401 W 86th Street Parking Modifications

Site Drainage Narrative and Calculations

~~Date: September 8, 2023~~

Rev: November 8, 2023

This project proposes some parking lot modifications at 401 86th Street West in Bloomington. The site falls within Nine Mile Creek Watershed District (NMCWD.)

USDA NRS SOILS SURVEY

ITCO Allied report dated September 1st, 2023 indicates that the soil samples collected on site had 88% and 96% sand. The report had seemed to indicate that HSG A soils.

The adjacent site to the west had several full penetration borings to 20+ foot depths. Soils below the topsoil layer were well-graded sand with some gravel (SW) and poorly graded sand (SP). The proposed BMP is fairly close to these borings and HSG A soils will be assumed for infiltration rates.

No groundwater was encountered in these borings.

STORM WATER MODELING

Modeling uses HydroCAD with Atlas 14 rainfall events and MSE Type 3 storm distribution. Pervious and impervious surface is separated in the HydroCAD model. Storms used are the HydroCAD standards for Hennepin County.

2-year storm = 2.86”
10-year storm = 4.26”
100-year storm = 7.32”

HSG A soils are assumed for all areas.

	HSG A
Impervious	98
Grass/Pervious	39

DRAINAGE

Existing Conditions

This site has some existing impervious surface (driveway, parking areas and sidewalk). Most of the site drains south, with a small portion along the north draining to 86th Street West. Per direction of NMCWD, both properties owned by the applicant are to be included in the analysis.

		401 W 86th St	333 W 86th St	**Totals**
Gross lot area	sf	40,760	66,304	**107,064**
Impervious area	sf	20,982	61,500	**81,380**
Percent Impervious	sf	51.5%	92.8%	

Proposed Conditions

The existing parking areas will be modified to include curb and gutter. Some bituminous will be milled and overlaid. An additional central parking area will also be added.

		401 W 86th St
Undisturbed impervious	sf	14,446
Reconstructed impervious	sf	1,633
New impervious	sf	5,371
Mill and overlay	sf	4,231
Total impervious	**sf**	**25,681**
Regulated impervious	**sf**	**7,004**

The net increase in impervious is 4,699 sf (25,681 sf – 20,982 sf). Some existing impervious is converted to pervious and thus the new impervious on the table above does not equal the net increase in impervious.

No improvements are proposed for 333 W 86th Street.

REGULATION

Per Rule 4.2.2 (b), mill and overlay does not trigger stormwater management.

Rule 4.2.3 states:

> ***Redevelopment.*** *For sites other than those that qualify for the linear (4.2.4) or single-family home (4.2.3a) provisions below, if proposed activity on a site will disturb more than 50 percent of the existing impervious surface on the site or will increase the imperviousness of the entire site by more than 50 percent, the stormwater criteria of section 4.3 will apply to the entire project site. Otherwise, the criteria of section 4.3 will apply only to the disturbed areas, replaced and net additional impervious surface on the project site. For purposes of this paragraph, disturbed areas are those where underlying soils are exposed in the course of redevelopment.*

Even when analyzing 401 W 86th Street alone, less than 50% of the existing impervious will be disturbed, and the amount of total impervious increase is less than 50%. So only new and disturbed impervious surface must meet the stormwater management standards.

Total lot areas (both properties)	sf	107,064
Total existing impervious	sf	82,482
Total proposed impervious	sf	87,181
Net increase in impervious	sf	4,699
Net percent increase in impervious		**5.4%**
Existing impervious disturbed	sf	1,633
Percent of existing impervious disturbed		**2.0%**

VOLUME RETENTION

Provide for the retention onsite of 1.1 inches of runoff from the regulated impervious surface of the site;

i. Where infiltration or filtration facilities, practices or systems are proposed, pretreatment of runoff must be provided.

ii. Drawdown of water levels in infiltration and filtration facilities must be within 48 hours.

Regulated impervious surface	7,004	sf
Volume requirement	1.1	in
Volume required	642	cf
Volume provided	**8,933**	**cf**
Infiltration rate	1.60	in/hr
Surface area	4,400	sf
Drawdown time	**15.2**	**hours**

PEAK RUNOFF FLOW RATES

Limit peak runoff flow rates to that from existing conditions for the 2-, 10- and 100-year frequency storm events using a nested 24-hour rainfall distribution for all collection points where stormwater discharge leaves the site.

	Storm Event		
	2-year cfs	**10-year cfs**	**100-year cfs**
	To North		
Existing	**0.06**	**0.12**	**0.28**
Proposed	**0.06**	**0.12**	**0.28**

	To Southwest		
Existing	**2.03**	**3.51**	**7.15**
Proposed	**0**	**0**	**0**

WATER QUALITY

Provide for at least 60 percent annual removal efficiency for total phosphorus and at least 90 percent annual removal efficiency for total suspended solids from site runoff.

The MIDS model shows a 100% removal for TSS and TP (no runoff leaving site.)

LOW FLOOR ELEVATION ANALYSIS

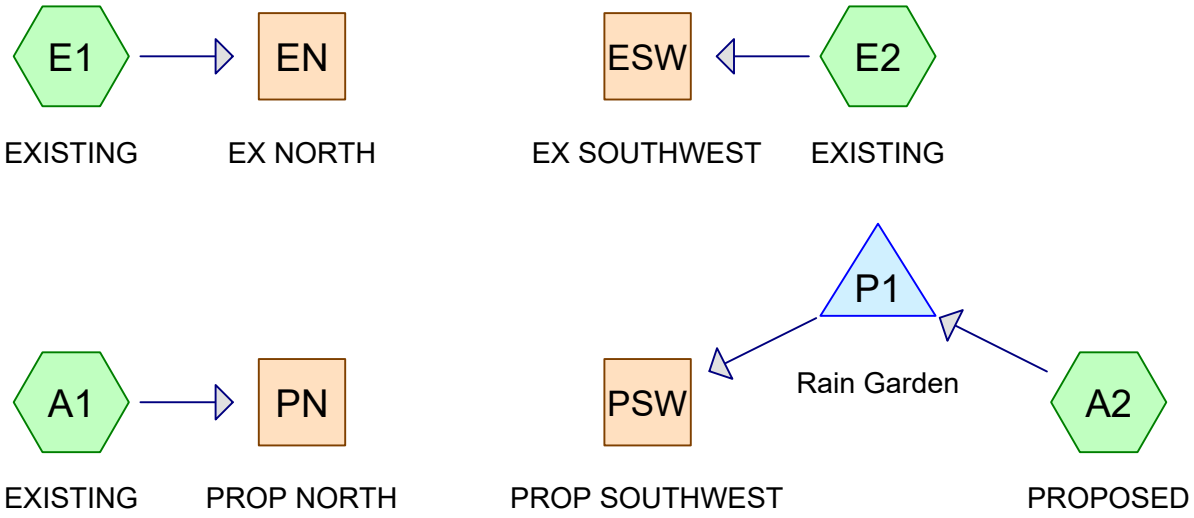
Appendix 4A provides guidance on HWL versus adjacent low floor elevations.

1. The HWL of the rain garden is 829.8
2. The low floor of the building to the south 829.3
3. The horizontal separation is approximately 15 feet
4. The soils are sand/gravel
5. Depth to water table is at least 16 feet (828.2 – 812.2)
    a. Per borings on property to west, the closest boring is #3, with a surface elevation of 833.2 and a depth of approximately 21 feet (without encountering water)
    b. Water table is no higher than 812.2 (833.2 – 21)

Plot 1 shows that the minimum depth to the water table for no further evaluation is approximately 14.5 feet. No further analysis is required.

LOW OPENING ELEVATION ANALYSIS

Per guidance from NMCWD, if the 100-year HWL is contained onsite, it is assumed that the lowest opening will be protected.



Subcat Reach Pond Link

Routing Diagram for 2077 HydroCAD (11.8.2023)
Prepared by Plowe Engineering, Inc., Printed 11/8/2023

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
47,194	98	IMPERVIOUS (A1, A2, E1, E2)
34,323	39	PERVIOUS (A1, A2, E1, E2)
81,517	**73**	**TOTAL AREA**

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: EXISTING Runoff Area=1,841 sf 28.79% Impervious Runoff Depth=0.76"
Tc=7.0 min CN=WQ Runoff=0.05 cfs 116 cf

SubcatchmentA2: PROPOSED Runoff Area=38,917 sf 65.99% Impervious Runoff Depth=1.73"
Tc=7.0 min CN=WQ Runoff=2.39 cfs 5,626 cf

SubcatchmentE1: EXISTING Runoff Area=1,841 sf 28.79% Impervious Runoff Depth=0.76"
Tc=7.0 min CN=WQ Runoff=0.05 cfs 116 cf

SubcatchmentE2: EXISTING Runoff Area=38,918 sf 52.55% Impervious Runoff Depth=1.38"
Tc=7.0 min CN=WQ Runoff=1.91 cfs 4,481 cf

Reach EN: EX NORTH Inflow=0.05 cfs 116 cf
Outflow=0.05 cfs 116 cf

Reach ESW: EX SOUTHWEST Inflow=1.91 cfs 4,481 cf
Outflow=1.91 cfs 4,481 cf

Reach PN: PROP NORTH Inflow=0.05 cfs 116 cf
Outflow=0.05 cfs 116 cf

Reach PSW: PROP SOUTHWEST Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond P1: Rain Garden Peak Elev=828.70' Storage=2,415 cf Inflow=2.39 cfs 5,626 cf
Discarded=0.19 cfs 5,628 cf Primary=0.00 cfs 0 cf Outflow=0.19 cfs 5,628 cf

Total Runoff Area = 81,517 sf Runoff Volume = 10,339 cf Average Runoff Depth = 1.52"
42.11% Pervious = 34,323 sf 57.89% Impervious = 47,194 sf

Summary for Subcatchment A1: EXISTING

Runoff = 0.05 cfs @ 12.14 hrs, Volume= 116 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

	Area (sf)	CN	Description
*	530	98	IMPERVIOUS
*	1,311	39	PERVIOUS
	1,841		Weighted Average
	1,311	39	71.21% Pervious Area
	530	98	28.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment A2: PROPOSED

Runoff = 2.39 cfs @ 12.14 hrs, Volume= 5,626 cf, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

	Area (sf)	CN	Description
*	25,681	98	IMPERVIOUS
*	13,236	39	PERVIOUS
	38,917		Weighted Average
	13,236	39	34.01% Pervious Area
	25,681	98	65.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment E1: EXISTING

Runoff = 0.05 cfs @ 12.14 hrs, Volume= 116 cf, Depth= 0.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

	Area (sf)	CN	Description
*	530	98	IMPERVIOUS
*	1,311	39	PERVIOUS
	1,841		Weighted Average
	1,311	39	71.21% Pervious Area
	530	98	28.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment E2: EXISTING

Runoff = 1.91 cfs @ 12.14 hrs, Volume= 4,481 cf, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 2-Year Rainfall=2.86"

	Area (sf)	CN	Description
*	20,453	98	IMPERVIOUS
*	18,465	39	PERVIOUS
	38,918		Weighted Average
	18,465	39	47.45% Pervious Area
	20,453	98	52.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Reach EN: EX NORTH

Inflow Area = 1,841 sf, 28.79% Impervious, Inflow Depth = 0.76" for 2-Year event
Inflow = 0.05 cfs @ 12.14 hrs, Volume= 116 cf
Outflow = 0.05 cfs @ 12.14 hrs, Volume= 116 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach ESW: EX SOUTHWEST

Inflow Area = 38,918 sf, 52.55% Impervious, Inflow Depth = 1.38" for 2-Year event
Inflow = 1.91 cfs @ 12.14 hrs, Volume= 4,481 cf
Outflow = 1.91 cfs @ 12.14 hrs, Volume= 4,481 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PN: PROP NORTH

Inflow Area = 1,841 sf, 28.79% Impervious, Inflow Depth = 0.76" for 2-Year event
Inflow = 0.05 cfs @ 12.14 hrs, Volume= 116 cf
Outflow = 0.05 cfs @ 12.14 hrs, Volume= 116 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PSW: PROP SOUTHWEST

Inflow Area = 38,917 sf, 65.99% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Pond P1: Rain Garden

Inflow Area = 38,917 sf, 65.99% Impervious, Inflow Depth = 1.73" for 2-Year event
Inflow = 2.39 cfs @ 12.14 hrs, Volume= 5,626 cf
Outflow = 0.19 cfs @ 12.81 hrs, Volume= 5,628 cf, Atten= 92%, Lag= 40.1 min
Discarded = 0.19 cfs @ 12.81 hrs, Volume= 5,628 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 828.70' @ 12.81 hrs Surf.Area= 5,216 sf Storage= 2,415 cf
Flood Elev= 829.80' Surf.Area= 7,220 sf Storage= 9,208 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 94.5 min (849.2 - 754.7)

Volume	Invert	Avail.Storage	Storage Description
#1	828.20'	10,690 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
828.20	4,400	0	0
829.00	5,700	4,040	4,040
830.00	7,600	6,650	10,690

Device	Routing	Invert	Outlet Devices
#1	Discarded	828.20'	**1.600 in/hr Exfiltration over Surface area**
#2	Primary	829.80'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.19 cfs @ 12.81 hrs HW=828.70' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=828.20' TW=0.00' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: EXISTING Runoff Area=1,841 sf 28.79% Impervious Runoff Depth=1.21"
Tc=7.0 min CN=WQ Runoff=0.07 cfs 186 cf

SubcatchmentA2: PROPOSED Runoff Area=38,917 sf 65.99% Impervious Runoff Depth=2.68"
Tc=7.0 min CN=WQ Runoff=3.59 cfs 8,697 cf

SubcatchmentE1: EXISTING Runoff Area=1,841 sf 28.79% Impervious Runoff Depth=1.21"
Tc=7.0 min CN=WQ Runoff=0.07 cfs 186 cf

SubcatchmentE2: EXISTING Runoff Area=38,918 sf 52.55% Impervious Runoff Depth=2.15"
Tc=7.0 min CN=WQ Runoff=2.86 cfs 6,977 cf

Reach EN: EX NORTH Inflow=0.07 cfs 186 cf
Outflow=0.07 cfs 186 cf

Reach ESW: EX SOUTHWEST Inflow=2.86 cfs 6,977 cf
Outflow=2.86 cfs 6,977 cf

Reach PN: PROP NORTH Inflow=0.07 cfs 186 cf
Outflow=0.07 cfs 186 cf

Reach PSW: PROP SOUTHWEST Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond P1: Rain Garden Peak Elev=829.03' Storage=4,219 cf Inflow=3.59 cfs 8,697 cf
Discarded=0.21 cfs 8,697 cf Primary=0.00 cfs 0 cf Outflow=0.21 cfs 8,697 cf

Total Runoff Area = 81,517 sf Runoff Volume = 16,046 cf Average Runoff Depth = 2.36"
42.11% Pervious = 34,323 sf 57.89% Impervious = 47,194 sf

Summary for Subcatchment A1: EXISTING

Runoff = 0.07 cfs @ 12.14 hrs, Volume= 186 cf, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (sf)	CN	Description
*	530	98	IMPERVIOUS
*	1,311	39	PERVIOUS
	1,841		Weighted Average
	1,311	39	71.21% Pervious Area
	530	98	28.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment A2: PROPOSED

Runoff = 3.59 cfs @ 12.14 hrs, Volume= 8,697 cf, Depth= 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (sf)	CN	Description
*	25,681	98	IMPERVIOUS
*	13,236	39	PERVIOUS
	38,917		Weighted Average
	13,236	39	34.01% Pervious Area
	25,681	98	65.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment E1: EXISTING

Runoff = 0.07 cfs @ 12.14 hrs, Volume= 186 cf, Depth= 1.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (sf)	CN	Description
*	530	98	IMPERVIOUS
*	1,311	39	PERVIOUS
	1,841		Weighted Average
	1,311	39	71.21% Pervious Area
	530	98	28.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment E2: EXISTING

Runoff = 2.86 cfs @ 12.14 hrs, Volume= 6,977 cf, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 10-Year Rainfall=4.26"

	Area (sf)	CN	Description
*	20,453	98	IMPERVIOUS
*	18,465	39	PERVIOUS
	38,918		Weighted Average
	18,465	39	47.45% Pervious Area
	20,453	98	52.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Reach EN: EX NORTH

Inflow Area = 1,841 sf, 28.79% Impervious, Inflow Depth = 1.21" for 10-Year event
Inflow = 0.07 cfs @ 12.14 hrs, Volume= 186 cf
Outflow = 0.07 cfs @ 12.14 hrs, Volume= 186 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach ESW: EX SOUTHWEST

Inflow Area = 38,918 sf, 52.55% Impervious, Inflow Depth = 2.15" for 10-Year event
Inflow = 2.86 cfs @ 12.14 hrs, Volume= 6,977 cf
Outflow = 2.86 cfs @ 12.14 hrs, Volume= 6,977 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PN: PROP NORTH

Inflow Area = 1,841 sf, 28.79% Impervious, Inflow Depth = 1.21" for 10-Year event
Inflow = 0.07 cfs @ 12.14 hrs, Volume= 186 cf
Outflow = 0.07 cfs @ 12.14 hrs, Volume= 186 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PSW: PROP SOUTHWEST

Inflow Area = 38,917 sf, 65.99% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Pond P1: Rain Garden

Inflow Area = 38,917 sf, 65.99% Impervious, Inflow Depth = 2.68" for 10-Year event
Inflow = 3.59 cfs @ 12.14 hrs, Volume= 8,697 cf
Outflow = 0.21 cfs @ 13.23 hrs, Volume= 8,697 cf, Atten= 94%, Lag= 65.2 min
Discarded = 0.21 cfs @ 13.23 hrs, Volume= 8,697 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 829.03' @ 13.23 hrs Surf.Area= 5,759 sf Storage= 4,219 cf
Flood Elev= 829.80' Surf.Area= 7,220 sf Storage= 9,208 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 164.3 min (915.2 - 750.9)

Volume	Invert	Avail.Storage	Storage Description
#1	828.20'	10,690 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
828.20	4,400	0	0
829.00	5,700	4,040	4,040
830.00	7,600	6,650	10,690

Device	Routing	Invert	Outlet Devices
#1	Discarded	828.20'	**1.600 in/hr Exfiltration over Surface area**
#2	Primary	829.80'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.21 cfs @ 13.23 hrs HW=829.03' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=828.20' TW=0.00' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

Time span=0.00-100.00 hrs, dt=0.01 hrs, 10001 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-Q
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

SubcatchmentA1: EXISTING Runoff Area=1,841 sf 28.79% Impervious Runoff Depth=2.67"
Tc=7.0 min CN=WQ Runoff=0.16 cfs 410 cf

SubcatchmentA2: PROPOSED Runoff Area=38,917 sf 65.99% Impervious Runoff Depth=4.97"
Tc=7.0 min CN=WQ Runoff=6.49 cfs 16,130 cf

SubcatchmentE1: EXISTING Runoff Area=1,841 sf 28.79% Impervious Runoff Depth=2.67"
Tc=7.0 min CN=WQ Runoff=0.16 cfs 410 cf

SubcatchmentE2: EXISTING Runoff Area=38,918 sf 52.55% Impervious Runoff Depth=4.14"
Tc=7.0 min CN=WQ Runoff=5.35 cfs 13,432 cf

Reach EN: EX NORTH Inflow=0.16 cfs 410 cf
Outflow=0.16 cfs 410 cf

Reach ESW: EX SOUTHWEST Inflow=5.35 cfs 13,432 cf
Outflow=5.35 cfs 13,432 cf

Reach PN: PROP NORTH Inflow=0.16 cfs 410 cf
Outflow=0.16 cfs 410 cf

Reach PSW: PROP SOUTHWEST Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond P1: Rain Garden Peak Elev=829.76' Storage=8,933 cf Inflow=6.49 cfs 16,130 cf
Discarded=0.26 cfs 16,133 cf Primary=0.00 cfs 0 cf Outflow=0.26 cfs 16,133 cf

Total Runoff Area = 81,517 sf Runoff Volume = 30,381 cf Average Runoff Depth = 4.47"
42.11% Pervious = 34,323 sf 57.89% Impervious = 47,194 sf

Summary for Subcatchment A1: EXISTING

Runoff = 0.16 cfs @ 12.15 hrs, Volume= 410 cf, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

	Area (sf)	CN	Description
*	530	98	IMPERVIOUS
*	1,311	39	PERVIOUS
	1,841		Weighted Average
	1,311	39	71.21% Pervious Area
	530	98	28.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment A2: PROPOSED

Runoff = 6.49 cfs @ 12.14 hrs, Volume= 16,130 cf, Depth= 4.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

	Area (sf)	CN	Description
*	25,681	98	IMPERVIOUS
*	13,236	39	PERVIOUS
	38,917		Weighted Average
	13,236	39	34.01% Pervious Area
	25,681	98	65.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment E1: EXISTING

Runoff = 0.16 cfs @ 12.15 hrs, Volume= 410 cf, Depth= 2.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

	Area (sf)	CN	Description
*	530	98	IMPERVIOUS
*	1,311	39	PERVIOUS
	1,841		Weighted Average
	1,311	39	71.21% Pervious Area
	530	98	28.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Subcatchment E2: EXISTING

Runoff = 5.35 cfs @ 12.14 hrs, Volume= 13,432 cf, Depth= 4.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-Q, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs
MSE 24-hr 3 100-Year Rainfall=7.32"

	Area (sf)	CN	Description
*	20,453	98	IMPERVIOUS
*	18,465	39	PERVIOUS
	38,918		Weighted Average
	18,465	39	47.45% Pervious Area
	20,453	98	52.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0					**Direct Entry,**

Summary for Reach EN: EX NORTH

Inflow Area = 1,841 sf, 28.79% Impervious, Inflow Depth = 2.67" for 100-Year event
Inflow = 0.16 cfs @ 12.15 hrs, Volume= 410 cf
Outflow = 0.16 cfs @ 12.15 hrs, Volume= 410 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach ESW: EX SOUTHWEST

Inflow Area = 38,918 sf, 52.55% Impervious, Inflow Depth = 4.14" for 100-Year event
Inflow = 5.35 cfs @ 12.14 hrs, Volume= 13,432 cf
Outflow = 5.35 cfs @ 12.14 hrs, Volume= 13,432 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PN: PROP NORTH

Inflow Area = 1,841 sf, 28.79% Impervious, Inflow Depth = 2.67" for 100-Year event
Inflow = 0.16 cfs @ 12.15 hrs, Volume= 410 cf
Outflow = 0.16 cfs @ 12.15 hrs, Volume= 410 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Reach PSW: PROP SOUTHWEST

Inflow Area = 38,917 sf, 65.99% Impervious, Inflow Depth = 0.00" for 100-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2

Summary for Pond P1: Rain Garden

Inflow Area = 38,917 sf, 65.99% Impervious, Inflow Depth = 4.97" for 100-Year event
Inflow = 6.49 cfs @ 12.14 hrs, Volume= 16,130 cf
Outflow = 0.26 cfs @ 13.58 hrs, Volume= 16,133 cf, Atten= 96%, Lag= 86.2 min
Discarded = 0.26 cfs @ 13.58 hrs, Volume= 16,133 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-100.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 829.76' @ 13.58 hrs Surf.Area= 7,147 sf Storage= 8,933 cf
Flood Elev= 829.80' Surf.Area= 7,220 sf Storage= 9,208 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 315.6 min (1,065.3 - 749.7)

Volume	Invert	Avail.Storage	Storage Description
#1	828.20'	10,690 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
828.20	4,400	0	0
829.00	5,700	4,040	4,040
830.00	7,600	6,650	10,690

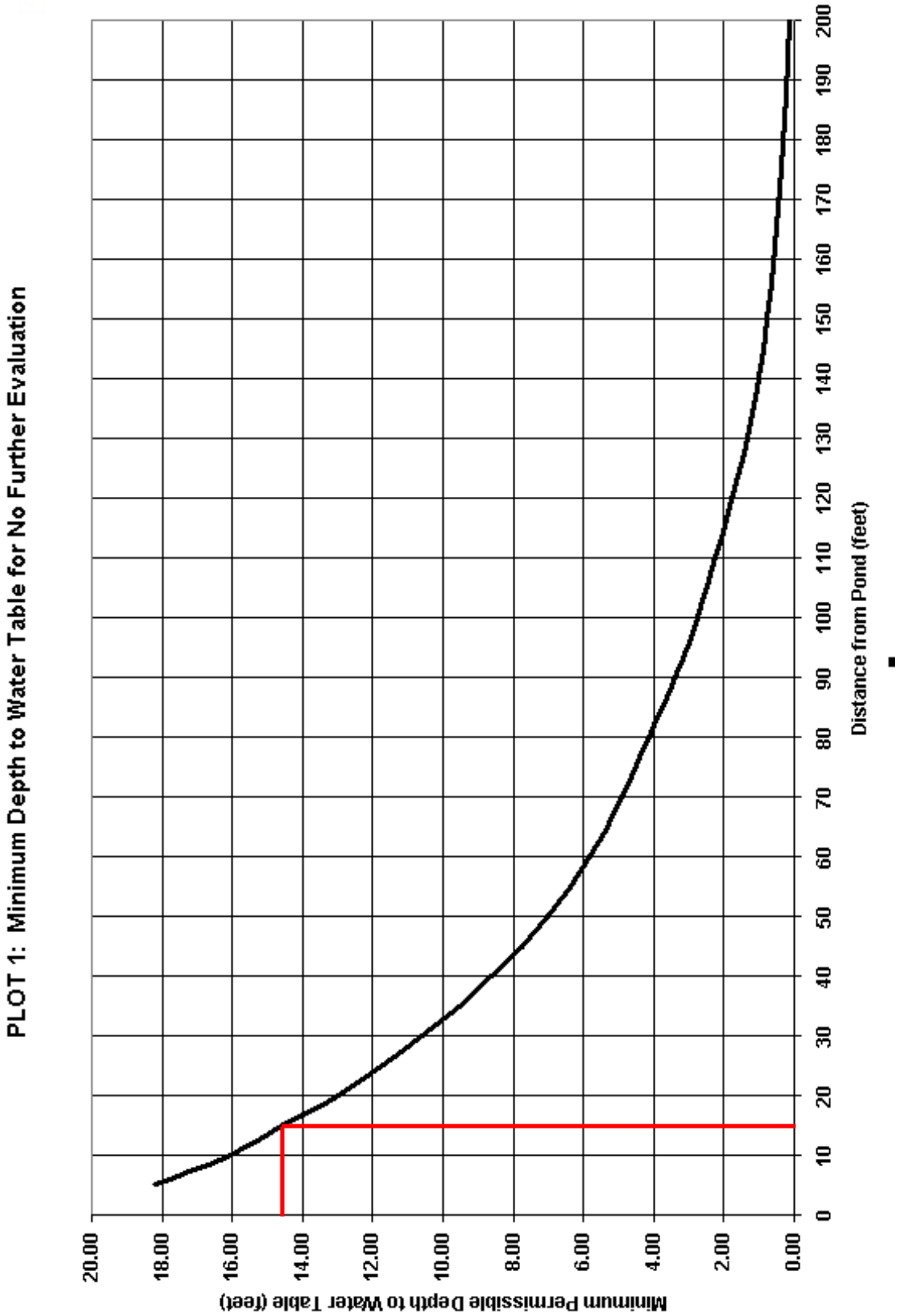
Device	Routing	Invert	Outlet Devices
#1	Discarded	828.20'	**1.600 in/hr Exfiltration over Surface area**
#2	Primary	829.80'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.26 cfs @ 13.58 hrs HW=829.76' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.26 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=828.20' TW=0.00' (Dynamic Tailwater)
↑**2=Broad-Crested Rectangular Weir**(Controls 0.00 cfs)

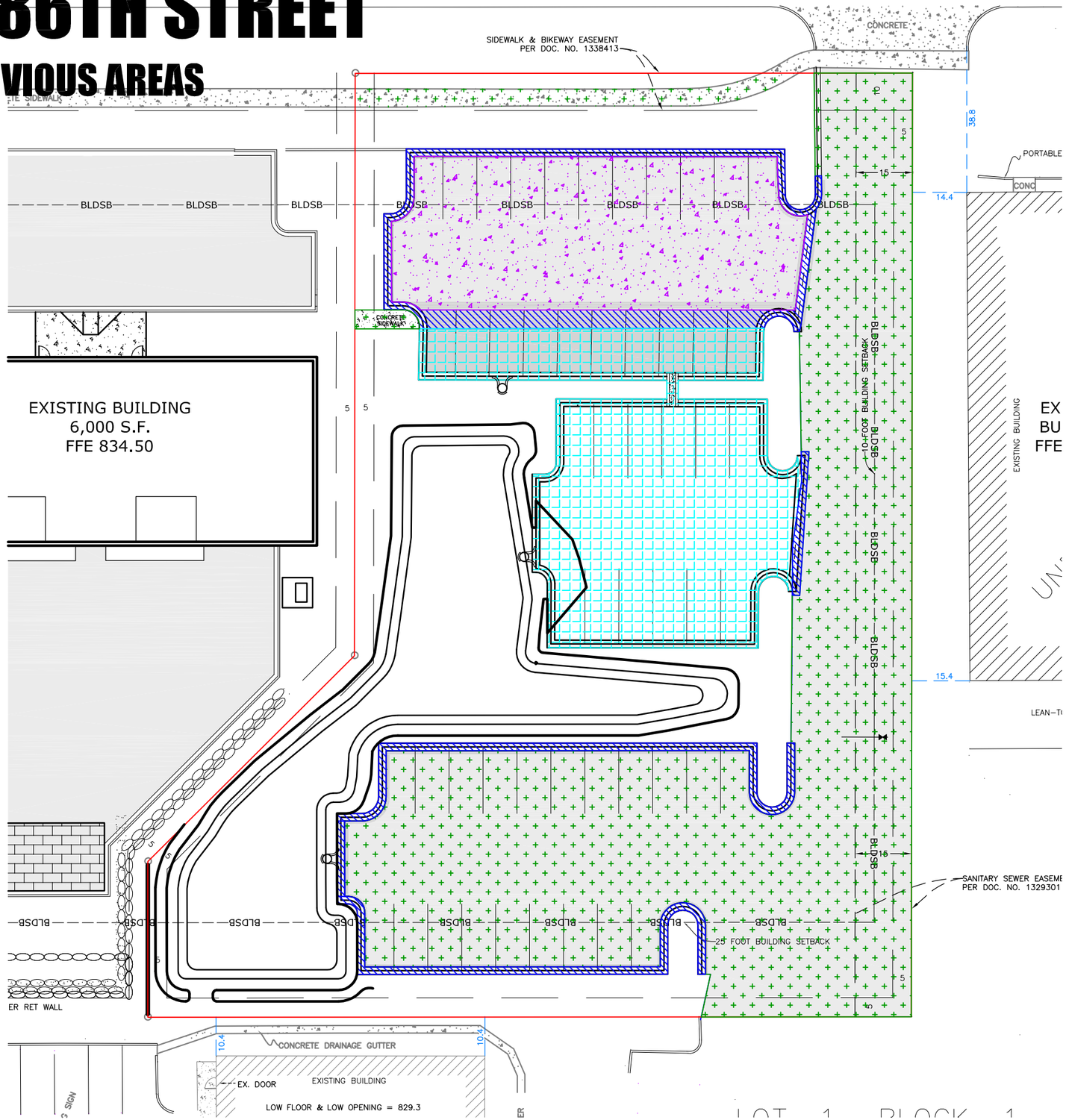
Summary Information

Total impervious cover (acres)	0.59
Total watershed area (acres)	0.89
Site runoff coefficient, Rv	0.68
% Impervious	66%
Development volume retention requirement (cubic feet)	**2,354**
Volume removed by BMPs (cubic feet)	2,354
Additional volume removal needed to meet requirement (cubic feet)	0
Percent volume removed	100.00%
Post-developoment annual volume (acre-ft)	1.43
Annual volume removed by BMPs (acre-ft)	1.43
Percent annual volume removed	100.00%
Post-development annual Particulate P load (lb/yr)	0.64
Annual Particulate load removed by BMPs (lb/yr)	0.64
Post-development annual Dissolved P load (lb/yr)	0.53
Annual Dissolved P load removed by BMPs (lb/yr)	0.53
Percent annual TP removed	100.00%
Post-development annual TSS load (lb/yr)	212
Annual TSS load removed by BMPs (lb/yr)	212
Percent annual TSS removed	100.00%


PLOT 1: Minimum Depth to Water Table for No Further Evaluation
Minimum Permissible Depth to Water Table (feet)
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
Distance from Pond (feet)

401 W 86TH STREET

TOTAL IMPERVIOUS AREAS



PROPOSED AREAS

- UNDISTURBED IMPERVIOUS = 14,446 SF
- RECONSTRUCTED IMPERVIOUS = 1,663 SF
- NEW IMPERVIOUS = 5,371 SF
- MILL AND OVERLAY = 4,231 SF

NORTH

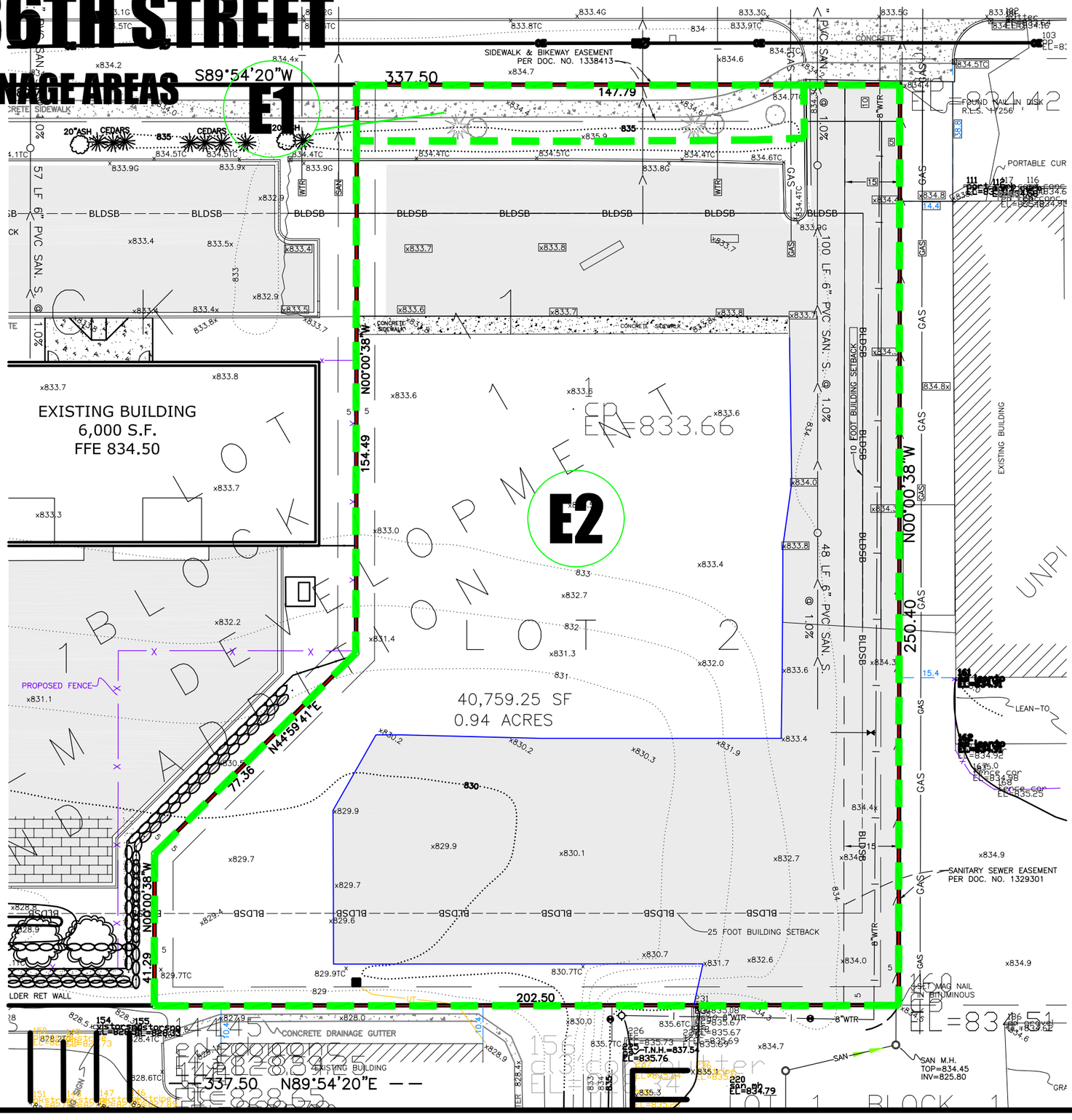
0 15 30

1 INCH = 30 FEET

11/8/2023

401 W 86TH STREET

EXISTING DRAINAGE AREAS



NORTH

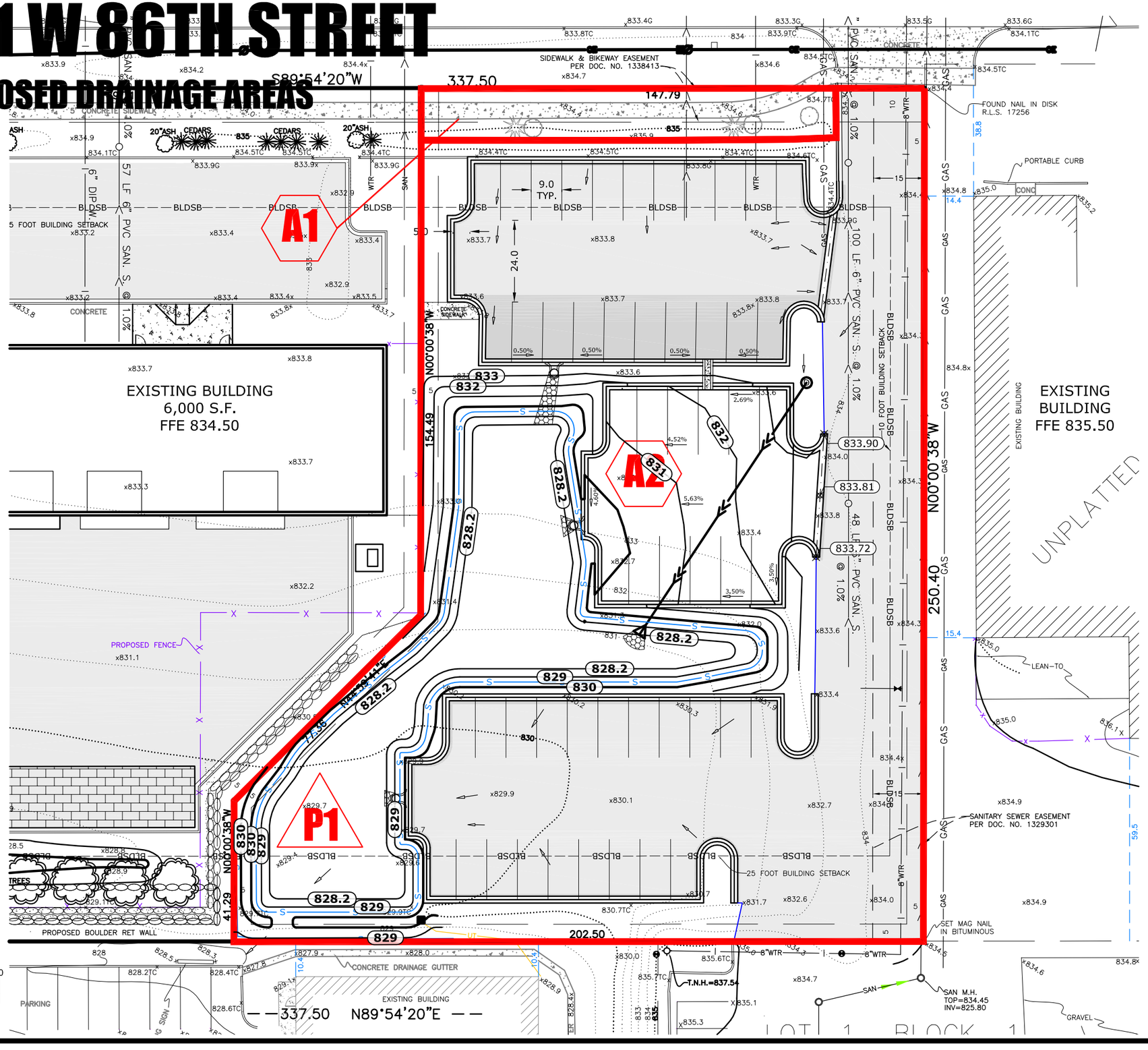
0 15 30

1 INCH = 30 FEET

9/8/2023

401 W 86TH STREET

PROPOSED DRAINAGE AREAS



NORTH

0 15 30

1 INCH = 30 FEET

11/8/2023