Supplement to the Site Engineering Technical Report for 47° North

Revised September 10, 2020

Prepared for

Sun Communities, Inc.
27777 Franklin Road, Suite 200
Southfield, MI 48034

09/10/2020

Submitted by

ESM Consulting Engineers, LLC
33400 8th Avenue S, Suite 205
Federal Way, WA 98003

253.838.6113 tel
253.838.7104 fax

www.esmcivil.com

Table of Contents

Tables

Figures

Appendix – HLA Memorandum

Introduction

The purpose of the Supplement to the Site Engineering Technical Report (SETR) for 47° North is to serve as an update to the 2002 SETR by W&H Pacific, Inc., as relevant for the 47° North development. The SETR was completed as Appendix E of the Final Environmental Impact Statement (EIS) for the Trendwest Properties Cle Elum UGA (2002 EIS).

The updates in this supplement consist of evaluating the following alternatives as part of the 47° North Master Site Plan Supplemental Environmental Impact Statement (SEIS):

- SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment
- FEIS Alternative 5 – Original Bullfrog Flats Master Site Plan
- SEIS Alternative 5 (No Action Alternative) – Approved Bullfrog Flats Master Site Plan

The alternatives are compared, relative to the codes in effect at the time of the 2002 UGA EIS for FEIS Alternative 5 and the codes currently in effect for SEIS Alternatives 5 and 6. With each comparison, any new significant impacts will be identified, and mitigation measures proposed.

The Draft SETR will evaluate impacts in the following categories, matching the format of the 2002 SETR:

- Section 1 Site Information, including clearing, grading, and impervious area data
- Section 2 Stormwater, including hydrologic modeling for existing and developed conditions and a water quality analysis
- Section 3 Preliminary Water Plans
- Section 4 Preliminary Sewer Plans
- Section 5 Solid Wastes

1.1 Clearing, Grading, and Impervious Area Information

This section provides estimates of areas to be cleared during construction, impervious areas, and cut and fill earthwork volumes for SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment and compares them to FEIS Alternative 5 and SEIS Alternative 5.

1.1.1 Project Clearing

In order to maintain the natural setting of the project under SEIS Alternative 6, the extent of clearing associated with project construction would be kept to reasonable minimums through project design. Estimated areas to be cleared are presented in **Table 1-1** by type of land use category and compared to FEIS Alternative 5. SEIS Alternative 5 did not include a breakdown of cleared and impervious area, however, the total developed area for SEIS Alternative 5 is 401 acres, which is less than FEIS Alternative 5 cleared area. Therefore, for the purposes of this comparison, the areas under SEIS Alternative 5 and FEIS Alternative 5 are estimated to be the same.

Cleared areas for roads were assumed to be the full road right-of-way over the length of the roads. The connector road right-of-way was assumed to be 70 feet. Cleared areas for other land uses include their respective roadways and were taken as the assumed maximum developed area for each land use. Impervious areas by land use category are also presented in **Table 1-1**.

It should be noted that some of the areas assumed to be cleared and in impervious surfaces differ between the alternatives (public facilities, community recreation center, school expansion, and cemetery expansion) because different assumptions were made for these areas in the 2002 EIS for FEIS Alternative 5, the SEIS Alternative 5, and the current revised plan for SEIS Alternative 6.

Table 1-1: Estimated Cleared and Impervious Areas, Acres [a]

Land Use	SEIS Alternative 6		FEIS & SEIS Alternative 5[b]	
	Area Cleared	Impervious Area	Area Cleared	Impervious Area
Residential	143	71	161	104
Residential Amenity Center	6	5	0	0
Adventure Center	6	5	0	0
Roads	10	8	122	61
Public Facilities	0	0	23	4
Community Recreation Ctr.	0	0	10	6
School Expansion	0	0	17	8
Cemetery Expansion	0	0	8	1
Commercial Development	18	17	62	63
RV Park	146	57	0	0
RV Amenity Center	5	4	0	0
Total	**333**	**167**	**403**	**247**

[a] Note: Numbers may not sum to totals shown due to rounding.
[b] Excludes Reserve Area.

1.1.2 Site Grading

The general considerations for grading throughout the site under SEIS Alternative 6 include the following:

- Clearing limits would be minimized as discussed previously.
- Grading will be performed to provide positive drainage.
- Grading designs would seek reasonable balances of cut and fill by development area phases.
- No excavated materials are expected to be transported off-site.
- Except as discussed in the following sections, no general borrow materials are expected to be imported from off-site sources.
- Excavated topsoil would be stockpiled and reused.
- Erosion and sedimentation control measures would be implemented.

Estimated earthwork quantities are presented in **Table 1-2** under SEIS Alternative 6 (and compared to FEIS Alternative 5 and SEIS Alternative 5). The proposed 47° North development grading under SEIS Alternative 6 is shown on **Figure 1-1**. For SEIS Alternative 6, roadway quantities to subgrade have been determined from a preliminary roadway vertical design based on the horizontal alignments presented in the master site plan. Quantities of cut and fill for other land uses were estimated on the basis of unit area volume procedures for each land use type. The unit area volumes were applied to the assumed maximum development areas estimated for each land use category.

Table 1-2: Estimated Earthwork Quantities, Cubic Yards

Land Use	SEIS Alternative 6		FEIS & SEIS Alternative 5[a]	
	Cut	Fill	Cut	Fill
Residential	126,000	164,000	116,000	75,000
Residential Amenity Center	4,000	14,000	0	0
Adventure Center	3,000	16,000	0	0
Roads	2,000	4,000	79,000	16,000
Public Facilities	0	0	82,000	15,000
Community Recreation Ctr.	0	0	19,000	19,000
School Expansion	0	0	37,000	37,000
Cemetery Expansion	0	0	8,000	16,000
Commercial Development	99,000	2,000	303,000	242,000
RV Park	106,000	108,000	0	0
RV Amenity Center	11,000	2,000	0	0
Total	**351,000**	**310,000**	**644,000**	**420,000**

[a] Excludes Reserve Area.

Stripping volumes for SEIS Alternative 6 are 391,000 cubic yards for an estimated stripping depth of 12 inches. Stripping volumes for FEIS Alternative 5 were not calculated as part of the 2002 EIS SETR.

1.2 Imported Materials

In the event on-site materials are not able to be used for construction, imported materials will be required under SEIS Alternative 6. These materials would include gravel base course and crushed rock base course materials for roadway, parking areas and paved trails; asphalt concrete; and bedding materials for pipelines. The estimated total volume of these materials is 150,000 cubic yards.

Delivery of imported materials under SEIS Alternative 6 would follow the proposed construction schedule for the infrastructure, which is estimated to be 5 to 10 years. Assuming a six-month construction season for site work (May - October), approximately 2,500 to 5,000 cubic yards per month would be delivered to the site. Assuming 12 cubic yard capacity trucks are used, the material importing activities would generate about 210 to 420 truck trips per month.

Some stockpiling of materials on site would be expected such as bedding materials for pipeline construction. Stockpiling would tend to increase daily truck trip volumes above the average daily truck trip volume for the construction season. However, the total truck trip volume for the season would not be expected to change.

1.3 Site Information Summary

The proposed SEIS Alternative 6 development cleared and impervious areas, as well as the cut and fill earthwork volumes, are significantly less than under FEIS Alternative 5 in the 2002 EIS SETR and SEIS Alternative 5. The reason for the reduction in cleared and impervious areas is mostly because the commercial development footprint is significantly smaller. Therefore, less associated impacts are anticipated (e.g., erosion and sedimentation into water resources), and no additional mitigation is proposed other than what is already required by current codes.

FOR CONTINUATION SEE SHEET 2 OF 2

BULLFROG ROAD

SECONDARY ENTRY

ADVENTURE CENTER

MUNICIPAL RECREATION CENTER SITE

CLE ELUM – ROSLYN SCHOOL DISTRICT 404

EXISTING HIGH SCHOOL

EXISTING ELEMENTARY AND MIDDLE SCHOOL

MANUFACTURED HOUSING

POND

AMENITY CENTER

IRRIGATION PUMP STATION

COMMUNICATIONS

POWER STATION

MULTI–FAMILY

CITY OF CLE ELUM WATER TREATMENT PLANT

PRIMARY ENTRY

SR-903

BUSINESS PARK

25' SETBACK FOR CLEARING AND GRADING FROM 25% SLOPE (TYP)

WASHINGTON STATE HORSE PARK

INTERSTATE 90

YAKIMA RIVER

CEMETERY EXPANSION

EXISTING CEMETERY

SCALE: 1" = 200'

200 100 0 200 400

CONTOUR INTERVAL = 2'

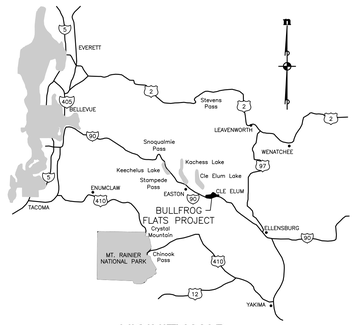
PRELIMINARY GRADING VOLUMES

RESIDENTIAL UNITS & BUSINESS PARK
CUT: 234,068 CY
FILL: 199,435 CY
NET: 34,633 CY (CUT)

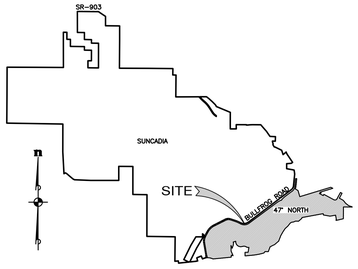
12" STRIPPING: 252,333 CY

RV & REC–1 UNITS
CUT: 116,741 CY
FILL: 110,122 CY
NET: 6,619 CY (CUT)

12" STRIPPING: 138,389 CY



VICINITY MAP
NOT TO SCALE



KEY MAP
NOT TO SCALE

47°N
RV RESORT & RESIDENCES

REVISIONS		
NO.	DESCRIPTION/DATE	BY

ESM CONSULTING ENGINEERS, LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003
www.esmcivil.com
(253) 838-6113
(425) 837-9900
FEDERAL WAY
EVERETT
Civil Engineering
Public Works
Land Planning
Landscape Architecture
Land Surveying
Project Management
WASHINGTON

SUN COMMUNITIES INC

47° NORTH

CONCEPTUAL GRADING PLAN

CITY OF CLE ELUM

JOB NO.	2050-001-018
DWG. NAME	EN-19
DESIGNED BY:	LGB
DRAWN BY:	JJH
CHECKED BY:	
DATE:	03/30/2020

FIG 1-1

1 OF 2 SHEETS

File: \\Esm8\comp\LSM--JOBS\2050\001\018\exhibits\EN-19.dwg
Plotted: 3/30/2020 9:35 AM
Plotted By: Jeff Hicks

47° N
RV RESORT & RESIDENCES

REVISIONS		
NO.	DESCRIPTION/DATE	BY

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003
FEDERAL WAY (253) 838-6113
EVERETT (425) 297-9900
www.esmcivil.com
Civil Engineering | Land Surveying | Land Planning
Public Works | Project Management | Landscape Architecture

SUN COMMUNITIES INC

47° NORTH

CONCEPTUAL GRADING PLAN

CITY OF CLE ELUM — WASHINGTON

JOB NO.	2050-001-018
DWG. NAME	EN-19
DESIGNED BY:	LGB
DRAWN BY:	JJH
CHECKED BY:	
DATE:	03/30/2020

FIG 1-1

2 OF 2 SHEETS

Section 2 Stormwater

This section updates the stormwater analysis for the property under the proposed SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment and SEIS Alternative 5. The stormwater analysis is compared to FEIS Alternative 5 as related to current code compliance, including the following items:

- Hydrology, including hydrologic model of existing and developed conditions. Developed conditions include development methodology for flow control, water quality, and conveyance.
- Water quality analysis of adjacent water bodies.

The current stormwater design standards for the property, including hydrologic modeling, are outlined in the 2019 Washington State Department of Ecology (Ecology) Stormwater Management Manual for Eastern Washington (SMMEW). The following current stormwater codes were also used for additional guidelines:

- 2019 Ecology Stormwater Management Manual for Wester Washington (SMMWW) – used for reference since it describes some stormwater concepts in more detail than the SMMEW.
- 2016 King County Surface Water Design Manual (KCSWDM) – used for reference as related to master drainage plans.
- 2019 Washington State Department of Transportation (WSDOT) Highway Runoff Manual (HRM) meets the level of stormwater management established in the SMMEW and has additional best management practices (BMPs).

2.1 Hydrology

2.1.1 Hydrologic Model

Following is an update to the stormwater hydrologic modeling completed for the 2002 EIS SETR:

- Evaluation of the original hydrologic modeling to verify it complies with current code requirements.
- Estimate of hydrologic impacts of the proposed SEIS Alternative 6 and SEIS Alternative 5 as compared to FEIS Alternative 5 and recommendations for associated mitigation.

2.1.2 Hydrologic Model Comparison

The hydrologic simulation model originally used for the 2002 EIS SETR is the same model used by the neighboring Suncadia project. The model is the Hydrologic Simulation Program - Fortran (HSPF) Release 11, (United States Environmental Protection Agency, 1996). The model continuously simulates the rainfall-runoff response of a watershed by simulating the physical process response to changing climatic conditions. HSPF is a standard hydrologic computational tool.

In past documentation, Ecology noted that HSPF is relatively complex to use and is best suited for basin plans and master drainage plans. Ecology requires the use of a continuous simulation model for basin plans. Due to the large size of the MountainStar watershed (19.5. square miles) and environmental review considerations, the HSPF model was selected for that project.

The 2019 SMMEW identifies HSPF as one of the best rainfall-runoff modeling approaches for Eastern Washington, but it does not go into further detail as to its benefits. Therefore, the 2016 KCSWDM was used as an additional guideline as relevant to HSPF and master drainage plans to confirm its applicability. The 2016 KCSWDM states *"HSPF is also an approved model but is more complex than other approved models and is typically used for basin planning and master drainage plan analyses."*

Therefore, the original hydrologic modeling continues to meet current code requirements and can be used for estimating hydrologic impacts of the proposed SEIS Alternative 6 and SEIS Alternative 5 development as compared to FEIS Alternative 5.

2.1.3 HSPF to MSRTS

Input to the model includes land segment information such as soil parameters, elevation and vegetation parameters, as well as several continuous climatological time series for the time period being simulated. The climatological parameters required by HSPF for runoff and snow simulation are:

- Precipitation
- Evaporation
- Air temperature
- Dewpoint temperature
- Solar radiation
- Wind movement

Runoff is modeled as the combined effect of surface flow, shallow subsurface flow (interflow) and groundwater flow response to climatological conditions. The distribution of flow between runoff mechanisms is determined by land segment characteristics such as soil moisture content, infiltration rate, and interception storage. The model generates flow from pervious and impervious land segments, and routes it through the drainage network. The drainage network can include pipes, streams, vaults, detention ponds, lakes and wetlands.

Snow accumulation and melt are simulated based on energy balance equations. Snowpack conditions, including ice content, density, albedo (reflectivity of the snow) and temperature, change over time according to climate conditions. Snowmelt water is added to precipitation inputs to the land segment and is routed through the land segment runoff mechanisms before entering the drainage network.

Northwest Hydraulics Incorporated, with the permission of King County, took the output from the HSPF model and used it to modify the King County Runoff Time Series (KCRTS) program. This new modified KCRTS program became the Mountain Star Runoff Time Series (MSRTS) that is used for the hydrology calculations for the Suncadia Master Planned Resort and the Bullfrog UGA that is now the proposed 47° North development. To most accurately model the pre and post developed conditions, all areas entered into MSRTS are classified in the gradual slope categories.

2.2 Existing Conditions

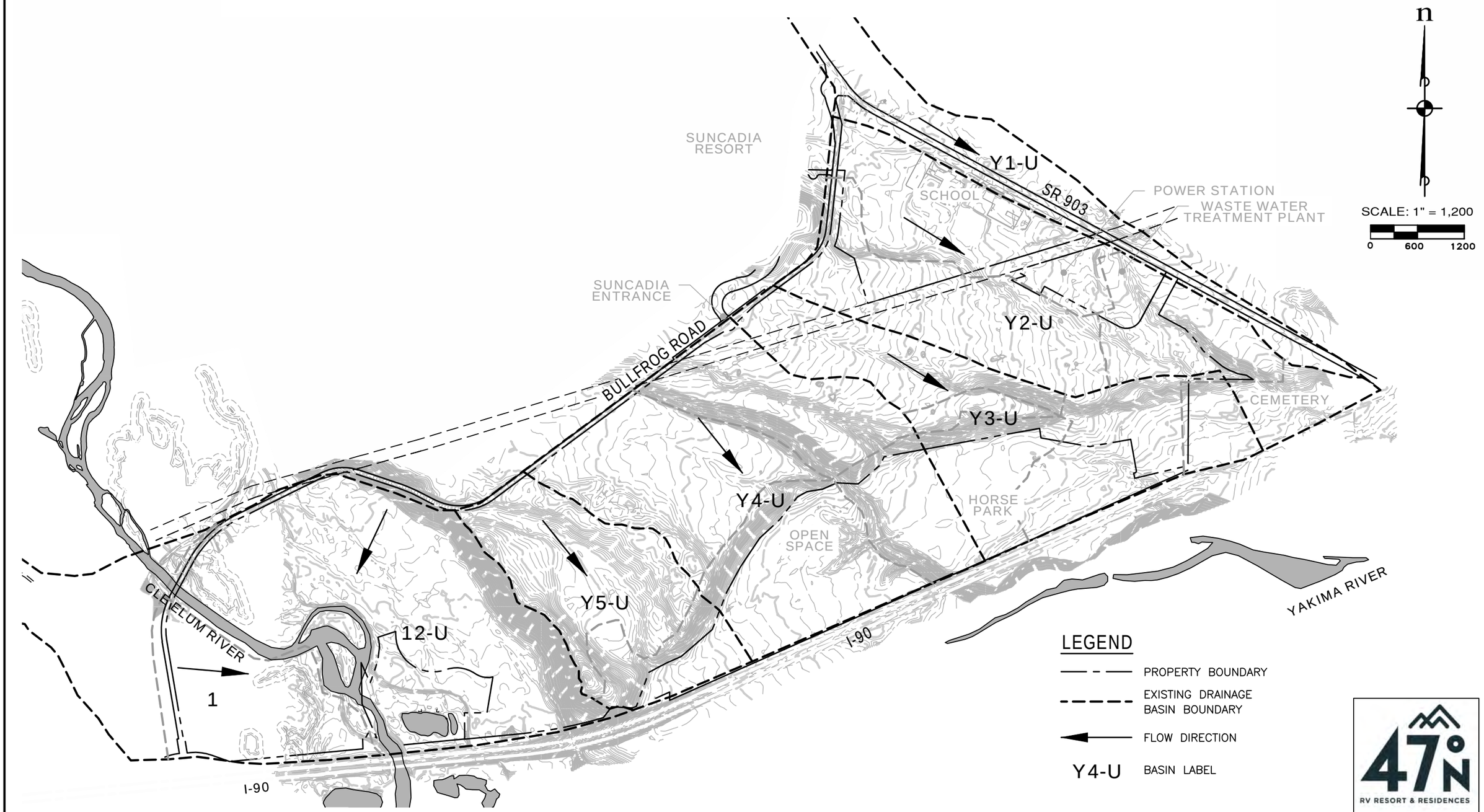
The existing conditions hydrologic model was developed as part of the 2002 EIS SETR, with basins and sub-basins, according to soil type, vegetative cover, and average slope conditions for FEIS Alternative 2, because it represented the highest impact alternative.

As described in Section 1 – Site Information, the SEIS Alternative 6 cleared, graded, and impervious areas are significantly less than FEIS Alternative 5, and SEIS Alternative 5 which are also less than FEIS Alternative 2. Therefore, the existing conditions hydrologic model of the 2002 EIS SETR is not required to be updated.

The existing condition basin information has been updated as relevant to the proposed 47° North development under SEIS Alternative 6 and SEIS Alternative 5. The soil type has been evaluated in more detail by Associated Earth Sciences, Inc. (AESI). The vegetative cover has been updated by Raedeke Associates, Inc.

The topographic aerial information and associated average slope conditions have remained generally the same to date, therefore the existing conditions model basin boundaries remain the same and are shown in **Figure 2-1**.

Alternative 6 and 47° North Master Plan



Source: ESM Consulting Engineers, 2020.

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003

Figure 2-1
Existing Subbasins

2.2.1 Soil Type

CDM (formerly AGI Technologies) originally characterized soil types on the property that have been analyzed in more detail by AESI for the 47° North development. **Table 2-1** summarizes the soil types present in each of the subbasins. The soil types for the property watershed are shown in **Figure 2-2.**

Table 2-1: Existing Subbasin Soil Types[a]

Subbasin	Basin Area (acres)	Alpine Till (Acres)	Outwash (Acres)	Dirty Glacial Outwash (acres)	Alluvium (acres)
Basin 1-1U	71	-	-	-	71
Basin 1-2U	-	-	-	-	-
Basin 12-U	225	13	163	-	49
Basin Y1-U	4	-	4	-	-
Basin Y2-U1	80	-	80	-	-
Basin Y2-U2	46	-	46	-	-
Basin Y2-U3	-	-	-	-	-
Basin Y2-U4	8	-	8	-	-
Basin Y3-U1	60	-	60	-	-
Basin Y3-U2	12	-	12	-	-
Basin Y3-U3	10	-	10	-	-
Basin Y3-U4	32	-	32	-	-
Basin Y3-U5	2	-	2	-	-
Basin Y4-U1	97	24	73	-	-
Basin Y4-U2	16	6	10	-	-
Basin Y4-U3	70	-	70	-	-
Basin Y4-U4	5	-	5	-	-
Basin Y5-U1	91	49	1	41	-
Basin Y5-U2	21	12	1	8	-
Total	**850**	**104**	**577**	**49**	**120**

[a] Includes only the portions of basins within 47° North development and commercial development.

2.2.2 Cover

Vegetative cover information has been field verified and analyzed by Raedeke Associates, Inc. into two general cover classes for the hydrologic model: forested for the majority of the site and grass with shrubs for the areas under the powerlines. The vegetative cover types for the property watershed are shown in **Figure 2-3.**

2.2.3 Slope

The existing ground topographic survey data has remained the same since the original 2002 EIS SETR was completed. In addition to the slope analysis performed originally, ESM has

performed an additional slope delineation, identifying 15 percent slope areas, 25 to 71 percent steep slope areas and the associated setback for clearing and grading. The slope limits were identified in the areas where the ground surface has a vertical relief of 10 feet or more at 25 percent. The results of the slope category delineation for the project watershed are shown in **Figure 2-4.**

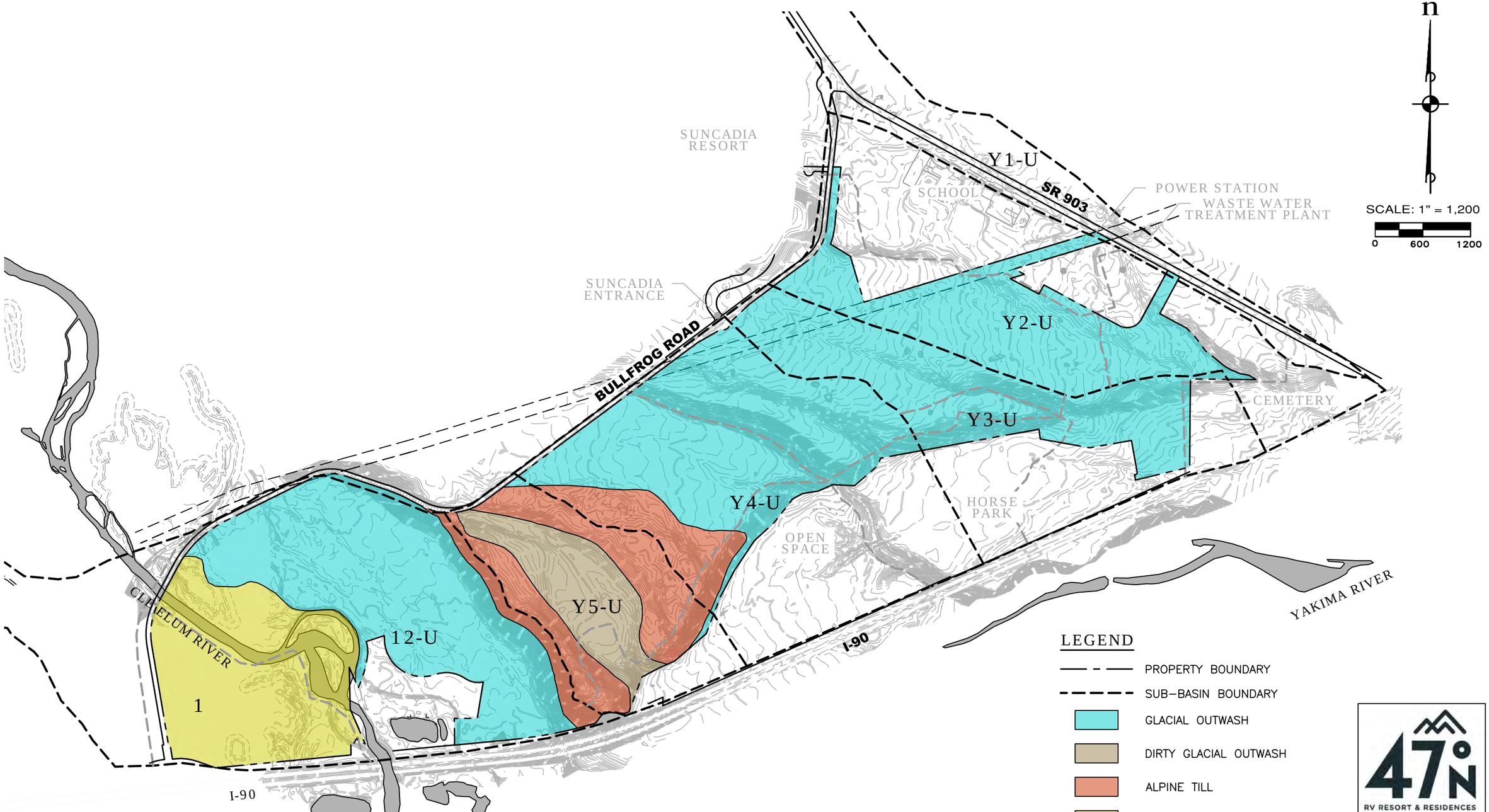
A summary of the existing conditions land use for the site is contained in **Table 2-2.**

Table 2-2: Pre-Developed Condition Subbasin Land-Use/Land Cover[a]

Subbasin	Basin Area (acres)	Forested Area (acres)	Grass/Shrubs (acres)	Impervious Roads (acres)	Impervious Other (acres)
Basin 1-1U	71	71	-	-	-
Basin 1-2U	-	-	-	-	-
Basin 12-U	225	225	-	-	-
Basin Y1-U	4	4	-	-	-
Basin Y2-U1	80	70	10	-	-
Basin Y2-U2	46	44	2	-	-
Basin Y2-U3	-	-	-	-	-
Basin Y2-U4	8	2	6	-	-
Basin Y3-U1	60	53	7	-	-
Basin Y3-U2	12	12	-	-	-
Basin Y3-U3	10	10	-	-	-
Basin Y3-U4	32	30	2	-	-
Basin Y3-U5	2	2	-	-	-
Basin Y4-U1	97	97	-	-	-
Basin Y4-U2	16	16	-	-	-
Basin Y4-U3	70	63	7	-	-
Basin Y4-U4	5	5	-	-	-
Basin Y5-U1	91	91	-	-	-
Basin Y5-U2	21	21	-	-	-
Total	**850**	**816**	**34**	**-**	**-**

[a] Includes only the portions of basins within 47° North development and commercial development.

Alternative 6 and 47° North Master Plan

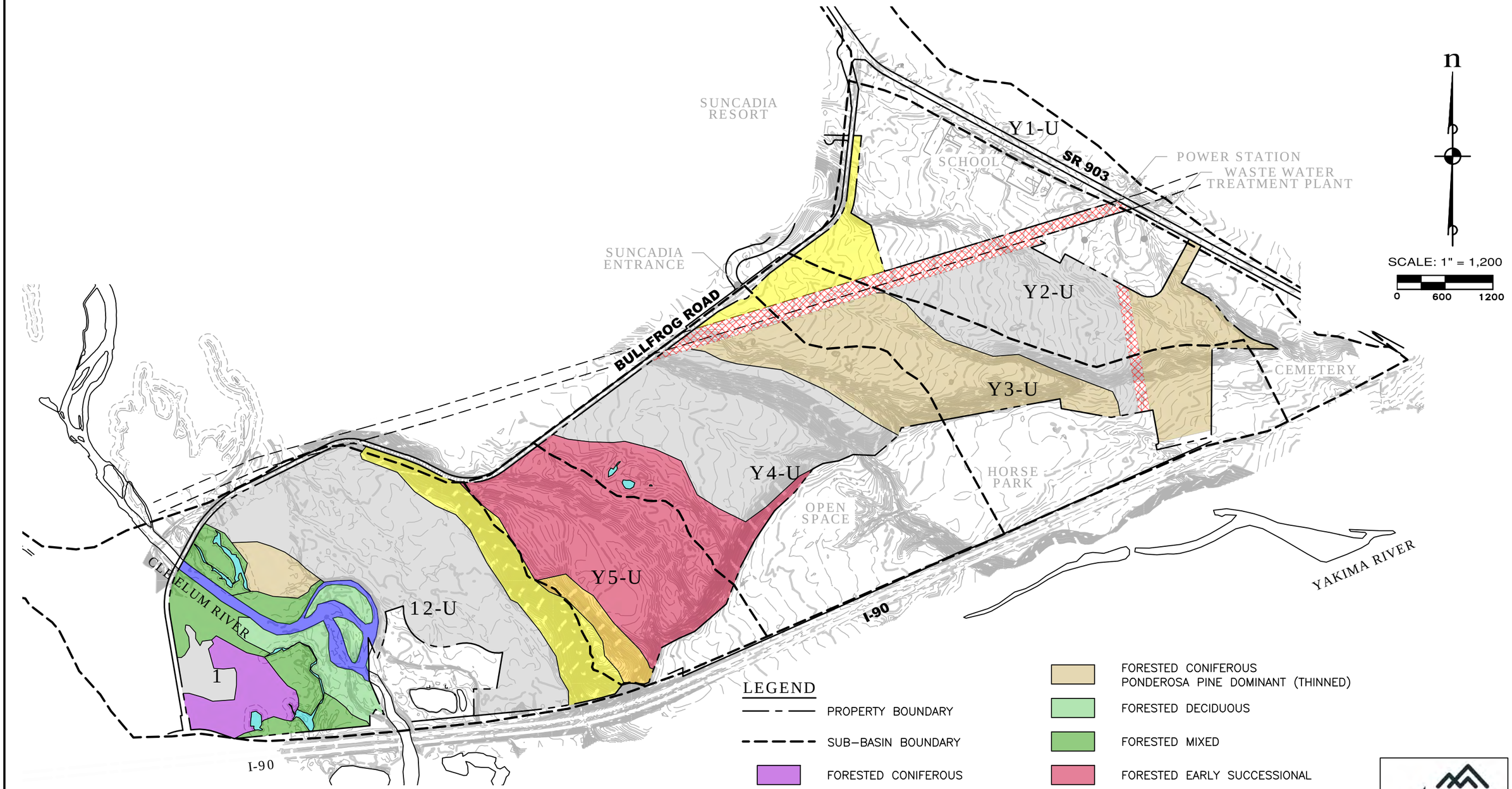


Source: Associated Earth Sciences Inc., 2020.

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003

Figure 2-2
Soil Types

Alternative 6 and 47° North Master Plan

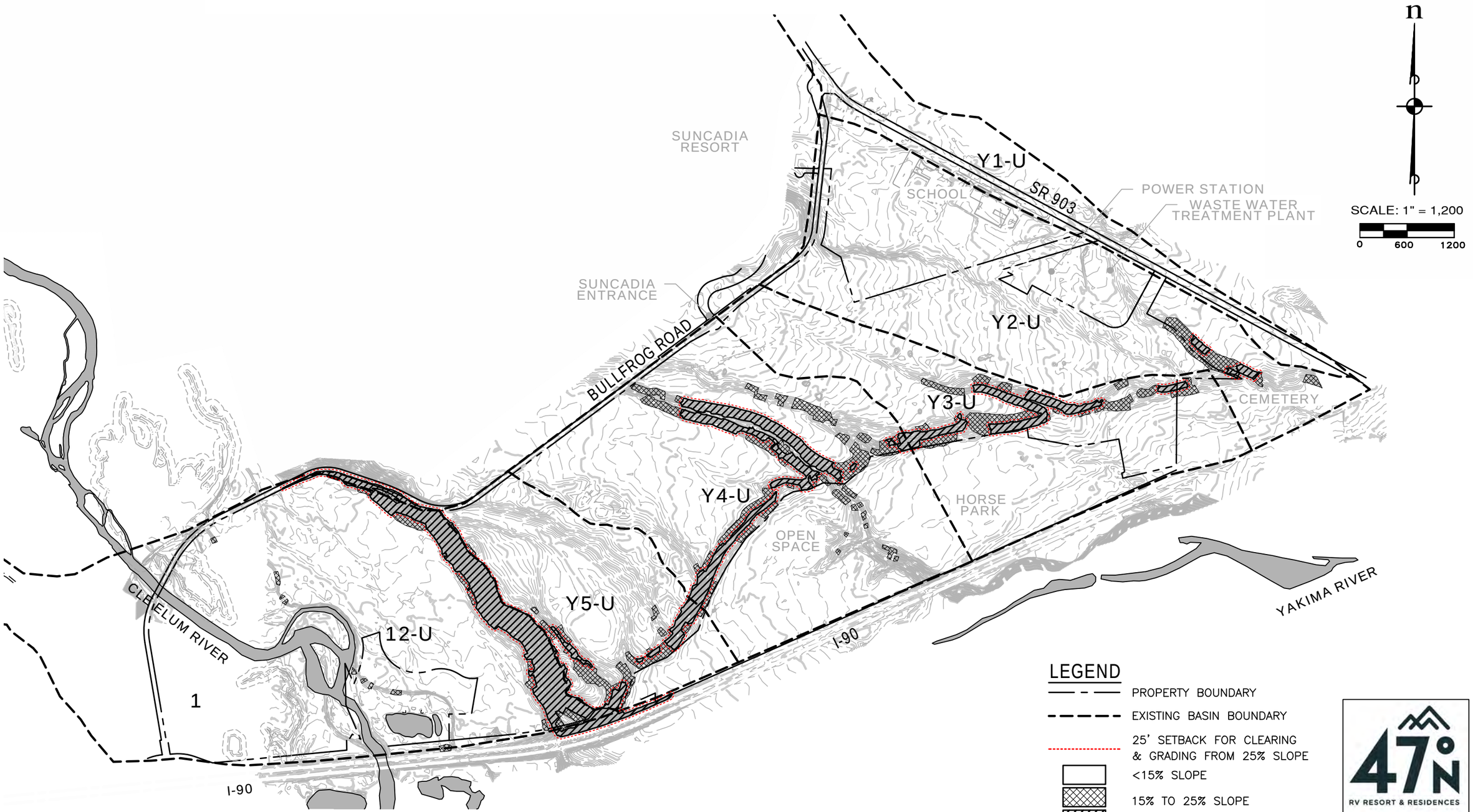


Source: Raedeke Associates Inc., 2020.

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003

Figure 2-3
Existing Vegetative Cover

Alternative 6 and 47° North Master Plan



Source: ESM Consulting Engineers, 2020.

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003

Figure 2-4
Slope Map

2.3 Developed Conditions

The developed condition drainage concept under SEIS Alternative 6 includes collection and conveyance facilities, water quality treatment facilities, infiltration basins, and detention basins.

Table 2-3 provides a summary of the developed land use/land cover.

Table 2-3: Developed Condition Subbasin Land-use/Land Cover, SEIS Alternative 6[a]

Subbasin	Basin Area (acres)	Undisturbed Area (acres)	Landscape Area (acres)	Impervious Road (acres)	Impervious Other (acres)
Basin 1-1U	71.0	71.0	-	-	-
Basin 1-2U	-	-	-	-	-
Basin 12-U	225.0	225.0	-	-	-
Basin Y1-U	4.0	-	0.7	-	3.3
Basin Y2-U1A	33.0	19.2	-	1.6	12.2
Basin Y2-U1B	13.0	-	6.4	1.4	5.2
Basin Y2-U1C	18.0	-	7.2	1.9	8.9
Basin Y2-U1D	20.0	0.9	9.8	2.2	7.1
Basin Y2-U2	49.0	2.7	15.9	5.7	24.7
Basin Y2-U3	-	-	-	-	-
Basin Y2-U4	6.0	6.0	-	-	-
Basin Y3-U1A	33.0	8.6	8.8	2.1	13.5
Basin Y3-U1B	16.0	-	7.3	2.0	6.7
Basin Y3-U2	10.0	-	5.0	1.1	3.9
Basin Y3-U3	12.0	12.0	-	-	-
Basin Y3-U4	51.0	20.7	28.3	0.4	1.6
Basin Y3-U5	2.0	2.0	-	-	-
Basin Y4-U1A	42.0	5.6	20.9	6.8	8.7
Basin Y4-U1B	55.0	15.0	22.1	8.2	9.7
Basin Y4-U2	13.0	13.0	-	-	-
Basin Y4-U3	13.0	1.3	6.9	1.3	3.5
Basin Y4-U4	52.0	32.7	17.5	0.6	1.2
Basin Y5-U1	95.0	24.0	50.2	8.1	12.7
Basin Y5-U2	17.0	17.0	-	-	-
Total	**850.0**	**476.7**	**207.0**	**43.4**	**122.9**

[a] Includes only the portions of basins within 47° North development and commercial development.

For comparison, impervious and landscaped areas for SEIS Alternative 6, FEIS Alternative 5, and SEIS Alternative 5 are summarized in Table 2-4.

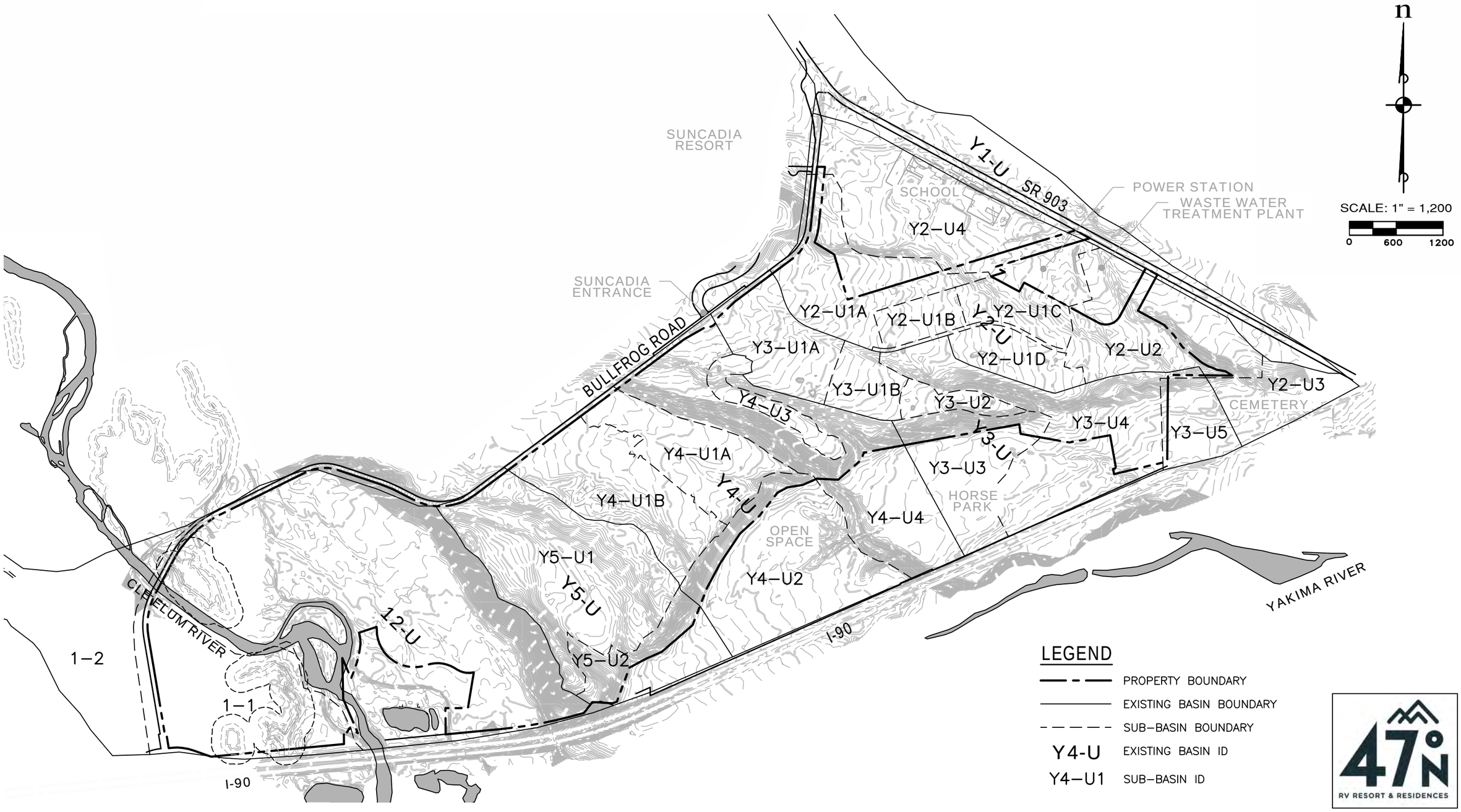
Table 2-4: Impervious and Landscape Area Summaries[a]

Surface Type, Acres	Project Alternative			
	SEIS Alternative 6		FEIS & SEIS Alternative 5[b]	
	Impervious Area	Landscape Area	Impervious Area	Landscape Area
Residential	71	72	104	57
Residential Amenity Center	5	1	0	0
Adventure Center	5	1	0	0
Roads	8	2	61	61
Public Facilities	0	0	4	19
Community Recreation Ctr.	0	0	6	4
School Expansion	0	0	8	9
Cemetery Expansion	0	0	1	7
Commercial Development	17	1	63	0
RV Park	57	88	0	0
RV Amenity Center	4	1	0	0
Total	**167**	**166**	**247**	**157**

[a]Note: Numbers may not sum to totals shown due to rounding.
[b]Excludes Reserve Area.

Developed conditions and developed condition basin boundaries are shown on **Figures 2-5** and **2-6.**

Alternative 6 and 47° North Master Plan



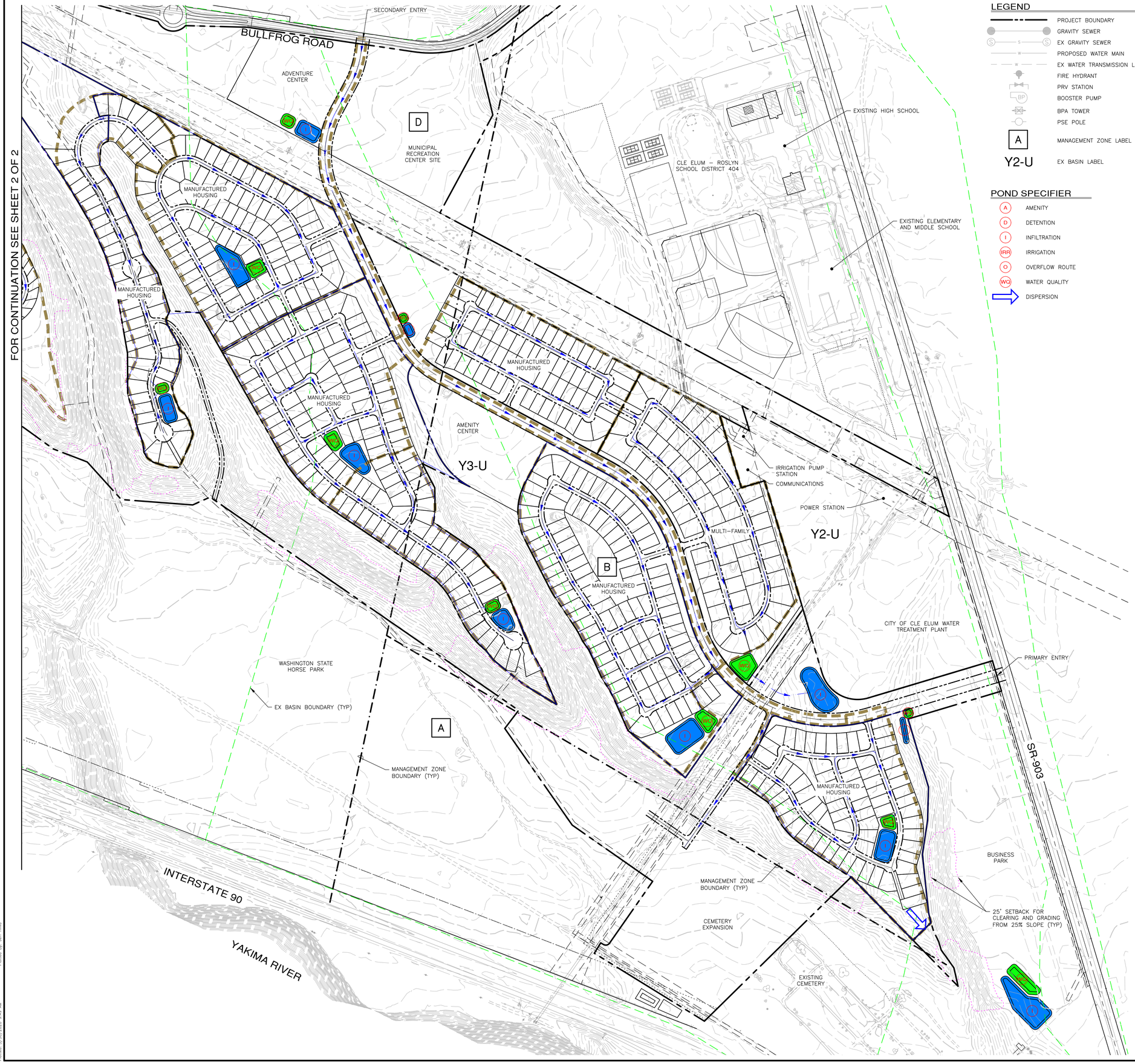
Source: ESM Consulting Engineers, 2020.

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003

Figure 2-5

Developed Condition Basin Boundaries

FOR CONTINUATION SEE SHEET 2 OF 2



LEGEND

- PROJECT BOUNDARY
- GRAVITY SEWER
- EX GRAVITY SEWER
- PROPOSED WATER MAIN
- EX WATER TRANSMISSION LINE
- FIRE HYDRANT
- PRV STATION
- BOOSTER PUMP
- BPA TOWER
- PSE POLE
- A — MANAGEMENT ZONE LABEL
- Y2-U — EX BASIN LABEL
- MANAGEMENT ZONE BOUNDARY
- DEV. MAJOR DRAINAGE BASIN BOUNDARY
- DEV. MINOR DRAINAGE BASIN BOUNDARY
- WATER QUALITY TREATMENT
- INFILTRATION TRENCH OR INFILTRATION POINT DRAIN
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAINAGE SWALE
- EX STORM DRAIN
- 25' SETBACK FOR CLEARING AND GRADING FROM 25% SLOPE
- WATER QUALITY
- INFILTRATION/DETENTION

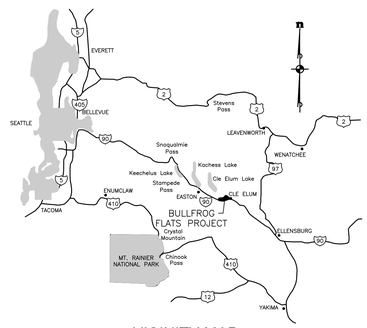
POND SPECIFIER

- A — AMENITY
- D — DETENTION
- I — INFILTRATION
- IRR — IRRIGATION
- O — OVERFLOW ROUTE
- WQ — WATER QUALITY
- DISPERSION

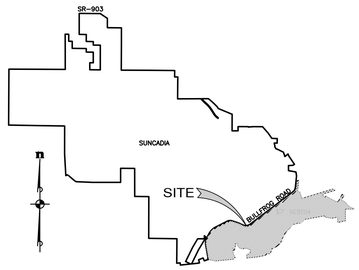
SCALE: 1" = 200'

200 100 0 200 400

CONTOUR INTERVAL = 2'



VICINITY MAP
NOT TO SCALE



KEY MAP
NOT TO SCALE

47° N
RV RESORT & RESIDENCES

REVISIONS		
NO.	DESCRIPTION/DATE	BY

ESM CONSULTING ENGINEERS, LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003
www.esmcivil.com
(253) 838-6113
(425) 337-3865
Land Planning
Landscape Architecture
Land Surveying
Project Management
Civil Engineering
Public Works

SUN COMMUNITIES INC

47° NORTH

COMCEPTUAL STORM DRAINAGE PLAN

CITY OF CLE ELUM WASHINGTON

JOB NO.	2050-001-018
DWG. NAME	EN-14
DESIGNED BY:	LGB
DRAWN BY:	JJH
CHECKED BY:	
DATE:	03/30/2020

FIG 2-6

1 OF 2 SHEETS

File: \\Esm8\engr\2050-001\2050\001\018\exhibits\EN-14.dwg
Plotted: 3/30/2020 9:49 AM
Plotted By: Jeff Hoss

LEGEND

- PROJECT BOUNDARY
- GRAVITY SEWER
- EX GRAVITY SEWER
- PROPOSED WATER MAIN
- EX WATER TRANSMISSION LINE
- FIRE HYDRANT
- PRV STATION
- BOOSTER PUMP
- BPA TOWER
- PSE POLE
- MANAGEMENT ZONE BOUNDARY
- DEV. MAJOR DRAINAGE BASIN BOUNDARY
- DEV. MINOR DRAINAGE BASIN BOUNDARY
- WATER QUALITY TREATMENT
- INFILTRATION TRENCH OR INFILTRATION POINT DRAIN
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAINAGE SWALE
- EX STORM DRAIN
- 25' SETBACK FOR CLEARING AND GRADING FROM 25% SLOPE
- WATER QUALITY
- INFILTRATION/DETENTION
- A — MANAGEMENT ZONE LABEL
- Y2-U — EX BASIN LABEL

POND SPECIFIER

- A — AMENITY
- D — DETENTION
- I — INFILTRATION
- IRR — IRRIGATION
- O — OVERFLOW ROUTE
- WQ — WATER QUALITY
- DISPERSION

SECONDARY ENTRY

PRIMARY ENTRY

BULLFROG ROAD

RV RESORT

RV RESORT

AMENITY CENTER

MANUFACTURED HOUSING

Y5-U

Y4-U

25' SETBACK FOR CLEARING AND GRADING FROM 25% SLOPE (TYP)

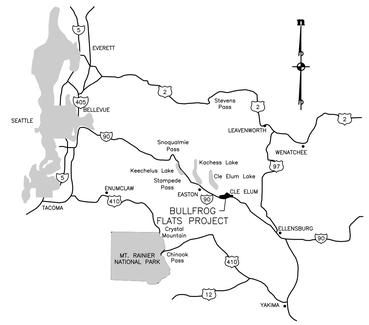
INTERSTATE 90

FOR CONTINUATION SEE SHEET 1 OF 2

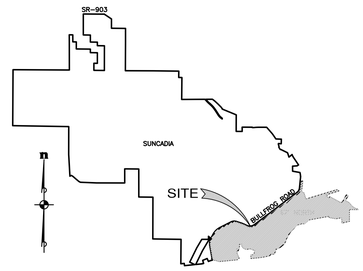
SCALE: 1" = 200'

200 100 0 200 400

CONTOUR INTERVAL = 2'



VICINITY MAP
NOT TO SCALE



KEY MAP
NOT TO SCALE

47°N RV RESORT & RESIDENCES

ESM CONSULTING ENGINEERS LLC
33400 8th Ave S, Suite 205
Federal Way, WA 98003
www.esmcivil.com
(253) 838-6113
(425) 657-0900
Civil Engineering
Public Works
Land Planning
Landscape Architecture
Land Surveying
Project Management

REVISIONS		
NO.	DESCRIPTION/DATE	BY

SUN COMMUNITIES INC

47° NORTH

CONCEPTUAL STORM DRAINAGE PLAN

CITY OF CLE ELUM WASHINGTON

JOB NO.	2050-001-018
DWG. NAME	EN-14
DESIGNED BY:	LGB
DRAWN BY:	JJH
CHECKED BY:	
DATE:	03/30/2020

FIG 2-6

2 OF 2 SHEETS

File: \\Esm8\engr\LSM-JOBS\2050\001\018\exhibits\EN-14.dwg
Plotted: 3/30/2020 9:49 AM
Plotted By: JeffHinz

2.4 Flow Control, Water Quality Treatment, and Conveyance Methodology

Under SEIS Alternative 6, stormwater runoff from the developed project areas impervious and landscaped surfaces will generally be collected in catch basins or roadside water quality swales and directed to water quality and infiltration or detention facilities (depending on existing soil features) via pipes or conveyance swales or dispersed, if feasible. Overflow routes will be provided for all proposed stormwater facilities.

2.4.1 Flow Control

The proposed flow control facilities will consist of either infiltration, detention, or sheet flow dispersion. Infiltration and detention facilities would be ponds or vaults, and the dispersion facilities would be trenches.

2.4.1.1 Infiltration Facilities

The majority of flow control facilities shown on **Figure 2-6** are infiltration ponds, as allowed by the existing outwash soils. These infiltration facilities were sized based on preliminary infiltration rates of 5 to 10 inches per hour recommended by AESI with a factor of safety of 20 percent. The infiltration facilities will infiltrate the 100-year storm event.

2.4.1.2 Detention Facilities

One proposed detention facility is located in the lower plateau of the RV park, because the existing soils in this area are alpine till. The proposed detention facility has been designed to detain the proposed developed flows and release pre-developed forested flows (50 percent of the 2-year storm event flow up to the 50-year storm event) to a dispersion trench that transforms the released flows to sheet flow dispersion at the natural discharge location.

2.4.1.3 Sheet Flow Dispersion

Sheet flow dispersion will also be used to for stormwater flow control, as may be applicable for single family and RV resort areas that abut open space and slope away from the developed areas in a native vegetated area with slopes less than 15 percent.

2.4.2 Water Quality Treatment

Water quality treatment will be provided for runoff from impervious road and parking surfaces. Treatment will be provided in one of several Ecology recommended treatment facility types. Water quality treatment options include wetponds, biofiltration swales, bio-infiltration and sheet flow dispersion. All water quality facilities are sized to treat the water quality storm. The water quality storm is that storm for which all storms equal or smaller in size account for 90 percent of the average annual runoff. Proposed water quality facilities are described in the following sections.

The 2002 UGA EIS divided the property into four water quality management zones named A, B, C, and D, as a result of underlying geology and the groundwater flow patterns. The developed

condition basin boundaries were established by an analysis of existing drainage basins, proposed roadway locations, and areas suitable for stormwater infiltration.

The water quality management zones and associated subbasins for the developed conditions are shown in **Figure 2-6**. The alluvial soils found adjacent to the Cle Elum River represent Management Zone C. The main central portion of the property is Management Zone D, which has areas of both till and outwash soils at the surface. Further east, under Management Zones A and B, the surface soils are similar to Zone D. However, Zones A and B are distinguished from D because the thick lacustrine aquitard is absent. Zone A is more proximate to the Yakima River and the associated Yakima Hatchery intake wells, which is why the two zones are separated.

Management Zone D runoff requires the basic level of treatment. This requirement can be satisfied by the use of a single facility such as a biofiltration swale or a water quality pond. Zone C does not have development proposed and thus has no direct influence on water quality. Zones A and B have less natural filtration afforded from the underlying sediments. Runoff from these zones requires enhanced treatment to further reduce dissolved metals and other contaminants prior to infiltration.

Management Zones A and B require the use of Ecology's enhanced treatment menu and Management Zone D will use the basic treatment menu. The water quality treatment best management practices most suited for the proposed 47° North development under SEIS Alternative 6 are described below.

2.4.2.1 Sheet Flow Dispersion

Sheet flow dispersion is an approved Ecology basic water quality and quantity control method for areas that preserve the existing forest duff, in a native vegetated area with slopes less than 15 percent.

2.4.2.2 Biofiltration Swales

Biofiltration swales are another approved Ecology basic water quality treatment facility which are sized to treat the water quality design storm. They may be used for enhanced treatment as part of a treatment train. Biofiltration uses vegetation in conjunction with slow and shallow-depth flow for runoff treatment. As runoff passes through the vegetation, pollutants are removed through the combined effects of sedimentation filtration, soil sorption, and plant uptake.

Biofiltration swales are not anticipated to be irrigated and therefore must be seeded with drought resistant vegetation suitable for the upper Kittitas County climate. The typical seed mixture that can be used for biofiltration swales is listed in **Table 2-5**.

Table 2-5: Typical Seed Mixture

Seed Mixture Type	Percentage
Sherman Big Blue Grass	10
Joseph Idaho Fescue	30
Sodar Streambank Bunch Grass	30
Secar Blue Bunch Wheat Grass	30

(Source: Wildland, Inc., Richland, WA, October 2000.)

This mixture may be changed based on recommendations from design professionals to accommodate site conditions.

2.4.2.3 Bioinfiltration Swales

Bioinfiltration swales, also known as grassed percolation areas, combine grasses (or other vegetation) and soils to remove stormwater pollutants by percolation into the ground. Their pollutant removal mechanisms include filtration, soil sorption, and uptake by vegetated root zones. Bioinfiltration swales may be used for basic or enhanced water quality treatment.

2.4.2.4 Bioretention Cells or Swales

Bio-retention cells or swales provide treatment by using a designed planting soil mix and a variety of plant material, including trees, shrubs, grasses, and/or other herbaceous plants. Bioretention cells or swales may be used for basic or enhanced water quality treatment.

2.4.2.5 Water Quality Ponds or Vaults

Water quality ponds or vaults provide basic runoff treatment by allowing the settling of particulates during quiescent conditions. Additionally, when a shallow marsh area is provided for a wet pond, basic runoff treatment is provided by biological uptake through plant growth and by vegetative filtration. Water quality ponds contain a permanent pool of water and a wet pool equal to the runoff volume of the water quality storm event. Water quality ponds or vaults are sized based upon the volume of the water quality storm and may be combined with a detention facility or be part of a treatment train for enhanced treatment.

2.4.2.6 Infiltration Ponds

Infiltration ponds may also be used for basic or enhanced water quality treatment where soils remove pollutants from stormwater using either suitable native soils or a treatment layer.

2.4.2.7 Sand Filters

Sand filters provide enhanced water quality treatment from filtration, which removes particulates and associated contaminants, and from adherence of contaminants within the filter.

2.4.2.8 Filter Strips

Filter strips provide biofiltration of runoff and basic or enhanced water quality treatment. They may be used in a treatment train for enhanced water quality or stand-alone, with compost-amended vegetation. Filter strips are typically installed adjacent to paved areas (road, parking, drives), receive runoff directly from those areas, and discharge to a collection system.

2.4.3 Conveyance

Collection and conveyance of stormwater will be by conventional methods of curbs and gutters, catchbasins, and buried storm drainpipes, depending on the development area. Where appropriate to specific site design, conveyance by grass-lined ditches and swales may be considered.

Culvert crossings will be designed for the locations where proposed roadways or utility infrastructure cross draws or ravines. These culverts will be sized to convey the upstream runoff, following Ecology requirements.

2.4.4 Overflow Routes

Each detention or infiltration stormwater facility is anticipated to have an overflow route that discharges to an overflow drainage swale or enclosed pipe where it is conveyed to a downstream facility or controlled dispersion area. In the case of infiltration ponds, overflow routes are provided to the next downstream infiltration facility where feasible. This provides for the infiltration of stormwater even if one facility is partially clogged or out of operation.

2.5 Developed Condition Summary

Based on the 2002 EIS SETR, 7.40 acre-feet of average runoff was established per acre of equivalent impervious area. The total impervious area and estimated runoff comparing SEIS Alternative 6 with FEIS Alternative 5 and SEIS Alternative 5 is shown in **Table 2-6.**

Table 2-6: Estimated Annual Runoff

Alternative	Equivalent Impervious Area, Acres	Estimated Average Runoff (Surface and Interflow), Ac-Ft
SEIS Alt. 6	166	1,236
FEIS & SEIS Alt. 5	247	1,828

2.6 Water Quality Analysis

A Water Quality Technical Report was originally completed as part of the 2002 UGA EIS as it relates to water quality elements of the Yakima and Cle Elum Rivers and groundwater.

The proposed 47° North development under SEIS Alternative 6 will infiltrate or disperse all stormwater runoff and no direct discharge of stormwater is proposed to the Yakima river. The proposed infiltration and dispersion facilities are at a distance of approximately 3,000 feet from the Yakima river.

No development is proposed in the Cle Elum river drainage basin.

The purpose of this water quality analysis is to update the 2002 UGA EIS water quality information for current conditions and codes currently in effect.

2.6.1 Hydrologic Setting

The hydrologic setting of the property was previously described in the 2002 UGA EIS and has not changed in 2020. The proposed 47° North development lies within the upper Yakima River drainage basin, which is designated as Water Resource Inventory Area (WRIA) 39 (Washington State Department of Fisheries [WDF] 1975). The property is adjacent to the lower portion of the Cle Elum River between Bullfrog Road and Interstate 90. The Cle Elum River runs along the western boundary of the site and joins the Yakima River at River Mile (RM) 185.6. The Yakima River and Interstate 90 run along the southern boundary of the site.

528 acres of the property is topographically located within the Yakima River basin, and 296 acres is topographically within the Cle Elum River basin. Due to the nature of surface soils on the site, natural drainage from the site occurs through infiltration and subsurface groundwater flow. The Cle Elum River flows are controlled at the Cle Elum Dam operated by the United States Bureau of Reclamation (USBR). The dam is upstream of the project at RM 8.2. Water impounded by the dam forms Cle Elum Lake, which the USBR uses primarily for storing fall, winter and spring flows to supply late-spring through early fall irrigation demands in the Yakima Valley. A secondary function of the dam is flood control.

2.6.2 Surface Water Quality

Use designations for fresh waters by water resource inventory area (WRIA) are described in WAC 173-201A-602.

The Yakima River, for the reach from the Cle Elum River confluence (RM 185.6) up to its headwaters, has the following uses:

Aquatic Life Use:	Core summer salmonid habitat
Recreation Use:	Primary contact recreation
Other Uses:	Water Supply Uses (Domestic, Industrial, Agricultural, Stock) and Miscellaneous Uses (Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics).

The Yakima River, from its mouth to the confluence with the Cle Elum River has the following uses:

Aquatic Life Use:	Salmonid spawning, rearing, and migration
Recreation Use:	Primary contact recreation
Other Uses:	Water Supply Uses (Domestic, Industrial, Agricultural, Stock) and Miscellaneous Uses (Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics).

The Cle Elum River from the mouth to Cle Elum Dam (RM 8.2) is identified as water body segment WA-39-1050 and has the following uses:

Aquatic Life Use:	Core summer salmonid habitat
Recreation Use:	Primary contact recreation
Other Uses:	Water Supply Uses (Domestic, Industrial, Agricultural, Stock) and Miscellaneous Uses (Wildlife Habitat, Harvesting, Commerce/Navigation, Boating, Aesthetics).

The Yakima River, from its mouth to the confluence with the Cle Elum River has the following water quality criterion:

Temperature:	17.5°C (63.5°F)
Supplemental spawning:	None
Dissolved Oxygen (DO):	8.0 mg/L
pH:	pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.5 units
Turbidity:	5 NTU over background when the background is 50 NTU or less; or a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Bacteria:	E. coli and fecal coliform criteria are expressed as colony forming units (CFU) or most probable number (MPN). To protect recreational use: ➢ E.coli organism levels must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 320 CFU or MPN per 100 mL. ➢ Fecal coliform organism levels must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 CFU or MPN per 100 mL. (The use of

fecal coliform organism levels to determine compliance will expire December 31, 2020.)

Other requirements:

- A minimum of three samples is required to calculate a geometric mean for comparison to the geometric mean criteria. Sample collection dates shall be well distributed throughout the averaging period so as not to mask noncompliance periods.
- When averaging bacteria sample values for comparison to the geometric mean criteria, it is preferable to average by season. The averaging period of bacteria sample data shall be ninety days or less.

The Yakima River, for the reach from the Cle Elum River confluence up to its headwaters, and the Cle Elum River from the mouth to Cle Elum Dam have the following water quality criterion:

Temperature:	16°C (60.8°F)
Supplemental spawning:	Salmon and trout (13°c) from 9/15 to 6/15
Dissolved Oxygen (DO):	9.5 mg/L
pH:	pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 units
Turbidity:	5 NTU over background when the background is 50 NTU or less; or a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Bacteria:	E. coli and fecal coliform criteria are expressed as CFU or MPN.

To protect recreational use:

- E.coli organism levels must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 320 CFU or MPN per 100 mL.
- Fecal coliform organism levels must not exceed a geometric mean value of 100 CFU or MPN per 100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 CFU or MPN per 100 mL. (The use of fecal coliform organism levels to determine compliance will expire December 31, 2020.)

Other requirements:

- A minimum of three samples is required to calculate a geometric mean for comparison to the geometric mean

criteria. Sample collection dates shall be well distributed throughout the averaging period so as not to mask noncompliance periods.

- When averaging bacteria sample values for comparison to the geometric mean criteria, it is preferable to average by season. The averaging period of bacteria sample data shall be ninety days or less.

For both the Yakima and Cle Elum Rivers, the water quality standards have generally remained the same since the 2002 UGA EIS and are listed below. The only notable update is that the Yakima River (from its mouth to the confluence with the Cle Elum River) has a reduced temperature requirement from 18°C (64.4°F) to 17.5°C (63.5°F). This temperature variation does not affect the proposed development because there is no direct discharge of stormwater proposed to the Yakima River.

2.6.3 The Water Quality Assessment and the 303(d) List

The Water Quality Assessment was completed by Ecology with water bodies divided into the following categories:

Category 1:	Meets standards for parameter(s) for which it has been tested.
Category 2:	Waters of concern.
Category 3:	Waters with no data or insufficient data available.
Category 4:	Polluted waters that do not require a TMDL because a) they have an approved TMDL being implemented, or b) they have a pollution control program in place that should solve the problem, or c) are impaired by a non-pollutant such as low water flow, dams, or culverts.
Category 5:	Polluted waters that require a TMDL – the 303(d) list.

Based on the Ecology website, the Yakima River is identified as Category 1 and the Cle Elum River is identified as Category 2, waters of concern with the specific concern of temperature. No development is proposed in the Cle Elum river drainage basin; therefore no mitigation is proposed.

2.6.4 Stormwater Runoff National Pollutant Discharge Elimination System (NPDES) Permit

Temporary stormwater management will be completed such as to prevent the transport of sediment from the project site to downstream water resources, following the best management practices and requirements of the Construction Stormwater Pollution Prevention Plan.

For all new construction activity exceeding 1 acre in size, a Notice of Intent (NOI) must be filed for a NPDES General Permit with Ecology, as associated with clearing, grading, and temporary erosion and sediment control. A Stormwater Pollution Prevention Plan (SWPPP) is also required for the project.

The property currently has an active NPDES Permit (No. WA0052361). This permit will be amended to include a transfer of coverage for new ownership. A SWPPP document was also prepared by W&H Pacific, Inc. in 2002. The SWPPP will be amended prior to the construction phase of the project as applicable to the proposed 47° North development and current Ecology requirements.

2.7 Stormwater Summary

The proposed SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment development cleared and impervious areas are significantly less than FEIS Alternative 5 in the 2002 EIS SETR and SEIS Alternative 5, and therefore will generate less impact to onsite stormwater as well as downstream to the Yakima River. No significant impacts are anticipated, and no additional mitigation is proposed other than what is already required by current codes.

Presented in this section is information on the preliminary water system concepts for SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment and a comparison to the FEIS Alternative 5 estimates as evaluated in the 2002 EIS SETR and SEIS Alternative 5.

3.1 System Capacity Requirements

The City of Cle Elum 2015 Water System Plan (WSP) was used as a guideline to determine requirements for the proposed 47° North development. This plan is in the process of being updated with completion anticipated in February 2022.

Two water systems are available for the 47° North development: a treated water system and an untreated water system.

The proposed 47° North development under SEIS Alternative 6 intends to use the treated water system as a standard potable water system providing water to all dwelling units and commercial uses in the area. The treated system would provide some minor irrigation for common areas as associated with entries, amenities, and public road right-of-way. The proposed project will include low-flow fixtures consistent with State building code requirements, limitations on landscaping, and other water-conservation measures as coordinated with the City of Cle Elum.

The untreated water system is available, if desired, for irrigation water to larger demand areas such as amenity and adventure centers, recreation areas and other open spaces.

3.2 Treated (Domestic) Water Requirements

Water demands for the development were based on Washington State Department of Health standard unit demands. Unit interior water demands for each unit type are described below.

3.2.1 Single Family and Multi-Family

Unit interior demands for single family residences and multi-family unit accommodations are summarized in Tables 3-1 and 3-2, respectively.

Table 3-1: SEIS Alternative 6 Single Family Residences

	Primary Residences
Party Size	2.34
Unit Demand (gpdpc)	100
Total Interior Unit Demand (gpd)	234
Average Annual Occupancy	90%

Table 3-2: SEIS Alternative 6 Multi-Family Units

	Primary Residences
Party Size	2.34
Unit Demand (gpdpc)	100
Total Interior Unit Demand (gpd)	234
Average Annual Occupancy	90%

Water use for both single and multi-family units was calculated using the Total Interior Unit Demand of 234 gpd x 707 units x 90 percent average annual occupancy resulting in 148,894 gpd.

3.2.2 Commercial Development

Potable water use for the business center was based on 0.085 gpd x 150,000 square-feet of office space resulting in 12,750 gpd.

3.2.3 RV Park Guests

Campsite water use was based on 627 units x 3 persons per unit x unit demand of 50 gpd per person per unit x average annual occupancy was assumed to be 50 percent resulting in 47,025 gpd.

3.2.4 Amenity and Adventure Center Guests

The amenity and adventure centers demand is estimated to be 12 gpd per person, matching the 2002 EIS SETR. A total maximum of 500 guests per day was assumed for both amenity centers and the adventure center resulting in 6,000 gpd.

3.2.5 Outside Water Demands

Outside water demands were calculated as a percentage of total landscaped area. The total proposed development landscaped area under SEIS Alternative 6 is approximately 200 acres, and 10 percent is estimated to be irrigated, for a total irrigated landscaped area of 20 acres. For the commercial area, the estimated irrigated landscaped area is 1 acre.

The irrigation demands calculated for the months of June to September using the same irrigation factors from the 2002 EIS SETR. The net unit area irrigation requirement for turf and the resulting applied irrigation rate at a 60 percent irrigation efficiency are given in Table 3-3. Maximum monthly irrigation allowances for each maximum irrigated area are presented in Table 3-4.

Table 3-3: Irrigation Requirements

Month	Net Irrigation Requirement, in [a]	Applied Irrigation Requirement, in [b]
May	0.0	0.0
June	3.3	5.5
July	6.5	10.8
August	4.8	8.0
September	3.5	5.8
October	0.0	0.0
Total	18.1	30.2

[a] Source: Washington State Irrigation Guide, turf/pasture requirements, Cle Elum.
[b] At 60 percent irrigation efficiency.

Table 3-4: Maximum Allowable Irrigation Flows, gpd

Month	Residential	Commercial
June	99,559	4,978
July	195,497	9,775
August	144,813	7,241
September	104,989	5,249

Monthly treated water demands at buildout, including irrigation demands, for SEIS Alternative 6, FEIS Alternative 5, and SEIS Alternative 5 are presented in Tables 3-5 and 3-6.

Table 3-5: Avg. Daily Treated Water Demands at Buildout, mgd

Alt. No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.	Total (ac-ft)
SEIS 6	0.20	0.20	0.20	0.20	0.20	0.30	0.40	0.35	0.31	0.20	0.20	0.20	0.25	277
FEIS 5[a]	0.33	0.33	0.33	0.33	0.33	0.47	0.60	0.53	0.48	0.33	0.33	0.33	0.39	442
SEIS 5[a]	0.31	0.31	0.31	0.31	0.31	0.41	0.50	0.45	0.41	0.31	0.31	0.31	0.35	389

[a] Excludes Reserve Area.

Table 3-6: Avg. Daily Treated Water Demands at Buildout for Commercial Development Demands, mgd

Alt. No.	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.	Total (ac-ft)
SEIS 6	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02	17
FEIS 5[a]	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	100
SEIS 5[a]	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	100

[a] Excludes Reserve Area.

Peaking factors used for the water system design are presented in Table 3-7 and are applied to maximum month average daily demands. Equalizing storage will be provided to accommodate

hourly peak requirements. These peaking factors are applicable only to the treated water demands.

Table 3-7: Peaking Factors

Ratio	Peaking Factor
Maximum Daily to Average Daily (Maximum Month)	2.00
Maximum Daily to Average Daily for Commercial Development (Maximum Month)	3.33
Maximum Hourly to Average Daily (Maximum Month)	5.00

Using the above average daily water demands and peaking factors, the maximum month design demands (at buildout) are given in Table 3-8. The maximum month design demands (at buildout) for the commercial development demands are given in Table 3-9.

Table 3-8: Maximum Month Treated Water Demands

	Average Daily Demand (ADD)[a,b]	Maximum Day Demand (MDD)[a,c]	Peak Hour Demand (PHD)[a,d]
SEIS Alt. 6	0.27 mgd (189 gpm)	0.61 mgd (420 gpm)	1.21 mgd (840 gpm)
FEIS Alt. 5[e, f]	0.60 mgd (417 gpm)	0.88 mgd (611 gpm)	1.27 mgd (882 gpm)
SEIS Alt. 5[e]	0.38 mgd (265 gpm)	1.50 mgd (1,042 gpm)	3.00 mgd (2,085 gpm)

[a] For treated water the daily system loss is calculated as total annual demand x 10% / 365 = 24,730 gpd (SEIS Alt. 6), 35,800 gpd (FEIS Alt. 5), and 34,690 gpd (SEIS Alt. 5).
[b] ADD is calculated as average month estimated demand + system loss.
[c] MDD was obtained from Tables 3 and 4 of the HLA memorandum dated August 14, 2020.
[d] PHD was obtained from Tables 3 and 4 of the HLA memorandum dated August 14, 2020.
[e] Excludes Reserve Area.
[f] Uses original 2002 EIS SETR calculations and 1.5 MDD and 2.2 PHD peaking factors.

Table 3-9: Maximum Month Treated Water Demands, Commercial Development Demands

	Average Daily Demand (ADD)[a,b]	Maximum Day Demand (MDD)[a,c]	Peak Hour Demand (PHD)[a,d]
SEIS Alt. 6	0.02 mgd (11 gpm)	0.09 mgd (60 gpm)	0.08 mgd (52 gpm)
FEIS Alt. 5[e, f]	0.09 mgd (60 gpm)	0.13 mgd (90 gpm)	0.19 mgd (130 gpm)
SEIS Alt. 5[e]	0.10 mgd (69 gpm)	0.32 mgd (221 gpm)	0.46 mgd (326 gpm)

[a] For treated water the daily system loss is calculated as total annual demand x 10% / 365 = 1,500 gpd (SEIS Alt. 6), 8,100 gpd (FEIS Alt. 5), and 9,000 gpd (SEIS Alt. 5).
[b] ADD is calculated as average month estimated demand + system loss.
[c] MDD is calculated as maximum month estimated demand x 3.33 + irrigation + system loss.
[d] PHD is calculated as maximum month estimated demand x 5.00 + irrigation + system loss.
[e] Excludes Reserve Area.
[f] Uses original 2002 EIS SETR calculations and 1.5 MDD and 2.2 PHD peaking factors.

3.2.6 Equivalent Residential Unit (ERU) Demands

The ERU values were evaluated as part of the original 2002 EIS SETR and estimated at 302 gpd/ERU ADD and 750 gpd/ERU MDD. An analysis of ERU values will be completed to confirm demand.

In accordance with the City of Cle Elum's adopted water policy for the urban growth area, the City will initially issue certificates of water availability for the project based on the water use rate set forth in the City's 2015 Comprehensive Water Plan. The Washington State DOH design criteria requires a minimum of three years of historical consumption data be used in establishing ERU average demand.

3.2.7 Fire Flows

Fire flow and domestic water demand requirements will account for all buildings other than residential to be sprinkled.

Chapter 248-293-640 Washington Administrative Code (WAC), specifies minimum fire flow demands of 500 gpm for 30 minutes for residential areas, and 750 gpm for 60 minutes for commercial and multi-family areas. The City of Cle Elum supersedes this requirement in the WSP where fire suppression storage equals 480,000 gallons (4,000 gpm for 2 hr duration). The minimum fire flow at locations not otherwise identified in the WSP is 1,000 gpm.

All proposed construction will be evaluated in accordance to the City of Cle Elum, the 2015 International Fire Code, and the City of Cle Elum Fire Chief for compliance with applicable fire protection safety standards.

3.3 Untreated Water Requirements

Untreated water may be used in the future for recreational irrigation and public landscape irrigation. Untreated water is not proposed to be used at this time.

3.4 Water Use Standards

Draft Water Use Standards will be updated as part of the Development Standards for the 47° North development. The Standards would be required under the project CC&R's. The Draft Water Use Standards are provided at the end of this section. The conditions of approval as well as the CC&Rs will require that these water use standards in the UGA be met.

3.5 Source of Water Supply

Based on the 2015 Water System Plan, the domestic water system in Cle Elum consists of a municipal water supply system on three distribution pressure zones. Four sources supply water to the system. Two major water supply sources owned by the City of Cle Elum are surface water

sources on the Yakima and Cle Elum Rivers. These two river sources pump water to the Cle Elum water treatment plant for filtration and chlorination before entering the distribution system. The Town of South Cle Elum also owns two ground water sources (Well No. 1, and Well No. 7) that are included in the regional water system and have have a combined pumping capacity of 300 gpm.

There is an existing water treatment plant, located at the northeast corner of the property, just west of SR 903 and south of the Puget Sound Energy Substation as shown in Figure 3-1.

The existing water treatment plant has been active since 2004. Its purpose is to generate potable water by filtering and processing raw Yakima River and Cle Elum River water. The current treatment capacity of this plant currently is 6 million gallons per day with room for expansion to 8 million gallons per day. This water plant serves the City of Cle Elum, the Town of South Cle Elum, and Suncadia.

FEIS Alternative 5 of the 2002 EIS SETR was included as a community planned to be serviced by this water treatment plant.

3.6 Preliminary Water Distribution System Plan

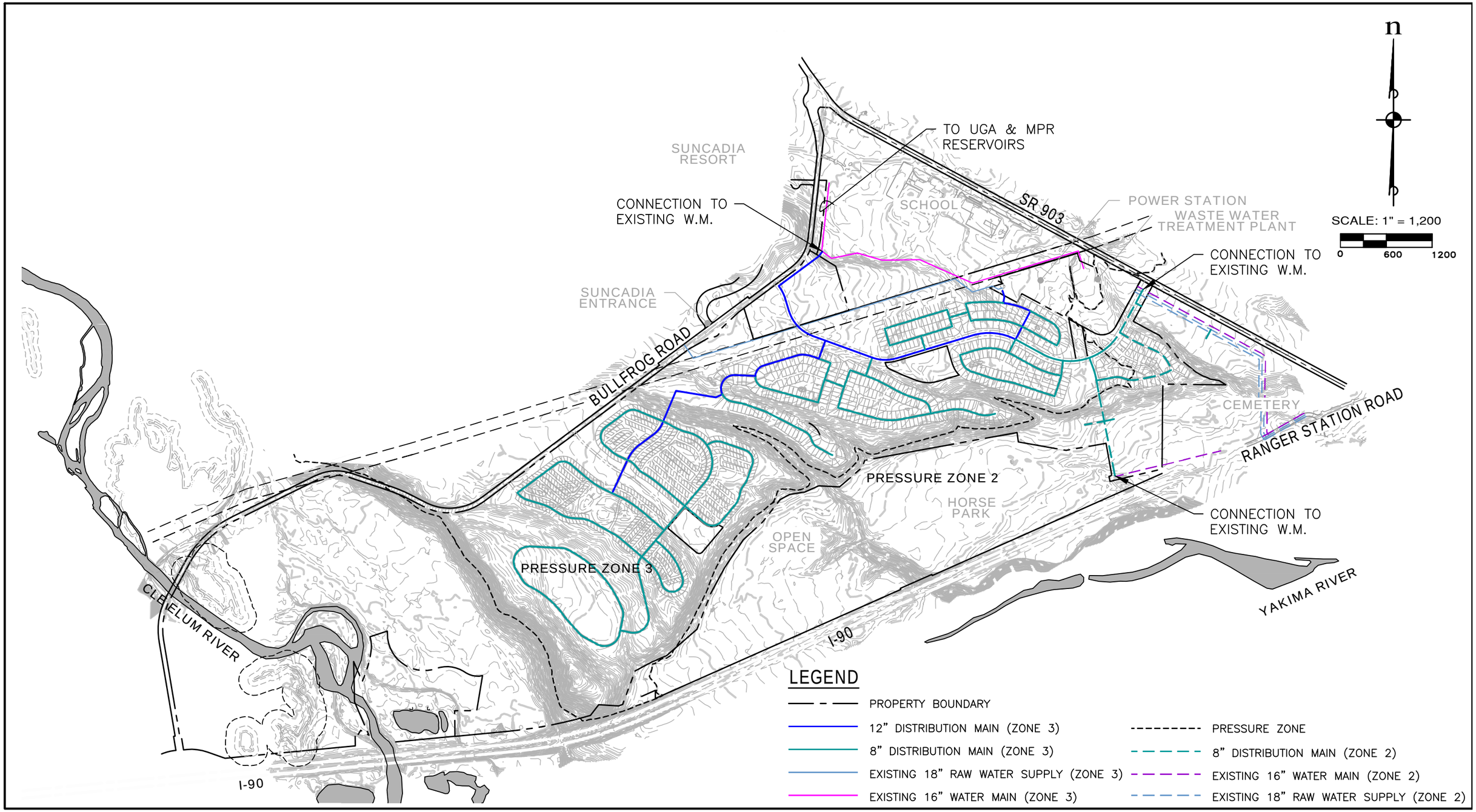
The preliminary water distribution system for domestic supply for the 47° North development under SEIS Alternative 6 is shown on Figure 3-1. Also shown on Figure 3-1 are the existing water utilities, including the treated domestic water transmission main and the untreated raw water irrigation transmission main.

The preliminary water distribution system has four points of connections proposed in order to avoid dead-end conditions that can hinder fire flow demand and add flexibility for maintenance and operation of the network system. The available points of connection for the site's fire and treated domestic water supply are as follows:

- To an existing 16-inch diameter treated water line that supplies the reservoir tank, at a point north of the BPA easement and west of the existing high school site (Pressure Zone 3).
- To an existing 16-inch diameter treated water line that supplies the reservoir tank, at a point south of the BPA easement and south of the existing high school site (Pressure Zone 3).
- To an existing 16-inch diameter City supply line that flows from the Water Treatment Plant towards Cle Elum, on the east side of the project site, along SR 903 (Pressure Zone 2).
- To an existing 16-inch diameter City treated water main stub-out on Douglas Munro Boulevard, near the southwest corner of the existing cemetery (Pressure Zone 2).

The proposed single- and multi-family development as well as the RV resort will be part of a private Group A water system that will be permitted thru the Department of Health and owned, operated, and maintained privately. One water meter is anticipated to serve the single- and multi-family portion of the developed site and a second water meter will serve the RV resort site. The water mains will connect to the nearest available points of connection as listed above.

The commercial development will be served by the existing 8-inch diameter treated City supply line in an estimated looped system and metered thru the City of Cle Elum.



Source: ESM Consulting Engineers, 2020.

EA Engineering, Science, and Technology, Inc., PBC

Figure 3-1

Preliminary Water Plan - SEIS Alternative 6

3.6.1 Pressure Zones

The study area for FEIS Alternative 5, SEIS Alternative 5, and SEIS Alternative 6 is split into two pressure zones at an elevation of approximately 2,080 feet. Zone 3 (upper elevation pressure zone) encompass the elevations between 2,154 and 2,080. Zone 2 (lower elevation pressure zone) encompasses the elevations between 2,080 and 2,000. Pressure reducing stations would be installed at most of the distribution lines crossing the boundary between Zones 3 and 2.

3.6.2 Treated Water Storage

Treated Water Storage was evaluated by the City Engineer, HLA Engineering and Land Surveying, Inc., as part of an updated water system analysis that preliminarily evaluates storage and pumping. Based on this preliminary evaluation, the existing water system is not sufficient to meet projected water storage requirements. The proposed treated water storage mitigation consists of a new reservoir in Zone 3.

3.6.3 Distribution Mains

The distribution systems for the 47° North development under SEIS Alternative 5 is comprised of looping water distribution pipe networks of 8- to 12-inch diameter waterlines. The distribution system for each alternative will provide water at pressures between 31 and 72 psi to all services during maximum day demand.

The untreated irrigation demands, if needed, would be served from the transmission mains shown in Figure 3-1.

3.7 Water Use Standards

The Water Use Standards were established as part of the original 2002 EIS SETR to minimize indoor and outdoor water use. The indoor water use standards required water conservation fixtures and encouraged water conservation appliances and the outdoor water use standards limits irrigated areas. These standards are not anticipated to require revisions. Water use and conservation policies will be contained in the CC&R's for the 47° North development, including low-flow fixtures, limitations on landscaping, and other water-conservation measures as coordinated with the City of Cle Elum.

3.8 Preliminary Water Plans Summary

The proposed SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment development water demand is significantly less than FEIS Alternative 5 and SEIS Alternative 5 because the proposed RV use and commercial development footprint generate less demand than the uses previously contemplated.

In addition to water storage, the HLA updated water system analysis also evaluated preliminarily pumping. Based on this preliminary evaluation, the existing water system is not sufficient to meet both projected water demand and storage requirements.

The total proposed mitigation consists of three new elements: a filter train, a finished water pump, and a Zone 3 reservoir. SEIS Alternative 5 would be responsible for 72% of these improvements while the proposed 47° North development is responsible for only 59% of these improvements. For more information see the HLA memorandum dated August 14, 2020 in the appendix.

In summary, the proposed development triggers additional mitigation for water storage and pumping and will be responsible for 59% of this mitigation.

Section 4 Preliminary Sewer Plans

Presented in this section is information on the preliminary sewer system concepts for SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment and a comparison to the FEIS Alternative 5 estimates as evaluated in the 2002 EIS SETR and SEIS Alternative 5.

4.1 Wastewater Flow Projections

Wastewater flow projections were generally estimated the same way as in the 2002 EIS SETR, with updated uses for SEIS Alternative 6. The wastewater production is calculated as a percentage of inside water demand, as shown in **Table 4-1**. The percent return values were developed considering Ecology's standard flow rate for new systems (including normal infiltration), side sewer length considerations relative to the type of unit appropriate adjustments infiltration, and typical wastewater flow data presented in the literature (i.e., Metcalf & Eddy, *Wastewater Engineering - Treatment, Disposal, Reuse*, 3rd edition). For purposes of system pipe sizing and design, seasonally varying infiltration and inflow percentages, shown in **Table 4-2**, were applied to the wastewater generation estimates.

Table 4-1: Wastewater Generation/Return Flow as a Fraction of Inside Water Demand – SEIS Alternative 6

Unit Type	Percentage of Water Demand
Multi-Family	90
Single Family	80
Daytime Visitors/Employees	80
Amenity and Adventure Centers	80
RV Park	80
Business Center	80

Table 4-2: Infiltration/Inflow as a Percentage of Maximum Month Wastewater Production – SEIS Alternative 6

Month	Infiltration/Inflow, Percentage of Wastewater Production
January	20
February	25
March	25
April	15
May	15
June	10
July	10
August	10
September	10
October	10
November	10
December	15

Usual practice is to estimate infiltration/inflow rates as a maximum value on a per acre basis. However, seasonally varying infiltration/inflow (I/I) rates have been used to estimate the monthly I/I return flow component for the water supply analysis. Very little inflow is expected, as the 47° North development under SEIS Alternative 6 will prohibit discharge of stormwater to the sanitary sewer system. Ecology's standard residential unit rate of 100 gpcd includes an allowance for normal infiltration. From **Table 4-1,** the normal wastewater is 80 percent times the water demand of 100 gpcd, or 80 gpcd. From **Table 4-2,** the normal maximum seasonal I/I allowance is 25 percent of maximum month wastewater generation. Using the 80 gpcd inside generation for the maximum month and the 25 percent I/I allowance, the seasonal maximum wastewater generation would be:

80 gpcd + 25 percent x 80 gpcd = 100 gpcd.

This is the same value as recommended by Ecology for new sewer systems in the 2008 Criteria for Sewage Works Design.

Wastewater generation for single and multi-family units are summarized in **Tables 4-3** and **4-4,** respectively.

Table 4-3: Wastewater Generation - Single Family, SEIS Alternative 6

Parameter	Primary Residences
Party Size	2.34
Unit Water Demand (gpdpc)	100
Wastewater Production Percentage	80%
Total Wastewater Production (gpd)	187

Table 4-4: Wastewater Generation - Multi-family, SEIS Alternative 6

Parameter	Primary Residences
Party Size	2.34
Unit Water Demand (gpdpc)	100
Wastewater Production Percentage	90%
Total Wastewater Production (gpd)	211

The original party value used in the 2002 SETR was 2.4 people per household. The party value was updated to 2.34 persons per household based on current US Census figures.

Commercial development wastewater production, which is assumed at 80 percent of inside water use, was assumed to be 0.068 gallons per day per square foot of the building in the 2002 EIS SETR. There was no updated information available since the 2002 EIS SETR, so this rate will continue to be used.

Similarly, for the RV park under SEIS Alternative 6, the following 2002 EIS SETR will be continued to be used: a daily wastewater production of 120 gpd per site was used. This is based on 3 persons

per campsite, 50 gpd per person water demand and an 80 percent wastewater fraction of water demand.

For visitor and employees under SEIS Alternative 6, 16 gpd per person was used based on a water demand of 20 gpd per person and an 80 percent wastewater fraction of water demand. There was no updated information available since the 2002 EIS SETR, so this rate will continue to be used. For the amenity and adventure centers, a total of 500 visitors and 125 employees are estimated per day. For the commercial development under SEIS Alternative 6, a total of 500 visitors and 377 employees are estimated per day.

The projected monthly wastewater flows at buildout under SEIS Alternative 6, FEIS Alternative 5 and SEIS Alternative 5 are provided in **Table 4-5.**

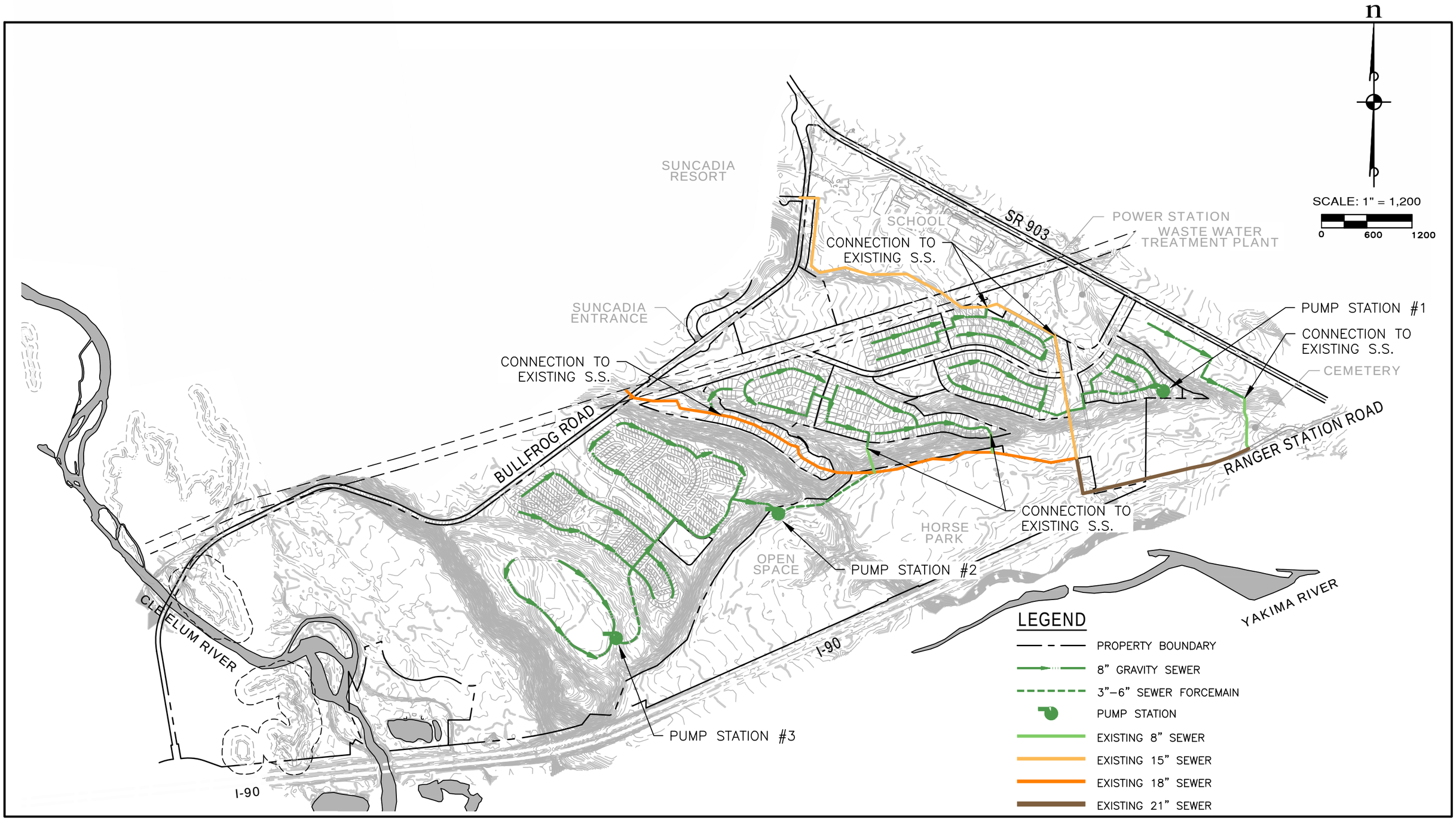
Table 4-5: Monthly Wastewater Flow at Buildout, mgd[a]

Alt.	Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Average Annual
SEIS 6	30 w/o I/I [b]	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
SEIS 6	30 w/ I/I	0.23	0.24	0.24	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.22	0.22
FEIS 5[c]	30 w/o I/I	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
FEIS 5[c]	30 w/ I/I	0.30	0.32	0.31	0.29	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.28	0.28
SEIS 5[c]	30 w/o I/I	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
SEIS 5[c]	30 w/ I/I	0.29	0.30	0.29	0.28	0.27	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27

[a] Includes wastewater flows from the commercial development.

[b] I/I represents infiltration and inflow, which varies by month from 10 percent to 25 percent of maximum month inside wastewater production.

[c] Excludes Reserve Area.



Source: ESM Consulting Engineers, 2020.

EA Engineering, Science, and Technology, Inc., PBC

Figure 4-1

Preliminary Sewer Plan - SEIS Alternative 6

4.2 Collection and Conveyance System

The existing and proposed preliminary sewer systems layout for SEIS Alternative 6 are shown on **Figure 4-1**.

An existing sewer trunk system network traverses the site to provide service to Suncadia and the proposed development. This existing sanitary sewer system consists of 15- and 18-inch diameter sewer mains that border the east and south sides of the property, respectively, and are available to serve the proposed 47° North development. The 18-inch diameter sewer main has 8-inch diameter stub-outs designed and constructed to serve future development. The two sewer mains connect to the southeast and continue east along an existing 21-inch diameter sanitary trunk system that follows Douglas Munro Blvd and connects with the South Cle Elum trunk sewer.

The 47° North single and multi-family development, as well as the associated amenity and adventure centers under SEIS Alternative 6 are proposed to be served by private 8- to 12-inch diameter gravity sanitary sewer mains that would be owned, operated, and maintained privately.

The 47° North RV park development under SEIS Alternative 6 is proposed to be served by private 8-inch diameter gravity sanitary sewer mains that would also be owned, operated, and privately maintained by the owner. These gravity sewer mains would connect to sewer lift stations that would flow via a force main (3 inches to 6 inches in diameter), all owned, operated, and maintained privately to the existing 18-inch diameter sewer main.

The commercial development under SEIS Alternative 6 will be served by public 8-inch diameter gravity sewer mains that will be owned, operated, and maintained by the City of Cle Elum.

The topography of the site requires two estimated lift stations for SEIS Alternative 6 to transport sewage from lower to higher elevations, as shown in **Figure 4-1**. Preliminary design conditions for each sewage lift station with 5 hp or more requirements are presented in **Table 4-6.**

Table 4-6: Preliminary SEIS Alternative 6 Lift Station Design Parameters

Alternative	Lift Station No.	Capacity (gpm)	Elevation Head (ft)
6	1	50	26
	2	450	22
	3	140	42

4.3 Wastewater Treatment and Disposal

4.3.1 Flows and Loadings

Estimated wastewater flows for buildout of SEIS Alternative 6, FEIS Alternative 5, and SEIS Alternative 5 are provided in **Tables 4-7, 4-8** and **4-9** respectively. A peak hourly factor of 3.5 was used, matching the 2002 EIS calculations.

Table 4-7: Projected Wastewater Flows for SEIS Alternative 6, mgd[a]

Flow Condition	Buildout
Annual Average	0.22
Wet Weather (Oct.-Apr.):	
Average	0.22
Peak Hourly	0.77
Dry Weather (May-Sept.):	
Average	0.21
Peak Hourly	0.74

[a] Includes I/I and wastewater flows for the commercial development.

Table 4-8: Projected Wastewater Flows for FEIS Alternative 5, mgd[a,b]

Flow Condition	Buildout
Annual Average	0.36
Wet Weather (Oct.-Apr.):	
Average	0.37
Peak Hourly	1.28
Dry Weather (May-Sept.):	
Average	0.35
Peak Hourly	1.21

[a] Includes wastewater flows for non-Trendwest demands located in the UGA.

[b] Excludes reserve area.

Table 4-9: Projected Wastewater Flows for SEIS Alternative 5, mgd[a,b]

Flow Condition	Buildout
Annual Average	0.35
Wet Weather (Oct.-Apr.):	
Average	0.36
Peak Hourly	1.26
Dry Weather (May-Sept.):	
Average	0.34
Peak Hourly	1.19

[a] Includes wastewater flows for non-Trendwest demands located in the UGA.

[b] Excludes reserve area.

Estimated wastewater loadings, in terms of biochemical oxygen demand (BOD) and total suspended solids (TSS) are given in **Table 4-10**. These loadings are based on a unit loading for BOD and TSS of 0.2 pounds per day per person. Population for SEIS Alternative 6 was calculated as follows: 1,654 people for residential areas (707 residences x 2.34 people per residence), 941 people at the RV park (627 x 3 people per site x 50 percent occupancy), 500 visitors, and 377 employees for the commercial development for a total of 3,472 people.

Table 4-10: Projected Loadings, lb. per day[a]

Alternative No.	BOD&TSS	Buildout
SEIS Alt. 6	Annual Average	694
	Max. Month Average (Aug.)	733
FEIS Alt. 5[b]	Annual Average	720
	Max. Month Average (Aug.)	760
SEIS Alt. 5[b]	Annual Average	699
	Max. Month Average (Aug.)	738

[a] Includes wastewater flows for commercial development demand.

[b] Excludes Reserve Area.

4.4 Wastewater Treatment and Disposal Alternatives

The City of Cle Elum does not currently have an adopted General Sewer Plan. However, preparation of a General Sewer Plan is in process with completion anticipated in April 2022. The 47° North site is in the City of Cle Elum's sewer service area.

The City of Cle Elum completed the construction of a new 3.6 million gallon per day Sequential Batch Reactor (SBR) wastewater treatment plant in the spring of 2005. This new SBR plant, which is called the Upper Kittitas County Regional Wastewater Treatment Facility (WWTF), has replaced the old lagoon treatment system and it now provides wastewater treatment for the following entities:

- City of Cle Elum and its UGA
- Town of South Cle Elum
- City of Roslyn
- Community of Ronald (and its nearby unincorporated areas)
- Existing Units in Pine Loc III
- Suncadia Resort

FEIS Alternative 5 of the 2002 EIS SETR was included as a community planned to be serviced by this facility.

4.5 Preliminary Sewer Plans Summary

The proposed SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment development sewer demand is less than FEIS Alternative 5 and about equal to SEIS Alternative 5 because population per household was reduced from 2.4 to 2.34 people per unit. Furthermore, the proposed RV use and commercial development footprint generate less demand than the uses previously contemplated. The existing treatment facilities were designed to include the proposed development. Therefore, no significant impacts are anticipated, and no mitigation is proposed other than what is already required by current codes.

This section estimates the expected sources and quantities of solid wastes that would be generated by the proposed SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment and compared to the FEIS Alternative 5 estimates as evaluated in the 2002 EIS SETR and SEIS Alternative 5.

5.1 Solid Waste Sources and Classifications

The sources of solid waste for SEIS Alternative 6 were identified in the following categories.

5.1.1 Construction and Demolition Debris (C&D):

Construction and demolition debris (C&D) was described in the 2002 EIS SETR as Construction and Inert Waste (CDL) and includes waste material that is produced in the process of construction of new structures. Structures include buildings of all types, both residential and nonresidential, as well as roads, utilities and bridges. It should be noted that construction wastes from renovation or demolition of existing structures are estimated to be minor through buildout and are, therefore, not estimated.

5.1.2 Residential

Residential solid waste would be generated from the single-family residences, multi-family units, and in the RV park.

5.1.3 Commercial

Commercial solid waste would be generated from the amenity and adventure centers as well as the commercial development.

5.1.4 Streets and Recreation Areas

This source includes waste from all internal roadways and recreation areas.

5.1.5 Water and Wastewater Treatment

This source includes waste from the water and wastewater treatment facilities and was included in the 2002 EIS SETR. There are no proposed water and wastewater treatment facilities as part of SEIS Alternative 6 and therefore no associated waste.

5.2 Classification of Solid Wastes

The solid wastes that will be generated for SEIS Alternative 6 are classified as follows.

5.2.1 Construction and Demolition Debris (C&D)

This waste stream is composed of both construction and demolition wastes, each of which includes inert and non-inert components.

"*Demolition waste" means solid waste, largely inert waste, resulting from the demolition or razing of buildings, roads and other man-made structures. Demolition waste consists of, but is not limited to, concrete, brick, bituminous concrete, wood and masonry, composition roofing and*

roofing paper, steel, and minor amounts of other metals like copper. Plaster (i.e., sheet rock or plaster board) or any other material, other than wood, that is likely to produce gases or a leachate during the decomposition process and asbestos wastes are not considered to be demolition waste for the purposes of this regulation (WAC 173-304-100(19)).

"Inert wastes" means noncombustible, nondangerous solid wastes that are likely to retain their physical and chemical structure under expected conditions of disposal, including resistance to biological attack and chemical attack from acidic rainwater (WAC 173-304- 100(40)).

Specific components of demolition waste - drywall, plaster, wood, and asphalt shingles - are not considered inert waste. Neither drywall nor wood waste are considered C&D for disposal. Drywall must be disposed of as municipal solid waste. Wood waste can be recycled, given away, converted to wood chips, or disposed of as municipal solid waste.

5.2.2 Municipal Wastes

These include food wastes and rubbish. Food wastes are the animal, fruit, or vegetable residues resulting from the handling, preparation, cooking, and eating of foods. They are generated from the residential and commercial land uses.

Rubbish consists of combustible and noncombustible solid wastes of households, institutions, and commercial activities, excluding food wastes or other highly putrescible materials. It is produced by the residential, commercial and recreational land uses.

5.2.3 Hazardous/Moderate Risk Wastes

These include chemical, biological, flammable, explosive, or radioactive wastes that pose a moderate risk, immediately or over time, to human, plant, or animal life. For SEIS Alternative 6, moderate risk wastes will be generally produced by households and commercial operations in small quantities. These waste materials include many common products, such as:

- Oil based and water-based paints
- Paint thinners and solvents
- Adhesives, glues and sealant
- Brake fluid and antifreeze
- Used motor oil
- Car batteries
- Pesticides/herbicides
- Unwanted fuels (gasoline, kerosene)

5.2.4 Biosolids/Septage

Biosolids include the solid and semi-solid wastes from water and wastewater treatment facilities in this classification. Septage (the combination of sludge, scum, and liquid pumped from septic tanks) is also included in this classification.

5.2.5 Yard Waste

This includes leaves, grass clippings, brush, garden waste, tree trunks, holiday trees, and pruning from trees or shrubs. Yard waste results from the care and maintenance of landscaped areas. It is mostly generated by residential, commercial, street, and recreational land uses.

5.2.6 Land Clearing

Land clearing waste includes trees and vegetation removed for construction, but not sold as timber.

5.3 Waste Stream Quantities and Management

The waste stream quantity estimates from SEIS Alternative 6 are presented in this section.

5.3.1 C&D Waste Generation Estimate

C&D wastes were estimated at 4.38 lbs per sf of new construction for residential areas and 3.89 lbs per sf of new construction for non-residential areas (2002 EIS SETR - EPA, "Characterization of Building-Related Construction and Demolition Debris in the United State," 1998). This original estimate is likely too conservative, because both single and multi-family units proposed as part of the 47° North development will be constructed offsite and hauled in. However, there are no updated C&D waste rates found, so this rate will be used.

Based on the 2011 Kittitas County Solid Waste Management Plan Overall Waste Composition, C&D is comprised of the following: 2 percent concrete, 7 percent asphalt paving, 17 percent asphalt roofing, 22 percent clean wood waste, 17 percent other wood waste, 9 percent gypsum board, 3 percent rock, soil and fines, and 23 percent composite materials.

The residential building areas for FEIS Alternative 5 and SEIS Alternative 5 are estimated to be the same because the same residential units were proposed in both alternatives.

The residential building areas for SEIS Alternative 6 were calculated using 1,800 sf per residential single-family home (527 units) and 2,550 sf per multi-family cluster unit (60 units). Quantity estimates are based on these rates and the building areas given in **Tables 5-1** and **5-2**.

Table 5-1: Estimated Residential Building Areas

Residential Building Area, sf	
SEIS Alternative 6	FEIS & SEIS Alternative 5[a]
1,102,000	2,719,000

[a] Excludes buildings in 175-acre reserve parcel, for which uses are undefined.

The commercial development areas for FEIS Alternative 5 and SEIS Alternative 5 are the same.

Table 5-2: Estimated Non-Residential Building Areas

	Total Building Area, sf	
Facility	**SEIS Alternative 6**	**FEIS & SEIS Alternative 5[a]**
Water Treatment Plant	-	13,000
SF and MF Amenity Center	31,000	-
Adventure Center	3,500	-
General Maintenance Building	-	9,000
RV Amenity Center	31,000	-
Community Center	-	10,000
Commercial Development	150,000	950,000
RV Park/Temporary RV Park	18,500	2,500[b]
Residential Recreation Buildings/Neighborhood Center	-	12,500
Total	**234,000**	**997,000**

[a] Excludes Reserve Area.
[b] Temporary RV park.

Estimated total build-out C&D quantities are given in **Table 5-3**. Since residential and non-residential units are the same for both FEIS Alternative 5 and SEIS Alternative 5, the associated C&D quantities are the same as well.

Table 5-3: Projected C&D Generation Rates and Total Quantity at Full Buildout, tons

	SEIS Alternative 6		FEIS & SEIS Alternative 5[a]	
	Residential	**Non-residential**	**Residential**	**Non-residential**
Buildout Total (tons)[b]	2,413	455	5,955	1,939

[a] Excludes Reserve Area.
[b] Buildout total represents the cumulative total quantity for Alternative 6 by year 2037 and for FEIS & SEIS Alternative 5 by year 2051.

The proposed SEIS Alternative 6 will generate significantly less C&D based on building square footage, for both residential and non-residential construction, because the proposed development square footage is significantly smaller. Furthermore, both single family and multi-family units proposed as part of the 47° North development will be constructed offsite and hauled in. The generation estimates presented in **Table 5-3** do not include wastes from road, utility, and non-building structure construction. Estimating criteria for this waste stream was not found in the literature. However, the magnitude of this waste stream is expected to be minor.

Inert C&D waste will be collected on-site and hauled directly to the Kittitas County Inert/Demolition Debris Waste Landfill at Ryegrass. Non-inert C&D wastes will be collected on-

site and hauled to the Cle Elum Transfer Station (also known as the Upper County Transfer Station) for disposal. Non-inert construction waste will be hauled to Kittitas County-owned transfer stations. A C&D recycling program will be developed that will require participation of all contractors working on the 47° North development. The program will be approved by the Kittitas County Solid Waste Department prior to the start of construction.

5.3.2 C&D Management Provisions

C&D collection points will be at locations specified by the City of Cle Elum through its building permit process. Inert and non-inert waste will be handled as described below.

5.3.3 Inert Wastes

Drop boxes will be maintained on-site for temporary storage of inert wastes during construction. Inert wastes collected in drop boxes will be hauled directly to the permitted Ryegrass landfill by the contractors or by Waste Management by agreement with the contractors. The recyclable materials will be segregated from the waste stream on-site.

5.3.4 Non-Inert Wastes

Non-inert wastes will be temporarily stored in separate drop boxes on-site until hauled to the Cle Elum Transfer Station. The wastes except for the recyclables will then be transported to the Greater Wenatchee Landfill, Douglas County for the final disposal. Recyclable materials will be segregated from the waste stream as discussed for inert wastes.

5.3.5 Wood Wastes

Construction wood waste will be handled on-site. Wood wastes will not be hauled to the Kittitas County municipal solid waste facilities. Wood waste will be given away as firewood, chipped, or recycled.

5.3.6 Municipal and Other Wastes

For residential solid waste, a generation rate of 5.45 lbs per person per day was originally used (2002 SETR - 1999 Washington State). According to the Kittitas County 2020 Solid Waste and Moderate Risk Waste Management Plan, the 2017 rate was 4.33 lbs per person per day. According to the EPA Advancing Sustainable Materials Management: Facts and Figures 2013, the 2013 rate was 4.40 lbs per persons per day. The more current 4.40 lbs per person per day was applied to SEIS Alternative 5 and SEIS Alternative 6 for residential areas and RV park areas.

For street and alley cleaning solid waste, a generation rate of 0.25 lb per person per day was originally used (2002 SETR - Tchobanoglous, "Solid Waste Management: Engineering Principles and Management Issues", 1993). There were no updated generation rates found, so this rate was applied to the residential areas and RV park areas.

For yard waste, a generation rate of 0.44 lbs per person per day was originally used (2002 EIS SETR - EPA, *Decision-Maker's Guide to Solid Waste Management*, Second Edition, 1995). According to the Kittitas County 2020 Solid Waste and Moderate Risk Waste Management Plan,

the 2017 yard waste was 0.30 lbs per person per day. The more current 0.30 lbs per person per day was applied to SEIS Alternative 5 and SEIS Alternative 6 for residential areas and RV park areas.

Household hazardous/moderate waste was originally estimated based on 1997-1999 Kittitas County records at 0.13 lbs per person per day. The 2011 Kittitas County Solid Waste Management Plan states that households generated an annual average of 233 tons for 2008. Based on a population of 39,365 in 2008, this is equivalent to a daily average of 0.08 pounds per household or 0.03 pounds per person per day. The more current 0.03 lbs per persons per day was applied to SEIS Alternative 5 and SEIS Alternative 6 for residential areas and RV park areas.

The original party value used in the 2002 SETR was 2.4 people per household. The party value was updated to 2.34 persons per household based on current US Census figures for SEIS Alternative 5 and SEIS Alternative 6.

The original occupancy percentage is estimated to have been 100 percent in the 2002 UGA EIS for solid waste production. This occupancy percentage has been revised to 90 percent for residential units. A 50 percent occupancy will be estimated for the RV park.

For the commercial development, the waste stream quantities have been estimated based on a generation rate of 0.16 lbs per person per day (2002 EIS SETR - Tchobanoglous, "Integrated Solid Waste Management: Engineering Principles and Management Issues," 1993). There were no updated generation rates found for this use, so this rate was applied based on the number of employees. Since no current data is available and the commercial development waste is a small portion of the overall generated solid waste, the total estimated buildout commercial development solid waste was added to the municipal waste portion of each buildout year.

Total yearly projections of solid waste generation are presented in **Table 5-4**.

Table 5-4: Solid Waste Production (tons/year)

Buildout Year	SEIS Alternative 6	FEIS Alternative 5[a]	SEIS Alternative 5[a]
Municipal	1,520	1,635	1,595
Yard	97	102	100
Hazardous/Moderate Risk [b]	10	10	10
Total Year 2025 (tons/year)	**1,627**	**1,747**	**1,705**
Municipal	2,042	1,997	1,948
Yard	131	126	123
Hazardous/Moderate Risk [b]	13	13	12
Total Year 2030 (tons/year)	**2,186**	**2,136**	**2,083**
Municipal	2,042	2,311	2,254
Yard	131	146	142
Hazardous/Moderate Risk [b]	13	15	14
Total Year 2037 (tons/year)	**2,186**	**2,472**	**2,410**
Municipal	2,042	2,765	2,697
Yard	131	175	171
Hazardous/Moderate Risk [b]	13	18	17
Total Buildout (tons/year)[c]	**2,186**	**2,958**	**2,885**

[a] Excludes Reserve Area.

[b] Includes non-residential hazardous waste.

[c] Buildout total represents the cumulative total quantity for Alternative 6 by year 2037 and for Alternative 5 by year 2051.

5.3.7 Management Provisions

The 47° North development will generate an estimated 2,186 tons of municipal solid wastes annually at full buildout under SEIS Alternative 6. Waste Management of Ellensburg or its successors will collect the wastes. The methods and points of connection will vary by type of use and accommodation. The principal arrangements are likely to be as follows:

Accommodation/Area	Collection Responsibility	Collection Point
Single family residential	Residents	Curb-side pickup by Waste Management
Multi-family residential	Residents	Central dumpsters
Amenity and Adventure Centers, Commercial Development, and RV park areas	Operators/tenants	Central dumpsters

The wastes will then be hauled to the Cle Elum Transfer Station prior to transport to the Greater Wenatchee Landfill in Douglas County for final disposal.

Yard waste disposal by residents will be by curb-side pickup by Waste Management, or self-haul to an allowable transfer station. Yard waste disposal for commercial operators/tenants will be the responsibility of their commercial landscape services.

Streets will be cleaned periodically in accordance with City of Cle Elum practices.

Hazardous/moderate risk wastes will be disposed of by residents and commercial operators/tenants at local community-sponsored turn-in events.

5.3.8 Recycling

Chapter 70.95 RCW establishes statewide recycling and waste reduction goals. A goal of 50 percent was established by 2007. No new additional goals have been noted since. According to the Kittitas County 2020 Solid Waste and Moderate Risk Waste Management Plan, 2017 recycling rate for Kittitas County was 11.4 percent, a significant decrease from the 27.8 percent in 2008. Materials that had a decrease in the quantity recycled include cardboard, ferrous metal, nonferrous metal, cooking oil, and used oil.

The City of Cle Elum does not have curbside recycling at this time. Residences in the area self-haul recycling to transfer stations.

Recycling within the 47° North development will be encouraged. Many of the residents will move from areas with effective recycling programs and will expect similar programs to be in place. Preliminarily, the recycling program elements are expected to include recycle bins at each central dumpster location for use by residents and commercial operators/tenants. It is recommended that the dumpster/recycle stations be designed so that the dumpsters can be removed without moving the recycling containers. These stations will receive aluminum cans, corrugated cardboard, glass, magazines, newspaper, plastic milk jugs, plastic pop bottles, and tin cans. The destination(s) of these materials will be determined at a later date.

5.3.9 Septage Wastes

Septage wastes are not proposed for SEIS Alternative 6.

5.3.10 Land Clearing Wastes

It is not anticipated that any wastes generated from land clearing operations under SEIS Alternative 6 or SEIS Alternative 5 will be hauled to Kittitas County solid waste facilities. Land clearing wastes remaining after removal of saleable timber will likely be burned, given away as free firewood, or chipped on-site. Chipped wood wastes could be marketed as pulp material or made available free of charge to the public.

5.3.11 Waste Loading Impacts

Based on data presented in **Table 5-3** and **5-4**, SEIS Alternative 6 generates less quantities of C&D and MSW than FEIS Alternative 5 and SEIS Alternative 5. The reason for the smaller quantities is because both residential and commercial development square footages are smaller in the SEIS Alternative 6.

5.3.12 Cle Elum Transfer Station

Based on communication with Kittitas County Solid Waste, the Cle Elum Transfer Station is reported by Kittitas County to have processed 11,096 tons of waste in 2019. Customers made a total of 40,119 deliveries to the transfer station. The station is reported to be near capacity, based on the number of cars queued at the station on Saturdays. Tuesdays and Saturdays are the busiest days at the station, as it is closed Sundays and Mondays.

Kittitas County Solid Waste is currently working on another station entrance to improve queuing.

5.3.13 Ryegrass Landfill.

C&D inert wastes will be hauled to the landfill at the Ryegrass site for disposal. Kittitas County Solid Waste is currently working on the expansion for this facility.

5.3.14 Solid Wastes Projections

About 5 percent of the C&D wastes is estimated to be inert and hauled to the landfill, which is calculated at 143 tons for the buildout condition (without recycling).

Based on the 2020 Solid Waste and Moderate Risk Waste Management Plan, 38,282 tons of municipal solid waste would be processed in year 2025. SEIS Alternative 6 municipal solid wastes would add 1,623 tons (without recycling), or 4 percent. Similarly, for year 2030, 40,234 tons of municipal solid waste would be processed and SEIS Alternative 6 would add 2,181 tons, or 5 percent. For year 2037, which is also the buildout condition, 43,137 tons of municipal solid waste would be processed and SEIS Alternative 6 would continue to add the same 2,181 tons, or 5 percent.

An effective recycling program would likely reduce both C&D and municipal solid waste volumes substantially. At a minimum, it is estimated to have at least a 10 percent reduction in waste due to recycling.

5.4 Solid Wastes Summary

The proposed SEIS Alternative 6 – Proposed 47° North Master Site Plan Amendment development solid waste generation is less than FEIS Alternative 5 and SEIS Alternative 5 because the proposed development square footage is significantly smaller. The estimated impact may be further reduced with an effective recycling program for both C&D and municipal solid waste streams.

Kittitas County Solid Waste will confirm whether or not the 47° North development is responsible to mitigate impacts for its proportional share of the costs associated with improvements to the Cle Elum Transfer Station and the Ryegrass Landfill.

Appendix

HLA
Engineering and Land Surveying, Inc.

* MEMORANDUM *

Phone: (509) 966-7000 / FAX: (509) 965-3800
2803 River Road, Yakima, WA 98902

Date: August 14, 2020

Project No.: 19055E

To: ESM Consulting Engineers
33400 8th Avenue South, Suite 205
Federal Way, 98003

Attention: Laura Bartenhagen
Project Manager

From: Benjamin A. Annen, PE

Re: 47° North Development – Updated Water System Analysis

Sun Communities (Developer) has proposed the 47° North (47N) residential development on approximately 1,100 acres in the Bull Frog Flats area of the City of Cle Elum (City) within the City Limits. 47N intends to connect to the City's domestic water system as a single customer, while maintaining a private on-site water system. To determine water system impacts of the 47N development, HLA has conducted preliminary storage and pump analysis for the Cle Elum water system as a whole, as well as Pressure Zone 3, which is the primary location of the development.

As the 2015 Water System Plan (2015 WSP) update is in the early stages of development and incomplete, projection data from the 2015 WSP was used to develop current condition estimates. The 2019 projections presented in the 2015 WSP were assumed to be the best representation of current conditions including background growth.

Water Demand

The current water system demand by pressure zone, assumed to equal 2019 projections, are summarized in Table 1.

To allow for direct comparison to the 2019 projections, two proposed major developments were converted to Equivalent Residential Units (ERUs) based on the demands recorded in 2015 WSP Table 2-27:

- 207 gpd Average Annual Demand (ADD) per 1.0 ERU
- 689 gpd Maximum Day Demand (MDD) per 1.0 ERU

The two proposed major developments included the City Heights (CH) development and the 47N development, both with active Development Agreements. As the 47N development is anticipated to be built-out in 2037 and the CH development build-out for 2040, total maximum CH ERUs were estimated for 2037 at 85% of full build-out.

The 47N development is considered SEIS Alternative 6 and is compared to the no action, Bullfrog Flats Adopted Master Plan, SEIS Alternative 5 (Alt 5). The projected 2037 water demand for CH, 47N (SEIS Alt 6), and SEIS Alt 5 are summarized in Table 2, Table 3, and Table 4, respectively.

Table 1: Current Water Demand (2019)

Zone	No. of Services[a]	Annual Demand[a] *gpy*	Total ADD[b] *gpd*	ADD ERUs[c]	Total MDD[a] *gpd*	MDD ERUs[d]	Peak Hour Demand[a] *gpm*
1	1,164	147,149,750	403,150	*Non-applicable*	1,298,088	*Non-applicable*	1,803
2	284	60,798,780	166,572	*Non-applicable*	619,795	*Non-applicable*	861
3	364	168,043,810	460,394	2,224	1,580,175	2,293	2,195
Total	1,812	375,992,340	1,030,116	4,976	3,498,058	5,082	4,907

[a] Values from 2015 WSP Table 2-36

[b] Divide Annual Demand by 365 days per year

[c] Divide Annual Day Demand by 207 gpd/ERU

[d] Values from 2015 WSP Table 2-31

Table 2: Projected Water Demand for City Heights at 85% Buildout

	Zone	No. of Services[a]	ADD/Service[b] *gpd*	Total ADD[c] *gpd*	ADD ERUs/Service[b]	ADD ERUs[d]	MDD/Service[b] *gpd*	Total MDD[e] *gpd*	MDD ERUs/Service[b]	MDD ERUs[f]	Peak Hour Demand[g] *gpm*
Single Family Residences	3	438	207	90,614	1.0	438	689	301,610	1.00	438	419
Multi-Family Units	3	128	691	88,103	3.3	426	1,329	169,448	1.93	246	235
Subtotal	-	565	-	178,717	-	863	-	471,057	-	684	654

[a] Values from Conceptual Water Systems Connections for City Heights – 85% of maximum units for Zones 3 and 4

[b] Values from 2015 WSP Table 2-27

[c] Multiply number of services by ADD per service.

[d] Multiply number of services by ADD ERUs/service.

[e] Multiply number of services by MDD per service.

[f] Multiply number of services by ADD ERUs/service.

[g] MDD divided by 1,440 then multiplied by 2.

Table 3: Projected Water Demand for 47° North at Full Buildout

	Zone	No. of Services[a]	ADD/Service[a] *gpd*	Total ADD[b] *gpd*	ADD ERU/Service[c]	ADD ERUs[d]	MDD/Service[e] *gpd*	Total MDD[f] *gpd*	MDD ERUs/Service[g]	MDD ERUs[h]	Peak Hour Demand[i] *gpm*
Business Park and Irrigation[j]	2	1	15,020	15,020	72.56	73	50,017	50,017	72.59	73	69
Single and Multi-Family Units	3	707	211	148,894	1.02	719	421	297,788	0.61	432	414
RV Units	3	627	75	47,025	0.36	227	150	94,050	0.22	137	131
Amenity Center	3	1	6,000	6,000	28.99	29	12,000	12,000	17.42	17	17
Residential Irrigation[j]	3	1	45,405	45,405	219.35	219	151,198	151,198	219.45	219	210
Subtotal	-	1,337		262,344		1,267		605,054		878	840

[a] Values from Section 3 Preliminary Water Plans, ESM Consulting Addendum to the Site Engineering Technical Report for 47° North.

[b] Multiply number of services by ADD per service.

[c] Divide ADD/service by 207 GPD per ADD ERU from 2015 WSP Table 2-27.

[d] Multiply number of services by ADD ERUs/service.

[e] Multiply ADD/service by 3.33 peaking factor from ESM SETR Section 3, Table 3-7: Peaking Factor (Business Park and Irrigation and Residential Irrigation) and 2.0 peaking factor per DOH Water System Design Manual (Single/Multi-family Units, RV Units, and Amenity Center).

[f] Multiply number of services by MDD per service.

[g] Divide GPD/service by 689 GPD per MDD ERU from 2015 WSP Table 2-27.

[h] Multiply number of services by MDD ERUs/service.

[i] MDD divided by 1,440 then multiplied by 2.

[j] ADD irrigation demand estimated as average maximum allowable irrigation flows for all 12 months.

Table 4: Projected Water Demand for SEIS Alt 5 at Full Buildout

	Zone	No. of Services[a]	ADD/Service[b] *gpd*	Total ADD[c] *gpd*	ADD ERU/Service[d]	ADD ERUs[e]	MDD/Service[f] *gpd*	Total MDD[g] *gpd*	MDD ERUs/Service[h]	MDD ERUs[i]	Peak Hour Demand[j] *gpm*
Business Park and Irrigation[k,l]	2	1	15,020	15,020	72.56	73	50,017	50,017	72.59	73	69
Business Park and Irrigation[k,m]	3	1	80,108	80,108	387.00	387	266,760	266,760	387.17	387	370
Single Family Units	3	810	211	170,910	1.02	826	703	569,130	1.02	826	790
Multi-Family Units	3	524	211	110,564	1.02	534	703	368,178	1.02	534	511
Amenity Center/ Clubhouse[n]	3	1	6,000	6,000	28.99	29	19,980	19,980	29.00	29	28
Residential Irrigation[o]	3	1	68,107	68,107	329.02	329	226,797	226,797	329.17	329	315
Subtotal	-	1,338		450,710		2,177		1,500,863		2,178	2,085

[a] Values from 2002 EIS Table 2-5 Summary – Alternative 5

[b] Values from Section 3 Preliminary Water Plans, ESM Consulting Addendum to the Site Engineering Technical Report for 47° North

[c] Multiply number of services by ADD per service.

[d] Divide ADD/service by 207 GPD per ADD ERU from 2015 WSP Table 2-27.

[e] Multiply number of services by ADD ERUs/service.

[f] Multiply ADD/service by 3.33 peaking factor from ESM SETR Section 3, Table 3-7: Peaking Factor

[g] Multiply number of services by MDD per service.

[h] Divide GPD/service by 689 GPD per MDD ERU from 2015 WSP Table 2-27.

[i] Multiply number of services by MDD ERUs/service.

[j] MDD divided by 1,440 then multiplied by 2.

[k] ADD irrigation demand estimated as average maximum allowable irrigation flows for all 12 months from Section 3, Table 3-4: Maximum Allowable Irrigation Flows

[l] Zone 2 Business Park and Irrigation Demand assumed equivalent to 47N Zone 2 demands

[m] Zone 3 Business Park and Irrigation Demand assumed 5.33 times greater than Zone 2 (800,000 SF / 150,000 SF)

[n] Amenity Center and Neighborhood Clubhouse demand assumed equivalent to 47N Amenity and Adventure Center demands

[o] ADD irrigation demand estimated as 150% of 47N average maximum allowable flows for all 12 months from Section 3, Table 3-4: Maximum Allowable Irrigation Flows

Physical capacity of the total water system, including water rights, source, treatment, and storage capacity, was analyzed as part of the 2015 WSP in terms of ERU capacity. A Demand Rate per ERU for each system component was calculated with production values rather than consumption values to account for relatively high system loss (15-25%). The ERUs for 2012 (last year of complete data from 2015 WSP), estimated current conditions, and full buildout of CH (85%), 47N, and Alt 5, summarized below, allow for direct comparison to the original capacity analysis:

Table 5A: Summarization of ERUs – 47N

	ADD ERUs	MDD ERUs
2012	3,843	3,950
Current Conditions	4,976	5,082
City Heights	863	684
47º North	1,267	878
Proposed ERUs	2,131	1,562
Total	7,107	6,644

Table 5B: Summarization of ERUs – Alt 5

	ADD ERUs	MDD ERUs
2012	3,843	3,950
Current Conditions	4,976	5,082
City Heights	863	684
SEIS Alt. 5	2,177	2,178
Proposed ERUs	3,041	2,862
Total	8,017	7,944

Each analysis below was completed for two scenarios. Scenario A includes 2019 projections, CH development projections (at 85% of full buildout), and 47N projections. Scenario B includes 2019 projections, CH development projections (at 85% of full buildout), and SEIS Alt 5 projections.

Water Rights

Table 6 summarizes the water rights capacity analysis for 47N. The rights are granted by the existing development agreement with Suncadia Properties, which transfers Suncadia's existing water rights (included in current capacities below) as development and subsequent water demand occurs within the Cle Elum Bull Frog Flats area. This analysis includes the Bull Frog Flats area, or 47N, but includes only 140 units of the CH development as defined in the 2011 City Heights Annexation and Development Agreement. The revised ERU capacity for water rights with the 47N development is 1,859 and 3,386 for Annual and Instantaneous Rights, respectively.

Table 6A: Water Rights Analysis – 47N

Water Right	Current Capacity[a]		Demand/ERU[a]		Current Available ERU Capacity[b]	Proposed ERUs[c]	Revised Available ERU Capacity[d]
Annual (Q_a)	783	mg	0.095	mg	3,266	1,407	1,859
Instantaneous (Q_i)	4,667	gpm	0.492	gpm	4,404	1,018	3,386

[a] Values from 2015 WSP Table 2-35

[b] Divide current capacity by demand/ERU and subtract current ERUs

[c] 140 CH ERUs and all 47N ERUs from Table 5A

[d] Subtract proposed ERUs from current available ERU capacity

The revised ERU capacity for water rights with the Alt 5 development is 949 and 2,085 for Annual and Instantaneous Rights, respectively.

Table 6B: Water Rights Analysis –Alt 5

Water Right	Current Capacity[a]		Demand/ERU[a]		Current Available ERU Capacity[b]	Proposed ERUs[c]	Revised Available ERU Capacity[d]
Annual (Q_a)	783	mg	0.095	mg	3,266	2,317	949
Instantaneous (Q_i)	4,667	gpm	0.492	gpm	4,404	2,318	2,085

[a] Values from 2015 WSP Table 2-35

[b] Divide current capacity by demand/ERU and subtract current ERUs

[c] 140 CH ERUs and all Alt 5 ERUs from Table 5B

[d] Subtract proposed ERUs from current available ERU capacity

Source Analysis

Source capacity must be analyzed for raw water pumping capacity, total system finished water capacity, and Zone 3 finished water capacity.

Source (Raw Water)

Table 7 summarizes the source capacity analysis for the raw water pumps. There are no future improvements planned to increase source pumping capacity, which is the capacity of three 1,400 gpm pumps, or 4,200 gpm total. The revised ERU source capacity for raw water with the 47N development is 16,227 and 1,893 for ADD and MDD, respectively.

Table 7A: Source (Raw Water) Analysis – 47N

Total	Current Capacity[a]		Demand/ERU[a]		Current Available ERU Capacity[b]	Proposed ERUs[c]	Revised Available ERU Capacity[d]
ADD	4,200	gpm	0.18	gpm	18,357	2,131	16,227
MDD	4,200	gpm	0.492	gpm	3,455	1,562	1,893

[a] Values from 2015 WSP Table 2-35

[b] Divide current capacity by demand/ERU and subtract current ERUs

[c] Values from Table 5A

[d] Subtract proposed ERUs from current available ERU capacity

The revised ERU source capacity for raw water with the Alt 5 development is 15,317 and 593 for ADD and MDD, respectively.

Table 7B: Source (Raw Water) Analysis – Alt 5

Total	Current Capacity[a]		Demand/ERU[a]		Current Available ERU Capacity[b]	Proposed ERUs[c]	Revised Available ERU Capacity[d]
ADD	4,200	gpm	0.18	gpm	18,357	3,041	15,317
MDD	4,200	gpm	0.492	gpm	3,455	2,862	593

[a] Values from 2015 WSP Table 2-35

[b] Divide current capacity by demand/ERU and subtract current ERUs

[c] Values from Table 5B

[d] Subtract proposed ERUs from current available ERU capacity

Source (Total System Finished Water)

Table 8 summarizes the source capacity analysis for the finished water filter trains. Since the 2015 WSP, one of two new 2.0 mgd filter trains has been constructed, which increased the total capacity at the treatment plant to 4,500 gpm. With one filter train out of service (consistent with DOH standards), the finished water capacity is 3,100 gpm. The revised ERU source capacity for total system finished water with the 47N development is 10,115 and -343 for ADD and MDD, respectively.

Table 8A: Source (Total System Finished Water) Analysis – 47N

Total	Current Capacity[a]		Demand/ERU[b]		Current Available ERU Capacity[c]	Proposed ERUs[d]	Revised Available ERU Capacity[e]
ADD	3,100	gpm	0.18	gpm	12,246	2,131	10,115
MDD	3,100	gpm	0.492	gpm	1,219	1,562	-343

[a] Three 2.0 mgd filter trains at treatment plant and 300 gpm well, assumed one filter train out of service consistent with DOH standards
[b] Values from 2015 WSP Table 2-35
[c] Divide current capacity by demand/ERU and subtract current ERUs
[d] Values from Table 5A
[e] Subtract proposed ERUs from current available ERU capacity

The revised ERU source capacity for total system finished water with the Alt 5 development is 9,206 and -1,643 for ADD and MDD, respectively.

Table 8B: Source (Total System Finished Water) Analysis – Alt 5

Total	Current Capacity[a]		Demand/ERU[b]		Current Available ERU Capacity[c]	Proposed ERUs[d]	Revised Available ERU Capacity[e]
ADD	3,100	gpm	0.18	gpm	12,246	3,041	9,206
MDD	3,100	gpm	0.492	gpm	1,219	2,862	-1,643

[a] Three 2.0 mgd filter trains at treatment plant and 300 gpm well, assumed one filter train out of service consistent with DOH standards
[b] Values from 2015 WSP Table 2-35
[c] Divide current capacity by demand/ERU and subtract current ERUs
[d] Values from Table 5B
[e] Subtract proposed ERUs from current available ERU capacity

Source (Zone 3 Finished Water)

Table 9 summarizes the source capacity analysis for the Zone 3 finished water pumps. The water treatment plant currently includes two Zone 3, 1,400 gpm, finished water pumps. With one pump out of service (consistent with DOH standards), the pumping capacity to Zone 3 is 1,400 gpm. The ERU source capacity for Zone 3 finished water with the 47N development is 3,496 and -937 for ADD and MDD, respectively.

Table 9A: Source (Zone 3 Finished Water) Analysis – 47N

Total	Current Capacity[a]		Demand/ERU[b]		Current Available ERU Capacity[c]	Proposed ERUs[d]	Revised Available ERU Capacity[e]
ADD	1,400	gpm	0.18	gpm	5,554	2,058	3,496
MDD	1,400	gpm	0.492	gpm	553	1,489	-937

[a] Two 1,400 gpm finished water Zone 3 pumps, assume one pump out of service consistent with DOH standards
[b] Values from 2015 WSP Table 2-35
[c] Divide current capacity by demand/ERU and subtract current ERUs
[d] Values from Table 5A
[e] Subtract proposed ERUs from current available ERU capacity

The ERU source capacity for Zone 3 finished water with the Alt 5 development is 2,586 and -2,237 for ADD and MDD, respectively.

Table 9B: Source (Zone 3 Finished Water) Analysis – Alt 5

Total	Current Capacity[a]		Demand/ERU[b]		Current Available ERU Capacity[c]	Proposed ERUs[d]	Revised Available ERU Capacity[e]
ADD	1,400	gpm	0.18	gpm	5,554	2,968	2,586
MDD	1,400	gpm	0.492	gpm	553	2,789	-2,237

[a] Two 1,400 gpm finished water Zone 3 pumps, assume one pump out of service consistent with DOH standards
[b] Values from 2015 WSP Table 2-35
[c] Divide current capacity by demand/ERU and subtract current ERUs
[d] Values from Table 5B
[e] Subtract proposed ERUs from current available ERU capacity

Storage Analysis

Table 10A summarizes the current and proposed water demands calculated in Tables 1, 2, and 3.

Table 10A: Summarization of Water Demand – 47N

	ADD		MDD		PHD
	gpd	*mgd*	*gpd*	*mgd*	*gpm*
Current Demand	1,030,116	1.030	3,498,058	3.498	4,907
Proposed Demand	441,061	0.441	1,076,111	1.076	1,495
City Heights	178,717	0.179	471,057	0.471	654
47º North	262,344	0.262	605,054	0.605	840
Current & Proposed Demand	1,471,177	1.471	4,574,169	4.574	6,402

Table 10B summarizes the current and proposed water demands calculated in Tables 1, 2, and 4.

Table 10B: Summarization of Water Demand – Alt 5

	ADD		MDD		PHD
	gpd	*mgd*	*gpd*	*mgd*	*gpm*
Current Demand	1,030,116	1.030	3,498,058	3.498	4,907
Proposed Demand	629,426	0.629	1,971,920	1.972	2,739
City Heights	178,717	0.179	471,057	0.471	654
SEIS Alt. 5	450,710	0.451	1,500,863	1.501	2,085
Current & Proposed Demand	1,659,542	1.660	5,469,978	5.470	7,646

The storage analysis tables and calculations below are consistent with those presented in Chapter 3 of the 2015 WSP, and have been updated to reflect the current and proposed demands summarized above.

Total System Storage

Standby Storage: The current conditions have been updated to reflect the additional 2.0 mgd filter train, which increased the supply source total (net the largest source) to 4.5 mg. Calculations for Scenarios A and B are shown in Table 11A and 11B, respectively.

Table 11A: Total System Standby Storage – 47N

	Current		Current & Proposed	
System ADD	1.030	mgd	1.471	mgd
X 2 Days	2		2	
Storage Subtotal	2.060	mg	2.942	mg
Sum of all Sources minus Largest Source	4.5	mg	4.5	mg
Storage Subtotal minus Supply Subtotal	less than 0		less than 0	
Equivalent Residential Units (ERUs)	4,976		7,107	
x Min. 200 gal	200	gal	200	gal
Storage Minimum	0.995	mg	1.421	mg
Minimum Required Standby Storage	**0.995**	**mg**	**1.421**	**mg**

Table 11B: Total System Standby Storage – Alt 5

	Current		Current & Proposed	
System ADD	1.030	mgd	1.660	mgd
X 2 Days	2		2	
Storage Subtotal	2.060	mg	3.319	mg
Sum of all Sources minus Largest Source	4.5	mg	4.5	mg
Storage Subtotal minus Supply Subtotal	less than 0		less than 0	
Equivalent Residential Units (ERUs)	4,976		8,017	
x Min. 200 gal	200	gal	200	gal
Storage Minimum	0.995	mg	1.603	mg
Minimum Required Standby Storage	**0.995**	**mg**	**1.603**	**mg**

Fire Suppression Storage: The City of Cle Elum requirement of 480,000 gal, which exceeds DOH minimum requirements, will remain the minimum fire suppression storage for the water system for both scenarios.

Equalizing Storage: As with standby storage, the current conditions have been updated to reflect the additional 2.0 mgd filter train, which increased the supply source total to 4,500 gpm. Calculations for Scenarios A and B are shown in Table 12A and 12B, respectively.

Table 12A: Total System Equalizing Storage – 47N

	Current		Current & Proposed	
Peak Hour Demand	4,907	gpm	6,402	gpm
- Maximum Source Capacity	4,500	gpm	4,500	gpm
Equalizing Storage Subtotal	407	gpm	1,902	gpm
x DOH Multiplier	150	gal/gpm	150	gal/gpm
Equalizing Storage Total	**0.061**	**mg**	**0.285**	**mg**

Table 12B: Total System Equalizing Storage – Alt 5

	Current		Current & Proposed	
Peak Hour Demand	4,907	gpm	7,646	gpm
- Maximum Source Capacity	4,500	gpm	4,500	gpm
Equalizing Storage Subtotal	407	gpm	3,146	gpm
x DOH Multiplier	150	gal/gpm	150	gal/gpm
Equalizing Storage Total	**0.061**	**mg**	**0.472**	**mg**

Operational Storage: Consistent with the 2015 WSP, the operational storage for the system is equal to 456,280 gallons in both scenarios.

Total Storage: The total storage requirements have been updated per the current conditions and all proposed developments for Scenarios A and B, which are summarized in Table 13A and 13B, respectively.

Table 13A: Total System Storage Requirements – 47N
(Storage values in mg)

	Current	Current & Proposed
Number of ERUs	4,976	7,107
Operational Storage	0.456	0.456
Equalizing Storage	0.061	0.285
Standby Storage	0.995	1.421
Fire Suppression Storage	0.480	0.480
Subtotal	1.992	2.643
10% Contingency for Losses	0.199	0.264
Total Storage Required	2.191	2.907
Existing Storage Capacity	2.574	2.574
Available System Storage	**0.383**	**-0.333**

Table 13B: Total System Storage Requirements – Alt 5
(Storage values in mg)

	Current	Current & Proposed
Number of ERUs	4,976	8,017
Operational Storage	0.456	0.456
Equalizing Storage	0.061	0.472
Standby Storage	0.995	1.603
Fire Suppression Storage	0.480	0.480
Subtotal	1.992	3.011
10% Contingency for Losses	0.199	0.301
Total Storage Required	2.191	3.312
Existing Storage Capacity	2.574	2.574
Available System Storage	**0.383**	**-0.738**

Zone 3 Storage

Standby Storage: As discussed in the Zone 3 Finished Water analysis, the pumping capacity for the Zone 3 standby storage calculation assumes one of two pumps out of service for a source capacity of 2.0 mg. Calculations for Scenarios A and B are shown in Table 14A and 14B, respectively.

Table 14A: Zone 3 Standby Storage – 47N

	Current		Current & Proposed	
Zone 3 ADD	0.460	mgd	0.886	mgd
X 2 Days	2		2	
Storage Subtotal	0.921	mg	1.773	mg
Sum of all Sources minus Largest Source	2.0	mg	2.0	mg
Storage Subtotal minus Supply Subtotal	less than 0		less than 0	
Equivalent Residential Units (ERUs)	2,224		4,282	
x Min. 200 gal	200	gal	200	gal
Storage Minimum	0.445	mg	0.856	mg
Minimum Required Standby Storage	**0.445**	**mg**	**0.856**	**mg**

Table 14B: Zone 3 Standby Storage – Alt 5

	Current		Current & Proposed	
Zone 3 ADD	0.460	mgd	0.641	mgd
X 2 Days	2		2	
Storage Subtotal	0.921	mg	1.282	mg
Sum of all Sources minus Largest Source	2.0	mg	2.0	mg
Storage Subtotal minus Supply Subtotal	less than 0		less than 0	
Equivalent Residential Units (ERUs)	2,224		5,192	
x Min. 200 gal	200	gal	200	gal
Storage Minimum	0.445	mg	1.038	mg
Minimum Required Standby Storage	**0.445**	**mg**	**1.038**	**mg**

Fire Suppression Storage: The City of Cle Elum requirement of 480,000 gal, which exceeds DOH requirements, will remain the minimum fire suppression storage for the Zone 3 reservoir for both scenarios.

Equalizing Storage: The maximum source capacity for Zone 3 is the two existing 1,400 gpm pumps. Calculations for Scenarios A and B are shown in Table 15A and 15B, respectively.

Table 15A: Zone 3 Equalizing Storage – 47N

	Current		Current & Proposed	
Peak Hour Demand	2,195	gpm	3,620	gpm
- Maximum Source Capacity	2,800	gpm	2,800	gpm
Equalizing Storage Subtotal	less than 0		820	gpm
x DOH Multiplier	150	gal/gpm	150	gal/gpm
Equalizing Storage Total	**0.000**	**mg**	**0.123**	**mg**

Table 15B: Zone 3 Equalizing Storage – Alt 5

	Current		Current & Proposed	
Peak Hour Demand	2,195	gpm	4,864	gpm
- Maximum Source Capacity	2,800	gpm	2,800	gpm
Equalizing Storage Subtotal	less than 0		2,064	gpm
x DOH Multiplier	150	gal/gpm	150	gal/gpm
Equalizing Storage Total	**0.000**	**mg**	**0.310**	**mg**

Operational Storage: Consistent with the 2015 WSP, the operational storage for Zone 3 is equal to 54,149 gallons in both scenarios.

Total Storage: The Zone 3 storage requirements have been updated per the current conditions and all proposed developments for Scenarios A and B, which are summarized in Table 16A and 16B, respectively.

Table 16A: Zone 3 Storage Requirements – 47N
(Storage values in mg)

	Current	Current & Proposed
Number of ERUs	2,224	4,282
Operational Storage	0.054	0.054
Equalizing Storage	0.000	0.179
Standby Storage	0.445	0.856
Fire Suppression Storage	0.480	0.480
Subtotal	0.979	1.569
10% Contingency for Losses	0.098	0.157
Total Storage Required	1.077	1.726
Existing Storage Capacity	1.400	1.400
Available Zone 3 Storage	**0.323**	**-0.265**

Table 16B: Zone 3 Storage Requirements – Alt 5
(Storage values in mg)

	Current	Current & Proposed
Number of ERUs	2,224	5,192
Operational Storage	0.054	0.054
Equalizing Storage	0.000	0.310
Standby Storage	0.445	1.038
Fire Suppression Storage	0.480	0.480
Subtotal	0.979	1.882
10% Contingency for Losses	0.098	0.188
Total Storage Required	1.077	2.070
Existing Storage Capacity	1.400	1.400
Available Zone 3 Storage	**0.323**	**-0.670**

Conclusion

The existing water system is not sufficient to meet projected water demand nor storage requirements of either Scenario A or B. Three system components will need to be addressed to accommodate 85% of City Heights development full buildout and full buildout of either the 47° North or the original Bullfrog Flats (SEIS Alternative 5) developments:

- Source – New filter train (per MDD analysis)
- Source – New zone 3 finished water pump (per MDD analysis)
- Storage – New zone 3 reservoir storage (per ADD and MDD analysis)

Projected water demands will be translated into actual consumption as the development phases are constructed. Consistent with 2001 Water Supply System Project Development Agreement between the City of Cle Elum and Trendwest, the filter train mitigation "trigger" should be based on when either of the following conditions have been met; potable water production equals 4.0 million gallons per day for three or more days within a 12-month period; or when 47N has added 1,334 new residential water service connections. The zone 3 finished water pump mitigation "trigger" should be based on when either of the following Zone 3 conditions have been met; zone 3 potable water production equals 2.0 million gallons per day for three or more days within a 12-month period; or when 47N has added 1,334 new residential water service connections. The zone 3 reservoir storage mitigation "trigger" should be based on when either of the following Zone 3 conditions have been met; zone 3 storage requirement is within 85% of existing capacity; or when 47N has added 1,334 new residential water service connections.

Table 17 (next page) summarizes the results of each analysis for Scenarios A and B.

The proportionate share responsibility for the water system deficiencies under Scenarios A and B are calculated as the ratio of proposed ERUs for the two developments to the total number of proposed ERUs for each scenario within the analyzed buildout period. The results are shown in Table 18 below:

Table 18: Development Proportionate Share Responsibility

	Scenario A			*Scenario B*		
	CH	47N	Total	CH	Alt 5	*Total*
ADD ERUs	863	1,267	2,131	863	2,177	3,041
Proportionate Responsibility	**41%**	**59%**	**100%**	**28%**	**72%**	**100%**
MDD ERUs	684	878	1,562	684	2,178	2,862
Proportionate Responsibility	**44%**	**56%**	**100%**	**24%**	**76%**	**100%**

Table 17A: Summarization of Water System Source Analyses

System Component	Current Capacity	Demand/ERU	Current ERU Capacity	Scenario A – CH & 47N		Scenario B – CH & Alt 5	
				Proposed ERUs	Current and Proposed Available ERU Capacity	Proposed ERUs	Current and Proposed Available ERU Capacity
Water Rights							
Annual	783 mg	0.095 mg	3,266	1,407	1,859	2,317	949
Instantaneous	4,667 gpm	0.492 gpm	4,404	1,018	3,386	2,318	2,085
Source (Raw Water)							
Total ADD	4,200 gpm	0.18 gpm	18,357	2,131	16,227	3,041	15,317
Total MDD	4,200 gpm	0.492 gpm	3,455	1,562	1,893	2,862	593
Source (Finished Water)							
Total ADD	3,100 gpm	0.18 gpm	12,246	2,131	10,115	3,041	9,206
Total MDD	3,100 gpm	0.492 gpm	1,219	1,562	-343	2,862	-1,643
Source (Zone 3 Finished Water)							
Total ADD	1,400 gpm	0.18 gpm	5,554	2,058	3,496	2,968	2,586
Total MDD	1,400 gpm	0.492 gpm	553	1,489	-937	2,789	-2,237

Table 17B: Summarization of Water System Storage Analyses

Storage (all values in mg)	Existing Capacity	Current Storage Demand	Available Storage	Current and Proposed Storage Demand	Available Storage	Current and Proposed Storage Demand	Available Storage
Total System	2.574	2.191	0.383	2.907	-0.333	3.312	-0.738
Zone 3	1.400	1.077	0.323	1.665	-0.265	2.070	-0.670