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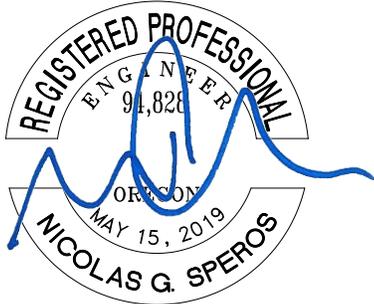
# MEMORANDUM

**TO:** Erik Huffman, PE, PLS, CWRE, LEED AP  
BECON, Engineer of Record, City of Sisters

**FROM:** Nicolas Speros, P.E., HHPR

**CC:** Kevin Eckert, BUILD, LLC

**SUBJECT:** The Woodlands (Barclay Drive and Pine Street)  
Sanitary Sewer and Water Infrastructure Re-Zone Impact Summary



EXPIRES: 06/30/20

## INTRODUCTION AND PURPOSE

The subject Woodlands property has a gross area of approximately 35.8 gross acres. This includes approximately 4.28 acres of roadway easement for Barclay Drive and Pine Street resulting in approximately 31.6 acres of net developable area. The property is generally bounded by Barclay Drive to the north, Pine Street to the east, USFS property to the south, and US Highway 20 to the west. The property is currently a mix of zones, Urban Area Reserve (UAR), Open Space (OS) and Public Facility (PF) as follows: UAR – 4.8 acres, OS – 3.5 acres, and PF – 27.5 acres.

The property is proposed to be rezoned to a mix of OS, Downtown Commercial (DC), Multi-Family (MF) and North Sisters Business Park (NSBP).

Per the City of Sisters Development Code, Section 4.7.300 B.3, for a Land Use District Map change, “the applicant shall demonstrate that the property and affected area shall be served with adequate public facilities...to support maximum anticipated levels and densities of use allowed by the District without adversely impacting current levels of service provided to existing users...”

This memo addresses the City of Sisters sanitary sewer and water infrastructure and any associated impacts of the proposed land use change and confirms the requirements of the Development Code are being met.

### **SANITARY SEWER ANALYSIS**

The City's Sanitary Sewer infrastructure is outlined in the Wastewater System Capital Facilities Plan Update (WSCFPU or Master Plan), current version dated February 2016. In this document, design flows for the City's collection system are calculated on an Equivalent Dwelling Unit (EDU) basis. The report is prepared with a 20-year outlook and identifies the City's anticipated infrastructure needs through the year 2035. In order to determine the design flows in the system, a specific amount of square footage was designated per EDU for each land use zone to determine the total design flow from each tributary area by land use. The specifics of the design flow determination is discussed in Section 6.2 of the Master Plan and this method is noted to be conservative for planning purposes.

This design memo conservatively assumes the re-zone application for the property north of Barclay Drive (USFS Parcel 3) from UAR to LI will be implemented.

Based on current zoning, the following existing design sewer flow for the entire subject property in the Master Plan is calculated as follows:

4.8 acres UAR (excluded from Master Plan) = 0 EDU's.

3.5 acres OS x (43,560 SF / acre) x (1 EDU / 20,000 SF OS) = 7.6 EDU's.

27.5 acres PF x (43,560 SF / acre) x (1 EDU / 10,000 SF PF) = 119.8 EDU's.

Total assumed EDU's allocated to subject property = 127.4 EDU

**The corresponding design flow in gallons per minute can then be calculated. In the Master Plan, a design flow of 125 gallons per day (gpd) is assigned to each EDU and the existing design flow is calculated as:**

127.4 EDU x 15 gpd / EDU x (1 day / 1,440 minutes) x 2.4 peak factor = 26.5 gpm.

**However, City staff has stated the actual flow is 165 gpd per EDU (75 gpcd x 2.2 capita/dwelling) and requested the design flow calculation utilize this higher value. Of note, this value was determined by taking the total measured flow for 2019 at the treatment facility divided by the 2019 population of Sisters. In other words, the EDU design flow value does not account for any flows generated by non-residential uses. Utilizing this more conservative value, the existing design flow of the property is:**

127.4 EDU x 165 gpd / EDU x (1 day / 1,440 minutes) x 2.4 peak factor = 35.0 gpm.

As noted above, the property will be re-zoned with a mix of OS, DC, MF and NSBP land uses.

The proposed mix of residential and non-residential uses and units can be summarized as follows;

Cottage housing: 72 units	x 1.0	=	72.0 EDU's
Apartments: 112 units	x 0.80	=	89.6 EDU's
Townhomes with ADU: 79+79 =158 units	x 0.80	=	126.4 EDU's
Congregate Housing (80 beds @ 2 bd/rm = 40 rms	x 0.40	=	16.0 EDU's
2.6 acres of NSBP: (1 EDU per 20,000 SF)		=	5.7 EDU's
0.55 acres of DC: (1 EDU per 5,000 SF)		=	4.8 EDU's
<u>2.3 acres of OS @ PF (1 EDU per 10,000 SF)</u>		=	<u>10.0 EDU's</u>
	Total	=	324.5 EDU's

The 0.8 EDU reduction factor is for multi-family dwellings, and for reference is utilized by the City of Bend.

The 0.4 EDU reduction factor is for hotel and dormitory type facilities and for reference is utilized by the City of Bend.

Calculating EDU's based on land use was utilized for the NSBP (2.6 acres, net of Barclay Drive area), DC (24,000 SF of commercial space), and OS (2.3 acres, 80% of net amenity area, at PF land use for potential amenity) zones. All other EDU's are based on proposed unit counts, including the apartments above the DC zoned commercial area.

Utilizing the Master Plan EDU flow rate of 125 gpd/EDU yields the following peak flow:

$$324.5 \text{ EDU} \times 125 \text{ gpd} / \text{EDU} \times (1 \text{ day} / 1,440 \text{ minutes}) \times 2.4 \text{ peak factor} = 67.6 \text{ gpm.}$$

However, utilizing the City requested value of 165 gpd/EDU the new design flow is calculated as:

$$324.5 \text{ EDU} \times 165 \text{ gpd} / \text{EDU} \times (1 \text{ day} / 1,440 \text{ minutes}) \times 2.4 \text{ peak factor} = 89.2, \text{ rounded to } 89.0 \text{ gpm.}$$

The design flows noted above are for the entire 35.8 acre property. Per data previously provided by the City, approximately 32.2 acres of the property is tributary to Pump Station #2 (PS#2) at the NW corner of Barclay Drive and Pine Street. This is consistent with the topography of the site, which slopes from the southwest down to the northeast towards PS#2. The site is currently served by a 6" gravity sewer connected to PS#2. The remaining 3.6 acres is tributary (in the Master Plan) to the 18" gravity main adjacent to the west and south boundaries, however the topography would likely allow this area to also drain to PS#2 if desired.

However, as requested by the City, the existing 10” gravity main downstream of PS#2 in Barclay Drive is not to receive any additional flow and the entire project site needs to sewer to the south, towards the existing 18” gravity main regardless of the capacity in PS#2.

Therefore, the subject property will be required to sewer the entire project to the 18” gravity main via gravity sewer pipes, a pump/lift station, or a combination of the two.

Due to the topography of the site and the existing inverts of the 18” gravity main, it is not feasible to achieve a solely gravity sewer solution without significant grading and possible import of material which will not allow for the significant tree preservation that is intended.

From preliminary analysis, of the total 89 gpm of project peak flow, approximately 40 gpm of peak flow will need to be pumped with the remaining 49 gpm likely able to gravity flow to the 18” main south of the property.

The options to pump this flow include installing a smaller neighborhood pump station at the NE corner of the project or utilizing existing PS#2 with modifications. PS#2 Modifications would include re-routing the force main to connect to the existing 18” gravity main instead of the 10” gravity main in Barclay Drive, upsizing of wet well storage, and a power generator. Utilization of PS#2 is likely the preferable option as it would not add an additional pump station to the City’s infrastructure and it would also reduce flows to the existing 10” gravity main in Barclay Drive that is already at capacity (50% flow, d/D).

PS#2 is currently experiencing peak flows of approximately 19 gpm plus another 10 gpm from the property north of Barclay Drive is assumed. With the addition of peak flows (40 gpm) from the subject property, PS#2 will need to accommodate peak flows in the range of  $19 + 10 + 40 = 69$  gpm. Per the Master Plan, PS#2 has a capacity of 150 gpm, so with modifications to the sub-standard wet well and the addition of a generator, the pump station should be capable of the post-project peak flows.

City staff has indicated that reimbursement or EDU credits may be available for improvements to PS#2 that would divert flow away from the 10” gravity main and Pump Station #1 (PS#1).

In consideration of future development within the City and expansions of the Urban Growth Boundary (UGB), per the Master Plan, the City of Sisters has considered the intersection of Pine Street and the 18” gravity main as the preferred approximate location for a new “West Side” pump station. This new pump station would re-direct sewer flows, via approximately 4,400 LF of new force main, to the existing 12” force main in Locust Drive south of US Highway 20, where it will continue to be pumped to the treatment facility south of town.

The purpose of this new pump station would be to reduce flows to PS#1, which will be at or near capacity within the current planning period. In addition, this bypass of flows will create significant capacity in the system for potential future development and/or annexations on the west side of town and on the northeast side of town near the airport.

The subject property will be required to contribute a proportionate share to this new pump station and force main cost. Prior to Master Plan approval, as briefly discussed with City staff, an alternate location for the new pump station may also merit consideration. For example, placing the new pump station near the current elementary school property, which is adjacent to the intersection of the 18” gravity main and the 10” gravity main conveying sewer flows from the south part of town, would allow significantly more sewer flow to be diverted from PS#1 and also eliminate the costly 4,400 LF of force main across town. In addition, by relocating the pump station further downstream, it would reduce the proximity of PS#2 to the new pump station, which may be favorable for reducing concentrated peak flow occurrences in the system.

For this application, the new pump station at Pine Street and associated force main would represent an upper limit of cost with the potential for a reduced cost solution to be considered prior to submittal of the Master Plan package.

In summary, based on the analysis above, the post-project peak flow of approximately 89 gpm, an increase of 54 gpm above the pre-project flow of 35 gpm, can be mitigated with appropriate infrastructure improvements.

## WATER ANALYSIS

This memo addresses two water service issues: available water and Water Rights.

The City’s Water infrastructure is outlined in the 2017 Water Capital Facilities Plan Update (WCFPU or Master Plan), current version dated April 2017. A fire flow analysis will be provided with the Master Plan application that will be specific to the proposed site plan and water main layout.

Available Water – City staff has previously confirmed water is available to serve the property.

Water Rights – As requested, a water volume analysis based on land use was performed to determine the acreage of water mitigation rights necessary to be purchased by the City (or reimbursed for) and the corresponding fee required to be paid at building permit issuance to offset this City cost.

The OS and PF zoned areas have existing water rights credit based on their land use. City staff has stated the UAR zoned areas do not have any associated water rights credit.

Based on the proposed uses and units counts, a new water rights calculation will determine the total volume of water rights needed for the project. The existing water rights will then be subtracted from the new total to determine the net volume required and fees due that will be payable at building permit.

The existing water rights associated with the property can be calculated as follows:

4.8 acres UAR (excluded from Master Plan) = 0 EDU's.  
 3.5 acres OS x (43,560 SF / acre) x (1 EDU / 20,000 SF OS) = 7.6 EDU's.  
 27.5 acres PF x (43,560 SF / acre) x (1 EDU / 10,000 SF PF) = 119.8 EDU's.  
 Total assumed EDU's allocated to subject property = 127.4 EDU

127.4 EDU x 2.2 people/dwelling unit = 280.3 people x 300 gallons per capita per day = 84,090 gpd  
 84,090 gpd x 365 days / year = 30,692,850 gallons / year = 94.19 acre-ft / year.

The gross proposed project water rights needed for the property can be calculated using the proposed mix of units of and non-residential uses as noted in the sewer analysis, and is re-summarized as follows:

Cottage housing: 72 units	x 1.0 =	72.0 EDU's
Apartments: 112 units	x 0.80 =	89.6 EDU's
Townhomes with ADU: 79+79 =158 units	x 0.80 =	126.4 EDU's
Congregate Housing (80 beds @ 2 bd/rm = 40 rms	x 0.40 =	16.0 EDU's
* 2.6 acres of NSBP: (2,000 gallons per acre per day)	=	* see below
0.55 acres of DC: (1 EDU per 5,000 SF)	=	4.8 EDU's
<u>2.3 acres of OS @ PF (1 EDU per 10,000 SF)</u>	=	<u>10.0 EDU's</u>
	Total =	318.8 EDU's + NSBP

\* For the NSBP area, the water volume was calculated using a value of 2,000 gallons per acre day, which yields: 2.6 NSBP acres x (2,000 gallons / acre / day) = 1,898,000 gallons / year = 5.82 acre-ft / year

318.8 EDU x 2.2 people/dwelling unit = 701.4 people x 300 gallons per capita per day = 210,420 gpd  
 210,420 gpd x 365 days / year = 76,803,300 gallons / year = 235.70 acre-ft / year.

Post-project water volume = 5.82 ac-ft / year + 235.70 ac-ft / year = 241.52 ac-ft / year

Net water volume required = 241.52 ac-ft / year – 94.19 ac-ft / year = 147.33 ac-ft / year

Reduce by 180 days per year (use 0.5) and 40% consumption factor →

(147.33 acre-ft / year) x 0.5 x 0.40 = 29.47 acre-ft / year

One acre purchased of water rights provides 1.8 acre-ft / acre / year at a cost of \$6,800 / acre.

Acres needed to be purchased → (29.47 acre-ft) / (1.8 acre-ft / acre) = 16.37 acres

**Fee Calculation → 16.37 acres x (\$6,800 / acre) = \$111,316 total due at building permit issuance.**

**The fee total is for the entire project and will be divided on a per unit or similar basis.**