

August 20, 2018

Re: Artisan Point – Sanitary Sewer Capacity
Project: 17086

Mr. Jeff Thorn, PE
City of Lee's Summit
Water Utilities
220 SE Green Street
Lee's Summit, MO 64063

Dear Mr. Thorn,

Attached are calculations in conformance with Section 6501 regarding the capacity of existing sanitary sewer mains downstream of the proposed Artisan Point apartment project. This work supersedes prior studies dated May 3, 2018 and July 27, 2018. Any previous study by this firm should be discarded.

This work is in response to the Applicant Meeting held with the Lee's Summit staff on August 08, 2018. At that time, we were advised of minor coefficients and applications of the code that would result in slightly different calculations. Additionally, the applicant meeting comment centered on the requirement for analysis of any other potential contributing drainage area. The following material provides hydraulic analysis of approximately 700 acres, 12,000 linear feet of existing lines and 5,200 feet of potential extensions in the future.

Of most significance, is the notion of routing all possible flows to the 24" line running along the east side of Millcreek Lake. We have prepared schematic design of a line extending from the northeast corner of Artisan Point, block 2, east along Millcreek, then north and northeast through open space to connect to an existing 24" sanitary line located along the rear property line of lot 91, Mill Creek of Summit Mill.

An additional area of interest is a remnant run of 8" pipe laying along the south side of SE Langsford Road. Schematic design is attached that identifies approximately 490 linear feet of 24" line that will replace the inadequate 8" pipe.

The analysis extends 5,400 feet south of the subject property to the East Prairie Lee EFHB. We have derived a hydraulic profile of the system from GIS data provided by the City. The loads have been derived from Section 6501.C.1. Worksheets are attached.

Preliminary designs for sanitary sewer mains serving the commercial area immediately south of the Artisan Point development direct those loads to the west and around this area of interest.

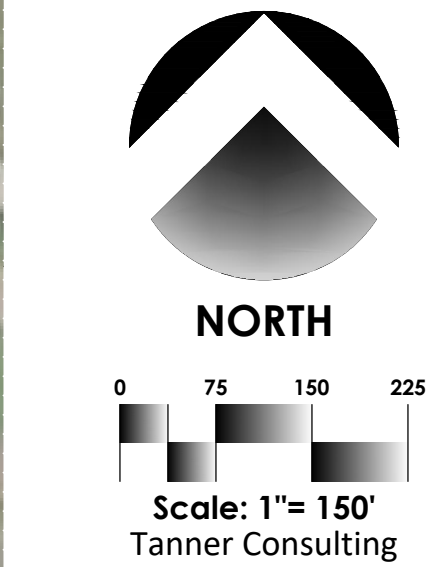
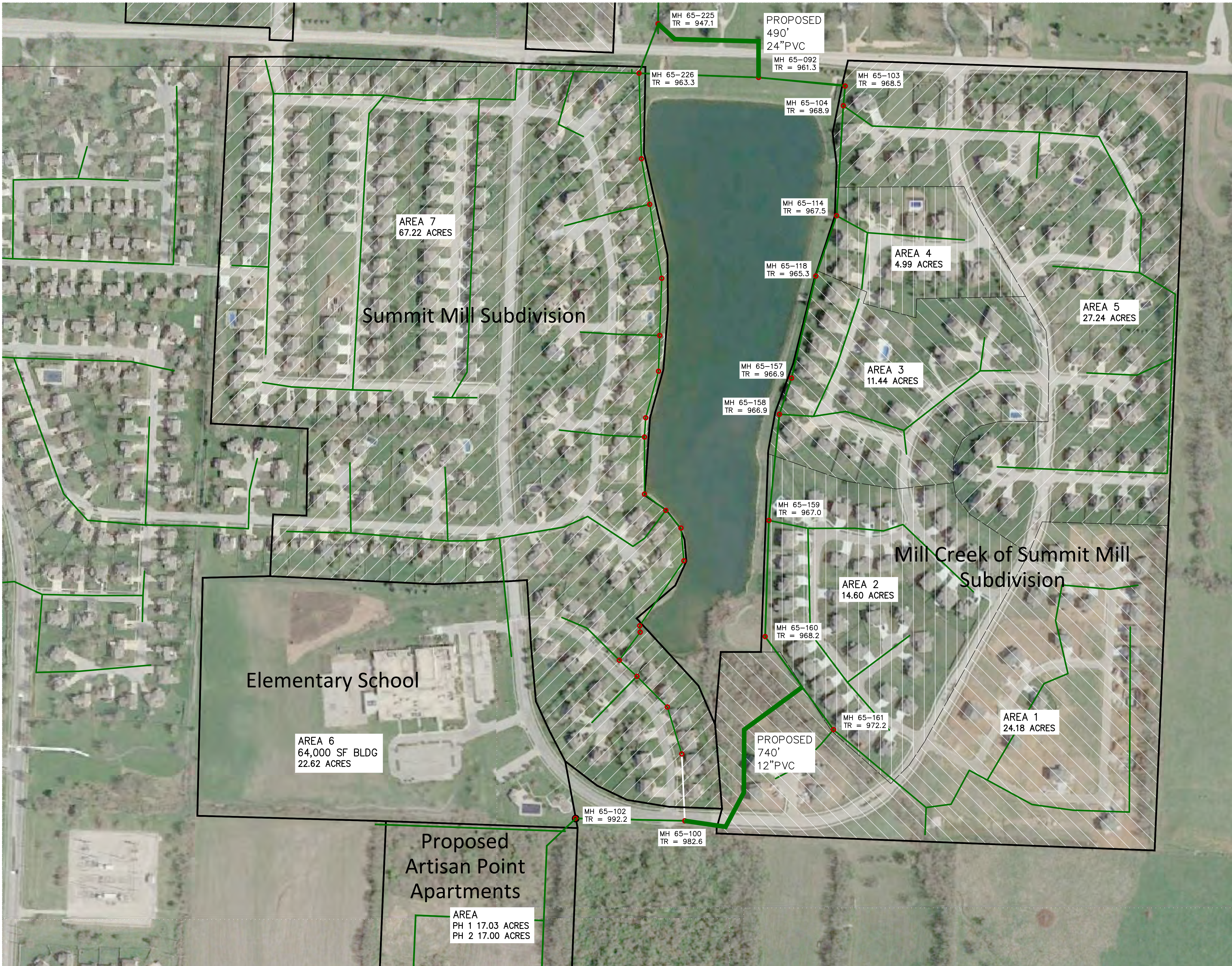
The hydraulic grade lines resulting from the fully loaded condition, rely on the pipe to discharge at normal depth at the EFHB, and, in that instance, minor areas of surcharge may be expected. (See profile).

This study encompasses 700 acres of land, 12,500 linear feet of existing sanitary sewer mains and outlines extension of 5,200 linear feet of potential future mains. This work has been prepared in support of the Artisan Point Development plan.

For your consideration,



Dan E. Tanner, PE



5323 SOUTH LEWIS AVENUE
TULSA OKLAHOMA 74105-6539
OFFICE: 918.745.9929
www.tannerbaltshop.com
MISSOURI CERTIFICATION NO.
2007025524 EXP. 12/31/2019



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ALL CONSTRUCTION TO BE IN STRICT ACCORDANCE WITH CURRENT CITY OF TULSA STANDARDS AND SPECIFICATIONS (INCLUDING O.D.O.T. 2009 EDITION).

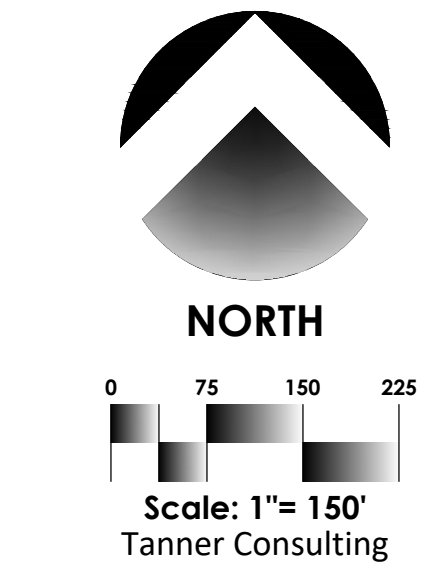
Artisan Point
Shenandoah Dr
Lee's Summit, MO

PROJECT: 17086
ISSUE DATE: 5/4/2018
ATLAS PAGE NO:

PLAN SCALE: (H)
(V)

Existing SS
South
Connections

SS-01



Tanner Consulting LLC
CIVIL ENGINEERING |
5323 SOUTH LEWIS AVENUE
TULSA, OKLAHOMA 74105-6539
OFFICE: 918.745.9929
www.tannerbaltshop.com
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Shenandoah Dr
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PROJECT: 17086
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ATLAS PAGE NO:

PLAN SCALE: (H)
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Existing SS
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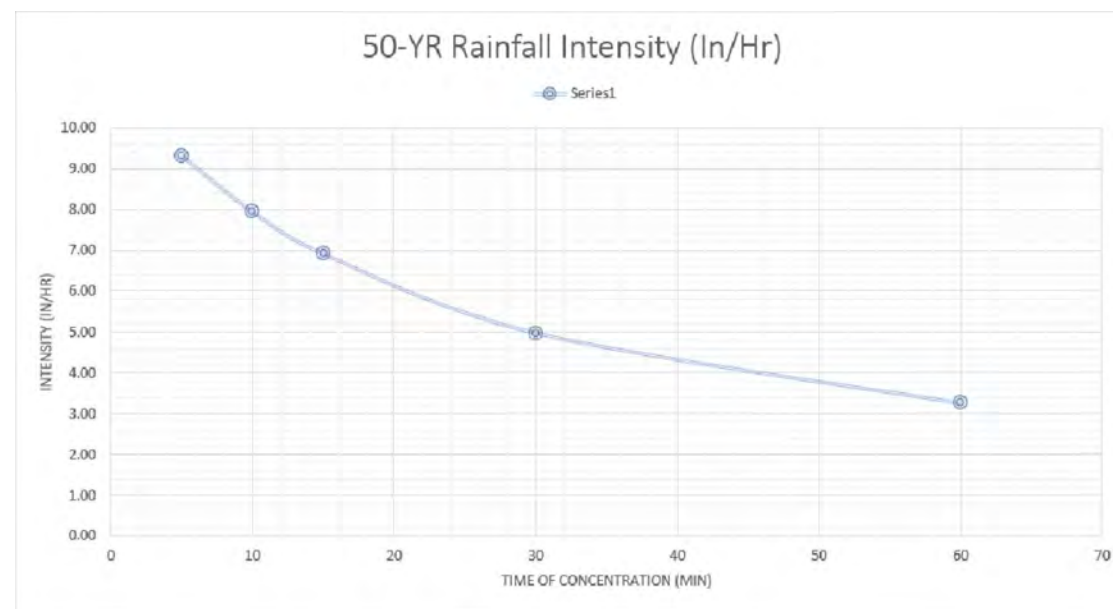
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1. Peak Base Flow					
Existing Basin	Equivalent Development Units (EDU)	Area (Acres)	Peak Base Flow (GPD/AC)	Peak Flow (GPD)	Peak Flow (CFS)
Area 1 - MH 65-161	1.0	24.18	1,500	36,270	0.0561
Area 2 - MH 65-159	1.0	14.60	1,500	21,900	0.0339
Area 3 - MH 65-158	1.0	11.44	1,500	17,160	0.0266
Area 4 - MH 65-114	1.0	4.99	1,500	7,485	0.0116
Area 5 - MH 65-104	1.0	27.24	1,500	40,860	0.0632
Area 7 - MH 65-225	1.0	67.22	1,500	100,830	0.1560
Area 8 - MH 65-150	1.0	9.40	1,500	14,100	0.0218
Area 9 - MH 65-148	1.0	31.60	1,500	47,400	0.0733
Area 10 - MH 65-147	1.0	33.10	1,500	49,650	0.0768
Area 11 - MH 65-148	1.0	4.94	1,500	7,410	0.0115
Area 12 - MH 65-146	1.0	25.84	1,500	38,760	0.0600
Area 13 - MH 65-145	1.0	14.75	1,500	22,125	0.0342
		SF	GPD/1000SF		
Area 6 - MH 65-225 (Elementary School)	0.8	64,000.00	300	19,200	0.0297
		Peak Existing Base Flow Sum =		423,150	0.6547
Proposed Basin	EDU	Area (Acres)	Peak Flow/Capita (GPD)	Peak Flow (GPD)	Peak Flow (CFS)
Proposed Apartments PH 1 MH 65-102	1.0	17.03	1,500	25,545	0.0395
Proposed Apartments PH 2 MH 65-102	1.0	17.00	1,500	25,500	0.0395
		Peak Existing and Proposed Base Flow Sum =		448,650	0.69

2. Peak Infiltration				
Existing Basin	Area (Acres)	Peak Infiltration per Acre (GPD/Acre)	Peak Flow (GPD)	Peak Flow (CFS)
Area 1 - MH 65-161	24.18	500	12,090	0.0187
Area 2 - MH 65-159	14.60	500	7,300	0.0113
Area 3 - MH 65-158	11.44	500	5,720	0.0089
Area 4 - MH 65-114	4.99	500	2,495	0.0039
Area 5 - MH 65-104	27.24	500	13,620	0.0211
Area 7 - MH 65-225	67.22	500	33,610	0.0520
Area 8 - MH 65-150	9.40	500	4,700	0.0073
Area 9 - MH 65-148	31.60	500	15,800	0.0244
Area 10 - MH 65-147	33.10	500	16,550	0.0256
Area 11 - MH 65-148	4.94	500	2,470	0.0038
Area 12 - MH 65-146	25.84	500	12,920	0.0200
Area 13 - MH 65-145	14.75	500	7,375	0.0114
Area 6 - MH 65-225 (Elementary School)	22.62	250	5,655	0.0087
	Peak Existing Infiltration Sum =		140,305	0.2171
Proposed Basin	Area (Acres)	Peak Infiltration per Acre (GPD/Acre)	Peak Flow (GPD)	Peak Flow (CFS)
Proposed Apartments PH 1 MH 65-102	17.03	500	8,515	0.0132
Proposed Apartments PH 2 MH 65-102	17.00	500	8,500	0.0132
Peak Existing and Proposed Infiltration Sum =			148,805	0.2302

3. Peak Inflow					
Existing Basin	Area (Acres)	Inflow Factor (K)	Time of Concentration (Minutes)	Rainfall Intensity For 50-YR Storm (Inches/Hour)	Peak Flow (CFS)
Area 1 - MH 65-161	24.18	0.006	41.5	4.2	0.6093
Area 2 - MH 65-159	14.60	0.006	36.5	4.5	0.3942
Area 3 - MH 65-158	11.44	0.006	34.3	4.6	0.3157
Area 4 - MH 65-114	4.99	0.006	27.8	3.4	0.1018
Area 5 - MH 65-104	27.24	0.006	42.7	4.1	0.6701
Area 7 - MH 65-225	67.22	0.006	53.7	4	1.6133
Area 8 - MH 65-150	9.40	0.006	32.7	4	0.2256
Area 9 - MH 65-148	31.60	0.006	44.4	4.7	0.8911
Area 10 - MH 65-147	33.10	0.006	44.9	4.1	0.8143
Area 11 - MH 65-148	4.94	0.006	27.8	4	0.1186
Area 12 - MH 65-146	25.84	0.006	42.2	5.1	0.7907
Area 13 - MH 65-145	14.75	0.006	36.6	4.1	0.3629
Area 6 - MH 65-225 (Elementary School)	22.62	0.003	40.8	4.3	0.2918
Peak Existing Inflow Sum =					7.1994
Proposed Basin	Area (Acres)	Inflow Factor (K)	Time of Concentration (Minutes)	Rainfall Intensity For 50-YR Storm (Inches/Hour)	Peak Flow (CFS)
Proposed Apartments PH 1 MH 65-102	17.03	0.006	38.0	4.1	0.4189
Proposed Apartments PH 2 MH 65-102	17.00	0.006	37.9	4.1	0.4182
			Peak Existing and Proposed Inflow Sum = 7.6176		

4. Totals				
Existing Basin	Peak Base Flow (CFS)	Peak Infiltration (CFS)	Peak Inflow (CFS)	Total Basin CFS
Area 1 - MH 65-161	0.0561	0.0187	0.6093	0.6842
Area 2 - MH 65-159	0.0339	0.0113	0.3942	0.4394
Area 3 - MH 65-158	0.0266	0.0089	0.3157	0.3511
Area 4 - MH 65-114	0.0116	0.0039	0.1018	0.1172
Area 5 - MH 65-104	0.0632	0.0211	0.6701	0.7544
Area 7 - MH 65-225	0.1560	0.0520	1.6133	1.8213
Area 8 - MH 65-150	0.0218	0.0073	0.2256	0.2547
Area 9- MH 65-148	0.0733	0.0244	0.8911	0.9889
Area 10 - MH 65-147	0.0768	0.0256	0.8143	0.9167
Area 11 - MH 65-148	0.0115	0.0038	0.1186	0.1338
Area 12 - MH 65-146	0.0600	0.0200	0.7907	0.8707
Area 13 - MH 65-145	0.0342	0.0114	0.3629	0.4085
Area 6 - MH 65-225 (Elementary School)	0.0297	0.0087	0.2918	0.3303
Proposed Basin				
Proposed Apartments PH 1 MH 65-102	0.0395	0.0132	0.4189	0.4716
Proposed Apartments PH 2 MH 65-102	0.0395	0.0132	0.4182	0.4708
SUM =	0.7337	0.2434	8.0365	
			Total Sum (CFS)=	9.0136



d. The rainfall intensity can be determined using the table below and the tributary area's T_t as calculated above. Use interpolation to calculate rainfall intensities for T_t not listed in the table.

Year	Time of Concentration (min)									
	5	10	15	30	60	120	180	240	360	600
	Rainfall Intensity (iph)									
1	4.48	3.53	3.05	2.09	1.41	0.86	0.60	0.47	0.35	0.25
3	5.84	4.77	4.13	2.90	1.93	1.18	0.86	0.69	0.51	0.36
5	6.47	5.34	4.63	3.28	2.17	1.32	0.97	0.79	0.58	0.40
10	7.33	6.12	5.32	3.79	2.50	1.52	1.13	0.93	0.68	0.47
25	8.46	7.16	6.22	4.47	2.93	1.78	1.34	1.12	0.80	0.56
50	9.32	7.94	6.91	4.98	3.26	1.98	1.50	1.26	0.90	0.62
75	9.82	8.40	7.31	5.27	3.46	2.10	1.59	1.34	0.96	0.66
100	10.18	8.72	7.59	5.49	3.59	2.18	1.65	1.39	1.00	0.69

$$e. \text{ Peak Flow} = \text{Peak Base Flow} + \text{Peak Infiltration} + \text{Peak Inflow}$$

Source	EDU		Parameter
Institutional			
Hospital (not including ancillary services, i.e., cafeterias)	0.8	per	bed
Nursing Home	0.4	per	unit
Prison/Jail	0.4	per	inmate
Retirement Home	0.4	per	unit
Schools:			
Elementary	0.8	per	1000 ft ²
Middle and High	1.0	per	1000 ft ²
Commercial/Retail			
Office-General	0.3	per	1000 ft ²
Retail Stores	0.2	per	1000 ft ²
Warehouse (minimum 70% warehouse)	0.1	per	1000 ft ²
Shopping Centers and Stores	0.2	per	1000 ft ²
Restaurants:			
Drive-In	0.1	per	parking space
Fast Food (disposable patron wares)	1.6	per	1000 ft ²
Full Service	3.5	per	1000 ft ²
Animal Clinics	1.0	per	1000 ft ²
Auditoriums	0.6	per	1000 ft ²
Automobile Dealerships:			
Office Rate + Service Bays	office rate + 0.1 per service bay		
Automobile Service:			
Fast Service	0.5	per	service bay
Major Service	0.1	per	service bay
Bars and Cocktail Lounges	2.4	per	1000 ft ²
Banquet Rooms—food catered	0.5	per	1000 ft ²
Banquet Rooms—food prepared	1.1	per	1000 ft ²
Beauty Shop/Barber Shop	0.1	per	1000 ft ²
Body Shop	0.1	per	1000 ft ²
Bowling Alleys	0.4	per	lane
Car Wash			
self-service	3.0	per	stall
automatic at service station	6.0	per	stall
tunnel, car pulled through	requires equipment		
Churches	0.5	per	1000 ft ²
Daycare/Nursery Schools	1.5	per	1000 ft ²
Dry Cleaners	0.3	per	1000 ft ²
Childhouse (apartment)	1.0		
County Club			
private with golf course	3.0 + 2.2/1000 ft ²		
private without golf course	2.2	per	1000 ft ²
Exercise Area			
gym without showers	0.5	per	1000 ft ²
gym with showers	1.4	per	1000 ft ²
Fire Station	by water use		

Source	EDU		Parameter
Game Room/Arcade	0.8	per	1000 ft ²
Golf Course	3.0		
Greenhouse (area open to public)	0.2	per	1000 ft ²
Group Home	0.4	per	bed
Handball and Racquetball Courts	2.0	per	court
Hotel/Motel	0.3	per	room
Laundromat/Commercial Laundry	0.6/washer or 8.0/1000 ft ²		
Library (excluding book/file storage)	0.4	per	1000 ft ²
Locker Rooms	0.1	per	locker
Medical Offices/Outpatient Clinics	0.4	per	1000 ft ²
Meeting/Conference Rooms	0.6	per	1000 ft ²
Museum	0.4	per	1000 ft ²
Rifle/Handgun Ranges	0.2	per	lane
Roller Link	1.2	per	1000 ft ²
Schools—Technical Vocational Institute, Junior College	0.9	per	1000 ft ²
Gas Station:			
with convenience center and without service bays	1.0 + 0.3/1000 ft ²		
without convenience center and without service bays	1.0		
Service Station:			
with 2 service bays	2.0		
with 2 service bays and car wash	8.0		
with 2 service bays and convenience center	2.0 + 0.3/1000 ft ²		
with 2 service bays, convenience center, and car wash	8.0 + 0.3/1000 ft ²		
Swimming Pools—public (private no charge)	1.1	per	1000 ft ²
Stadium/Arena	1.0/110 seats or 1.0/165 LF	of bleachers	
Tanning Rooms/Centers	0.3	per	1000 ft ²
Tennis Courts—with shower facilities	2.0	per	court
Theater	1.2	per	1000 ft ²
Vacant Land	3.0	per	acre
Vehicle Garage	0.2	per	1000 ft ²
Yard Storage Buildings (excluding lumber storage)			
customer pick-up, no permanent employees	0.1	per	1000 ft ²
Industry	varies—industry specific		

Table 6501-1

09/16/04



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Reference Materials

SS-03

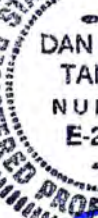
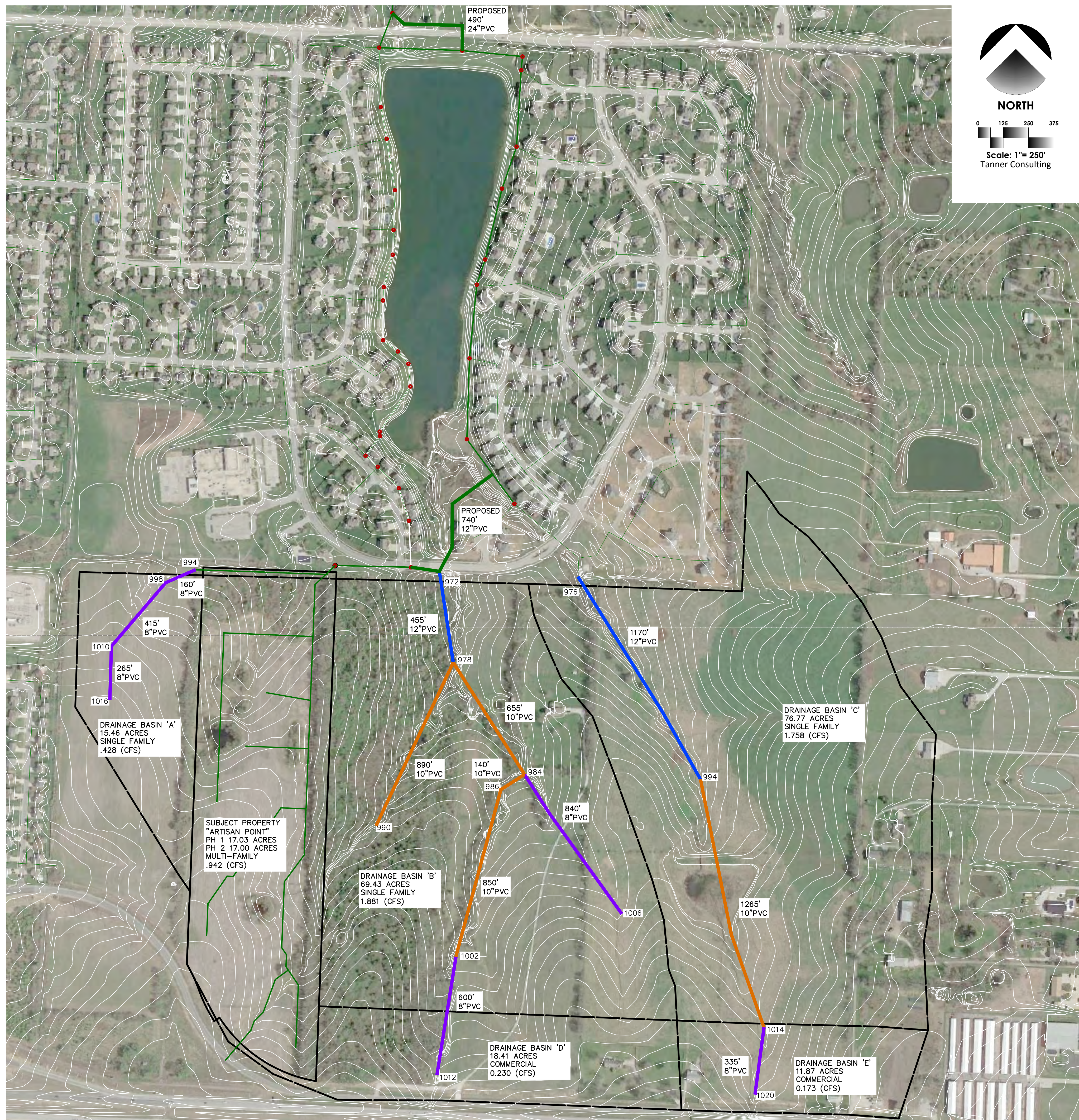
FUTURE PEAK BASE FLOW, FUTURE INFILTRATION, AND FUTURE INFLOW WERE ALL DERIVED USING THE LEE'S SUMMIT DESIGN CRITERIA, SECTION 6500. THE COMMERCIAL LOTS BUILDING SIZES RANGE FROM 10,000 - 15,000 SF TO ALLOW A RANGE OF MULTIPLE SIZES PER SITE. AN EDU OF 1.6 WAS USED FOR A HIGHER MID SPECTRUM NUMBER ALLOWING FOR SOME HIGHER AND SOME LOWER EDU'S AS BASIS FOR ESTIMATING PROJECTIONS IN THE SYSTEM.

1. Future Peak Base Flow					
Future Basin	Equivalent Development Units (EDU)	Area (Acres)	Peak Base Flow (GPD/AC)	Peak Flow (GPD)	Peak Flow (CFS)
Area A - Single Family	1.0	15.46	1,500	23,190	0.0359
Area B - Single Family	1.0	69.43	1,500	104,145	0.1611
Area C - Single Family	1.0	76.77	1,500	115,155	0.1782
		SF	GPD/1000SF		
Area D - Commercial *	1.6	15,000.00	300	4,500	0.0070
Area E - Commercial *	1.6	10,000.00	300	3,000	0.0046

2. Future Peak Infiltration				
Future Basin	Area (Acres)	Peak Infiltration per Acre (GPD/Acre)	Peak Flow (GPD)	Peak Flow (CFS)
Area A - Single Family	15.46	500	7,730	0.0120
Area B - Single Family	69.43	500	34,715	0.0537
Area C - Single Family	76.77	500	38,385	0.0594
Area D - Commercial *	18.41	250	4,603	0.0071
Area E - Commercial *	11.87	250	2,968	0.0046

3. Future Peak Inflow					
Future Basin	Area (Acres)	Inflow Factor (K)	Time of Concentration (Minutes)	Rainfall Intensity For 50-YR Storm (Inches/Hour)	Peak Flow (CFS)
Area A - Single Family	15.46	0.006	37.0	4.1	0.3803
Area B - Single Family	69.43	0.006	54.1	4.0	1.6663
Area C - Single Family	76.77	0.006	55.5	3.3	1.5200
Area D - Commercial *	18.41	0.003	38.7	3.9	0.2154
Area E - Commercial *	11.87	0.003	34.7	4.6	0.1638

4. Min. Slope Pipe Capacities				
Pipe Size	Minimum slope	n-Value	Depth	Q Available
8" (0.67')	0.60%	0.014	.54'	.861 CFS
10" (0.83')	0.42%	0.014	.66'	1.275 CFS
12" (1.00')	0.33%	0.014	.80'	1.858 CFS
15" (1.25')	0.24%	0.014	1.00'	2.872 CFS
18" (1.50')	0.19%	0.014	1.20'	4.156 CFS
24" (2.00')	0.13%	0.014	1.60'	7.405 CFS



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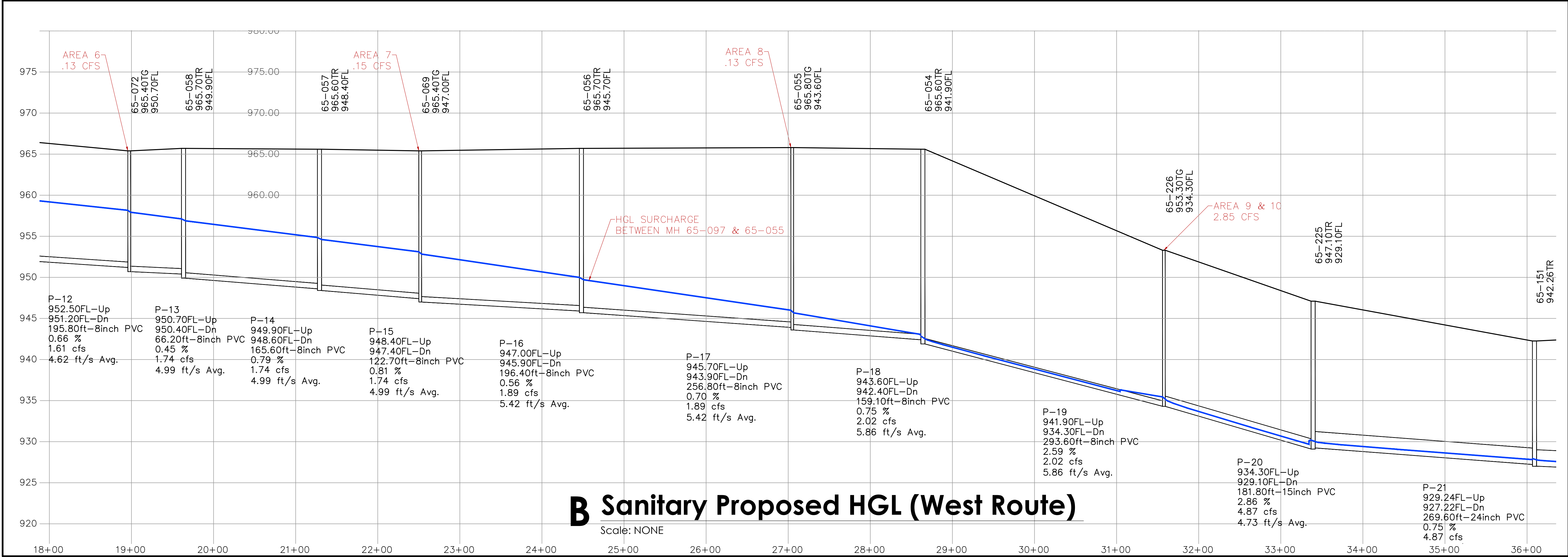
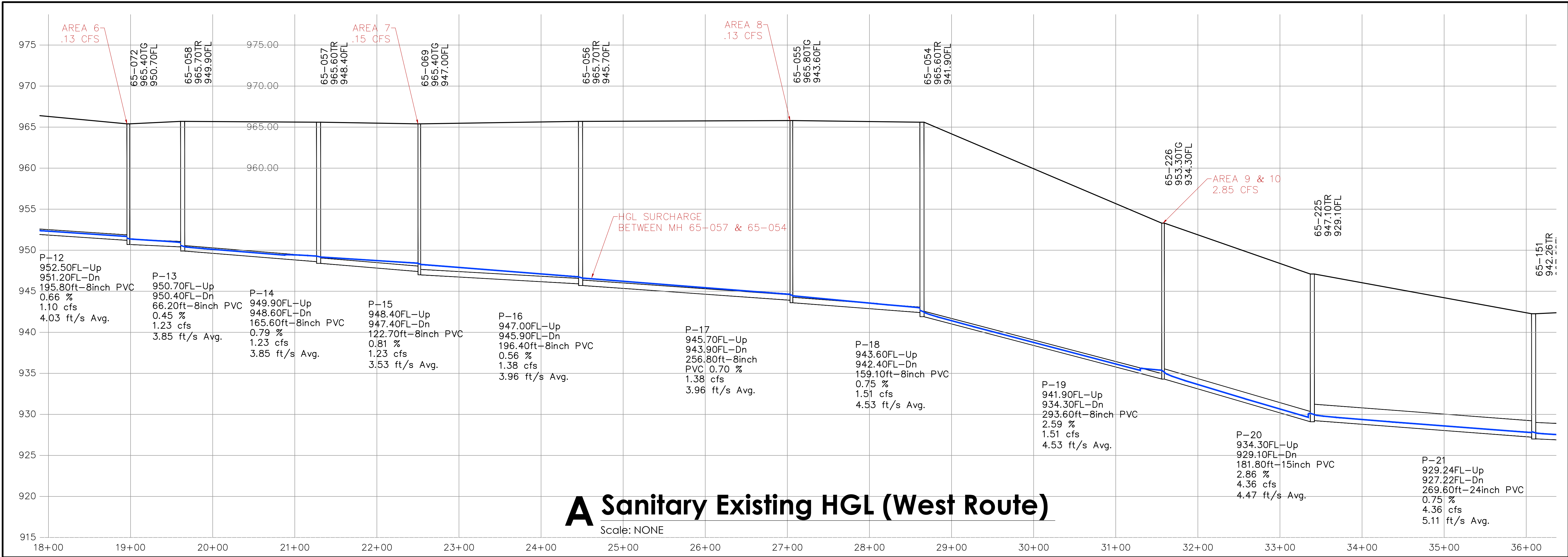
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Future SS Improvements

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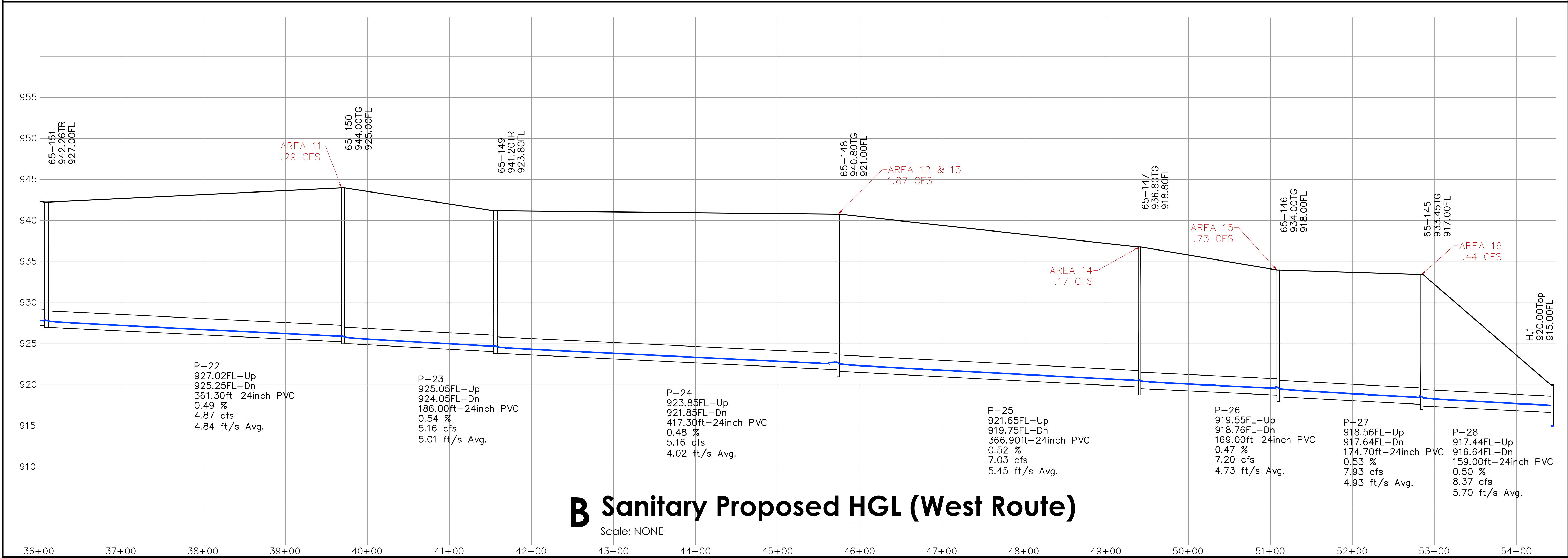
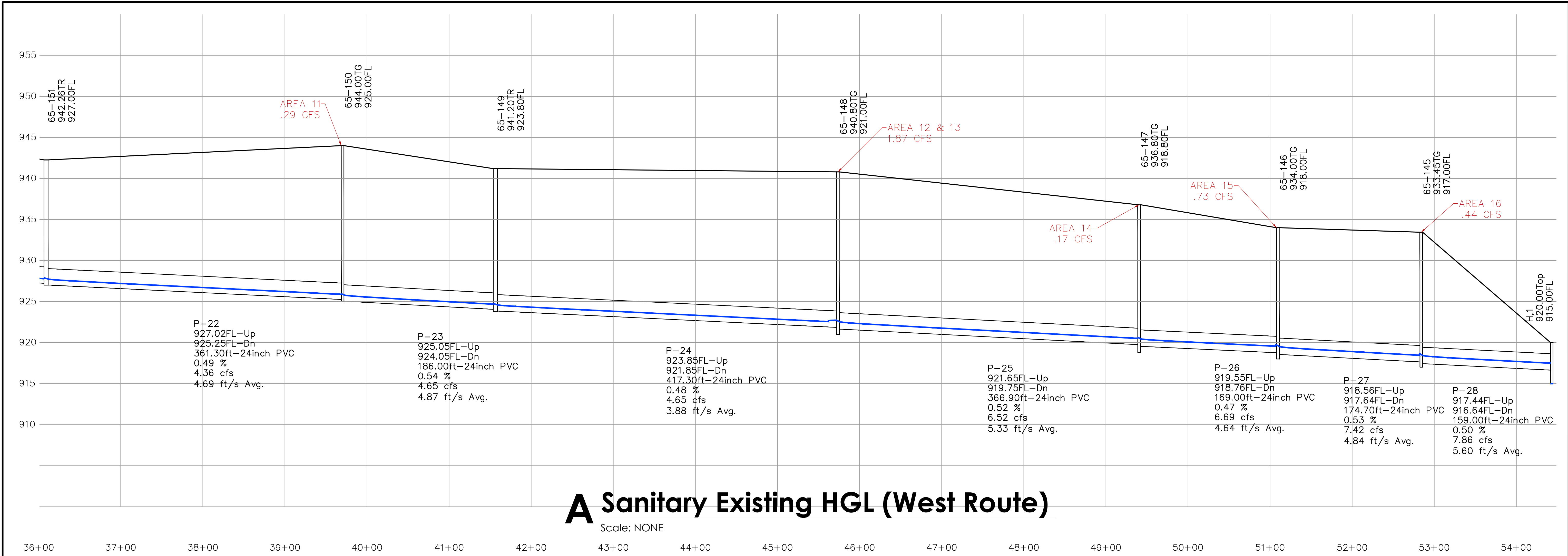
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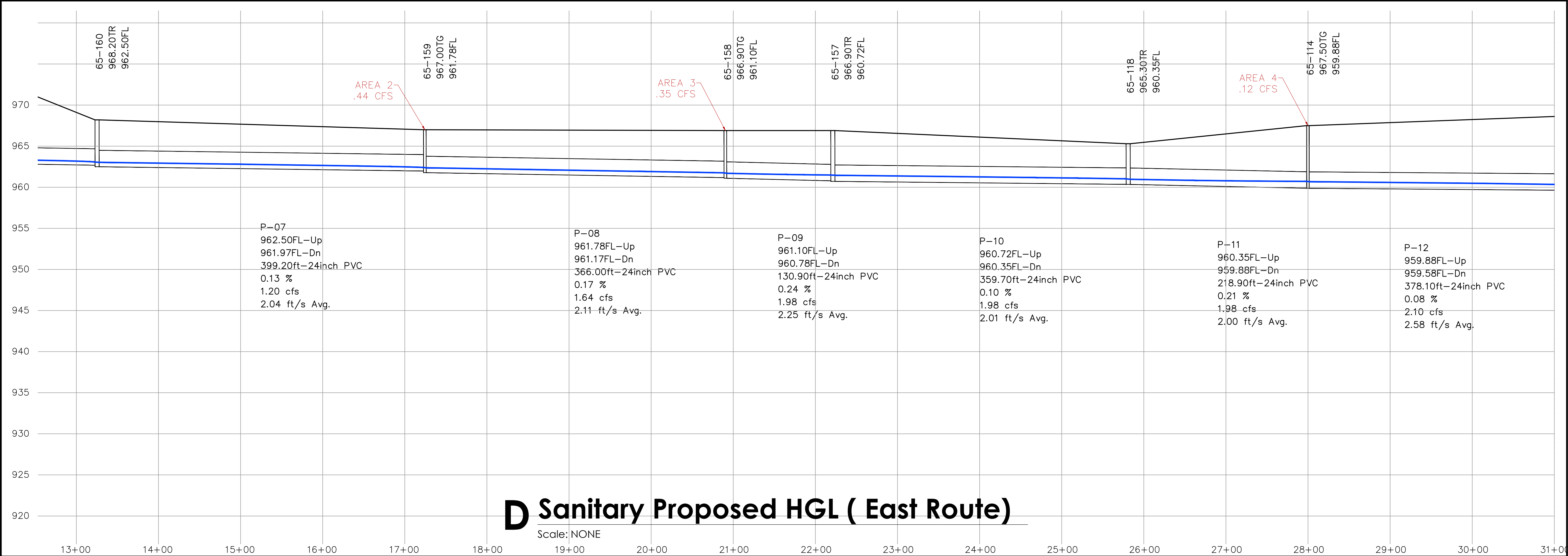
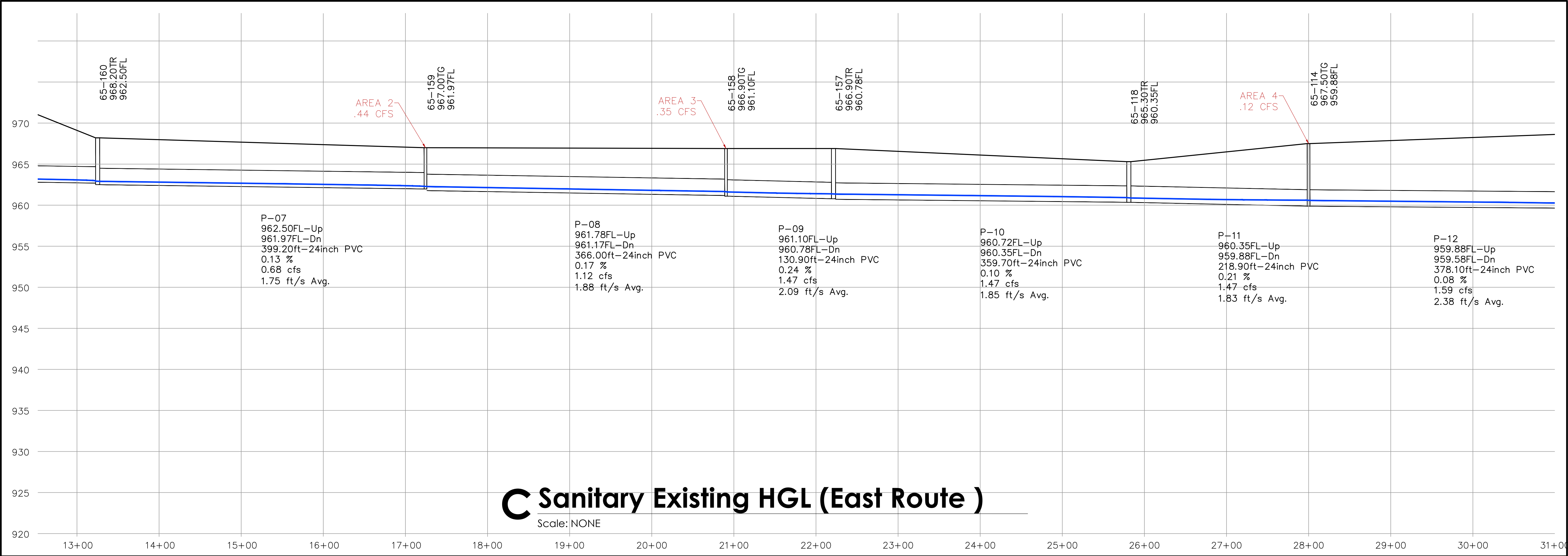
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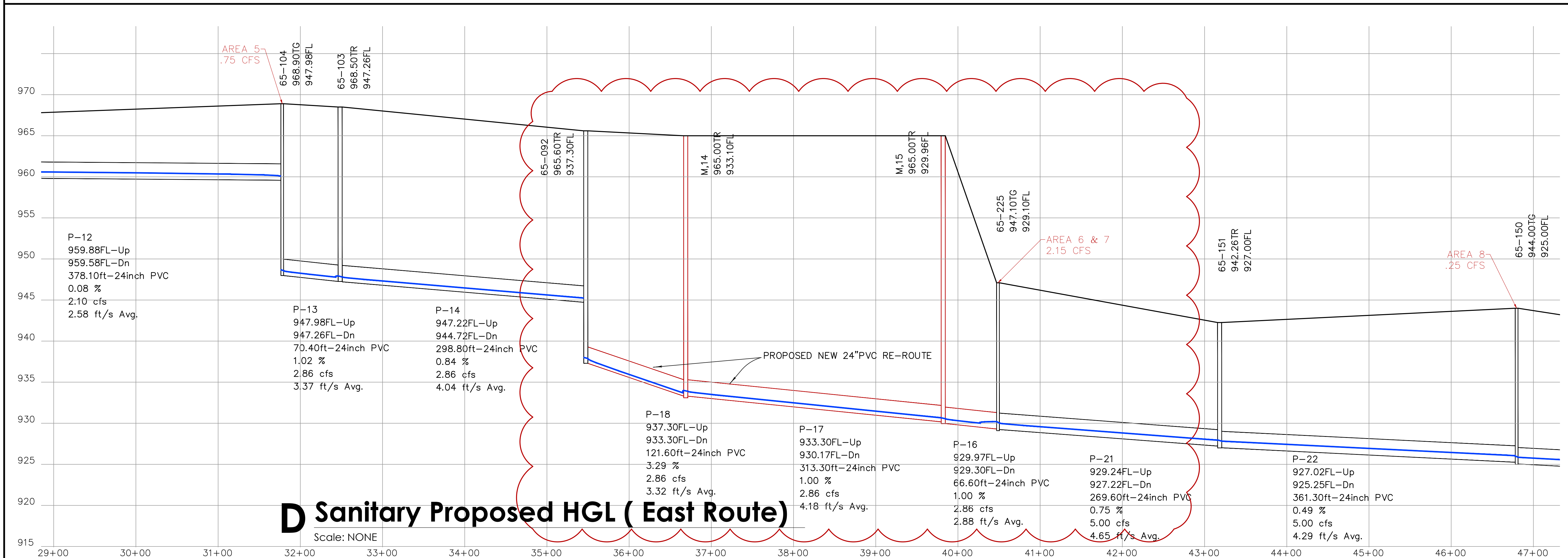
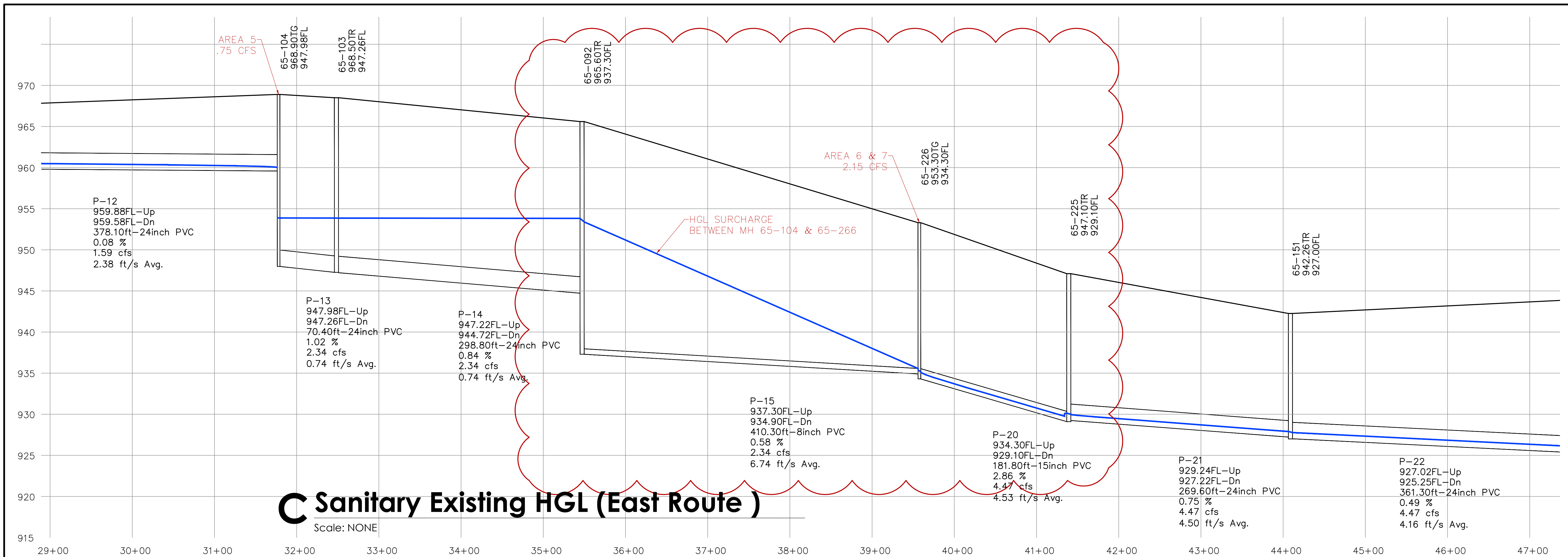
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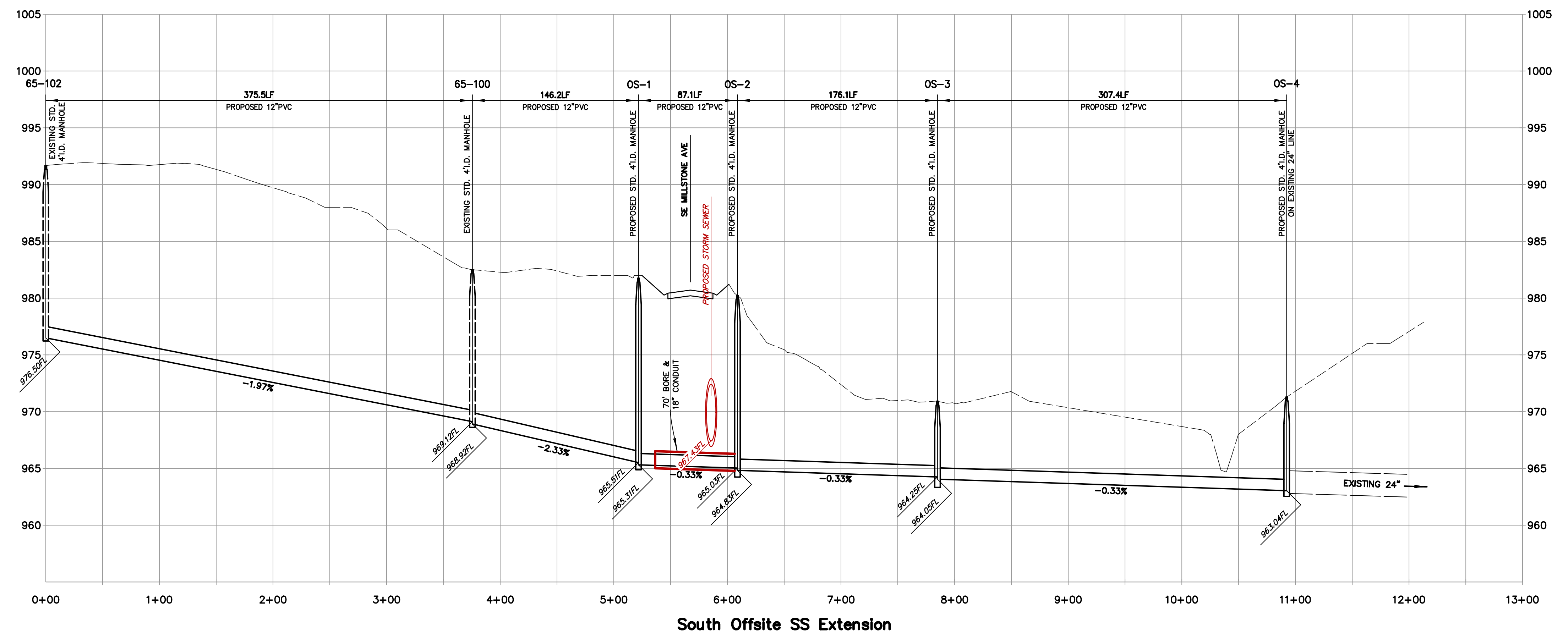
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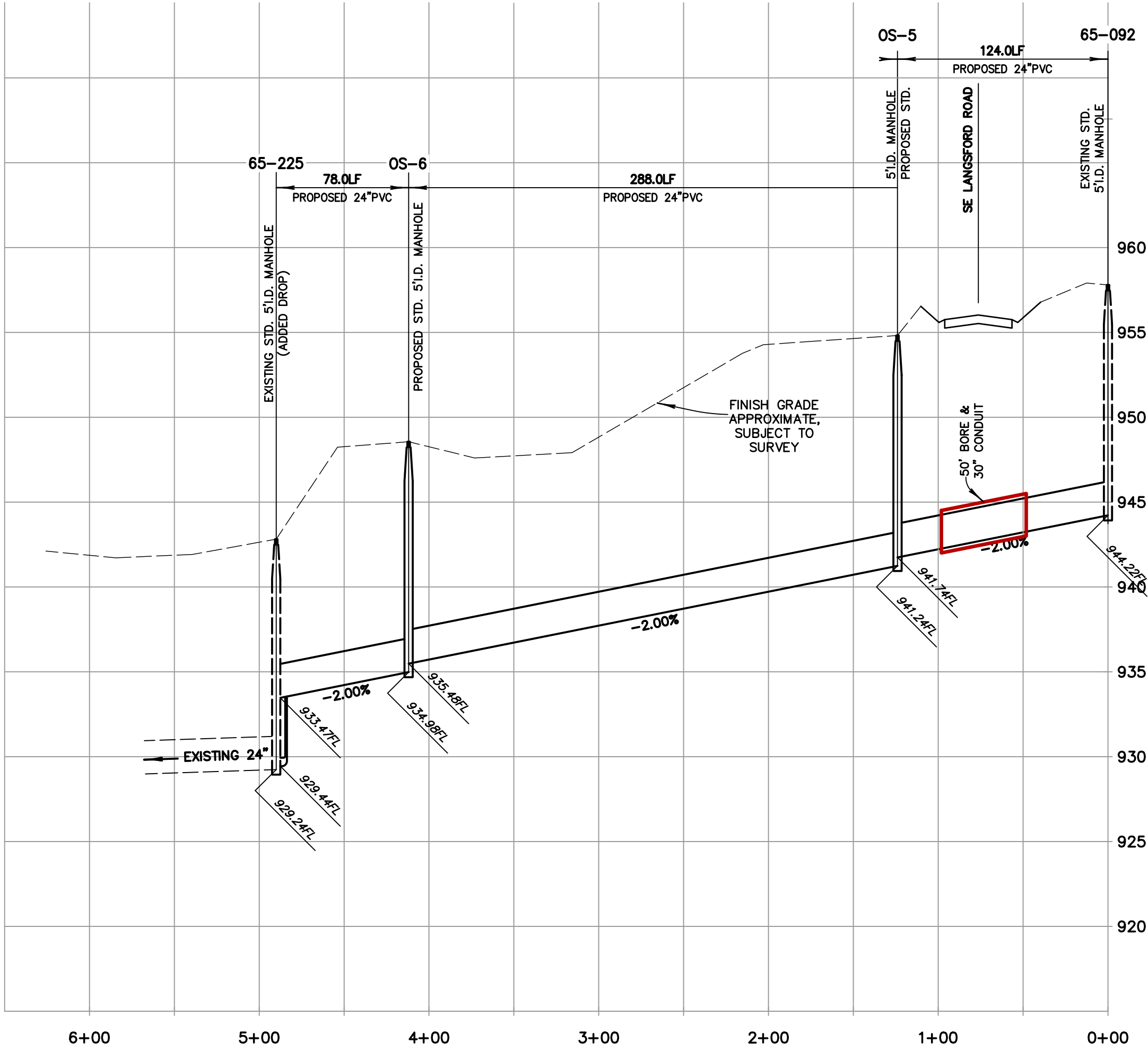
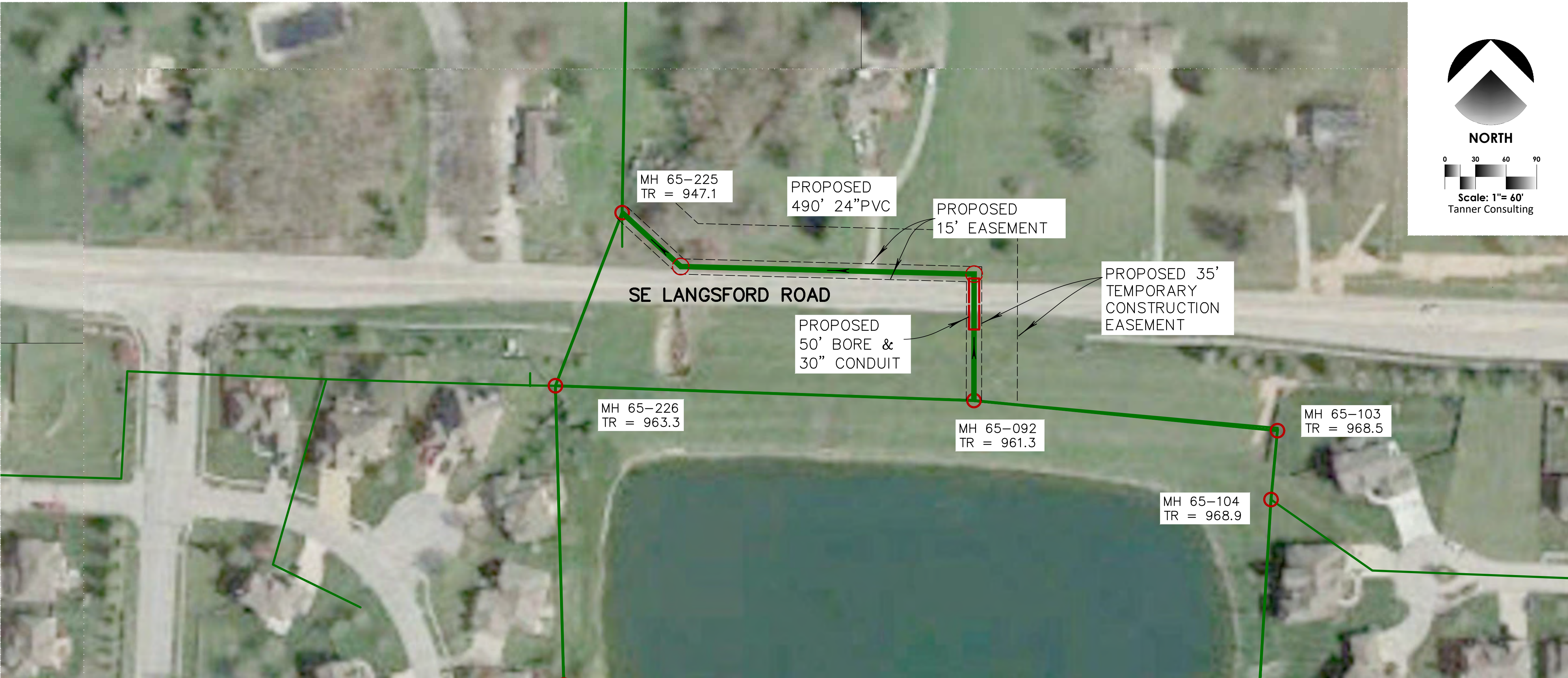
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