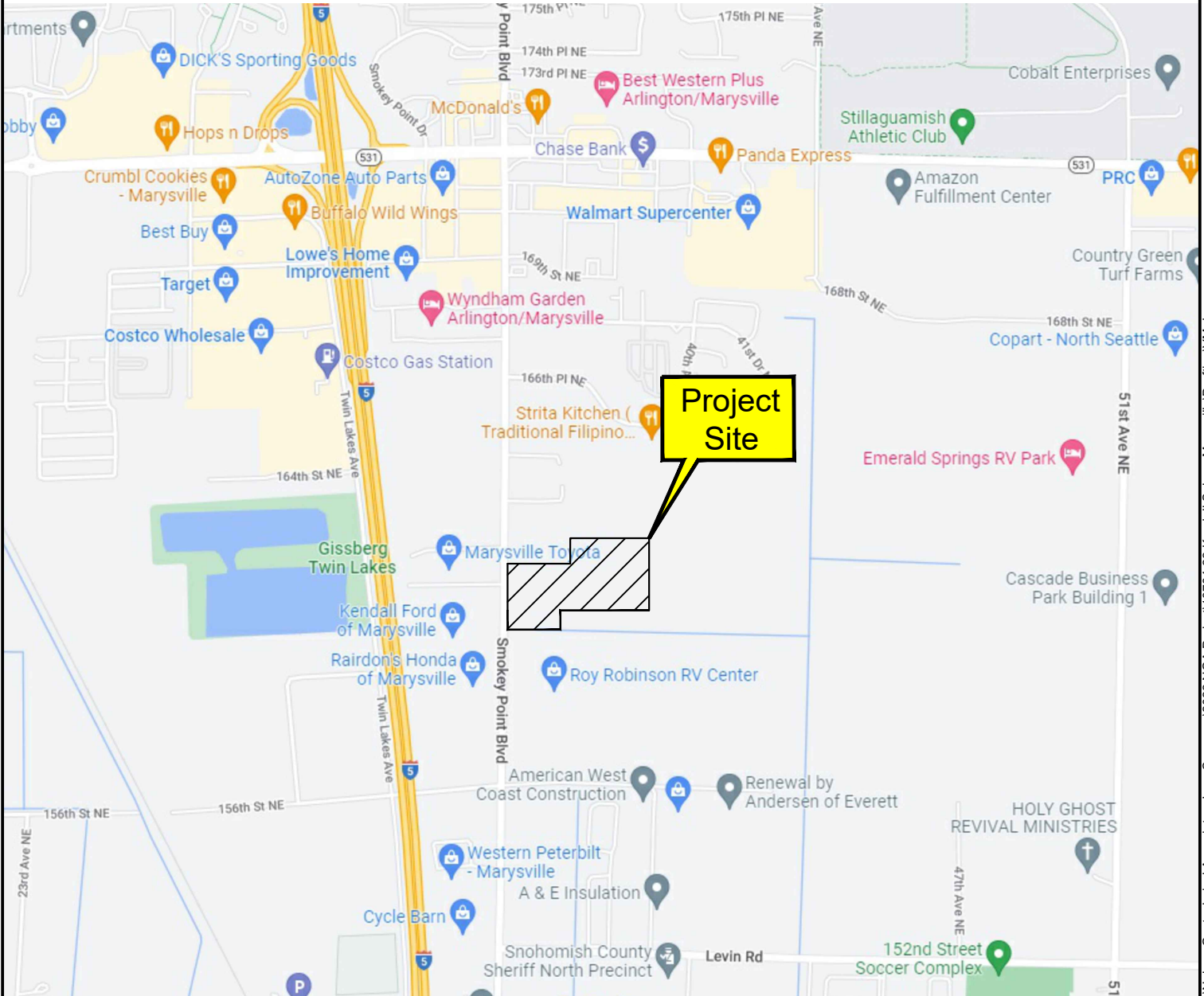
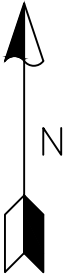
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Four Figures Attached



# VICINITY MAP

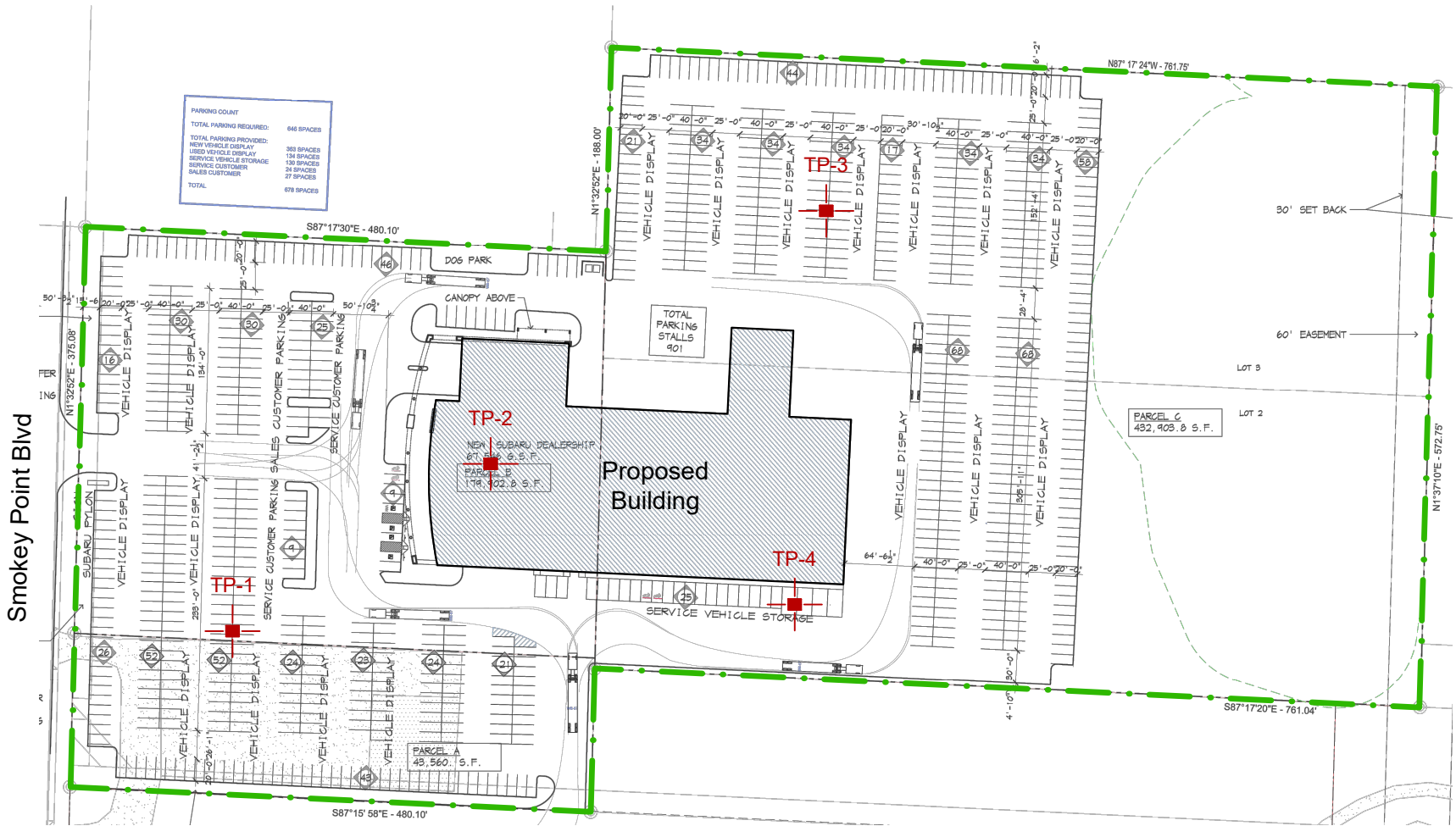
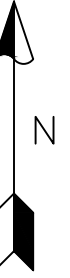
Not to Scale




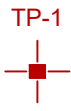
## Marysville, WA

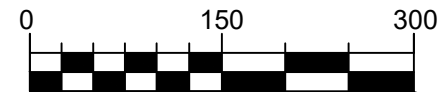
Project Number 1378422	Kendall Subaru Marysville Vicinity Map	 <p><b>NELSON GEOTECHNICAL ASSOCIATES, INC</b></p> <p>Woodinville Office 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510</p> <p>Wenatchee Office 105 Palouse St Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692</p> <p>www.nelsongeotech.com</p>	No. Date Revision By CK	1 6/27/22 Original DPN DJO	
Figure 1					

# Site Plan



## LEGEND

-  Property line
-  TP-1  
Number and approximate location of test pit



Scale: 1 inch = 150 feet

Project Number  
1378422  
Figure 2

Kendall Subaru Marysville  
Site Plan



**NELSON GEOTECHNICAL ASSOCIATES, INC**

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No.	Date	Revision	By	CK
1	6/27/22	Original	DPN	DUO

Reference: Site plan based on a plan dated May 26, 2022 titled "New Auto Dealership for: Kendall Subaru," prepared by 2012 Architecture.

# UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
<b>COARSE - GRAINED SOILS</b>  MORE THAN 50 % RETAINED ON NO. 200 SIEVE	<b>GRAVEL</b>  MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
		GRAVEL WITH FINES	GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
		GRAVEL WITH FINES	GC	CLAYEY GRAVEL
	<b>SAND</b>  MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
		SAND WITH FINES	SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
		SAND WITH FINES	SC	CLAYEY SAND
<b>FINE - GRAINED SOILS</b>  MORE THAN 50 % PASSES NO. 200 SIEVE	<b>SILT AND CLAY</b>  LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
		INORGANIC	CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	<b>SILT AND CLAY</b>  LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
		INORGANIC	CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
<b>HIGHLY ORGANIC SOILS</b>			PT	PEAT

**NOTES:**

- 1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.
- 2) Soil classification using laboratory tests is based on ASTM D 2488-93.
- 3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

**SOIL MOISTURE MODIFIERS:**

- Dry - Absence of moisture, dusty, dry to the touch
- Moist - Damp, but no visible water.
- Wet - Visible free water or saturated, usually soil is obtained from below water table

<b>Project Number</b>	Kendall Subaru Marysville Soil Classification Chart	 <b>NELSON GEOTECHNICAL ASSOCIATES, INC</b> <small>Woodinville Office 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510</small>	<small>Wenatchee Office 105 Palouse St Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692</small>	<b>No.</b>	<b>Date</b>	<b>Revision</b>	<b>By</b>	<b>CK</b>
Figure 3				1	6/27/22	Original	DPN	DJO

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## LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
<b>TEST PIT ONE</b>		
0.0 – 0.5		<b>TOPSOIL</b>
0.5 – 1.5	SP	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH IRON-OXIDE WEATHERING AND TRACE ROOTS (MEDIUM DENSE, MOIST)
1.5 – 6.5	SP	GRAY, FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED MINOR GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 3.0 FEET HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 3.75 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 2.0 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022
<b>TEST PIT TWO</b>		
0.0 – 0.5		<b>TOPSOIL / WOOD CHIPS</b>
0.5 – 1.5	SP-SM	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH SILT, IRON-OXIDE WEATHERING, AND TRACE ROOTS (MEDIUM DENSE, MOIST)
1.5 – 6.5	SP	GRAY, FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 3.5 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 3.0 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022
<b>TEST PIT THREE</b>		
0.0 – 0.75		ORANGE-BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS AND ORGANICS (LOOSE TO MEDIUM DENSE, MOIST) ( <b>FILL/DISTURBED GROUND</b> )
0.75 – 2.0	SP-SM	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH SILT, IRON-OXIDE WEATHERING, AND TRACE ROOTS (MEDIUM DENSE, MOIST)
2.0 – 6.5	SW	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 4.0 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 3.5 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022
<b>TEST PIT FOUR</b>		
0.0 – 1.0		ORANGE-BROWN TO DARK BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS AND ORGANICS (LOOSE TO MEDIUM DENSE, MOIST) ( <b>FILL/DISTURBED GROUND</b> )
1.0 – 2.5	SP-SM	ORANGE-BROWN TO ORANGE-GRAY, FINE TO MEDIUM SAND WITH SILT AND IRON-OXIDE WEATHERING (MEDIUM DENSE, MOIST)
2.5 – 6.5	SW	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE NOT COLLECTED HEAVY GROUNDWATER SEEPAGE WAS ENCOUNTERED AT 4.0 FEET MODERATE TEST PIT CAVING WAS ENCOUNTERED FROM 3.5 TO 6.5 FEET TEST PIT WAS COMPLETED AT 6.5 FEET ON 06/22/2022

C. Operation and Maintenance Manual

**Table V-A.5: Maintenance Standards - Catch Basins**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regouted and secure at basin wall.
	Settlement/ Mis-alignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

**Table V-A.17: Maintenance Standards - Coalescing Plate Oil/Water Separators**

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with no thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Oil accumulation that exceeds 1-inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water.
	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound. Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

**Table V-A.18: Maintenance Standards - Catch Basin Inserts**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

**Table V-A.19: Maintenance Standards - Media Filter Drain (MFD)**

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean to spread flows evenly over entire embankment width.

## **6.0 Other Permits**

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A right-of-way permit will be required for the city of Marysville.