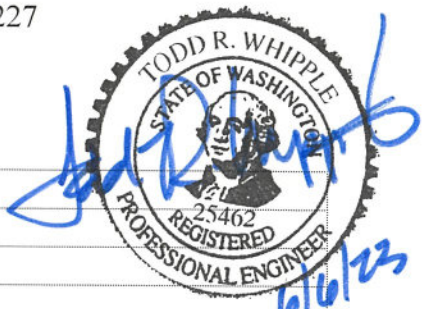
WCE

Whipple Consulting Engineers, Inc.

21 S. Pines Road
Spokane Valley, WA 99216
Ph 509-893-2617 Fax 509-926-0227



MEMORANDUM

TO:	Mike Nilsson, P.E.		
FROM:	Todd R. Whipple, P.E.		
DATE:	June 6, 2023		
PROJECT NO:	-	**NAME:**	Red Band Short Plat #3345
REGARDING:	Red Band Apartments Water & Sewer Analysis		

Per the comment letter Re on May 26th, 2022 we have prepared the following memo related to the expected water usage, and proposed sewer usage.

WATER

CITY WATER ANTICIPATED USE CALCULATIONS ADD/MDD/PHD
GALLONS PER DAY (GPD)

# OF UNITS	208.0	
	100.0	GALLONS PER CAPITA PER DAY
	1.5	CAPITA PER UNIT
	31,200.0	AVERAGE DAILY DEMAND (GPD) (ADD)
	2.3	FACTOR FOR MAXIMUM DAILY DEMAND (GPD)(MDD)
	71,760.0	MAXIMUM DAY DEMAND (GPD)(MDD)
	1.7	FACTOR FOR PEAK HOUR DEMAND (GPD)(PHD)
	121,992.0	PEAK HOUR DEMAND (GPD)(PHD)

CITY WATER ANTICIPATED USE CALCULATIONS ADD/MDD/PHD
GALLONS PER MINUTE (GPM) NOTE 1440= 24HR/DAY X 60MIN/HR

ADD	21.7	GPM
MDD	49.8	GPM
PHD	84.7	GPM

Fire Flow	1,500.0	GPM

Note: Fire flow is expected to be 1,500 GPM as all the buildings are planned to be sprinkled.

SEWER:

Per the Holy Names sewer lift station report the existing siphon system is determined to have 45 gpm of additional availability out of the 600 gpm. These 45 gpm accounts for the River Run lift station expansion that would discharge 180 GPM discharge to the siphon.

Based on review of the April 26th, 2013 Taylor Engineering and March 17th, 2006 River Run PUD Siphon Headworks Relocation Letter we believe that the 0.340 gpm per unit number is to high and not indictive of apartment units as the and Holy Names peak flow data provide by the City of Spokane in October 13th of 2016 used a 0.218 gpm per unit number, which was subsequently used for the Holy Names study, which is at 120 gpm currently. Therefore, 180 -120 = 60 gpm + 45 gpm = 105 gpm available.

Using the above-mentioned 0.218 gpm per unit amount we should be able to discharge 96+/- units to the existing River Run lift station without needing to upgrade the existing sewer pump station, which is at 120 gpm currently. Therefore, 180-120=60, 60+45=105 gpm available.

For this proposed project we expect to construct 256 units, of which 208 units are proposed to discharge into the gravity sewer system on Whistalks Way. At a discharge rate of 0.218 gpm per unit is expected to discharge 45.35 gpm, 45.35 gpm $\leq$ 105 gpm available for discharge to the City of Spokane siphon. For this reason, we will be able to discharge to the existing siphon without needing to upgrade the existing siphon.

48 units as mentioned above will also be able to discharge to the existing River Run lift station without needing to upgrade the existing sewer pump station, because the new 48 units are apart of the total of 96 units to already included to discharge to the existing lift station, which will still keep it less than the Tayler rate of 120 gpm.

CITY SEWER ANTICIPATED USE CALCULATIONS ADD/MDD/PHD

GALLONS PER DAY (GPD)

# OF UNITS		208.0	
		100.0	GALLONS PER CAPITA PER DAY
		1.5	CAPITA PER UNIT
		31,200.0	CAPITA FLOW W/O PEAKING FACTOR (GPD)
		312.0	POPULATION SEE TAABLE BELOW FOR FACTOR
		2.3	PEAKING FACTOR, SEE TABLE BELOW
		71,760.0	PEAK FLOW (GPD)

CITY WATER ANTICIPATED USE CALCULATIONS ADD/MDD/PHD

GALLONS PER MINUTE (GPM) NOTE 1440= 24HR/DAY X 60MIN/HR

W/O	21.7	GPM
PEAK	49.8	GPM

Population	Peak Factor
0 to 300	3.5
300 to 400	3.0
400 to 1,000	2.5
1,000 to 4,000	2.0
4,000 to 70,000	1.5

WCE
WHIPPLE CONSULTING ENGINEERS

10/13/2016 TRW
Holy Names
Sewer Peak Flows from Palouse Family Reduction
WCE Job Number 1560
Peak Flows provided by the City of Spokane - Sewer Utility

	Month	Date	AM/PM	Peak Flow (gpm)	
1	June	18	AM	47	
2		18	PM	1	EXCEPTED OUT DUE TO LOW FLOWS
3		19	AM	30	
4		19	PM	37	
5		19	PM	6	EXCEPTED OUT DUE TO LOW FLOWS
6		20	AM	57	
7		20	PM	47	
8		21	AM	40	
9		21	PM	37	
10		22	AM	50	
11		22	PM	49	
12		23	AM	63	
13		23	PM	54	
14		24	AM	46	
15		24	PM	48	
16		26	AM	72	
17		26	PM	95	
18		27	AM	179	
19		27	PM	66	
20		28	AM	31	
21		28	PM	26	
22		29	AM	51	
23		29	PM	49	
24		30	AM	49	
25		30	PM	55	
26	JULY	1	AM	33	
27		1	PM	35	
28		2	AM	35	
29		2	PM	23	
30		3	AM	31	
31		3	PM	32	

TOTAL	SUM	1467.00	gpm
NUMBER OF MEASUREMENT		29.00	days
AVERAGE PEAK FLOW PER DAY		50.59	gpm
PALOUSE FAMILY UNITS		232.00	units
	PEAK FLOW / UNIT	0.218	gpm

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

835 NORTH POST, SUITE 201 | SPOKANE, WA 99201 | P 509.328.3371

TECHNICAL MEMORANDUM

DATE:	June 12, 2020
TO:	Bill Peacock, P.E. Mike Morris, P.E.
FROM:	Tom Jordan, E.I.T. Mike Morse, P.E.
SUBJECT:	River Run P.U.D. Sewer Capacity Analysis
CC:	Mark Murphy, Ft. Wright, L.L.C.
PROJECT NUMBER:	377-8522-001
PROJECT NAME:	River Run Sewer Capacity

Purpose

This Technical Memorandum (Tech Memo) was prepared to provide a sewage capacity evaluation for the possible addition of multi-family residential buildings and commercial development within a portion of the River Run P.U.D. The proposed development is located adjacent to West Ft. George Wright Drive, east of River Ridge Boulevard and within the limits of parcel number 25116.0077. The proposed development would be serviced by the River Run Sewage Lift Station and the TJ Meenach inverted siphon (depressed sewer).

Background/Introduction

The sewage capacity evaluation will combine the existing flows at the River Run sewage lift station with the projected inflows from the new development. The City of Spokane (City) provided historical River Run lift station wet well level data from March 28th, 2019 to April 4th, 2019. The data and background information were analyzed to determine the existing operating conditions of the lift station. These analyses were then used to compare the capacities of the facilities (i.e., lift station and depressed sewer) to the City's "will-serve" capacity for River Run P.U.D. of 180 gpm of the previously determined siphon capacity of 645 gpm. See **Attachment A** for a copy of the letter from the City.

Existing Sewage Inflows

The River Run Lift Station, located at 1712 N River Vista St. in Spokane, WA, is a lift station owned and operated by the City of Spokane. The station receives sewage inflows from the single-family homes within the River Run Development, Life Center Church, the Cottages at River Run apartments and the residential area south of the Cottages at River Run apartments. These flows are of typical residential quantity and quality, and flow to the station via gravity pipelines.

The City provided wet well level measurements were analyzed based on a calculated wet well plug volume and cycle times for the seven days of provided data. For more information on how the operational volume of the River Run lift station wet well was calculated, please see **Attachment B**. The sewage flows were calculated for each inflow/outflow cycle by determining the time for each cycle and a known volume. A sample of these calculations is provided in **Attachment C**. Based on these calculations, the existing low, average and peak inflows into the lift station are 5 gpm, 35 gpm (approximately 50,000 gpd), and 80 gpm, respectively. The lift station pumping capacities averaged from 118 gpm to 127 gpm for pumps #1 and #2, respectively. These pump rates are not based on the station pump numbering convention. Figure 1 on the next page shows the inflow into the lift station

over the provided duration of wet well level data. The diurnal graph below indicates generally the largest daytime flows occurring on Saturday, March 30th and Sunday, March 31st, with peak flows occurring on Friday, March 29th.

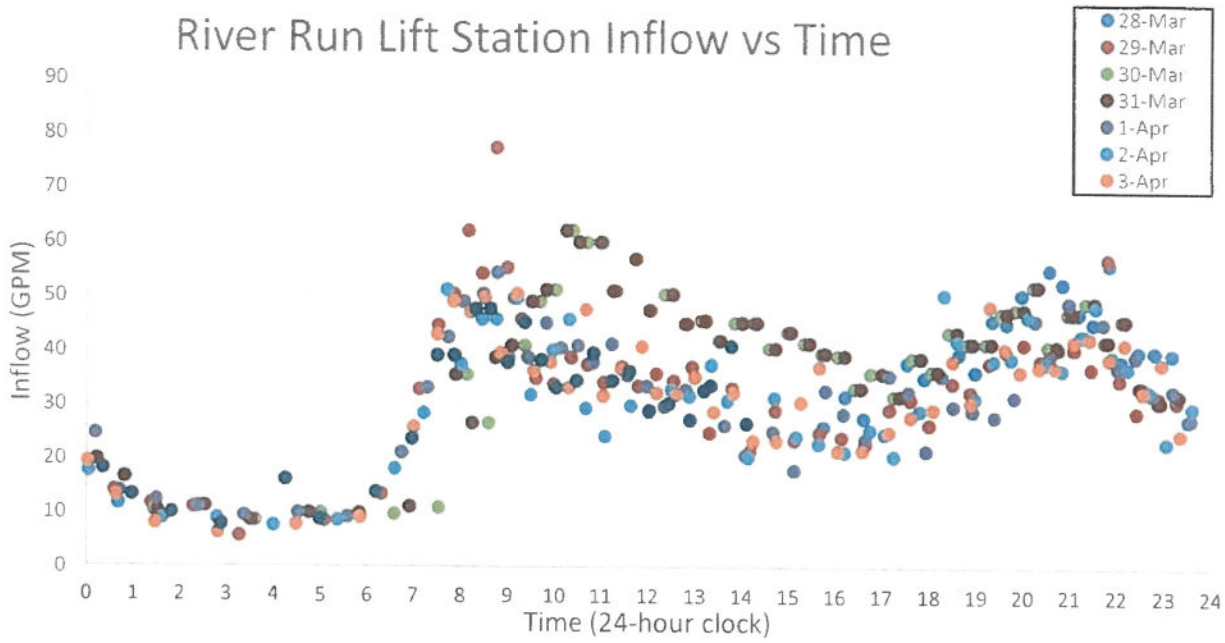


Figure 1: River Run Lift Station Calculated Inflows

Future Sewage Inflows

Based on the information calculated from the wet well level data and using pump station cycling calculations (see **Attachment D**) a maximum allowable increase in lift station pumping capacity was determined to be between 50 and 70 gpm during peak hour conditions. This range requires that the existing pump impellers be upgraded to a pumping capacity of 180 gpm which is equivalent to the "will-serve" flowrate and represents an approximate 60 - 88% increase of the current peak inflows. If pump upgrades are not possible or undesirable, then the maximum allowable increase is between 10 and 20 gpm during peak conditions. It is noted that these calculations only utilize simplex pumping configurations, which adheres to the City's preferred lift station operating mode (i.e., duplex pumping conditions are typically not used to handle peak inflow conditions). The pump station cycle time calculator takes several best practices into account; first the wet well fill and run time intervals are limited to less than 30 minutes, then the pump on/off cycles per hour are checked to ensure they are less than 10; and finally the system is checked to determine if there are any other issues caused by the increase in flow.

Table 1 on the next page details the available increases in multi-family units that could be constructed in the River Run P.U.D. sewer basin while remaining within the "will-serve" flow limit of 180 gpm leaving the lift station. The peaking factor used in this analysis is based on the available wet well level data and is 2.3 (or, 80 gpm divided by 35 gpm).

Table 1: Constructible Multi-Family Units in Parcel 25116.0077

Scenario	Calculated Sewage Flow Increases - Peak (gpm) / Average (gpm) / gpd	Flow per Multi-Family Unit*	Calculated Multi-Family Unit Increase
Future with no pumping upgrades	10-20 gpm / 4.35-8.70 gpm / 6,264 - 12,528 gpd	0.340 gpm peak per unit	29-59 Units
Future with pumping upgrades	50-70 gpm / 21.7-30.4 gpm / 31,248 - 37,584 gpd	0.340 gpm peak per unit	147-206 Units

*Flow per multi-family unit was derived from the predicted peak ultimate sewage flows provided in the City of Spokane's March 17, 2006 River Run PUD Siphon Headworks Relocation letter and Taylor Engineering, Incl.'s April 26, 2013 Cottages at River Run – Multi-Family Sewer Capacity Review letter. Copies of these letters are provided in **Attachment A**.

The results provided in Table 1 above do not include sewage flows from possible commercial development within the parcel. Provided below is a sample computation to illustrate the small expected peak sewage from an assumed 1.4 acres of commercial development along Ft. George Wright Drive.

800-1,200 gal/acre-day typical flow from commercial development (ref. Metcalf & Eddy)

1,000 gal/acre-day (assumed average daily flow)

Commercial sewage flow = 1,400 GPD (1.4 acres of commercial devel. x 1,00 gal/acre-day) or 0.97 GPM

Applying a 2.3 peaking factor results in 2.2 GPM of peak flow from 1.4 acres of commercial development.

Depressed Sewer Capacity

The existing depressed sewer that the River Run lift station pumps into has a calculated capacity of 645 gpm per the siphon headworks relocation record drawings provided in **Attachment E**. The City has requested an updated calculation for this capacity that includes entrance and exit losses. City GIS sewer utility information was used for the lengths of the two 8-inch depressed sewer pipes and the fittings count for equivalent length calculations. The Hazen Williams equation was used based on known information to calculate the updated depressed sewer capacity of approximately 598 gpm. This includes equivalent lengths for entrance and exit losses as well as two 45-degree bends. See **Attachment F** for a summary of the requested depressed sewer capacity calculations.

Conclusions

The calculations and results presented in this Tech Memo show that the planned construction of multi-family units within the River Run P.U.D. development on parcel 25116.0077 can include up to 206 new multi-family units (if pump upgrades are included). We do recommend that the pumps in the existing station be upgraded to be closer to the 180 gpm maximum. Based on revised calculations, the available capacity of the depressed sewer is likely near 598 gpm. Within the limits of this tech memo, no further analysis of the effects of this change in depressed sewer capacity were performed, nor any conclusions drawn.

Attachment A

River Run P.U.D. Sewer Capacity Letters

DEPARTMENT OF
ENGINEERING SERVICES
808 W. SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6700
FAX (509) 625-6349 / (509) 625-6124
www.spokaneengineering.org

March 17, 2006

MR MICHAEL F MORSE PE
TAYLOR ENGINEERING INC
106 W MISSION AVE
SPOKANE WA 99201-2345

RE: River Run PUD Siphon Headworks Relocation; File 2005097 Swr

Dear Mike.

The following correspondence is sent in response to your e-mail request concerning the additional capacity of the 8-inch siphon under the Spokane River, north of the T.J. Meenach Bridge, following the headworks relocation by your client for the River Run PUD Development.

The relocation of the siphon headworks was approved as part of the River Run 2nd Addition engineering plans and is intended to increase the capacity of the siphon to accommodate the full build-out of the River Run Development.

From your calculations, the ultimate build-out of the River Run PUD sanitary sewer basin is expected to produce approximately 180 GPM. This predicted peak ultimate sewage flow includes 174 residential lots (72.5 GPM peak), 225 multi-family units (76.6 GPM peak), approximately 11.1 acres of commercial development (27.0 GPM peak) and the Life Center Church (9.7 GPM peak). With the re-location of the siphon headworks and estimated ultimate peak sewage flows of approximately 180 GPM from the build-out of the River Run PUD, the total consumed capacity of the ultimate siphon will be approximately 600 GPM of the approximate total remaining capacity of 645 GPM.

The approved preliminary plat for the River Run PUD that includes all of the previously mentioned predicted flows will vest the capacity in the relocated siphon for the River Run PUD. As long as the platting action remains valid, the capacity will be reserved for the River Run PUD as shown on the preliminary plat. Please note: If the plat expires or is no longer valid, capacity will be allocated by the City of Spokane on a first-come, first-served basis.

If there are any questions or if additional clarification is required, please contact me at (509) 625-6424.

Sincerely,

James Sakamoto, P.E.
Senior Engineer – Developer Services

JSS/jme

cc Tom Arnold, P.E., Director (file)
Eldon Brown, P.E., Principal Engineer - Developer Services
Bill Peacock, P.E., Principal Engineer – WWM
Steve Haynes, Planning Services
Tim Coles, Developer Services (DS file)
Mr. Mike Murphy
Fort Wright Development, LLC
C/O Central Pre-Mix Concrete Company
PO Box 3366
Spokane, WA 99220

Developer Services\River Run PUD siphon headworks relocation, ltr to Taylor Engrs

Taylor Engineering, Inc.
Civil Design and Land Planning

Principals:
Stanley R. Stirling
Mark A. Aronson, P.E.
Ronald G. Pace, P.E
Chris H. Mansfield, P.E.

Chief Financial Officer:
Edwin G. Wagnild

Senior Associates:
Scott M. Busch, P.E.
Frank R. Ide, A.S.L.A.
Thomas K. Stirling

Associates:
Kevin M. Ames
Darrel W. Carsten, P.L.S.
Michael J. Leaming, P.E.
Michael F. Morse, P.E.
David M. Seese, P.L.S
Mark A. Switzer, P.E.

April 26, 2013

Ms. Cindy Kinzer, P.E.
City of Spokane – Engineering Services
808 W. Spokane Falls Blvd.
Spokane, WA 99201

RE: **Cottages at River Run – Multi-family**
Sewer Capacity Review

Dear Ms. Kinzer:

This letter is prepared in regard to the current submittal for the referenced project. Upon submittal of the design for Cottages at River Run Plat, along the southerly boundary of this project, comment 14 from the first City review of that project requested an evaluation of the sewer capacity. Following is the information provided in the previous comment response letter (dated 10-11-12) regarding the sewer capacity:

14. Attached is a copy of the 3-17-06 letter from Jim Sakamoto which references the Peak Ultimate Flowrate of 180 GPM for build-out of the River Run PUD. Also attached is a schematic of the overall River Run area. The area highlighted in "green", River Run First, Second and Third Addition, account for the 174 residential lots referenced in the letter. The area highlighted in "orange", River Run Addition, accounts for the Life Center Church. As a result, the remaining capacity of 103.6 GPM (commercial and multi-family) is available for the last two unplatted areas consisting of the overall Cottages and Commercial along Fort George Wright Drive. The overall Cottages at River Run, including the current design area together with the two future development areas contain the following uses:
    - Multi-family – 120 units @ .340 GPM/Unit
    - 4 Unit Townhouses – 16 units (4 Lots @ 4 units per lot) @ .340 GPM/Unit
    - Residential – 37 Lots @ .417 GPM/Lot

    The resulting sewer flowrate for the overall Cottages at River Run is calculated to be 61.7 GPM based on prorating the flowrates provided in the attached 3-17-06 letter. Considering this, the remaining surplus available for the unplatted commercial area along Fort George Wright Drive (approximately 13.7 acres) is 41.9 GPM. This calculates to 3.06 GPM/ Acre which exceeds the 2.43 GPM/Acre based on prorating the commercial values in the letter. Based on this information there is not a capacity issue.

As you will note on the current submittal, there are 130 multi-family units plus the Clubhouse/Office resulting in 131 units. Applying this revision to the calculations noted above in the response, the revised resulting sewer flowrate for the overall Cottages at River Run is calculated to be 65.4 GPM, again, based on the prorated flowrates provided. Based on this the revised remaining surplus for the unplatted commercial area along Fort George Wright Drive (13.7 acres±) is 38.2 GPM. Considering that area and flowrate, this calculates to 2.79 GPM/Acre which still exceeds the 2.43 GPM/Acre based on prorating the commercial values in the attached letter. Based on this revised information it appears that there is not a capacity issue.

Following your review, we would be happy to answer any questions you may have regarding this information.

Sincerely,

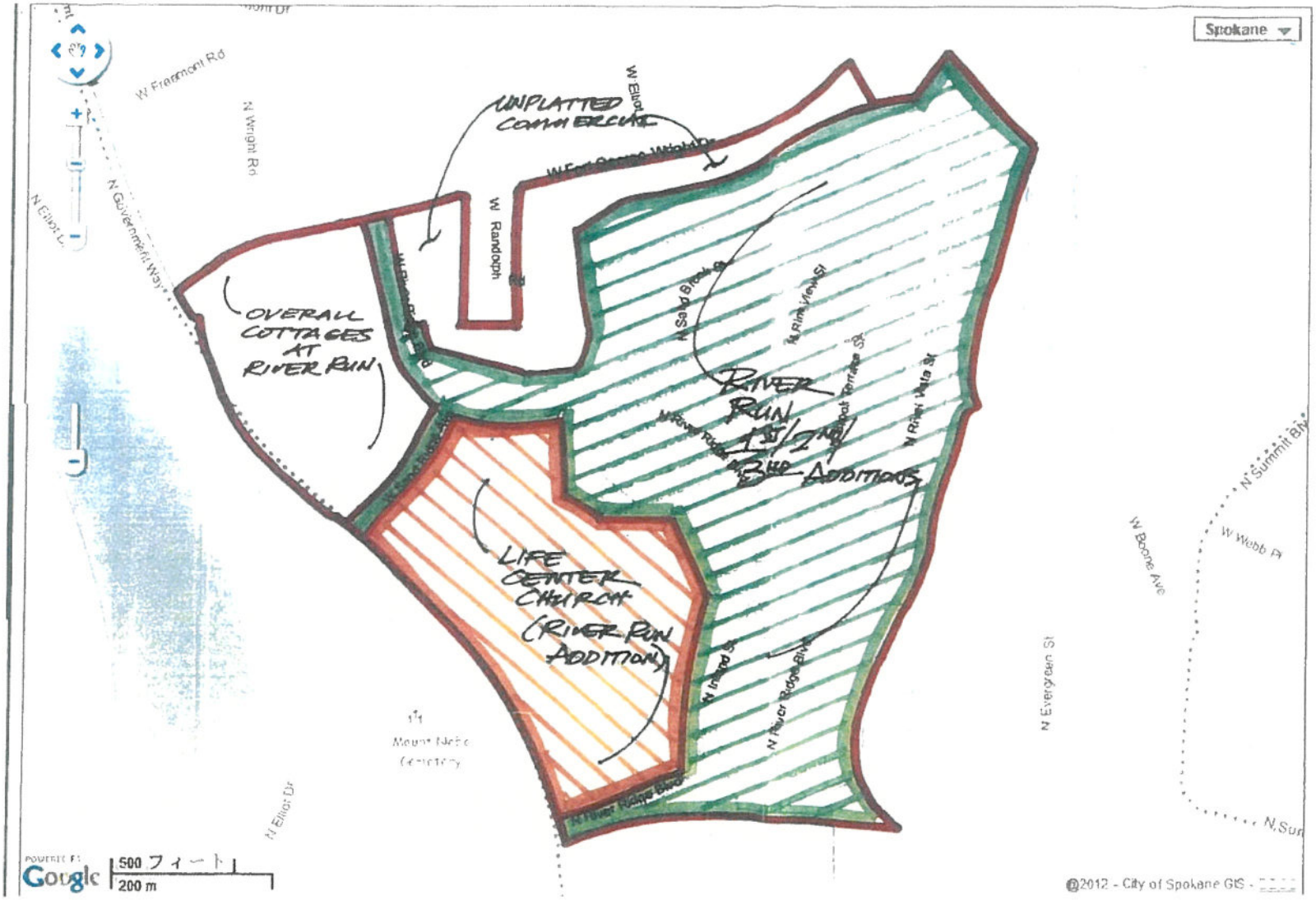
TAYLOR ENGINEERING, INC.

Scott M. Busch

Scott M. Busch, P.E.
Senior Associate/Project Engineer

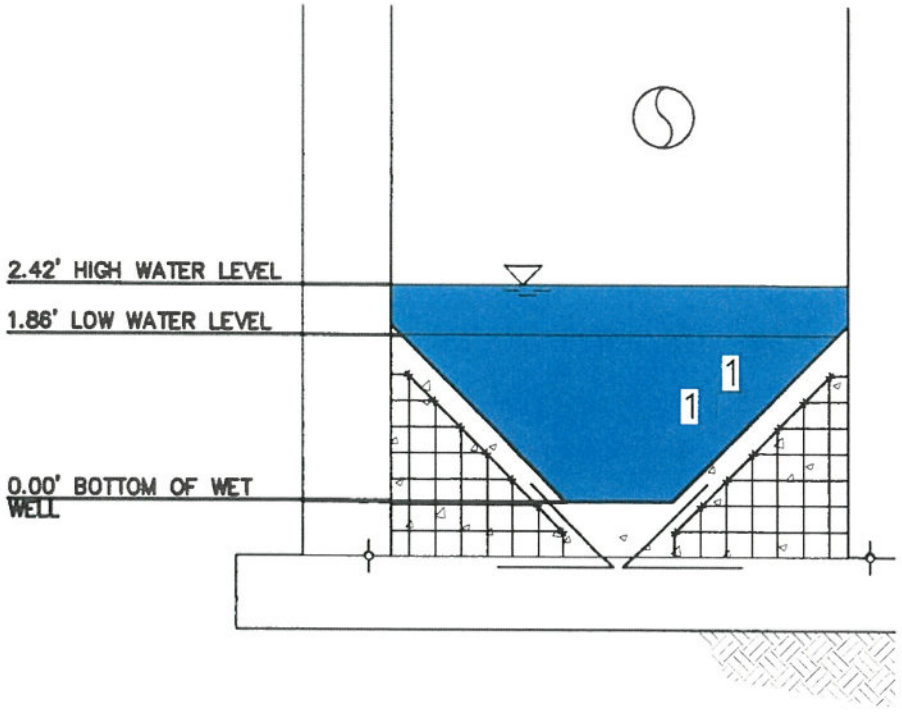
Enclosure

cc: File

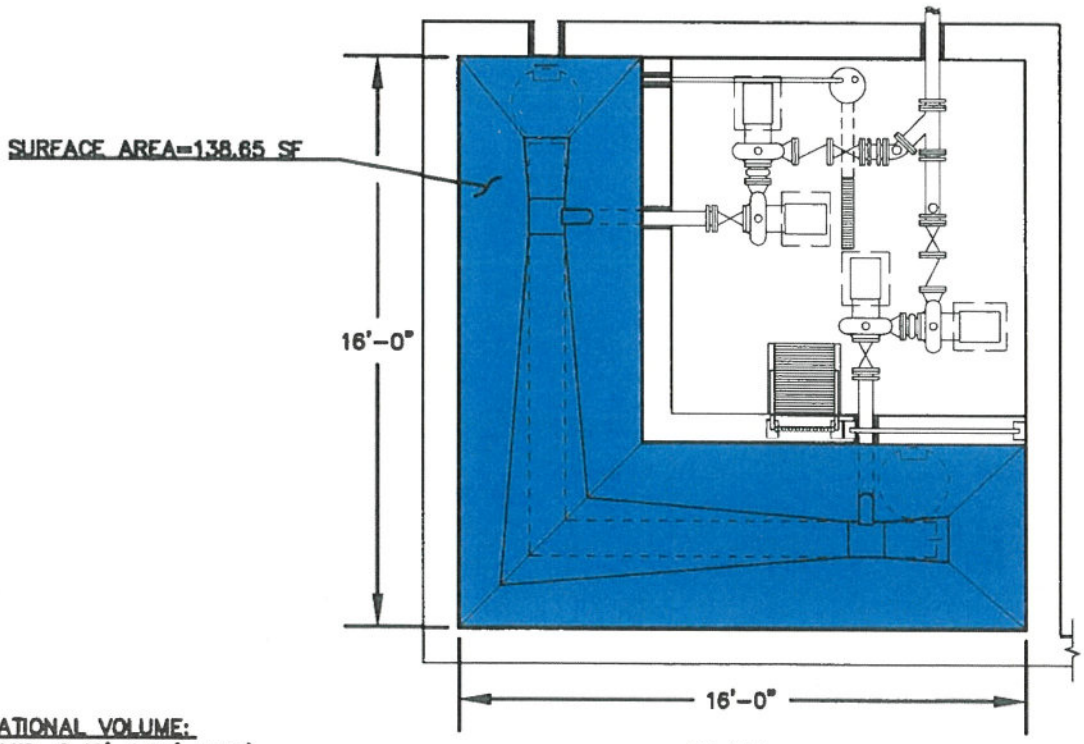

UNPLATTED COMMERCIAL
OVERALL COTTAGES AT RIVER RUN
RIVER RUN 1ST/2ND BLD ADDITIONS
LIFE CENTER CHURCH (RIVER RUN ADDITION)
W Randolph Rd
W Freemont Rd
N Wright Rd
N Government Way
N Elliot Dr
N Summit Blvd
W Webb Pl
W Boone Ave
N Evergreen St
Spokane
500 フィート
200 m
©2012 - City of Spokane GIS

Attachment B

Wet Well Operational Storage Calculations



ELEVATION
SCALE: 1"=2'



PLAN
SCALE: 1"=10'

OPERATIONAL VOLUME:
HWL-LWL=2.42'-1.86'=0.56'
V=H*SA=(0.56')*(138.65 sqft.)=77.64 CF
77.64 CF=580.82 GAL

ATTACHMENT B -
OPERATIONAL VOLUME
CALCULATION

Attachment C

Sample Lift Station Inflow/Outflow Calculations

Inflow Calculations

Plug Volume	Average Inflow (all days)
580 gal	34.14 gpm

Date	Start Cycle Time	End Cycle Time	Difference in Days	Difference in Min	Inflow (GPM)
March 28, 2019	15:45:40	16:08:00	0.015509259	22.3	25.97
	16:13:30	16:31:50	0.012731481	18.3	31.64
	16:37:30	16:58:30	0.014583333	21.0	27.62
	17:04:10	17:27:40	0.016319444	23.5	24.68
	17:33:00	17:48:20	0.010648148	15.3	37.83
	17:54:30	18:11:00	0.011458333	16.5	35.15
	18:16:20	18:32:40	0.011342593	16.3	35.51
	18:39:00	18:53:40	0.010185185	14.7	39.55
	18:59:10	19:15:10	0.011111111	16.0	36.25
	19:21:30	19:34:10	0.008796296	12.7	45.79
	19:40:00	19:52:50	0.008912037	12.8	45.19
	19:59:30	20:11:00	0.007986111	11.5	50.43
	20:16:50	20:28:00	0.00775463	11.2	51.94
	20:35:30	20:46:00	0.007291667	10.5	55.24
	20:52:20	21:03:20	0.007638889	11.0	52.73
	21:12:10	21:24:30	0.008564815	12.3	47.03
	21:30:30	21:43:20	0.008912037	12.8	45.19
	21:51:20	22:01:40	0.007175926	10.3	56.13
	22:07:20	22:22:30	0.010532407	15.2	38.24
	22:28:50	22:43:20	0.010069444	14.5	40.00
	22:48:50	23:03:20	0.010069444	14.5	40.00
	23:10:50	23:25:30	0.010185185	14.7	39.55
	23:31:30	23:52:40	0.014699074	21.2	27.40
March 29, 2019	00:36:00	01:17:30	0.028819444	41.5	13.98
	01:22:40	02:12:50	0.034837963	50.2	11.56
	02:18:00	03:11:10	0.036921296	53.2	10.91
	03:16:40	05:00:20	0.071990741	103.7	5.59
	05:05:10	06:14:00	0.047800926	68.8	8.43
	06:19:20	07:02:40	0.030092593	43.3	13.38
	07:08:00	07:25:40	0.012268519	17.7	32.83
	07:32:00	07:45:00	0.009027778	13.0	44.62
	07:51:10	08:02:40	0.007986111	11.5	50.43
	08:10:10	08:19:30	0.006481481	9.3	62.14
	08:27:50	08:38:30	0.007407407	10.7	54.37
	08:45:50	08:53:20	0.005208333	7.5	77.33
	08:59:40	09:10:10	0.007291667	10.5	55.24
	09:17:50	09:30:30	0.008796296	12.7	45.79
	09:36:10	09:52:50	0.011574074	16.7	34.80
	09:59:10	10:16:20	0.011921296	17.2	33.79
	10:21:30	10:36:30	0.010416667	15.0	38.67
	10:42:40	10:58:10	0.010763889	15.5	37.42
	11:03:30	11:20:30	0.011805556	17.0	34.12
	11:26:40	11:42:20	0.01087963	15.7	37.02
	11:47:40	12:05:00	0.012037037	17.3	33.46
	12:11:20	12:27:30	0.011226852	16.2	35.88
	12:33:20	12:50:10	0.011689815	16.8	34.46
	12:56:50	13:12:30	0.01087963	15.7	37.02
	13:18:30	13:41:40	0.016087963	23.2	25.04
	13:48:00	14:05:30	0.012152778	17.5	33.14
	14:10:50	14:37:50	0.01875	27.0	21.48
	14:43:40	15:03:40	0.013888889	20.0	29.00
	15:08:30	15:33:10	0.01712963	24.7	23.51
	15:40:20	16:03:40	0.016203704	23.3	24.86
	16:08:50	16:33:00	0.016782407	24.2	24.00
	16:39:50	17:05:10	0.017592593	25.3	22.89
	17:10:10	17:30:00	0.013773148	19.8	29.24
	17:36:50	17:55:30	0.012962963	18.7	31.07
	18:00:40	18:22:40	0.015277778	22.0	26.36
	18:30:10	18:47:10	0.011805556	17.0	34.12
	18:52:50	19:10:40	0.012384259	17.8	32.52
	19:17:30	19:32:50	0.010648148	15.3	37.83
	19:39:10	19:53:40	0.010069444	14.5	40.00
	20:02:30	20:16:30	0.009722222	14.0	41.43
	20:23:10	20:38:20	0.010532407	15.2	38.24
	20:46:30	21:00:50	0.009953704	14.3	40.47
	21:06:30	21:20:50	0.009953704	14.3	40.47
	21:27:50	21:43:30	0.01087963	15.7	37.02
	21:49:00	21:59:10	0.007060185	10.2	57.05
	22:04:30	22:21:10	0.011574074	16.7	34.80
	22:26:30	22:46:30	0.013888889	20.0	29.00
	22:53:00	23:11:20	0.012731481	18.3	31.64
	23:16:30	23:35:20	0.013078704	18.8	30.80

Outflow Calculations

Operational Volume

580 gal

Date	Start Cycle Time	Stop Cycle Time	Difference (days)	Difference (min)	Outflow Net (gpm)	Inflow (gpm)	Inflow Average (gpm)	Pumping Capacity Pump #1	Pumping Capacity Pump #2
						25 97			
March 28, 2019	16:08:00	16:13:30	0.003819444	5.5	105.45	31 64	28.80	134.26	
	16:31:50	16:37:30	0.003935185	5.7	102.35	27.62	29 63		131.98
	16:58:30	17:04:10	0.003935185	5.7	102.35	24 68	26.15	128.50	
	17:27:40	17:33:00	0.003703704	5 3	108.75	37 83	31 25		140.00
	17:48:20	17:54:30	0.004282407	6 2	94.05	35.15	36.49	130.54	
	18:11:00	18:16:20	0.003703704	5 3	108.75	35 51	35.33		144.08
	18:32:40	18:39:00	0.004398148	6 3	91.58	39 55	37.53	129.11	
	18:53:40	18:59:10	0 003819444	5.5	105.45	36 25	37.90		143.35
	19:15:10	19:21:30	0 004398148	6 3	91 58	45.79	41.02	132.60	
	19:34:10	19:40:00	0 004050926	5 8	99.43	45 19	45 49		144.92
	19:52:50	19:59:30	0.00462963	6.7	87.00	50 43	47 81	134.81	
	20:11:00	20:16:50	0.004050926	5 8	99.43	51.94	51.19		150.62
	20:28:00	20:35:30	0.005208333	7 5	77 33	55 24	53.59	130.92	
	20:46:00	20:52:20	0 004398148	6 3	91 58	52 73	53.98		145.56
	21:03:20	21:12:10	0 006134259	8 8	65 66	47 03	49 88	115.54	
	21:24:30	21:30:30	0.004166667	6 0	96 67	45 19	46.11		142.78
	21:43:20	21:51:20	0.005555556	8 0	72 50	56 13	50 66	123.16	
	22:01:40	22:07:20	0.003935185	5.7	102.35	38 24	47 19		149.54
	22:22:30	22:28:50	0 004398148	6 3	91 58	40 00	39.12	130.70	
	22:43:20	22:48:50	0.003819444	5 5	105.45	40 00	40 00		145.45
	23:03:20	23:10:50	0 005208333	7 5	77 33	39 55	39.77	117.11	
	23:25:30	23:31:30	0.004166667	6 0	96 67	27.40	33 47		130.14
						13 98	20.69		
March 29, 2019	01:17:30	01:22:40	0.003587963	5 2	112.26	11.56	12 77		125.03
	02:12:50	02:18:00	0 003587963	5 2	112.26	10 91	11 24	123.49	
	03:11:10	03:16:40	0 003819444	5.5	105.45	5 59	8.25		113 71
	05:00:20	05:05:10	0 003356481	4 8	120.00	8 43	7 01	127 01	
	06:14:00	06:19 20	0 003703704	5 3	108.75	13 38	10.91		119 66
	07:02:40	07:08.00	0 003703704	5 3	108 75	32 83	23 11	131.86	
	07:25:40	07:32 00	0 004398148	6 3	91 58	44 62	36.72		130 30
	07:45:00	07:51 10	0 004282407	6 2	94 05	50 43	47.53	141 58	
	08:02:40	08:10 10	0 005208333	7.5	77 33	62 14	56.29		133 62
	08:19:30	08:27 50	0 005787037	8 3	69 60	54 37	58.26	127 86	
	08:38:30	08:45:50	0 005092593	7 3	79 09	77 33	65 85		144 95
	08:53:20	08:59 40	0 004398148	6 3	91 58	55 24	66.29	157 86	
	09.10:10	09:17 50	0 005324074	7 7	75 65	45.79	50 51		126 17
	09:30:30	09:36 10	0 003935185	5 7	102.35	34 80	40.29	142 65	
	09:52:50	09:59 10	0 004398148	6 3	91 58	33.79	34.29		125 87
	10:16:20	10:21 30	0 003587963	5 2	112.26	38 67	36.23	148 48	
	10:36:30	10:42 40	0 004282407	6 2	94 05	37 42	38.04		132 10
	10:58:10	11:03 30	0 003703704	5 3	108.75	34 12	35.77	144 52	
	11:20:30	11:26:40	0 004282407	6 2	94 05	37 02	35 57		129 62
	11:42:20	11 47 40	0 003703704	5 3	108.75	33 46	35.24	143 99	
	12:05:00	12:11 20	0 004398148	6 3	91 58	35.88	34.67		126 25
	12:27:30	12 33 20	0 004050926	5 8	99 43	34 46	35.17	134 59	
	12:50:10	12 56 50	0 00462963	6 7	87 00	37 02	35.74		122 74
	13:12:30	13:18 30	0 004166667	6 0	96 67	25 04	31.03	127 70	
	13:41:40	13:48 00	0 004398148	6 3	91 58	33 14	29 09		120 67
	14:05:30	14:10 50	0 003703704	5 3	108.75	21 48	27 31	136 06	
	14:37:50	14:43 40	0 004050926	5 8	99 43	29 00	25 24		124 67
	15:03:40	15 08 30	0 003356481	4 8	120.00	23 51	26 26	146 26	
	15:33:10	15:40:20	0.004976852	7.2	80 93	24 86	24.19		105.12
	16:03:40	16:08:50	0.003587963	5 2	112.26	24 00	24.43	136 69	
	16:33:00	16:39:50	0.00474537	6 8	84 88	22 89	23 45		108.33
	17:05:10	17:10:10	0.003472222	5 0	116.00	29 24	26.07	142 07	
	17:30:00	17:36:50	0 00474537	6 8	84 88	31 07	30.16		115.04
	17:55:30	18:00:40	0.003587963	5 2	112.26	26 36	28.72	140.98	
	18:22:40	18:30:10	0.005208333	7 5	77.33	34 12	30.24		107.57
	18:47:10	18:52:50	0.003935185	5.7	102.35	32 52	33.32	135.67	
	19:10:40	19:17:30	0 00474537	6 8	84 88	37 83	35.17		120.05
	19:32:50	19:39:10	0.004398148	6 3	91 58	40 00	38.91	130.49	
	19:53:40	20:02:30	0.006134259	8 8	65 66	41.43	40.71		106.37
	20:16:30	20:23:10	0 00462963	6 7	87 00	38 24	39 84	126 84	
	20:38:20	20:46:30	0.005671296	8 2	71 02	40 47	39.35		110.37
	21:00:50	21:06:30	0.003935185	5.7	102.35	40 47	40.47	142 82	
	21:20:50	21:27:50	0.004861111	7.0	82 86	37 02	38 74		121.60
	21:43:30	21:49:00	0.003819444	5 5	105.45	57 05	47 04	152 49	
	21:59:10	22:04:30	0.003703704	5 3	108.75	34 80	45 92		154.67
	22:21:10	22:26:30	0.003703704	5 3	108 75	29 00	31.90	140.65	
	22:46:30	22:53:00	0.004513889	6 5	89 23	31 64	30 32		119.55
	23:11:20	23:16:30	0 003587963	5 2	112.26	30 80	31 22	143.47	

Attachment D

Pump Station Cycling Calculations

Riverrun sewage flow evaluation
Tom Jordan
6/11/2020
RIVER RUN SEWAGE PUMP STATION
Existing Sewage Flows plus additional

Designed: TLJ

PUMP CYCLE CALCULATOR

Inflow Calculations

Sewage Source	Low Flow	Average Flow	Peak Flow
Combo of MF and Comm	5	35	80

INPUT DATA

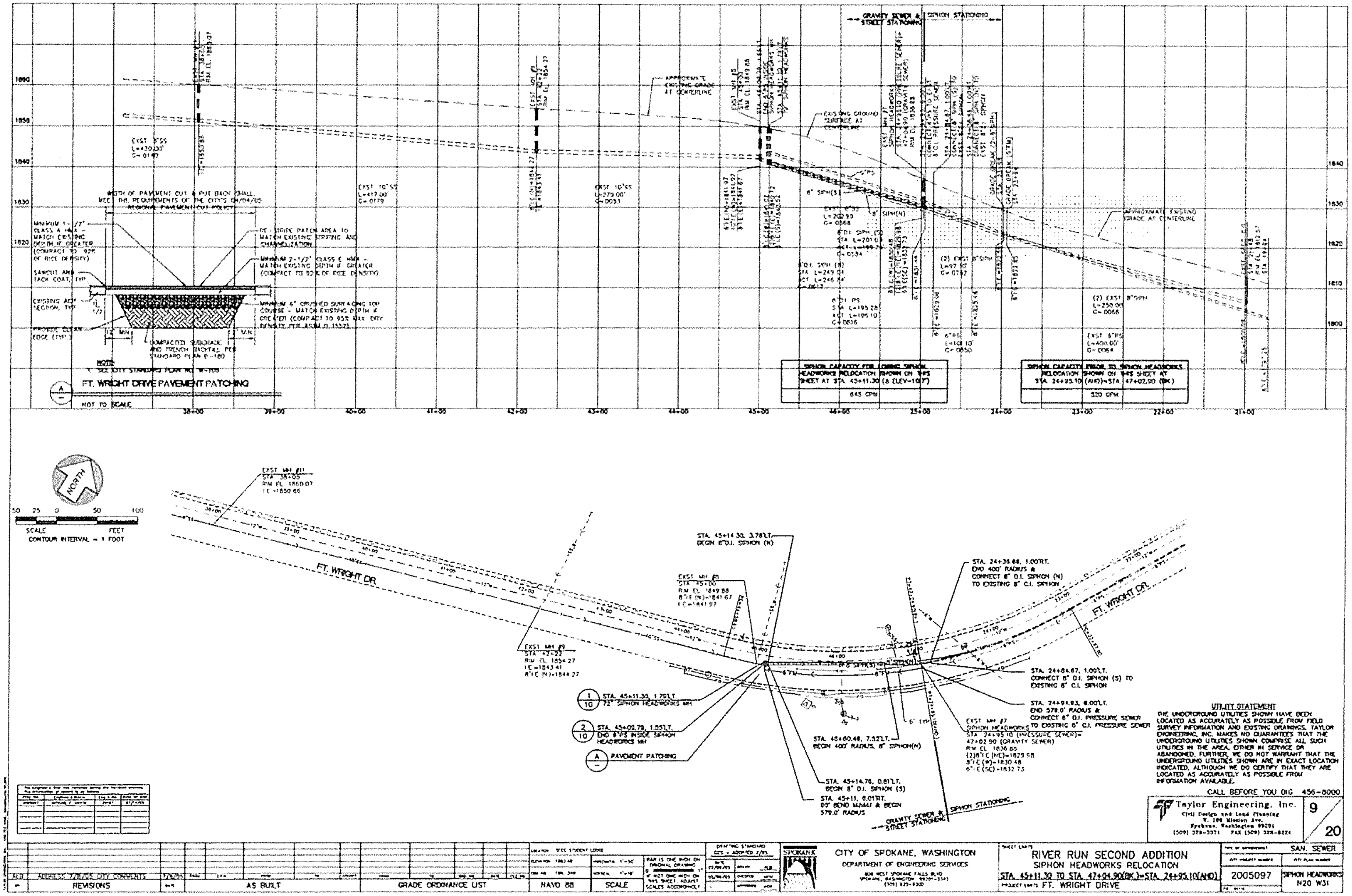
	low	avg	peak	Future peak	Future no pump upgrades
Wet Well Surface Area		138.7		138.7	138.7
Pump Down Distance (feet)		0.56		0.56	0.56
Average Pump Flow (gpm)		120.0		180.0	120.0
Inflow (gpm)	5.0	35.0	80.0	150.0	100.0

CYCLE TIME CALCULATED RESULTS

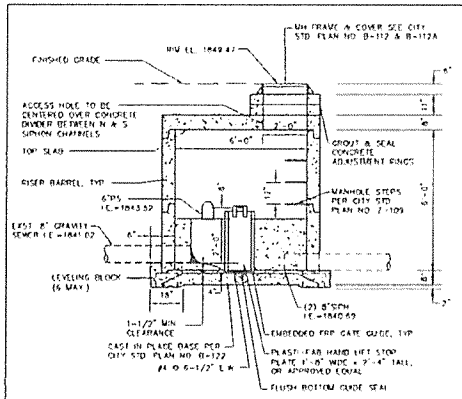
	low	avg	peak	Future peak	Future no pump upgrades
Pump Down Volume (gal)		580.8		580.8	580.8
Wet Well Fill Time (min)	116.2	16.6	7.3	3.9	5.8
Run Time (min) No inflow		4.8		3.2	4.8
Run Time (min) With Inflow	5.1	6.8	14.5	19.4	29.0
Starts / hr With Inflow	0.5	2.6	2.8	2.6	1.7
Fill + Run Time (min)	121.2	23.4	21.8	23.2	34.8

Attachment E

Siphon (Depressed Sewer)
Headworks Relocation Record
Drawings

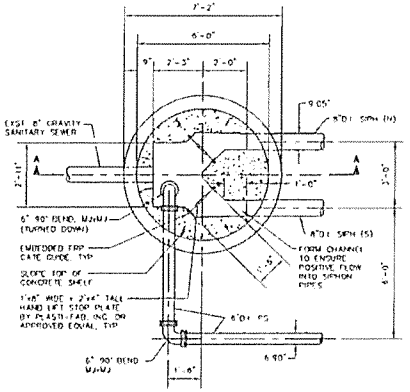


GRAVITY SEWER & STREET STATIONING
SIPHON STATIONING
APPROXIMATE EXISTING GRADE AT CENTERLINE
EXISTING GROUND SURFACE AT CENTERLINE
WIDTH OF PAVEMENT CUT & PUT BACK SHALL MEET THE REQUIREMENTS OF THE CITY'S 04/04/05 REGIONAL PAVEMENT CUT POLICY
MINIMUM 1-1/2" CLASS A HMA - MATCH EXISTING DEPTH IF GREATER (COMPACT TO 92% OF RICE DENSITY)
SAWCUT AND TACK COAT, TYP.
EXISTING ACP SECTION, TYP.
PROVIDE CLEAN EDGE (TYP.)
RE-STRIPE PATCH AREA TO MATCH EXISTING STRIPING AND CHANNELIZATION
MINIMUM 2-1/2" CLASS E HMA - MATCH EXISTING DEPTH IF GREATER (COMPACT TO 92% OF RICE DENSITY)
MINIMUM 6" CRUSHED SURFACING TOP COURSE - MATCH EXISTING DEPTH IF GREATER (COMPACT TO 95% MAX. DRY DENSITY PER ASTM D 1557)
COMPACTED SUBGRADE AND TRENCH BACKFILL PER STANDARD PLAN B-180
NOTE:
1. SEE CITY STANDARD PLAN NO. W-705
FT. WRIGHT DRIVE PAVEMENT PATCHING
NOT TO SCALE
SIPHON CAPACITY FOR LOWING SIPHON HEADWORKS RELOCATION SHOWN ON THIS SHEET AT STA. 45+11.30 (A ELEV=1017')
645 GPM
SIPHON CAPACITY PRIOR TO SIPHON HEADWORKS RELOCATION SHOWN ON THIS SHEET AT STA. 24+95.10 (AHD)=STA. 47+02.90 (BK)
520 GPM
NORTH
SCALE
FEET
CONTOUR INTERVAL = 1 FOOT
FT. WRIGHT DR.
STA. 45+14.30, 3.78'LT. BEGIN 8"D.I. SIPHON (N)
STA. 24+36.66, 1.00'RT. END 400' RADIUS & CONNECT 8" D.I. SIPHON (N) TO EXISTING 8" C.I. SIPHON
STA. 24+84.67, 1.00'LT. CONNECT 8" D.I. SIPHON (S) TO EXISTING 8" C.I. SIPHON
STA. 24+94.93, 6.00'LT. END 579.0' RADIUS & CONNECT 8" D.I. PRESSURE SEWER TO EXISTING 8" C.I. PRESSURE SEWER
STA. 45+11.30, 1.70'LT. 72" SIPHON HEADWORKS MH
STA. 45+02.79, 1.55'LT. END 8"PS INSIDE SIPHON HEADWORKS MH
PAVEMENT PATCHING
STA. 45+60.48, 7.52'LT. BEGIN 400' RADIUS, 8" SIPHON(N)
STA. 45+14.76, 0.81'LT. BEGIN 8" D.I. SIPHON (S)
STA. 45+11, 6.01'RT. 90° BEND MJxMJ & BEGIN 579.0' RADIUS
UTILITY STATEMENT
THE UNDERGROUND UTILITIES SHOWN HAVE BEEN LOCATED AS ACCURATELY AS POSSIBLE FROM FIELD SURVEY INFORMATION AND EXISTING DRAWINGS. TAYLOR ENGINEERING, INC. MAKES NO GUARANTEES THAT THE UNDERGROUND UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. FURTHER, WE DO NOT WARRANT THAT THE UNDERGROUND UTILITIES SHOWN ARE IN EXACT LOCATION INDICATED, ALTHOUGH WE DO CERTIFY THAT THEY ARE LOCATED AS ACCURATELY AS POSSIBLE FROM INFORMATION AVAILABLE.
CALL BEFORE YOU DIG 456-8000
Taylor Engineering, Inc.
Civil Design and Land Planning
Spokane, Washington 99201
9
20
CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
RIVER RUN SECOND ADDITION
SIPHON HEADWORKS RELOCATION
STA. 45+11.30 TO STA. 47+04.90(BK.)=STA. 24+95.10(AHD)
FT. WRIGHT DRIVE
SAN. SEWER
2005097
SIPHON HEADWORKS
N20 W31
REVISIONS
AS BUILT
GRADE ORDINANCE LIST
NAVD 88
SCALE



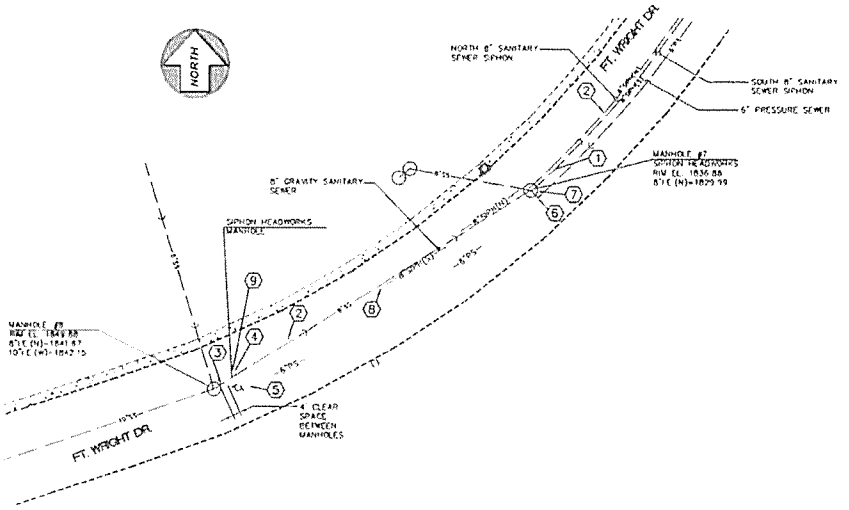
1/9 SIPHON HEADWORKS MANHOLE - SECTION A-A

NOT TO SCALE



2/9 SIPHON HEADWORKS MANHOLE - PLAN

NOT TO SCALE



3/9 ENLARGED PIPING SCHEMATIC DETAIL

SCALE: 1"=30'-0"

CALL BEFORE YOU DIG 456-8000

Taylor Engineering, Inc.
Civil Design and Land Planning
W. 108 Mission Ave.
Spokane, Washington 99201
(509) 328-3371 FAX (509) 328-8214

10/20

NO.	REVISIONS	DATE	AS BUILT	GRADE ORDINANCE UST	NAVD 88	SCALE
1	ADDRESS 7/28/95 CITY COMMENTS	7/6/95				

CITY OF SPOKANE, WASHINGTON
DEPARTMENT OF ENGINEERING SERVICES
808 WEST SPOKANE FALLS BLVD.
SPOKANE, WASHINGTON 99201-3343
(509) 625-6300

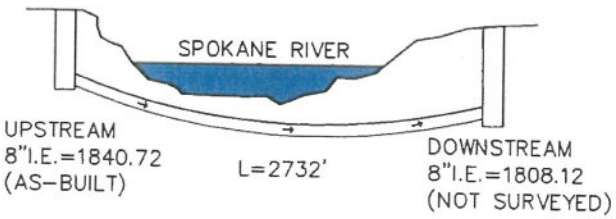
RIVER RUN SECOND ADDITION
SIPHON HEADWORKS RELOCATION DETAILS
FT. WRIGHT DRIVE

TYPE OF IMPROVEMENT	SAN. SEWER
CITY PROJECT NUMBER	2005097
CITY PLAN NUMBER	SIPHON HEADWORKS
T.R. NUMBER	N20 W31

Attachment F

Depressed Sewer Capacity Calculation

DEPRESSED SEWER CALCULATIONS:
EQUATIONS USED:
-HAZEN WILLIAMS HEAD LOSS
-REYNOLD'S NUMBER
-EQUIVALENT LENGTH



$\Delta H = 1840.72 - 1808,12 = 32.6'$

HAZEN WILLIAMS: $Hf = 0.2083\left(\frac{100}{C}\right)^{1.85}\frac{(Q)^{1.85}}{(D)^{4.8655}}$

WHERE: Hf=HEAD LOSS PER 100 FEET OF PIPE
C=HAZEN WILLIAMS FRICTION FACTOR (100 FOR STEEL)
Q=FLUID FLOWRATE (GPM)
D=DIAMETER OF PIPE (INCHES)

REYNOLD'S NUMBER: $Re = (7745.8)\frac{VD}{v}$

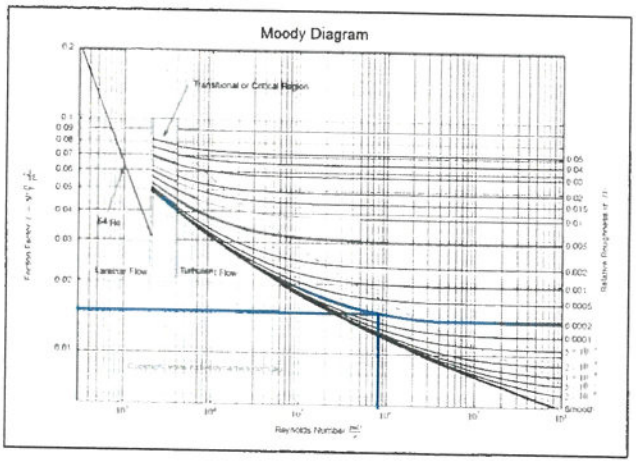
WHERE: V=VELOCITY (FT/S)
D=DIAMETER (INCHES)
v=KINEMATIC VISCOSITY (cSt)($1cSt = 10^{-6}m^2/S$)

EQUIVALENT LENGTH: $\frac{K(D)}{f}$

WHERE: K=MINOR LOSS COEFFICIENT
D=DIAMETER (FT)
f=DARCY WEISBACH FRICTION FACTOR

CALCULATE THE TOTAL LENGTH OF PIPE INCLUDING EQUIVALENT LENGTHS OF FITTINGS AND ENTRANCE AND EXIT LOSS COEFFICIENTS.
2X45 DEGREE BENDS Le=15.4'
1X ENTRANCE K=0.5
1X EXIT K=1.0

TO FIND EQ. LENGTH OF PIPE FOR THE ENTRANCE AND EXIT LOSSES, DETERMINE THE REYNOLDS NUMBER USING THE FRICTION FACTOR FROM THE MOODY DIAGRAM (RIGHT).



ASSUME 600 GPM IN A 8 INCH PIPE, V=3.83 FT/S
v=0.294 cSt

$Re = (7745.8)\frac{(3.83)(8)}{0.294} = 807249$ (FULLY TURBULENT)
ALSO NEED RELATIVE ROUGHNESS FOR
STEEL PIPE : $\varepsilon = 0.0018$ (IN)
$\varepsilon/D = (0.0018)/(8) = 0.000225$
THEREFORE F=0.015

FIND EQUIVALENT LENGTH: $\frac{(1.5)(0.666)}{(0.015)} = 66.6'$

COMBINED LENGTH: (2732)+(66.6)+(15.4)=2814 FT

Hf=32.6/(2814/100)=1.158 FT/100 FT

$1.158 = 0.2083(100/100)^{1.85}(Q)^{1.85}/(8)^{4.8635}$

CALCULATED CAPACITY OF DEPRESSED SEWER INCLUDING MINOR LOSSES
Q=598.22 GPM

ATTACHMENT F -
DEPRESSED SEWER
CAPACITY CALCULATION