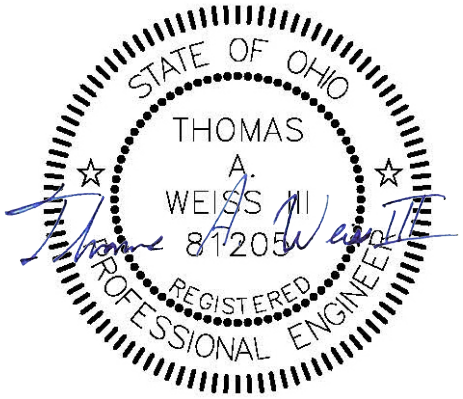
STORM WATER MANAGEMENT CALCULATIONS
for
MASSILLON EAST SIDE ELEMENTARY

Located in
CITY OF MASSILLON
STARK COUNTY, STATE OF OHIO

February 14, 2023



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Job No. 22-070

Massillon East Side Elementary
Storm Water Management

Narrative

The storm water management basin presented in these calculations has been designed for the new Massillon East Side Elementary School building in the City of Massillon. The site is comprised of type "C" soils according to the USDA soil maps. The existing site includes existing buildings, driveways, lawn areas and gravel parking. The proposed site includes a new elementary school, parking and supporting facilities.

Based on the pre-developed and post-developed 1-yr runoff volumes for the site and associated improvements, the critical storm for the site was calculated as a 5-year storm.

The site disturbance is greater than 1 acre, therefore, water quality treatment is required. Water quality treatment is provided using Wet Extended Detention (24-hour drawdown) in accordance with the Ohio EPA General Construction Permit OHC000005.

The outflow from the detention basin is controlled through a 3.5" diameter orifice for water quality, a 10" orifice for the critical storm and an open top manhole riser for the remainder of the storm control.

The table below summarizes the final existing and proposed peak run-off rates for the proposed detention basin.

Storm Event (Year)	Pre-Developed Run-off Rates (C.F.S.)	Post-Developed Run-off Rates (C.F.S.)	Allowed Combined Release Rate (C.F.S.)	Peak Detention Basin Release Rates (C.F.S.)	Peak Storage Elevation (FT.)
1	13.57	17.69	13.57	1.32	1036.58
2	18.96	23.31	13.57	2.56	1036.95
5*	27.50	31.92	13.57	3.64	1037.58
10	35.16	39.45	35.16	4.37	1038.14
25	47.00	50.79	47.00	5.20	1038.95
50	57.37	60.51	57.37	5.74	1039.61
100	68.73	71.07	68.73	8.18	1040.23

* Indicates critical storm

The proposed detention pond discharges to the existing stream where all the site water drains towards currently.

Massillon East Side Elementary
Storm Water Management

Storm Water Quality Volume Calculation

The water quality volume for this site is calculated in accordance with the Ohio EPA General Construction Permit OHC000005 dated April 23, 2018. Since this site is a redevelopment site, water quality is calculated using Equation 3 on Page 23 of 60.

Calculate the run-off coefficient "R_{V1}" (Existing Conditions):
$R_{V1} = 0.05+0.9i$

R_{V1} =Coefficient
i=Imperviousness ratio=imperviousness acreage / total acreage=2.70/12.94=0.209

$R_{V1} = 0.05+0.9(0.209) = 0.2381$

Calculate the run-off coefficient "R_{V2}" (Proposed Conditions):
$R_{V2} = 0.05+0.9i$

R_{V2} =Coefficient
i=Imperviousness ratio=imperviousness acreage / total acreage=7.85/12.94=0.607

$R_{V2} = 0.05+0.9(0.607) = 0.5963$

Calculate the required "Water Quality Pond Volume" (WQV) (Equation 3):
$WQV = P \times A \times [(R_{V1} \times 0.2) + (R_{V2} - R_{V1})] / 12$

WQV = Volume in Acre-Feet
R_{V1} = Existing Conditions Run-Off Coefficient= 0.2381
R_{V2} = Proposed Conditions Run-Off Coefficient= 0.5963
P = Precipitation Depth = 0.9 Inches
A = Drainage Area = 12.94 Acres

$WQV = 0.9 \times 12.94 \times [(0.2381 \times 0.2) + (0.5963 - 0.2381)] / 12$
WQV = 0.36764481 Acre-Feet
WQV = 16,014.61 Cubic Feet

Required volume below the water surface (elevation 1035.00).

(16,014.61 * 1.00) + (16,014.61 * 0.20) = 19,217.53 Cubic Feet

The pond volume table states the permanent water pool volume is approximately 42,408 Cubic Feet.

Required volume above the water surface.

16,014.61 * 1.00 = 16,014.61 Cubic Feet

Apply the storage volume (16,014.611 c.f.) to the pond. The resulting water elevation is 1035.97. Interpolating from the provided Elevation vs. Area table, you will determine that at elevation 1035.97, the pond storage volume is approximately 16,108.33 c.f. which is above the required volume.

Using the Drain Time Calculator in Pond Pack software to demonstrate that it takes at least 24 hours to drain the pond from elevation 1035.97 through a 3.5" diameter orifice. 24 hours is the minimum drain time for wet extended detention. Following is a print out of the Time vs. Volume table from the Drain Time Calculator starting at elevation 1035.97 showing 2,121 c.f. of water is retained in the basin at 24 hours (1440 minutes). The table shows it will take longer than 24 hours to drain the pond from elevation 1035.97.

In addition, the minimum drain time, 50% of the above pool volume must remain in the water quality basin for the first 8 hours (480 minutes). The Time vs. Volume table from the Drain Time Calculator starting at elevation 1035.97 demonstrates that 8,222 c.f. is remaining in the basin beyond the initial 8 hours.

References:

1.) O.E.P.A. N.P.D.E.S. for Discharge of Storm Water from Construction Sites. (Permit OHC000005 effective April 23, 2018)
2.) Rainwater and Land Development Manual for Ohio. Post-Construction Storm Water Treatment Section. Water Quality Ponds.

Type.... Time vs. Volume
Name.... MDRAIN 1 OUT

File.... F:\22-070\22-070_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
.00	16068	15968	15870	15772	15677
25.00	15579	15484	15389	15294	15199
50.00	15106	15011	14918	14826	14731
75.00	14636	14544	14451	14359	14267
100.00	14175	14085	13993	13903	13814
125.00	13724	13634	13545	13458	13370
150.00	13281	13194	13107	13020	12933
175.00	12846	12760	12673	12588	12504
200.00	12418	12333	12249	12167	12083
225.00	12001	11917	11835	11753	11673
250.00	11592	11510	11431	11351	11270
275.00	11191	11111	11032	10953	10874
300.00	10795	10718	10641	10564	10488
325.00	10411	10336	10260	10185	10111
350.00	10037	9962	9890	9816	9744
375.00	9672	9598	9526	9454	9382
400.00	9310	9240	9169	9099	9030
425.00	8960	8890	8821	8754	8686
450.00	8619	8552	8485	8420	8352
475.00	8287	8222	8157	8092	8030
500.00	7965	7900	7837	7772	7710
525.00	7647	7585	7524	7462	7401
550.00	7341	7280	7220	7162	7101
575.00	7043	6985	6927	6870	6812
600.00	6756	6700	6644	6588	6532
625.00	6478	6422	6368	6314	6261
650.00	6207	6153	6099	6047	5994
675.00	5942	5890	5841	5789	5740
700.00	5690	5640	5591	5543	5494
725.00	5446	5399	5351	5304	5259
750.00	5213	5166	5121	5077	5032
775.00	4988	4943	4900	4857	4813
800.00	4772	4729	4688	4644	4603
825.00	4562	4523	4484	4444	4407
850.00	4368	4331	4296	4258	4223
875.00	4188	4155	4120	4087	4055
900.00	4022	3991	3960	3929	3897
925.00	3868	3837	3808	3781	3751
950.00	3724	3697	3670	3642	3617
975.00	3590	3565	3541	3516	3491
1000.00	3468	3444	3421	3398	3375
1025.00	3353	3332	3311	3289	3268
1050.00	3247	3227	3206	3187	3167

480 min.
8 hrs.

Type.... Time vs. Volume
Name.... MDRAIN 1 OUT

File.... F:\22-070\22-070_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
1075.00	3148	3129	3111	3092	3075
1100.00	3055	3038	3019	3001	2984
1125.00	2966	2949	2932	2914	2897
1150.00	2882	2864	2847	2831	2816
1175.00	2799	2783	2768	2752	2737
1200.00	2722	2706	2691	2675	2660
1225.00	2647	2631	2618	2602	2589
1250.00	2573	2560	2546	2533	2520
1275.00	2506	2493	2479	2466	2452
1300.00	2439	2427	2414	2402	2389
1325.00	2377	2364	2353	2341	2328
1350.00	2316	2305	2293	2282	2270
1375.00	2259	2247	2237	2226	2214
1400.00	2203	2193	2182	2172	2161
1425.00	2151	2140	2130	2121	2111
1450.00	2100	2090	2080	2071	2061
1475.00	2052	2042	2033	2023	2015
1500.00	2006	1996	1987	1979	1970
1525.00	1960	1952	1943	1935	1928
1550.00	1918	1910	1903	1893	1885
1575.00	1878	1870	1863	1855	1845
1600.00	1838	1830	1824	1817	1809
1625.00	1802	1794	1786	1781	1773
1650.00	1765	1758	1752	1744	1739
1675.00	1731	1725	1718	1712	1704
1700.00	1699	1693	1685	1679	1674
1725.00	1666	1660	1655	1649	1643
1750.00	1638	1632	1626	1620	1615
1775.00	1609	1603	1598	1592	1586
1800.00	1580	1575	1569	1565	1559
1825.00	1554	1548	1544	1539	1533
1850.00	1529	1523	1518	1514	1508
1875.00	1502	1499	1493	1487	1483
1900.00	1478	1474	1468	1462	1459
1925.00	1453	1449	1443	1440	1434
1950.00	1430	1424	1421	1415	1411
1975.00	1405	1402	1396	1392	1386
2000.00	1383	1377	1373	1369	1364
2025.00	1360	1354	1350	1347	1341
2050.00	1337	1331	1328	1324	1318
2075.00	1314	1310	1305	1301	1297
2100.00	1293	1288	1284	1280	1276
2125.00	1271	1267	1263	1259	1254
2150.00	1250	1246	1242	1238	1233

1440 min
24 hrs

Type.... Time vs. Volume
Name.... MDRAIN 1 OUT

File.... F:\22-070\22-070_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
2175.00	1229	1225	1221	1218	1214
2200.00	1210	1204	1200	1197	1193
2225.00	1189	1185	1181	1178	1174
2250.00	1170	1164	1161	1157	1153
2275.00	1149	1145	1142	1138	1134
2300.00	1130	1127	1123	1119	1115
2325.00	1111	1108	1104	1100	1098
2350.00	1094	1091	1087	1083	1079
2375.00	1075	1072	1068	1064	1060
2400.00	1058	1055	1051	1047	1043
2425.00	1039	1036	1034	1030	1026
2450.00	1022	1019	1017	1013	1009
2475.00	1005	1002	1000	996	992
2500.00	988	986	983	979	977
2525.00	973	969	966	964	960
2550.00	956	954	950	947	945
2575.00	941	937	935	932	928
2600.00	926	922	918	916	913
2625.00	911	907	903	901	898
2650.00	896	892	888	886	882
2675.00	880	877	875	871	869
2700.00	865	862	860	856	854
2725.00	850	848	845	843	839
2750.00	837	833	831	829	826
2775.00	824	820	818	814	812
2800.00	809	807	805	801	799
2825.00	795	794	790	788	786
2850.00	782	780	778	775	773
2875.00	769	767	765	761	760
2900.00	758	754	752	750	746
2925.00	745	743	739	737	735
2950.00	733	729	728	726	722
2975.00	720	718	716	712	711
3000.00	709	707	703	701	699
3025.00	697	694	692	690	688
3050.00	684	682	680	678	677
3075.00	673	671	669	667	665
3100.00	663	660	658	656	654
3125.00	652	650	646	645	643
3150.00	641	639	637	635	631
3175.00	629	628	626	624	622
3200.00	620	618	616	614	611
3225.00	609	607	605	603	601
3250.00	599	597	596	594	592

Type.... Time vs. Volume
Name.... MDRAIN 1 OUT

File.... F:\22-070\22-070_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
3275.00	590	588	586	584	582
3300.00	580	579	577	575	573
3325.00	571	569	567	565	563
3350.00	562	560	558	556	554
3375.00	552	550	548	547	545
3400.00	543	541	539	537	535
3425.00	533	531	530	528	526
3450.00	524	522	520	520	518
3475.00	516	515	513	511	509
3500.00	507	505	503	501	501
3525.00	499	498	496	494	492
3550.00	490	488	488	486	484
3575.00	483	481	479	477	477
3600.00	475	473	471	469	467
3625.00	467	466	464	462	460
3650.00	460	458	456	454	452
3675.00	451	451	449	447	445
3700.00	445	443	441	439	437
3725.00	437	435	434	432	432
3750.00	430	428	426	426	424
3775.00	422	420	420	419	417
3800.00	415	415	413	411	409
3825.00	409	407	405	404	404
3850.00	402	400	400	398	396
3875.00	396	394	392	390	390
3900.00	388	387	387	385	383
3925.00	383	381	379	379	377
3950.00	375	375	373	372	372
3975.00	370	368	368	366	364
4000.00	364	362	360	360	358
4025.00	358	356	355	355	353
4050.00	351	351	349	349	347
4075.00	345	345	343	341	341
4100.00	340	340	338	336	336
4125.00	334	334	332	332	330
4150.00	328	328	326	326	325
4175.00	323	323	321	321	319
4200.00	319	317	315	315	313
4225.00	313	311	311	310	310
4250.00	308	308	306	304	304
4275.00	302	302	300	300	298
4300.00	298	296	296	294	294
4325.00	293	293	291	291	289
4350.00	287	287	285	285	283

Type.... Time vs. Volume
Name.... MDRAIN 1 OUT

File.... F:\22-070\22-070_DET.PPW

TIME vs. VOLUME (cu.ft)

Time min	Output Time increment = 5.00 min Time on left represents time for first value in each row.				
4375.00	283	281	281	279	279
4400.00	278	278	276	276	276
4425.00	274	274	272	272	270
4450.00	270	268			

Massillon East Side Elementary

Critical Storm Calculations
Run-off Volume Calculations

Massillon East Side Elementary

% Increase in Stormwater Volume

$$\%_{incr.}=[(V_{pst}-V_{pre})/V_{pre}]*100$$

$$\% = [(49{,}848-36{,}278)/\ 36{,}278]*100 = 37.41\%$$

◦˚◦ 5-yr. *critical* storm.

Type.... Runoff CN Vol (weighted)
Name.... PRE

File.... F:\22-070\22-070_DET.PPW

COMPUTE RUNOFF VOLUME USING CN
(From Composite Weighted CN)
::

CN Data Form ID = Pre

Frequency = 1 years
Rain Depth = 2.0400 in

Soil/Surface Description	Adjusted CN	Area acres	Runoff in	Volume cu.ft
Impervious	98.00	2.700		
Gravel	96.00	2.820		
Lawn	74.00	7.420		
COMPOSITE RUNOFF VOLUME --->	84	12.940	.7723	36278

::

Type.... Runoff CN Vol (weighted)
Name.... POST

File.... F:\22-070\22-070_DET.PPW

COMPUTE RUNOFF VOLUME USING CN
(From Composite Weighted CN)
::

CN Data Form ID = Post

Frequency = 1 years
Rain Depth = 2.0400 in

Soil/Surface Description	Adjusted CN	Area acres	Runoff in	Volume cu.ft
Water	100.00	.350		
Impervious	98.00	7.850		
Lawn	74.00	4.740		
COMPOSITE RUNOFF VOLUME --->	89	12.940	1.0612	49848

::

Massillon East Side Elementary
Storm Water Management

Pre-Developed Runoff Conditions
Time of Concentration Calculations
“CN” Calculations
Peak Runoff Rates

Type.... Tc Calcs
Name.... PRE DEVELOPED

File.... F:\22-070\22-070_DET.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n .1500
Hydraulic Length 100.00 ft
2yr, 24hr P 2.4400 in
Slope .070000 ft/ft

Avg.Velocity .25 ft/sec

Segment #1 Time: 6.80 min

Segment #2: Tc: TR-55 Shallow

Hydraulic Length 401.00 ft
Slope .062000 ft/ft
Unpaved

Avg.Velocity 4.02 ft/sec

Segment #2 Time: 1.66 min

Segment #3: Tc: TR-55 Shallow

Hydraulic Length 71.00 ft
Slope .021000 ft/ft
Unpaved

Avg.Velocity 2.34 ft/sec

Segment #3 Time: .51 min

==========
Total Tc: 8.97 min

Calculated Tc < Min.Tc:
Use Minimum Tc...
Use Tc = 10.00 min
==========

Type.... Tc Calcs
Name.... PRE DEVELOPED

File.... F:\22-070\22-070_DET.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

Type.... Runoff CN-Area
Name.... PRE DEVELOPED

File.... F:\22-070\22-070_DET.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Impervous	98	2.700			98.00
Gravel	96	2.820			96.00
Lawn "C"	74	7.420			74.00
COMPOSITE AREA & WEIGHTED CN --->		12.940			83.80 (84)

::

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 1440.00 min Rain Depth = 2.0400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - PRE DEVELOPED 1
Tc (Min. Tc) = 10.00 min
Drainage Area = 12.940 acres Runoff CN= 84

==========
Computational Time Increment = 1.333 min
Computed Peak Time = 720.00 min
Computed Peak Flow = 13.57 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 13.57 cfs
==========

DRAINAGE AREA

ID:PRE DEVELOPED
CN = 84
Area = 12.940 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

.7723 in
36278 cu.ft

HYG Volume... 36279 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 10.000 min (ID: PRE DEVELOPED)
Computational Incr, Tm = 1.333 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 87.97 cfs
Unit peak time Tp = 6.667 min
Unit receding limb, Tr = 26.667 min
Total unit time, Tb = 33.333 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 1440.00 min Rain Depth = 2.4400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - PRE DEVELOPED 2
Tc (Min. Tc) = 10.00 min
Drainage Area = 12.940 acres Runoff CN= 84

==========
Computational Time Increment = 1.333 min
Computed Peak Time = 720.00 min
Computed Peak Flow = 18.96 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 18.96 cfs
==========

DRAINAGE AREA

ID:PRE DEVELOPED
CN = 84
Area = 12.940 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

1.0696 in
50241 cu.ft

HYG Volume... 50243 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 10.000 min (ID: PRE DEVELOPED)
Computational Incr, Tm = 1.333 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 87.97 cfs
Unit peak time Tp = 6.667 min
Unit receding limb, Tr = 26.667 min
Total unit time, Tb = 33.333 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 5 year storm
Duration = 1440.00 min Rain Depth = 3.0400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - PRE DEVELOPED 5
Tc (Min. Tc) = 10.00 min
Drainage Area = 12.940 acres Runoff CN= 84

==========
Computational Time Increment = 1.333 min
Computed Peak Time = 720.00 min
Computed Peak Flow = 27.50 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 27.50 cfs
==========

DRAINAGE AREA

ID:PRE DEVELOPED
CN = 84
Area = 12.940 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

1.5493 in
72772 cu.ft

HYG Volume... 72774 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 10.000 min (ID: PRE DEVELOPED)
Computational Incr, Tm = 1.333 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 87.97 cfs
Unit peak time Tp = 6.667 min
Unit receding limb, Tr = 26.667 min
Total unit time, Tb = 33.333 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration = 1440.00 min Rain Depth = 3.5600 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - PRE DEVELOPED 10
Tc (Min. Tc) = 10.00 min
Drainage Area = 12.940 acres Runoff CN= 84

==========
Computational Time Increment = 1.333 min
Computed Peak Time = 720.00 min
Computed Peak Flow = 35.16 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 35.16 cfs
==========

DRAINAGE AREA

ID:PRE DEVELOPED
CN = 84
Area = 12.940 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

1.9879 in
93378 cu.ft

HYG Volume... 93380 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 10.000 min (ID: PRE DEVELOPED)
Computational Incr, Tm = 1.333 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 87.97 cfs
Unit peak time Tp = 6.667 min
Unit receding limb, Tr = 26.667 min
Total unit time, Tb = 33.333 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 1440.00 min Rain Depth = 4.3400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - PRE DEVELOPED 25
Tc (Min. Tc) = 10.00 min
Drainage Area = 12.940 acres Runoff CN= 84

==========
Computational Time Increment = 1.333 min
Computed Peak Time = 718.67 min
Computed Peak Flow = 47.00 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 46.90 cfs
==========

DRAINAGE AREA

ID:PRE DEVELOPED
CN = 84
Area = 12.940 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

2.6730 in
125558 cu.ft

HYG Volume... 125559 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 10.000 min (ID: PRE DEVELOPED)
Computational Incr, Tm = 1.333 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 87.97 cfs
Unit peak time Tp = 6.667 min
Unit receding limb, Tr = 26.667 min
Total unit time, Tb = 33.333 min

Type.... Unit Hyd. Summary
Name.... PRE DEVELOPED Tag: 50 Event: 50 yr
File.... F:\22-070\22-070_DET.PPW

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 50 year storm
Duration = 1440.00 min Rain Depth = 5.0100 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - PRE DEVELOPED 50
Tc (Min. Tc) = 10.00 min
Drainage Area = 12.940 acres Runoff CN= 84

==========
Computational Time Increment = 1.333 min
Computed Peak Time = 718.67 min
Computed Peak Flow = 57.37 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 57.10 cfs
==========

DRAINAGE AREA

ID:PRE DEVELOPED
CN = 84
Area = 12.940 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

3.2796 in
154049 cu.ft

HYG Volume... 154050 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 10.000 min (ID: PRE DEVELOPED)
Computational Incr, Tm = 1.333 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 87.97 cfs
Unit peak time Tp = 6.667 min
Unit receding limb, Tr = 26.667 min
Total unit time, Tb = 33.333 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 1440.00 min Rain Depth = 5.7400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - PRE DEVELOPED 100
Tc (Min. Tc) = 10.00 min
Drainage Area = 12.940 acres Runoff CN= 84

==========
Computational Time Increment = 1.333 min
Computed Peak Time = 718.67 min
Computed Peak Flow = 68.73 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 68.26 cfs
==========

DRAINAGE AREA

ID:PRE DEVELOPED
CN = 84
Area = 12.940 acres
S = 1.9048 in
0.2S = .3810 in

Cumulative Runoff

3.9538 in
185717 cu.ft

HYG Volume... 185719 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 10.000 min (ID: PRE DEVELOPED)
Computational Incr, Tm = 1.333 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 87.97 cfs
Unit peak time Tp = 6.667 min
Unit receding limb, Tr = 26.667 min
Total unit time, Tb = 33.333 min

Massillon East Side Elementary
Storm Water Management

Pst-Developed Runoff Conditions
Time of Concentration Calculations
“CN” Calculations
Peak Runoff Rates

Type.... Tc Calcs
Name.... POST DEVELOPMENT

File.... F:\22-070\22-070_DET.PPW

::
TIME OF CONCENTRATION CALCULATOR
::

Segment #1: Tc: TR-55 Sheet

Mannings n	.0110
Hydraulic Length	18.00 ft
2yr, 24hr P	2.4400 in
Slope	.020000 ft/ft
Avg.Velocity	.85 ft/sec

Segment #1 Time: .35 min

Segment #2: Tc: TR-55 Sheet

Mannings n	.1500
Hydraulic Length	42.00 ft
2yr, 24hr P	2.4400 in
Slope	.083300 ft/ft
Avg.Velocity	.22 ft/sec

Segment #2 Time: 3.17 min

Segment #3: Tc: TR-55 Sheet

Mannings n	.0110
Hydraulic Length	40.00 ft
2yr, 24hr P	2.4400 in
Slope	.040000 ft/ft
Avg.Velocity	1.32 ft/sec

Segment #3 Time: .51 min

Type.... Tc Calcs
Name.... POST DEVELOPMENT

File.... F:\22-070\22-070_DET.PPW

Segment #4: Tc: TR-55 Shallow

Hydraulic Length 156.00 ft
Slope .040000 ft/ft
Paved

Avg.Velocity 4.07 ft/sec

Segment #4 Time: .64 min

Segment #5: Tc: TR-55 Shallow

Hydraulic Length 73.00 ft
Slope .010000 ft/ft
Paved

Avg.Velocity 2.03 ft/sec

Segment #5 Time: .60 min

Segment #6: Tc: Length & Vel.

Hydraulic Length 1120.00 ft
Avg.Velocity 2.50 ft/sec

Segment #6 Time: 7.47 min

Total Tc: 12.73 min

Type.... Tc Calcs
Name.... POST DEVELOPMENT

File.... F:\22-070\22-070_DET.PPW

Tc Equations used...

==== SCS TR-55 Sheet Flow ==========

Tc = (.007 * ((n * Lf)**0.8)) / ((P**.5) * (Sf**.4))

Where: Tc = Time of concentration, hrs
n = Mannings n
Lf = Flow length, ft
P = 2yr, 24hr Rain depth, inches
Sf = Slope, %

==== SCS TR-55 Shallow Concentrated Flow ==========

Unpaved surface:
V = 16.1345 * (Sf**0.5)

Paved surface:
V = 20.3282 * (Sf**0.5)

Tc = (Lf / V) / (3600sec/hr)

Where: V = Velocity, ft/sec
Sf = Slope, ft/ft
Tc = Time of concentration, hrs
Lf = Flow length, ft

==== User Defined Length & Velocity ==========

Tc = (Lf / V) / (3600sec/hr)

Where: Tc = Time of concentration, hrs
Lf = Flow length, ft
V = Velocity, ft/sec

Type.... Runoff CN-Area
Name.... POST DEVELOPMENT

File.... F:\22-070\22-070_DET.PPW

RUNOFF CURVE NUMBER DATA
::

Soil/Surface Description	CN	Area acres	Impervious Adjustment %C	%UC	Adjusted CN
Water	100	.350			100.00
Impervious	98	7.850			98.00
Lawn "C"	74	4.740			74.00
COMPOSITE AREA & WEIGHTED CN --->		12.940			89.26 (89)

::

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 1 year storm
Duration = 1440.00 min Rain Depth = 2.0400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - POST DEVELOPMENT 1
Tc = 12.73 min
Drainage Area = 12.940 acres Runoff CN= 89

==========
Computational Time Increment = 1.697 min
Computed Peak Time = 721.35 min
Computed Peak Flow = 17.69 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 17.38 cfs
WARNING: The difference between calculated peak flow
and interpolated peak flow is greater than 1.50%
==========

DRAINAGE AREA

ID:POST DEVELOPMENT
CN = 89
Area = 12.940 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

1.0612 in
49848 cu.ft

HYG Volume... 49851 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 12.730 min (ID: POST DEVELOPMENT)
Computational Incr, Tm = 1.697 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 69.11 cfs
Unit peak time Tp = 8.486 min
Unit receding limb, Tr = 33.946 min
Total unit time, Tb = 42.432 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 2 year storm
Duration = 1440.00 min Rain Depth = 2.4400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - POST DEVELOPMENT 2
Tc = 12.73 min
Drainage Area = 12.940 acres Runoff CN= 89

==========
Computational Time Increment = 1.697 min
Computed Peak Time = 721.35 min
Computed Peak Flow = 23.31 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 22.99 cfs
==========

DRAINAGE AREA

ID:POST DEVELOPMENT
CN = 89
Area = 12.940 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

1.4024 in
65873 cu.ft

HYG Volume... 65877 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 12.730 min (ID: POST DEVELOPMENT)
Computational Incr, Tm = 1.697 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 69.11 cfs
Unit peak time Tp = 8.486 min
Unit receding limb, Tr = 33.946 min
Total unit time, Tb = 42.432 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 5 year storm
Duration = 1440.00 min Rain Depth = 3.0400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - POST DEVELOPMENT 5
Tc = 12.73 min
Drainage Area = 12.940 acres Runoff CN= 89

==========
Computational Time Increment = 1.697 min
Computed Peak Time = 721.35 min
Computed Peak Flow = 31.92 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 31.61 cfs
==========

DRAINAGE AREA

ID:POST DEVELOPMENT
CN = 89
Area = 12.940 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

1.9360 in
90939 cu.ft

HYG Volume... 90945 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 12.730 min (ID: POST DEVELOPMENT)
Computational Incr, Tm = 1.697 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 69.11 cfs
Unit peak time Tp = 8.486 min
Unit receding limb, Tr = 33.946 min
Total unit time, Tb = 42.432 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 10 year storm
Duration = 1440.00 min Rain Depth = 3.5600 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - POST DEVELOPMENT 10
Tc = 12.73 min
Drainage Area = 12.940 acres Runoff CN= 89

==========
Computational Time Increment = 1.697 min
Computed Peak Time = 721.35 min
Computed Peak Flow = 39.45 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 39.17 cfs
==========

DRAINAGE AREA

ID:POST DEVELOPMENT
CN = 89
Area = 12.940 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

2.4127 in
113329 cu.ft

HYG Volume... 113336 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 12.730 min (ID: POST DEVELOPMENT)
Computational Incr, Tm = 1.697 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 69.11 cfs
Unit peak time Tp = 8.486 min
Unit receding limb, Tr = 33.946 min
Total unit time, Tb = 42.432 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 25 year storm
Duration = 1440.00 min Rain Depth = 4.3400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - POST DEVELOPMENT 25
Tc = 12.73 min
Drainage Area = 12.940 acres Runoff CN= 89

==========
Computational Time Increment = 1.697 min
Computed Peak Time = 721.35 min
Computed Peak Flow = 50.79 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 50.55 cfs
==========

DRAINAGE AREA

ID:POST DEVELOPMENT
CN = 89
Area = 12.940 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

3.1435 in
147658 cu.ft

HYG Volume... 147667 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 12.730 min (ID: POST DEVELOPMENT)
Computational Incr, Tm = 1.697 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 69.11 cfs
Unit peak time Tp = 8.486 min
Unit receding limb, Tr = 33.946 min
Total unit time, Tb = 42.432 min

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 50 year storm
Duration = 1440.00 min Rain Depth = 5.0100 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - POST DEVELOPMENT 50
Tc = 12.73 min
Drainage Area = 12.940 acres Runoff CN= 89

==========
Computational Time Increment = 1.697 min
Computed Peak Time = 721.35 min
Computed Peak Flow = 60.51 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 60.31 cfs
==========

DRAINAGE AREA

ID:POST DEVELOPMENT
CN = 89
Area = 12.940 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

3.7815 in
177626 cu.ft

HYG Volume... 177635 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 12.730 min (ID: POST DEVELOPMENT)
Computational Incr, Tm = 1.697 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 69.11 cfs
Unit peak time Tp = 8.486 min
Unit receding limb, Tr = 33.946 min
Total unit time, Tb = 42.432 min

Type.... Unit Hyd. Summary
Name.... POST DEVELOPMENT Tag: 100 Event: 100 yr
File.... F:\22-070\22-070_DET.PPW

SCS UNIT HYDROGRAPH METHOD

STORM EVENT: 100 year storm
Duration = 1440.00 min Rain Depth = 5.7400 in
Rain Dir = F:\22-070\
Rain File -ID = - TypeII 24hr
Unit Hyd Type = Default Curvilinear
HYG Dir = F:\22-070\
HYG File - ID = 22-070_D.HYG - POST DEVELOPMENT 100
Tc = 12.73 min
Drainage Area = 12.940 acres Runoff CN= 89

==========
Computational Time Increment = 1.697 min
Computed Peak Time = 721.35 min
Computed Peak Flow = 71.07 cfs

Time Increment for HYG File = 3.00 min
Peak Time, Interpolated Output = 720.00 min
Peak Flow, Interpolated Output = 70.92 cfs
==========

DRAINAGE AREA

ID:POST DEVELOPMENT
CN = 89
Area = 12.940 acres
S = 1.2360 in
0.2S = .2472 in

Cumulative Runoff

4.4839 in
210618 cu.ft

HYG Volume... 210629 cu.ft (area under HYG curve)

***** SCS UNIT HYDROGRAPH PARAMETERS *****

Time Concentration, Tc = 12.730 min (ID: POST DEVELOPMENT)
Computational Incr, Tm = 1.697 min = 0.20000 Tp

Unit Hyd. Shape Factor = 483.432 (37.46% under rising limb)
K = 483.43/645.333, K = .7491 (also, K = 2/(1+(Tr/Tp))
Receding/Rising, Tr/Tp = 1.6698 (solved from K = .7491)

Unit peak, qp = 69.11 cfs
Unit peak time Tp = 8.486 min
Unit receding limb, Tr = 33.946 min
Total unit time, Tb = 42.432 min

Massillon East Side Elementary
Storm Water Management

Retention Volume Calculations
Retention Basin Outlet Structure

Type.... Vol: Elev-Area
Name.... BELOW WS

File.... F:\22-070\22-070_DET.PPW

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (cu.ft)	Volume Sum (cu.ft)
1031.00	-----	6207	0	0	0
1032.00	-----	8306	21693	7231	7231
1033.00	-----	10532	28191	9397	16628
1034.00	-----	12881	35060	11687	28315
1035.00	-----	15342	42281	14094	42408

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Type.... Vol: Elev-Area
Name.... POND 10

File.... F:\22-070\22-070_DET.PPW

Elevation (ft)	Planimeter (sq.in)	Area (sq.ft)	A1+A2+sqr(A1*A2) (sq.ft)	Volume (cu.ft)	Volume Sum (cu.ft)
1035.00	-----	15342	0	0	0
1036.00	-----	17904	49820	16607	16607
1037.00	-----	20567	57660	19220	35827
1038.00	-----	23330	65802	21934	57761
1039.00	-----	26194	74245	24748	82509
1040.00	-----	29158	82988	27663	110172
1041.00	-----	32223	92033	30678	140849
1042.00	-----	35388	101379	33793	174643

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Type.... Outlet Input Data
Name.... Outlet 1

File.... F:\22-070\22-070_DET.PPW
Title... Project Date: 2/15/2023
Project Engineer: Thomas Weiss
Project Title: Massillon Eastside Elementary School
Project Comments:

REQUESTED POND WS ELEVATIONS:

Min. Elev.= 1035.00 ft
Increment = .10 ft
Max. Elev.= 1042.00 ft

****
OUTLET CONNECTIVITY
****

---> Forward Flow Only (UpStream to DnStream)
<--- Reverse Flow Only (DnStream to UpStream)
<---> Forward and Reverse Both Allowed

Structure	No.		Outfall	E1, ft	E2, ft
Inlet Box	4	--->	2	1040.000	1042.000
Orifice-Circular	3	--->	2	1035.970	1042.000
Orifice-Circular	1	--->	2	1035.000	1042.000
Culvert-Circular	2	--->	TW	1035.000	1042.000
Weir-XY Points	5	--->	TW	1041.000	1042.000

TW SETUP, DS Channel

Type.... Outlet Input Data
Name.... Outlet 1

File.... F:\22-070\22-070_DET.PPW
Title... Project Date: 2/15/2023
Project Engineer: Thomas Weiss
Project Title: Massillon Eastside Elementary School
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID = 4
Structure Type = Inlet Box

# of Openings = 1
Invert Elev. = 1040.00 ft
Orifice Area = 4.0000 sq.ft
Orifice Coeff. = .670
Weir Length = 8.00 ft
Weir Coeff. = 3.100
K, Submerged = .000
K, Reverse = 1.000
Kb,Barrel = .000000 (per ft of full flow)
Barrel Length = .00 ft
Mannings n = .0000

Structure ID = 3
Structure Type = Orifice-Circular

# of Openings = 1
Invert Elev. = 1035.97 ft
Diameter = 10.00 in
Orifice Coeff. = .670

Structure ID = 1
Structure Type = Orifice-Circular

# of Openings = 1
Invert Elev. = 1035.00 ft
Diameter = 3.50 in
Orifice Coeff. = .670

Type.... Outlet Input Data
Name.... Outlet 1

File.... F:\22-070\22-070_DET.PPW
Title... Project Date: 2/15/2023
Project Engineer: Thomas Weiss
Project Title: Massillon Eastside Elementary School
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID = 2
Structure Type = Culvert-Circular

No. Barrels	=	1
Barrel Diameter	=	15.00 in
Upstream Invert	=	1035.00 ft
Dnstream Invert	=	1034.21 ft
Horiz. Length	=	117.50 ft
Barrel Length	=	117.50 ft
Barrel Slope	=	.00674 ft/ft

OUTLET CONTROL DATA...

Mannings n	=	.0110
Ke	=	.0000 (forward entrance loss)
Kb	=	.016629 (per ft of full flow)
Kr	=	.0000 (reverse entrance loss)
HW Convergence	=	.001 +/- ft

INLET CONTROL DATA...

Equation form	=	1
Inlet Control K	=	.0018
Inlet Control M	=	2.5000
Inlet Control c	=	.03000
Inlet Control Y	=	.7400
T1 ratio (HW/D)	=	1.078
T2 ratio (HW/D)	=	1.217
Slope Factor	=	-.500

Use unsubmerged inlet control Form 1 equ. below T1 elev.
Use submerged inlet control Form 1 equ. above T2 elev.

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...
At T1 Elev = 1036.35 ft ---> Flow = 4.80 cfs
At T2 Elev = 1036.52 ft ---> Flow = 5.49 cfs

Type.... Outlet Input Data
Name.... Outlet 1

File.... F:\22-070\22-070_DET.PPW
Title... Project Date: 2/15/2023
Project Engineer: Thomas Weiss
Project Title: Massillon Eastside Elementary School
Project Comments:

OUTLET STRUCTURE INPUT DATA

Structure ID = 5
Structure Type = Weir-XY Points

# of Openings = 1
WEIR X-Y GROUND POINTS

X, ft	Elev, ft
.00	1042.00
4.00	1041.00
14.00	1041.00
18.00	1042.00

Lowest Elev. = 1041.00 ft

Weir Coeff. = 3.100000

Weir TW effects (Use adjustment equation)

Structure ID = TW
Structure Type = TW SETUP, DS Channel

FREE OUTFALL CONDITIONS SPECIFIED

CONVERGENCE TOLERANCES...
Maximum Iterations= 30
Min. TW tolerance = .01 ft
Max. TW tolerance = .01 ft
Min. HW tolerance = .01 ft
Max. HW tolerance = .01 ft
Min. Q tolerance = .10 cfs
Max. Q tolerance = .10 cfs

Type.... Composite Rating Curve
Name.... Outlet 1

File.... F:\22-070\22-070_DET.PPW
Title... Project Date: 2/15/2023
Project Engineer: Thomas Weiss
Project Title: Massillon Eastside Elementary School
Project Comments:

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
1035.00	.00	Free Outfall		(no Q: 4,3,1,2,5)
1035.10	.02	Free Outfall	1,2	(no Q: 4,3,5)
1035.20	.06	Free Outfall	1,2	(no Q: 4,3,5)
1035.30	.13	Free Outfall	1,2	(no Q: 4,3,5)
1035.40	.16	Free Outfall	1,2	(no Q: 4,3,5)
1035.50	.19	Free Outfall	1,2	(no Q: 4,3,5)
1035.60	.22	Free Outfall	1,2	(no Q: 4,3,5)
1035.70	.24	Free Outfall	1,2	(no Q: 4,3,5)
1035.80	.26	Free Outfall	1,2	(no Q: 4,3,5)
1035.90	.28	Free Outfall	1,2	(no Q: 4,3,5)
1035.97	.30	Free Outfall	1,2	(no Q: 4,3,5)
1036.00	.31	Free Outfall	3,1,2	(no Q: 4,5)
1036.10	.37	Free Outfall	3,1,2	(no Q: 4,5)
1036.20	.49	Free Outfall	3,1,2	(no Q: 4,5)
1036.30	.65	Free Outfall	3,1,2	(no Q: 4,5)
1036.40	.85	Free Outfall	3,1,2	(no Q: 4,5)
1036.50	1.11	Free Outfall	3,1,2	(no Q: 4,5)
1036.60	1.37	Free Outfall	3,1,2	(no Q: 4,5)
1036.70	1.67	Free Outfall	3,1,2	(no Q: 4,5)
1036.80	1.99	Free Outfall	3,1,2	(no Q: 4,5)
1036.90	2.47	Free Outfall	3,1,2	(no Q: 4,5)
1037.00	2.67	Free Outfall	3,1,2	(no Q: 4,5)
1037.10	2.86	Free Outfall	3,1,2	(no Q: 4,5)
1037.20	3.04	Free Outfall	3,1,2	(no Q: 4,5)
1037.30	3.21	Free Outfall	3,1,2	(no Q: 4,5)
1037.40	3.36	Free Outfall	3,1,2	(no Q: 4,5)
1037.50	3.52	Free Outfall	3,1,2	(no Q: 4,5)
1037.60	3.67	Free Outfall	3,1,2	(no Q: 4,5)
1037.70	3.81	Free Outfall	3,1,2	(no Q: 4,5)
1037.80	3.95	Free Outfall	3,1,2	(no Q: 4,5)
1037.90	4.07	Free Outfall	3,1,2	(no Q: 4,5)
1038.00	4.20	Free Outfall	3,1,2	(no Q: 4,5)
1038.10	4.33	Free Outfall	3,1,2	(no Q: 4,5)
1038.20	4.45	Free Outfall	3,1,2	(no Q: 4,5)

Type.... Composite Rating Curve
Name.... Outlet 1

File.... F:\22-070\22-070_DET.PPW
Title... Project Date: 2/15/2023
Project Engineer: Thomas Weiss
Project Title: Massillon Eastside Elementary School
Project Comments:

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
1038.30	4.56	Free Outfall		3,1,2 (no Q: 4,5)
1038.40	4.67	Free Outfall		3,1,2 (no Q: 4,5)
1038.50	4.79	Free Outfall		3,1,2 (no Q: 4,5)
1038.60	4.90	Free Outfall		3,1,2 (no Q: 4,5)
1038.70	4.99	Free Outfall		3,1,2 (no Q: 4,5)
1038.80	5.07	Free Outfall		3,1,2 (no Q: 4,5)
1038.90	5.17	Free Outfall		3,1,2 (no Q: 4,5)
1039.00	5.25	Free Outfall		3,1,2 (no Q: 4,5)
1039.10	5.33	Free Outfall		3,1,2 (no Q: 4,5)
1039.20	5.41	Free Outfall		3,1,2 (no Q: 4,5)
1039.30	5.50	Free Outfall		3,1,2 (no Q: 4,5)
1039.40	5.57	Free Outfall		3,1,2 (no Q: 4,5)
1039.50	5.65	Free Outfall		3,1,2 (no Q: 4,5)
1039.60	5.73	Free Outfall		3,1,2 (no Q: 4,5)
1039.70	5.81	Free Outfall		3,1,2 (no Q: 4,5)
1039.80	5.89	Free Outfall		3,1,2 (no Q: 4,5)
1039.90	5.96	Free Outfall		3,1,2 (no Q: 4,5)
1040.00	6.03	Free Outfall		3,1,2 (no Q: 4,5)
1040.10	6.74	Free Outfall		4,3,1,2 (no Q: 5)
1040.20	7.86	Free Outfall		4,3,1,2 (no Q: 5)
1040.30	9.12	Free Outfall		4,3,1,2 (no Q: 5)
1040.40	10.47	Free Outfall		4,3,1,2 (no Q: 5)
1040.50	12.87	Free Outfall		4,2 (no Q: 3,1,5)
1040.60	13.00	Free Outfall		4,2 (no Q: 3,1,5)
1040.70	13.12	Free Outfall		4,2 (no Q: 3,1,5)
1040.80	13.25	Free Outfall		4,2 (no Q: 3,1,5)
1040.90	13.37	Free Outfall		4,2 (no Q: 3,1,5)
1041.00	13.49	Free Outfall		4,2 (no Q: 3,1,5)
1041.10	14.62	Free Outfall		4,2,5 (no Q: 3,1)
1041.20	16.66	Free Outfall		4,2,5 (no Q: 3,1)
1041.30	19.38	Free Outfall		4,2,5 (no Q: 3,1)
1041.40	22.70	Free Outfall		4,2,5 (no Q: 3,1)
1041.50	26.60	Free Outfall		4,2,5 (no Q: 3,1)
1041.60	31.05	Free Outfall		4,2,5 (no Q: 3,1)

Type.... Composite Rating Curve
Name.... Outlet 1

File.... F:\22-070\22-070_DET.PPW
Title... Project Date: 2/15/2023
Project Engineer: Thomas Weiss
Project Title: Massillon Eastside Elementary School
Project Comments:

***** COMPOSITE OUTFLOW SUMMARY ****

WS Elev, Total Q		Converge		Notes
Elev. ft	Q cfs	TW Elev ft	Error +/-ft	Contributing Structures
1041.70	36.06	Free Outfall	4,2,5	(no Q: 3,1)
1041.80	41.64	Free Outfall	4,2,5	(no Q: 3,1)
1041.90	47.75	Free Outfall	4,2,5	(no Q: 3,1)
1042.00	54.42	Free Outfall	4,2,5	(no Q: 3,1)

Massillon East Side Elementary
Storm Water Management

Detention Basin Peak Release Rates

Type.... Pond Routing Summary
Name.... POND 10 OUT Tag: 1 Event: 1 yr
File.... F:\22-070\22-070_DET.PPW
Storm... TypeII 24hr Tag: 1

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\22-070\
Inflow HYG file = NONE STORED - POND 10 IN 1
Outflow HYG file = NONE STORED - POND 10 OUT 1

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 1035.00 ft
Starting Volume = 0 cu.ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = 3.00 min

INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==========
Peak Inflow = 17.38 cfs at 720.00 min
Peak Outflow = 1.32 cfs at 780.00 min

Peak Elevation = 1036.58 ft
Peak Storage = 27452 cu.ft
==========

MASS BALANCE (cu.ft)

+ Initial Vol = 0
+ HYG Vol IN = 49851
- Infiltration = 0
- HYG Vol OUT = 49603
- Retained Vol = 248

Unrouted Vol = -1 cu.ft (.002% of Inflow Volume)

Type.... Pond Routing Summary
Name.... POND 10 OUT Tag: 2 Event: 2 yr
File.... F:\22-070\22-070_DET.PPW
Storm... TypeII 24hr Tag: 2

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\22-070\
Inflow HYG file = NONE STORED - POND 10 IN 2
Outflow HYG file = NONE STORED - POND 10 OUT 2

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 1035.00 ft
Starting Volume = 0 cu.ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = 3.00 min

INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==========
Peak Inflow = 22.99 cfs at 720.00 min
Peak Outflow = 2.56 cfs at 756.00 min

Peak Elevation = 1036.95 ft
Peak Storage = 34741 cu.ft
==========

MASS BALANCE (cu.ft)

+ Initial Vol = 0
+ HYG Vol IN = 65877
- Infiltration = 0
- HYG Vol OUT = 65629
- Retained Vol = 248

Unrouted Vol = -1 cu.ft (.002% of Inflow Volume)

Type.... Pond Routing Summary
Name.... POND 10 OUT Tag: 5 Event: 5 yr
File.... F:\22-070\22-070_DET.PPW
Storm... TypeII 24hr Tag: 5

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\22-070\
Inflow HYG file = NONE STORED - POND 10 IN 5
Outflow HYG file = NONE STORED - POND 10 OUT 5

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 1035.00 ft
Starting Volume = 0 cu.ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = 3.00 min

INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==========
Peak Inflow = 31.61 cfs at 720.00 min
Peak Outflow = 3.64 cfs at 753.00 min

Peak Elevation = 1037.58 ft
Peak Storage = 48227 cu.ft
==========

MASS BALANCE (cu.ft)

+ Initial Vol = 0
+ HYG Vol IN = 90945
- Infiltration = 0
- HYG Vol OUT = 90696
- Retained Vol = 248

Unrouted Vol = -1 cu.ft (.002% of Inflow Volume)

Type.... Pond Routing Summary
Name.... POND 10 OUT Tag: 10 Event: 10 yr
File.... F:\22-070\22-070_DET.PPW
Storm... TypeII 24hr Tag: 10

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\22-070\
Inflow HYG file = NONE STORED - POND 10 IN 10
Outflow HYG file = NONE STORED - POND 10 OUT 10

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 1035.00 ft
Starting Volume = 0 cu.ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = 3.00 min

INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==========
Peak Inflow = 39.17 cfs at 720.00 min
Peak Outflow = 4.37 cfs at 753.00 min

Peak Elevation = 1038.14 ft
Peak Storage = 60973 cu.ft
==========

MASS BALANCE (cu.ft)

+ Initial Vol = 0
+ HYG Vol IN = 113336
- Infiltration = 0
- HYG Vol OUT = 113087
- Retained Vol = 248

Unrouted Vol = -1 cu.ft (.001% of Inflow Volume)

Type.... Pond Routing Summary
Name.... POND 10 OUT Tag: 25 Event: 25 yr
File.... F:\22-070\22-070_DET.PPW
Storm... TypeII 24hr Tag: 25

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\22-070\
Inflow HYG file = NONE STORED - POND 10 IN 25
Outflow HYG file = NONE STORED - POND 10 OUT 25

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 1035.00 ft
Starting Volume = 0 cu.ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = 3.00 min

INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==========
Peak Inflow = 50.55 cfs at 720.00 min
Peak Outflow = 5.20 cfs at 756.00 min

Peak Elevation = 1038.95 ft
Peak Storage = 81144 cu.ft
==========

MASS BALANCE (cu.ft)

+ Initial Vol = 0
+ HYG Vol IN = 147667
- Infiltration = 0
- HYG Vol OUT = 147418
- Retained Vol = 248

Unrouted Vol = -1 cu.ft (.001% of Inflow Volume)

Type.... Pond Routing Summary
Name.... POND 10 OUT Tag: 50 Event: 50 yr
File.... F:\22-070\22-070_DET.PPW
Storm... TypeII 24hr Tag: 50

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\22-070\
Inflow HYG file = NONE STORED - POND 10 IN 50
Outflow HYG file = NONE STORED - POND 10 OUT 50

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev = 1035.00 ft
Starting Volume = 0 cu.ft
Starting Outflow = .00 cfs
Starting Infiltr. = .00 cfs
Starting Total Qout= .00 cfs
Time Increment = 3.00 min

INFLOW/OUTFLOW HYDROGRAPH SUMMARY
==========
Peak Inflow = 60.31 cfs at 720.00 min
Peak Outflow = 5.74 cfs at 756.00 min

Peak Elevation = 1039.61 ft
Peak Storage = 99135 cu.ft
==========

MASS BALANCE (cu.ft)

+ Initial Vol = 0
+ HYG Vol IN = 177635
- Infiltration = 0
- HYG Vol OUT = 177387
- Retained Vol = 248

Unrouted Vol = -1 cu.ft (.001% of Inflow Volume)

Type.... Pond Routing Summary
Name.... POND 10 OUT Tag: 100 Event: 100 yr
File.... F:\22-070\22-070_DET.PPW
Storm... TypeII 24hr Tag: 100

LEVEL POOL ROUTING SUMMARY

HYG Dir = F:\22-070\
Inflow HYG file = NONE STORED - POND 10 IN 100
Outflow HYG file = NONE STORED - POND 10 OUT 100

Pond Node Data = POND 10
Pond Volume Data = POND 10
Pond Outlet Data = Outlet 1

No Infiltration

INITIAL CONDITIONS

Starting WS Elev	=	1035.00 ft
Starting Volume	=	0 cu.ft
Starting Outflow	=	.00 cfs
Starting Infiltr.	=	.00 cfs
Starting Total Qout	=	.00 cfs
Time Increment	=	3.00 min

INFLOW/OUTFLOW HYDROGRAPH SUMMARY

Peak Inflow	=	70.92 cfs	at	720.00 min
Peak Outflow	=	8.18 cfs	at	753.00 min
Peak Elevation	=	1040.23 ft		
Peak Storage	=	116818 cu.ft		

MASS BALANCE (cu.ft)

+ Initial Vol	=	0
+ HYG Vol IN	=	210629
- Infiltration	=	0
- HYG Vol OUT	=	210380
- Retained Vol	=	248
Unrouted Vol	=	-1 cu.ft (.001% of Inflow Volume)

Massillon East Side Elementary
Storm Water Management

Sediment Basin Calculations

SEDIMENT BASIN CALCULATIONS
FOR
MASSILLON EASTSIDE ELEMENTARY SCHOOL
LOCATED IN
CITY OF MASSILLON, STARK COUNTY, OHIO

SEDIMENT STORAGE ZONE VOLUME:

METHOD 1:

Disturbed Area (DA) in drainage watershed: 12.94 acres.

SSZV = 1,000 c.f./acre * DA

SSZV = 1,000 c.f./acre * 12.94 acres

SSZV =12,940 c.f.

At elevation 1035.00 – 42,408 c.f. is provided in the surface detention

DEWATERING ZONE VOLUME:

Total Drainage Area (TDA) of contributing area: 12.94 acres.

DZV = 1,800 c.f./acre * TDA acres

DZV = 1,800 c.f./acre * 12.94 acres

DZV = 23,292 c.f.

At elevation 1065.53 (above elevation 1035.00) – 42,185 c.f. is provided in the sediment basin

OUTLET DRAWDOWN:

Outlet must drawdown the dewatering zone between 48 hours and 7 days.
Floating skimmer method shall be used.
Skimmer bottom shall be at the top or above the sediment storage zone volume.

SKIMMER SIZING:

Dewatering calculations are based on the contractor using a “Faircloth Skimmer”.

DZV = 23,292 c.f.
Drawdown Time = 48 hours = 2 days

From sheet 2 of “Determining the Skimmer Size and the Required Orifice for the Faircloth Skimmer Surface Drain” a 4” diameter skimmer with a reduced orifice should be used.

ORIFICE SIZING:

Orifice Area = DZV / FACTOR

DZV = 23,292 c.f.
FACTOR = 3,202 c.f./sq. in.

OA = 23,292 c.f. / 3,202 c.f./sq. in. = 7.27 sq. in.

Orifice Diameter = sq. root (4 * OA / 3.14)

OD = sq. root (4 * 7.27 sq. in. / 3.14)

OD= 3.04 in.

RESULTS:

USE A 4” DIAMETER SKIMMER WITH A 3.04” DIAMETER ORIFICE.

Determining the Skimmer Size and the Required Orifice for the *Faircloth Skimmer®* Surface Drain

November 2007

Important note: *The orifice sizing chart in the Pennsylvania Erosion Control Manual and reproduced in the North Carolina Design Manual* ***DOES NOT APPLY*** *to our skimmers. It will give the wrong size orifice and not specify which size skimmer is required. Please use the information below to choose the size skimmer required for the basin volume provided and determine the orifice size required for the drawdown time, typically 4-7 days in Pennsylvania and 3 days in North Carolina.*

The **size** of a Faircloth Skimmer®, for example a 4" skimmer, refers to the maximum diameter of the skimmer inlet. The inlet on each of the 8 sizes offered can be reduced to adjust the flow rate by cutting a hole or ***orifice*** in a plug using an adjustable cutter (both supplied).

Determining the skimmer size needed and the orifice for that skimmer required to drain the sediment basin's volume in the required time involves two steps: **First**, determining the size skimmer required based on the volume to be drained and the number of days to drain it; and **Second,** calculate the orifice size to adjust the flow rate and "customize" the skimmer for the basin's volume. *The second step is not always necessary* if the flow rate for the skimmer with the inlet wide open equals or is close to the flow rate required for the basin volume and the drawdown time.

Both the skimmer size and the required orifice radius for the skimmer should be shown for each basin on the erosion and sediment control plan. Make it clear that the dimension is either the radius or the diameter. It is also helpful to give the basin volume in case there are questions. During the skimmer installation the required orifice can be cut in the plastic plug using the supplied adjustable cutter and installed in the skimmer using the instructions provided.

The plan review and enforcement authority may require the calculations showing that the skimmer used can drain the basin in the required time.

Determining the Skimmer Size

Step 1. Below are approximate **skimmer maximum flow capacities** based on typical draw down requirements, which can vary between States and jurisdictions and watersheds. If one 6" skimmer does not provide enough capacity, multiple skimmers can be used to drain the basin. For drawdown times not shown, multiply the 24-hour figure by the number of days required.

Example: A basin's volume is 29,600 cubic feet and it must be drained in 3 days. A 3" skimmer with the inlet wide open will work perfectly. (Actually, the chart below gives 29,322 cubic feet but this is well within the accuracy of the calculations and the basin's constructed volume.)
Example: A basin's volume is 39,000 cubic feet and it must be drained in 3 days. The 3"

skimmer is too small; a 4" skimmer has enough capacity but it is too large, so the inlet will need to be reduced using step 2 to adjust the flow rate for the basin's volume. (It needs a 3.2" diameter orifice.)

1½" skimmer:	1,728 cubic feet in **24 hours**	6,912 cubic feet in **4 days**
with a 1½" head	3,456 cubic feet in **2 days**	12,096 cubic feet in **7 days**
	5,184 cubic feet in **3 days**	
2" skimmer:	3,283 cubic feet in **24 hours**	13,132 cubic feet in **4 days**
with a 2" head	6,566 cubic feet in **2 days**	22,982 cubic feet in **7 days**
	9,849 cubic feet in **3 days**	
2½" skimmer:	6,234 cubic feet in **24 hours**	24,936 cubic feet in **4 days**
with a 2.5" head	12,468 cubic feet in **2 days**	43,638 cubic feet in **7 days**
	18,702 cubic feet in **3 days**	
3" skimmer:	9,774 cubic feet in **24 hours**	39,096 cubic feet in **4 days**
with a 3" head	19,547 cubic feet in **2 days**	68,415 cubic feet in **7 days**
	29,322 cubic feet in **3 days**	
4" skimmer:	20,109 cubic feet in **24 hours**	80,436 cubic feet in **4 days**
with a 4" head	40,218 cubic feet in **2 days**	140,763 cubic feet in **7 days**
	60,327 cubic feet in **3 days**	
5" skimmer:	32,832 cubic feet in **24 hours**	131,328 cubic feet in **4 days**
with a 4" head	65,664 cubic feet in **2 days**	229,824 cubic feet in **7 days**
	98,496 cubic feet in **3 days**	
6" skimmer:	51,840 cubic feet in **24 hours**	207,360 cubic feet in **4 days**
with a 5" head	103,680 cubic feet in **2 days**	362,880 cubic feet in **7 days**
	155,520 cubic feet in **3 days**	
8" skimmer:	97,978 cubic feet in **24 hours**	391,912 cubic feet in **4 days**
with a 6" head	195,956 cubic feet in **2 days**	685,846 cubic feet in **7 days**
	293,934 cubic feet in **3 days**	

Determining the Orifice

Step 2. To determine the orifice required to reduce the flow rate for the basin's volume and the number of days to drain the basin, simply use the formula volume ÷ **factor** (from the chart below) for the same size skimmer chosen in the first step and the same number of days. This calculation will give the **area** of the required orifice. Then calculate the orifice radius using Area = π r^2 and solving for *r,* $r = \sqrt{(Area / 3.14)}$ .The supplied cutter can be adjusted to this radius to cut the orifice in the plug. The instructions with the plug and cutter has a ruler divided into tenths of inches. Again, this step is not always necessary as explained above.

An alternative method is to use the orifice equation with the head for a particular skimmer shown on the previous page and determine the orifice needed to give the required flow for the volume and draw down time. C = 0.59 is used in this chart.

Example: A 4" skimmer is the smallest skimmer that will drain 39,000 cubic feet in 3 days but a 4" inlet will drain the basin too fast (in 1.9 days) To determine the orifice required use the factor of 4,803 from the chart below for a 4" skimmer and a drawdown time of 3 days. 39,000 cubic feet ÷ 4,803 = 8.12 square inches of orifice required. Calculate the orifice radius using Area = π r^2 and solving for r, $r = \sqrt{(8.12/3.14)}$ and r = 1.61". As a practical matter 1.6" is about as close as the cutter can be adjusted and the orifice cut..

Factors (in cubic feet of flow per square inch of opening through a **round** orifice with the head for that skimmer and for the drawdown times shown) for determining the **orifice radius** for a basin's volume to be drained. This quick method works because the orifice is centered and has a constant head (given above in Step 1).

1½" skimmer:	960 to drain in **24 hours**	3,840 to drain in **4 days**
	1,920 to drain in **2 days**	6,720 to drain in **7 days**
	2,880 to drain in **3 days**	
2" skimmer:	1,123 to drain in **24 hours**	4,492 to drain in **4 days**
	2,246 to drain in **2 days**	7,861 to drain in **7 days**
	3,369 to drain in **3 days**	
2½" skimmer:	1,270 to drain in **24 hours**	5,080 to drain in **4 days**
Revised 11-6-07	2,540 to drain in **2 days**	8,890 to drain in **7 days**
	3,810 to drain in **3 days**	
3" skimmer:	1,382 to drain in **24 hours**	5,528 to drain in **4 days**
	2,765 to drain in **2 days**	9,677 to drain in **7 days**
	4,146 to drain in **3 days**	
4" skimmer:	1,601 to drain in **24 hours**	6,404 to drain in **4 days**
Revised 11-6-07	3,202 to drain in **2 days**	11,207 to drain in **7 days**
	4,803 to drain in **3 days**	
5" skimmer:	1,642 to drain in **24 hours**	6,568 to drain in **4 days**
	3,283 to drain in **2 days**	11,491 to drain in **7 days**
	4,926 to drain in **3 days**	
6" skimmer:	1,814 to drain in **24 hours**	7,256 to drain in **4 days**
	3,628 to drain in **2 days**	12,701 to drain in **7 days**
	5,442 to drain in **3 days**	
8" skimmer:	1,987 to drain in **24 hours**	7,948 to drain in **4 days**
	3,974 to drain in **2 days**	13,909 to drain in **7 days**
	5,961 to drain in **3 days**	

J. W. Faircloth & Son, Inc.
Post Office Box 789
Hillsborough, North Carolina 27278

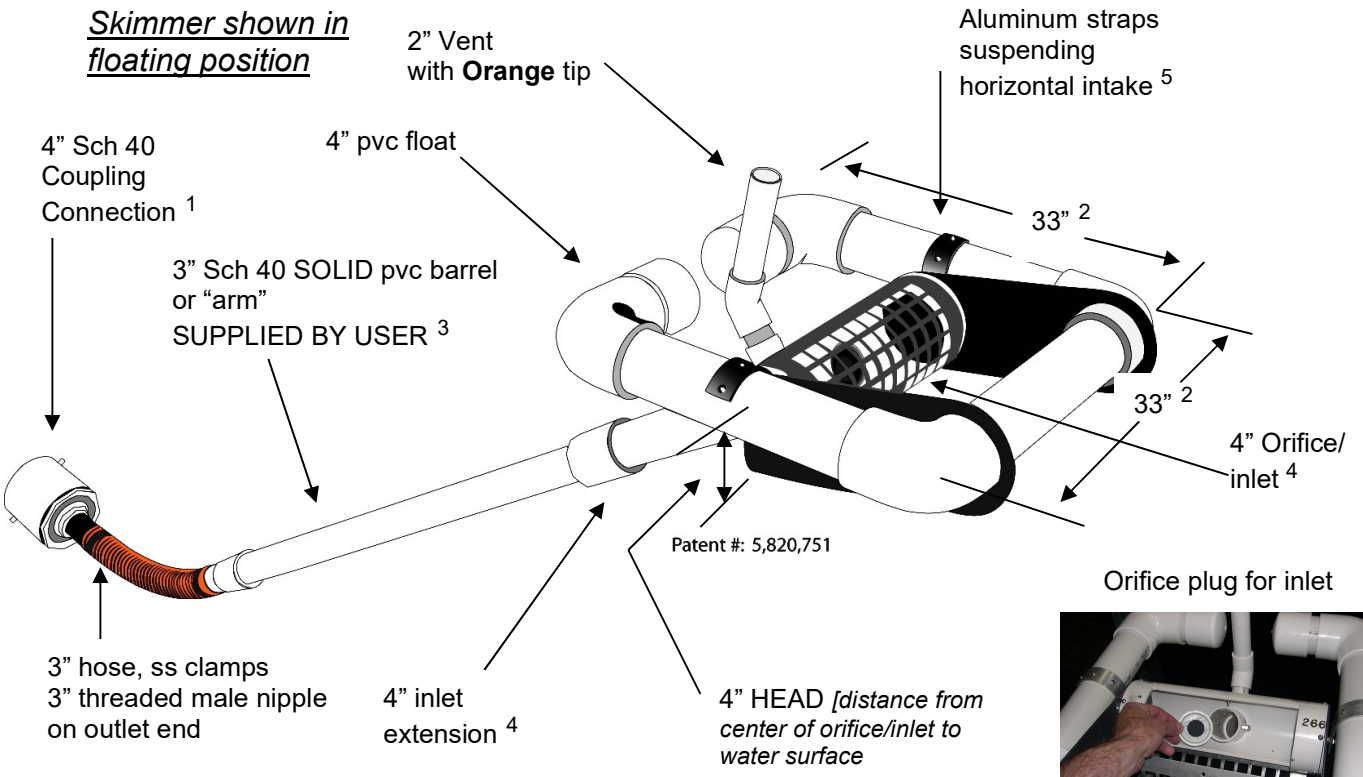
Telephone (919) 732-1244 FAX (919) 732-1266

FairclothSkimmer.com

Orifice sizing Revised 2-2-01; 3-3-05; 2-1-07; 11-6-07; 3-20-20.

4” *Faircloth Skimmer®* Surface Drain Cut Sheet

J. W. Faircloth & Son, Inc.
www.FairclothSkimmer.com



Orifice plug for inlet

1. Coupling can be removed and hose attached to outlet using the threaded 3” nipple. Typical methods used: a) a metal structure with a steel stub out welded on the side at the bottom with a 3” threaded coupling or reducer(s); b) a concrete structure with a hole or orifice at the bottom - use a steel plate with a hole cut in it and coupling welded to it that will fit over the hole in the concrete and bolted to the structure with sealant; or c) it is possible to grout a 4” pvc pipe in a hole in the concrete to connect the skimmer but this is less secure than other methods.

2. Dimensions are approximate, not intended as plans for construction.

3. Barrel (solid, not foam core pipe) should be 1.4 times the depth of water with a minimum length of 8’ so the inlet can be pulled to the side for maintenance. If more than 10’ long, weight may have to be added to inlet to counter the increased buoyancy.

4. Orifice/inlet tapers down from 4” maximum inlet to a 3” barrel and hose. Barrel is smaller to reduce buoyancy and tendency to lift inlet but is sufficient for flow through inlet because of slope. The orifice/inlet can be reduced using the plug and cutter provided to control the outflow rate – see #6.

5. Horizontal intake is 8” pipe between the straps with slots cut in the inlet and aluminum screen door (smaller than shown in illustration) for access to the 4” inlet and orifice inside.

6. **Capacity:** 20,109 cubic feet per day maximum with 4” inlet and 4” head. Inlet can be reduced by installing a smaller orifice using the plug and cutter provided to adjust flow rate for the particular drawdown time required. Please use the sizing template at www.fairclothskimmer.com .

7. Ships assembled. User glues inlet extension and barrel, installs vent, cuts orifice in plug and attaches to outlet pipe or structure. Includes float, flexible hose, rope, orifice plug and cutter. Does NOT include 3” Sch 40 SOLID pvc barrel or “arm” SUPPLIED BY USER.

Massillon East Side Elementary
Storm Water Management

Storm Sewer Calculations

Massillon CSD Eastside Elementary School
CITY OF MASSILLON
3/24/2023
PROJECT #22-070

C VALUES
LAWN = 0.40
WOODS = 0.35
IMPERVIOUS = 0.96

	AREAS					
STRUCTURE #	LAWN	IMPERVIOUS	DOWNSPOUT	WOODS	TOTAL	"C" VALUE
ST 1	0.01	0.08	0.00	0.00	0.09	0.90
ST 2	OUTLET STRUCTURE					
ST 3	HEADWALL					
ST 4	0.10	0.10	0.00	0.00	0.21	0.68
ST 5	0.22	0.02	0.00	0.00	0.24	0.45
ST 6	0.02	0.17	0.00	0.00	0.19	0.91
ST 7	0.02	0.16	0.00	0.00	0.18	0.91
ST 8	0.08	0.02	0.00	0.00	0.10	0.50
ST 9	0.08	0.21	0.21	0.00	0.50	0.87
ST 10	0.01	0.01	0.00	0.00	0.01	0.60
ST 11	0.07	0.30	0.00	0.00	0.36	0.86
ST 12	0.01	0.18	0.00	0.00	0.19	0.93
ST 13	0.16	0.24	0.00	0.00	0.40	0.74
ST 14	0.00	0.01	0.00	0.00	0.01	0.96
ST 15	0.15	0.43	0.00	0.00	0.58	0.81
ST 16	0.00	0.50	0.00	0.00	0.50	0.96
ST 17	0.02	0.02	0.00	0.00	0.04	0.65
ST 18	0.01	0.17	0.00	0.00	0.18	0.93
ST 19	0.00	0.17	0.35	0.00	0.52	0.96
ST 20	0.14	0.00	0.00	0.00	0.14	0.40
ST 21	0.15	0.94	0.00	0.00	1.08	0.88
ST 22	0.09	0.13	0.00	0.00	0.21	0.73
ST 23	0.16	0.20	0.00	0.00	0.37	0.71
ST 24	0.00	0.43	0.00	0.00	0.43	0.96
ST 25	0.12	0.00	0.00	0.00	0.12	0.40
ST 26	0.32	0.84	0.00	0.00	1.15	0.81
ST 27	HEADWALL					
ST 28	0.18	0.28	0.00	0.00	0.47	0.74
ST 29	0.15	0.11	0.00	0.00	0.26	0.65
ST 30	HEADWALL					
ST 31	0.24	0.00	0.00	0.00	0.24	0.40
ST 32	0.11	0.16	0.00	0.00	0.27	0.74
ST 33	0.22	0.00	0.00	0.00	0.22	0.40
ST 34	0.17	0.00	0.08	0.00	0.25	0.58
ST 35	0.29	0.21	0.00	0.00	0.50	0.64
ST 36	MANHOLE					

	AREAS					
STRUCTURE #	LAWN	IMPERVIOUS	DOWNSPOUT	WOODS	TOTAL	"C" VALUE
ST 37	MANHOLE					
ST 38	MANHOLE					
ST 39	0.09	0.15		0.00	0.24	0.75
ST 40	0.03	0.03		0.00	0.06	0.68
ST 41	HEADWALL					
ST 42	0.00	0.00	0.20	0.00	0.20	0.96
ST 43	0.15	0.05	0.33	0.00	0.52	0.80
ST 44	0.02	0.02	0.15	0.00	0.19	0.91
ST 45	0.02	0.00	0.06	0.00	0.08	0.85
ST 46	0.01	0.00	0.00	0.00	0.01	0.40
ST 47	0.00	0.00	0.06	0.00	0.06	0.96
ST 48	0.05	0.00	0.00	0.00	0.05	0.40
ST 49	0.07	0.00	0.00	0.00	0.07	0.40
ST 50	0.08	0.10	0.00	0.00	0.18	0.71
ST 51	0.04	0.06	0.00	0.00	0.10	0.74
ST 52	0.07	0.05	0.00	0.00	0.12	0.63
ST 53	HEADWALL					

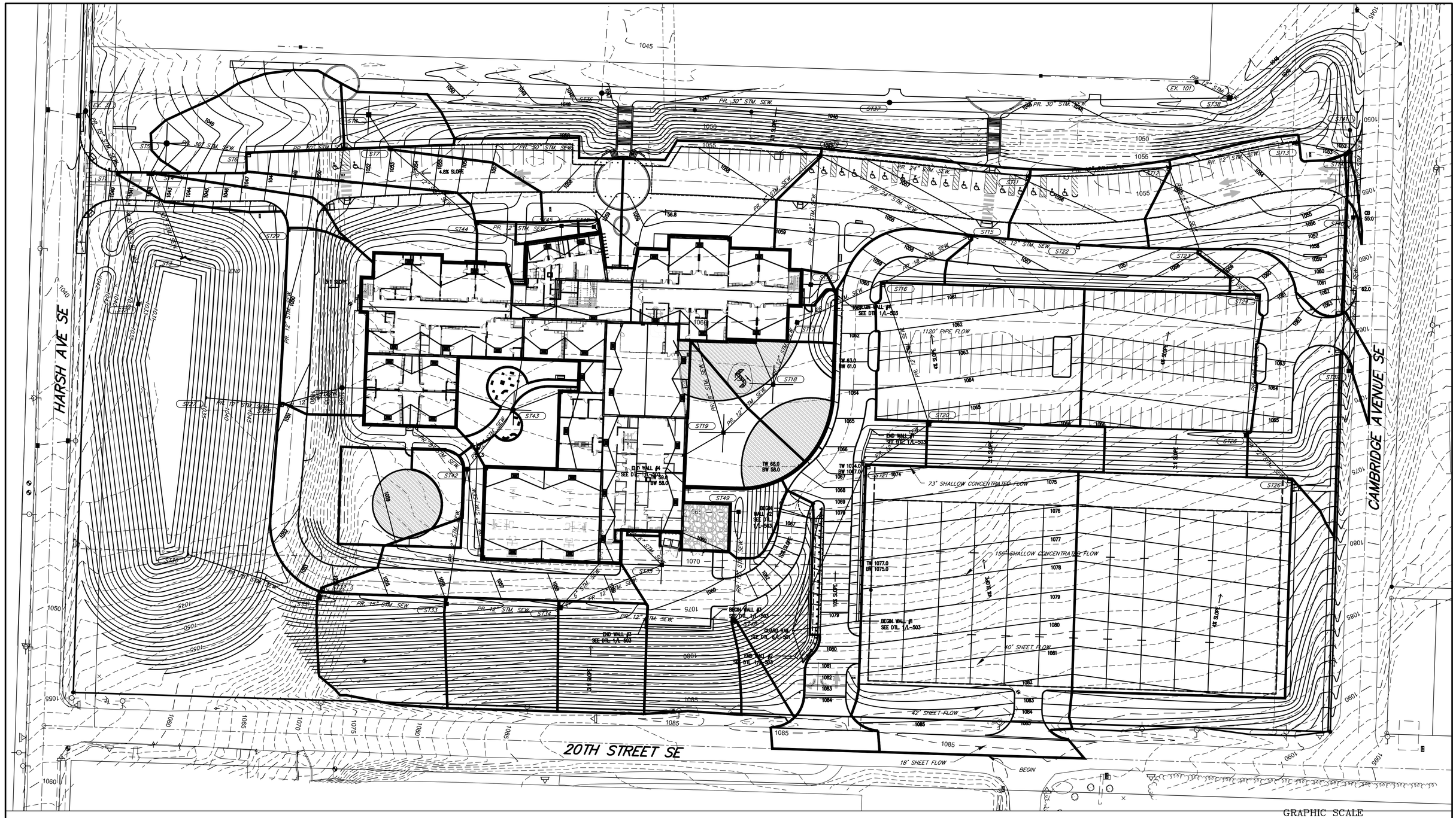
Lewis Land Professionals, Inc.
8691 Wadsworth Road Suite 100 Wadsworth, Ohio 44281
(330) 335-8232

STORM SEWER COMPUTATION SHEET

PROJECT:	Massillon CSD Eastside Elementary School								BY:	MBK			n=0.013 - RCP		
DATE:	3/24/2023	10-yr Design Storm							CHECKED BY:				n=0.012 - HDPE		
M.H. or C.B. No.	Drains to	DRAINAGE AREA					TIME		RAINFALL INTENSITY	DISCHARGE	PIPE	PIPE	PIPE	MEAN	CAPACITY	REMARKS
		ΔA	ΣA	C	ΔCA	ΣCA	ΔT	ΣT	I_s	Q_s	LEN-GTH	SLOPE	SIZE	VELOCITY	FLOWING FULL	
		ACRES	ACRES		ACRES	ACRES	MIN.	MIN.	IN./HR.	C.F.S.	FT.	FT./FT.	IN.	F.P.S.	C.F.S.	
ST 49	ST 48	0.07	0.07	0.40	0.03	0.03	10	10	4.90	0.14	97	0.0100	12	4.55	3.57	HDPE
ST 48	ST 35	0.05	0.12	0.40	0.02	0.05	10	10	4.90	0.24	97	0.0100	12	4.55	3.57	HDPE
ST 35	ST 34	0.50	0.62	0.64	0.32	0.37	10	10	4.90	1.80	97	0.0103	12	4.62	3.63	HDPE
ST 34	ST 33	0.25	0.87	0.58	0.15	0.51	10	10	4.90	2.51	100	0.0107	12	4.71	3.70	HDPE
ST 43	ST 42	0.52	0.52	0.80	0.42	0.42	10	10	4.90	2.04	67	0.0100	12	4.55	3.57	HDPE
ST 42	ST 33	0.20	0.72	0.96	0.19	0.61	10	10	4.90	2.98	120	0.0135	12	5.28	4.15	HDPE
ST 33	ST 31	0.22	1.81	0.40	0.09	1.21	10	10	4.90	5.92	113	0.0225	15	7.92	9.72	HDPE
ST 32	ST 31	0.27	0.27	0.74	0.20	0.20	10	10	4.90	0.98	7	0.0200	12	6.43	5.05	HDPE
ST 31	HDWL 30	0.24	2.32	0.40	0.10	1.50	10	10	4.90	7.37	122	0.0918	15	15.99	19.62	HDPE
ST 26	ST 25	1.15	1.15	0.81	0.93	0.93	10	10	4.90	4.56	55	0.1224	12	15.91	12.50	HDPE
ST 25	ST 24	0.12	1.27	0.40	0.05	0.98	10	10	4.90	4.80	124	0.0263	12	7.38	5.79	HDPE
ST 24	ST 23	0.43	1.70	0.96	0.41	1.39	10	10	4.90	6.82	65	0.0608	12	11.22	8.81	HDPE
ST 23	ST 12	0.37	2.07	0.71	0.26	1.66	10	10	4.90	8.11	78	0.0500	15	11.80	14.48	HDPE
ST 14	ST 13	0.01	0.01	0.96	0.01	0.01	10	10	4.90	0.05	47	0.0100	12	4.55	3.57	HDPE

M.H. or C.B. No.	Drains to	DRAINAGE AREA					TIME		RAINFALL INTENSITY	DISCHARGE	PIPE	PIPE	PIPE	MEAN	CAPACITY	REMARKS
		ΔA	ΣA	C	ΔCA	ΣCA	ΔT	ΣT	I_s	Q_s	LEN-GTH	SLOPE	SIZE	VELOCITY	FLOWING FULL	
		ACRES	ACRES		ACRES	ACRES	MIN.	MIN.	IN./HR.	C.F.S.	FT.	FT./FT.	IN.	F.P.S.	C.F.S.	
ST 13	ST 12	0.40	0.41	0.74	0.30	0.31	10	10	4.90	1.50	114	0.0100	12	4.55	3.57	HDPE
ST 12	ST 11	0.19	2.67	0.93	0.18	2.14	10	10	4.90	10.47	124	0.0100	18	5.96	10.53	HDPE
ST 11	ST 9	0.36	3.03	0.86	0.31	2.45	10	10	4.90	11.99	185	0.0100	24	7.22	22.68	HDPE
ST 21	ST 20	1.08	1.08	0.88	0.95	0.95	10	10	4.90	4.66	65	0.0968	12	14.15	11.11	HDPE
ST 20	ST 16	0.14	1.22	0.40	0.06	1.01	10	10	4.90	4.93	131	0.0352	12	8.53	6.70	HDPE
ST 19	ST 18	0.52	0.52	0.96	0.50	0.50	10	10	4.90	2.45	61	0.0100	12	4.55	3.57	HDPE
ST 18	ST 17	0.18	0.70	0.93	0.17	0.67	10	10	4.90	3.27	59	0.0100	12	4.55	3.57	HDPE
ST 17	ST 16	0.04	0.74	0.65	0.03	0.69	10	10	4.90	3.39	84	0.0100	12	4.55	3.57	HDPE
ST 16	ST 15	0.50	2.46	0.96	0.48	2.18	10	10	4.90	10.68	88	0.0110	18	6.25	11.05	HDPE
ST 22	ST 15	0.21	0.21	0.73	0.15	0.15	10	10	4.90	0.75	95	0.0100	12	4.55	3.57	HDPE
ST 15	ST 9	0.58	3.25	0.81	0.47	2.80	10	10	4.90	13.73	151	0.0100	24	7.22	22.68	HDPE
ST 10	ST 9	0.01	0.01	0.60	0.01	0.01	10	10	4.90	0.03	115	0.0150	12	5.57	4.38	HDPE
ST 9	ST 7	0.50	6.79	0.87	0.44	5.69	10	10	4.90	27.88	378	0.0100	30	8.38	41.13	HDPE
ST 8	ST 7	0.10	0.10	0.50	0.05	0.05	10	10	4.90	0.25	35	0.0100	12	4.55	3.57	HDPE
ST 46	ST 45	0.01	0.01	0.40	0.00	0.00	10	10	4.90	0.02	29	0.0100	12	4.55	3.57	HDPE
ST 45	ST 44	0.08	0.09	0.85	0.07	0.07	10	10	4.90	0.35	75	0.0100	12	4.55	3.57	HDPE

M.H. or C.B. No.	Drains to	DRAINAGE AREA					TIME		RAINFALL INTENSITY	DISCHARGE	PIPE LEN-GTH	PIPE SLOPE	PIPE SIZE	MEAN VELOCITY	CAPACITY FLOWING FULL	REMARKS
		ΔA	ΣA	C	ΔCA	ΣCA	ΔT	ΣT	I_s	Q_s						
		ACRES	ACRES		ACRES	ACRES	MIN.	MIN.	IN./HR.	C.F.S.	FT.	FT./FT.	IN.	F.P.S.	C.F.S.	
ST 44	ST 7	0.19	0.28	0.91	0.17	0.24	10	10	4.90	1.20	102	0.0400	12	9.10	7.14	HDPE
ST 7	ST 6	0.18	7.35	0.91	0.16	6.15	10	10	4.90	30.13	125	0.0100	30	8.38	41.13	HDPE
ST 6	ST 5	0.19	7.54	0.91	0.17	6.32	10	10	4.90	30.98	73	0.0100	30	8.38	41.13	HDPE
ST 5	ST 4	0.24	7.78	0.45	0.11	6.43	10	10	4.90	31.51	30	0.0100	30	8.38	41.13	HDPE
ST 4	HDWL 3	0.21	7.99	0.68	0.14	6.57	10	10	4.90	32.20	80	0.0220	30	12.43	61.00	HDPE
ST 29	ST 28	0.26	0.26	0.65	0.17	0.17	10	10	4.90	0.83	155	0.0200	12	6.43	5.05	HDPE
ST 47	ST 28	0.06	0.06	0.96	0.06	0.06	10	10	4.90	0.28	57	0.0500	12	10.17	7.99	HDPE
ST 28	HDWL 27	0.47	0.79	0.74	0.35	0.57	10	10	4.90	2.81	66	0.1189	12	15.68	12.32	HDPE
ST 39	ST 40	0.24	0.24	0.75	0.18	0.18	10	10	4.90	0.88	136	0.0812	12	12.96	10.18	HDPE
ST 40	ST 41	0.06	0.30	0.68	0.04	0.22	10	10	4.90	1.08	92	0.0324	12	8.19	6.43	HDPE
ST50	ST51	0.18	0.18	0.71	0.13	0.13	10	10	4.90	0.63	122	0.0050	12	3.22	2.53	HDPE
ST51	ST52	0.10	0.28	0.74	0.07	0.20	10	10	4.90	0.99	173	0.0050	12	3.22	2.53	HDPE
ST52	ST53	0.12	0.40	0.63	0.08	0.28	10	10	4.90	1.36	290	0.0050	12	3.22	2.53	HDPE



– PLAN PREPARED BY –

LEWIS LAND PROFESSIONALS INC.

LEWIS LAND PROFESSIONALS

CIVIL ENGINEERING LAND SURVEYING
8691 WADSWORTH ROAD SUITE 100
WADSWORTH, OH 44281 (330) 335-8232

REVISION TABLE

NO.	DATE	DESCRIPTION	BY

PROJECT:

MASSILLON CSD EASTSIDE ELEMENTARY SCHOOL

TITLE:

STORM SEWER CALCULATIONS

SCALES: HORIZONTAL 1"=40'	DATE: 3/24/2023
DRAWING FILE: 22-070_D-CALC.DWG	PROJECT NUMBER: 22-070
M.C.S.E. NUMBER: N/A	SHEET NUMBER: 1 of 1

Massillon East Side Elementary
Storm Water Management

Supporting Documents

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Stark County, Ohio

Massillon Washington High School DA

June 22, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

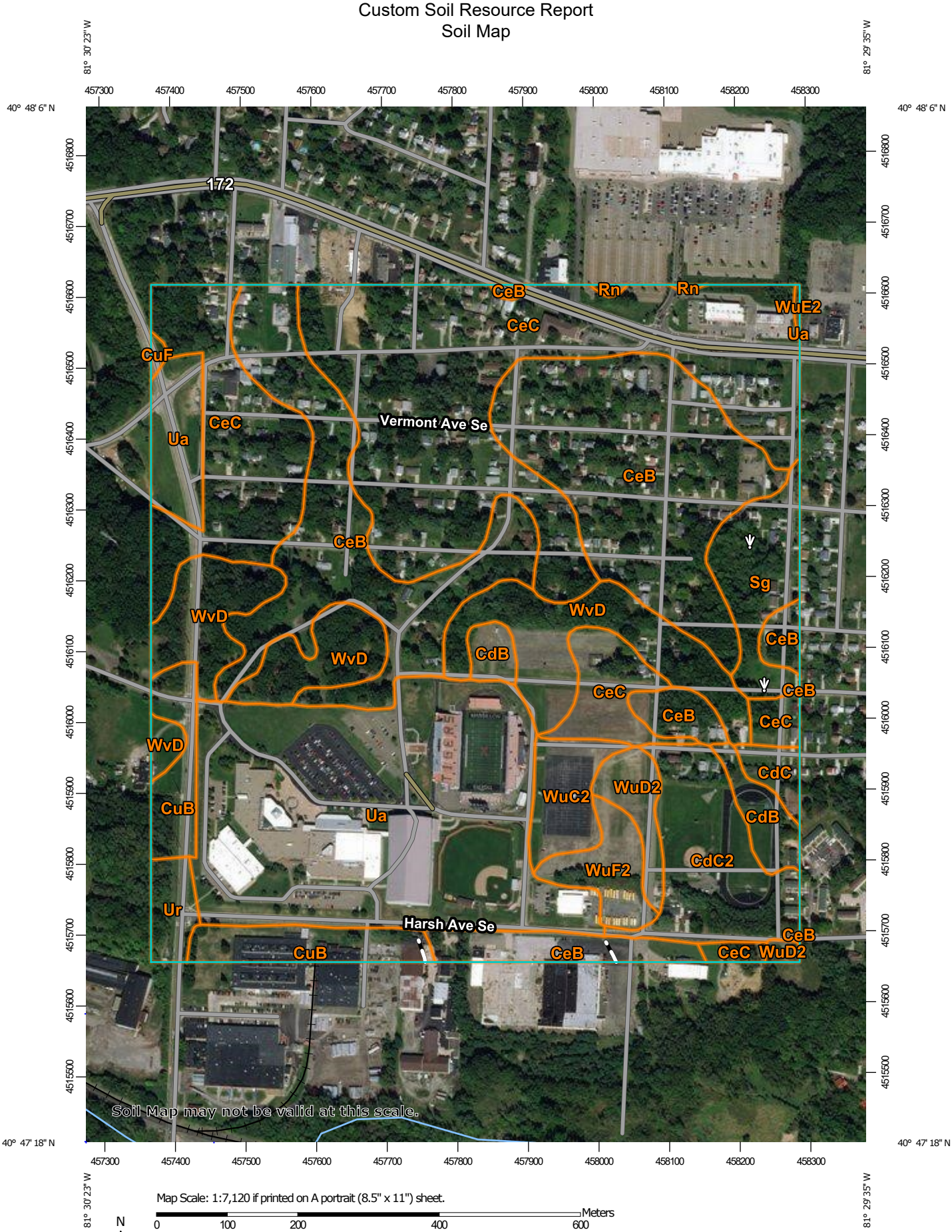
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,120 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Stark County, Ohio
Survey Area Data: Version 18, Sep 14, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 25, 2014—Mar 21, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CdB	Canfield silt loam, 2 to 6 percent slopes	3.6	1.7%
CdC	Canfield silt loam, 6 to 12 percent slopes	1.4	0.7%
CdC2	Canfield silt loam, 6 to 12 percent slopes, eroded	10.3	4.7%
CeB	Canfield-Urban land complex, 2 to 6 percent slopes	51.3	23.6%
CeC	Canfield-Urban land complex, 6 to 12 percent slopes	59.2	27.2%
CuB	Chili-Urban land complex, undulating	7.7	3.5%
CuF	Chili-Urban land complex, steep	0.2	0.1%
Rn	Ravenna-Urban land complex, 0 to 6 percent slopes	0.2	0.1%
Sg	Sebring-Urban land complex, 0 to 2 percent slopes	6.3	2.9%
Ua	Udorthents	44.5	20.4%
Ur	Urban land	2.2	1.0%
WuC2	Wooster silt loam, 6 to 12 percent slopes, moderately eroded	3.9	1.8%
WuD2	Wooster silt loam, 12 to 18 percent slopes, moderately eroded	3.0	1.4%
WuE2	Wooster silt loam, 18 to 25 percent slopes, moderately eroded	0.1	0.0%
WuF2	Wooster silt loam, 25 to 50 percent slopes, moderately eroded	3.7	1.7%
WvD	Wooster-Urban land complex, steep	20.2	9.3%
Totals for Area of Interest		**217.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named

according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Stark County, Ohio

CdB—Canfield silt loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2v03t
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Canfield and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canfield

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Till

Typical profile

Ap - 0 to 6 inches: silt loam
BE - 6 to 9 inches: silt loam
Bt1 - 9 to 15 inches: silt loam
2Bt2 - 15 to 21 inches: loam
2Bt3 - 21 to 26 inches: loam
2Btx1 - 26 to 38 inches: loam
2Btx2 - 38 to 45 inches: loam
2C1 - 45 to 62 inches: loam
2C2 - 62 to 80 inches: loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 15 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 10 to 21 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: F139XY004OH - Moist Acidic Slopes

Hydric soil rating: No

Minor Components

Ravenna

Percent of map unit: 10 percent
Landform: Till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

CdC—Canfield silt loam, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: 2v040
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Canfield and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canfield

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Till

Typical profile

Ap - 0 to 6 inches: silt loam
BE - 6 to 9 inches: silt loam
Bt1 - 9 to 15 inches: silt loam
2Bt2 - 15 to 21 inches: loam
2Bt3 - 21 to 26 inches: loam
2Btx1 - 26 to 38 inches: loam
2Btx2 - 38 to 45 inches: loam
2C1 - 45 to 62 inches: loam
2C2 - 62 to 80 inches: loam

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: 15 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 10 to 21 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

Minor Components

Ravenna

Percent of map unit: 10 percent
Landform: Till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

CdC2—Canfield silt loam, 6 to 12 percent slopes, eroded

Map Unit Setting

National map unit symbol: 2v043
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Canfield, eroded, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canfield, Eroded

Setting

Landform: Till plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Till

Typical profile

Ap - 0 to 6 inches: silt loam
BE - 6 to 7 inches: silt loam
Bt1 - 7 to 13 inches: silt loam
2Bt2 - 13 to 19 inches: loam
2Bt3 - 19 to 24 inches: loam
2Btx1 - 24 to 36 inches: loam
2Btx2 - 36 to 43 inches: loam
2C1 - 43 to 60 inches: loam
2C2 - 60 to 80 inches: loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 15 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 10 to 21 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

Minor Components

Ravenna

Percent of map unit: 10 percent
Landform: Till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

CeB—Canfield-Urban land complex, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2v03v
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F

Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Canfield and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canfield

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Till

Typical profile

Ap - 0 to 6 inches: silt loam
BE - 6 to 9 inches: silt loam
Bt1 - 9 to 15 inches: silt loam
2Bt2 - 15 to 21 inches: loam
2Bt3 - 21 to 26 inches: loam
2Btx1 - 26 to 38 inches: loam
2Btx2 - 38 to 45 inches: loam
2C1 - 45 to 62 inches: loam
2C2 - 62 to 80 inches: loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 15 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 10 to 21 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Udorthents
Percent of map unit: 10 percent
Hydric soil rating: Unranked

Ravenna
Percent of map unit: 10 percent
Landform: Till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

CeC—Canfield-Urban land complex, 6 to 12 percent slopes

Map Unit Setting
National map unit symbol: 2v041
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition
Canfield and similar soils: 50 percent
Urban land: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canfield

Setting
Landform: Till plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Till

Typical profile
Ap - 0 to 6 inches: silt loam
BE - 6 to 9 inches: silt loam
Bt1 - 9 to 15 inches: silt loam
2Bt2 - 15 to 21 inches: loam
2Bt3 - 21 to 26 inches: loam

2Btx1 - 26 to 38 inches: loam
2Btx2 - 38 to 45 inches: loam
2C1 - 45 to 62 inches: loam
2C2 - 62 to 80 inches: loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 15 to 30 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 10 to 21 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: Unranked

CuB—Chili-Urban land complex, undulating

Map Unit Setting

National map unit symbol: 9nnm
Elevation: 700 to 1,160 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 133 to 193 days
Farmland classification: Not prime farmland

Map Unit Composition

Chili and similar soils: 51 percent
Urban land: 49 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chili

Setting

Landform: Terraces
Parent material: Outwash

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 19 inches: silt loam
H3 - 19 to 36 inches: gravelly sandy loam
H4 - 36 to 60 inches: loamy coarse sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Hydrologic Soil Group: A
Ecological site: F139XY003OH - Dry Calcareous Till Plains
Forage suitability group: Unnamed (G139XYB-1OH)
Other vegetative classification: Unnamed (G139XYB-1OH)
Hydric soil rating: No

CuF—Chili-Urban land complex, steep

Map Unit Setting

National map unit symbol: 9nnp
Elevation: 700 to 1,160 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 133 to 193 days
Farmland classification: Not prime farmland

Map Unit Composition

Chili and similar soils: 51 percent
Urban land: 49 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chili

Setting

Landform: Terraces
Parent material: Outwash

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 19 inches: silt loam
H3 - 19 to 36 inches: gravelly sandy loam
H4 - 36 to 60 inches: loamy coarse sand

Properties and qualities

Slope: 12 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Hydrologic Soil Group: A
Ecological site: F139XY002OH - Moist Calcareous Till Flats
Forage suitability group: Unnamed (G139XYB-1OH)
Other vegetative classification: Unnamed (G139XYB-1OH)
Hydric soil rating: No

Rn—Ravenna-Urban land complex, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2v04r
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Ravenna and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ravenna

Setting

Landform: Till plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Till

Typical profile

Ap - 0 to 8 inches: silt loam
BE - 8 to 12 inches: silt loam
Bt - 12 to 22 inches: silt loam
Btx - 22 to 48 inches: loam
BC - 48 to 53 inches: loam
C - 53 to 74 inches: loam

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: 14 to 30 inches to fragipan
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low (0.01 to 0.14 in/hr)
Depth to water table: About 7 to 11 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: D
Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: Unranked

Frenchtown

Percent of map unit: 5 percent
Landform: Depressions

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Sg—Sebring-Urban land complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2v05c
Elevation: 590 to 1,970 feet
Mean annual precipitation: 33 to 52 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Sebring and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sebring

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
BEg - 9 to 14 inches: silt loam
Btg - 14 to 38 inches: silty clay loam
BCg - 38 to 44 inches: silty clay loam
Cg - 44 to 72 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: About 0 to 9 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 9 percent
Available water supply, 0 to 60 inches: Very high (about 12.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Ecological site: F139XY011OH - Wet Calcareous Depression
Hydric soil rating: Yes

Description of Urban Land

Setting

Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: Unranked

Fitchville

Percent of map unit: 5 percent
Landform: Lakebeds (relict), terraces
Landform position (three-dimensional): Tread, talf
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ua—Udorthents

Map Unit Setting

National map unit symbol: 9nnx
Elevation: 160 to 1,970 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Properties and qualities

Depth to restrictive feature: More than 80 inches

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Ur—Urban land

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WuC2—Wooster silt loam, 6 to 12 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 9nt5
Elevation: 590 to 1,970 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Wooster and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wooster

Setting

Landform: Till plains, moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Till

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 21 inches: loam
H3 - 21 to 40 inches: loam
H4 - 40 to 60 inches: loam

Properties and qualities

Slope: 6 to 12 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 6 percent
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F139XY005OH - Dry Acidic Till Plains
Forage suitability group: Unnamed (G139XYF-3OH)
Other vegetative classification: Unnamed (G139XYF-3OH)
Hydric soil rating: No

Minor Components

Ravenna

Percent of map unit:
Landform: Till plains

Chili

Percent of map unit:
Landform: Terraces

WuD2—Wooster silt loam, 12 to 18 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 9nt6
Elevation: 590 to 1,970 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Wooster and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wooster

Setting

Landform: Till plains, moraines
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Till

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 21 inches: loam
H3 - 21 to 40 inches: loam
H4 - 40 to 60 inches: loam

Properties and qualities

Slope: 12 to 18 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 6 percent
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F139XY004OH - Moist Acidic Slopes
Forage suitability group: Unnamed (G139XYF-3OH)
Other vegetative classification: Unnamed (G139XYF-3OH)
Hydric soil rating: No

Minor Components

Chili

Percent of map unit:
Landform: Terraces

WuE2—Wooster silt loam, 18 to 25 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 9nt7
Elevation: 590 to 1,970 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Wooster and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wooster

Setting

Landform: Till plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Till

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 21 inches: loam
H3 - 21 to 40 inches: loam
H4 - 40 to 60 inches: loam

Properties and qualities

Slope: 18 to 25 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 6 percent
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F139XY004OH - Moist Acidic Slopes
Forage suitability group: Unnamed (G139XYF-3OH)
Other vegetative classification: Unnamed (G139XYF-3OH)
Hydric soil rating: No

Minor Components

Loam surface layer

Percent of map unit:

Chili

Percent of map unit:
Landform: Terraces

WuF2—Wooster silt loam, 25 to 50 percent slopes, moderately eroded

Map Unit Setting

National map unit symbol: 9nt8
Elevation: 590 to 1,970 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Wooster and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wooster

Setting

Landform: Till plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Till

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 21 inches: loam
H3 - 21 to 40 inches: loam
H4 - 40 to 60 inches: loam

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 6 percent
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

Minor Components

Severely eroded areas

Percent of map unit:

WvD—Wooster-Urban land complex, steep

Map Unit Setting

National map unit symbol: 9nt9
Elevation: 590 to 1,970 feet
Mean annual precipitation: 32 to 42 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 140 to 195 days

Farmland classification: Not prime farmland

Map Unit Composition

Wooster and similar soils: 51 percent
Urban land: 49 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wooster

Setting

Landform: Till plains, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Till

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 21 inches: loam
H3 - 21 to 40 inches: loam
H4 - 40 to 60 inches: loam

Properties and qualities

Slope: 25 to 50 percent
Depth to restrictive feature: 20 to 36 inches to fragipan
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 6 percent
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Hydrologic Soil Group: C
Ecological site: F139XY004OH - Moist Acidic Slopes
Hydric soil rating: No

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REVISION TABLE

NO.	DATE	DESCRIPTION	BY
1	5/2/23	REV. PER SWCD COMMENTS	TAW

PROJECT:
MASSILLON CSD EASTSIDE ELEMENTARY SCHOOL

TITLE:
PRE-DEVELOPED CONDITIONS

SCALES:
HORIZONTAL 1"=40'

DRAWING FILE:
22-070_D-CALC.DWG

M.C.S.E. NUMBER:
N/A

DATE:
2/13/2023

PROJECT NUMBER:
22-070

SHEET NUMBER:
1 of 2

HARSH AVE SE

CAMBRIDGE AVENUE SE

20TH STREET SE

EX. 30"

EX. 101

PR. 30" STM. SEW.

PR. 24" STM. SEW.

PR. 18" STM. SEW.

PR. 15" STM. SEW.

PR. 12" STM. SEW.

PR. 6" STM. SEW.

PR. 2" STM. SEW.

ST1 ST2 ST3 ST4 ST5 ST6 ST7 ST8 ST9 ST10 ST11 ST12 ST13 ST14 ST15 ST16 ST17 ST18 ST19 ST20 ST21 ST22 ST23 ST24 ST25 ST26 ST27 ST28 ST29 ST30 ST31 ST32 ST33 ST34 ST35 ST36 ST37 ST38 ST39 ST40 ST41 ST42 ST43 ST44 ST45 ST46 ST47 ST48 ST49

END

4.8% SLOPE

5% SLOPE

10% SLOPE

45% SLOPE

56.8

1120' PIPE FLOW

73' SHALLOW CONCENTRATED FLOW

156' SHALLOW CONCENTRATED FLOW

40' SHEET FLOW

42' SHEET-FLOW

18' SHEET FLOW

BEGIN

TW 63.0
BW 61.0

TW 68.0
BW 58.0

TW 1077.0
BW 1075.0

CON. WALL #1
SEE DTL 1/L-503

BEGIN WALL #2
SEE DTL 1/L-503

BEGIN WALL #3
SEE DTL 1/L-503

BEGIN WALL #1
SEE DTL 1/L-503

END WALL #3
SEE DTL 1/L-503

END WALL #2
SEE DTL 1/L-503

END WALL #1
SEE DTL 1/L-503

DRAIN WALL
SEE DTL 4/L-501

POST-DEVELOPED CONDITIONS SUMMARY:
WATER (CN=100) = 0.35 ACRES
IMPERVIOUS (CN=98) = 7.85 ACRES
LAWN "C" (CN=74) = 4.74 ACRES
TOTAL (CN=89) = 12.94 ACRES

NORTH

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

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