Country Meadows Estates Phase 1

Staff Report Supplement

Published May 20th, 2024

Table of Exhibits:

Country Meadows Estates Phase 1
Staff Report Supplement
Exhibit A: Traffic Impact Analysis

COUNTRY MEADOW ESTATES I

Yelm, WA/Thurston County

TRAFFIC IMPACT ASSESSMENT (TIA)

Revised: February 21, 2024

HEATH & ASSOCIATES
Transportation Planning & Engineering

COUNTRY MEADOW ESTATES I
TRAFFIC IMPACT ANALYSIS

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02/21/2024

February 21, 2024

City of Yelm/WSDOT

Subject: Revisions to The Country Meadow Estates I Traffic Impact Analysis.

This letter is in response to the city of Yelm and WSDOT review comments regarding the TIA for The Country Meadow Estates I project.

WSDOT Comments

- *Consider including phase II located in vicinity map.*

  The TIA has been updated accordingly.

- In the vicinity, WSDOT has both SR 507/SR 510 and SR 507/1st St N classified as functional class 4 (minor arterials).

  The TIA has been updated accordingly.

- Please use a peak hour factor of 1.0 for future scenarios at SR 507, SR 510.

  The TIA has been updated accordingly.

- Please preform safety analysis.

  The TIA has been updated accordingly.

- Please clarify the use of the phased TIA. The future year with/without project are 2026 for both phase I and II.

  The TIA for Phase II has been updated with a forecast 2027 horizon year as buildout is projected a year after Phase 1.

Please call if you require anything further.

Sincerely,
Aaron Van Aken, P.E., PTOE

COUNTRY MEADOW ESTATES I
TRAFFIC IMPACT ANALYSIS

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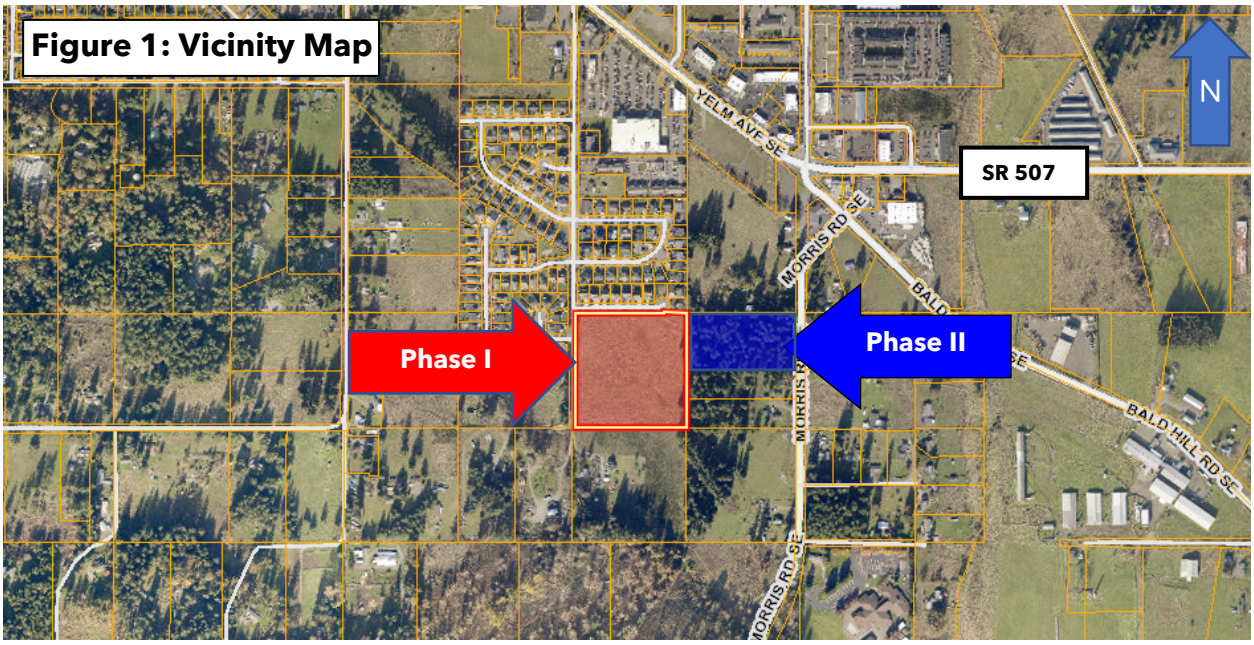
COUNTRY MEADOW ESTATES I
TRAFFIC IMPACT ANALYSIS

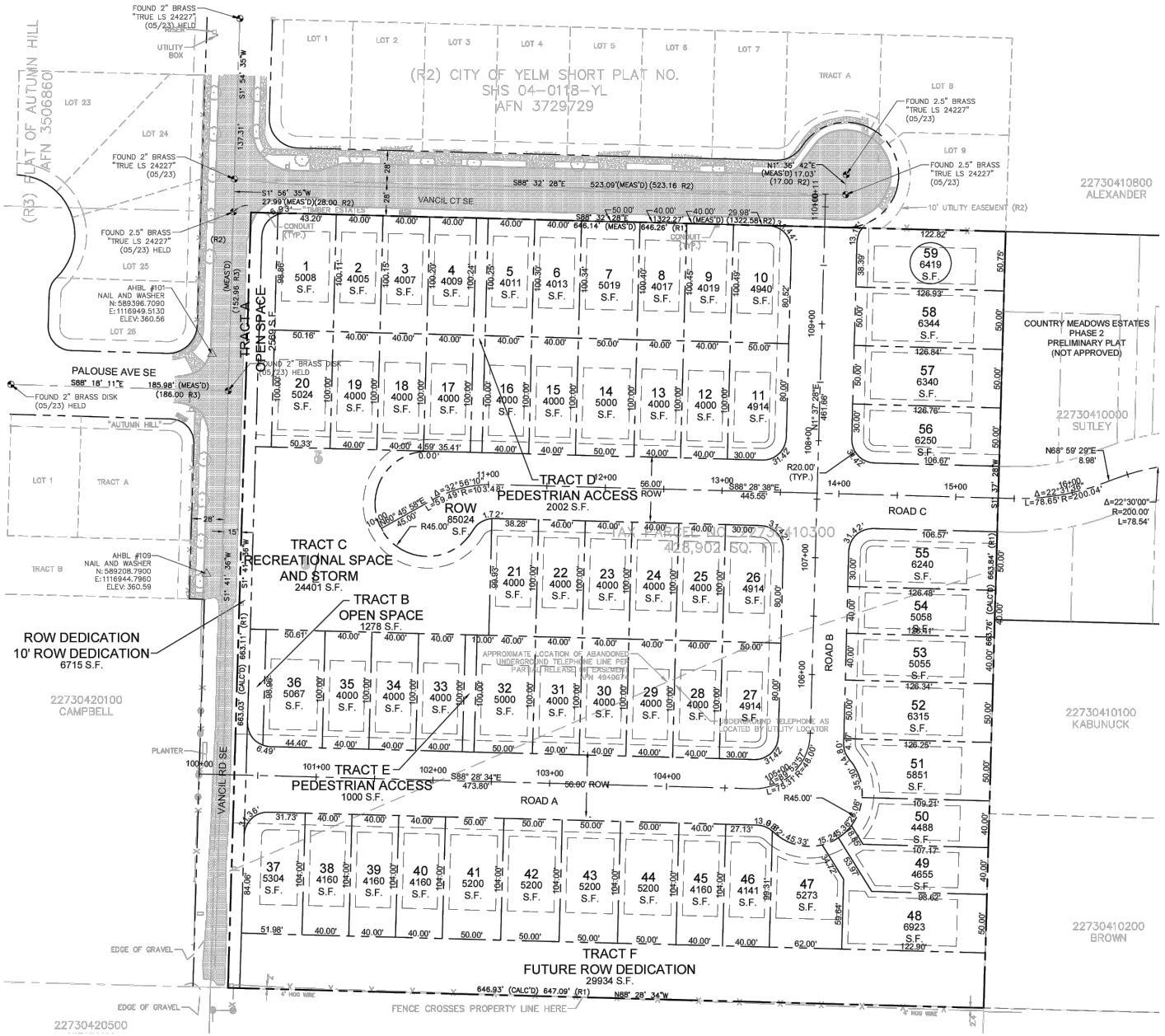
1. INTRODUCTION

The main goals of this study focus on the assessment of existing roadway conditions and forecasts of newly generated project traffic. The first task includes the review of general roadway information on the adjacent street system and baseline vehicular volumes. Forecasts of future traffic and dispersion patterns on the street system are then determined using established trip generation and distribution techniques. As a final step, appropriate conclusions and mitigation measures are defined if needed.

2. PROJECT DESCRIPTION

Country Meadow Estates I proposes for the construction of a residential development consisting of 59 single-family homes located within unincorporated Thurston County. The subject site is bordered to the west by Vancil Road SE situated 10.0-acres within undeveloped tax parcel #: 22730410300. Site ingress/egress is proposed via one new access point extending east from Vancil Road SE. Connectivity to the north development is also proposed via Vancil Court SE. Moreover, a future easterly connection is provided (to tie into Country Meadow Estates II). A vicinity map is provided below with Phase I shown in red and phase II shown in blue. Figure 2 on the following page displays the conceptual site plan.





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COUNTRY MEADOW ESTATES I

SITE PLAN
FIGURE 2

3. EXISTING CONDITIONS

3.1 Existing Street System

Characteristics of the major roadways and arterials serving the subject site are provided in Table 1 below.

Table 1: Roadway Network

Functional Classification	Roadway	Speed Limit (MPH)	Lanes	Sidewalk/ Walking Path	Street Parking	Bike Lane
WSDOT – Minor Arterial	SR 507/SR 510[1]	25-45	2-3	In city area	Some	Some
	1st St S/SR 507[2]	25-40	2-3	N/O Mossman	No	No
Urban Arterial	1st St N	25	2-3	S/O Stevens	No	No
Neighborhood Collector	Clark Rd SE	35	2	No	No	No
	Vancil Rd SE	25	2	Some	No	No
Local	Plaza Dr	25*	2	Yes	Yes	No

*No observed speed limit so city standard 25 mph applies.

3.2 Transit Service

A review of the Intercity Transit regional bus schedule indicates that transit is available within walking distance (under one mile) from the subject site. The closest stop in relation to the subject site is located at the Nisqually Plaza (~ 2,300' north of site). The bus route served at the intersection is Route 94 – Boulevard Road/Yelm. Route 94 provides service from the Olympia Transit Center to the Yelm Walmart. Weekday service is provided from 6:04 AM – 9:58 PM with approximately 60-minute headways during peak travel times. Weekend service is provided from 6:39 AM – 9:58 PM with approximately 60-minute headways. Refer to the Intercity Transit website for more detailed information.

[1] WSDOT – Functional Class 4 (Minor Arterial)

[2] WSDOT – Functional Class 4 (Minor Arterial)

3.3 Existing Peak Hour Volumes and Travel Patterns

Field data for this study was collected in May and June 2023 at four outlying study intersections (school still in session). Each intersection is listed on the following page.

- SR 510/SR 507 & N 1st Street/S 1st Street/SR 507 (6/14/2023)
- SR 507 & Clark Road SE (6/14/2023)
- SR 507 & Vancil Road SE (5/3/2023)
- SR 507 & Plaza Drive (6/14/2023)

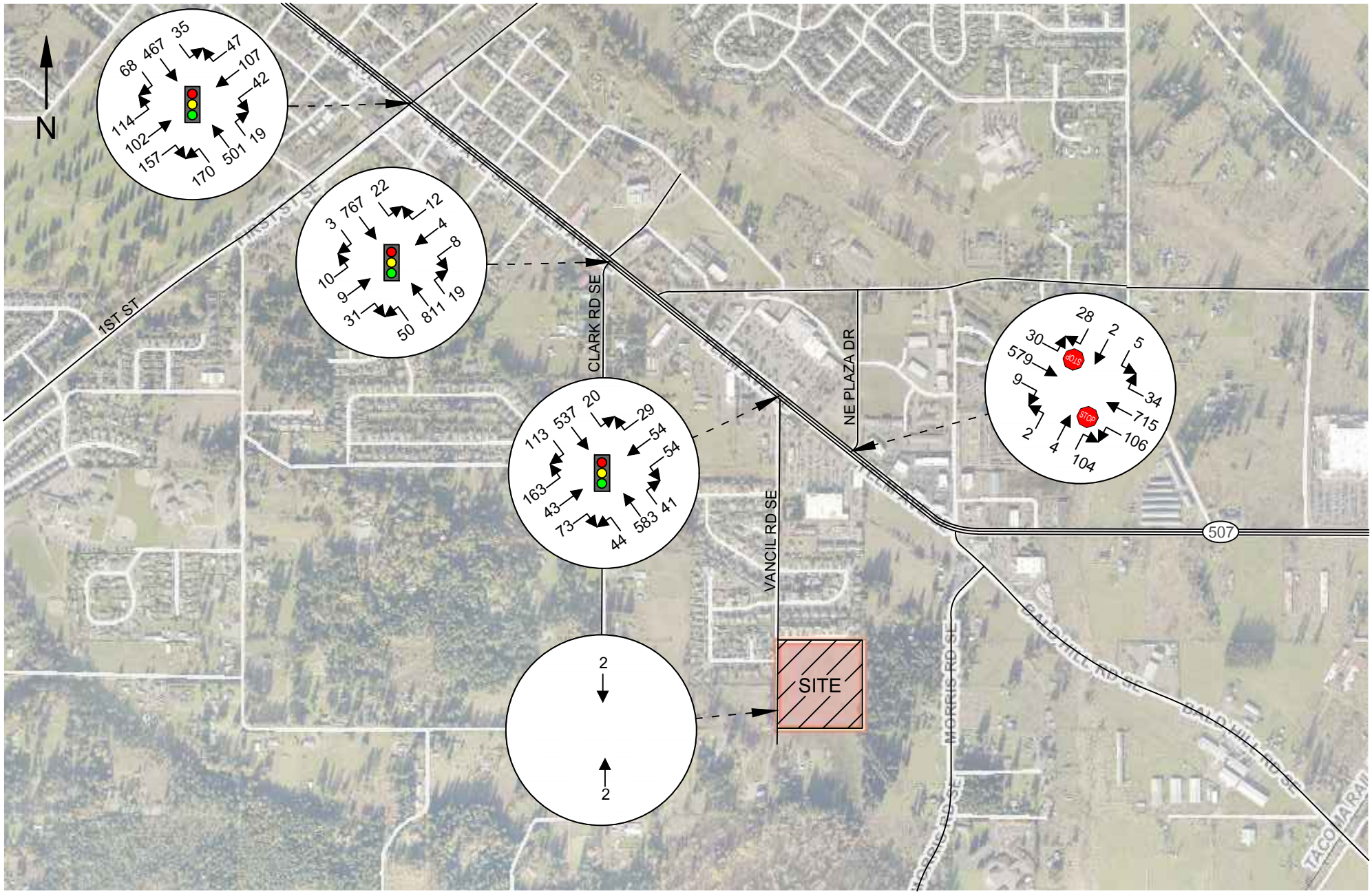
Data were obtained during the evening peak period from 4:00-6:00 PM. The single hour representing peak volumes for the PM time period is then determined and used for capacity analysis. Figure 3 highlights existing PM peak hour volumes. Count sheets have been included in the appendix for reference.

It is important to note that the proposed access for the project is to be situated south of Palouse Avenue SE, in which, Vancil Road SE supports three single family homes. The Institute of Transportation Engineers (ITE) publication, *Trip Generation,* 11th Edition was utilized to estimate the existing traffic crossing the proposed access point. LUC 210 was utilized (Single-Family Detached Homes) with dwelling units as the input variable and ITE equations to determine trip ends. ITE estimates that the three single family homes will result in 4 PM peak hour trips (2 inbound / 2 outbound) which will be applied as existing conditions along the projects frontage. Refer to the appendix for the trip generation output sheets.

3.4 Non-Motorist Activity and Infrastructure

Pedestrian and bicycle activity were monitored at each intersection studied for this project during routine PM peak hour field counts. Figures 4 and 5 display the existing non-motorist activity observed at each study intersection.

Non motorist infrastructure in the area consists of continuous sidewalk along Vancil Road SE which provides connection to SR 507 where many amenities and transit opportunities are present.



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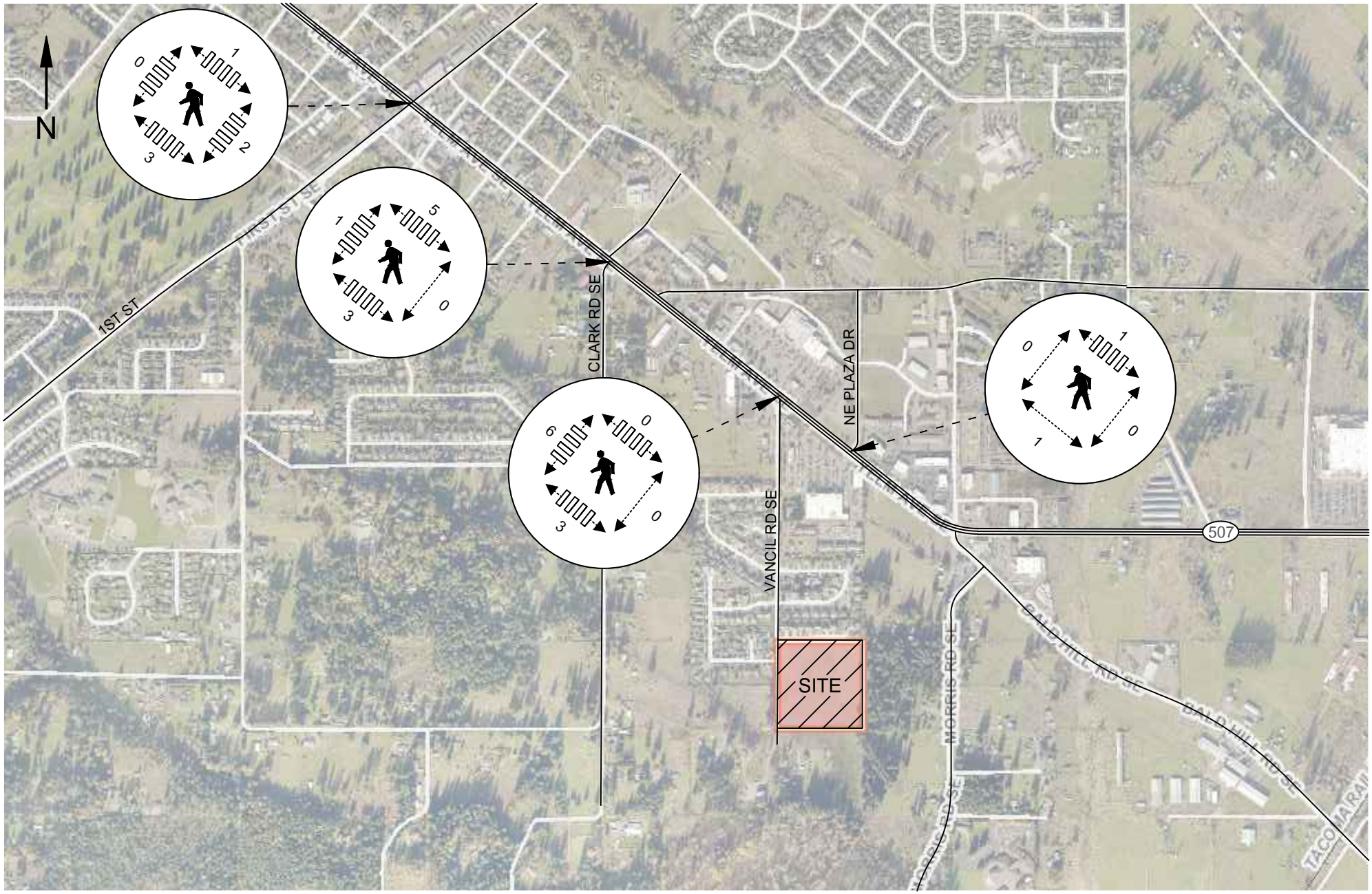
COUNTRY MEADOW ESTATES I

EXISTING PM PEAK HOUR VOLUMES
FIGURE 3



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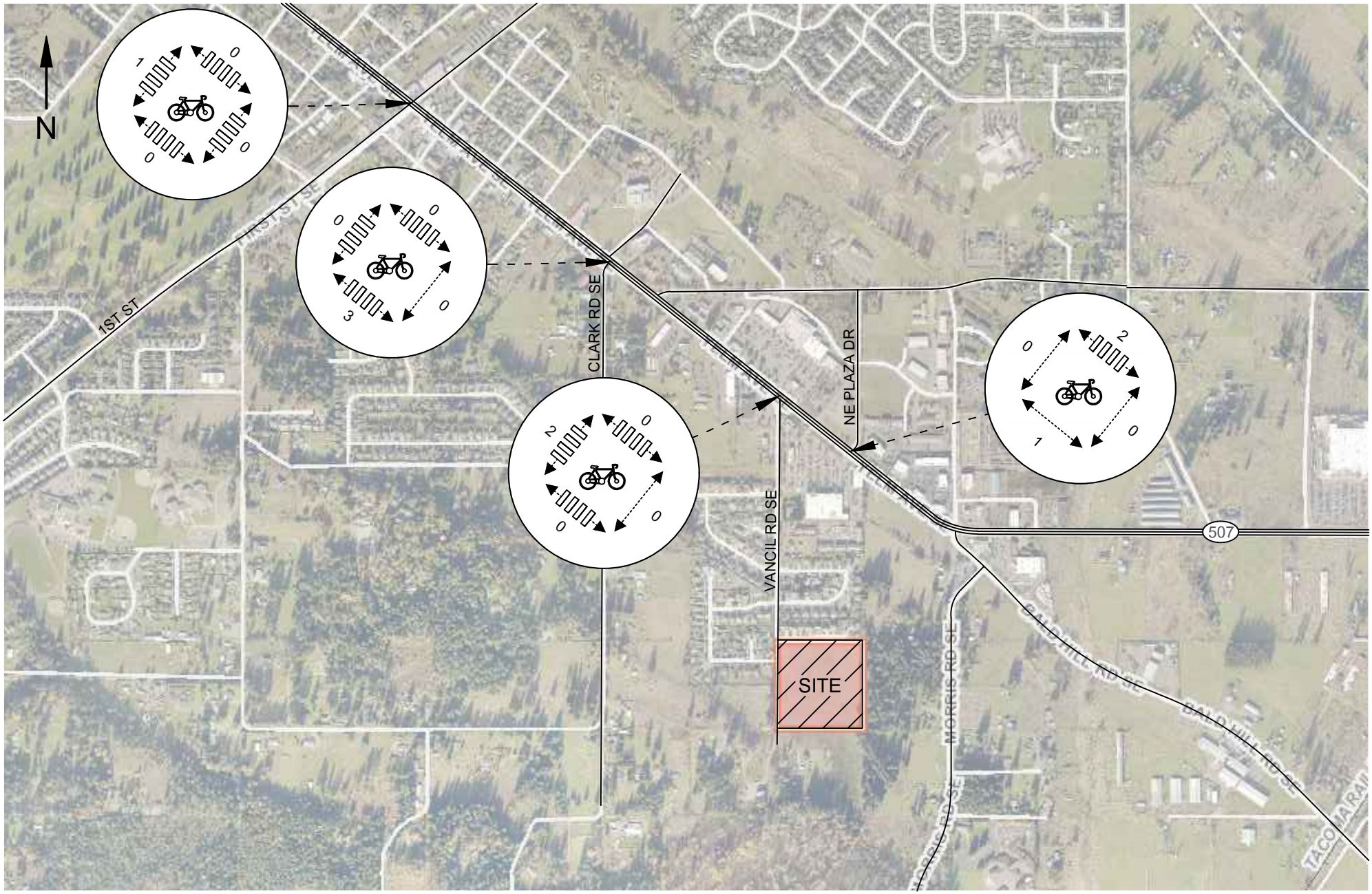
COUNTRY MEADOW ESTATES I

EXISTING PM PEAK HOUR PEDESTRIAN VOLUMES
FIGURE 4



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COUNTRY MEADOW ESTATES I

EXISTING PM PEAK HOUR BICYCLE VOLUMES
FIGURE 5

3.5 Roadway Improvements

The city of Yelm's most recent (2022-2027) Transportation Improvement Plan, the Thurston County Transportation Plan (2023-2028), and the Washington State STIP (Statewide Transportation Improvement program) (2023-2026) were all reviewed. The city of Yelm's TIP and the WSDOT STIP both indicated planned improvements in the vicinity of the proposed project, each project is listed and described below.

Table 2: Transportation Improvement Projects

Name	Location	Improvement	Cost
City of Yelm			
2nd Ave SE ID #: WA12343	Mosman Ave to 575' south	Construct 5-foot-wide multi-use concrete sidewalk along the west side of 2nd Street SE from Cochrane Park to the existing sidewalk at Mosman Ave.	$250,000
Mosman Ave SE ID #: WA-12344	2nd St SE to 3rd St SE	Construct sidewalks on both sides of Mosman Ave, install intersection treatment at 2nd St and Mosman Ave. Construct bike lanes from 2nd St to 3rd St.	$310,000
Yelm Ave Improvements ID #: WA-12346	1st St to 4th St	Construction and repair of sidewalks, installation of new parallel parking, intersection treatment, and access control along both sides of Yelm Ave.	$2,321,800
Mosman Ave II ID #: Yelm 13 01	Longmire to Railroad	Construct a new road connecting Longmire St with the new Mosman Ave intersection. Bike lanes, sidewalk, street lighting, and storm water improvements are included. Improvements include construction of new road from Longmire to Solberg, and reconstruction of Mosman between Solberg and Railroad.	$11,482,200
Statewide Transportation Improvement Plan			
SR 510/Yelm Loop	SR 510	Traffic throughout the city is extremely congested at this time. This project will construct the second stage of a new alignment for SR 510 through the city of Yelm. When complete, this project will relieve congestion and improve motorist safety.	$58,697,552

Several planned improvements would further increase non-motorist mobility in the area. Moreover, the anticipated new SR 510 loop would relieve congestion along SR 507/510 (E Yelm Avenue).

3.6 Existing Level of Service

Peak hour delays were determined through the use of the *Highway Capacity Manual* 7th Edition. Capacity analysis is used to determine level of service (LOS) which is an established measure of congestion for transportation facilities. The range[3] for intersection level of service is LOS A to LOS F with the former indicating the best operating conditions with low control delays and the latter indicating the worst conditions with heavy control delays. Detailed descriptions of intersection LOS are given in the Highway Capacity Manual. Level of service calculations were made through the use of the *Synchro 12* analysis program. For signalized intersections, LOS is determined by the overall average delay. For side-street stop-controlled intersections, LOS is determined by the approach with the highest delay. Table 3 below summarizes existing LOS and delays for the key intersections of study.

Table 3: Existing PM Peak Hour Level of Service

Delays given in seconds per vehicle

Intersection	Control	Movement	LOS	Delay
SR 507/SR 510 & 1st St	Signal	Overall	C	22.8
SR 507 & Clark Rd SE	Signal	Overall	B	10.0
SR 507 & Vancil Rd SE	Signal	Overall	B	19.1
SR 507 & NE Plaza Dr	Stop	SWB	D	25.2

*SWB-Southwest Bound

City Level of Service Standards[4]: Yelm has an adopted a Level of Service Standard D.

State Level of Service Standards[5]: SR 507/SR 510 also have an adopted a Level of Service Standard D.

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[3] *Signalized Intersections - Level of Service*

Level of Service	Control Delay per Vehicle (sec)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

Stop Controlled Intersections – Level of Service

Level of Service	Control Delay per Vehicle (sec)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Highway Capacity Manual, 7th Edition

[4] Yelm Comprehensive Plan.

[5] WSDOT – Level of Service Standard - ArcGIS

Existing PM peak hour conditions are shown to operate with LOS D conditions or better meeting state and city level of service standards, no intersection deficiencies are identified.

It is important to note that a new route SR 510/Yelm Loop is proposed in WSDOT's Statewide Improvement Plan which is reported to relieve congestion along SR 510 and thus lowering the delay times.

3.7 Collision History

Collision history at each study intersection was requested from WSDOT for five full years from the beginning of 2018 through 2022. For each intersection, the crash rate per million entering vehicles (MEV)[6] was calculated, see below. ADT estimates are based on the PM peak hour volumes multiplied by 10. Refer to Table 4 below.

Table 4: Collision History

Intersection	2018	2019	2020	2021	2022	Avg/Yr	MEV
SR 507/SR 510 & 1st St	3	7	3	9	5	5.4	0.8
SR 507 & Clark Rd SE	4	3	0	3	0	2.0	0.3
SR 507 & Vancil Rd SE	3	1	3	9	5	4.2	0.7
SR 507 & NE Plaza Dr	4	4	0	1	4	2.6	0.5
Vancil Rd SE & Access	0	0	0	0	0	0.0	0.0

The study area (five intersections) received a total of 71 collisions with 29 collisions resulting in possible injury (20), suspected minor injury (7), and suspected serious injury (2) – with zero fatalities.

The collision types were listed as rear-end (46), followed by enter at angle (8), sideswipe (5), from opposite direction (4), from same direction (4), struck building (2), and vehicle strikes pedalcyclist (2).

Non-Motorist Involved Collisions:
Both non-motorist collisions occurred at the intersection of SR 507 & Vancil Road SE. The first collision took place in 2018 around noon. A vehicle was making a left turn when they struck a pedalcyclist. There is no driver contributing circumstance listed. The second collision took place in 2020 as a northwestbound vehicle struck a cyclist. There is no drive contributing circumstance listed. Both collisions resulted in possible/minor injury.

[6] $R = \frac{A*1{,}000{,}000}{365*N*V}$, Where A = # of crashes and V = Intersection ADT

4. FORECAST TRAFFIC DEMAND & ANALYSIS

4.1 Project Trip Generation

Trip generation is defined as the number of vehicle movements that enter or exit the respective project site during a designated time period, such as a specific peak hour (AM or PM) or an entire day. The magnitude of the anticipated vehicle trip generation for the proposed project was derived from the Institute of Transportation Engineers (ITE) publication, *Trip Generation,* 11th Edition. Based on the proposed development, the designated land use is defined as LUC – 210 Single-Family Detached Housing. Dwelling units were used as the input variable with ITE's equations to determine trip ends. ITE trip generation sheets have been included in the appendix for reference. See Table 5 below.

Table 5: Project Trip Generation

Land Use	Units	AWDT	AM Peak-Hour Trips			PM Peak-Hour Trips		
			In	Out	Total	In	Out	Total
LUC 210 Single Family	59	621	12	34	**46**	38	23	**61**

Based on the data presented in Table 5, the project can be expected to generate 621 average weekday daily trips with 46 trips (12 inbound / 34 outbound) occurring in the AM peak hour and 61 trips (38 inbound / 23 outbound) occurring in the PM peak hour.

4.2 Distribution & Assignment

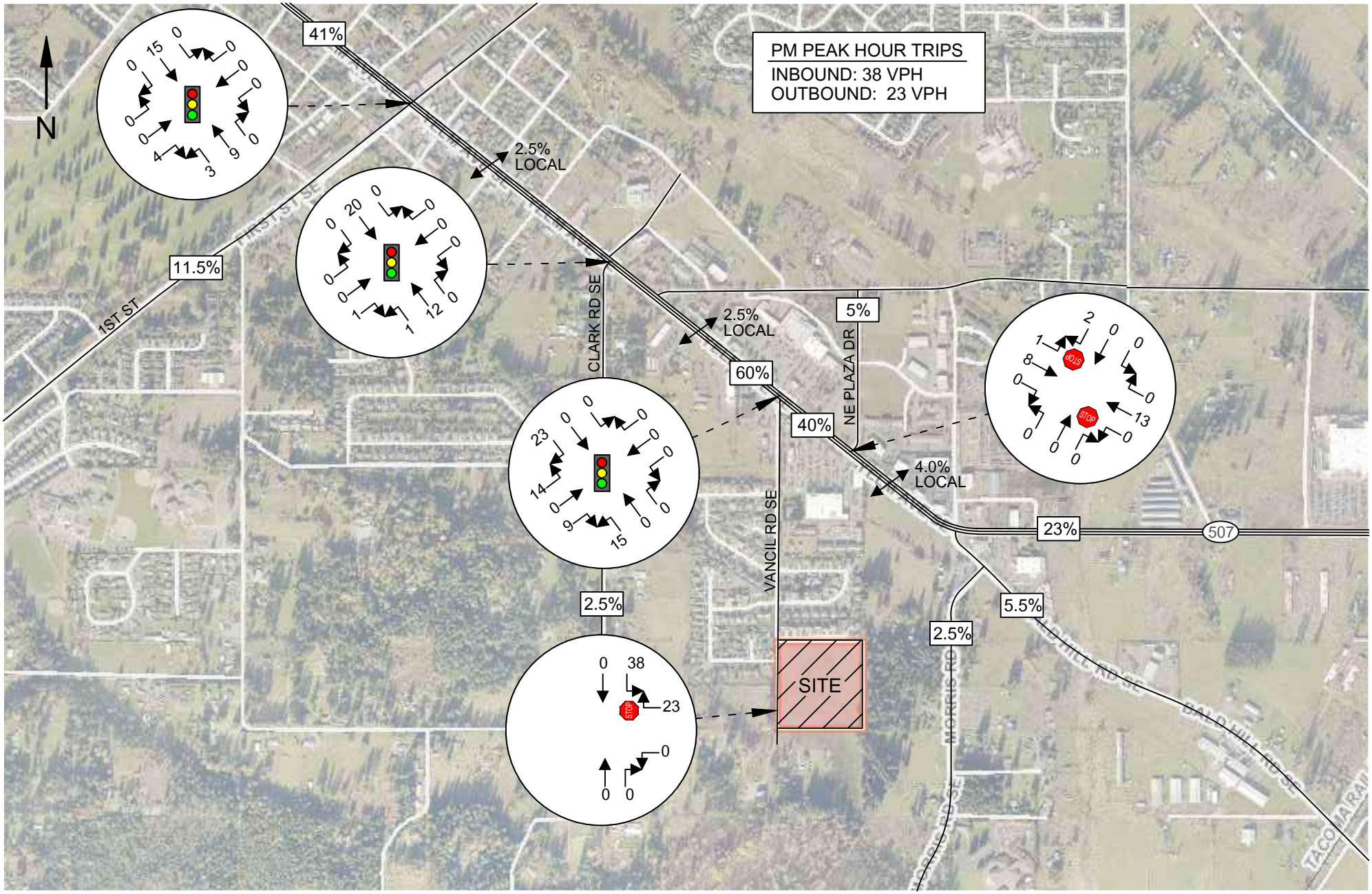
Trip distribution describes the process by which project generated trips are dispersed on the roadway network surrounding the site. The trip distribution for this project utilized the TAZ 726 Map which was provided by TRPC. Figure 6 highlights the PM peak hour trip distribution & assignment.

4.3 Future Peak Hour Volumes

A 3-year horizon of 2026 was used for future traffic delay analysis. Forecast 2026 background traffic volumes were derived by applying a one percent compound annual growth rate to the existing volumes shown in Figure 3. This growth rate was developed from WSDOT volumes along SR 507 just south of 1st Street which are shown to be consistent from 2016 (ADT – 18,000) to 2019 (ADT – 18,000) (pre-COVID conditions). Moreover, also taken into consideration are in-process developments within the city which includes: The Hutch[7], Durant Street Plat, Alpine Estates, Tahoma Boulevard Apartments, El Rey Burro, The Summit at Thompson Creek, Samantha Ridge, Habitat for Humanity, Liberty Grove, and 407 E Yelm Coffee. PM peak hour pipeline volumes are shown in Figure 7.

Forecast 2026 PM peak hour volumes without the project (background growth plus pipeline) are shown in Figure 8 while Figure 9 illustrates forecast 2026 volumes with the addition of project-generated traffic. It is important to note that phase I of the project is estimated to be completed in 2026. Phase II has an estimated 2027 horizon year.

[7] Based on site visit (6/14/23), approximately 40/118 homes were constructed and occupied. Therefore, 70% of the trips have been applied as pipeline trips.



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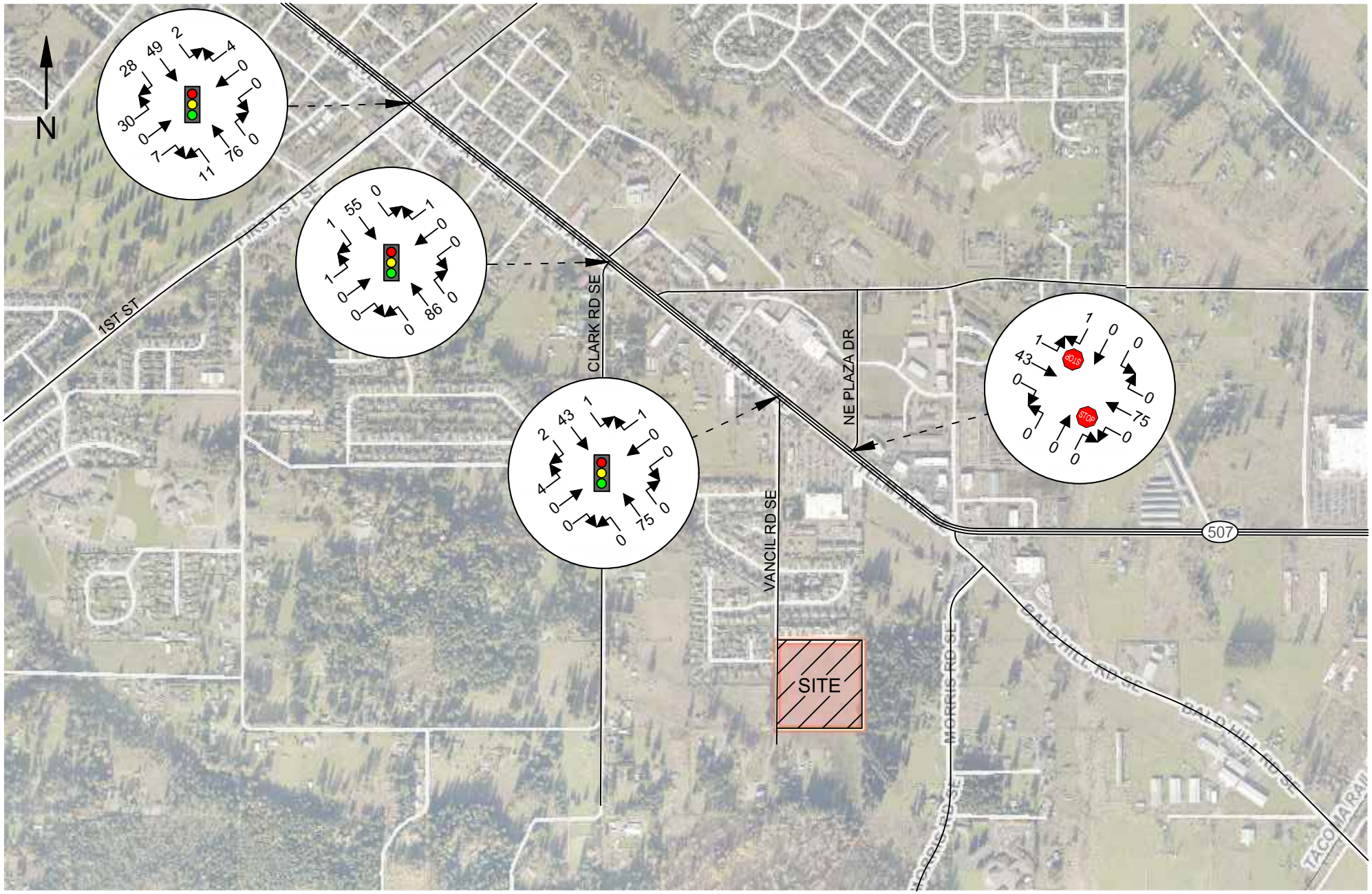
COUNTRY MEADOW ESTATES I

PM PEAK HOUR TRIP DISTRIBUTION & ASSIGNMENT
FIGURE 6



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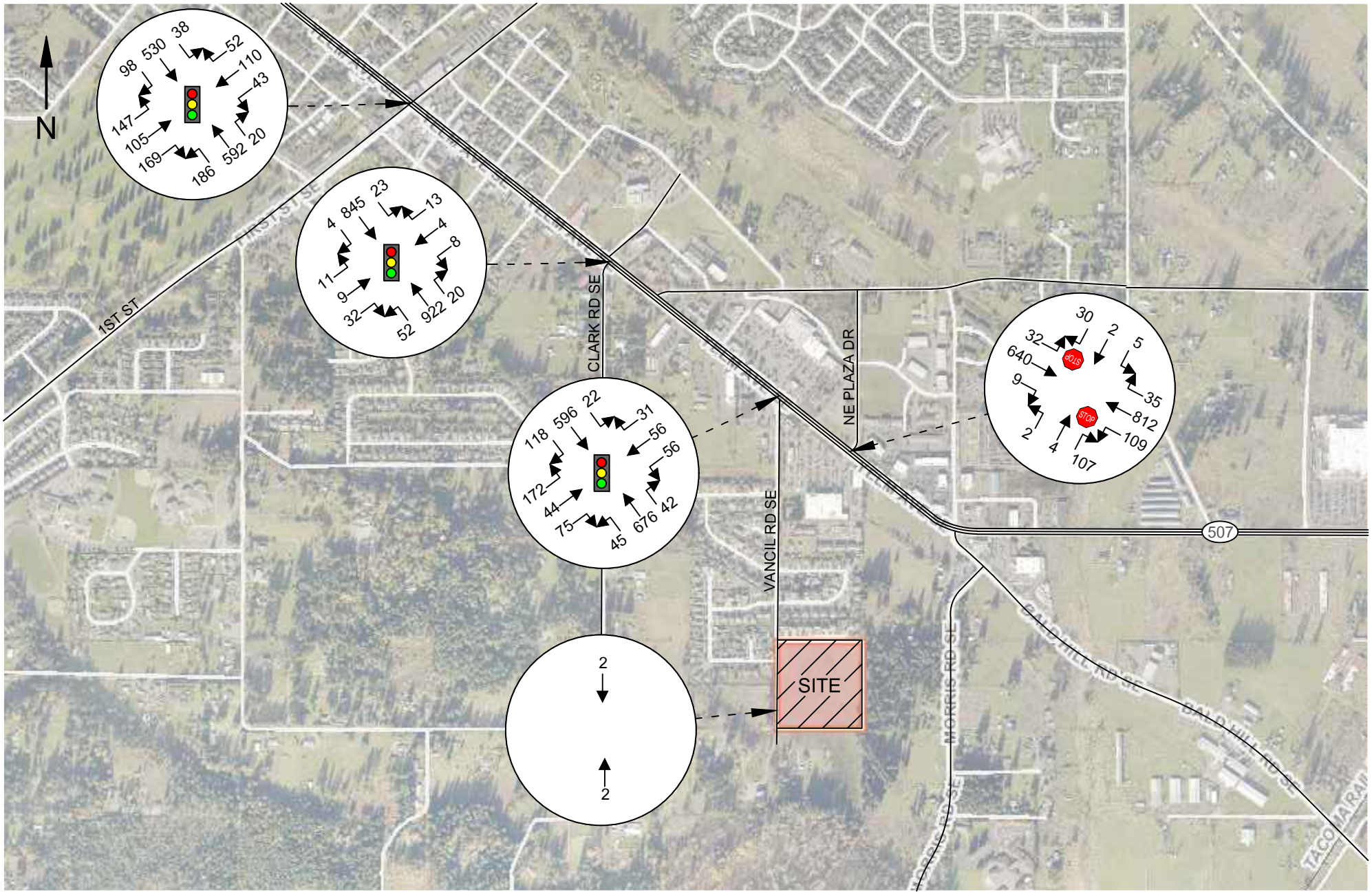
COUNTRY MEADOW ESTATES I

PM PEAK HOUR PIPELINE VOLUMES
FIGURE 7



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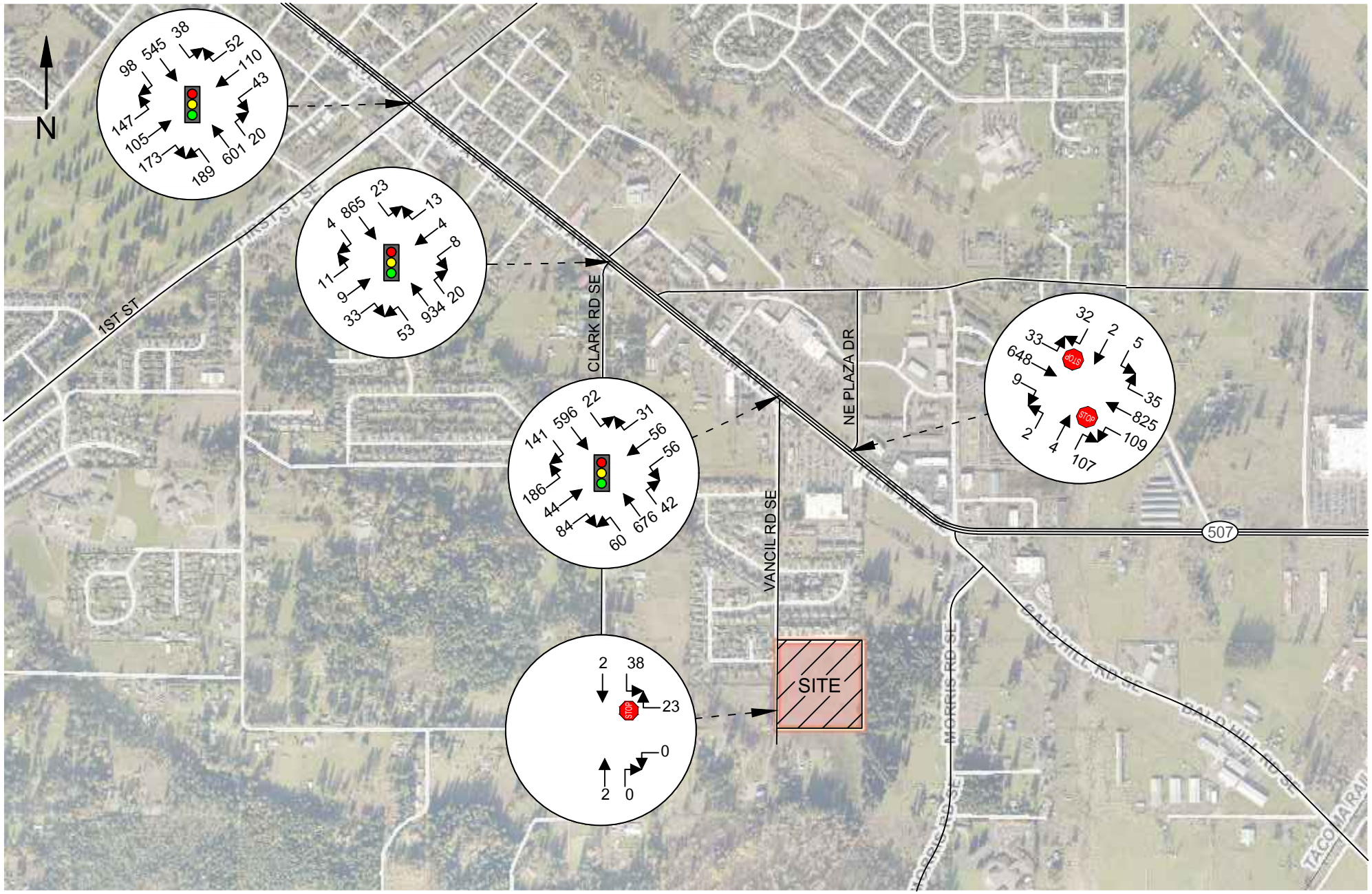
COUNTRY MEADOW ESTATES I

FORECAST 2026 PM PEAK HOUR VOLUMES WITHOUT PROJECT
FIGURE 8



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COUNTRY MEADOW ESTATES I

FORECAST 2026 PM PEAK HOUR VOLUMES WITH PROJECT
FIGURE 9

4.4 Future Level of Service

Level of service analyses were made of the future PM peak hour volumes without (background) and with project related trips added to the key roadways and intersections. This analysis once again involved the use of the *Synchro 12 analysis* program. Delays for the study/access intersections under future conditions are shown below in Table 6.

Per WSDOT Synchro policy, the peak hour factor (PHF) for all state intersections have been changed to 1.0 under forecast conditions.

Table 6: Forecast 2026 Weekday Peak Hour Level of Service Project

Delays Given in Seconds per Vehicle

				Without Project		*With Project*	
Intersection	**LOS Standard**	**Control**	**Critical Mvm.**	**LOS**	**Delay**	**LOS**	**Delay**
SR 507/SR 510 & 1st St	D	Signal	Overall	C	25.1	C	25.9
SR 507 & Clark Rd SE	D	Signal	Overall	B	10.1	B	10.3
SR 507 & Vancil Rd SE	D	Signal	Overall	C	20.3	C	21.1
SR 507 & NE Plaza Dr	D	Two-Way Stop	SWB	D	29.4	D	29.7
Vancil Rd SE & Access	D	One-Way Stop	WB	--	--	A	8.4

Forecast 2026 PM peak hour level of service is shown to operate with LOS D conditions or better, meeting city and state level of service standards. As such, no operational deficiencies are identified as a result of the proposed development.

4.5 Access & Sight Distance

Access to and from the site is proposed via one new access point extending east from Vancil Road SE. Access is also proposed via a northern connection to Vancil Court SE and via a future easterly connection (to Country Meadows II).

In accordance with established AASHTO Standards[8] and the 35-mph posted speed limit along Vancil Road SE, sight lines would need to meet or exceed 390 feet. Based on preliminary measurements, sight lines are shown to exceed the 390-feet requirement. No deficiencies are identified with the proposed access location.

4.6 Left Turn Lane Warrant

Left turn lanes are a means of providing necessary storage space for left turning vehicles at intersections. Procedures prescribed by WSDOT Design Manual Exhibit 1310-9 were used to ascertain storage requirements at the proposed access intersection via Vancil Road SE. Based on forecast 2026 PM peak hour volumes with project traffic – a left turn lane *would not be warranted*. Refer to the appendix for the left turn warrant nomograph.

[8] AASHTO Green Book (pg. 4.13)

5. CONCLUSIONS & MITIGATION

Country Meadow Estates I is a proposed residential development comprised of 59 single family homes located within the city of Yelm's Urban Growth Area (UGA) of Thurston County. The subject site is bordered to the west by Vancil Road SE situated on 10.0-acres within a single tax parcel. Site ingress/egress is proposed via one new access extending east from Vancil Road SE with connectivity to the north and future connectivity to the east.

PM peak hour turning movement counts were conducted at four outlying study intersections. Based on ITE data, the incoming project is anticipated to generate 621 average weekday daily trips with 46 AM peak hour trips and 61 PM peak hour trips. A three-year horizon of 2026 was used to assess future conditions with and without project generated traffic. Future peak hour analysis included a 1.0% background growth rate to the existing volumes shown in Figure 4. Moreover, PM peak hour pipeline volumes from several nearby projects have been accounted for. Forecast 2026 PM peak hour level of service was shown to continue operating with LOS D conditions with the project, meeting city and state LOS standards. No operational deficiencies are identified as a result of the proposed Country Meadow Estates I project.

Based on the analysis above, recommended mitigation is as follows:

1. The subject development would be subject for Transportation Facilities Charge per city of Yelm requirements. The city imposes a fee of $1,497.00 per PM peak hour primary trip. Initial fees are estimated as follows:

   61 PM Peak Hour Trips x $1,497.00 = $91,317.00.

Please feel free to contact me should you have any questions.

Aaron Van Aken, P.E., PTOE

COUNTRY MEADOW ESTATES I
TRAFFIC IMPACT ANALYSIS

APPENDIX

Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5166c
Site Code : 00005166
Start Date : 6/14/2023
Page No : 1

Groups Printed- Passenger + - Heavy

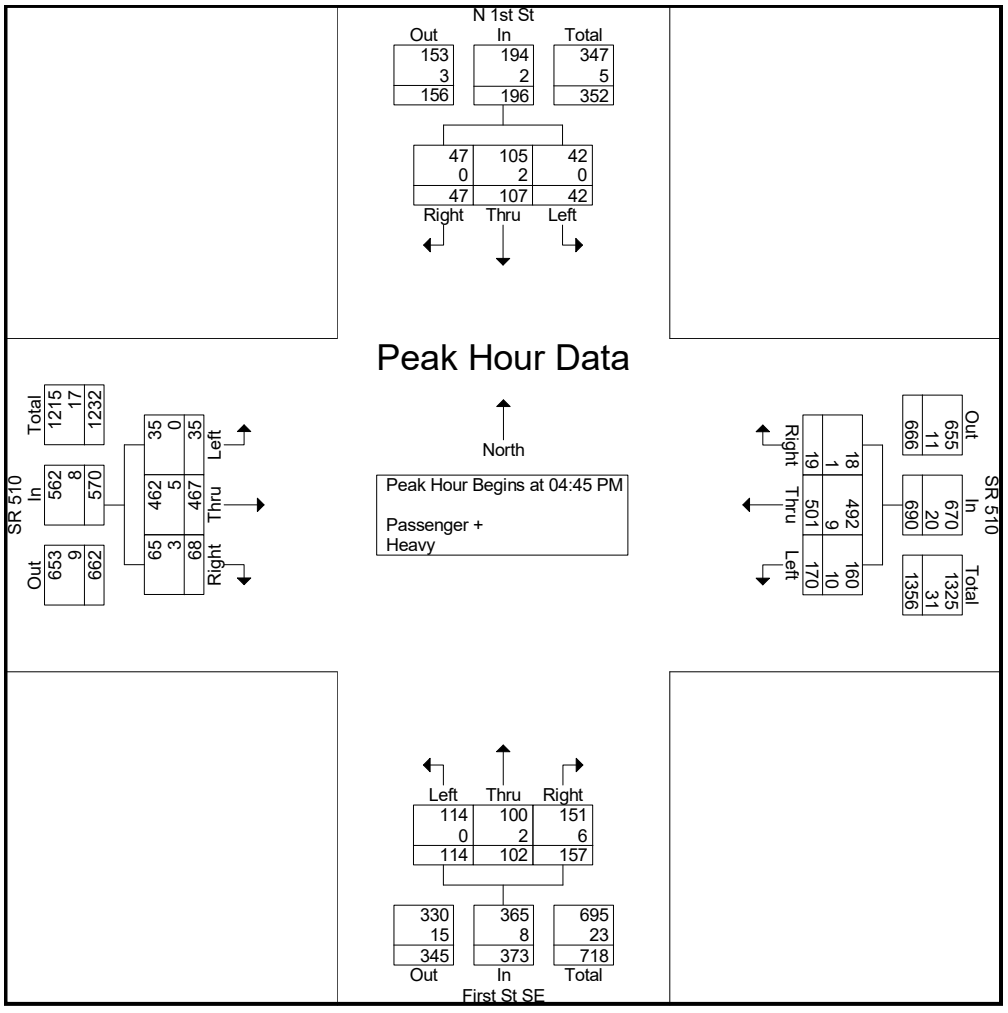
	N 1st St Southbound				SR 510 Westbound				First St SE Northbound				SR 510 Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
04:00 PM	21	29	7	57	7	101	55	163	32	29	33	94	5	106	8	119	433
04:15 PM	12	31	10	53	3	130	53	186	39	31	27	97	7	90	5	102	438
04:30 PM	9	30	6	45	6	103	62	171	39	25	23	87	6	116	10	132	435
04:45 PM	13	27	8	48	5	125	37	167	45	26	25	96	20	124	4	148	459
Total	55	117	31	203	21	459	207	687	155	111	108	374	38	436	27	501	1765
05:00 PM	12	35	15	62	5	133	48	186	36	26	32	94	18	101	7	126	468
05:15 PM	8	21	11	40	2	126	43	171	39	24	30	93	13	131	10	154	458
05:30 PM	14	24	8	46	7	117	42	166	37	26	27	90	17	111	14	142	444
05:45 PM	6	29	5	40	5	114	47	166	46	14	24	84	19	123	9	151	441
Total	40	109	39	188	19	490	180	689	158	90	113	361	67	466	40	573	1811
Grand Total	95	226	70	391	40	949	387	1376	313	201	221	735	105	902	67	1074	3576
Apprch %	24.3	57.8	17.9		2.9	69	28.1		42.6	27.3	30.1		9.8	84	6.2		
Total %	2.7	6.3	2	10.9	1.1	26.5	10.8	38.5	8.8	5.6	6.2	20.6	2.9	25.2	1.9	30	
Passenger +	92	222	69	383	39	923	370	1332	298	197	218	713	102	888	66	1056	3484
% Passenger +	96.8	98.2	98.6	98	97.5	97.3	95.6	96.8	95.2	98	98.6	97	97.1	98.4	98.5	98.3	97.4
Heavy	3	4	1	8	1	26	17	44	15	4	3	22	3	14	1	18	92
% Heavy	3.2	1.8	1.4	2	2.5	2.7	4.4	3.2	4.8	2	1.4	3	2.9	1.6	1.5	1.7	2.6

Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5166c
Site Code : 00005166
Start Date : 6/14/2023
Page No : 2

	N 1st St Southbound				SR 510 Westbound				First St SE Northbound				SR 510 Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	13	27	8	48	5	125	37	167	**45**	**26**	25	**96**	**20**	124	4	148	459
05:00 PM	12	**35**	**15**	**62**	5	**133**	**48**	**186**	36	26	**32**	94	18	101	7	126	**468**
05:15 PM	8	21	11	40	2	126	43	171	39	24	30	93	13	**131**	10	**154**	458
05:30 PM	**14**	24	8	46	**7**	117	42	166	37	26	27	90	17	111	**14**	142	444
Total Volume	47	107	42	196	19	501	170	690	157	102	114	373	68	467	35	570	1829
% App. Total	24	54.6	21.4		2.8	72.6	24.6		42.1	27.3	30.6		11.9	81.9	6.1		
PHF	.839	.764	.700	.790	.679	.942	.885	.927	.872	.981	.891	.971	.850	.891	.625	.925	.977
Passenger +	47	105	42	194	18	492	160	670	151	100	114	365	65	462	35	562	1791
% Passenger +	100	98.1	100	99.0	94.7	98.2	94.1	97.1	96.2	98.0	100	97.9	95.6	98.9	100	98.6	97.9
Heavy	0	2	0	2	1	9	10	20	6	2	0	8	3	5	0	8	38
% Heavy	0	1.9	0	1.0	5.3	1.8	5.9	2.9	3.8	2.0	0	2.1	4.4	1.1	0	1.4	2.1



Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5164a
Site Code : 00005164
Start Date : 6/14/2023
Page No : 1

Groups Printed- Passenger + - Heavy

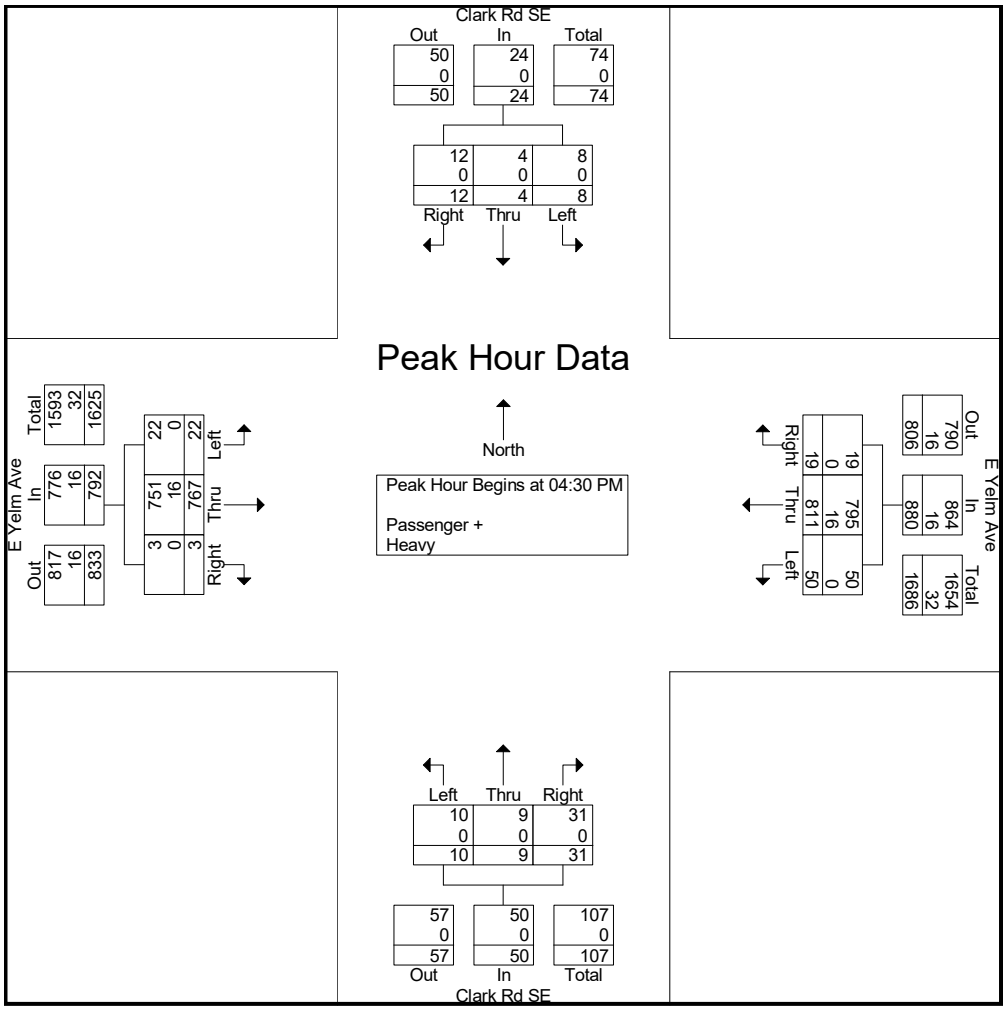
	Clark Rd SE Southbound				E Yelm Ave Westbound				Clark Rd SE Northbound				E Yelm Ave Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
04:00 PM	1	2	2	5	1	172	13	186	18	2	4	24	2	145	5	152	367
04:15 PM	3	2	1	6	4	209	12	225	16	2	4	22	2	159	6	167	420
04:30 PM	2	1	0	3	2	207	13	222	10	3	2	15	2	206	6	214	454
04:45 PM	4	0	4	8	5	196	7	208	8	4	6	18	0	184	7	191	425
Total	10	5	7	22	12	784	45	841	52	11	16	79	6	694	24	724	1666
05:00 PM	2	2	3	7	6	201	22	229	7	1	2	10	1	175	6	182	428
05:15 PM	4	1	1	6	6	207	8	221	6	1	0	7	0	202	3	205	439
05:30 PM	4	0	1	5	4	190	10	204	14	0	2	16	4	181	6	191	416
05:45 PM	1	0	3	4	5	202	24	231	11	2	1	14	1	203	3	207	456
Total	11	3	8	22	21	800	64	885	38	4	5	47	6	761	18	785	1739
Grand Total	21	8	15	44	33	1584	109	1726	90	15	21	126	12	1455	42	1509	3405
Apprch %	47.7	18.2	34.1		1.9	91.8	6.3		71.4	11.9	16.7		0.8	96.4	2.8		
Total %	0.6	0.2	0.4	1.3	1	46.5	3.2	50.7	2.6	0.4	0.6	3.7	0.4	42.7	1.2	44.3	
Passenger +	21	7	15	43	33	1541	108	1682	87	15	20	122	12	1425	42	1479	3326
% Passenger +	100	87.5	100	97.7	100	97.3	99.1	97.5	96.7	100	95.2	96.8	100	97.9	100	98	97.7
Heavy	0	1	0	1	0	43	1	44	3	0	1	4	0	30	0	30	79
% Heavy	0	12.5	0	2.3	0	2.7	0.9	2.5	3.3	0	4.8	3.2	0	2.1	0	2	2.3

Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5164a
Site Code : 00005164
Start Date : 6/14/2023
Page No : 2

	Clark Rd SE Southbound				E Yelm Ave Westbound				Clark Rd SE Northbound				E Yelm Ave Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	2	1	0	3	2	**207**	13	222	**10**	3	2	15	**2**	**206**	6	**214**	**454**
04:45 PM	**4**	0	**4**	**8**	5	196	7	208	8	**4**	**6**	**18**	0	184	**7**	191	425
05:00 PM	2	**2**	3	7	**6**	201	**22**	**229**	7	1	2	10	1	175	6	182	428
05:15 PM	4	1	1	6	6	207	8	221	6	1	0	7	0	202	3	205	439
Total Volume	12	4	8	24	19	811	50	880	31	9	10	50	3	767	22	792	1746
% App. Total	50	16.7	33.3		2.2	92.2	5.7		62	18	20		0.4	96.8	2.8		
PHF	.750	.500	.500	.750	.792	.979	.568	.961	.775	.563	.417	.694	.375	.931	.786	.925	.961
Passenger +	12	4	8	24	19	795	50	864	31	9	10	50	3	751	22	776	1714
% Passenger +	100	100	100	100	100	98.0	100	98.2	100	100	100	100	100	97.9	100	98.0	98.2
Heavy	0	0	0	0	0	16	0	16	0	0	0	0	0	16	0	16	32
% Heavy	0	0	0	0	0	2.0	0	1.8	0	0	0	0	0	2.1	0	2.0	1.8



Int #4

Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5142b
Site Code : 00005142
Start Date : 5/3/2023
Page No : 1

Groups Printed- Passenger + - Heavy

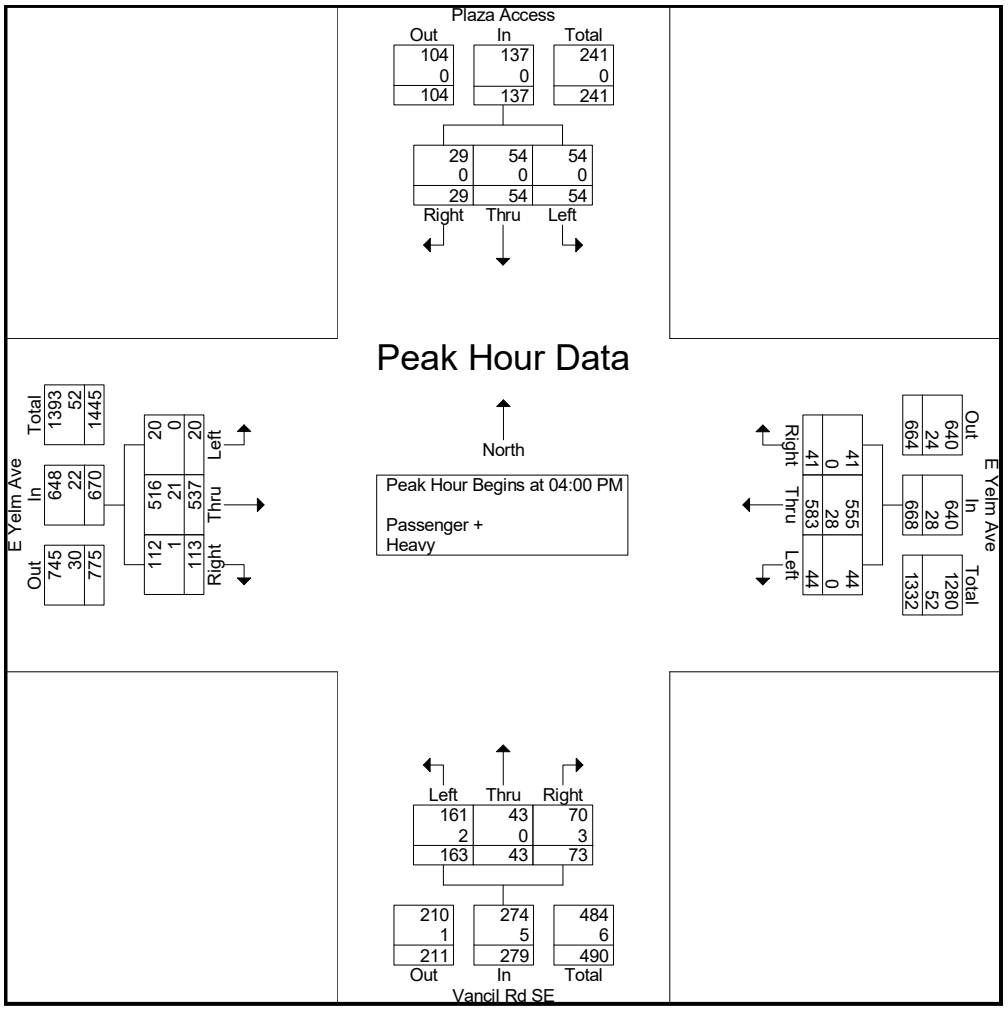
	Plaza Access Southbound				E Yelm Ave Westbound				Vancil Rd SE Northbound				E Yelm Ave Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
04:00 PM	7	9	15	31	12	155	9	176	12	15	34	61	32	128	8	168	436
04:15 PM	7	18	16	41	7	142	9	158	19	10	54	83	29	127	3	159	441
04:30 PM	8	13	15	36	11	141	11	163	21	7	42	70	22	141	3	166	435
04:45 PM	7	14	8	29	11	145	15	171	21	11	33	65	30	141	6	177	442
Total	29	54	54	137	41	583	44	668	73	43	163	279	113	537	20	670	1754
05:00 PM	11	15	12	38	17	129	10	156	16	7	35	58	28	123	7	158	410
05:15 PM	6	17	16	39	9	127	9	145	20	7	44	71	44	144	7	195	450
05:30 PM	11	8	18	37	5	144	9	158	22	5	36	63	38	114	8	160	418
05:45 PM	7	18	15	40	7	137	5	149	17	14	39	70	27	133	10	170	429
Total	35	58	61	154	38	537	33	608	75	33	154	262	137	514	32	683	1707
Grand Total	64	112	115	291	79	1120	77	1276	148	76	317	541	250	1051	52	1353	3461
Apprch %	22	38.5	39.5		6.2	87.8	6		27.4	14	58.6		18.5	77.7	3.8		
Total %	1.8	3.2	3.3	8.4	2.3	32.4	2.2	36.9	4.3	2.2	9.2	15.6	7.2	30.4	1.5	39.1	
Passenger +	64	112	115	291	79	1074	77	1230	145	76	315	536	247	1020	52	1319	3376
% Passenger +	100	100	100	100	100	95.9	100	96.4	98	100	99.4	99.1	98.8	97.1	100	97.5	97.5
Heavy	0	0	0	0	0	46	0	46	3	0	2	5	3	31	0	34	85
% Heavy	0	0	0	0	0	4.1	0	3.6	2	0	0.6	0.9	1.2	2.9	0	2.5	2.5

Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5142b
Site Code : 00005142
Start Date : 5/3/2023
Page No : 2

	Plaza Access Southbound				E Yelm Ave Westbound				Vancil Rd SE Northbound				E Yelm Ave Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	7	9	15	31	**12**	**155**	9	**176**	12	**15**	34	61	**32**	128	**8**	168	436
04:15 PM	7	**18**	**16**	**41**	7	142	9	158	19	10	**54**	**83**	29	127	3	159	441
04:30 PM	**8**	13	15	36	11	141	11	163	**21**	7	42	70	22	**141**	3	166	435
04:45 PM	7	14	8	29	11	145	**15**	171	21	11	33	65	30	141	6	**177**	**442**
Total Volume	29	54	54	137	41	583	44	668	73	43	163	279	113	537	20	670	1754
% App. Total	21.2	39.4	39.4		6.1	87.3	6.6		26.2	15.4	58.4		16.9	80.1	3		
PHF	.906	.750	.844	.835	.854	.940	.733	.949	.869	.717	.755	.840	.883	.952	.625	.946	.992
Passenger +	29	54	54	137	41	555	44	640	70	43	161	274	112	516	20	648	1699
% Passenger +	100	100	100	100	100	95.2	100	95.8	95.9	100	98.8	98.2	99.1	96.1	100	96.7	96.9
Heavy	0	0	0	0	0	28	0	28	3	0	2	5	1	21	0	22	55
% Heavy	0	0	0	0	0	4.8	0	4.2	4.1	0	1.2	1.8	0.9	3.9	0	3.3	3.1



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PO Box 397 Puyallup, WA 98371

File Name : 5164b
Site Code : 00005164
Start Date : 6/14/2023
Page No : 1

Groups Printed- Passenger + - Heavy

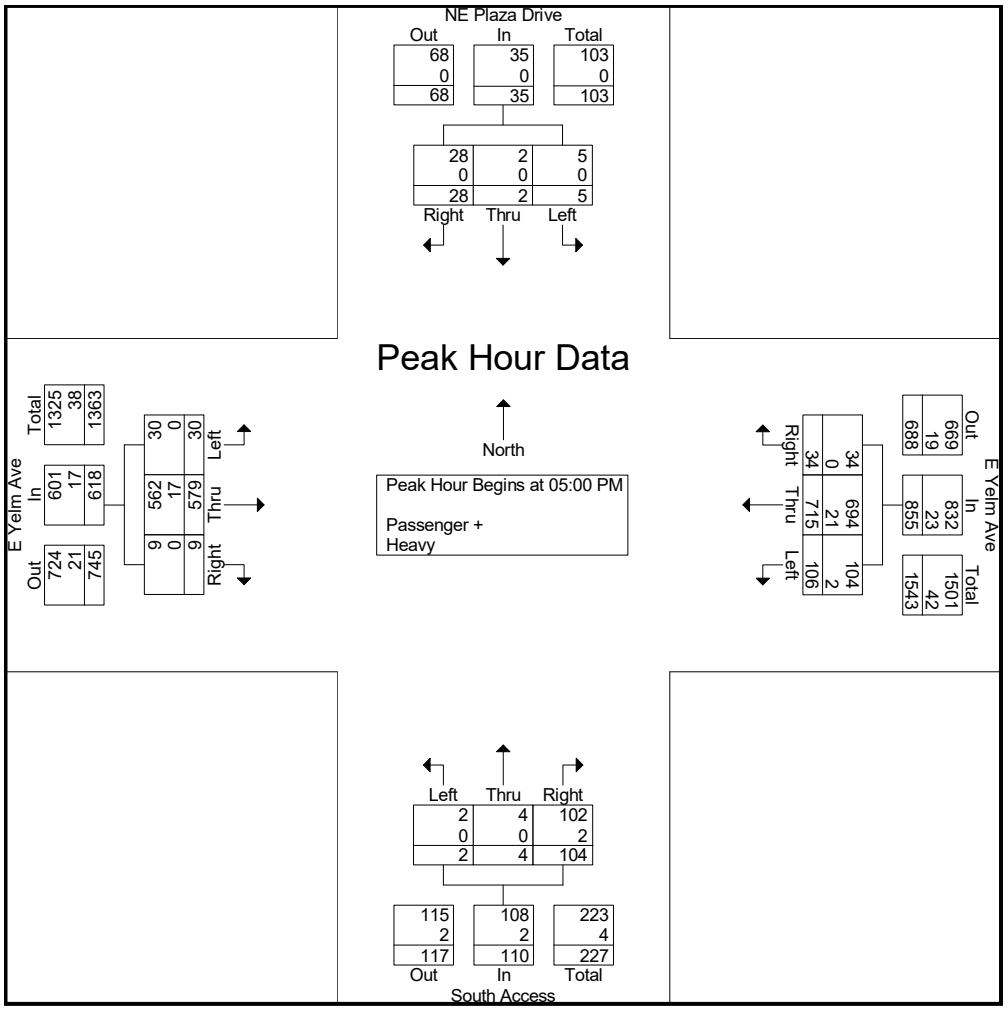
	NE Plaza Drive Southbound				E Yelm Ave Westbound				South Access Northbound				E Yelm Ave Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
04:00 PM	11	0	1	12	9	195	30	234	22	1	0	23	1	113	10	124	393
04:15 PM	9	0	2	11	11	173	36	220	22	0	1	23	2	139	7	148	402
04:30 PM	6	0	1	7	8	176	17	201	27	0	0	27	1	127	8	136	371
04:45 PM	12	1	2	15	8	194	36	238	23	0	0	23	1	121	6	128	404
Total	38	1	6	45	36	738	119	893	94	1	1	96	5	500	31	536	1570
05:00 PM	5	1	1	7	9	191	33	233	27	2	1	30	2	120	6	128	398
05:15 PM	8	0	0	8	8	181	26	215	25	1	0	26	1	145	8	154	403
05:30 PM	7	0	2	9	5	168	21	194	26	0	0	26	2	165	6	173	402
05:45 PM	8	1	2	11	12	175	26	213	26	1	1	28	4	149	10	163	415
Total	28	2	5	35	34	715	106	855	104	4	2	110	9	579	30	618	1618
Grand Total	66	3	11	80	70	1453	225	1748	198	5	3	206	14	1079	61	1154	3188
Apprch %	82.5	3.8	13.8		4	83.1	12.9		96.1	2.4	1.5		1.2	93.5	5.3		
Total %	2.1	0.1	0.3	2.5	2.2	45.6	7.1	54.8	6.2	0.2	0.1	6.5	0.4	33.8	1.9	36.2	
Passenger +	66	3	11	80	68	1411	223	1702	192	5	3	200	14	1045	59	1118	3100
% Passenger +	100	100	100	100	97.1	97.1	99.1	97.4	97	100	100	97.1	100	96.8	96.7	96.9	97.2
Heavy	0	0	0	0	2	42	2	46	6	0	0	6	0	34	2	36	88
% Heavy	0	0	0	0	2.9	2.9	0.9	2.6	3	0	0	2.9	0	3.2	3.3	3.1	2.8

Heath & Associates

PO Box 397 Puyallup, WA 98371

File Name : 5164b
Site Code : 00005164
Start Date : 6/14/2023
Page No : 2

	NE Plaza Drive Southbound				E Yelm Ave Westbound				South Access Northbound				E Yelm Ave Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	5	**1**	1	7	9	**191**	**33**	**233**	**27**	**2**	**1**	**30**	2	120	6	128	398
05:15 PM	**8**	0	0	8	8	181	26	215	25	1	0	26	1	145	8	154	403
05:30 PM	7	0	**2**	9	5	168	21	194	26	0	0	26	2	**165**	6	**173**	402
05:45 PM	8	1	2	**11**	**12**	175	26	213	26	1	1	28	**4**	149	**10**	163	**415**
Total Volume	28	2	5	35	34	715	106	855	104	4	2	110	9	579	30	618	1618
% App. Total	80	5.7	14.3		4	83.6	12.4		94.5	3.6	1.8		1.5	93.7	4.9		
PHF	.875	.500	.625	.795	.708	.936	.803	.917	.963	.500	.500	.917	.563	.877	.750	.893	.975
Passenger +	28	2	5	35	34	694	104	832	102	4	2	108	9	562	30	601	1576
% Passenger +	100	100	100	100	100	97.1	98.1	97.3	98.1	100	100	98.2	100	97.1	100	97.2	97.4
Heavy	0	0	0	0	0	21	2	23	2	0	0	2	0	17	0	17	42
% Heavy	0	0	0	0	0	2.9	1.9	2.7	1.9	0	0	1.8	0	2.9	0	2.8	2.6



Single-Family Detached Housing
(210)

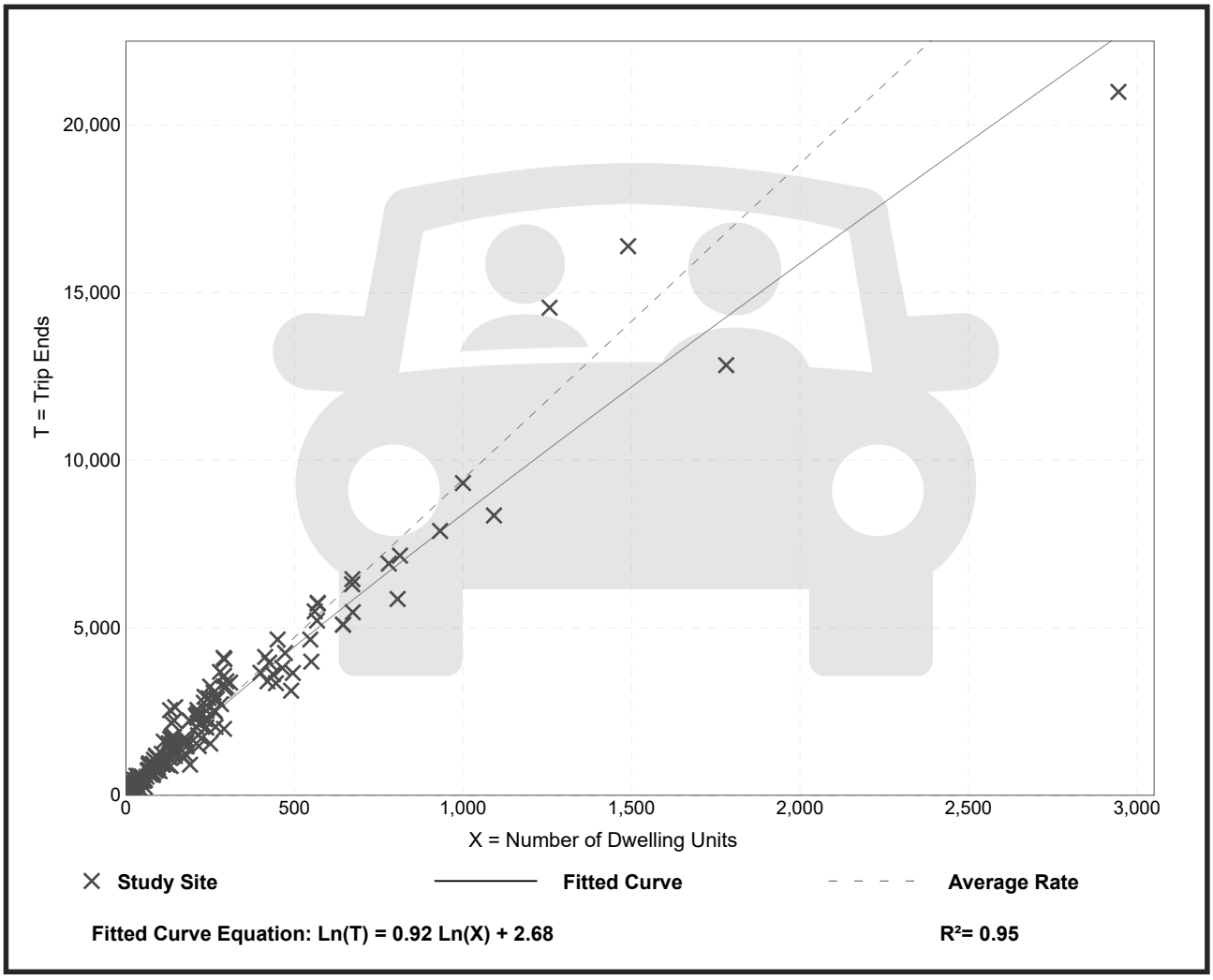
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 174
Avg. Num. of Dwelling Units: 246
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.43	4.45 - 22.61	2.13

Data Plot and Equation



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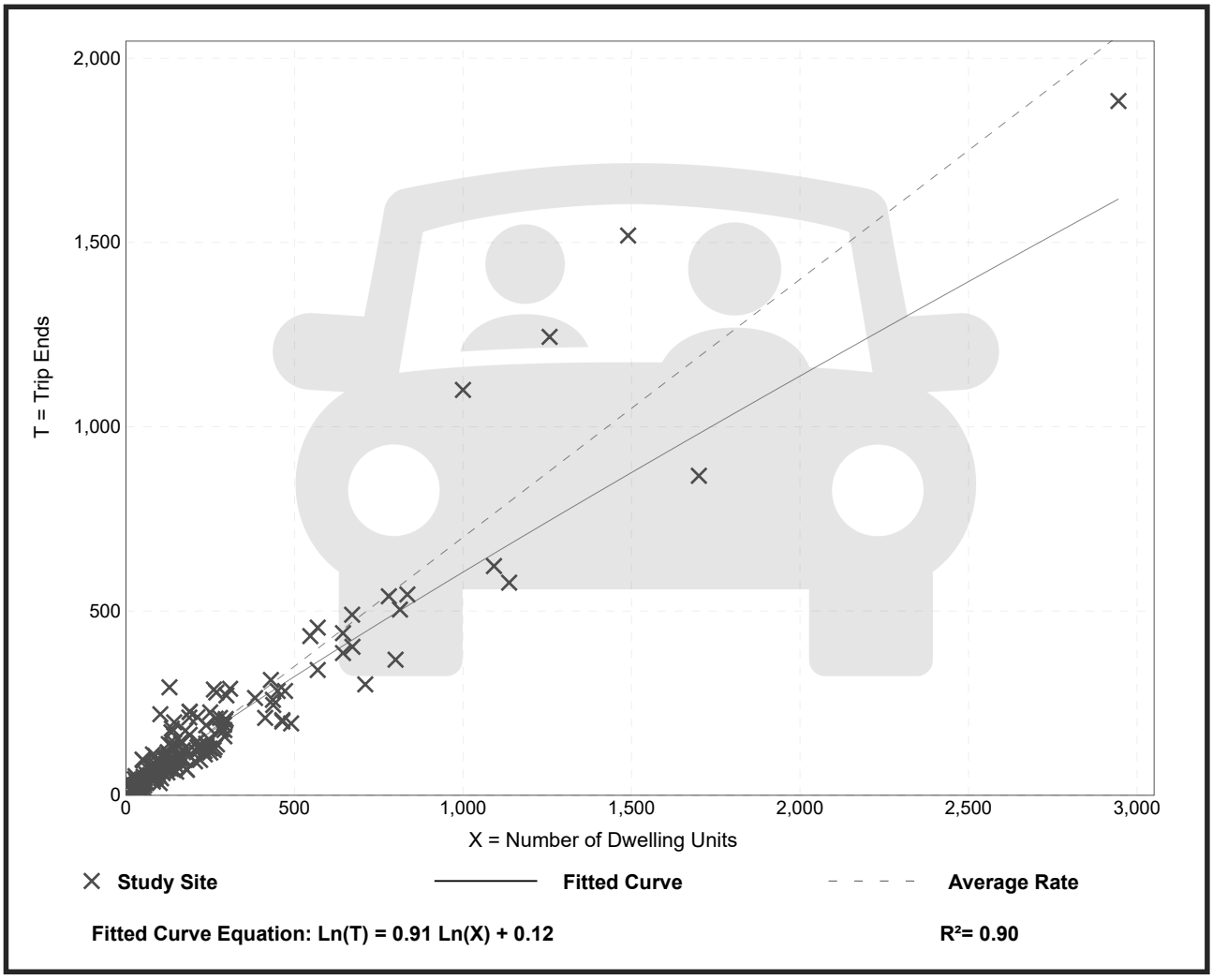
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 192
Avg. Num. of Dwelling Units: 226
Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

Data Plot and Equation



Trip Gen Manual, 11th Edition ● Institute of Transportation Engineers

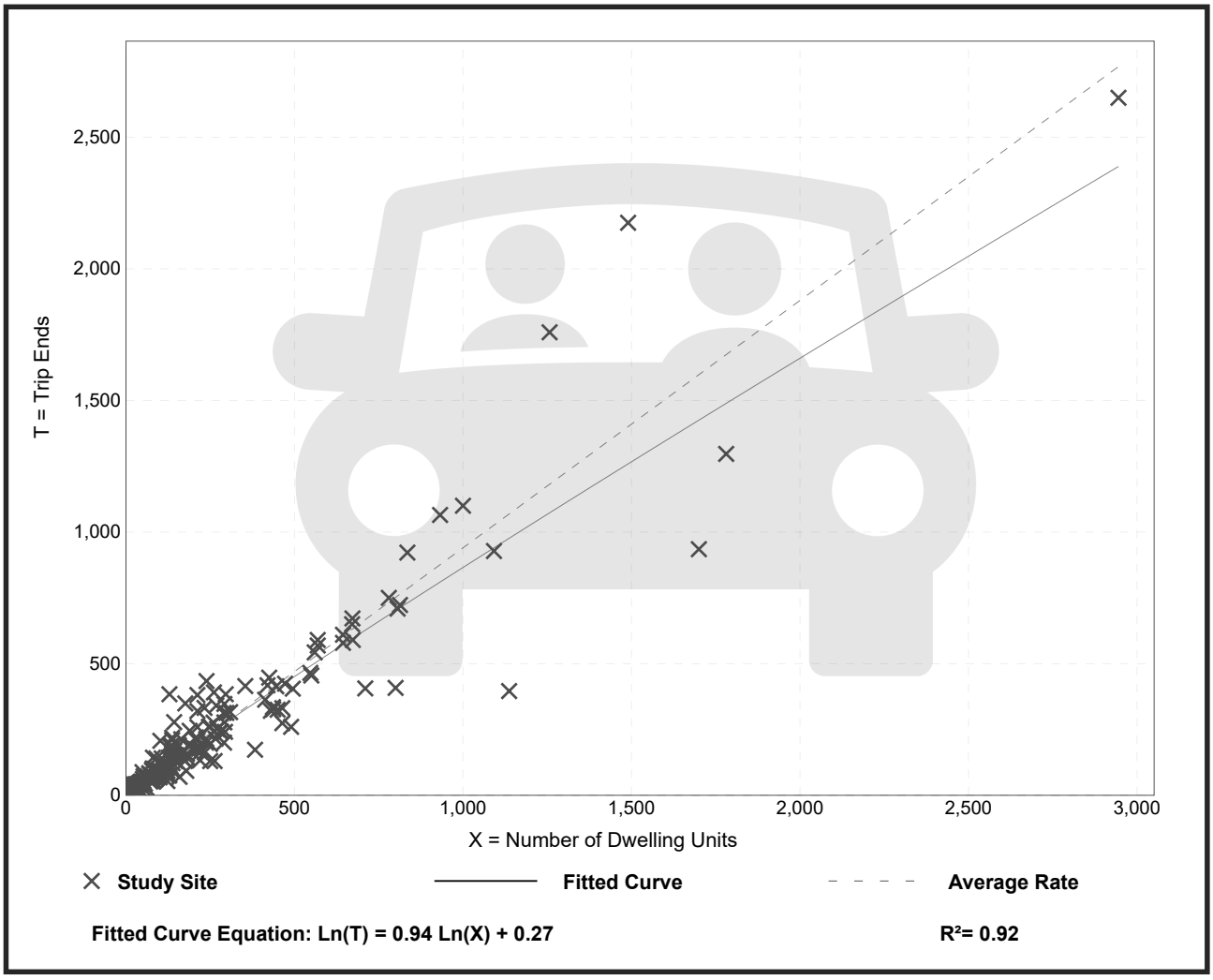
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 208
Avg. Num. of Dwelling Units: 248
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

Data Plot and Equation



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SR 507 & 1st St
PM Peak Hour
Pipeline Volume Summations

1. The Hutch	4				20				10	6	11	2
2. Durant St Plat					4				3	2	2	
3. Alpine Estates						11	7		7	11		
4. Tahoma Blvd Apartments					7				3	2	5	
5. El Rey Burro					3				2	2	3	
6. The Summit At Thompson Creek					28				5	5	14	
7. Samantha Ridge					5						2	
8. Habitat for Humanity					4						3	
9. Liberty Grove					5						8	
10. 407 E Yelm Coffee											1	
Totals	4	0	0	0	76	11	7	0	30	28	49	2

SR 507 & Clark Rd SE
PM Peak Hour
Pipeline Volume Summations

1. The Hutch	1				19				1	1	10	
2. Durant St Plat					4						2	
3. Alpine Estates					11						7	
4. Tahoma Blvd Apartments					7						5	
5. El Rey Burro					3						3	
6. The Summit At Thompson Creek					28						14	
7. Samantha Ridge					5						2	
8. Habitat for Humanity					4						3	
9. Liberty Grove					5						8	
10. 407 E Yelm Coffee											1	
Totals	1	0	0	0	86	0	0	0	1	1	55	0

SR 507 & Vancil Rd SE
PM Peak Hour
Pipeline Volume Summations

1. The Hutch	1				13				4	2	6	1
2. Durant St Plat					4						2	
3. Alpine Estates					11						7	
4. Tahoma Blvd Apartments					7						5	
5. El Rey Burro					3						3	
6. The Summit At Thompson Creek					28						14	
7. Samantha Ridge					5						2	
8. Habitat for Humanity					4						3	
9. Liberty Grove												
10. 407 E Yelm Coffee											1	
Totals	1	0	0	0	75	0	0	0	4	2	43	1

SR 507 & NE Plaza Dr
PM Peak Hour
Pipeline Volume Summations

1. The Hutch	1				13						6	1
2. Durant St Plat					4						2	
3. Alpine Estates					11						7	
4. Tahoma Blvd Apartments					7						5	
5. El Rey Burro					3						3	
6. The Summit At Thompson Creek					28						14	
7. Samantha Ridge					5						2	
8. Habitat for Humanity					4						3	
9. Liberty Grove												
10. 407 E Yelm Coffee											1	
Totals	1	0	0	0	75	0	0	0	0	0	43	1

Vancil Rd SE & Access
PM Peak Hour
Pipeline Volume Summations

1. The Hutch												
2. Durant St Plat												
3. Alpine Estates												
4. Tahoma Blvd Apartments												
5. El Rey Burro												
6. The Summit At Thompson Creek												
7. Samantha Ridge												
8. Habitat for Humanity												
9. Liberty Grove												
10. 407 E Yelm Coffee												
Totals	0	0	0	0	0	0	0	0	0	0	0	0

PM Peak Hour Forecast Intersection Volumes

Annual Growth Rate: 1 %

# of Years to Horizon: 3

2026

1. SR 507 & 1st St

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	47	107	42	19	501	170	157	102	114	68	467	35
Project Trips	0	0	0	0	9	3	4	0	0	0	15	0
Pipeline	4	0	0	0	76	11	7	0	30	28	49	2
Without	52	110	43	20	592	186	169	105	147	98	530	38
With	52	110	43	20	601	189	173	105	147	98	545	38

2. SR 507 & Clark Rd SE

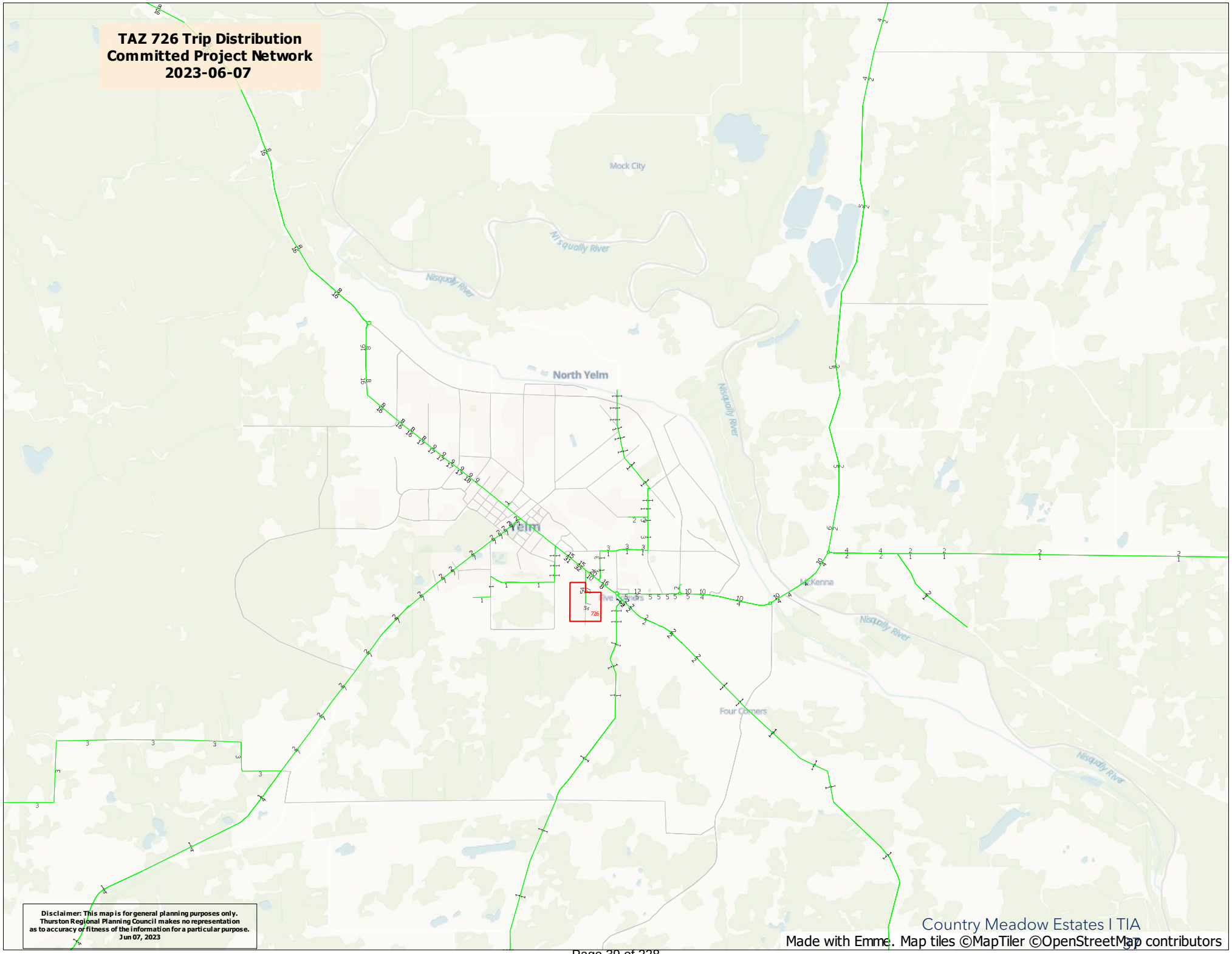
	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	12	4	8	19	811	50	31	9	10	3	767	22
Project Trips	0	0	0	0	12	1	1	0	0	0	20	0
Pipeline	1	0	0	0	86	0	0	0	1	1	55	0
Without	13	4	8	20	922	52	32	9	11	4	845	23
With	13	4	8	20	934	53	33	9	11	4	865	23

3. SR 507 & Vancil Rd SE

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	29	54	54	41	583	44	73	43	163	113	537	20
Project Trips	0	0	0	0	0	15	9	0	14	23	0	0
Pipeline	1	0	0	0	75	0	0	0	4	2	43	1
Without	31	56	56	42	676	45	75	44	172	118	596	22
With	31	56	56	42	676	60	84	44	186	141	596	22

4. SR 507 & Plaza Dr

	SBR	SBT	SBL	WBR	WBT	WBL	NBR	NBT	NBL	EBR	EBT	EBL
Existing	28	2	5	34	715	106	104	4	2	9	579	30
Project Trips	2	0	0	0	13	0	0	0	0	0	8	1
Pipeline	1	0	0	0	75	0	0	0	0	0	43	1
Without	30	2	5	35	812	109	107	4	2	9	640	32
With	32	2	5	35	825	109	107	4	2	9	648	33


TAZ 726 Trip Distribution
Committed Project Network
2023-06-07
Mock City
Nisqually River
North Yelm
Yelm
McKenna
Four Corners
726
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Jun 07, 2023
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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	35	467	68	170	501	19	114	102	157	42	107	47
Future Volume (veh/h)	35	467	68	170	501	19	114	102	157	42	107	47
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1841	1811	1870	1826	1885	1870	1841	1885	1870	1885
Adj Flow Rate, veh/h	36	477	69	173	511	19	116	104	160	43	109	48
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	1	1	4	6	2	5	1	2	4	1	2	1
Cap, veh/h	67	602	485	224	737	27	155	143	219	76	210	92
Arrive On Green	0.04	0.32	0.32	0.13	0.41	0.41	0.09	0.22	0.22	0.04	0.17	0.17
Sat Flow, veh/h	1795	1885	1520	1725	1791	67	1795	659	1014	1795	1218	536
Grp Volume(v), veh/h	36	477	69	173	0	530	116	0	264	43	0	157
Grp Sat Flow(s),veh/h/ln	1795	1885	1520	1725	0	1858	1795	0	1674	1795	0	1754
Q Serve(g_s), s	1.2	14.2	2.0	6.0	0.0	14.4	3.9	0.0	9.0	1.4	0.0	5.0
Cycle Q Clear(g_c), s	1.2	14.2	2.0	6.0	0.0	14.4	3.9	0.0	9.0	1.4	0.0	5.0
Prop In Lane	1.00		1.00	1.00		0.04	1.00		0.61	1.00		0.31
Lane Grp Cap(c), veh/h	67	602	485	224	0	764	155	0	362	76	0	302
V/C Ratio(X)	0.54	0.79	0.14	0.77	0.00	0.69	0.75	0.00	0.73	0.57	0.00	0.52
Avail Cap(c_a), veh/h	785	1143	922	755	0	1127	785	0	1113	785	0	1166
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.1	19.1	14.9	25.9	0.0	14.9	27.4	0.0	22.4	28.9	0.0	23.1
Incr Delay (d2), s/veh	6.5	2.4	0.1	5.6	0.0	1.1	7.0	0.0	2.8	6.5	0.0	1.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	6.1	0.7	2.7	0.0	5.7	1.9	0.0	3.6	0.7	0.0	2.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	35.6	21.5	15.1	31.5	0.0	16.0	34.5	0.0	25.3	35.4	0.0	24.5
LnGrp LOS	D	C	B	C		B	C		C	D		C
Approach Vol, veh/h		582			703			380			200	
Approach Delay, s/veh		21.6			19.9			28.1			26.9	
Approach LOS		C			B			C			C	

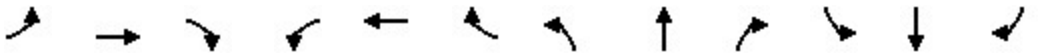
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.5	24.1	9.8	15.1	6.8	29.8	7.1	17.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	26.9	37.3	26.9	40.9	26.9	37.3	26.9	40.9
Max Q Clear Time (g_c+I1), s	8.0	16.2	5.9	7.0	3.2	16.4	3.4	11.0
Green Ext Time (p_c), s	0.4	3.4	0.3	1.0	0.1	3.7	0.1	1.9

Intersection Summary	
HCM 7th Control Delay, s/veh	22.8
HCM 7th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	767	3	50	811	19	10	9	31	8	4	12
Future Volume (veh/h)	22	767	3	50	811	19	10	9	31	8	4	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.98		0.95	0.99		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1870	1885	1885	1870	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	23	799	3	52	845	20	10	9	32	8	4	12
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	1	2	1	1	2	1	1	1	1	1	1	1
Cap, veh/h	333	1033	4	389	1053	25	298	42	148	277	49	146
Arrive On Green	0.03	0.55	0.55	0.05	0.58	0.58	0.12	0.12	0.12	0.12	0.12	0.12
Sat Flow, veh/h	1795	1862	7	1795	1819	43	1375	349	1242	1357	407	1221
Grp Volume(v), veh/h	23	0	802	52	0	865	10	0	41	8	0	16
Grp Sat Flow(s),veh/h/ln	1795	0	1869	1795	0	1862	1375	0	1592	1357	0	1628
Q Serve(g_s), s	0.3	0.0	16.5	0.6	0.0	18.0	0.3	0.0	1.1	0.3	0.0	0.4
Cycle Q Clear(g_c), s	0.3	0.0	16.5	0.6	0.0	18.0	0.8	0.0	1.1	1.4	0.0	0.4
Prop In Lane	1.00		0.00	1.00		0.02	1.00		0.78	1.00		0.75
Lane Grp Cap(c), veh/h	333	0	1037	389	0	1078	298	0	190	277	0	194
V/C Ratio(X)	0.07	0.00	0.77	0.13	0.00	0.80	0.03	0.00	0.22	0.03	0.00	0.08
Avail Cap(c_a), veh/h	1557	0	2038	1569	0	2031	1472	0	1548	1435	0	1584
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.3	0.0	8.5	6.9	0.0	8.1	19.6	0.0	19.6	20.2	0.0	19.3
Incr Delay (d2), s/veh	0.1	0.0	1.3	0.2	0.0	1.4	0.0	0.0	0.6	0.0	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	5.2	0.2	0.0	5.5	0.1	0.0	0.4	0.1	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	7.4	0.0	9.8	7.1	0.0	9.6	19.7	0.0	20.2	20.3	0.0	19.5
LnGrp LOS	A		A	A		A	B		C	C		B
Approach Vol, veh/h		825			917			51			24	
Approach Delay, s/veh		9.7			9.4			20.1			19.7	
Approach LOS		A			A			C			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.0	31.8		10.4	5.8	33.0		10.4				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	34.9	53.7		47.9	34.9	53.7		47.9				
Max Q Clear Time (g_c+I1), s	2.6	18.5		3.4	2.3	20.0		3.1				
Green Ext Time (p_c), s	0.1	7.6		0.1	0.0	8.5		0.2				

Intersection Summary	
HCM 7th Control Delay, s/veh	10.0
HCM 7th LOS	B



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	537	113	44	583	41	163	43	73	54	54	29
Future Volume (veh/h)	20	537	113	44	583	41	163	43	73	54	54	29
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	1.00		1.00	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1841	1885	1885	1826	1885	1885	1885	1841	1885	1885	1885
Adj Flow Rate, veh/h	20	542	114	44	589	41	165	43	0	55	55	29
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	1	4	1	1	5	1	1	1	4	1	1	1
Cap, veh/h	43	702	589	79	733	639	218	380		92	150	79
Arrive On Green	0.02	0.38	0.38	0.04	0.40	0.40	0.12	0.20	0.00	0.05	0.13	0.13
Sat Flow, veh/h	1795	1841	1544	1795	1826	1592	1795	1885	0	1795	1140	601
Grp Volume(v), veh/h	20	542	114	44	589	41	165	43	0	55	0	84
Grp Sat Flow(s),veh/h/ln	1795	1841	1544	1795	1826	1592	1795	1885	0	1795	0	1741
Q Serve(g_s), s	0.6	14.5	2.8	1.3	15.9	0.9	5.0	1.0	0.0	1.7	0.0	2.5
Cycle Q Clear(g_c), s	0.6	14.5	2.8	1.3	15.9	0.9	5.0	1.0	0.0	1.7	0.0	2.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.00	1.00		0.35
Lane Grp Cap(c), veh/h	43	702	589	79	733	639	218	380		92	0	229
V/C Ratio(X)	0.47	0.77	0.19	0.55	0.80	0.06	0.76	0.11		0.60	0.00	0.37
Avail Cap(c_a), veh/h	209	2286	1918	337	2398	2090	818	1398		337	0	825
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	27.0	15.2	11.6	26.2	14.8	10.3	23.8	18.3	0.0	26.0	0.0	22.2
Incr Delay (d2), s/veh	7.7	1.8	0.2	5.9	2.1	0.0	5.3	0.1	0.0	6.0	0.0	1.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	5.4	0.8	0.7	5.8	0.3	2.2	0.4	0.0	0.8	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	34.7	17.0	11.7	32.1	16.9	10.3	29.1	18.4	0.0	32.0	0.0	23.2
LnGrp LOS	C	B	B	C	B	B	C	B		C		C
Approach Vol, veh/h		676			674			208			139	
Approach Delay, s/veh		16.7			17.5			26.9			26.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.0	25.8	11.3	11.9	5.8	27.0	7.4	15.8
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	10.5	69.5	25.5	26.5	6.5	73.5	10.5	41.5
Max Q Clear Time (g_c+I1), s	3.3	16.5	7.0	4.5	2.6	17.9	3.7	3.0
Green Ext Time (p_c), s	0.0	4.3	0.4	0.4	0.0	4.5	0.0	0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	19.1
HCM 7th LOS	B

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

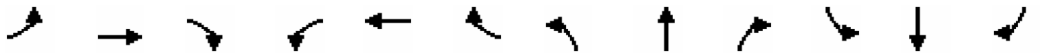
Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	30	579	9	106	715	34	2	4	104	5	2	28
Future Vol, veh/h	30	579	9	106	715	34	2	4	104	5	2	28
Conflicting Peds, #/hr	1	0	1	1	0	1	1	0	1	1	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	100	150	-	160	20	-	-	220	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	98	98	98	98	98	98	98	98	98	98	98	98
Heavy Vehicles, %	1	3	1	2	3	1	1	1	2	1	1	1
Mvmt Flow	31	591	9	108	730	35	2	4	106	5	2	29

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	765	0	0	601	0	0	1601	1635	593	1602	1609	732
Stage 1	-	-	-	-	-	-	653	653	-	947	947	-
Stage 2	-	-	-	-	-	-	948	982	-	655	662	-
Critical Hdwy	4.11	-	-	4.12	-	-	7.11	6.51	6.22	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Follow-up Hdwy	2.209	-	-	2.218	-	-	3.509	4.009	3.318	3.509	4.009	3.309
Pot Cap-1 Maneuver	852	-	-	976	-	-	86	101	506	86	105	423
Stage 1	-	-	-	-	-	-	458	465	-	315	341	-
Stage 2	-	-	-	-	-	-	315	329	-	457	461	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	852	-	-	975	-	-	67	87	505	56	90	422
Mov Cap-2 Maneuver	-	-	-	-	-	-	67	87	-	56	90	-
Stage 1	-	-	-	-	-	-	441	448	-	303	303	-
Stage 2	-	-	-	-	-	-	259	292	-	344	444	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.46	1.13	17.09	25.19
HCM LOS			C	D

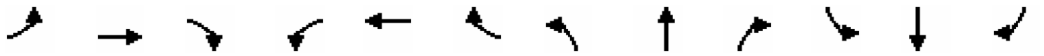
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	67	428	852	-	-	975	-	-	56	339
HCM Lane V/C Ratio	0.03	0.257	0.036	-	-	0.111	-	-	0.092	0.09
HCM Control Delay (s/veh)	60.3	16.3	9.4	-	-	9.2	-	-	76.3	16.7
HCM Lane LOS	F	C	A	-	-	A	-	-	F	C
HCM 95th %tile Q(veh)	0.1	1	0.1	-	-	0.4	-	-	0.3	0.3



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	530	98	186	592	20	147	105	169	43	110	52
Future Volume (veh/h)	38	530	98	186	592	20	147	105	169	43	110	52
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1841	1811	1870	1826	1885	1870	1841	1885	1870	1885
Adj Flow Rate, veh/h	38	530	98	186	592	20	147	105	169	43	110	52
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	1	4	6	2	5	1	2	4	1	2	1
Cap, veh/h	68	645	520	235	793	27	192	138	223	73	178	84
Arrive On Green	0.04	0.34	0.34	0.14	0.44	0.44	0.11	0.22	0.22	0.04	0.15	0.15
Sat Flow, veh/h	1795	1885	1520	1725	1798	61	1795	640	1030	1795	1186	561
Grp Volume(v), veh/h	38	530	98	186	0	612	147	0	274	43	0	162
Grp Sat Flow(s),veh/h/ln	1795	1885	1520	1725	0	1859	1795	0	1671	1795	0	1747
Q Serve(g_s), s	1.4	17.5	3.1	7.1	0.0	18.7	5.4	0.0	10.5	1.6	0.0	5.9
Cycle Q Clear(g_c), s	1.4	17.5	3.1	7.1	0.0	18.7	5.4	0.0	10.5	1.6	0.0	5.9
Prop In Lane	1.00		1.00	1.00		0.03	1.00		0.62	1.00		0.32
Lane Grp Cap(c), veh/h	68	645	520	235	0	820	192	0	361	73	0	262
V/C Ratio(X)	0.56	0.82	0.19	0.79	0.00	0.75	0.76	0.00	0.76	0.59	0.00	0.62
Avail Cap(c_a), veh/h	709	1032	832	681	0	1018	709	0	1003	709	0	1049
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	32.2	20.5	15.8	28.5	0.0	15.9	29.6	0.0	25.0	32.1	0.0	27.1
Incr Delay (d2), s/veh	7.1	2.9	0.2	5.8	0.0	2.4	6.2	0.0	3.3	7.2	0.0	2.4
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	7.8	1.0	3.2	0.0	7.7	2.6	0.0	4.3	0.8	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	39.4	23.5	15.9	34.3	0.0	18.2	35.7	0.0	28.3	39.3	0.0	29.5
LnGrp LOS	D	C	B	C		B	D		C	D		C
Approach Vol, veh/h		666			798			421			205	
Approach Delay, s/veh		23.3			22.0			30.9			31.6	
Approach LOS		C			C			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.8	27.8	11.8	14.7	7.1	34.5	7.3	19.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	26.9	37.3	26.9	40.9	26.9	37.3	26.9	40.9
Max Q Clear Time (g_c+I1), s	9.1	19.5	7.4	7.9	3.4	20.7	3.6	12.5
Green Ext Time (p_c), s	0.5	3.8	0.4	1.0	0.1	4.0	0.1	1.9

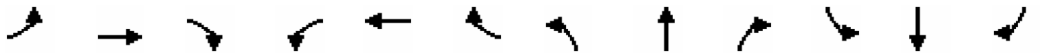
Intersection Summary	
HCM 7th Control Delay, s/veh	25.1
HCM 7th LOS	C



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	845	4	52	922	20	11	9	32	8	4	13
Future Volume (veh/h)	23	845	4	52	922	20	11	9	32	8	4	13
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.97		0.95	0.98		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1870	1885	1885	1870	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	23	845	4	52	922	20	11	9	32	8	4	13
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	2	1	1	2	1	1	1	1	1	1	1
Cap, veh/h	311	1095	5	385	1116	24	272	39	137	252	42	137
Arrive On Green	0.03	0.59	0.59	0.05	0.61	0.61	0.11	0.11	0.11	0.11	0.11	0.11
Sat Flow, veh/h	1795	1860	9	1795	1823	40	1371	349	1240	1356	381	1240
Grp Volume(v), veh/h	23	0	849	52	0	942	11	0	41	8	0	17
Grp Sat Flow(s),veh/h/ln	1795	0	1868	1795	0	1863	1371	0	1589	1356	0	1621
Q Serve(g_s), s	0.3	0.0	18.5	0.6	0.0	21.4	0.4	0.0	1.3	0.3	0.0	0.5
Cycle Q Clear(g_c), s	0.3	0.0	18.5	0.6	0.0	21.4	0.9	0.0	1.3	1.6	0.0	0.5
Prop In Lane	1.00		0.00	1.00		0.02	1.00		0.78	1.00		0.76
Lane Grp Cap(c), veh/h	311	0	1100	385	0	1140	272	0	176	252	0	179
V/C Ratio(X)	0.07	0.00	0.77	0.14	0.00	0.83	0.04	0.00	0.23	0.03	0.00	0.09
Avail Cap(c_a), veh/h	1425	0	1862	1457	0	1857	1340	0	1412	1307	0	1441
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.9	0.0	8.4	7.0	0.0	8.2	21.9	0.0	21.9	22.6	0.0	21.5
Incr Delay (d2), s/veh	0.1	0.0	1.2	0.2	0.0	1.7	0.1	0.0	0.7	0.1	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	5.8	0.2	0.0	6.5	0.1	0.0	0.5	0.1	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	8.0	0.0	9.5	7.2	0.0	9.9	22.0	0.0	22.6	22.6	0.0	21.8
LnGrp LOS	A		A	A		A	C		C	C		C
Approach Vol, veh/h		872			994			52			25	
Approach Delay, s/veh		9.5			9.7			22.4			22.1	
Approach LOS		A			A			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.2	36.2		10.5	6.0	37.5		10.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	34.9	53.7		47.9	34.9	53.7		47.9				
Max Q Clear Time (g_c+I1), s	2.6	20.5		3.6	2.3	23.4		3.3				
Green Ext Time (p_c), s	0.1	8.2		0.1	0.0	9.6		0.2				

Intersection Summary												
HCM 7th Control Delay, s/veh			10.1									
HCM 7th LOS			B									



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	596	118	45	676	42	172	44	75	56	56	31
Future Volume (veh/h)	22	596	118	45	676	42	172	44	75	56	56	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	1.00		1.00	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1841	1885	1885	1826	1885	1885	1885	1841	1885	1885	1885
Adj Flow Rate, veh/h	22	596	118	45	676	42	172	44	0	56	56	31
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	4	1	1	5	1	1	1	4	1	1	1
Cap, veh/h	45	785	659	77	811	707	223	377		88	140	77
Arrive On Green	0.03	0.43	0.43	0.04	0.44	0.44	0.12	0.20	0.00	0.05	0.12	0.12
Sat Flow, veh/h	1795	1841	1546	1795	1826	1592	1795	1885	0	1795	1117	619
Grp Volume(v), veh/h	22	596	118	45	676	42	172	44	0	56	0	87
Grp Sat Flow(s),veh/h/ln	1795	1841	1546	1795	1826	1592	1795	1885	0	1795	0	1736
Q Serve(g_s), s	0.8	17.6	3.0	1.6	20.9	1.0	5.9	1.2	0.0	2.0	0.0	3.0
Cycle Q Clear(g_c), s	0.8	17.6	3.0	1.6	20.9	1.0	5.9	1.2	0.0	2.0	0.0	3.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.00	1.00		0.36
Lane Grp Cap(c), veh/h	45	785	659	77	811	707	223	377		88	0	217
V/C Ratio(X)	0.48	0.76	0.18	0.58	0.83	0.06	0.77	0.12		0.63	0.00	0.40
Avail Cap(c_a), veh/h	183	2001	1681	295	2099	1830	716	1223		295	0	719
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	30.8	15.6	11.4	30.0	15.7	10.1	27.1	21.0	0.0	29.8	0.0	25.8
Incr Delay (d2), s/veh	7.8	1.5	0.1	6.8	2.3	0.0	5.6	0.1	0.0	7.3	0.0	1.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	6.6	0.9	0.8	7.8	0.3	2.7	0.5	0.0	1.0	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	38.5	17.1	11.5	36.8	18.0	10.2	32.7	21.1	0.0	37.1	0.0	27.0
LnGrp LOS	D	B	B	D	B	B	C	C		D		C
Approach Vol, veh/h		736			763			216			143	
Approach Delay, s/veh		16.8			18.7			30.3			30.9	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.3	31.8	12.4	12.5	6.1	32.9	7.7	17.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	10.5	69.5	25.5	26.5	6.5	73.5	10.5	41.5
Max Q Clear Time (g_c+I1), s	3.6	19.6	7.9	5.0	2.8	22.9	4.0	3.2
Green Ext Time (p_c), s	0.0	4.9	0.4	0.4	0.0	5.5	0.0	0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	20.3
HCM 7th LOS	C

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	32	640	9	109	812	35	2	4	107	5	2	30
Future Vol, veh/h	32	640	9	109	812	35	2	4	107	5	2	30
Conflicting Peds, #/hr	1	0	1	1	0	1	1	0	1	1	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	100	150	-	160	20	-	-	220	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	1	3	1	2	3	1	1	1	2	1	1	1
Mvmt Flow	32	640	9	109	812	35	2	4	107	5	2	30

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	848	0	0	650	0	0	1737	1771	642	1738	1745	814
Stage 1	-	-	-	-	-	-	705	705	-	1031	1031	-
Stage 2	-	-	-	-	-	-	1032	1066	-	707	714	-
Critical Hdwy	4.11	-	-	4.12	-	-	7.11	6.51	6.22	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Follow-up Hdwy	2.209	-	-	2.218	-	-	3.509	4.009	3.318	3.509	4.009	3.309
Pot Cap-1 Maneuver	794	-	-	936	-	-	69	84	474	69	87	379
Stage 1	-	-	-	-	-	-	429	441	-	283	312	-
Stage 2	-	-	-	-	-	-	282	300	-	428	436	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	793	-	-	935	-	-	52	71	473	43	73	379
Mov Cap-2 Maneuver	-	-	-	-	-	-	52	71	-	43	73	-
Stage 1	-	-	-	-	-	-	411	422	-	271	275	-
Stage 2	-	-	-	-	-	-	228	265	-	314	418	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.46	1.07	18.78	29.39
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	52	393	793	-	-	935	-	-	43	301
HCM Lane V/C Ratio	0.038	0.283	0.04	-	-	0.117	-	-	0.117	0.106
HCM Control Delay (s/veh)	76.4	17.7	9.7	-	-	9.4	-	-	99.8	18.4
HCM Lane LOS	F	C	A	-	-	A	-	-	F	C
HCM 95th %tile Q(veh)	0.1	1.1	0.1	-	-	0.4	-	-	0.4	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	545	98	189	601	20	147	105	173	43	110	52
Future Volume (veh/h)	38	545	98	189	601	20	147	105	173	43	110	52
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.99	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1885	1841	1811	1870	1826	1885	1870	1841	1885	1870	1885
Adj Flow Rate, veh/h	38	545	98	189	601	20	147	105	173	43	110	52
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	1	4	6	2	5	1	2	4	1	2	1
Cap, veh/h	67	656	529	238	807	27	192	137	226	73	179	85
Arrive On Green	0.04	0.35	0.35	0.14	0.45	0.45	0.11	0.22	0.22	0.04	0.15	0.15
Sat Flow, veh/h	1795	1885	1520	1725	1799	60	1795	630	1039	1795	1186	561
Grp Volume(v), veh/h	38	545	98	189	0	621	147	0	278	43	0	162
Grp Sat Flow(s),veh/h/ln	1795	1885	1520	1725	0	1859	1795	0	1669	1795	0	1747
Q Serve(g_s), s	1.5	18.6	3.2	7.4	0.0	19.4	5.6	0.0	11.0	1.7	0.0	6.1
Cycle Q Clear(g_c), s	1.5	18.6	3.2	7.4	0.0	19.4	5.6	0.0	11.0	1.7	0.0	6.1
Prop In Lane	1.00		1.00	1.00		0.03	1.00		0.62	1.00		0.32
Lane Grp Cap(c), veh/h	67	656	529	238	0	834	192	0	362	73	0	263
V/C Ratio(X)	0.57	0.83	0.19	0.79	0.00	0.74	0.77	0.00	0.77	0.59	0.00	0.62
Avail Cap(c_a), veh/h	688	1002	808	661	0	988	688	0	973	688	0	1019
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	33.2	21.0	15.9	29.3	0.0	16.0	30.5	0.0	25.8	33.1	0.0	27.9
Incr Delay (d2), s/veh	7.4	3.7	0.2	5.9	0.0	2.6	6.3	0.0	3.4	7.5	0.0	2.3
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	8.4	1.1	3.4	0.0	8.1	2.7	0.0	4.5	0.9	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	40.6	24.6	16.1	35.2	0.0	18.6	36.8	0.0	29.2	40.6	0.0	30.2
LnGrp LOS	D	C	B	D		B	D		C	D		C
Approach Vol, veh/h		681			810			425			205	
Approach Delay, s/veh		24.3			22.5			31.8			32.4	
Approach LOS		C			C			C			C	

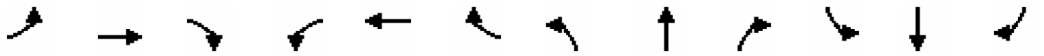
Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	28.9	12.0	15.1	7.1	36.0	7.3	19.7
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	26.9	37.3	26.9	40.9	26.9	37.3	26.9	40.9
Max Q Clear Time (g_c+I1), s	9.4	20.6	7.6	8.1	3.5	21.4	3.7	13.0
Green Ext Time (p_c), s	0.5	3.8	0.4	1.0	0.1	4.0	0.1	1.9

Intersection Summary	
HCM 7th Control Delay, s/veh	25.9
HCM 7th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	23	865	4	53	934	20	11	9	33	8	4	13
Future Volume (veh/h)	23	865	4	53	934	20	11	9	33	8	4	13
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	0.97		0.95	0.98		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1870	1885	1885	1870	1885	1885	1885	1885	1885	1885	1885
Adj Flow Rate, veh/h	23	865	4	53	934	20	11	9	33	8	4	13
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	2	1	1	2	1	1	1	1	1	1	1
Cap, veh/h	307	1103	5	376	1125	24	268	37	136	247	42	135
Arrive On Green	0.03	0.59	0.59	0.05	0.62	0.62	0.11	0.11	0.11	0.11	0.11	0.11
Sat Flow, veh/h	1795	1860	9	1795	1824	39	1371	340	1247	1354	381	1239
Grp Volume(v), veh/h	23	0	869	53	0	954	11	0	42	8	0	17
Grp Sat Flow(s),veh/h/ln	1795	0	1869	1795	0	1863	1371	0	1587	1354	0	1621
Q Serve(g_s), s	0.3	0.0	19.3	0.6	0.0	22.0	0.4	0.0	1.3	0.3	0.0	0.5
Cycle Q Clear(g_c), s	0.3	0.0	19.3	0.6	0.0	22.0	0.9	0.0	1.3	1.6	0.0	0.5
Prop In Lane	1.00		0.00	1.00		0.02	1.00		0.79	1.00		0.76
Lane Grp Cap(c), veh/h	307	0	1108	376	0	1149	268	0	173	247	0	177
V/C Ratio(X)	0.07	0.00	0.78	0.14	0.00	0.83	0.04	0.00	0.24	0.03	0.00	0.10
Avail Cap(c_a), veh/h	1406	0	1836	1432	0	1831	1320	0	1391	1286	0	1420
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	8.1	0.0	8.5	7.3	0.0	8.2	22.3	0.0	22.3	23.0	0.0	21.9
Incr Delay (d2), s/veh	0.1	0.0	1.3	0.2	0.0	1.9	0.1	0.0	0.7	0.1	0.0	0.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	6.1	0.2	0.0	6.8	0.1	0.0	0.5	0.1	0.0	0.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	8.2	0.0	9.7	7.5	0.0	10.1	22.4	0.0	23.0	23.1	0.0	22.1
LnGrp LOS	A		A	A		B	C		C	C		C
Approach Vol, veh/h		892			1007			53			25	
Approach Delay, s/veh		9.7			9.9			22.9			22.4	
Approach LOS		A			A			C			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.3	36.9		10.5	6.0	38.2		10.5				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	34.9	53.7		47.9	34.9	53.7		47.9				
Max Q Clear Time (g_c+I1), s	2.6	21.3		3.6	2.3	24.0		3.3				
Green Ext Time (p_c), s	0.1	8.5		0.1	0.0	9.7		0.3				

Intersection Summary		
HCM 7th Control Delay, s/veh		10.3
HCM 7th LOS		B



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	596	141	60	676	42	186	44	84	56	56	31
Future Volume (veh/h)	22	596	141	60	676	42	186	44	84	56	56	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		1.00	1.00		1.00	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1841	1885	1885	1826	1885	1885	1885	1841	1885	1885	1885
Adj Flow Rate, veh/h	22	596	141	60	676	42	186	44	0	56	56	31
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Percent Heavy Veh, %	1	4	1	1	5	1	1	1	4	1	1	1
Cap, veh/h	45	767	645	91	808	705	239	392		88	138	77
Arrive On Green	0.03	0.42	0.42	0.05	0.44	0.44	0.13	0.21	0.00	0.05	0.12	0.12
Sat Flow, veh/h	1795	1841	1546	1795	1826	1592	1795	1885	0	1795	1117	619
Grp Volume(v), veh/h	22	596	141	60	676	42	186	44	0	56	0	87
Grp Sat Flow(s),veh/h/ln	1795	1841	1546	1795	1826	1592	1795	1885	0	1795	0	1736
Q Serve(g_s), s	0.8	18.2	3.8	2.1	21.4	1.0	6.5	1.2	0.0	2.0	0.0	3.0
Cycle Q Clear(g_c), s	0.8	18.2	3.8	2.1	21.4	1.0	6.5	1.2	0.0	2.0	0.0	3.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.00	1.00		0.36
Lane Grp Cap(c), veh/h	45	767	645	91	808	705	239	392		88	0	215
V/C Ratio(X)	0.49	0.78	0.22	0.66	0.84	0.06	0.78	0.11		0.64	0.00	0.40
Avail Cap(c_a), veh/h	179	1958	1645	289	2054	1791	701	1198		289	0	704
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	31.4	16.4	12.2	30.5	16.1	10.4	27.4	21.0	0.0	30.5	0.0	26.4
Incr Delay (d2), s/veh	7.9	1.7	0.2	7.8	2.4	0.0	5.5	0.1	0.0	7.5	0.0	1.2
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	6.9	1.2	1.1	8.1	0.3	3.0	0.5	0.0	1.0	0.0	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	39.3	18.2	12.4	38.3	18.5	10.5	32.9	21.1	0.0	38.0	0.0	27.6
LnGrp LOS	D	B	B	D	B	B	C	C		D		C
Approach Vol, veh/h		759			778			230			143	
Approach Delay, s/veh		17.7			19.6			30.6			31.7	
Approach LOS		B			B			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.8	31.7	13.2	12.6	6.1	33.4	7.7	18.1
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	10.5	69.5	25.5	26.5	6.5	73.5	10.5	41.5
Max Q Clear Time (g_c+I1), s	4.1	20.2	8.5	5.0	2.8	23.4	4.0	3.2
Green Ext Time (p_c), s	0.0	5.0	0.4	0.4	0.0	5.5	0.0	0.2

Intersection Summary	
HCM 7th Control Delay, s/veh	21.1
HCM 7th LOS	C

Notes

Unsignalized Delay for [NBR] is excluded from calculations of the approach delay and intersection delay.

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	33	648	9	109	825	35	2	4	107	5	2	32
Future Vol, veh/h	33	648	9	109	825	35	2	4	107	5	2	32
Conflicting Peds, #/hr	1	0	1	1	0	1	1	0	1	1	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	150	-	100	150	-	160	20	-	-	220	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	1	3	1	2	3	1	1	1	2	1	1	1
Mvmt Flow	33	648	9	109	825	35	2	4	107	5	2	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	861	0	0	658	0	0	1760	1794	650	1761	1768	827
Stage 1	-	-	-	-	-	-	715	715	-	1044	1044	-
Stage 2	-	-	-	-	-	-	1045	1079	-	717	724	-
Critical Hdwy	4.11	-	-	4.12	-	-	7.11	6.51	6.22	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Follow-up Hdwy	2.209	-	-	2.218	-	-	3.509	4.009	3.318	3.509	4.009	3.309
Pot Cap-1 Maneuver	785	-	-	930	-	-	66	81	469	66	84	373
Stage 1	-	-	-	-	-	-	423	436	-	278	307	-
Stage 2	-	-	-	-	-	-	278	296	-	422	432	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	784	-	-	929	-	-	50	68	468	41	71	372
Mov Cap-2 Maneuver	-	-	-	-	-	-	50	68	-	41	71	-
Stage 1	-	-	-	-	-	-	405	417	-	266	271	-
Stage 2	-	-	-	-	-	-	222	261	-	309	413	-

Approach	EB	WB	NB	SB
HCM Control Delay, s/v	0.47	1.06	19.11	29.67
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	50	387	784	-	-	929	-	-	41	298
HCM Lane V/C Ratio	0.04	0.287	0.042	-	-	0.117	-	-	0.122	0.114
HCM Control Delay (s/veh)	80	18	9.8	-	-	9.4	-	-	104.7	18.6
HCM Lane LOS	F	C	A	-	-	A	-	-	F	C
HCM 95th %tile Q(veh)	0.1	1.2	0.1	-	-	0.4	-	-	0.4	0.4

Intersection	
Int Delay, s/veh	7.2

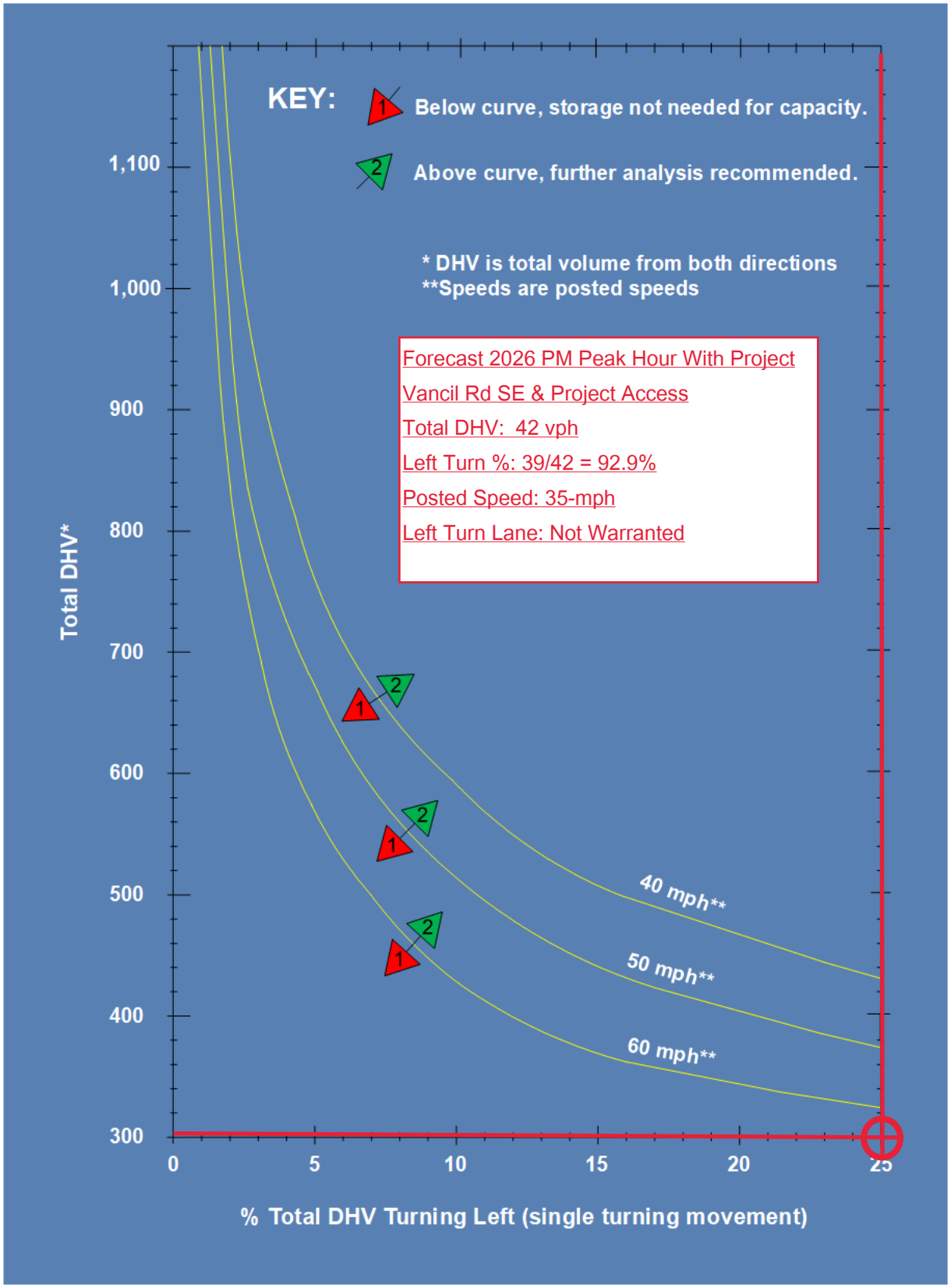
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	23	2	0	38	2
Future Vol, veh/h	0	23	2	0	38	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	25	2	0	41	2

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	87	2	0	0	2	0
Stage 1	2	-	-	-	-	-
Stage 2	85	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	914	1082	-	-	1620	-
Stage 1	1021	-	-	-	-	-
Stage 2	939	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	891	1082	-	-	1620	-
Mov Cap-2 Maneuver	891	-	-	-	-	-
Stage 1	1021	-	-	-	-	-
Stage 2	915	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	8.41	0	6.92
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1082	1620	-
HCM Lane V/C Ratio	-	-	0.023	0.025	-
HCM Control Delay (s/veh)	-	-	8.4	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0.1	-

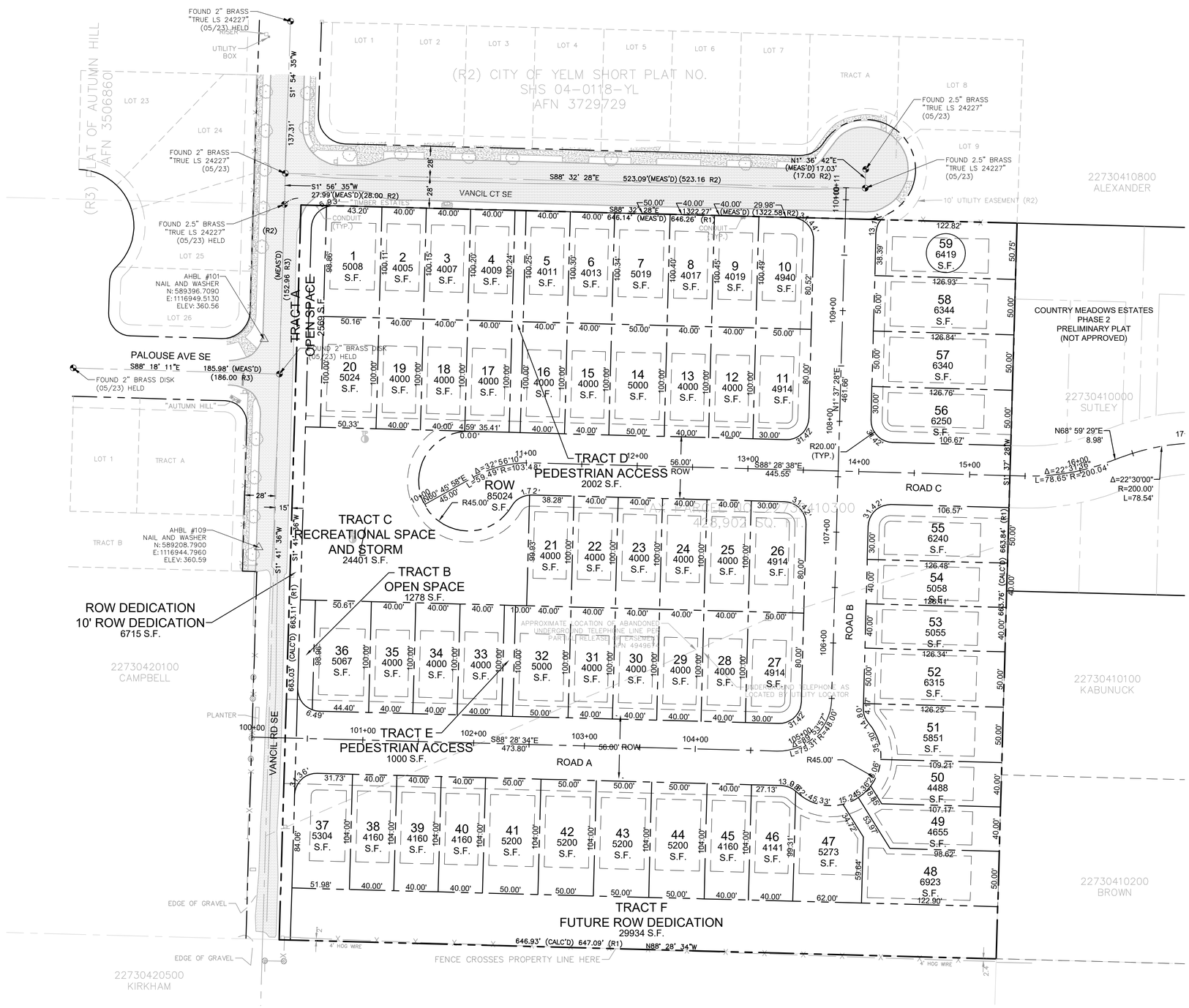
Exhibit 1310-9 Left-Turn Storage Guidelines: Two-Lane, Unsignalized



Know what's below. Call before you dig.

COUNTRY MEADOWS ESTATES PHASE 1 PRELIMINARY PLAT

A PORTION OF THE NE 1/4 OF THE SE 1/4 OF SEC. 30, TWN. 17 N., RGE. 02 E., W.M., CITY OF YELM, THURSTON COUNTY, WASHINGTON.



N

GRAPHIC SCALE

0 25 50 100

1" = 50 FEET

STATISTICS	
SITE AREA	428,902 (9.84 AC)
ZONING	R-6
DENSITY	6 DU/AC
PROPOSED LOTS	59 (59.1 MAKE 59) (20) - 50'± WIDE LOTS (40) - 40'± WIDE LOTS
OPEN SPACE REQUIRED	21,780 SF (0.50 AC) (5% GROSS SITE AREA MIN.)
OPEN SPACE SHOWN (TRACT C)	23,942 SF (0.54 AC)

LOT SETBACKS - SINGLE FAMILY	
FRONT YARD	15 FT
SIDE YARD	5 FT 15 FT (CORNER LOT)
REAR YARD	25 FT

TRACT IDENTIFICATION		
ITEM	SQUARE FEET	ACRES
TRACT 'A' - OPEN SPACE	2,569	0.06
TRACT 'B' - OPEN SPACE	1,278	0.03
TRACT 'C' - RECREATIONAL SPACE AND STORM	24,401	0.56
TRACT 'D' - PEDESTRIAN ACCESS	2,002	0.05
TRACT 'E' - PEDESTRIAN ACCESS	1,000	0.02
TRACT 'F' - FUTURE ROW DEDICATION	29,934	0.69

APPLICATION #999???

AHBL
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253.383.2422 TEL 253.383.2572 FAX www.ahbl.com WEB

Project Title:

COUNTRY MEADOWS ESTATES PHASE 1 PRELIMINARY PLAT

Client:

COPPER RIDGE LLC

P.O.BOX 73790
PUYALLUP, WA 98373

KURT WILSON / EVAN MANN

Project No.

2230251.10

Issue Set & Date:

PRELIMINARY PLAT

JULY 2023

J. MATTHEW WEBER STATE OF WASHINGTON 24858 REGISTERED PROFESSIONAL ENGINEER

Revisions:

3
2
1

Sheet Title:

PLAT MAP

Designed by: | Drawn by: | Checked by: MW/SK

Sheet No.

C1.1

3 of ? Sheets

DATE: July 20, 2021

Submitted To: Glenn Schorno

From: Gary Cooper, Local Planning Solutions

Subject: Mazama Pocket Gopher Survey Findings

This report has been completed following the Thurston County approved protocols for determining the presence of Pocket Gophers. Conclusions made in this report are based on two site visits conducted at the required intervals as well as data research from the Thurston County Geodata website and the Washington Department of Fish and Wildlife Priority Habitats and Species (PHS) database. Maps and summary reports obtained from both the Geodata and PHS sites are included with this report.

Survey Findings

No Mazama Gopher activity was observed on the property.

Property Information

Owners: G.E.S. Land, LLC

Site Address: None

Parcel Number: 22730410300

Parcel Size: 10 acres

Field Visit Dates: June 17, 2021
July 19, 2021

Photo 1: Property aerial

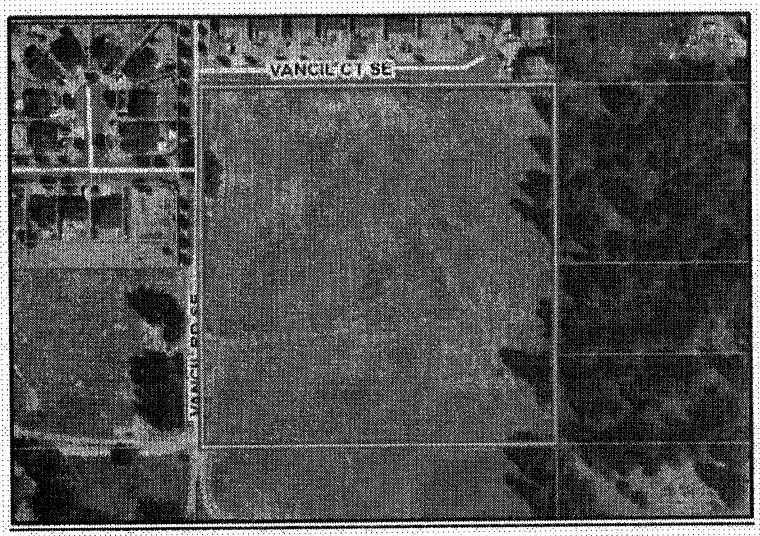
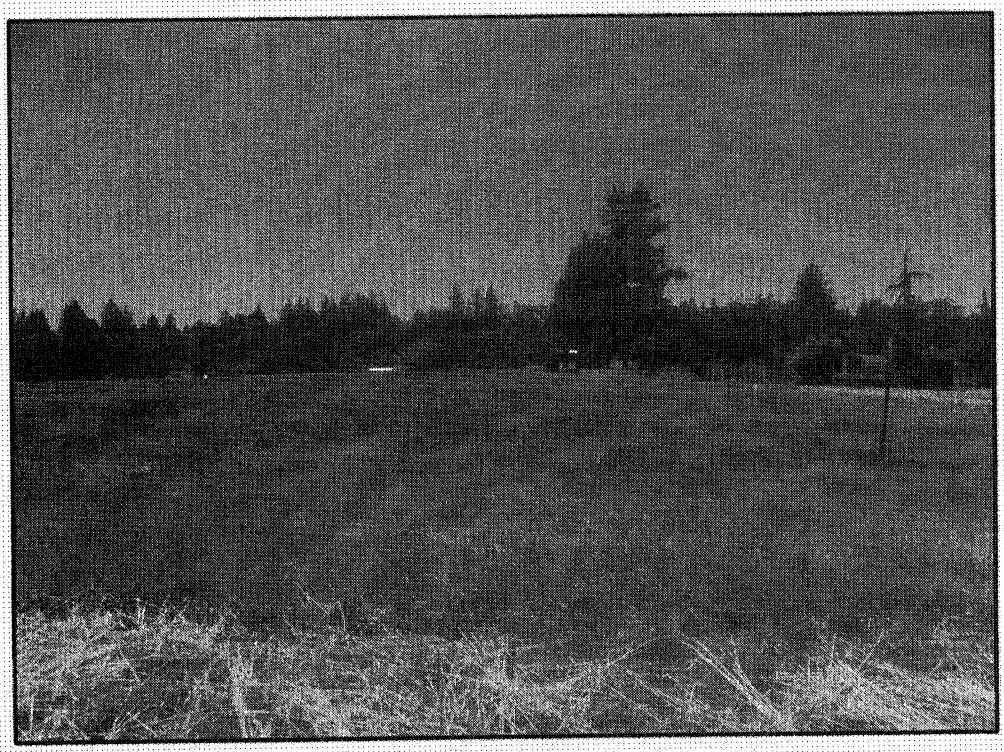


Photo 2: Photo taken from southwest corner



Thurston Geodata Review

A property search on the Thurston Geodata indicates that this parcel is comprised of Spanaway gravelly sandy loam 0-3% (#110), which is categorized as "More Preferred," and Spanaway stony sandy loam 0-3% (#112), which is categorized as "Less Preferred."

Photo 3: Gopher Soils Indicator Map

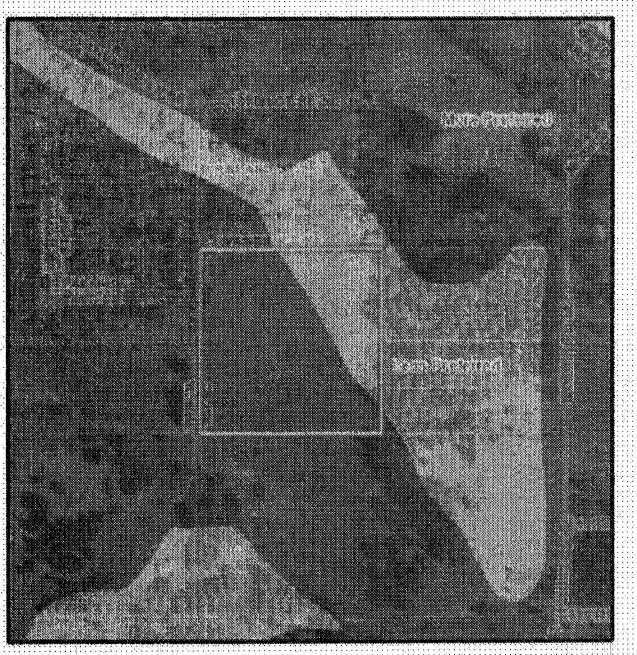
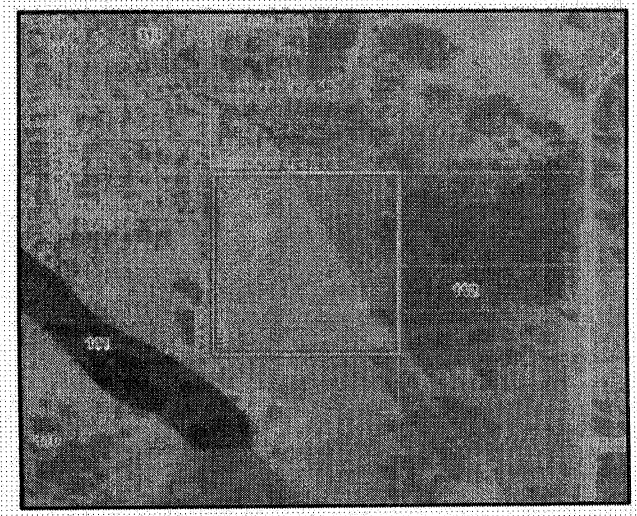


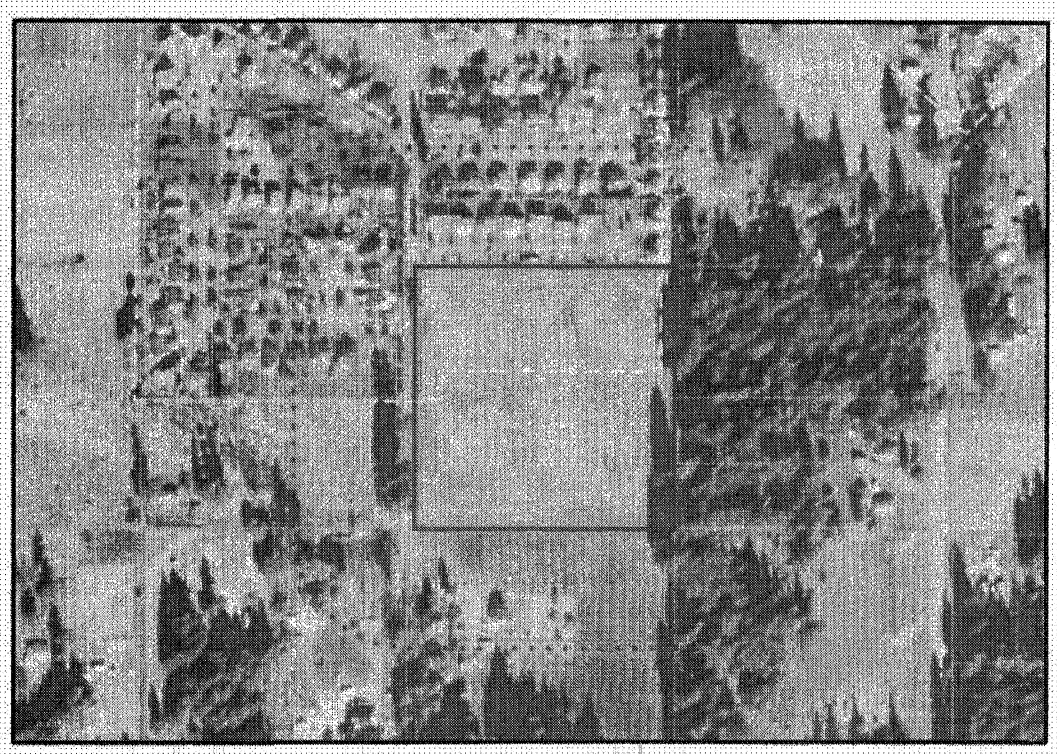
Photo 4: Soils Map



Priority Habitats and Species Review

A search of the Washington Department of Fish and Wildlife's (WDFW) Priority Habitats and Species (PHS) database did not indicate an occurrence of the Mazama Pocket Gopher within 300 feet of the property. A printout of PHS report for this area is included as an attachment.

Photo 5: PHS Report Area



Site Visit #1

The initial site visit was conducted on June 17, 2021. The parcel contains a single-family residence. Visibility was excellent. The site has numerous active mole mounds, but no gopher mounds were observed.

No Mazama Pocket Gopher mounds were observed on the parcel.

Site Visit #2

The second site visit was conducted on July 19, 2021, again following the County's protocol. As with the initial survey, numerous mole mounds were detected, but no gopher mounds were observed.

Photo 6: 1st Site Visit – GPS-tracked survey route

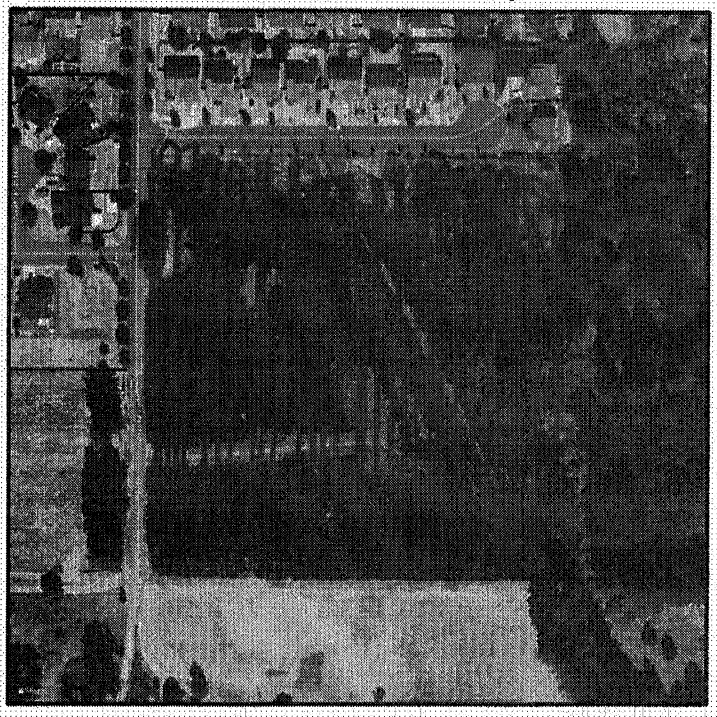


Photo 7: 2nd Site Visit – GPS-tracked survey route

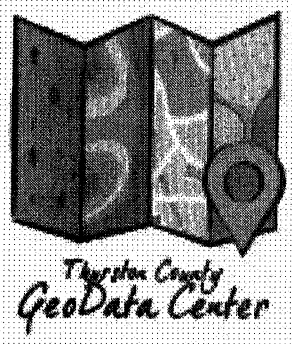
Conclusion

I have followed the protocols established by Thurston County to survey this property. Based on the results of 2 field visits, I conclude that there is presently no indication that the property is inhabited by the Mazama Pocket Gopher.

Signed: Gary Cooper

Gary Cooper, Local Planning Solutions

Date: 7/20/2021



Data for Parcel No. 22730410300

Owner(s):
GES LAND LLC

Address:	17835 STATE ROUTE 507 SE
City:	YELM
State:	WA, 98597
Site Address:	
Site City:	
Site Zip:	
Section:	S30172E
Abbreviated Legal:	Section 30 Township 17 Range 2E NW NE SE N & E OF S LATERAL DITCH
Usecode:	91
Tax Code Area:	221
Taxable:	Yes
Annual Tax:	View Property Taxes for Parcel
Property Type:	LND
Total Acres:	10
Land Value:	View Assessor's Data for Parcel
Building Value:	View Assessor's Data for Parcel
Total Value:	View Assessor's Data for Parcel
Current Use:	N
Exemptions:	None
Wetlands:	Unknown
Flood Zone:	OUT
Flood of 1999:	Unknown
Winter Flooding of 1996:	Unknown
High Groundwater Flood Hazards:	Unknown
Zoning:	RR1/5, Rural Residential
Commissioner District:	Gary Edwards - District 2
Historic Site:	No
Permitting Jurisdiction:	COUNTY
Jurisdiction of Influence:	YELMUGA
No Shooting Zone:	No
Animal Control:	Ordinance No. 12989. Contact Animal Services (360-352-2510).
Weed Containment Zone:	No
Landslide Hazard Review Area - Slope A:	Unknown
Landslide Hazard Review Area - Slope B:	Unknown
Landslide Hazard Review Area - Slope C, D, E:	Not mapped by GeoData
Ground Water Sensitive Areas:	No
DNR Natural Heritage Data:	Unknown

Mazama Pocket Gopher Indicator Soils:	Yes - Check with Permit Assistance Center
Mazama Pocket Gopher Soils Preference:	
Mazama Pocket Gopher Soils Review Area:	Yes - Check with Permit Assistance Center
Mazama Pocket Gopher Soils Review Area Preference:	Medium, Low
Marine Riparian Review Area - 300':	Unknown
Stream Riparian Review Area - 300':	Unknown
Wetland Review Area - 300':	Unknown
Shoreline Master Program and 100' Review Area:	No
FEMA Panel No.:	0365, 0362
Wellhead Protection Area:	Yes
Area of Groundwater Concern:	No
Elevated Nitrates:	No
Soil Type:	Spanaway gravelly sandy loam, 0 to 3% slopes
Hydric Soil:	Unknown
Watershed:	NISQUALLY RIVER
Water Service Area:	Unknown
Water Resource Inventory Area (WRIA):	11
School Attendance District:	YELM
Elementary School:	FORT STEVENS
Middle School:	MILL POND AND YELM
High School:	YELM
School Taxing District:	View Assessor's Data for Parcel
Fire Response District:	S.E. Thurston Fire Authority
Unconsolidated Fire Response District:	Yelm
Fire Taxing District:	View Assessor's Data for Parcel
Medic Response District:	M2
Residential Outdoor Burning:	Residential outdoor burning is banned within the city limits and urban growth areas.
Planning Region:	2
Census Tract:	012412
Radio or Cell Tower:	No
Airport Zone:	No
Contamination:	Unknown

Schorno Aerial

Legend

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

Scale 1: 6,949

0 300 600

Feet

Map Created Using GeoData Public Website

Published: 7/20/2021

Note:

THURSTON COUNTY

Thurston County GeoData Center

Gopher Soils

Legend

- Gopher Indicator Soils
  - Less Preferred
  - More Preferred
- Parcel Boundaries
- Roads - Major
  - Major Roads
  - Ramp
  - I 5; US 101
- Roads (Large Scale)
- Railroads
- County Border

Scale 1: 6,949

0 300 600

Feet

Map Created Using GeoData Public Website

Published: 7/20/2021

Note:

THURSTON COUNTY

Thurston County GeoData Center

Soils

Legend

Soils (USDA)

- Alderwood gravelly sandy loam, 0 to 3% slopes
- Alderwood gravelly sandy loam, 15 to 30% slopes
- Alderwood gravelly sandy loam, 3 to 15% slopes
- Alderwood gravelly sandy loam, 30 to 50% slopes
- Baldhill very stony sandy loam, 0 to 3% slopes
- Baldhill very stony sandy loam, 15 to 30% slopes
- Baldhill very stony sandy loam, 3 to 15% slopes
- Baldhill very stony sandy loam, 30 to 50% slopes
- Baumgard loam, 10 to 40% slopes
- Baumgard loam, 40 to 65% slopes
- Baumgard-Pheeney Complex, 40 to 65% slopes
- Baumgard-Pheeney complex, 10 to 40% slopes
- Baumgard-Rock outcrop complex, 40 to 65% slopes
- Bellingham silty clay loam
- Boisfort silt loam, 20 to 40% slopes
- Boisfort silt loam, 5 to 20% slopes
- Bunker gravelly silt loam, 30 to 65% slopes
- Bunker gravelly silt loam, 5 to 30% slopes
- Bunker-Boisfort complex, 40 to 65% slopes
- Cagey loamy sand
- Cathcart gravelly loam, 15 to 35% slopes
- Cathcart gravelly loam, 3 to

Scale 1: 6,949

0 300 600

Feet

Map Created Using GeoData Public Website

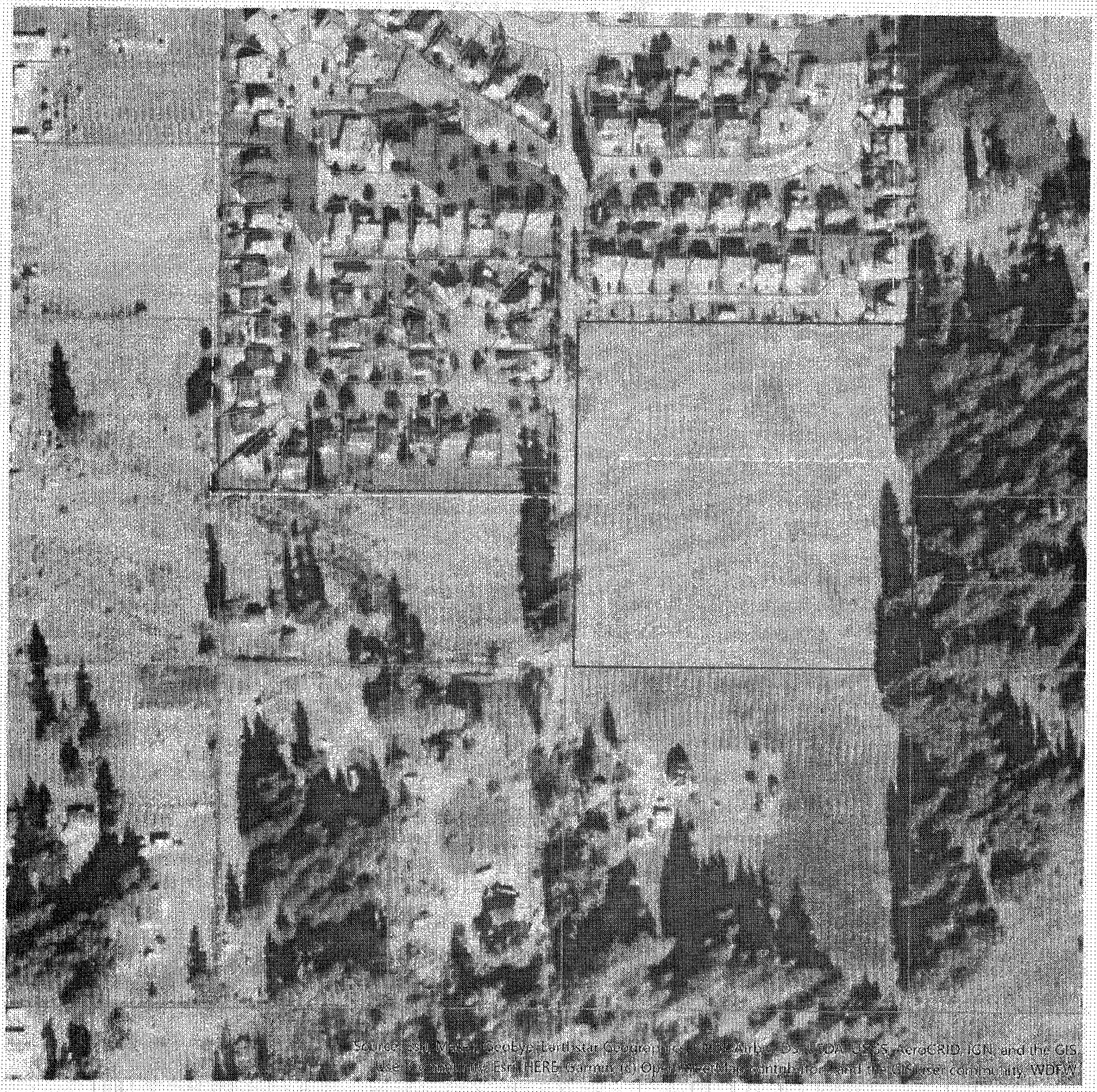
Published: 7/20/2021

Note:

THURSTON COUNTY

SINCE 1852

Thurston County GeoData Center



Buffer radius: 300 Feet

Report Date: 07/20/2021, Parcel ID: 22730410300

PHS Species/Habitats Overview:

Occurence Name	Federal Status	State Status	Generalized Location
Townsend's Big-eared Bat	N/A	Candidate	Yes
Yuma myotis	N/A	N/A	Yes

PHS Species/Habitats Details:

Townsend's Big-eared Bat	
Scientific Name	*Corynorhinus townsendii*
Notes	This polygon mask represents one or more records of the above species or habitat occurrence. Contact PHS Data Release (360-902-2543) for obtaining information about masked sensitive species and habitats.
Federal Status	N/A
State Status	Candidate
PHS Listing Status	PHS Listed Occurrence
Sensitive	Y
SGCN	Y
Display Resolution	TOWNSHIP
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00027

Yuma myotis	
Scientific Name	*Myotis yumanensis*
Notes	This polygon mask represents one or more records of the above species or habitat occurrence. Contact PHS Data Release (360-902-2543) for obtaining information about masked sensitive species and habitats.
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	Y
SGCN	N
Display Resolution	TOWNSHIP
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00605

2021 Thurston County Mazama Pocket Gopher Screening Field Form **Site Visit Date:** 6/17/2021

Site Name and Parcel #	**Parcel #:** 2273041030O **Project #:** **Site/Landowner:** Glenn Schorno
How were the data collected? **(circle the method for each)**	**Transect:** Trimble Garmin Aerial **Mounds** Trimble Garmin Aerial **Notes:** GPS TRACKER - SEE REPORT
Field Team Personnel: **(Indicate all staff present, CIRCLE who filled out form)**	**Name:** Gary Cooper **Name:** **Name:**
Others onsite (name/affiliation)	
Site visit # **(CIRCLE all that apply)**	(1st) 2nd Unable to screen **Notes:**
Do onsite conditions preclude the need for further visits?	Yes (No) **Dense woody cover that encompasses the entire site (trees/shrubs) that appears to preclude any potential MPG use.** **Impervious Compacted Graveled Flooded** **Other** _____ **Notes:**
Describe visibility for mound detection:	**Poor Fair (Good) Notes:**
Request mowing? **(CIRCLE and DESCRIBE WHERE MOWING IS NEEDED and SHOW ON AERIAL PHOTO**	**Yes (No) N/A Notes:**

Mounds observed over the whole site are characteristic of: Quantify or describe amount of each type and approx. # of mounds *Group = 3 mounds or more*	MPG Mounds	Likely MPG Mounds	Indeterminate	Likely Mole Mounds	Mole Mounds
	0	0	0	0	>50
	No MPG mounds (circle)				
MPG mounds in GPS? (CIRCLE and DESCRIBE) If MPG mounds present, entered in GPS?	None All Most Some Notes: Yes No N/A				
Does woody vegetation onsite match aerial photo?	Yes	No - describe differences and show on parcel map/aerial:			
What portion(s) of the property was screened? (CIRCLE and DESCRIBE)	All	Part - describe and show on parcel map/aerial:			
Notes -	Describe, and show on parcel map/aerial if applicable: SEE REPORT				
Team reviewed and agreed to data recorded on form? (CIRCLE, and EXPLAIN if "No")	Yes No Reviewed by initials: GLC ____ ____ ____ Notes:				

2021 Thurston County Mazama Pocket Gopher Screening Field Form **Site Visit Date:** 7/19/2021

Site Name and Parcel #	**Parcel #:** 2273041030O **Project #:** **Site/Landowner:** GLEN SCHORNO
How were the data collected? **(circle the method for each)**	**Transect:** Trimble Garmin Aerial **Mounds** Trimble Garmin Aerial **Notes:** GPS TRACKER, as depicted in report
Field Team Personnel: **(Indicate all staff present, CIRCLE who filled out form)**	**Name:** Gary Cooper **Name:** **Name:**
Others onsite (name/affiliation)	
Site visit # **(CIRCLE all that apply)**	1st (2nd) Unable to screen **Notes:**
Do onsite conditions preclude the need for further visits?	Yes (No) **Dense woody cover that encompasses the entire site (trees/shrubs) that appears to preclude any potential MPG use.** Impervious Compacted Graveled Flooded Other _____ **Notes:**
Describe visibility for mound detection:	Poor Fair (Good) **Notes:**
Request mowing? **(CIRCLE and DESCRIBE WHERE MOWING IS NEEDED and SHOW ON AERIAL PHOTO**	Yes (No) N/A **Notes:**

Mounds observed over the whole site are characteristic of:	**MPG Mounds**	**Likely MPG Mounds**	**Indeterminate**	**Likely Mole Mounds**	**Mole Mounds**
Quantify or describe amount of each type and approx. # of mounds ***Group = 3 mounds or more***					>50
	No MPG mounds (circle)				
MPG mounds in GPS? **(CIRCLE and DESCRIBE)** **If MPG mounds present, entered in GPS?**	**None All Most Some** **Notes:** **Yes No N/A**				
Does woody vegetation onsite match aerial photo?	**Yes No - describe differences and show on parcel map/aerial:**				
What portion(s) of the property was screened? **(CIRCLE and DESCRIBE)**	**All Part - describe and show on parcel map/aerial:**				
Notes -	**Describe, and show on parcel map/aerial if applicable:** SEE REPORT				
Team reviewed and agreed to data recorded on form? **(CIRCLE, and EXPLAIN if "No")**	**Yes No Reviewed by initials:** GLC ____ ____ ____ **Notes:**				

Local Planning Solutions
Knowledge, Experience, Results

DATE:	July 20, 2021
Submitted To:	Glenn Schorno
From:	Gary Cooper, Local Planning Solutions
Subject:	Mazama Pocket Gopher Survey Findings

This report has been completed following the Thurston County approved protocols for determining the presence of Pocket Gophers. Conclusions made in this report are based on two site visits conducted at the required intervals as well as data research from the Thurston County Geodata website and the Washington Department of Fish and Wildlife Priority Habitats and Species (PHS) database. Maps and summary reports obtained from both the Geodata and PHS sites are included with this report.

Survey Findings

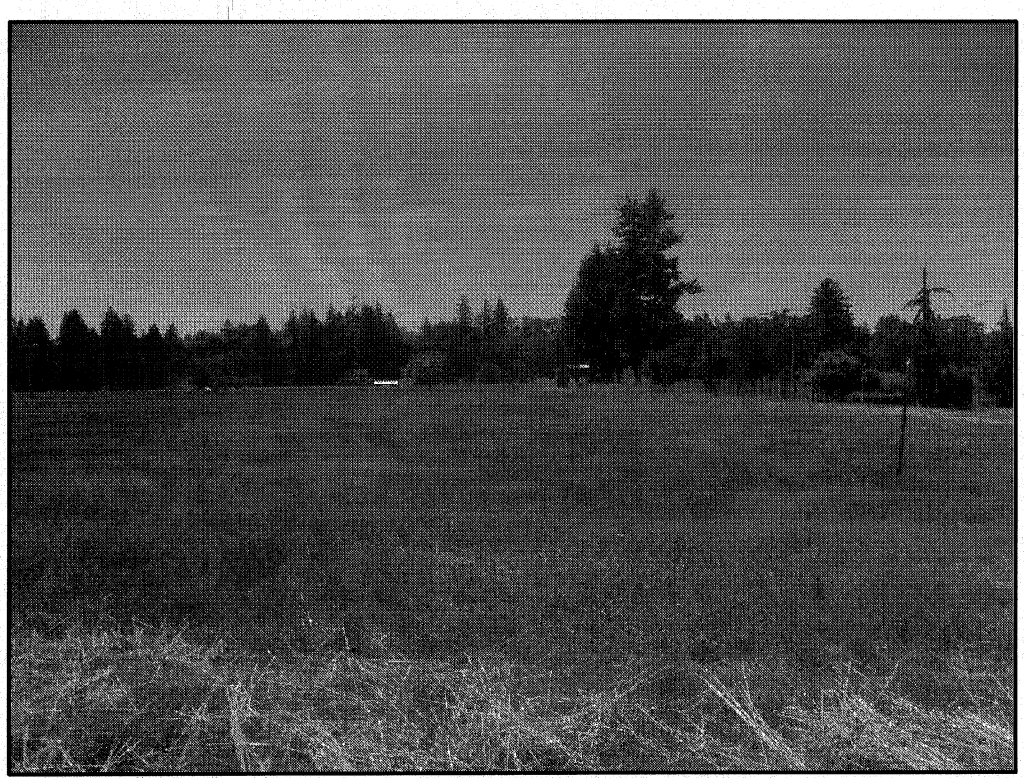
No Mazama Gopher activity was observed on the property.

Property Information

Owners:	G.E.S. Land, LLC
Site Address:	None
Parcel Number:	22730410300
Parcel Size:	10 acres
Field Visit Dates:	June 17, 2021 July 19, 2021

Photo 1: Property aerial

Photo 2: Photo taken from southwest corner



Thurston Geodata Review

A property search on the Thurston Geodata indicates that this parcel is comprised of Spanaway gravelly sandy loam 0-3% (#110), which is categorized as "More Preferred," and Spanaway stony sandy loam 0-3% (#112), which is categorized as "Less Preferred."

Photo 3: Gopher Soils Indicator Map

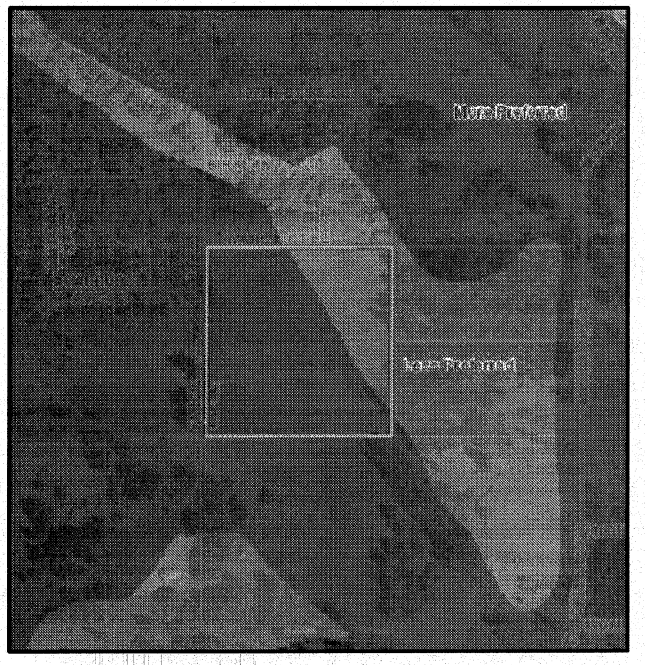
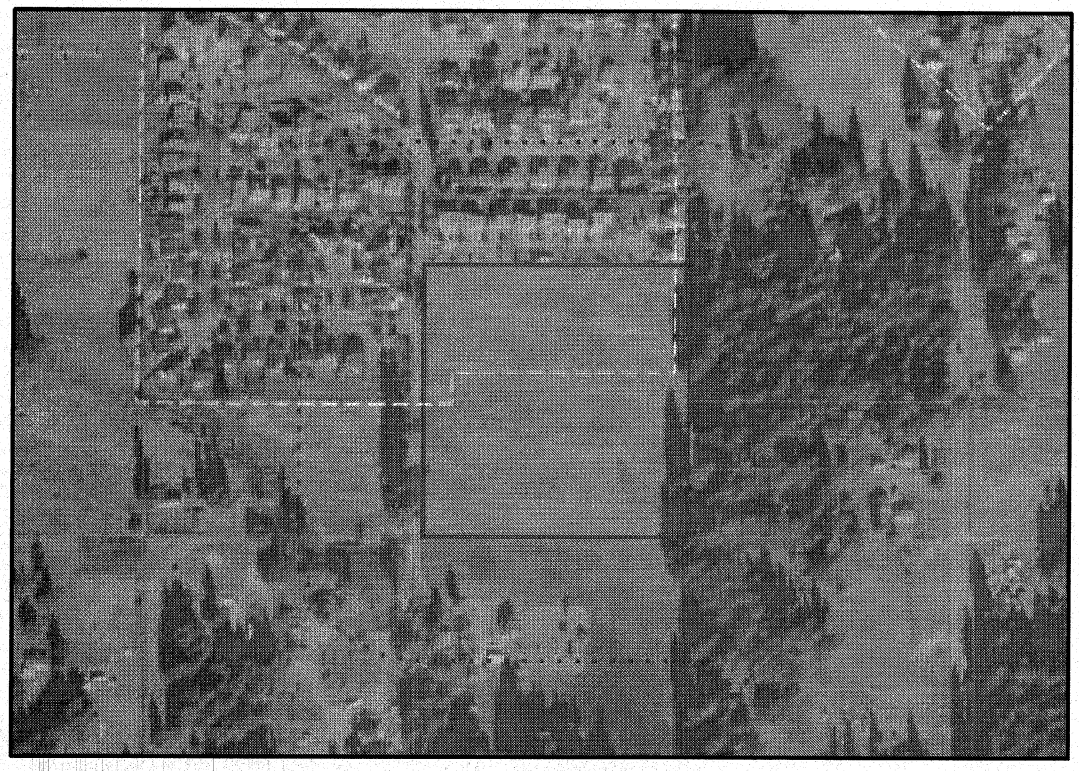


Photo 4: Soils Map

Priority Habitats and Species Review

A search of the Washington Department of Fish and Wildlife's (WDFW) Priority Habitats and Species (PHS) database did not indicate an occurrence of the Mazama Pocket Gopher within 300 feet of the property. A printout of PHS report for this area is included as an attachment.

Photo 5: PHS Report Area



Site Visit #1

The initial site visit was conducted on June 17, 2021. The parcel contains a single-family residence. Visibility was excellent. The site has numerous active mole mounds, but no gopher mounds were observed.

No Mazama Pocket Gopher mounds were observed on the parcel.

Site Visit #2

The second site visit was conducted on July 19, 2021, again following the County's protocol. As with the initial survey, numerous mole mounds were detected, but no gopher mounds were observed.

Photo 6: 1st Site Visit – GPS-tracked survey route

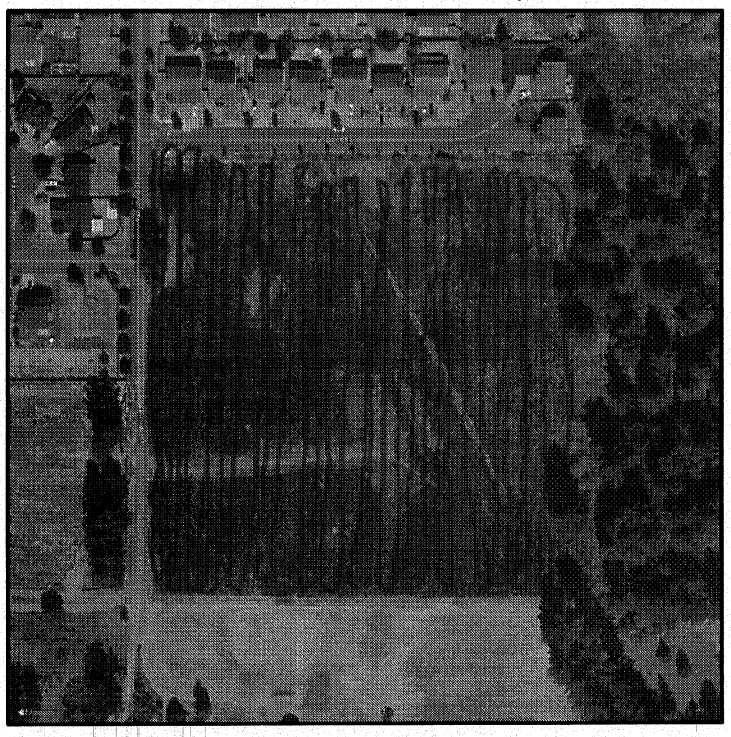


Photo 7: 2nd Site Visit – GPS-tracked survey route

Country Meadows Estates Phase 1
Staff Report Supplement
Exhibit C: Geotech Report

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

GEOTECHNICAL ENGINEERING STUDY
PROPOSED VANCIL ROAD SUBDIVISION
10800 VANCIL ROAD SOUTHEAST
THURSTON COUNTY (YELM), WASHINGTON

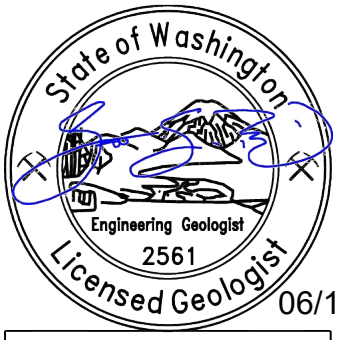
ES-9150

15365 N.E. 90th Street, Suite 100 Redmond, WA 98052
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

COPPER RIDGE, LLC

June 14, 2023



06/14/2023

Scott S. Riegel

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

06/14/2023

Kyle R. Campbell, P.E.
Senior Principal Engineer

GEOTECHNICAL ENGINEERING STUDY
PROPOSED VANCIL ROAD SUBDIVISION
10800 VANCIL ROAD SOUTHEAST
THURSTON COUNTY (YELM), WASHINGTON

ES-9150

Earth Solutions NW, LLC
15365 Northeast 90th Street, Suite 100
Redmond, Washington 98052
Phone: 425-449-4704 | Fax: 425-449-4711
www.earthsolutionsnw.com

Important Information about This

Geotechnical-Engineering Report

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

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

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

June 14, 2023
ES-9150

Copper Ridge, LLC
P.O. Box 73790
Puyallup, Washington 98373

Attention: Evan Mann

Dear Evan:

Earth Solutions NW, LLC (ESNW), is pleased to present this report to support the proposed project. Based on the results of our investigation, construction of the proposed residential development is feasible from a geotechnical standpoint.

Based on conditions observed during our fieldwork, the site is underlain primarily by native soils consisting of glacial outwash sand/gravel deposits. The proposed residential structures can be supported on conventional spread and continuous foundations bearing on undisturbed competent native soil, recompacted native soil, or new structural fill placed directly on a competent subgrade surface. We anticipate competent native soil suitable for support of foundations will generally be encountered beginning at depths of about two to four feet below existing grades across the site.

Based on our investigation, infiltration is considered feasible from a geotechnical standpoint due to the pervasive presence of relatively clean outwash sand/gravel soils.

This report provides geotechnical analyses and recommendations for the proposed residential development. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding the content of this study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

15365 N.E. 90th Street, Suite 100 • Redmond, WA 98052 • (425) 449-4704 • FAX (425) 449-4711

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ES-9150

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GRAPHICS

APPENDICES

GEOTECHNICAL ENGINEERING STUDY
VANCIL ROAD SUBDIVISION
10800 VANCIL ROAD SOUTHEAST
THURSTON COUNTY (YELM), WASHINGTON

ES-9150

INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed residential development to be constructed in Yelm, Washington. To complete our scope of services, we performed the following:

- Subsurface exploration to characterize the soil and groundwater conditions.
- Laboratory testing of representative soil samples collected on site.
- Engineering analyses.
- Preparation of this report.

The following documents and resources were reviewed as part of our report preparation:

- Vancil Road Layout, provided by the client, dated February 27, 2023.
- Morris Road Plat, prepared by AHBL, dated June 15, 2022.
- Surficial hydrogeologic units of the Puget Sound aquifer system, Washington and British Columbia, for the Centralia quadrangle (Plate 17 of 18) M.A. Jones 1998.
- Web Soil Survey (WSS) online resource, maintained by the Natural Resources Conservation Service (NRCS) under the United States Department of Agriculture (USDA).
- Pierce County Stormwater Management and Site Development Manual, effective July 1, 2021.
- Yelm Municipal Code Chapter 18.21.

Project Description

The overall project area is located off the east side of Vancil Road Southeast in Yelm, Washington.

Site grading plans were not available at the time of this proposal; however, we understand the Vancil Road project will consist of construction of 60 single-family homesites and the Morris Road site will be developed with 30 lots and associated infrastructure improvements. Each site will include a stormwater management facility, and will require seasonal groundwater monitoring. We presume infiltration will be pursued to the extent feasible.

At the time of report submission, specific building loads were not available for review; however, we anticipate the proposed residential structures will consist of relatively lightly loaded wood framing supported on conventional foundations. Based on our experience with similar developments, we estimate wall loads of about 1 to 3 kips per linear foot and slab-on-grade loading of 150 pounds per square foot (psf) will be incorporated into the final design. Based on the low topographic relief on this site, we anticipate grading will be limited to cuts and fills of about five feet or less for lots. Deeper cuts will occur for utilities and the stormwater tracts.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that appropriate geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The two properties that comprise the Vancil Road and Morris Road sites consist of Thurston County Parcel Nos. 22730410300 & 22730410000. The sites are vacant and the majority of the Vancil Road site area is surfaced with field grass used as fenced pasture while the Morris Road site is largely forested. Topography is gently undulating. The Vancil Road property is bordered to the north and west by residential development, to the east by the Morris Road property and to the south by open space. The Morris Road property is bordered to the north and south by residential property, to the east by Morris Road Southeast and to the west by the Vancil Road property.

Subsurface

A representative of ESNW observed, logged, and sampled 18 test pits at accessible locations within the property boundaries on April 24/25, 2023 using a machine and operator provided by the client. The explorations were completed to assess and classify the site soils and to characterize the groundwater conditions within areas proposed for new development. The maximum exploration depth was approximately 16 feet below the existing ground surface (bgs).

The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at our exploration locations were analyzed in general accordance with Unified Soil Classification System (USCS) and USDA methods and procedures.

Topsoil and Fill

Topsoil was generally encountered within the upper 12 to 18 inches of existing grades at the test pit locations, except several explorations that encountered up to 24 inches. It is possible that deeper or shallower pockets of topsoil will be encountered locally across the site. The topsoil was characterized by its dark brown color, the presence of fine organic material, and small root intrusions.

Fill was not encountered during the subsurface exploration; however, fill is likely present to varying degrees around existing structures.

Native Soil

Underlying the topsoil, native soils consisting primarily of medium dense poorly and well graded gravel with sand (USCS: GP and GW) soils were encountered. At an isolated location TP-6 at 16 feet), a well graded sand with silt (USCS: SW-SM) layer was encountered. Fines contents within the native soil deposits were less than 5 percent, except the isolated layer of sand with silt which had a fines content of about 7.4 percent at TP-6. The native soils were primarily observed to be in a damp to moist condition and caving was common within the relatively clean sandy gravel deposits.

Geologic Setting

Geologic mapping of the area identifies recessional outwash gravel deposits (Qvrg) as the primary geologic unit underlying the site. The online WSS resource identifies Spanaway series soils (Map Units 110 and 112) roughly evenly distributed across the site. The referenced soil survey characterizes Spanaway gravelly sandy loam with slow surface water runoff and little to no hazard of water erosion and are assigned to hydrologic soil group A.

Based on the soil conditions encountered during our fieldwork, the native soils are consistent with the geologic and soils mapping resources outlined in this section of outwash sand/gravel soils.

Groundwater

Groundwater was not observed, during the April 2023 subsurface explorations. Groundwater flow rates and elevations may fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months. In any case, groundwater conditions should be expected within deeper site excavations, particularly during the wet season. Depending on the timing, depth, and extent of such excavations, temporary dewatering may be necessary.

GEOLOGIC CRITICAL AREAS EVALUATION

The subject property was evaluated for the presence of geologic critical areas in general accordance with Yelm Municipal Code Chapter 18.21. Based on our review no geologic critical areas are present on or immediately adjacent to the subject site.

Based on review of the Thurston County Wellhead Protection Areas map, the site is located within a 10-year Time-of-Travel area.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed project include earthwork, temporary excavations, subgrade preparation, foundation support, and drainage.

Based on local geologic mapping and conditions observed during our fieldwork, the site is underlain primarily by native soils consisting of medium dense outwash sandy gravel deposits. The proposed residential structures can be supported on conventional spread and continuous foundations bearing on undisturbed competent native soil, recompacted native soil, or new structural fill placed directly on a competent subgrade. We anticipate competent native soil suitable for support of foundations will generally be encountered beginning at depths of about two to four feet below existing grades across the site.

Based on our investigation, infiltration is considered feasible from a geotechnical standpoint due to the presence of Spanaway gravel soils across the site.

This study has been prepared for the exclusive use of Copper Ridge, LLC and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Site preparation activities should consist of installing temporary erosion control measures, establishing grading limits, and performing site stripping. Subsequent earthwork activities will likely include site grading, utility installations, and associated site improvements.

Temporary Erosion Control

The following temporary erosion and sediment control Best Management Practices (BMPs) are recommended:

- Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide stable surfaces at site entrances. Placing geotextile fabric underneath the quarry spalls will provide greater stability if needed.

- Silt fencing should be placed around the appropriate portions of the site perimeter to prevent offsite migration of sediment.

- When not in use, soil stockpiles should be covered or otherwise protected (as necessary) to reduce the potential for soil erosion, especially during periods of wet weather.

- As necessary, temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or interceptor swales, should be installed prior to beginning earthwork activities. For this site, infiltration may also be considered for control of surface water runoff.

- Dry soils disturbed during construction should be wetted to minimize dust and airborne soil erosion.

Additional Best Management Practices, as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities. Temporary erosion control measures may be modified during construction as site conditions require, as approved by the site erosion control lead.

Stripping

Topsoil was encountered generally within the upper 12 to 18 inches with isolated areas up to 24 inches of existing grades at the test pit locations. ESNW should be retained to observe site stripping activities at the time of construction so that the degree of required stripping may be assessed. The exposed subgrade may still possess root elements, other organic material, or be present in a loose condition. As such, ESNW should evaluate the exposed soil subgrade to determine if further stripping or in-situ compaction efforts prior to fill operations or finish grading is necessary. Over-stripping should be avoided, as it is unnecessary and may result in increased project development costs. Topsoil and organic-rich soil are neither suitable for foundation support nor for use as structural fill. Topsoil and organic-rich soil may be used in non-structural areas if desired.

In-situ and Imported Soil

The in-situ soils encountered at the subject site have a low to moderate sensitivity to moisture and were generally in a damp to moist condition at the time of exploration. Soils anticipated to be exposed on site may degrade if exposed to wet weather and construction traffic. Compaction of the soils to the levels necessary for use as structural fill may be difficult to impossible during wet weather conditions. Soils encountered during site excavations that are excessively over the optimum moisture content will likely require aeration or treatment prior to placement and compaction. Conversely, soils that are substantially below the optimum moisture content will require moisture conditioning through the addition of water prior to use as structural fill. An ESNW representative should determine the suitability of in-situ soils for use as structural fill at the time of construction.

Imported soil intended for use as structural fill should be evaluated by ESNW during construction. The imported soil must be workable to the optimum moisture content, as determined by the Modified Proctor Method (ASTM D1557), at the time of placement and compaction. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas. Structural fill placed and compacted during site grading activities should meet the following specifications and guidelines:

- Structural fill material — Granular soil*
- Moisture content — At or slightly above optimum†
- Relative compaction (minimum) — 95 percent (Modified Proctor)‡
- Loose lift thickness (maximum) — 12 inches

* *Existing gravel soils will likely require moisture conditioning (addition of water) prior to placement and compaction.*
† *Soil shall not be placed dry of optimum and should be evaluated by ESNW during construction.*
‡ *Minimum relative compaction of 90% may be feasible for mass grading activities and should be evaluated by ESNW during construction.*

With respect to underground utility installations and backfill, local jurisdictions may dictate the soil type(s) and compaction requirements. Unsuitable material or debris must be removed from structural areas if encountered.

Excavations and Slopes

The following Federal Occupation Safety and Health Administration and Washington Industrial Safety and Health Act soil classifications and maximum allowable temporary slope inclinations may be used:

- Areas exposing groundwater seepage — 1.5H:1V (Type C)
- Loose soil and fill — 1.5H:1V (Type C)
- Medium dense to dense soil — 1H:1V (Type B)

Groundwater seepage should be anticipated during excavation activities, especially if excavations take place during the wet season. An ESNW representative should observe temporary excavations to evaluate the presence of groundwater seepage. If seepage is not observed, steeper temporary slope inclinations may be feasible pending evaluation by the geotechnical engineer.

Subgrade Preparation

Foundations should be constructed on competent native soil or structural fill placed directly on competent native soil. Loose or unsuitable soil conditions encountered below areas of footing and slab elements should be remedied as recommended in this report. In general, foundation subgrades on native cut surfaces should be compacted in-situ to a minimum depth of one foot below the design subgrade elevation. Uniform compaction of the foundation and slab subgrade areas will establish a relatively consistent subgrade condition below the foundation and slab elements. ESNW should observe the foundation and slab subgrade prior to placing formwork. Supplementary recommendations for subgrade improvement can be provided at the time of construction and would likely include further mechanical compaction effort and/or overexcavation and replacement with suitable structural fill.

Foundations

The proposed structures can be constructed on conventional continuous and spread footing foundations bearing on competent native soil, recompacted native soil, or new structural fill placed directly on competent native soil. Where loose or unsuitable soil conditions are encountered at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with suitable structural fill will likely be necessary. A representative of ESNW should confirm suitability of foundation subgrades at the time of construction. If deemed necessary, the undisturbed weathered native soils may be compacted in-situ provided the soil is at or slightly above the optimum moisture content.

Provided the structures will be supported as described above, the following parameters may be used for design of the new foundations:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40

A one-third increase in the allowable soil bearing capacity can be assumed for short-term wind and seismic loading conditions. The passive earth pressure and coefficient of friction values include a safety factor of 1.5. With structural loading as expected, total settlement in the range of one inch is anticipated, with differential settlement of about one-half inch. The majority of the settlement should occur during construction as dead loads are applied.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for retaining wall design:

- Active earth pressure (unrestrained condition) 35 pcf
- At-rest earth pressure (restrained condition) 55 pcf
- Traffic surcharge (passenger vehicles) 70 psf (rectangular distribution)
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40
- Seismic surcharge 8H psf*

* *Where H equals the retained height (in feet).*

The passive earth pressure and coefficient of friction values include a safety factor of 1.5. Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. Relatively clean (fines content less than 5 percent) native soils may be used as the drainage zone, but should be observed by ESNW prior to placement. The upper 12 inches of the wall backfill may consist of a less permeable soil, if desired.

Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3.

Seismic Design

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically with respect to earthquake loads. Based on the soil conditions encountered at the test pit locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

Parameter	**Value**
Site Class	D*
Mapped short period spectral response acceleration, S_S (*g*)	1.280
Mapped 1-second period spectral response acceleration, S_1 (*g*)	0.463
Short period site coefficient, F_a	1.000
Long period site coefficient, F_v	1.837
Adjusted short period spectral response acceleration, S_{MS} (*g*)	1.280
Adjusted 1-second period spectral response acceleration, S_{M1} (*g*)	0.850
Design short period spectral response acceleration, S_{DS} (*g*)	0.853
Design 1-second period spectral response acceleration, S_{D1} (*g*)	0.567

* *Assumes medium dense soil conditions, encountered to a maximum depth of 16 feet bgs during the April 2023 field exploration, remain medium dense or better to at least 100 feet bgs.*

† *Values assume F_v may be determined using linear interpolation per Table 11.4-2 in ASCE 7-16.*

As indicated in the table footnote, several of the seismic design values provided above are dependent on the assumption that site-specific ground motion analysis (per Section 11.4.8 of ASCE 7-16) will not be required for the subject project. ESNW recommends the validity of this assumption be confirmed at the earliest available opportunity during the planning and early design stages of the project. Further discussion between the project structural engineer, the project owner (or their representative), and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

Liquefaction is a phenomenon where saturated or loose soil suddenly loses internal strength and behaves as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or another intense ground shaking. In our opinion, site susceptibility to liquefaction may be considered negligible. The absence of a shallow groundwater table and the coarse (gravel) gradation of the native soil were the primary bases for this opinion.

Slab-on-Grade Floors

Slab-on-grade floors should be supported on a firm and unyielding subgrade consisting of competent native soil or at least 12 inches of new structural fill. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with suitable structural fill prior to slab construction.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less defined as the percent passing the number 200 sieve, based on the minus three-quarters-inch fraction. In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. The relatively clean (less than 5 percent fines) native gravel soils may be used or considered functionally equivalent as a capillary break; however, ESNW should observe native soils prior to placement to confirm suitability. If used, the vapor barrier should consist of a material specifically designed to function as a vapor barrier and should be installed in accordance with the manufacturer's specifications.

Drainage

Temporary measures to control surface water runoff and groundwater during construction would likely involve passive elements such as interceptor trenches, interceptor swales, and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and provide recommendations to reduce the potential for seepage-related instability.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures or slopes. Based on the presence of relatively clean sand/gravel soils on this site, footing drains may be omitted at the owner's discretion. If footing drains are omitted, we recommend ESNW be contacted to observe the subgrade to ensure the entire alignment exposes relatively free-draining sand/gravel. If footing drains will be installed, a foundation drain should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Preliminary Infiltration Evaluation

As indicated on the referenced preliminary site plan, a stormwater tract will be created in each of the project areas. The Vancil Road plat will include a storm tract in the western portion of the site, while the Morris Road plat will include a storm tract in the eastern portion. ESNW excavated three test pits in each storm tract (TP-5 through TP-7 for Vancil Road and TP-11 through TP-13 for the Morris Road site). Native soils encountered across the site during our fieldwork were characterized primarily as recessional outwash gravel deposits with relatively low fines contents. Based on our laboratory analyses, the native soils classify primarily as USDA loamy sand with fines contents ranging from about 1.3 to 4.7 percent with one outlier (TP-6) with a fines content of 7.4 percent. The results of our laboratory analyses are included in Appendix B of this report.

Using Method 3 - Soil Grain Size Analysis Method, in conjunction with the presence of Type A soil on the subject site, we determined a preliminary long-term design infiltration rate to be used primarily as a feasibility screening tool. A preliminary long-term design rate is calculated following the equation below, located in the Pierce County Stormwater and Site Development Manual.

$$log_{10}\,(K_{sat}\,) = \,-1.57\, + 1.90D_{10}\, +\, 0.015D_{60}\, -\, 0.013D_{90}\, -\, 2.08F_{fines}$$

The relatively clean Spanaway (Type A) gravels observed in across the site exhibit favorable infiltration characteristics and will likely be feasible for full infiltration. Based on the soil samples obtained at TP-5 through TP-7 and TP-11 through TP-13 within the vicinity of the proposed infiltration facilities at representative depths, preliminary calculated long-term design rates ranging between 7 inches/hour to 87 in/hr were calculated. We recommend using an allowable infiltration rate of 20 in/hr for the Vancil Road plat and 30 in/hr for preliminary sizing calculations/design for the proposed Morris Road stormwater facility. In-situ pilot infiltration testing should be completed for final design of the infiltration ponds.

Groundwater monitoring piezometers were installed at three test locations within each of the proposed stormwater tracts for future groundwater monitoring services, to be completed in the coming wet season. While no indications of seasonal groundwater were observed during the subsurface investigation, winter monitoring may result in alterations to future facility design based on potential groundwater conditions.

Based on our field observations and laboratory analyses, the native gravelly soils do not meet the requirements for water quality treatment per Volume V, Chapter 6.3 of the stormwater manual. Specifically, the measured soil infiltration rate significantly higher than the maximum allowable nine inches per hour. Additionally, the native Spanaway gravels likely possess a lower cation exchange capacity (CEC) and organic content than required by the manual. Therefore, a treatment layer or other provision will likely be required for facility designs.

Utility Support and Trench Backfill

In our opinion, the on-site soil will generally be suitable for support of utilities. Based on the conditions encountered at the exploration locations, groundwater seepage may be exposed within utility trench excavations and will likely require temporary shoring and construction dewatering. Use of the native soil as structural backfill in the utility trench excavations will depend on the in-situ moisture content at the time of placement and compaction. If native soil is placed below the optimum moisture content, settlement will likely occur once wet weather impacts the trenches. As such, backfill soils should be properly moisture conditioned, as necessary, to ensure acceptability of the soil moisture content at the time of placement and compaction. Large clasts greater than about six inches should be removed from utility trench backfill if encountered. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report or to the applicable requirements of the presiding jurisdiction.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proof rolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thick crushed rock or structural fill sections, prior to pavement. Cement treated base may be considered for stabilizing the subgrade if local jurisdictions allow this method of treatment.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot-mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;

- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

Heavier traffic areas generally require thicker pavement sections depending on site usage, pavement life expectancy, and site traffic. For preliminary design purposes, the following pavement sections for occasional truck traffic and access roadway areas may be considered:

- Three inches of HMA placed over six inches of CRB, or;

- Three inches of HMA placed over four and one-half inches of ATB.

A representative of ESNW should be requested to observe subgrade conditions prior to placement of CRB or ATB. As necessary, supplemental recommendations for achieving subgrade stability and drainage can be provided. If on-site roads will be constructed with an inverted crown, additional drainage measures may be recommended to assist in maintaining road subgrade and pavement stability.

Final pavement design recommendations, including recommendations for heavy traffic areas, access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the governing jurisdiction may supersede the recommendations provided in this report. The HMA, ATB, and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557.

LIMITATIONS

This study has been prepared for the exclusive use of Copper Ridge, LLC, and its representatives. The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the exploration locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services as needed during future design and construction phases of the project.

Reference:
Thurston County, Washington
OpenStreetMap.org

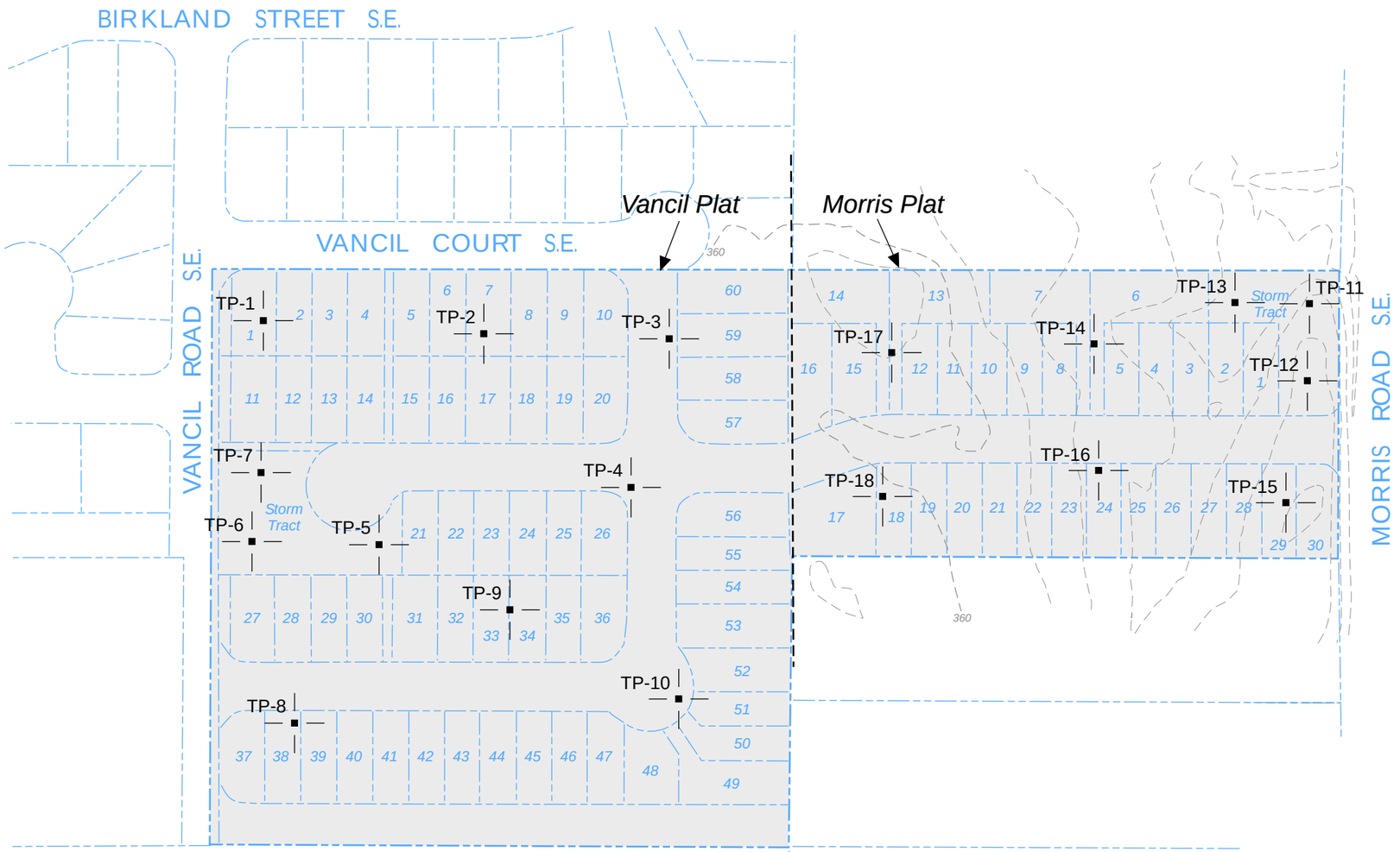
NORTH

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Drawn CAM	Date 06/06/2023	Proj. No. 9150
Checked SSR	Date June 2023	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-9150, April 2023

Subject Site

21 — Proposed Lot Number

NORTH

1"=150'

0 75 150 300

Scale in Feet

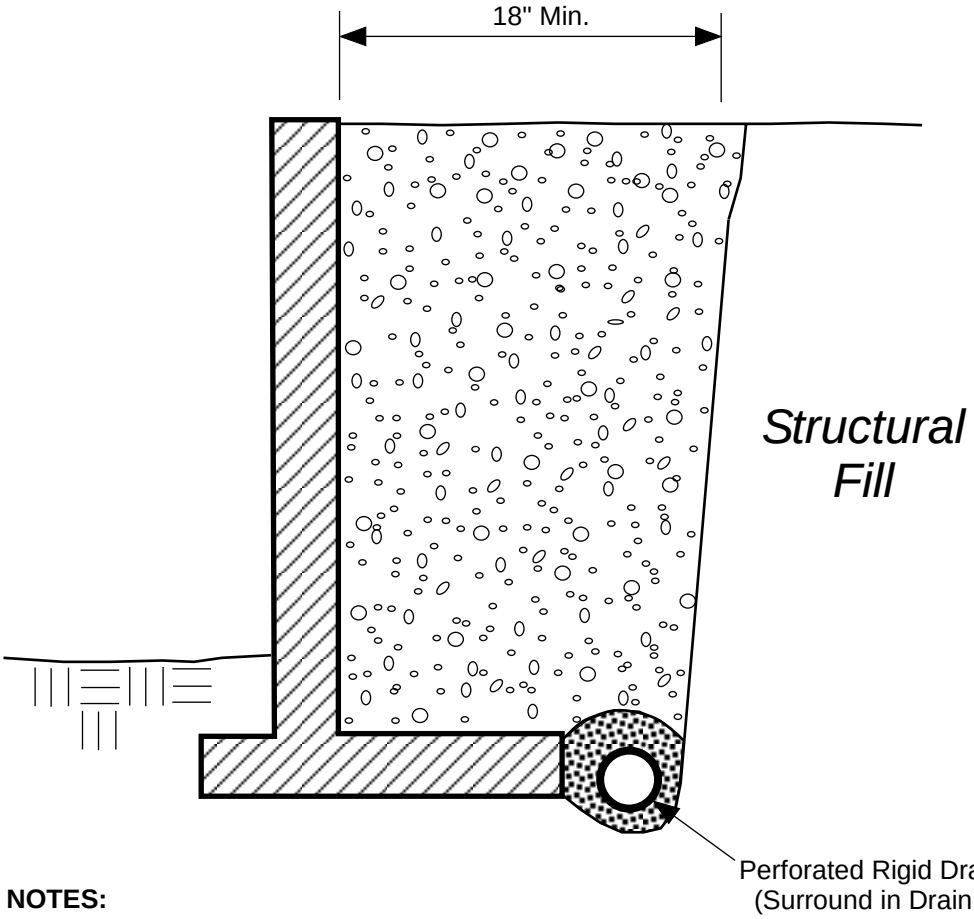
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drawn	CAM
Checked	SSR
Date	06/06/2023
Proj. No.	9150
Plate	2



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

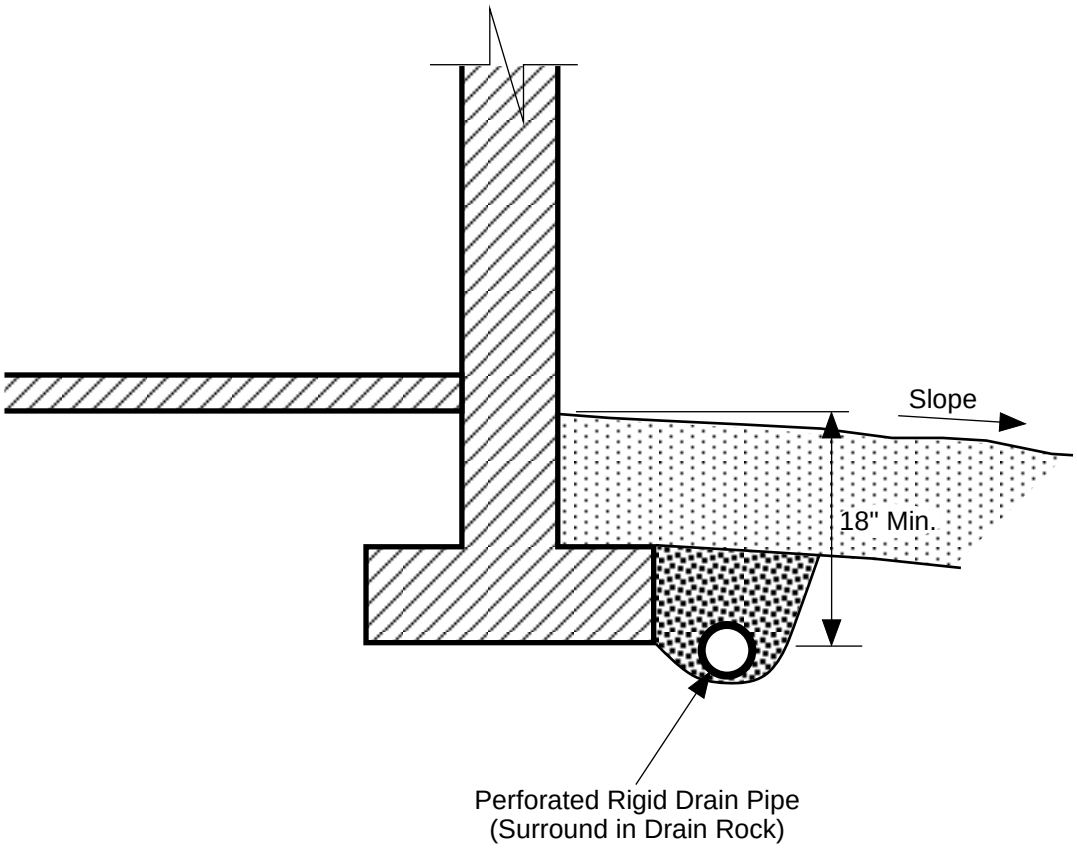
Free-draining Structural Backfill

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Drawn CAM	Date 06/06/2023	Proj. No. 9150
Checked SSR	Date June 2023	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Footing Drain Detail
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Drawn CAM	Date 06/06/2023	Proj. No. 9150
Checked SSR	Date June 2023	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

ES-9150

Subsurface conditions on site were explored by excavating 18 test pits on April 24/25, 2023, respectively, using equipment and operators provided by the client. The approximate locations of the test pits and borings are illustrated on Plate 2 of this study. The subsurface exploration logs are provided in this Appendix. The maximum exploration depth was 16 feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Coarse-Grained Soils - More Than 50% Retained on No. 200 Sieve	Gravels - More Than 50% of Coarse Fraction Retained on No. 4 Sieve	< 5% Fines	GW	Well-graded gravel with or without sand, little to no fines
			GP	Poorly graded gravel with or without sand, little to no fines
		> 12% Fines	GM	Silty gravel with or without sand
			GC	Clayey gravel with or without sand
	Sands - 50% or More of Coarse Fraction Passes No. 4 Sieve	< 5% Fines	SW	Well-graded sand with or without gravel, little to no fines
			SP	Poorly graded sand with or without gravel, little to no fines
		> 12% Fines	SM	Silty sand with or without gravel
			SC	Clayey sand with or without gravel
Fine-Grained Soils - 50% or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less Than 50		ML	Silt with or without sand or gravel; sandy or gravelly silt
			CL	Clay of low to medium plasticity; lean clay with or without sand or gravel; sandy or gravelly lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt with or without sand or gravel; sandy or gravelly elastic silt
			CH	Clay of high plasticity; fat clay with or without sand or gravel; sandy or gravelly fat clay
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils
Fill			FILL	Made Ground

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch

Damp - Perceptible moisture, likely below optimum MC

Moist - Damp but no visible water, likely at/near optimum MC

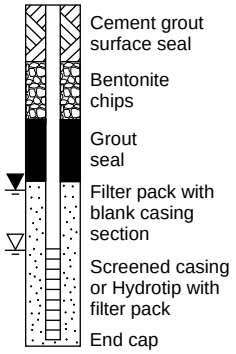
Wet - Water visible but not free draining, likely above optimum MC

Saturated/Water Bearing - Visible free water, typically below groundwater table

Symbols

ATD = At time of drilling

Static water level (date)



Terms Describing Relative Density and Consistency

Coarse-Grained Soils:

Density	SPT blows/foot
Very Loose	< 4
Loose	4 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	≥ 50

Fine-Grained Soils:

Consistency	SPT blows/foot
Very Soft	< 2
Soft	2 to 3
Medium Stiff	4 to 7
Stiff	8 to 14
Very Stiff	15 to 29
Hard	≥ 30

Test Symbols & Units

Fines = Fines Content (%)

MC = Moisture Content (%)

DD = Dry Density (pcf)

Str = Shear Strength (tsf)

PID = Photoionization Detector (ppm)

OC = Organic Content (%)

CEC = Cation Exchange Capacity (meq/100 g)

LL = Liquid Limit (%)

PL = Plastic Limit (%)

PI = Plasticity Index (%)

Component Definitions

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

Modifier Definitions

Percentage by Weight (Approx.)	Modifier
< 5	Trace (sand, silt, clay, gravel)
5 to 14	Slightly (sandy, silty, clayey, gravelly)
15 to 29	Sandy, silty, clayey, gravelly
≥ 30	Very (sandy, silty, clayey, gravelly)

Classifications of soils in this geotechnical report and as shown on the exploration logs are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D2487 and D2488 were used as an identification guide for the Unified Soil Classification System.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

EXPLORATION LOG KEY

Earth Solutions NW, LLC
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Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 358 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93068 **LONGITUDE** -122.59518

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					356.5
	GB	MC = 7.5			Brown poorly graded GRAVEL with sand, medium dense, damp
					-probed 4"
					-slight caving to BOH
5					
	GB	MC = 8.3	GP		
10					
15	GB	MC = 7.6			
15.0					343.0

Test pit terminated at 15.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-2

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 358 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.9305 **LONGITUDE** -122.59428

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
					1.0 357.0
					Brown well-graded GRAVEL with sand, medium dense, damp
	GB	MC = 5.8			-slight caving to BOH, probed 3"
5					
	GB	MC = 8.8 Fines = 3.8	GW		[USDA Classification: extremely gravelly coarse SAND]
10					
					-becomes gray
	GB	MC = 7.1			14.0 344.0
					Test pit terminated at 14.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 2.0 feet to BOH.
					LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-3

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 360 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93058 **LONGITUDE** -122.59333

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.0					359.0
	GB	MC = 5.2	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -moderate caving to BOH
5					
10					-becomes gray
11.5	GB	MC = 7.8			348.5
					Test pit terminated at 11.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 2.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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TEST PIT NUMBER TP-4

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 361 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93021 **LONGITUDE** -122.59339

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.0					360.0
	GB	MC = 6.8	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -moderate caving to BOH -probed 4"
5					
10					
	GB	MC = 9.3			
12.0					349.0

Test pit terminated at 12.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 2.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-5

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93001 **LONGITUDE** -122.59472

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
			GP		Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 6.8			-moderate caving to BOH, probed 3"
5					
5.0					352.0
			GW		Brown well-graded GRAVEL with sand, medium dense, damp to moist
10					
	GB	MC = 8.1 Fines = 4.7			
13.0					[USDA Classification: extremely gravelly loamy coarse SAND]
					344.0

Test pit terminated at 13.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 2.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-6

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93002 **LONGITUDE** -122.59521

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
			GP		Brown poorly graded GRAVEL with sand, medium dense, damp
					-probed 3"
	GB	MC = 7.7			-slight caving to BOH, probed 3"
5					
9.0					348.0
			GW		Brown well-graded GRAVEL with sand, medium dense, damp to moist
10					
15					
15.0					342.0
			SW-SM		Brown well-graded SAND with silt, medium dense to dense, moist
	GB	MC = 10.9 Fines = 7.4			[USDA Classification: very gravelly loamy coarse SAND]
16.0					341.0

Test pit terminated at 16.0 feet below existing grade. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-7

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.9303 **LONGITUDE** -122.59519

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
	GB	MC = 7.8	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -moderate caving to BOH
5					
10					
	GB	MC = 7.2 Fines = 4.9			
14.0					[USDA Classification: extremely gravelly loamy coarse SAND] 343.0 Test pit terminated at 14.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-8

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.92922 **LONGITUDE** -122.59478

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
	GB	MC = 7.4	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -slight caving to BOH
5					
10					
15	GB	MC = 8.5			
15.0					342.0

Test pit terminated at 15.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-9

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 358 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.92958 **LONGITUDE** -122.59398

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					356.5
	GB	MC = 8.0 Fines = 5.3	GP-GM		Brown poorly graded GRAVEL with silt and sand, medium dense, damp -probed 4" [USDA Classification: extremely gravelly loamy coarse SAND] -slight caving to BOH
5					
10					
	GB	MC = 8.1			-becomes gray
13.0					345.0

Test pit terminated at 13.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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TEST PIT NUMBER TP-10

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 359 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.92938 **LONGITUDE** -122.59327

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					357.5
					Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 7.9			-slight caving to BOH, probed 3"
5			GP		
10					-becomes gray
	GB	MC = 7.9			
13.5					345.5

Test pit terminated at 13.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-11

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 355 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93071 **LONGITUDE** -122.59039

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					353.5
					Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 9.1			-probed 3"
					-moderate caving to BOH
5			GP		
10					
					-becomes gray
15	GB	MC = 5.3 Fines = 2.2		15.0	[USDA Classification: extremely gravelly coarse SAND] 340.0

Test pit terminated at 15.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-12

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 356 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93049 **LONGITUDE** -122.59051

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL, roots to 18"	
					1.5	354.5
	GB	MC = 7.0	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -moderate caving to BOH	
5						
10						
	GB	MC = 6.0 Fines = 3.5			14.0	342.0
					[USDA Classification: extremely gravelly loamy coarse SAND]	

Test pit terminated at 14.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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TEST PIT NUMBER TP-13

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 351 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93071 **LONGITUDE** -122.59075

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL, roots to 18"	
1.5						349.5
			GP		Brown poorly graded GRAVEL with sand, medium dense, damp	
	GB	MC = 7.3			-probed 3"	
					-slight caving to BOH	
5						
10						
10.0						341.0
			GW		Brown well-graded GRAVEL with sand, medium dense, damp to moist	
15	GB	MC = 4.8 Fines = 1.3				
15.0					[USDA Classification: extremely gravelly SAND]	336.0

Test pit terminated at 15.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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TEST PIT NUMBER TP-14

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION** 355 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93064 **LONGITUDE** -122.59146

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 24"
1.5					353.5
	GB	MC = 8.8			Brown well-graded GRAVEL with sand, medium dense, damp to moist -probed 3" -moderate caving to BOH
5					
	GB	MC = 5.2 Fines = 1.5	GW		[USDA Classification: extremely gravelly coarse SAND]
10					
	GB	MC = 7.1			
12.5					342.5

Test pit terminated at 12.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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TEST PIT NUMBER TP-15

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION** 356 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93019 **LONGITUDE** -122.59064

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					354.5
	GB	MC = 10.6			Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3"
5					-moderate caving to BOH
	GB	MC = 8.5			-becomes gray
10			GP		
15	GB	MC = 9.8			
16.0					340.0

Test pit terminated at 16.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

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TEST PIT NUMBER TP-16

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.9302 **LONGITUDE** -122.59146

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 24"
2.0					Brown well-graded GRAVEL with sand, medium dense, damp
	GB	MC = 9.2 Fines = 4.3			-probed 3" [USDA Classification: extremely gravelly loamy coarse SAND] -slight caving to BOH
5					
			GW		
10					
	GB	MC = 7.4			
14.0					Test pit terminated at 14.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-17

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93064 **LONGITUDE** -122.59233

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 24"
				2.0	Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 7.9			-probed 3"
					-moderate caving to BOH
5			GP		
10					
	GB	MC = 6.6		12.0	

Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-18

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION** 361 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93026 **LONGITUDE** -122.59252

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					359.5
	GB	MC = 8.4	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 4" -slight caving to BOH
5					
10					
13.5	GB	MC = 4.8			347.5

Test pit terminated at 13.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Appendix B

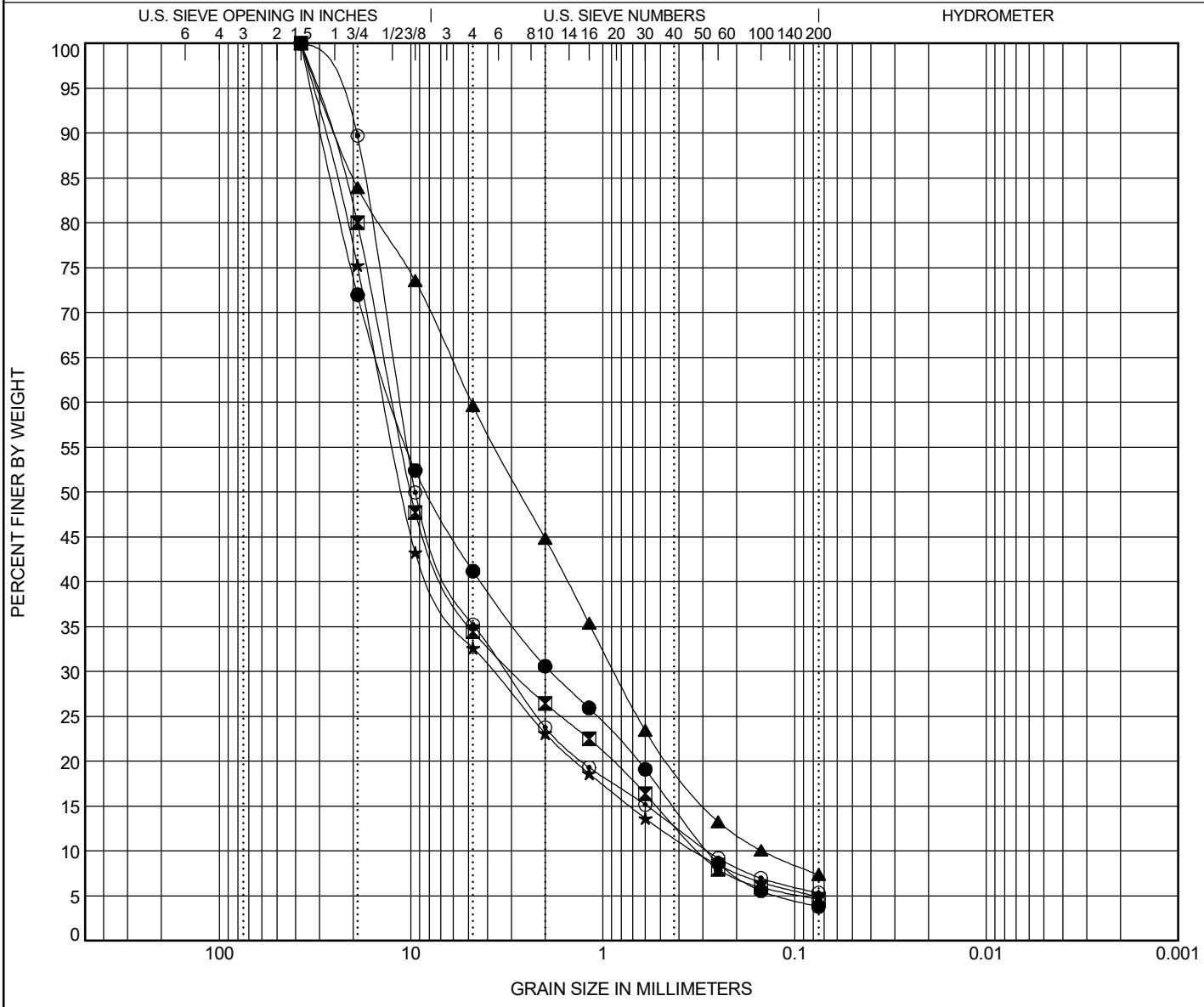
Laboratory Test Results

ES-9150

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-02	7.50ft.	USDA: Brown Extremely Gravelly Coarse Sand. USCS: GW with Sand.	1.00	44.36
⊠	TP-05	13.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GW with Sand.	2.26	40.04
▲	TP-06	16.00ft.	USDA: Brown Very Gravelly Loamy Coarse Sand. USCS: SW-SM with Gravel.	1.07	32.95
★	TP-07	14.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GP with Sand.	3.15	41.95
⊙	TP-09	2.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GP-GM with Sand.	3.22	40.31

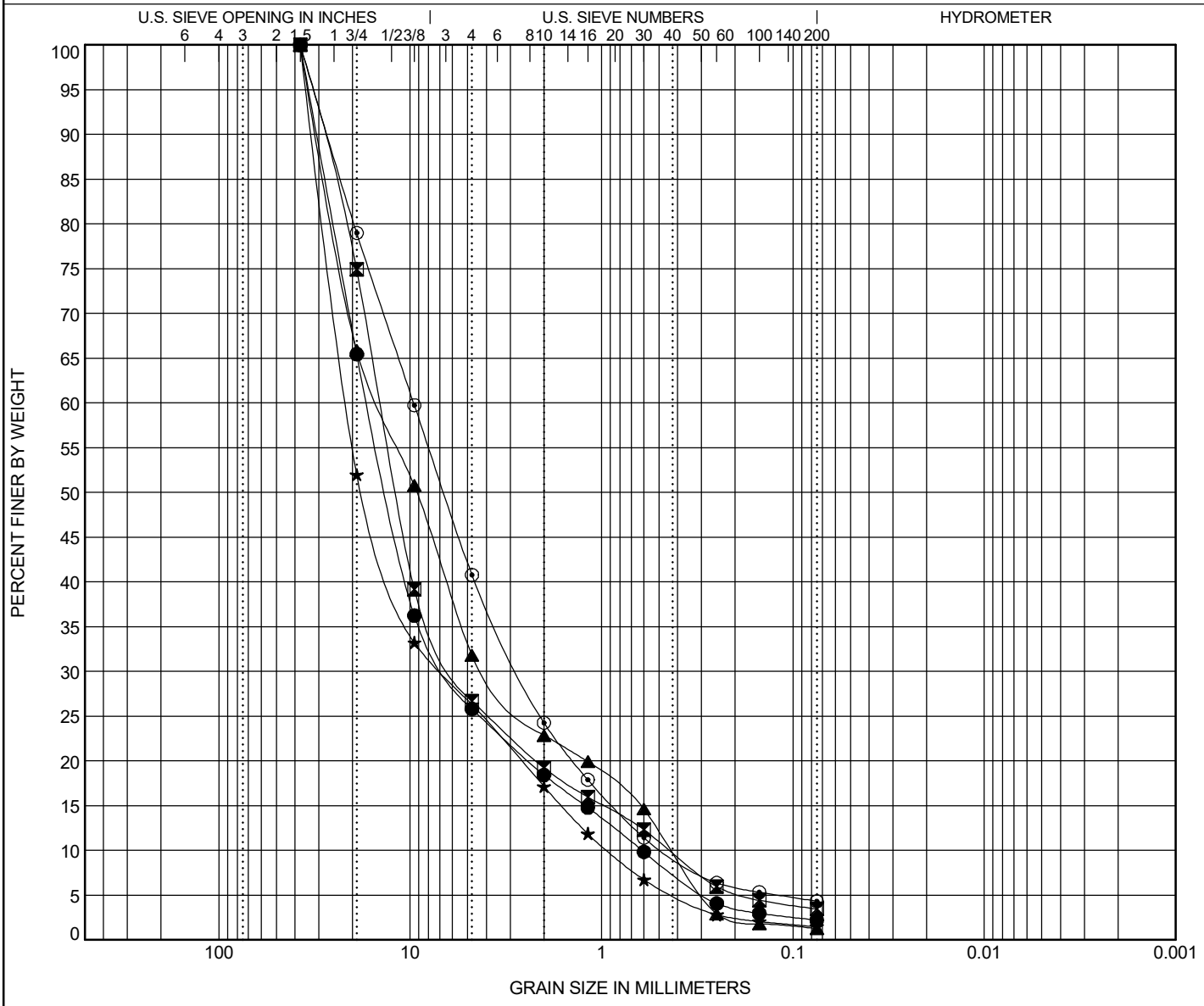
Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-02	7.5ft.	37.5	12.425	1.868	0.28				3.8	
⊠	TP-05	13.0ft.	37.5	12.362	2.94	0.309				4.7	
▲	TP-06	16.0ft.	37.5	4.834	0.87	0.147				7.4	
★	TP-07	14.0ft.	37.5	13.65	3.741	0.325				4.9	
⊙	TP-09	2.0ft.	37.5	11.317	3.196	0.281				5.3	

GRAIN SIZE USDA ES-9150 10800 VANCIL ROAD S.E. SUBDIVISION.GPJ GINT US LAB.GDT 5/3/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-11	15.00ft.	USDA: Gray Extremely Gravelly Coarse Sand. USCS: GP with Sand.	3.85	27.25
⊠	TP-12	14.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GP with Sand.	5.25	32.63
▲	TP-13	15.00ft.	USDA: Brown Extremely Gravelly Sand. USCS: GW with Sand.	2.58	34.17
★	TP-14	6.00ft.	USDA: Brown Extremely Gravelly Coarse Sand. USCS: GW with Sand.	2.41	23.12
⊙	TP-16	3.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GW with Sand.	1.62	20.48

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-11	15.0ft.	37.5	16.693	6.273	0.613				2.2	
⊠	TP-12	14.0ft.	37.5	14.225	5.708	0.436				3.5	
▲	TP-13	15.0ft.	37.5	14.5	3.987	0.424				1.3	
★	TP-14	6.0ft.	37.5	21.278	6.876	0.92				1.5	
⊙	TP-16	3.0ft.	37.5	9.585	2.699	0.468				4.3	

GRAIN SIZE USDA ES-9150 10800 VANCIL ROAD S.E. SUBDIVISION.GPJ GINT US LAB.GDT 5/3/23

Report Distribution

ES-9150

EMAIL ONLY

Copper Ridge, LLC
P.O. Box 73790
Puyallup, Washington 98373

Attention: Evan Mann

Country Meadows Estates Phase 1
Staff Report Supplement
Exhibit D: Stormwater Report

Stormwater Report

PREPARED FOR:

Mr. Evan Mann
Copper Ridge LLC
PO Box 73790
Puyallup, WA 98373-0790

PROJECT:

County Meadows Estates
Phase 1 Preliminary Plat
Yelm, Washington
2230251.10

PREPARED BY:

Chris Flyckt, PE
Project Engineer

REVIEWED BY:

J. Matthew Weber, PE
Principal

DATE:

August 2023

Stormwater Report

PREPARED FOR:

Mr. Evan Mann
Copper Ridge LLC
PO Box 73790
Puyallup, WA 98373-0790

PROJECT:

County Meadows Estates
Phase 1 Preliminary Plat
Yelm, Washington
2230251.10

PREPARED BY:

Chris Flyckt, PE
Project Engineer

REVIEWED BY:

J. Matthew Weber, PE
Principal

DATE:

August 2023

08/11/2023

I hereby state that this Stormwater Report for County Meadows Estates Phase 1 Preliminary Plat has been prepared by me or under my supervision and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that City of Yelm does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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A-2..... NRCS Soil Map
A-3..... Developed Basin Map
A-4..... FEMA 100-Year Flood Plain Map

Appendix B

Stormwater Facility Sizing Calculations

B-1..... WWHM Report
B-2..... Basin Map

Appendix C

Geotechnical Report
Earth Solutions NW, LLC
June 14, 2023

1.0 Project Overview

The following hydrology report summarizes the storm drainage analysis and design for a 59-lot development located at the 10800 Vancil Road SE Subdivision in Yelm, Thurston County, Washington. The land is currently a 9.84-acre property. The project includes the addition of 59 residential lots for single-family homes, a new roadway and sidewalks, sewer, water services, and stormwater facilities to treat and dispose of the project's stormwater. The proposed roadway features and utilities will be extended from Vancil Road SE.

No offsite road improvements will be required, other than frontage improvements along Vancil Road SE.

The 9.84-acre site is located in Section 30, Township 17 North, Range 02 East, W.M.
The Thurston County tax parcel number associated with the project is 22730410300.

The increased stormwater runoff resulting from the addition of impervious area will be treated and infiltrated in accordance with the most recent Washington State Department of Ecology *Stormwater Management Manual for Western Washington (SWMMWW)*.

2.0 Summary of Minimum Requirements

This project is subject to the *SWMMWW* and is a new development that will add more than 10,000 square feet of impervious surfaces; therefore, all Minimum Requirements (MR) apply to this project.

2.1 MR 1 – Preparation of Stormwater Site Plans

This report and the project plans represent the Stormwater Site Plan for this project and satisfy MR 1.

2.2 MR 2 - Construction Stormwater Pollution Prevention

A Construction Stormwater Pollution Prevention Plan (SWPPP) will be prepared with final engineering.

2.3 MR 3 – Source Control of Pollution

Pollution source control will be provided for the site by separating roof runoff from pollution generating surfaces. The residential roads should be maintained and cleaned of debris, garbage, and sediment, as required.

The Construction SWPPP, addressing MR 3, will be prepared with final engineering.

2.4 MR 4 – Preservation of Natural Drainage Systems and Outfalls

The project proposes to infiltrate all stormwater runoff, so all runoff will be retained in the developed condition. There are no natural drainage systems or outfalls to preserve.

2.5 MR 5 – Onsite Stormwater Control

This project will meet the Low Impact Development (LID) Performance Standard. The onsite soils have a high infiltration capacity and all runoff will be retained onsite through treatment systems and infiltration facilities. The LID Performance Standard will be met by infiltrating all stormwater runoff from the site. Refer to Section 10.0 for facility sizing.

2.6 MR 6 – Runoff Treatment

Over 5,000 square feet of pollution generating impervious surface (PGIS) will be added as part of these improvements; therefore, runoff treatment is required for this site. Stormwater from the roadways will be conveyed to stormwater treatment filters before being infiltrated. One distinct basin will convey stormwater to a treatment system and infiltration trench. Final treatment system sizing will be completed with final engineering.

2.7 MR 7 – Flow Control

The project exceeds the thresholds for new development projects and must provide flow control. Proposed flow control is achieved with the use of infiltration trenches that will infiltrate 100 percent of runoff. Refer to Section 10.0 for facility sizing.

2.8 MR 8 – Wetlands Protection

To our knowledge, no wetlands are located on or adjacent to the site.

2.9 MR 9 – Basin/Watershed Planning

To our knowledge, no basin plans exist for the site. All of Yelm is within a critical aquifer recharge area. Treatment of stormwater prior to infiltration is proposed via media filter manholes. Final sizing of the treatment system will be done with final engineering.

2.10 MR 10 – Operation and Maintenance

The stormwater system for the roadway improvements will be publicly owned and maintained. City of Yelm shall be responsible for the operation and maintenance of the public stormwater facilities. An Operation and Maintenance Plan consisting of maintenance checklists for stormwater management will be prepared with final engineering. Operation and maintenance for drainage facilities constructed for each lot shall be the responsibility of the individual owners.

3.0 Existing Conditions

The site is presently covered with grass, with slopes ranging from 0 to 3 percent.

4.0 Soils Reports

Site soils are identified by the Natural Resources Conservation Service (NRCS) Web Soil Survey as Spanaway gravelly sandy loam, a Type A soil. This soil is characterized as very deep, somewhat excessively drained.

Earth Solutions NW, LLC conducted a site investigation to confirm subsurface soil conditions and establish a design infiltration rate. Soil test holes were dug in the vicinity of the proposed infiltration basins of the project and observations confirm that the soil types match the SCS soil description. A soil log map showing the location of the test holes is included in the geotechnical report. The report recommends a design infiltration rate of 20 inches per hour. Refer to Appendix C for the complete Earth Solutions NW report.

5.0 Wells

To our knowledge, no wells are located onsite.

6.0 Fuel Tanks

No fuel tanks were observed at the project site.

7.0 Sub-Basin Description

From review of site topography, it does not appear that offsite runoff is tributary to the site from the north or west. The east half of Vancil Road SE does not have a curb and therefore does appear to infiltrate along the shoulder of the roadway.

There is one basin in the developed condition. It contains a treatment and infiltration system to manage runoff from the plat roads, landscape areas, on-lot driveways and the half-street widening of Vancil Road SE. The impervious areas used for determining flow control and water treatment do not include individual lots. On-lot runoff will be collected and infiltrated in individual drywells. Refer to Appendix A-3 for the Developed Basin Map. Drywell sizing will be provided with final engineering.

8.0 Analysis of the 100-Year Flood

Federal Emergency Management Agency (FEMA) mapping does not indicate flooding in the immediate area. Refer to the exhibit in Appendix A-4.

9.0 Aesthetic Considerations for Facilities

The proposed stormwater infiltration facilities will be underground and have minimal impact to the aesthetics of the site.

10.0 Facility Sizing and Downstream Analysis

The stormwater system was sized and analyzed using the latest edition of the Western Washington Hydrology Model (WWHM) continuous modeling software. Conservative infiltration rates of 20 inches per hour were used for the design calculations.

10.1 Conveyance

Conveyance sizing will be completed with final engineering.

10.2 Treatment

Basic treatment will be provided via media filter cartridge manholes/catch basins. Final sizing will be completed with final engineering.

10.3 Flow Control

Flow control will be provided by an infiltration trench. The basin will have a single trench.

Basin A will have a 4.0-foot deep trench with a bottom area of 4,000 square feet that will be constructed in the open space in Tract A.

Infiltration Basin Summary

Basin	Pervious Area (ac)	Impervious Area (ac)	Required Trench Area (sf)	Percent Infiltrated
A	3.58	2.87	-	-
B	0	0.43	-	-
TOTAL	3.58	3.3	4,000	100

The remaining 3.39 acres on the site are assumed to be covered by roofs; 2,500 square feet per lot was used as an impervious roof assumption. This runoff will be infiltrated by individual roof downspout infiltration trenches on each lot and, as such, is not included in the model.

The infiltration basin was sized in accordance with the *SWMMWW* and exceeds the required storage volumes.

10.4 Roof Runoff

Stormwater for the roof area of the homes will be infiltrated in individual drywells. The drywells will be sized in accordance with *SWMMWW* Volume 3, Chapter 3, Section 3.1.1 - BMP T5.10A Downspout Full Infiltration System. Refer to Appendix B-1 for the roof downspout system detail.

11.0 Covenants Dedications, Easements

The storm facilities for the right-of-way improvements shall be publicly owned and maintained. A maintenance agreement should be executed to ensure future maintenance of the facilities. The on-lot systems will be privately owned and maintained and therefore do not require covenants, dedications, or easements.

12.0 Property Owners Association Articles of Incorporation

Not applicable.

13.0 Conclusion

The proposed project involves site improvements associated with a 59-lot development. The project includes clearing, grading, erosion control, utility improvements, and stormwater management facilities. The site, as proposed, will meet the requirements of the most recent Department of Ecology *Stormwater Management Manual for Western Washington (SWMMWW)*. This report and associated plans have been prepared within the guidelines established by City of Yelm for stormwater management.

This analysis is based on data and records either supplied to or obtained by AHBL. These documents are referenced within the text of the analysis. The analysis has been prepared using procedures and practices within the standard accepted practices of the industry.

AHBL, Inc.
Chris Flyckt, PE
Project Engineer

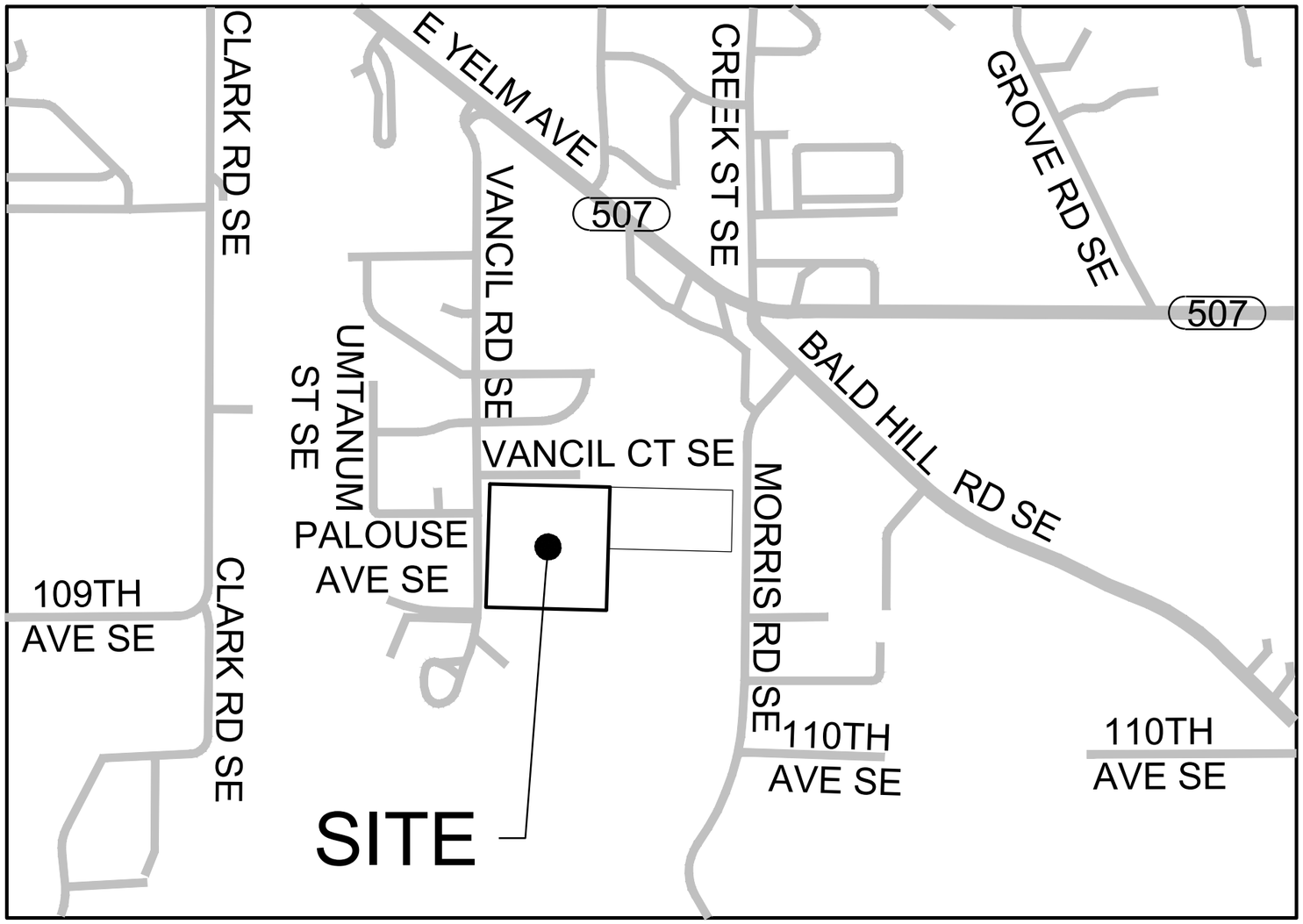
CF/lsk

August 2023

Q:\2023\2230251\WORDPROC\Reports\20230811 Rpt (Storm) 2230251.10.docx

Appendix A

Exhibits



VICINITY MAP

SCALE: 1" = 660' (1/8 MILE)

AHBL
2215 North 30th Street,
Suite 300,
Tacoma, WA 98403
253.383.2422 TEL
253.383.2572 FAX

Country Meadows Estate
Preliminary Plat Phase 1

VICINITY MAP

JOB NO.

DATE:

A-1

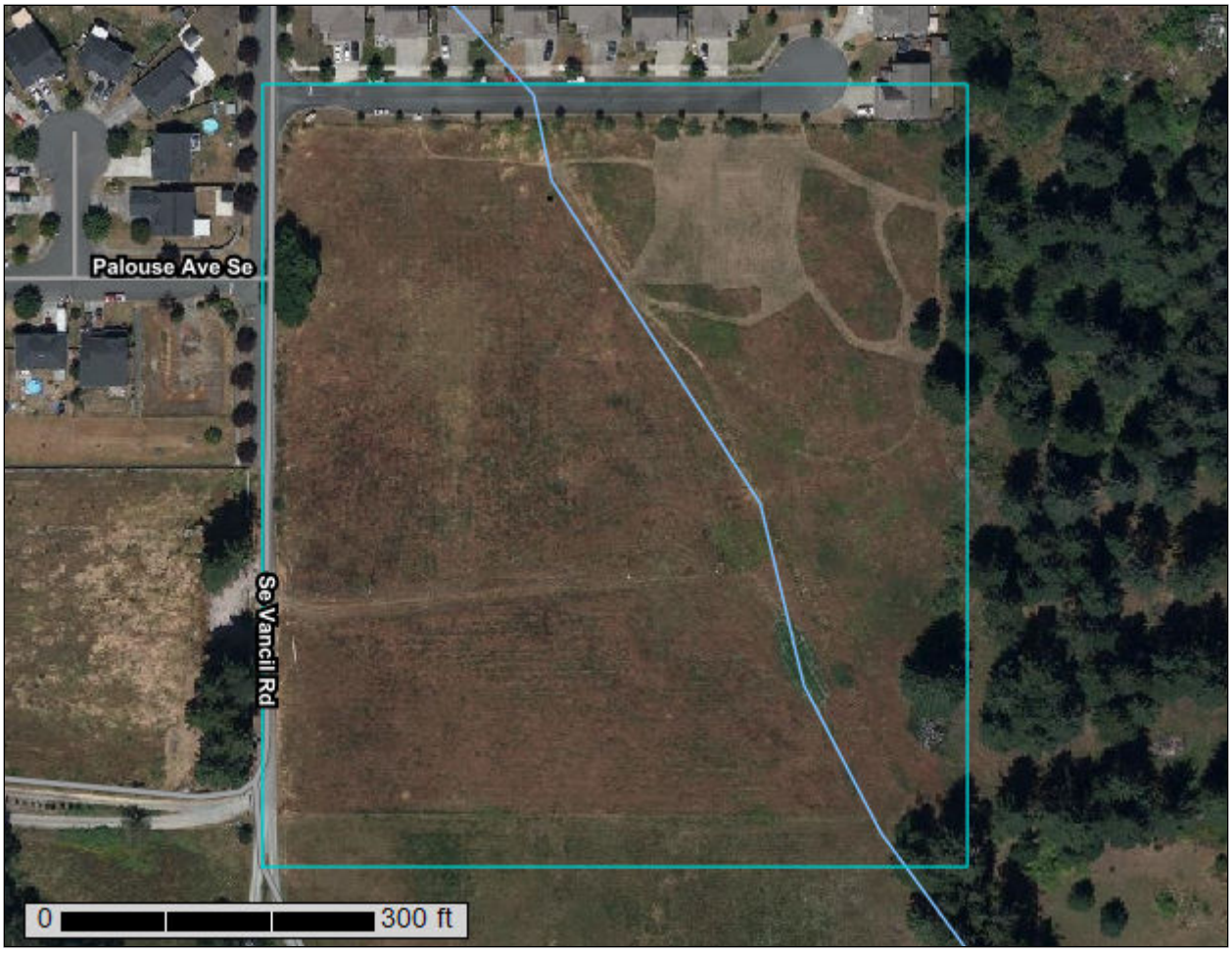
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Thurston County Area, Washington



July 18, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.


122° 35' 44" W
122° 35' 32" W
46° 55' 53" N
46° 55' 42" N
530780
530820
530860
530900
530940
530980
531020
5197620
5197580
5197540
5197500
5197460
5197420
5197380
5197340
5197300
112
110
Se Vancil Rd
Soil Map may not be valid at this scale.
Map Scale: 1:1,590 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 20 40 80 120
Feet
0 50 100 200 300
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 16, Sep 8, 2022

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

Date(s) aerial images were photographed: Jul 18, 2020—Jul 20, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
110	Spanaway gravelly sandy loam, 0 to 3 percent slopes	8.5	73.4%
112	Spanaway stony sandy loam, 0 to 3 percent slopes	3.1	26.6%
Totals for Area of Interest		**11.6**	**100.0%**

Map Unit Descriptions

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

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

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

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

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Thurston County Area, Washington

110—Spanaway gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2ndb6
Elevation: 330 to 1,310 feet
Mean annual precipitation: 35 to 65 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Spanaway and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Spanaway

Setting

Landform: Terraces, outwash plains
Parent material: Volcanic ash over gravelly outwash

Typical profile

H1 - 0 to 15 inches: gravelly sandy loam
H2 - 15 to 20 inches: very gravelly loam
H3 - 20 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: R002XA006WA - Puget Lowlands Prairie
Forage suitability group: Droughty Soils (G002XS401WA)
Other vegetative classification: Droughty Soils (G002XS401WA)
Hydric soil rating: No

112—Spanaway stony sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2ndb8

Elevation: 660 to 1,310 feet
Mean annual precipitation: 35 to 65 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Spanaway and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Spanaway

Setting

Landform: Terraces, outwash plains
Parent material: Volcanic ash over gravelly outwash

Typical profile

H1 - 0 to 16 inches: stony sandy loam
H2 - 16 to 22 inches: very gravelly sandy loam
H3 - 22 to 60 inches: extremely gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: R002XA006WA - Puget Lowlands Prairie
Forage suitability group: Droughty Soils (G002XS401WA)
Other vegetative classification: Droughty Soils (G002XS401WA)
Hydric soil rating: No

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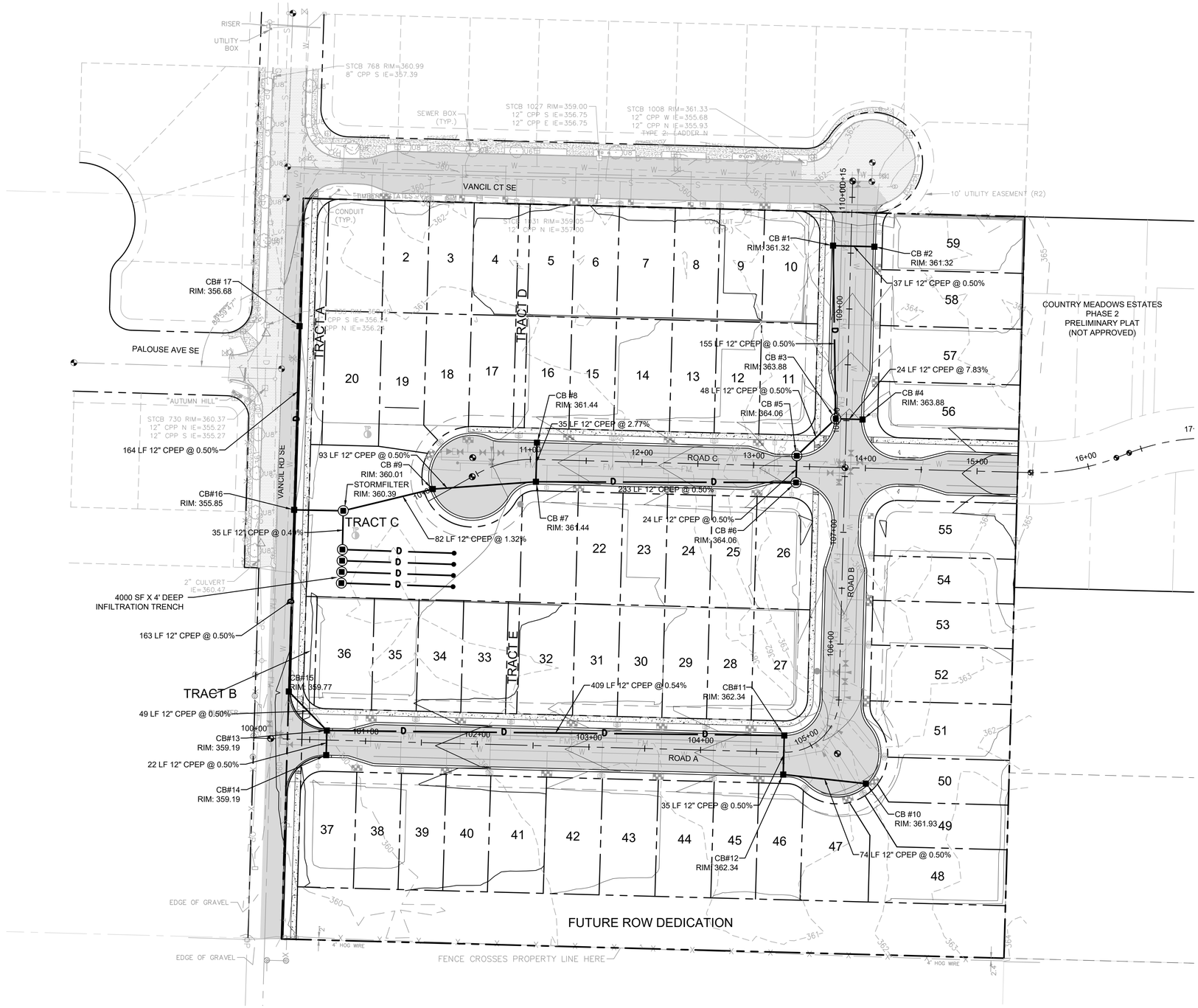
Know what's below. Call before you dig.

COUNTRY MEADOWS ESTATES PHASE 1 PRELIMINARY PLAT

A PORTION OF THE NE 1/4 OF THE SE 1/4 OF SEC. 30, TWN. 17 N., RGE. 02 E., W.M., CITY OF YELM, THURSTON COUNTY, WASHINGTON.



N

GRAPHIC SCALE

0 25 50 100

1" = 50 FEET

ROOF RUNOFF NOTE

ROOF RUNOFF WILL BE INFILTRATED WITHIN THE PRIVATE SYSTEM LOCATED ON EACH LOT.

APPLICATION #999???

AHBL

TACOMA · SEATTLE · SPOKANE · TRI-CITIES

2215 North 30th Street, Suite 300 Tacoma, WA 98403
253.383.2422 TEL 253.383.2572 FAX www.ahbl.com WEB

Project Title:

COUNTRY MEADOWS ESTATES PHASE 1 PRELIMINARY PLAT

Client:

COPPER RIDGE LLC

P.O.BOX 73790
PUYALLUP, WA 98373

KURT WILSON / EVAN MANN

Project No.

2230251.10

Issue Set & Date:

PRELIMINARY PLAT

8/23/2023

J. MATTHEW WEBER — STATE OF WASHINGTON — 21485 — REGISTERED PROFESSIONAL ENGINEER

4
3
2
1

Revisions:

DEVELOPED CONDITIONS MAP

Designed by: Drawn by: Checked by: MW/SK

A-3

National Flood Hazard Layer FIRMette

FEMA

122°35'58"W 46°56'N

122°35'20"W 46°55'36"N

Feet

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

1:6,000

Legend

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

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

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

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

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

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

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

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/18/2023 at 3:46 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Basemap Imagery Source: USGS National Map 2023

Appendix B

Stormwater Facility Sizing Calculations

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	20230803 CountryMeadowsPhase1PrelimSizing
Site Name:	Country Meadows Estates Phase 1
Site Address:	
City:	Yelm
Report Date:	8/9/2023
Gage:	Lake Lawrence
Data Start:	1955/10/01
Data End:	2008/09/30
Timestep:	15 Minute
Precip Scale:	0.857
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Forest, Flat	6.88
Pervious Total	6.88

Impervious Land Use	acre
Impervious Total	0
Basin Total	6.88

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Road A/B

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	3.58
Pervious Total	3.58

Impervious Land Use	acre
ROADS FLAT	3.3
Impervious Total	3.3
Basin Total	6.88

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	62.94 ft.
Bottom Width:	62.94 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	1
Pour Space of material for first layer:	0.33
Material thickness of second layer:	1
Pour Space of material for second layer:	0.33
Material thickness of third layer:	2
Pour Space of material for third layer:	0.33
Infiltration On	
Infiltration rate:	20
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	582.111
Total Volume Through Riser (ac-ft.):	0.001
Total Volume Through Facility (ac-ft.):	582.112
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	4 ft.
Riser Diameter:	10 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.091	0.000	0.000	0.000
0.0444	0.091	0.001	0.000	1.834
0.0889	0.091	0.002	0.000	1.834
0.1333	0.091	0.004	0.000	1.834
0.1778	0.091	0.005	0.000	1.834
0.2222	0.091	0.006	0.000	1.834
0.2667	0.091	0.008	0.000	1.834
0.3111	0.091	0.009	0.000	1.834
0.3556	0.091	0.010	0.000	1.834
0.4000	0.091	0.012	0.000	1.834
0.4444	0.091	0.013	0.000	1.834
0.4889	0.091	0.014	0.000	1.834
0.5333	0.091	0.016	0.000	1.834
0.5778	0.091	0.017	0.000	1.834
0.6222	0.091	0.018	0.000	1.834
0.6667	0.091	0.020	0.000	1.834
0.7111	0.091	0.021	0.000	1.834
0.7556	0.091	0.022	0.000	1.834
0.8000	0.091	0.024	0.000	1.834
0.8444	0.091	0.025	0.000	1.834
0.8889	0.091	0.026	0.000	1.834
0.9333	0.091	0.028	0.000	1.834
0.9778	0.091	0.029	0.000	1.834
1.0222	0.091	0.030	0.000	1.834

1.0667	0.091	0.032	0.000	1.834
1.1111	0.091	0.033	0.000	1.834
1.1556	0.091	0.034	0.000	1.834
1.2000	0.091	0.036	0.000	1.834
1.2444	0.091	0.037	0.000	1.834
1.2889	0.091	0.038	0.000	1.834
1.3333	0.091	0.040	0.000	1.834
1.3778	0.091	0.041	0.000	1.834
1.4222	0.091	0.042	0.000	1.834
1.4667	0.091	0.044	0.000	1.834
1.5111	0.091	0.045	0.000	1.834
1.5556	0.091	0.046	0.000	1.834
1.6000	0.091	0.048	0.000	1.834
1.6444	0.091	0.049	0.000	1.834
1.6889	0.091	0.050	0.000	1.834
1.7333	0.091	0.052	0.000	1.834
1.7778	0.091	0.053	0.000	1.834
1.8222	0.091	0.054	0.000	1.834
1.8667	0.091	0.056	0.000	1.834
1.9111	0.091	0.057	0.000	1.834
1.9556	0.091	0.058	0.000	1.834
2.0000	0.091	0.060	0.000	1.834
2.0444	0.091	0.061	0.000	1.834
2.0889	0.091	0.062	0.000	1.834
2.1333	0.091	0.064	0.000	1.834
2.1778	0.091	0.065	0.000	1.834
2.2222	0.091	0.066	0.000	1.834
2.2667	0.091	0.068	0.000	1.834
2.3111	0.091	0.069	0.000	1.834
2.3556	0.091	0.070	0.000	1.834
2.4000	0.091	0.072	0.000	1.834
2.4444	0.091	0.073	0.000	1.834
2.4889	0.091	0.074	0.000	1.834
2.5333	0.091	0.076	0.000	1.834
2.5778	0.091	0.077	0.000	1.834
2.6222	0.091	0.078	0.000	1.834
2.6667	0.091	0.080	0.000	1.834
2.7111	0.091	0.081	0.000	1.834
2.7556	0.091	0.082	0.000	1.834
2.8000	0.091	0.084	0.000	1.834
2.8444	0.091	0.085	0.000	1.834
2.8889	0.091	0.086	0.000	1.834
2.9333	0.091	0.088	0.000	1.834
2.9778	0.091	0.089	0.000	1.834
3.0222	0.091	0.090	0.000	1.834
3.0667	0.091	0.092	0.000	1.834
3.1111	0.091	0.093	0.000	1.834
3.1556	0.091	0.094	0.000	1.834
3.2000	0.091	0.096	0.000	1.834
3.2444	0.091	0.097	0.000	1.834
3.2889	0.091	0.098	0.000	1.834
3.3333	0.091	0.100	0.000	1.834
3.3778	0.091	0.101	0.000	1.834
3.4222	0.091	0.102	0.000	1.834
3.4667	0.091	0.104	0.000	1.834
3.5111	0.091	0.105	0.000	1.834
3.5556	0.091	0.106	0.000	1.834
3.6000	0.091	0.108	0.000	1.834

3.6444	0.091	0.109	0.000	1.834
3.6889	0.091	0.110	0.000	1.834
3.7333	0.091	0.112	0.000	1.834
3.7778	0.091	0.113	0.000	1.834
3.8222	0.091	0.114	0.000	1.834
3.8667	0.091	0.116	0.000	1.834
3.9111	0.091	0.117	0.000	1.834
3.9556	0.091	0.118	0.000	1.834
4.0000	0.091	0.120	0.000	1.834

Analysis Results

POC 1

POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

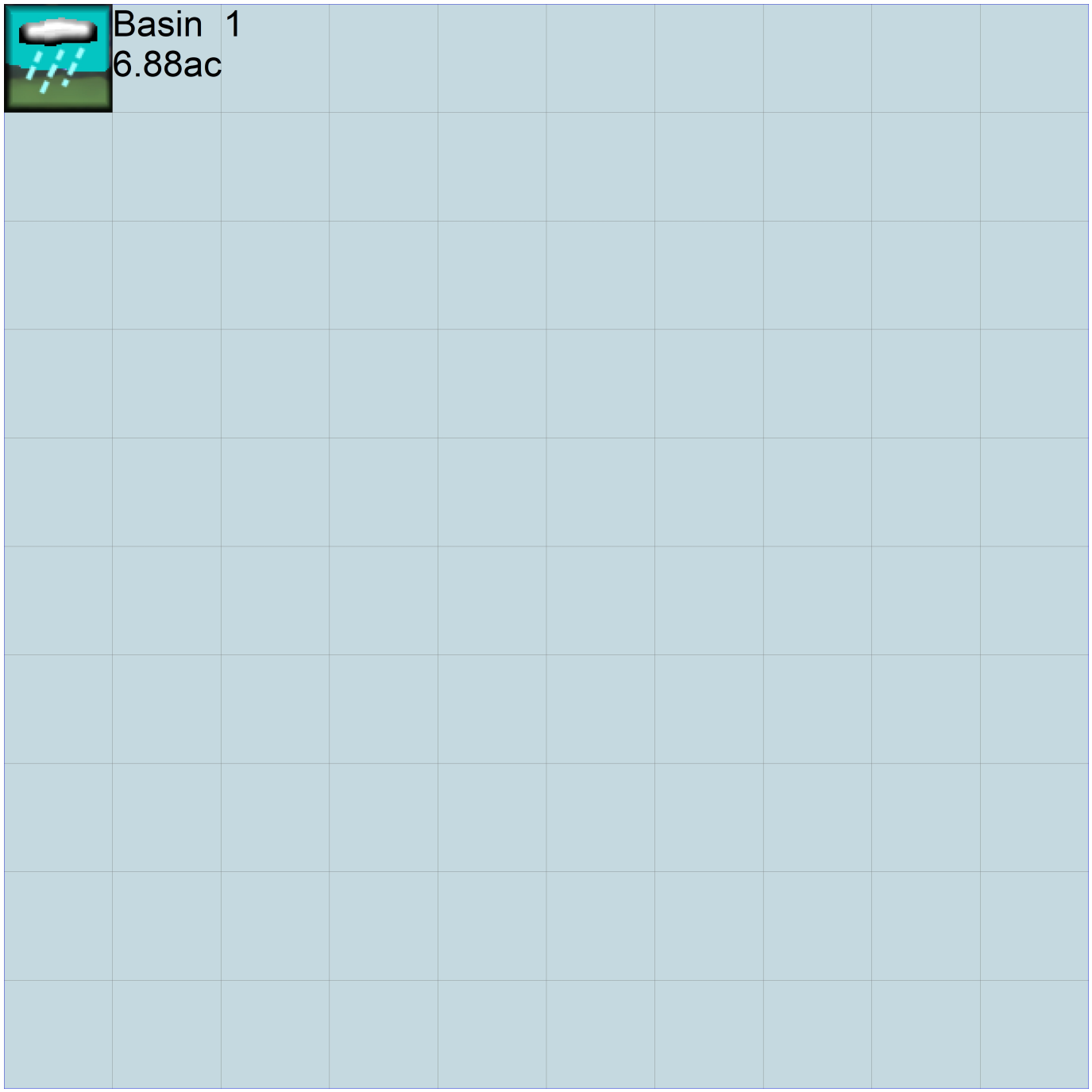
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                               ***
WDM         26   20230803 CountryMeadowsPhase1PrelimSizing.wdm
MESSU       25   Pre20230803 CountryMeadowsPhase1PrelimSizing.MES
            27   Pre20230803 CountryMeadowsPhase1PrelimSizing.L61
            28   Pre20230803 CountryMeadowsPhase1PrelimSizing.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                        in  out           ***
    1     A/B, Forest, Flat       1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    1         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    1         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    1         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1
```

```
  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    1             0         5         2       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    1             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    1          0.2       0.5      0.35         0       0.7       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    1             0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                <--Area-->     <-Target->   MBLK   ***
<Name>   #                <-factor->     <Name>   #   Tbl#   ***
```

```
******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                          in  out                            ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *          ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.857          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.857          IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
END EXT TARGETS
```

```
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***

END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1955 10 01        END    2008 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   20230803 CountryMeadowsPhase1PrelimSizing.wdm
MESSU      25   Mit20230803 CountryMeadowsPhase1PrelimSizing.MES
           27   Mit20230803 CountryMeadowsPhase1PrelimSizing.L61
           28   Mit20230803 CountryMeadowsPhase1PrelimSizing.L62
           30   POC20230803 CountryMeadowsPhase1PrelimSizing1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      IMPLND       1
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Gravel Trench Bed 1         MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                      in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7             0         5       0.8       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7          0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
    7             0         0         0         0         3         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                   in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
```

```
    # -  # ***PETMAX    PETMIN
    1             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Road A/B***
PERLND   7                       3.58     RCHRES   1      2
PERLND   7                       3.58     RCHRES   1      3
IMPLND   1                        3.3     RCHRES   1      5

******Routing******
PERLND   7                       3.58     COPY     1     12
IMPLND   1                        3.3     COPY     1     15
PERLND   7                       3.58     COPY     1     13
RCHRES   1                          1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                      in  out                               ***
    1     Gravel Trench Be-005    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
```

```
    1             1      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><--------->     <--><--><--><--><--> *** <--><--><--><--><--><--><-->
    1            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.090954  0.000000  0.000000  0.000000
  0.044444  0.090954  0.001334  0.000000  1.834232
  0.088889  0.090954  0.002668  0.000000  1.834232
  0.133333  0.090954  0.004002  0.000000  1.834232
  0.177778  0.090954  0.005336  0.000000  1.834232
  0.222222  0.090954  0.006670  0.000000  1.834232
  0.266667  0.090954  0.008004  0.000000  1.834232
  0.311111  0.090954  0.009338  0.000000  1.834232
  0.355556  0.090954  0.010672  0.000000  1.834232
  0.400000  0.090954  0.012006  0.000000  1.834232
  0.444444  0.090954  0.013340  0.000000  1.834232
  0.488889  0.090954  0.014674  0.000000  1.834232
  0.533333  0.090954  0.016008  0.000000  1.834232
  0.577778  0.090954  0.017342  0.000000  1.834232
  0.622222  0.090954  0.018676  0.000000  1.834232
  0.666667  0.090954  0.020010  0.000000  1.834232
  0.711111  0.090954  0.021344  0.000000  1.834232
  0.755556  0.090954  0.022678  0.000000  1.834232
  0.800000  0.090954  0.024012  0.000000  1.834232
  0.844444  0.090954  0.025346  0.000000  1.834232
  0.888889  0.090954  0.026680  0.000000  1.834232
  0.933333  0.090954  0.028014  0.000000  1.834232
  0.977778  0.090954  0.029348  0.000000  1.834232
  1.022222  0.090954  0.030682  0.000000  1.834232
  1.066667  0.090954  0.032016  0.000000  1.834232
  1.111111  0.090954  0.033350  0.000000  1.834232
  1.155556  0.090954  0.034684  0.000000  1.834232
  1.200000  0.090954  0.036018  0.000000  1.834232
  1.244444  0.090954  0.037352  0.000000  1.834232
  1.288889  0.090954  0.038686  0.000000  1.834232
  1.333333  0.090954  0.040020  0.000000  1.834232
  1.377778  0.090954  0.041354  0.000000  1.834232
  1.422222  0.090954  0.042688  0.000000  1.834232
  1.466667  0.090954  0.044022  0.000000  1.834232
  1.511111  0.090954  0.045356  0.000000  1.834232
  1.555556  0.090954  0.046690  0.000000  1.834232
  1.600000  0.090954  0.048024  0.000000  1.834232
  1.644444  0.090954  0.049358  0.000000  1.834232
  1.688889  0.090954  0.050692  0.000000  1.834232
  1.733333  0.090954  0.052025  0.000000  1.834232
  1.777778  0.090954  0.053359  0.000000  1.834232
  1.822222  0.090954  0.054693  0.000000  1.834232
  1.866667  0.090954  0.056027  0.000000  1.834232
  1.911111  0.090954  0.057361  0.000000  1.834232
  1.955556  0.090954  0.058695  0.000000  1.834232
  2.000000  0.090954  0.060029  0.000000  1.834232
  2.044444  0.090954  0.061363  0.000000  1.834232
  2.088889  0.090954  0.062697  0.000000  1.834232
  2.133333  0.090954  0.064031  0.000000  1.834232
  2.177778  0.090954  0.065365  0.000000  1.834232
  2.222222  0.090954  0.066699  0.000000  1.834232
  2.266667  0.090954  0.068033  0.000000  1.834232
```

```
  2.311111  0.090954  0.069367  0.000000  1.834232
  2.355556  0.090954  0.070701  0.000000  1.834232
  2.400000  0.090954  0.072035  0.000000  1.834232
  2.444444  0.090954  0.073369  0.000000  1.834232
  2.488889  0.090954  0.074703  0.000000  1.834232
  2.533333  0.090954  0.076037  0.000000  1.834232
  2.577778  0.090954  0.077371  0.000000  1.834232
  2.622222  0.090954  0.078705  0.000000  1.834232
  2.666667  0.090954  0.080039  0.000000  1.834232
  2.711111  0.090954  0.081373  0.000000  1.834232
  2.755556  0.090954  0.082707  0.000000  1.834232
  2.800000  0.090954  0.084041  0.000000  1.834232
  2.844444  0.090954  0.085375  0.000000  1.834232
  2.888889  0.090954  0.086709  0.000000  1.834232
  2.933333  0.090954  0.088043  0.000000  1.834232
  2.977778  0.090954  0.089377  0.000000  1.834232
  3.022222  0.090954  0.090711  0.000000  1.834232
  3.066667  0.090954  0.092045  0.000000  1.834232
  3.111111  0.090954  0.093379  0.000000  1.834232
  3.155556  0.090954  0.094713  0.000000  1.834232
  3.200000  0.090954  0.096047  0.000000  1.834232
  3.244444  0.090954  0.097381  0.000000  1.834232
  3.288889  0.090954  0.098715  0.000000  1.834232
  3.333333  0.090954  0.100049  0.000000  1.834232
  3.377778  0.090954  0.101383  0.000000  1.834232
  3.422222  0.090954  0.102717  0.000000  1.834232
  3.466667  0.090954  0.104051  0.000000  1.834232
  3.511111  0.090954  0.105385  0.000000  1.834232
  3.555556  0.090954  0.106719  0.000000  1.834232
  3.600000  0.090954  0.108053  0.000000  1.834232
  3.644444  0.090954  0.109387  0.000000  1.834232
  3.688889  0.090954  0.110721  0.000000  1.834232
  3.733333  0.090954  0.112055  0.000000  1.834232
  3.777778  0.090954  0.113389  0.000000  1.834232
  3.822222  0.090954  0.114723  0.000000  1.834232
  3.866667  0.090954  0.116057  0.000000  1.834232
  3.911111  0.090954  0.117391  0.000000  1.834232
  3.955556  0.090954  0.118725  0.000000  1.834232
  4.000000  0.090954  0.120059  0.000000  1.834232
  4.044444  0.090954  0.124101  0.082732  1.834232
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    0.857          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    0.857          IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>             <Name> # #<-factor->     <Name>                <Name> # #***
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  END MASS-LINK    5

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  END MASS-LINK   13

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  END MASS-LINK   17


END MASS-LINK

END RUN
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Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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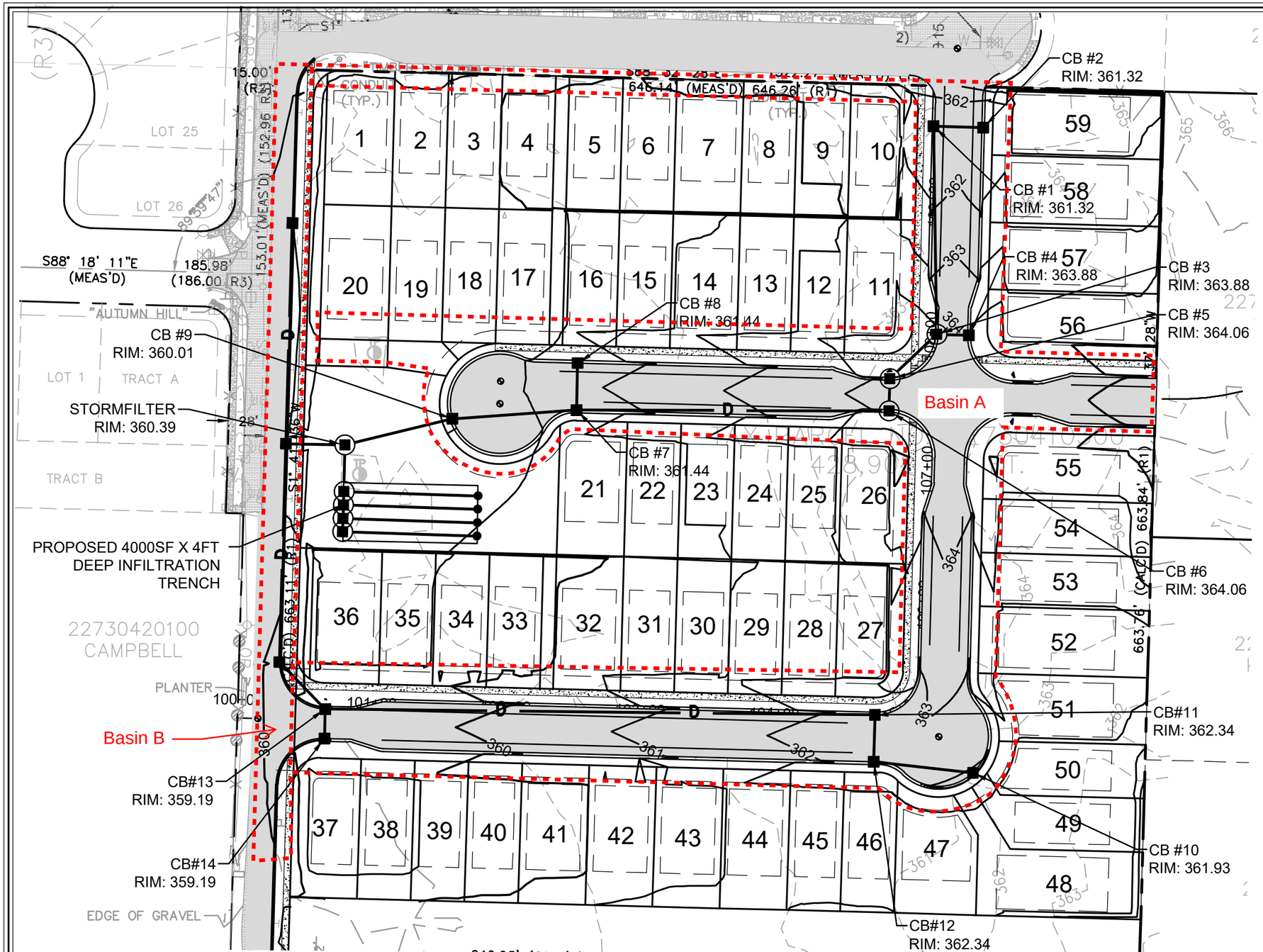
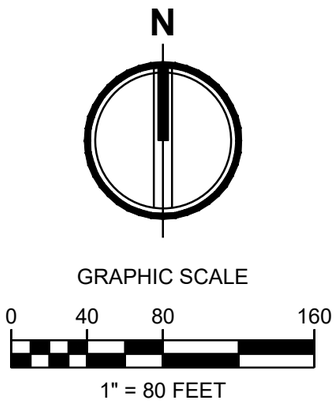




Basin	Pervious Area (ac)	Impervious Area (ac)	Required Trench Area (sf)	Percent Infiltrated
A	3.58	2.87	-	-
B	0	0.43	-	-
TOTAL	3.58	3.3	4,000	100

AHBL
2215 North 30th Street,
Suite 300,
Tacoma, WA 98403
253.383.2422 TEL
253.383.2572 FAX

COUNTRY MEADOW ESTATES
PHASE 1

BASIN MAP

JOB NO.

DATE:

B-2

Appendix C

Geotechnical Report
Earth Solutions NW, LLC
June 14, 2023

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

GEOTECHNICAL ENGINEERING STUDY
PROPOSED VANCIL ROAD SUBDIVISION
10800 VANCIL ROAD SOUTHEAST
THURSTON COUNTY (YELM), WASHINGTON

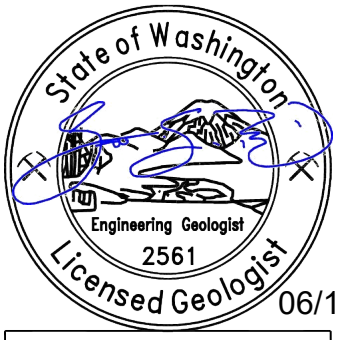
ES-9150

15365 N.E. 90th Street, Suite 100 Redmond, WA 98052
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

COPPER RIDGE, LLC

June 14, 2023



Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

Kyle R. Campbell, P.E.
Senior Principal Engineer

GEOTECHNICAL ENGINEERING STUDY
PROPOSED VANCIL ROAD SUBDIVISION
10800 VANCIL ROAD SOUTHEAST
THURSTON COUNTY (YELM), WASHINGTON

ES-9150

Earth Solutions NW, LLC
15365 Northeast 90th Street, Suite 100
Redmond, Washington 98052
Phone: 425-449-4704 | Fax: 425-449-4711
www.earthsolutionsnw.com

Important Information about This

Geotechnical-Engineering Report

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

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

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

June 14, 2023
ES-9150

Copper Ridge, LLC
P.O. Box 73790
Puyallup, Washington 98373

Attention: Evan Mann

Dear Evan:

Earth Solutions NW, LLC (ESNW), is pleased to present this report to support the proposed project. Based on the results of our investigation, construction of the proposed residential development is feasible from a geotechnical standpoint.

Based on conditions observed during our fieldwork, the site is underlain primarily by native soils consisting of glacial outwash sand/gravel deposits. The proposed residential structures can be supported on conventional spread and continuous foundations bearing on undisturbed competent native soil, recompacted native soil, or new structural fill placed directly on a competent subgrade surface. We anticipate competent native soil suitable for support of foundations will generally be encountered beginning at depths of about two to four feet below existing grades across the site.

Based on our investigation, infiltration is considered feasible from a geotechnical standpoint due to the pervasive presence of relatively clean outwash sand/gravel soils.

This report provides geotechnical analyses and recommendations for the proposed residential development. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding the content of this study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

Table of Contents

ES-9150

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Cont'd

ES-9150

GRAPHICS

APPENDICES

GEOTECHNICAL ENGINEERING STUDY
VANCIL ROAD SUBDIVISION
10800 VANCIL ROAD SOUTHEAST
THURSTON COUNTY (YELM), WASHINGTON

ES-9150

INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed residential development to be constructed in Yelm, Washington. To complete our scope of services, we performed the following:

- Subsurface exploration to characterize the soil and groundwater conditions.
- Laboratory testing of representative soil samples collected on site.
- Engineering analyses.
- Preparation of this report.

The following documents and resources were reviewed as part of our report preparation:

- Vancil Road Layout, provided by the client, dated February 27, 2023.
- Morris Road Plat, prepared by AHBL, dated June 15, 2022.
- Surficial hydrogeologic units of the Puget Sound aquifer system, Washington and British Columbia, for the Centralia quadrangle (Plate 17 of 18) M.A. Jones 1998.
- Web Soil Survey (WSS) online resource, maintained by the Natural Resources Conservation Service (NRCS) under the United States Department of Agriculture (USDA).
- Pierce County Stormwater Management and Site Development Manual, effective July 1, 2021.
- Yelm Municipal Code Chapter 18.21.

Project Description

The overall project area is located off the east side of Vancil Road Southeast in Yelm, Washington.

Site grading plans were not available at the time of this proposal; however, we understand the Vancil Road project will consist of construction of 60 single-family homesites and the Morris Road site will be developed with 30 lots and associated infrastructure improvements. Each site will include a stormwater management facility, and will require seasonal groundwater monitoring. We presume infiltration will be pursued to the extent feasible.

At the time of report submission, specific building loads were not available for review; however, we anticipate the proposed residential structures will consist of relatively lightly loaded wood framing supported on conventional foundations. Based on our experience with similar developments, we estimate wall loads of about 1 to 3 kips per linear foot and slab-on-grade loading of 150 pounds per square foot (psf) will be incorporated into the final design. Based on the low topographic relief on this site, we anticipate grading will be limited to cuts and fills of about five feet or less for lots. Deeper cuts will occur for utilities and the stormwater tracts.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that appropriate geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The two properties that comprise the Vancil Road and Morris Road sites consist of Thurston County Parcel Nos. 22730410300 & 22730410000. The sites are vacant and the majority of the Vancil Road site area is surfaced with field grass used as fenced pasture while the Morris Road site is largely forested. Topography is gently undulating. The Vancil Road property is bordered to the north and west by residential development, to the east by the Morris Road property and to the south by open space. The Morris Road property is bordered to the north and south by residential property, to the east by Morris Road Southeast and to the west by the Vancil Road property.

Subsurface

A representative of ESNW observed, logged, and sampled 18 test pits at accessible locations within the property boundaries on April 24/25, 2023 using a machine and operator provided by the client. The explorations were completed to assess and classify the site soils and to characterize the groundwater conditions within areas proposed for new development. The maximum exploration depth was approximately 16 feet below the existing ground surface (bgs).

The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at our exploration locations were analyzed in general accordance with Unified Soil Classification System (USCS) and USDA methods and procedures.

Topsoil and Fill

Topsoil was generally encountered within the upper 12 to 18 inches of existing grades at the test pit locations, except several explorations that encountered up to 24 inches. It is possible that deeper or shallower pockets of topsoil will be encountered locally across the site. The topsoil was characterized by its dark brown color, the presence of fine organic material, and small root intrusions.

Fill was not encountered during the subsurface exploration; however, fill is likely present to varying degrees around existing structures.

Native Soil

Underlying the topsoil, native soils consisting primarily of medium dense poorly and well graded gravel with sand (USCS: GP and GW) soils were encountered. At an isolated location TP-6 at 16 feet), a well graded sand with silt (USCS: SW-SM) layer was encountered. Fines contents within the native soil deposits were less than 5 percent, except the isolated layer of sand with silt which had a fines content of about 7.4 percent at TP-6. The native soils were primarily observed to be in a damp to moist condition and caving was common within the relatively clean sandy gravel deposits.

Geologic Setting

Geologic mapping of the area identifies recessional outwash gravel deposits (Qvrg) as the primary geologic unit underlying the site. The online WSS resource identifies Spanaway series soils (Map Units 110 and 112) roughly evenly distributed across the site. The referenced soil survey characterizes Spanaway gravelly sandy loam with slow surface water runoff and little to no hazard of water erosion and are assigned to hydrologic soil group A.

Based on the soil conditions encountered during our fieldwork, the native soils are consistent with the geologic and soils mapping resources outlined in this section of outwash sand/gravel soils.

Groundwater

Groundwater was not observed, during the April 2023 subsurface explorations. Groundwater flow rates and elevations may fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months. In any case, groundwater conditions should be expected within deeper site excavations, particularly during the wet season. Depending on the timing, depth, and extent of such excavations, temporary dewatering may be necessary.

GEOLOGIC CRITICAL AREAS EVALUATION

The subject property was evaluated for the presence of geologic critical areas in general accordance with Yelm Municipal Code Chapter 18.21. Based on our review no geologic critical areas are present on or immediately adjacent to the subject site.

Based on review of the Thurston County Wellhead Protection Areas map, the site is located within a 10-year Time-of-Travel area.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed project include earthwork, temporary excavations, subgrade preparation, foundation support, and drainage.

Based on local geologic mapping and conditions observed during our fieldwork, the site is underlain primarily by native soils consisting of medium dense outwash sandy gravel deposits. The proposed residential structures can be supported on conventional spread and continuous foundations bearing on undisturbed competent native soil, recompacted native soil, or new structural fill placed directly on a competent subgrade. We anticipate competent native soil suitable for support of foundations will generally be encountered beginning at depths of about two to four feet below existing grades across the site.

Based on our investigation, infiltration is considered feasible from a geotechnical standpoint due to the presence of Spanaway gravel soils across the site.

This study has been prepared for the exclusive use of Copper Ridge, LLC and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Site preparation activities should consist of installing temporary erosion control measures, establishing grading limits, and performing site stripping. Subsequent earthwork activities will likely include site grading, utility installations, and associated site improvements.

Temporary Erosion Control

The following temporary erosion and sediment control Best Management Practices (BMPs) are recommended:

- Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide stable surfaces at site entrances. Placing geotextile fabric underneath the quarry spalls will provide greater stability if needed.

- Silt fencing should be placed around the appropriate portions of the site perimeter to prevent offsite migration of sediment.

- When not in use, soil stockpiles should be covered or otherwise protected (as necessary) to reduce the potential for soil erosion, especially during periods of wet weather.

- As necessary, temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or interceptor swales, should be installed prior to beginning earthwork activities. For this site, infiltration may also be considered for control of surface water runoff.

- Dry soils disturbed during construction should be wetted to minimize dust and airborne soil erosion.

Additional Best Management Practices, as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities. Temporary erosion control measures may be modified during construction as site conditions require, as approved by the site erosion control lead.

Stripping

Topsoil was encountered generally within the upper 12 to 18 inches with isolated areas up to 24 inches of existing grades at the test pit locations. ESNW should be retained to observe site stripping activities at the time of construction so that the degree of required stripping may be assessed. The exposed subgrade may still possess root elements, other organic material, or be present in a loose condition. As such, ESNW should evaluate the exposed soil subgrade to determine if further stripping or in-situ compaction efforts prior to fill operations or finish grading is necessary. Over-stripping should be avoided, as it is unnecessary and may result in increased project development costs. Topsoil and organic-rich soil are neither suitable for foundation support nor for use as structural fill. Topsoil and organic-rich soil may be used in non-structural areas if desired.

In-situ and Imported Soil

The in-situ soils encountered at the subject site have a low to moderate sensitivity to moisture and were generally in a damp to moist condition at the time of exploration. Soils anticipated to be exposed on site may degrade if exposed to wet weather and construction traffic. Compaction of the soils to the levels necessary for use as structural fill may be difficult to impossible during wet weather conditions. Soils encountered during site excavations that are excessively over the optimum moisture content will likely require aeration or treatment prior to placement and compaction. Conversely, soils that are substantially below the optimum moisture content will require moisture conditioning through the addition of water prior to use as structural fill. An ESNW representative should determine the suitability of in-situ soils for use as structural fill at the time of construction.

Imported soil intended for use as structural fill should be evaluated by ESNW during construction. The imported soil must be workable to the optimum moisture content, as determined by the Modified Proctor Method (ASTM D1557), at the time of placement and compaction. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas. Structural fill placed and compacted during site grading activities should meet the following specifications and guidelines:

- Structural fill material — Granular soil*
- Moisture content — At or slightly above optimum†
- Relative compaction (minimum) — 95 percent (Modified Proctor)‡
- Loose lift thickness (maximum) — 12 inches

* *Existing gravel soils will likely require moisture conditioning (addition of water) prior to placement and compaction.*
† *Soil shall not be placed dry of optimum and should be evaluated by ESNW during construction.*
‡ *Minimum relative compaction of 90% may be feasible for mass grading activities and should be evaluated by ESNW during construction.*

With respect to underground utility installations and backfill, local jurisdictions may dictate the soil type(s) and compaction requirements. Unsuitable material or debris must be removed from structural areas if encountered.

Excavations and Slopes

The following Federal Occupation Safety and Health Administration and Washington Industrial Safety and Health Act soil classifications and maximum allowable temporary slope inclinations may be used:

- Areas exposing groundwater seepage — 1.5H:1V (Type C)
- Loose soil and fill — 1.5H:1V (Type C)
- Medium dense to dense soil — 1H:1V (Type B)

Groundwater seepage should be anticipated during excavation activities, especially if excavations take place during the wet season. An ESNW representative should observe temporary excavations to evaluate the presence of groundwater seepage. If seepage is not observed, steeper temporary slope inclinations may be feasible pending evaluation by the geotechnical engineer.

Subgrade Preparation

Foundations should be constructed on competent native soil or structural fill placed directly on competent native soil. Loose or unsuitable soil conditions encountered below areas of footing and slab elements should be remedied as recommended in this report. In general, foundation subgrades on native cut surfaces should be compacted in-situ to a minimum depth of one foot below the design subgrade elevation. Uniform compaction of the foundation and slab subgrade areas will establish a relatively consistent subgrade condition below the foundation and slab elements. ESNW should observe the foundation and slab subgrade prior to placing formwork. Supplementary recommendations for subgrade improvement can be provided at the time of construction and would likely include further mechanical compaction effort and/or overexcavation and replacement with suitable structural fill.

Foundations

The proposed structures can be constructed on conventional continuous and spread footing foundations bearing on competent native soil, recompacted native soil, or new structural fill placed directly on competent native soil. Where loose or unsuitable soil conditions are encountered at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with suitable structural fill will likely be necessary. A representative of ESNW should confirm suitability of foundation subgrades at the time of construction. If deemed necessary, the undisturbed weathered native soils may be compacted in-situ provided the soil is at or slightly above the optimum moisture content.

Provided the structures will be supported as described above, the following parameters may be used for design of the new foundations:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40

A one-third increase in the allowable soil bearing capacity can be assumed for short-term wind and seismic loading conditions. The passive earth pressure and coefficient of friction values include a safety factor of 1.5. With structural loading as expected, total settlement in the range of one inch is anticipated, with differential settlement of about one-half inch. The majority of the settlement should occur during construction as dead loads are applied.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for retaining wall design:

- Active earth pressure (unrestrained condition) 35 pcf
- At-rest earth pressure (restrained condition) 55 pcf
- Traffic surcharge (passenger vehicles) 70 psf (rectangular distribution)
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40
- Seismic surcharge 8H psf*

* *Where H equals the retained height (in feet).*

The passive earth pressure and coefficient of friction values include a safety factor of 1.5. Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. Relatively clean (fines content less than 5 percent) native soils may be used as the drainage zone, but should be observed by ESNW prior to placement. The upper 12 inches of the wall backfill may consist of a less permeable soil, if desired.

Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3.

Seismic Design

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically with respect to earthquake loads. Based on the soil conditions encountered at the test pit locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

Parameter	**Value**
Site Class	D*
Mapped short period spectral response acceleration, S_S (*g*)	1.280
Mapped 1-second period spectral response acceleration, S_1 (*g*)	0.463
Short period site coefficient, F_a	1.000
Long period site coefficient, F_v	1.837
Adjusted short period spectral response acceleration, S_{MS} (*g*)	1.280
Adjusted 1-second period spectral response acceleration, S_{M1} (*g*)	0.850
Design short period spectral response acceleration, S_{DS} (*g*)	0.853
Design 1-second period spectral response acceleration, S_{D1} (*g*)	0.567

* *Assumes medium dense soil conditions, encountered to a maximum depth of 16 feet bgs during the April 2023 field exploration, remain medium dense or better to at least 100 feet bgs.*

† *Values assume F_v may be determined using linear interpolation per Table 11.4-2 in ASCE 7-16.*

As indicated in the table footnote, several of the seismic design values provided above are dependent on the assumption that site-specific ground motion analysis (per Section 11.4.8 of ASCE 7-16) will not be required for the subject project. ESNW recommends the validity of this assumption be confirmed at the earliest available opportunity during the planning and early design stages of the project. Further discussion between the project structural engineer, the project owner (or their representative), and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

Liquefaction is a phenomenon where saturated or loose soil suddenly loses internal strength and behaves as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or another intense ground shaking. In our opinion, site susceptibility to liquefaction may be considered negligible. The absence of a shallow groundwater table and the coarse (gravel) gradation of the native soil were the primary bases for this opinion.

Slab-on-Grade Floors

Slab-on-grade floors should be supported on a firm and unyielding subgrade consisting of competent native soil or at least 12 inches of new structural fill. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with suitable structural fill prior to slab construction.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below the slab. The free-draining material should have a fines content of 5 percent or less defined as the percent passing the number 200 sieve, based on the minus three-quarters-inch fraction. In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. The relatively clean (less than 5 percent fines) native gravel soils may be used or considered functionally equivalent as a capillary break; however, ESNW should observe native soils prior to placement to confirm suitability. If used, the vapor barrier should consist of a material specifically designed to function as a vapor barrier and should be installed in accordance with the manufacturer's specifications.

Drainage

Temporary measures to control surface water runoff and groundwater during construction would likely involve passive elements such as interceptor trenches, interceptor swales, and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and provide recommendations to reduce the potential for seepage-related instability.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures or slopes. Based on the presence of relatively clean sand/gravel soils on this site, footing drains may be omitted at the owner's discretion. If footing drains are omitted, we recommend ESNW be contacted to observe the subgrade to ensure the entire alignment exposes relatively free-draining sand/gravel. If footing drains will be installed, a foundation drain should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Preliminary Infiltration Evaluation

As indicated on the referenced preliminary site plan, a stormwater tract will be created in each of the project areas. The Vancil Road plat will include a storm tract in the western portion of the site, while the Morris Road plat will include a storm tract in the eastern portion. ESNW excavated three test pits in each storm tract (TP-5 through TP-7 for Vancil Road and TP-11 through TP-13 for the Morris Road site). Native soils encountered across the site during our fieldwork were characterized primarily as recessional outwash gravel deposits with relatively low fines contents. Based on our laboratory analyses, the native soils classify primarily as USDA loamy sand with fines contents ranging from about 1.3 to 4.7 percent with one outlier (TP-6) with a fines content of 7.4 percent. The results of our laboratory analyses are included in Appendix B of this report.

Using Method 3 - Soil Grain Size Analysis Method, in conjunction with the presence of Type A soil on the subject site, we determined a preliminary long-term design infiltration rate to be used primarily as a feasibility screening tool. A preliminary long-term design rate is calculated following the equation below, located in the Pierce County Stormwater and Site Development Manual.

$$log_{10}\,(K_{sat}\,) = \,-1.57\, + 1.90D_{10}\, +\, 0.015D_{60}\, -\, 0.013D_{90}\, -\, 2.08F_{fines}$$

The relatively clean Spanaway (Type A) gravels observed in across the site exhibit favorable infiltration characteristics and will likely be feasible for full infiltration. Based on the soil samples obtained at TP-5 through TP-7 and TP-11 through TP-13 within the vicinity of the proposed infiltration facilities at representative depths, preliminary calculated long-term design rates ranging between 7 inches/hour to 87 in/hr were calculated. We recommend using an allowable infiltration rate of 20 in/hr for the Vancil Road plat and 30 in/hr for preliminary sizing calculations/design for the proposed Morris Road stormwater facility. In-situ pilot infiltration testing should be completed for final design of the infiltration ponds.

Groundwater monitoring piezometers were installed at three test locations within each of the proposed stormwater tracts for future groundwater monitoring services, to be completed in the coming wet season. While no indications of seasonal groundwater were observed during the subsurface investigation, winter monitoring may result in alterations to future facility design based on potential groundwater conditions.

Based on our field observations and laboratory analyses, the native gravelly soils do not meet the requirements for water quality treatment per Volume V, Chapter 6.3 of the stormwater manual. Specifically, the measured soil infiltration rate significantly higher than the maximum allowable nine inches per hour. Additionally, the native Spanaway gravels likely possess a lower cation exchange capacity (CEC) and organic content than required by the manual. Therefore, a treatment layer or other provision will likely be required for facility designs.

Utility Support and Trench Backfill

In our opinion, the on-site soil will generally be suitable for support of utilities. Based on the conditions encountered at the exploration locations, groundwater seepage may be exposed within utility trench excavations and will likely require temporary shoring and construction dewatering. Use of the native soil as structural backfill in the utility trench excavations will depend on the in-situ moisture content at the time of placement and compaction. If native soil is placed below the optimum moisture content, settlement will likely occur once wet weather impacts the trenches. As such, backfill soils should be properly moisture conditioned, as necessary, to ensure acceptability of the soil moisture content at the time of placement and compaction. Large clasts greater than about six inches should be removed from utility trench backfill if encountered. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report or to the applicable requirements of the presiding jurisdiction.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proof rolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thick crushed rock or structural fill sections, prior to pavement. Cement treated base may be considered for stabilizing the subgrade if local jurisdictions allow this method of treatment.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot-mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;

- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

Heavier traffic areas generally require thicker pavement sections depending on site usage, pavement life expectancy, and site traffic. For preliminary design purposes, the following pavement sections for occasional truck traffic and access roadway areas may be considered:

- Three inches of HMA placed over six inches of CRB, or;

- Three inches of HMA placed over four and one-half inches of ATB.

A representative of ESNW should be requested to observe subgrade conditions prior to placement of CRB or ATB. As necessary, supplemental recommendations for achieving subgrade stability and drainage can be provided. If on-site roads will be constructed with an inverted crown, additional drainage measures may be recommended to assist in maintaining road subgrade and pavement stability.

Final pavement design recommendations, including recommendations for heavy traffic areas, access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the governing jurisdiction may supersede the recommendations provided in this report. The HMA, ATB, and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557.

LIMITATIONS

This study has been prepared for the exclusive use of Copper Ridge, LLC, and its representatives. The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the exploration locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services as needed during future design and construction phases of the project.

Reference:
Thurston County, Washington
OpenStreetMap.org

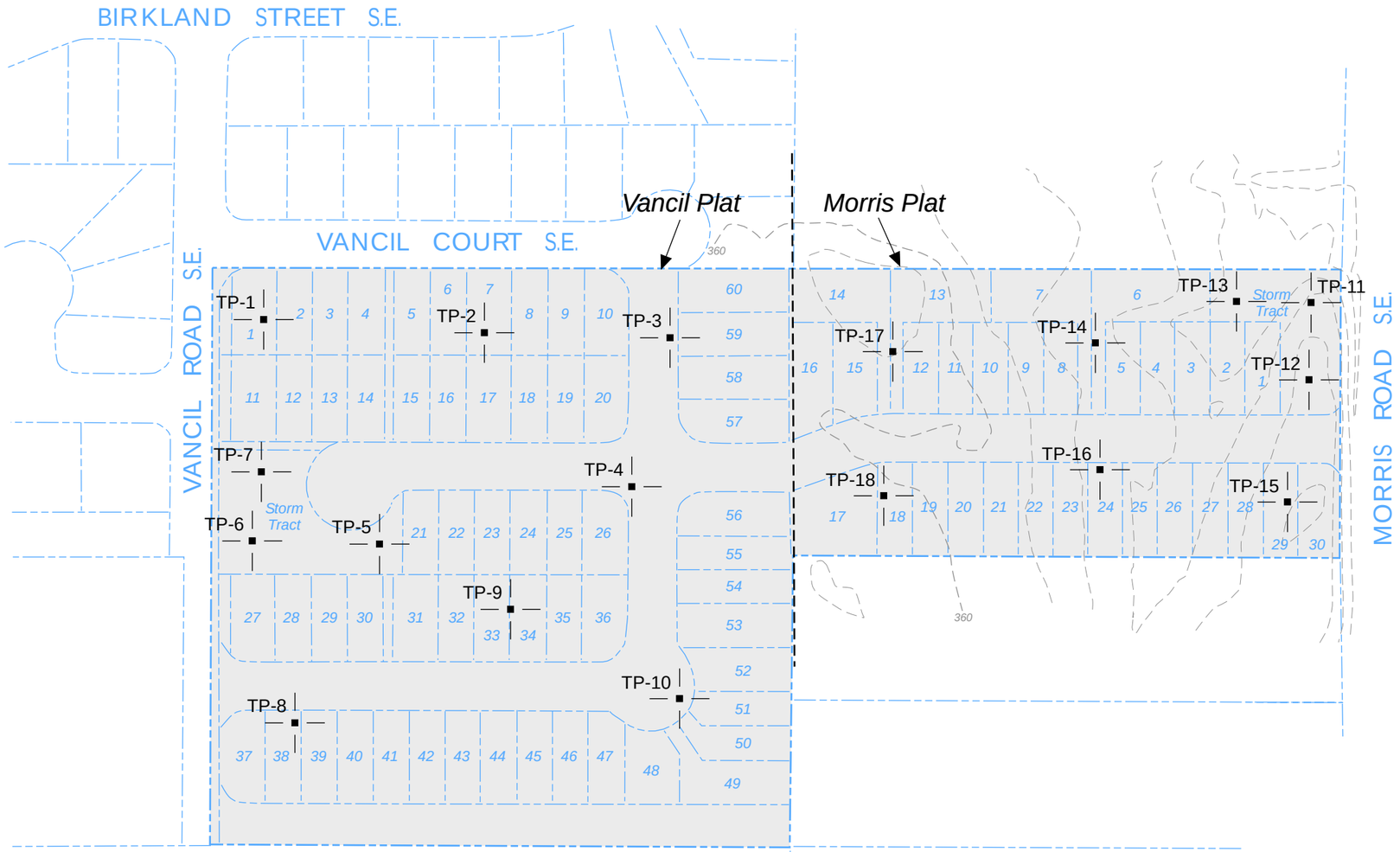
NORTH

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Drawn CAM	Date 06/06/2023	Proj. No. 9150
Checked SSR	Date June 2023	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-9150, April 2023

Subject Site

21 — Proposed Lot Number

NORTH

1"=150'

0 75 150 300

Scale in Feet

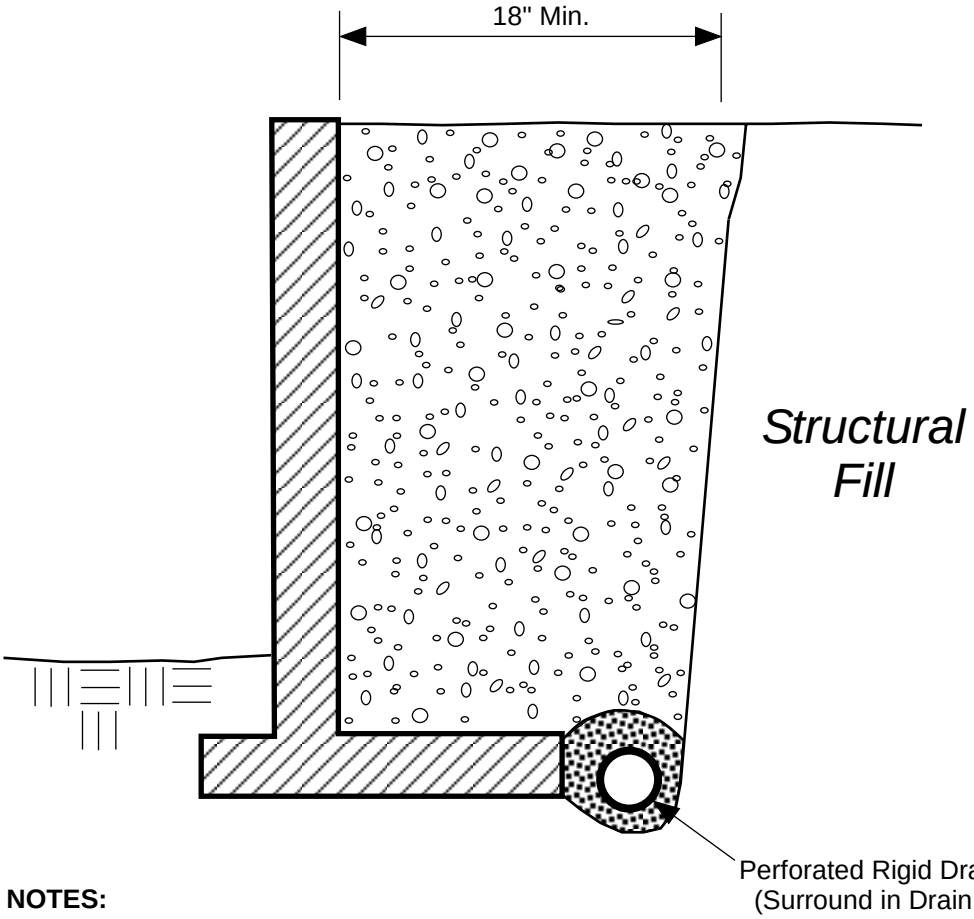
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drawn	CAM
Checked	SSR
Date	06/06/2023
Proj. No.	9150
Plate	2



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

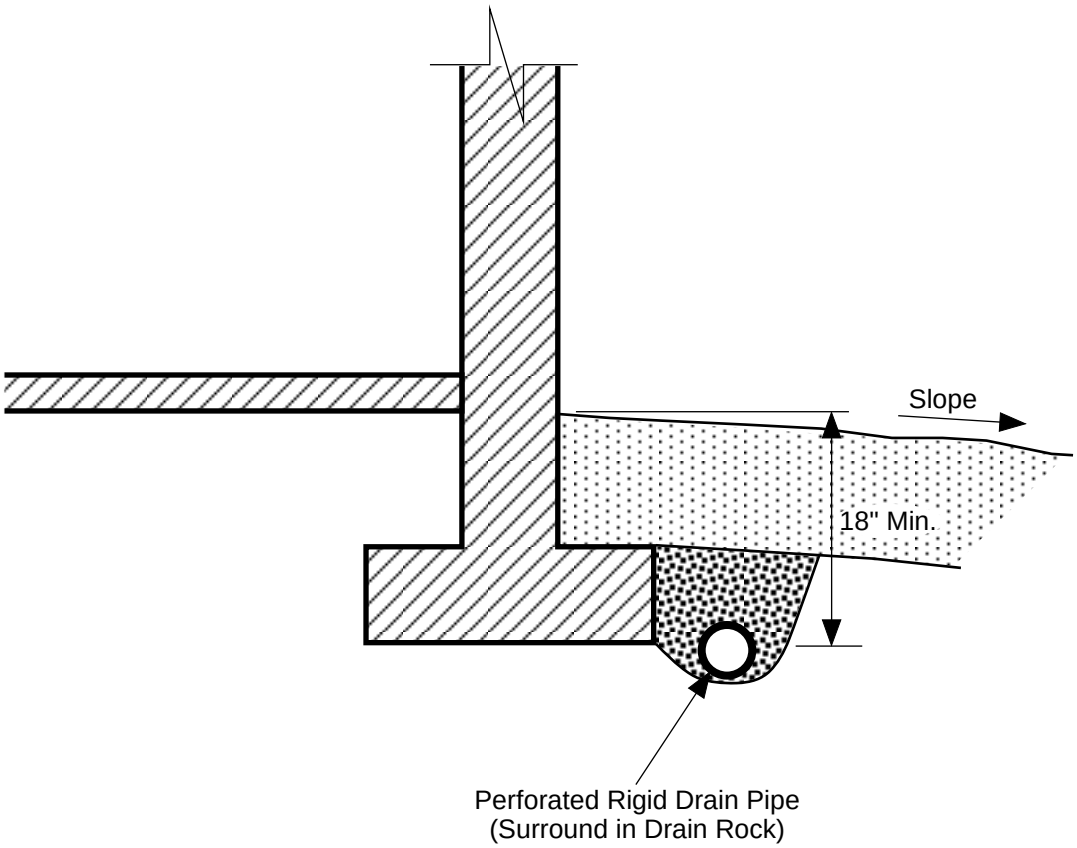
Free-draining Structural Backfill

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Drawn CAM	Date 06/06/2023	Proj. No. 9150
Checked SSR	Date June 2023	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Footing Drain Detail
10800 Vancil Road S.E. Subdivision
Thurston County (Yelm), Washington

Drawn CAM	Date 06/06/2023	Proj. No. 9150
Checked SSR	Date June 2023	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

ES-9150

Subsurface conditions on site were explored by excavating 18 test pits on April 24/25, 2023, respectively, using equipment and operators provided by the client. The approximate locations of the test pits and borings are illustrated on Plate 2 of this study. The subsurface exploration logs are provided in this Appendix. The maximum exploration depth was 16 feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Coarse-Grained Soils - More Than 50% Retained on No. 200 Sieve	Gravels - More Than 50% of Coarse Fraction Retained on No. 4 Sieve	< 5% Fines	GW	Well-graded gravel with or without sand, little to no fines
			GP	Poorly graded gravel with or without sand, little to no fines
		> 12% Fines	GM	Silty gravel with or without sand
			GC	Clayey gravel with or without sand
	Sands - 50% or More of Coarse Fraction Passes No. 4 Sieve	< 5% Fines	SW	Well-graded sand with or without gravel, little to no fines
			SP	Poorly graded sand with or without gravel, little to no fines
		> 12% Fines	SM	Silty sand with or without gravel
			SC	Clayey sand with or without gravel
Fine-Grained Soils - 50% or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less Than 50		ML	Silt with or without sand or gravel; sandy or gravelly silt
			CL	Clay of low to medium plasticity; lean clay with or without sand or gravel; sandy or gravelly lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt with or without sand or gravel; sandy or gravelly elastic silt
			CH	Clay of high plasticity; fat clay with or without sand or gravel; sandy or gravelly fat clay
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils
Fill			FILL	Made Ground

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch

Damp - Perceptible moisture, likely below optimum MC

Moist - Damp but no visible water, likely at/near optimum MC

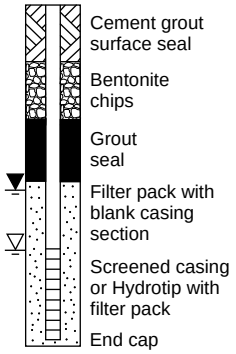
Wet - Water visible but not free draining, likely above optimum MC

Saturated/Water Bearing - Visible free water, typically below groundwater table

Symbols

ATD = At time of drilling

Static water level (date)



Terms Describing Relative Density and Consistency

Coarse-Grained Soils:

Density	SPT blows/foot
Very Loose	< 4
Loose	4 to 9
Medium Dense	10 to 29
Dense	30 to 49
Very Dense	≥ 50

Fine-Grained Soils:

Consistency	SPT blows/foot
Very Soft	< 2
Soft	2 to 3
Medium Stiff	4 to 7
Stiff	8 to 14
Very Stiff	15 to 29
Hard	≥ 30

Test Symbols & Units

Fines = Fines Content (%)

MC = Moisture Content (%)

DD = Dry Density (pcf)

Str = Shear Strength (tsf)

PID = Photoionization Detector (ppm)

OC = Organic Content (%)

CEC = Cation Exchange Capacity (meq/100 g)

LL = Liquid Limit (%)

PL = Plastic Limit (%)

PI = Plasticity Index (%)

Component Definitions

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

Modifier Definitions

Percentage by Weight (Approx.)	Modifier
< 5	Trace (sand, silt, clay, gravel)
5 to 14	Slightly (sandy, silty, clayey, gravelly)
15 to 29	Sandy, silty, clayey, gravelly
≥ 30	Very (sandy, silty, clayey, gravelly)

Classifications of soils in this geotechnical report and as shown on the exploration logs are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D2487 and D2488 were used as an identification guide for the Unified Soil Classification System.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

EXPLORATION LOG KEY

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 358 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93068 **LONGITUDE** -122.59518

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					356.5
	GB	MC = 7.5			Brown poorly graded GRAVEL with sand, medium dense, damp -probed 4" -slight caving to BOH
5	GB	MC = 8.3	GP		
10					
15	GB	MC = 7.6			
15.0					343.0

Test pit terminated at 15.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 358 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.9305 **LONGITUDE** -122.59428

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
					1.0 357.0
					Brown well-graded GRAVEL with sand, medium dense, damp
	GB	MC = 5.8			-slight caving to BOH, probed 3"
5					
	GB	MC = 8.8 Fines = 3.8	GW		[USDA Classification: extremely gravelly coarse SAND]
10					
					-becomes gray
	GB	MC = 7.1			14.0 344.0
					Test pit terminated at 14.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 2.0 feet to BOH.
					LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 360 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93058 **LONGITUDE** -122.59333

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.0					359.0
	GB	MC = 5.2	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -moderate caving to BOH
5					
10					-becomes gray
	GB	MC = 7.8			
11.5					348.5

Test pit terminated at 11.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 2.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 361 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93021 **LONGITUDE** -122.59339

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
					1.0 360.0
					Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 6.8			-moderate caving to BOH
					-probed 4"
5			GP		
10					
	GB	MC = 9.3			12.0 349.0

Test pit terminated at 12.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 2.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93001 **LONGITUDE** -122.59472

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
			GP		Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 6.8			-moderate caving to BOH, probed 3"
5					
5.0					352.0
			GW		Brown well-graded GRAVEL with sand, medium dense, damp to moist
10					
	GB	MC = 8.1 Fines = 4.7			
13.0					[USDA Classification: extremely gravelly loamy coarse SAND] 344.0

Test pit terminated at 13.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 2.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-6

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93002 **LONGITUDE** -122.59521

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
			GP		Brown poorly graded GRAVEL with sand, medium dense, damp
					-probed 3"
	GB	MC = 7.7			-slight caving to BOH, probed 3"
5					
9.0					348.0
			GW		Brown well-graded GRAVEL with sand, medium dense, damp to moist
10					
15					
15.0					342.0
			SW-SM		Brown well-graded SAND with silt, medium dense to dense, moist
	GB	MC = 10.9 Fines = 7.4			[USDA Classification: very gravelly loamy coarse SAND]
16.0					341.0

Test pit terminated at 16.0 feet below existing grade. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

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Telephone: 425-449-4704
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TEST PIT NUMBER TP-7

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.9303 **LONGITUDE** -122.59519

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
	GB	MC = 7.8	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -moderate caving to BOH
5					
10					
	GB	MC = 7.2 Fines = 4.9			
14.0					[USDA Classification: extremely gravelly loamy coarse SAND] 343.0 Test pit terminated at 14.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-8

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 357 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.92922 **LONGITUDE** -122.59478

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					355.5
	GB	MC = 7.4	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -slight caving to BOH
5					
10					
15	GB	MC = 8.5			
15.0					342.0

Test pit terminated at 15.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-9

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 358 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.92958 **LONGITUDE** -122.59398

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					356.5
	GB	MC = 8.0 Fines = 5.3	GP-GM		Brown poorly graded GRAVEL with silt and sand, medium dense, damp -probed 4" [USDA Classification: extremely gravelly loamy coarse SAND] -slight caving to BOH
5					
10					
	GB	MC = 8.1			-becomes gray
13.0					345.0
					Test pit terminated at 13.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-10

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 359 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.92938 **LONGITUDE** -122.59327

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Field Grass **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 12"
1.5					357.5
					Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 7.9			-slight caving to BOH, probed 3"
5			GP		
10					-becomes gray
	GB	MC = 7.9			
13.5					345.5

Test pit terminated at 13.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-11

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 355 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93071 **LONGITUDE** -122.59039

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					353.5
	GB	MC = 9.1			Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3" -moderate caving to BOH
5			GP		
10					-becomes gray
15	GB	MC = 5.3 Fines = 2.2		15.0	[USDA Classification: extremely gravelly coarse SAND] 340.0 Test pit terminated at 15.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-12

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 356 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93049 **LONGITUDE** -122.59051

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					354.5
	GB	MC = 7.0	GP		Brown poorly graded GRAVEL with sand, medium dense, damp
					-probed 3"
					-moderate caving to BOH
5					
10					
	GB	MC = 6.0 Fines = 3.5			
14.0					[USDA Classification: extremely gravelly loamy coarse SAND] 342.0

Test pit terminated at 14.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-13

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/24/23 **COMPLETED** 4/24/23 **GROUND ELEVATION** 351 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93071 **LONGITUDE** -122.59075

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL, roots to 18"	
					1.5	349.5
	GB	MC = 7.3	GP		Brown poorly graded GRAVEL with sand, medium dense, damp	
					-probed 3"	
					-slight caving to BOH	
5						
10					10.0	341.0
			GW		Brown well-graded GRAVEL with sand, medium dense, damp to moist	
15	GB	MC = 4.8 Fines = 1.3			15.0	336.0
					[USDA Classification: extremely gravelly SAND]	

Test pit terminated at 15.0 feet below existing grade due to caving. Piezo installed. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-14

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION** 355 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93064 **LONGITUDE** -122.59146

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 24"
1.5					353.5
	GB	MC = 8.8			Brown well-graded GRAVEL with sand, medium dense, damp to moist -probed 3" -moderate caving to BOH
5					
	GB	MC = 5.2 Fines = 1.5	GW		[USDA Classification: extremely gravelly coarse SAND]
10					
	GB	MC = 7.1			
12.5					342.5

Test pit terminated at 12.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.0 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-15

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION** 356 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93019 **LONGITUDE** -122.59064

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					354.5
	GB	MC = 10.6			Brown poorly graded GRAVEL with sand, medium dense, damp -probed 3"
5					-moderate caving to BOH
	GB	MC = 8.5			-becomes gray
10			GP		
15	GB	MC = 9.8			
16.0					340.0

Test pit terminated at 16.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-16

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.9302 **LONGITUDE** -122.59146

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 24"
2.0					Brown well-graded GRAVEL with sand, medium dense, damp
	GB	MC = 9.2 Fines = 4.3			-probed 3" [USDA Classification: extremely gravelly loamy coarse SAND] -slight caving to BOH
5					
			GW		
10					
14.0	GB	MC = 7.4			Test pit terminated at 14.0 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-17

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION**

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93064 **LONGITUDE** -122.59233

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 24"
				2.0	
			GP		Brown poorly graded GRAVEL with sand, medium dense, damp
	GB	MC = 7.9			-probed 3"
					-moderate caving to BOH
5					
10					
	GB	MC = 6.6		12.0	

Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-18

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision

DATE STARTED 4/25/23 **COMPLETED** 4/25/23 **GROUND ELEVATION** 361 ft

EXCAVATION CONTRACTOR Client Provided **LATITUDE** 46.93026 **LONGITUDE** -122.59252

LOGGED BY SKH **CHECKED BY** SSR **GROUND WATER LEVEL:**

NOTES ▽ **AT TIME OF EXCAVATION**

SURFACE CONDITIONS Forest Duff **AFTER EXCAVATION**

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 18"
1.5					359.5
	GB	MC = 8.4	GP		Brown poorly graded GRAVEL with sand, medium dense, damp -probed 4" -slight caving to BOH
5					
10					
13.5	GB	MC = 4.8			347.5

Test pit terminated at 13.5 feet below existing grade due to caving. No groundwater encountered during excavation. Caving observed from 3.5 feet to BOH.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

GENERAL BH / TP / WELL - 9150.GPJ - GINT US.GDT - 6/6/23

Appendix B

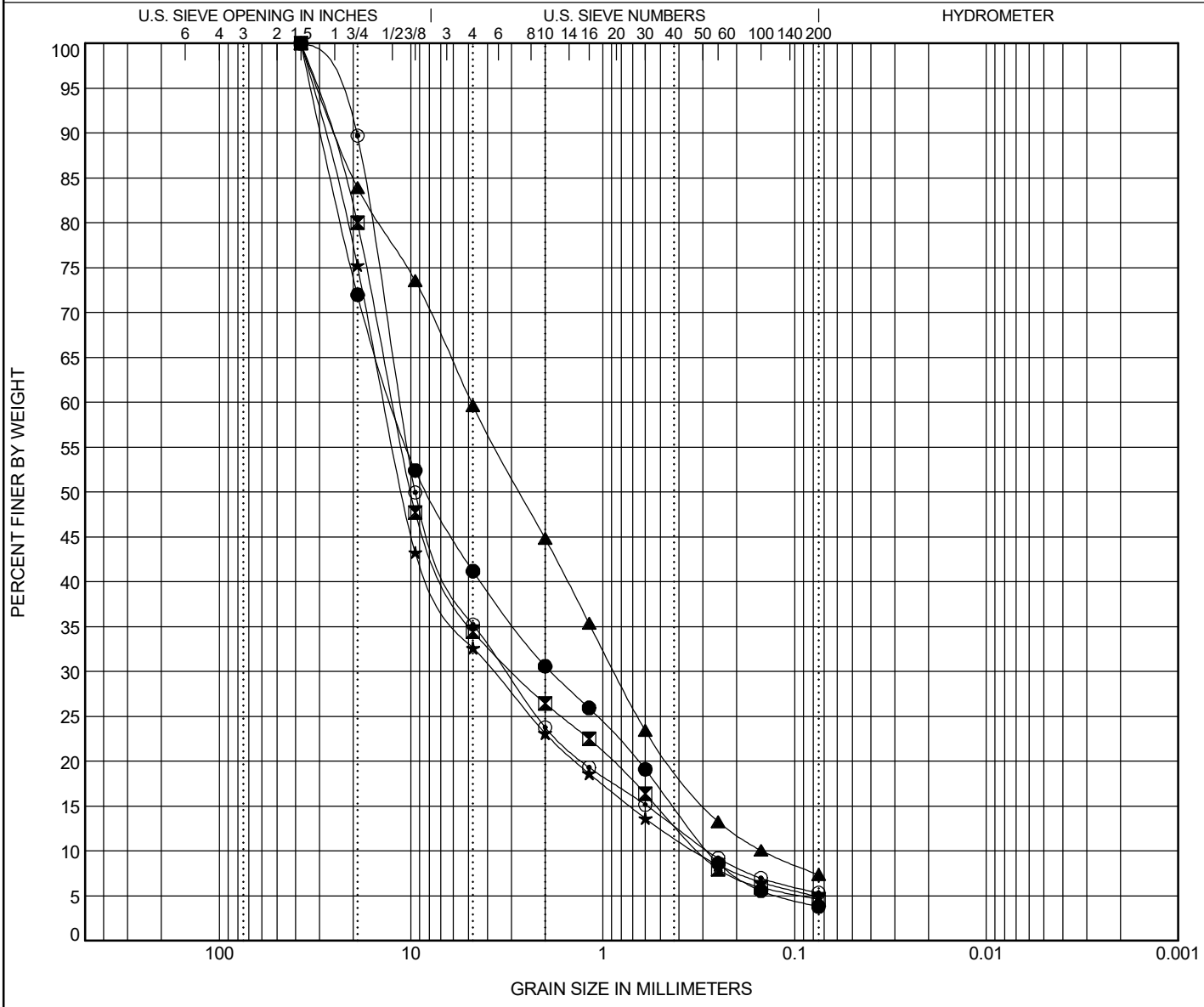
Laboratory Test Results

ES-9150

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-02	7.50ft.	USDA: Brown Extremely Gravelly Coarse Sand. USCS: GW with Sand.	1.00	44.36
⊠	TP-05	13.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GW with Sand.	2.26	40.04
▲	TP-06	16.00ft.	USDA: Brown Very Gravelly Loamy Coarse Sand. USCS: SW-SM with Gravel.	1.07	32.95
★	TP-07	14.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GP with Sand.	3.15	41.95
⊙	TP-09	2.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GP-GM with Sand.	3.22	40.31

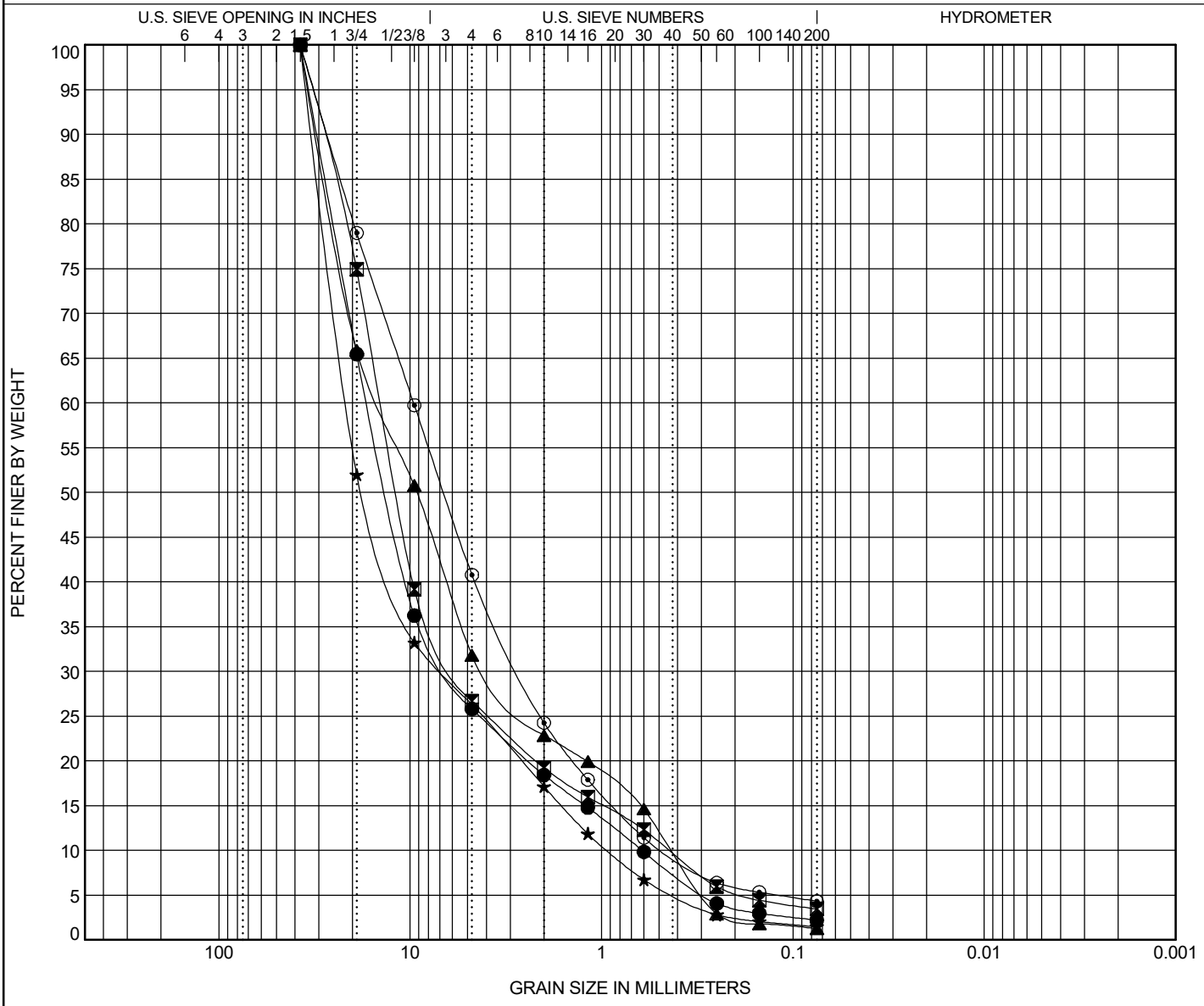
Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-02	7.5ft.	37.5	12.425	1.868	0.28				3.8	
⊠	TP-05	13.0ft.	37.5	12.362	2.94	0.309				4.7	
▲	TP-06	16.0ft.	37.5	4.834	0.87	0.147				7.4	
★	TP-07	14.0ft.	37.5	13.65	3.741	0.325				4.9	
⊙	TP-09	2.0ft.	37.5	11.317	3.196	0.281				5.3	

GRAIN SIZE USDA ES-9150 10800 VANCIL ROAD S.E. SUBDIVISION.GPJ GINT US LAB.GDT 5/3/23

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-9150 **PROJECT NAME** 10800 Vancil Road S.E. Subdivision



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-11	15.00ft.	USDA: Gray Extremely Gravelly Coarse Sand. USCS: GP with Sand.	3.85	27.25
⊠	TP-12	14.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GP with Sand.	5.25	32.63
▲	TP-13	15.00ft.	USDA: Brown Extremely Gravelly Sand. USCS: GW with Sand.	2.58	34.17
★	TP-14	6.00ft.	USDA: Brown Extremely Gravelly Coarse Sand. USCS: GW with Sand.	2.41	23.12
⊙	TP-16	3.00ft.	USDA: Brown Extremely Gravelly Loamy Coarse Sand. USCS: GW with Sand.	1.62	20.48

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-11	15.0ft.	37.5	16.693	6.273	0.613				2.2	
⊠	TP-12	14.0ft.	37.5	14.225	5.708	0.436				3.5	
▲	TP-13	15.0ft.	37.5	14.5	3.987	0.424				1.3	
★	TP-14	6.0ft.	37.5	21.278	6.876	0.92				1.5	
⊙	TP-16	3.0ft.	37.5	9.585	2.699	0.468				4.3	

GRAIN SIZE USDA ES-9150 10800 VANCIL ROAD S.E. SUBDIVISION.GPJ GINT US LAB.GDT 5/3/23

Report Distribution

ES-9150

EMAIL ONLY

Copper Ridge, LLC
P.O. Box 73790
Puyallup, Washington 98373

Attention: Evan Mann