

Date: January 6, 2023
To: ESM Consulting Engineers
33400 8th Avenue South, Suite 205
Federal Way, 98003
From: Benjamin A. Annen, PE
Re: 47° North Development – Updated Water System Analysis for Revised Proposal

Project No.: 19055E
Attention: Laura Bartenhagen
Project Manager

Sun Communities (Developer) has proposed the 47° North (47N) residential development on 889 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 under review by the Department of Health, and not yet adopted by the City, 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 gallons per day (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 current 47N development is considered Revised Proposal, compared to the SEIS Alternative 6 (Alt 6) and the no action, Bullfrog Flats Adopted Master Plan, SEIS Alternative 5 (Alt 5). The projected 2037 water demand for CH, 47N (Revised Proposal), SEIS Alt 6, and SEIS Alt 5 are summarized in Table 2, Table 3, Table 4, and Table 5, respectively.

In the Draft Supplemental Environmental Impact Statement (DSEIS), water demand from the single- and multi- family manufactured homes and RV units under the 47N Proposed Master Site Plan Amendment (SEIS Alt 6) was based on the Washington State Department of Health, Water System Design Manual standards; equating to 211 gpd for single- and multi- family, and 75 gpd for RV units. This was comparable to historical City of Cle Elum single-family home water demand data of 207 gpd as presented above. However, this was a very conservative approach as manufactured homes historically have lesser demands than single-family homes based on national data.

For the Final Supplemental Environmental Impact Statement (FSEIS), the Applicant provided a substantial amount of water demand data from over 60 Sun Community resorts across the country. The City reviewed this data, and revised the development's projected water demands, including factor of safety provisions; equating to 170 gpd for single- and multi- family, and 75 gpd for RV units, as presented in Table 3. These rates are higher than any of the other Sun Community resorts, and so still are considered conservative, but are lower than Cle Elum's historical single-family demands.

The Revised Proposal incorporates the 50 low-income housing units into the residential demands, totaling 757 residential units.

Table 1: Current Water Demand (2019)

Zone	No. of Services ^a	Annual Demand ^a <i>gpy</i>	Total ADD ^b <i>gpd</i>	ADD ERUs ^c	Total MDD ^a <i>gpd</i>	MDD ERUs ^d	Peak Hour Demand ^a <i>gpm</i>
1	1,164	147,149,750	403,150	<i>Non-applicable</i>	1,298,088	<i>Non-applicable</i>	1,803
2	284	60,798,780	166,572	<i>Non-applicable</i>	619,795	<i>Non-applicable</i>	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 <i>gpd</i>	Total ADD ^c <i>gpd</i>	ADD ERUs/Service ^b	ADD ERUs ^d	MDD/Service ^b <i>gpd</i>	Total MDD ^e <i>gpd</i>	MDD ERUs/Service ^b	MDD ERUs ^f	Peak Hour Demand ^g <i>gpm</i>
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 (Revised Proposal)

	Zone	No. of Services ^a	ADD/Service ^a <i>gpd</i>	Total ADD ^b <i>gpd</i>	ADD ERU/Service ^c	ADD ERUs ^d	MDD/Service ^e <i>gpd</i>	Total MDD ^f <i>gpd</i>	MDD ERUs/Service ^g	MDD ERUs ^h	Peak Hour Demand ⁱ <i>gpm</i>
Business Park	2	1	36,460	36,460	176.14	176	121,412	121,412	176.21	176	169
Business Park Irrigation ^j	2	1	2,270	2,270	10.97	11	9,775	9,775	14.19	14	14
Single and Multi-Family Units	3	757	170 ^l	128,690	0.82	622	340	257,380	0.49	374	357
RV Units	3	627	75 ^{k,l}	47,025	0.36	227	150	94,050	0.22	137	131
Amenity Center	3	1	5,925	5,925	28.62	29	11,850	11,850	17.20	17	16
Residential Irrigation ^j	3	1	45,405	45,405	219.35	219	195,497	195,497	283.74	284	272
Subtotal	-	1,388		265,775		1,284		689,964		1,001	958
10% Losses/Contingency				26,578		128		68,996		100	96
Total				292,353		1,412		758,960		1,102	1,054

^a Values from Section 3 Preliminary Water Plans, ESM Consulting Addendum to the Site Engineering Technical Report for 47° North, dated December 2022.

^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 3-8: Peaking Factor (Business Park) and 2.0 peaking factor per DOH Water System Design Manual (Single/Multi-family Units, RV Units, and Amenity Center). Irrigation MDD based on peak month projections from ESM SETR Table 3-5.

^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. MDD irrigation demand highest of 12-month period.

^k RV Units ADD is based on 50% annual occupancy.

^l ADD per service as supported by consumption documentation for comparable Sun Communities sites across the country.

Table 4: Projected Water Demand for SEIS Alt 6 at Full Buildout

	Zone	No. of Services ^a	ADD/Service ^a <i>gpd</i>	Total ADD ^b <i>gpd</i>	ADD ERU/Service ^c	ADD ERUs ^d	MDD/Service ^e <i>gpd</i>	Total MDD ^f <i>gpd</i>	MDD ERUs/Service ^g	MDD ERUs ^h	Peak Hour Demand ⁱ <i>gpm</i>
Business Park	2	1	33,475	33,475	161.71	162	111,472	111,472	161.79	162	155
Business Park Irrigation ^j	2	1	2,270	2,270	10.97	11	9,775	9,775	14.19	14	14
Single and Multi-Family Units	3	707	170 ^l	120,190	0.82	581	340	240,380	0.49	349	334
RV Units	3	627	75 ^{k,l}	47,025	0.36	227	150	94,050	0.22	137	131
Amenity Center	3	1	7,140	7,140	34.49	34	14,280	14,280	20.73	21	20
Residential Irrigation ^j	3	1	45,405	45,405	219.35	219	195,497	195,497	283.74	284	272
Subtotal	-	1,338		255,505		1,234		665,454		966	924
10% Losses/Contingency				25,551		123		66,545		97	92
Total				281,056		1,358		731,999		1,062	1,017

^a Values from Section 3 Preliminary Water Plans, ESM Consulting Addendum to the Site Engineering Technical Report for 47° North, dated December 2022.

^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 3-8: Peaking Factor (Business Park) and 2.0 peaking factor per DOH Water System Design Manual (Single/Multi-family Units, RV Units, and Amenity Center). Irrigation MDD based on peak month projections from ESM SETR Table 3-5.

^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. MDD irrigation demand highest of 12-month period.

^k RV Units ADD is based on 50% annual occupancy.

^l ADD per service as supported by consumption documentation for comparable Sun Communities sites across the country.

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

	Zone	No. of Services ^a	ADD/Service ^b <i>gpd</i>	Total ADD ^c <i>gpd</i>	ADD ERU/Service ^d	ADD ERUs ^e	MDD/Service ^f <i>gpd</i>	Total MDD ^g <i>gpd</i>	MDD ERUs/Service ^h	MDD ERUs ⁱ	Peak Hour Demand ^j <i>gpm</i>
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 3-8: 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 (Revised Proposal), Alt 6, and Alt 5, summarized below, allow for direct comparison to the original capacity analysis:

Table 6A: Summarization of ERUs – 47N (Revised Proposal)

	ADD ERUs	MDD ERUs
2012	3,843	3,950
Current Conditions	4,976	5,082
City Heights	863	684
47° North	1,412	1,102
Proposed ERUs	2,276	1,785
Total	7,252	6,867

Table 6B: Summarization of ERUs – Alt 6

	ADD ERUs	MDD ERUs
2012	3,843	3,950
Current Conditions	4,976	5,082
City Heights	863	684
SEIS Alt. 6	1,358	1,062
Proposed ERUs	2,221	1,746
Total	7,197	6,828

Table 6C: 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 three scenarios. Scenario A includes 2019 projections, CH development projections (at 85% of full buildout), and 47N Revised Proposal projections. Scenario B includes 2019 projections, CH development projections (at 85% of full buildout), and SEIS Alt 6 projections. Scenario C includes 2019 projections, CH development projections (at 85% of full buildout), and SEIS Alt 5 projections.

Water Rights

Table 7 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 Revised Proposal is 1,714 and 3,162 for Annual and Instantaneous Rights, respectively.

Table 7A: Water Rights Analysis – 47N (Revised Proposal)

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	1,552	1,714
Instantaneous (Q _i)	4,667 gpm	0.492 gpm	4,404	1,242	3,162

^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 6A

^d Subtract proposed ERUs from current available ERU capacity

The revised available ERU capacity for water rights with the Alt 6 development is 1,769 and 3,201 for Annual and Instantaneous Rights, respectively.

Table 7B: Water Rights Analysis – Alt 6

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	1,498	1,769
Instantaneous (Q _i)	4,667 gpm	0.492 gpm	4,404	1,202	3,201

^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 6 ERUs from Table 6B

^d Subtract proposed ERUs from current available ERU capacity

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

Table 7C: 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 6C

^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 8 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 Revised Proposal is 16,082 and 1,669 for ADD and MDD, respectively.

Table 8A: Source (Raw Water) Analysis – 47N (Revised Proposal)

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	2,276	16,082
MDD	4,200 gpm	0.492 gpm	3,455	1,785	1,669

^a Values from 2015 WSP Table 2-35

^b Divide current capacity by demand/ERU and subtract current ERUs

^c Values from Table 6A

^d Subtract proposed ERUs from current available ERU capacity

The revised ERU source capacity for raw water with the Alt 6 development is 16,136 and 1,708 for ADD and MDD, respectively.

Table 8B: Source (Raw Water) Analysis – Alt 6

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	2,221	16,136
MDD	4,200 gpm	0.492 gpm	3,455	1,746	1,708

^a Values from 2015 WSP Table 2-35

^b Divide current capacity by demand/ERU and subtract current ERUs

^c Values from Table 6B

^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 8C: 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 6C

^d Subtract proposed ERUs from current available ERU capacity

Source (Total System Finished Water)

Table 9 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 Revised Proposal is 9,971 and -566 for ADD and MDD, respectively.

Table 9A: Source (Total System Finished Water) Analysis – 47N (Revised Proposal)

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	2,276	9,971
MDD	3,100 gpm	0.492 gpm	1,219	1,785	-566

^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 6A

^e Subtract proposed ERUs from current available ERU capacity

The revised ERU source capacity for total system finished water with the Alt 6 development is 10,025 and -527 for ADD and MDD, respectively.

Table 9B: Source (Total System Finished Water) Analysis – Alt 6

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	2,221	10,025
MDD	3,100 gpm	0.492 gpm	1,219	1,746	-527

^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 6B

^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 9C: 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 6C

^e Subtract proposed ERUs from current available ERU capacity

Source (Zone 3 Finished Water)

Table 10 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 Revised Proposal is 3,398 and -1,092 for ADD and MDD, respectively.

Table 10A: Source (Zone 3 Finished Water) Analysis – 47N (Revised Proposal)

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	2,156	3,398
MDD	1,400 gpm	0.492 gpm	553	1,644	-1,092

^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 3 with exception of Business Park (Zone 2), with 10% losses/contingency

^e Subtract proposed ERUs from current available ERU capacity

The ERU source capacity for Zone 3 finished water with the Alt 6 development is 3,436 and -1,068 for ADD and MDD, respectively.

Table 10B: Source (Zone 3 Finished Water) Analysis – Alt 6

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	2,118	3,436
MDD	1,400 gpm	0.492 gpm	553	1,621	-1,068

^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 4 with exception of Business Park (Zone 2), with 10% losses/contingency

^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 10C: 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 5 with exception of Business Park (Zone 2), with 10% losses/contingency

^e Subtract proposed ERUs from current available ERU capacity

Storage Analysis

Table 11A summarizes the current and proposed water demands calculated in Tables 1, 2, and 3, for the Revised Proposal.

Table 11A: Summarization of Water Demand – 47N (Revised Proposal)

	ADD		MDD		PHD
	<i>gpd</i>	<i>mgd</i>	<i>gpd</i>	<i>mgd</i>	<i>gpm</i>
Current Demand	1,030,116	1.030	3,498,058	3.498	4,907
Proposed Demand	444,492	0.444	1,161,021	1.161	1,613
City Heights	178,717	0.179	471,057	0.471	654
47° North	265,775	0.266	689,964	0.690	958
Current & Proposed Demand	1,474,608	1.475	4,659,079	4.659	6,520

Table 11B summarizes the current and proposed water demands calculated in Tables 1, 2, and 4, for Alt 6.

Table 11B: Summarization of Water Demand – Alt 6

	ADD		MDD		PHD
	<i>gpd</i>	<i>mgd</i>	<i>gpd</i>	<i>mgd</i>	<i>gpm</i>
Current Demand	1,030,116	1.030	3,498,058	3.498	4,907
Proposed Demand	434,222	0.434	1,136,511	1.137	1,578
City Heights	178,717	0.179	471,057	0.471	654
SEIS Alt. 6	255,505	0.256	665,454	0.665	924
Current & Proposed Demand	1,464,338	1.464	4,634,569	4.635	6,485

Table 11C summarizes the current and proposed water demands calculated in Tables 1, 2, and 5, for Alt 5.

Table 11C: Summarization of Water Demand – Alt 5

	ADD		MDD		PHD
	<i>gpd</i>	<i>mgd</i>	<i>gpd</i>	<i>mgd</i>	<i>gpm</i>
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, B, and C, are shown in Table 12A, 12B, and 12C, respectively.

Table 12A: Total System Standby Storage – 47N (Revised Proposal)

	Current	Current & Proposed
System ADD	1.030 mgd	1.475 mgd
<u>X 2 Days</u>	2	2
Storage Subtotal	2.060 mg	2.949 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	7,252
<u>x Min. 200 gal</u>	200 gal	200 gal
Storage Minimum	0.995 mg	1.450 mg
Minimum Required Standby Storage	0.995 mg	1.450 mg

Table 12B: Total System Standby Storage – Alt 6

	Current	Current & Proposed
System ADD	1.030 mgd	1.464 mgd
<u>X 2 Days</u>	2	2
Storage Subtotal	2.060 mg	2.929 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	7,197
<u>x Min. 200 gal</u>	200 gal	200 gal
Storage Minimum	0.995 mg	1.439 mg
Minimum Required Standby Storage	0.995 mg	1.439 mg

Table 12C: Total System Standby Storage – Alt 5

	Current	Current & Proposed
System ADD	1.030 mgd	1.660 mgd
<u>X 2 Days</u>	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
<u>x Min. 200 gal</u>	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 all 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, B, and C are shown in Table 13A, 13B, and 13C, respectively.

Table 13A: Total System Equalizing Storage – 47N (Revised Proposal)

	Current	Current & Proposed
Peak Hour Demand	4,907 gpm	6,520 gpm
<u>- Maximum Source Capacity</u>	4,500 gpm	4,500 gpm
Equalizing Storage Subtotal	407 gpm	2,020 gpm
<u>x DOH Multiplier</u>	150 gal/gpm	150 gal/gpm
Equalizing Storage Total	0.061 mg	0.303 mg

Table 13B: Total System Equalizing Storage – Alt 6

	Current	Current & Proposed
Peak Hour Demand	4,907 gpm	6,485 gpm
<u>- Maximum Source Capacity</u>	4,500 gpm	4,500 gpm
Equalizing Storage Subtotal	407 gpm	1,985 gpm
<u>x DOH Multiplier</u>	150 gal/gpm	150 gal/gpm
Equalizing Storage Total	0.061 mg	0.298 mg

Table 13C: Total System Equalizing Storage – Alt 5

	Current	Current & Proposed
Peak Hour Demand	4,907 gpm	7,646 gpm
<u>- Maximum Source Capacity</u>	4,500 gpm	4,500 gpm
Equalizing Storage Subtotal	407 gpm	3,146 gpm
<u>x DOH Multiplier</u>	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 all scenarios.

Total Storage: The total storage requirements have been updated per the current conditions and all proposed developments for Scenarios A, B, and C, which are summarized in Table 14A, 14B, and 14C, respectively.

Table 14A: Total System Storage Requirements – 47N (Revised Proposal)

(Storage values in mg)

	Current	Current & Proposed
Number of ERUs	4,976	7,252
Operational Storage	0.456	0.456
Equalizing Storage	0.061	0.303
Standby Storage	0.995	1.450
Fire Suppression Storage	0.480	0.480
Subtotal	1.992	2.689
10% Contingency for Losses	0.199	0.269
Total Storage Required	2.191	2.958
Existing Storage Capacity	2.574	2.574
Available System Storage	0.383	-0.384

Table 14B: Total System Storage Requirements – Alt 6

(Storage values in mg)

	Current	Current & Proposed
Number of ERUs	4,976	7,197
Operational Storage	0.456	0.456
Equalizing Storage	0.061	0.298
Standby Storage	0.995	1.439
Fire Suppression Storage	0.480	0.480
Subtotal	1.992	2.673
10% Contingency for Losses	0.199	0.267
Total Storage Required	2.191	2.941
Existing Storage Capacity	2.574	2.574
Available System Storage	0.383	-0.367

Table 14B: 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, B, and C are shown in Table 15A, 15B, and 15C, respectively.

Table 15A: Zone 3 Standby Storage – 47N (Revised Proposal)

	Current	Current & Proposed
Zone 3 ADD	0.460 mgd	0.866 mgd
<u>X 2 Days</u>	2	2
Storage Subtotal	0.921 mg	1.732 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	4,196
<u>x Min. 200 gal</u>	200 gal	200 gal
Storage Minimum	0.445 mg	0.839 mg
Minimum Required Standby Storage	0.445 mg	0.839 mg

Table 15B: Zone 3 Standby Storage – Alt 6

	Current	Current & Proposed
Zone 3 ADD	0.460 mgd	0.859 mgd
<u>X 2 Days</u>	2	2
Storage Subtotal	0.921 mg	1.718 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	4,160
<u>x Min. 200 gal</u>	200 gal	200 gal
Storage Minimum	0.445 mg	0.832 mg
Minimum Required Standby Storage	0.445 mg	0.832 mg

Table 15C: Zone 3 Standby Storage – Alt 5

	Current	Current & Proposed
Zone 3 ADD	0.460 mgd	0.641 mgd
<u>X 2 Days</u>	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
<u>x Min. 200 gal</u>	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 all scenarios.

Equalizing Storage: The maximum source capacity for Zone 3 is the two existing 1,400 gpm pumps. Calculations for Scenarios A, B, and C are shown in Table 16A, 16B, and 16C, respectively.

Table 16A: Zone 3 Equalizing Storage – 47N (Revised Proposal)

	Current	Current & Proposed
Peak Hour Demand	2,195 gpm	3,626 gpm
- <u>Maximum Source Capacity</u>	2,800 gpm	2,800 gpm
Equalizing Storage Subtotal	less than 0	826 gpm
<u>x DOH Multiplier</u>	150 gal/gpm	150 gal/gpm
Equalizing Storage Total	0.000 mg	0.124 mg

Table 16B: Zone 3 Equalizing Storage – Alt 6

	Current	Current & Proposed
Peak Hour Demand	2,195 gpm	3,514 gpm
- <u>Maximum Source Capacity</u>	2,800 gpm	2,800 gpm
Equalizing Storage Subtotal	less than 0	714 gpm
<u>x DOH Multiplier</u>	150 gal/gpm	150 gal/gpm
Equalizing Storage Total	0.000 mg	0.107 mg

Table 16C: Zone 3 Equalizing Storage – Alt 5

	Current	Current & Proposed
Peak Hour Demand	2,195 gpm	3,605 gpm
- <u>Maximum Source Capacity</u>	2,800 gpm	2,800 gpm
Equalizing Storage Subtotal	less than 0	2,064 805
<u>x DOH Multiplier</u>	150 gal/gpm	150 gal/gpm
Equalizing Storage Total	0.000 mg	0.121 mg

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

Total Storage: The Zone 3 storage requirements have been updated per the current conditions and all proposed developments for Scenarios A, B, and C, which are summarized in Table 17A, 17B, and 17C, respectively.

Table 17A: Zone 3 Storage Requirements – 47N (Revised Proposal)*(Storage values in mg)*

	Current	Current & Proposed
Number of ERUs	2,224	4,196
Operational Storage	0.054	0.054
Equalizing Storage	0.000	0.124
Standby Storage	0.445	0.839
Fire Suppression Storage	0.480	0.480
Subtotal	0.979	1.497
10% Contingency for Losses	0.098	0.150
Total Storage Required	1.077	1.647
Existing Storage Capacity	1.400	1.400
Available Zone 3 Storage	0.323	-0.247

Table 17B: Zone 3 Storage Requirements – Alt 6*(Storage values in mg)*

	Current	Current & Proposed
Number of ERUs	2,224	4,160
Operational Storage	0.054	0.054
Equalizing Storage	0.000	0.121
Standby Storage	0.445	0.832
Fire Suppression Storage	0.480	0.480
Subtotal	0.979	1.487
10% Contingency for Losses	0.098	0.149
Total Storage Required	1.077	1.635
Existing Storage Capacity	1.400	1.400
Available Zone 3 Storage	0.323	-0.235

Table 17C: 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 Scenarios A, B, or C, as presented in Table 18 (next page). Three system components will need to be addressed to accommodate 85% of City Heights development full buildout and full buildout of the 47° North (Revised Proposal), SEIS Alternative 6, and 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)

Table 18 (next page) summarizes the results of each analysis for Scenarios A, B, and C.

Projected water demands will be translated into actual consumption as the development phases are constructed. The 2001 Water Supply System Project Development Agreement between the City of Cle Elum and Trendwest established “trigger” points when improvements would become necessary, including production thresholds for specified durations, or when a specified number of new water connections were reached. Similar “trigger” points should be established for three system components identified in this analysis.

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 19 below:

Table 19: Development Proportionate Share Responsibility

	Scenario A			Scenario B			Scenario C		
	CH	47N	Total	CH	Alt 6	Total	CH	Alt 5	Total
ADD ERUs	863	1,284	2,147	863	1,234	2,098	863	2,177	3,041
Proportionate Responsibility	40%	60%	100%	41%	59%	100%	28%	72%	100%
MDD ERUs	684	1,001	1,685	684	966	1,650	684	2,178	2,862
Proportionate Responsibility	41%	59%	100%	41%	59%	100%	24%	76%	100%

To confirm proportionate share responsibility, a usage monitoring/metering plan is recommended, that would adjust allocation on an actual demand basis. Monitoring/metering will already be necessary, to determine when the capacity improvements will be triggered.

Table 18A: Summarization of Water System Source Analyses

System Component	Current Capacity	Demand/ERU	Current ERU Capacity	Scenario A – CH & 47N (Revised Proposal)		Scenario B – CH & Alt 6		Scenario C – CH & Alt 5	
				Proposed ERUs	Current and Proposed Available ERU Capacity	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	1,552	1,714	1,498	1,769	2,317	949
Instantaneous	4,667 gpm	0.492 gpm	4,404	1,242	3,162	1,202	3,201	2,318	2,085
Source (Raw Water)									
Total ADD	4,200 gpm	0.18 gpm	18,357	2,276	16,082	2,221	16,136	3,041	15,317
Total MDD	4,200 gpm	0.492 gpm	3,455	1,785	1,669	1,746	1,708	2,862	593
Source (Finished Water)									
Total ADD	3,100 gpm	0.18 gpm	12,246	2,276	9,971	2,221	10,025	3,041	9,206
Total MDD	3,100 gpm	0.492 gpm	1,219	1,785	-566	1,746	-527	2,862	-1,643
Source (Zone 3 Finished Water)									
Total ADD	1,400 gpm	0.18 gpm	5,554	2,156	3,398	2,118	3,436	2,968	2,586
Total MDD	1,400 gpm	0.492 gpm	553	1,644	-1,092	1,621	-1,068	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	Current and Proposed Storage Demand	Available Storage
Total System	2.574	2.191	0.383	2.958	-0.384	2.941	-0.367	3.312	-0.738
Zone 3	1.400	1.077	0.323	1.647	-0.247	1.635	-0.235	2.070	-0.670