MCC AUTOMOTIVE INSTITUTE
MICRO DRAINAGE STUDY

Lee's Summit, Jackson County, Missouri

MARCH 22, 2024
REVISED MAY 31, 2024
REVISED JUNE 27, 2024

SUBMITTED FOR THE FINAL DEVELOPMENT PLAN

Prepared by

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Metropolitan Community College - Longview
500 SW Longview Road
Lee's Summit, MO 64081

MCC Automotive Institute
Preliminary Micro Drainage Study

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INTRODUCTION

A. Purpose

The purpose of this drainage study will be to evaluate the conditions in the drainage study area, to determine if storm water detention is warranted, and to determine the effect of the proposed development on the existing downstream drainage facilities. The site is shown below in red.

Figure 1
EXISTING CONDITIONS

B. Study Area Description

The proposed project site is located in Lee's Summit, Jackson County, Missouri and is located on the Metropolitan Community College – Longview campus. It is bounded by

Long Road on the North, the MCC-Longview High Technology building on the West, a tree line to the immediate South with SW County Park Road to the far South, and an existing MCC Longview parking lot on the East. The project site has a disturbed area of approximately 1.50 acres. The Jackson County Assessor Parcel Number (APN) for the site is 63-600-01-04-02-3-00-000. The site is within the Mouse Creek Watershed of Lee's Summit, MO. Soils on the site are classified as 'Greenton silty clay loam, with 5 to 9 Percent Slopes' and 'Urban land-Harvester complex, with 2 to 9 Percent Slopes'. The project area is not in a floodplain. The area is listed as an "Area with minimal hazard Zone X". See the FEMA Firmette and the USDA soils report in Appendix B. The existing site is mostly field grass along with trees and shrubs throughout site. The existing site is approximately 4.24% impervious. The construction of the new development includes a commercial building, concrete driveway, associated sidewalks, concrete courtyard, and landscaped areas. This will result in a site that is approximately 94% impervious. The remaining 6% of the site will be pervious (grass or landscaped).

2. DESIGN CRITERIA

A. Methodology

The criterion for this evaluation is derived from the "Standard Specifications and Design Criteria for the City of Kansas City, Missouri, Metropolitan Chapter of the American Public Works Association, Division V, Section 5600 - Storm Drainage Systems and Facilities" using the adopted Comprehensive Control Strategy, including a minimum 40-hour detention for water quality. With the drainage area covering approximately 1.50 acres, the TR-55

SCS method was utilized to calculate peak runoff rates. The comprehensive control strategy utilizes flat rates of discharge of 0.5 cfs/acre for the 2-year storm, 2.0 cfs/acre for the 10-year storm event, and 3.0 cfs/acre for the 100-year storm event. All calculations are included in Appendix A of this report.

Rainfalls of 10-year and 100-year reoccurrence intervals will be utilized to evaluate and design the system. A 10-year rainfall return frequency, a storm having a ten percent probability of occurring during any given year, will be used to size any on-site storm sewer pipes, except for those areas that are “land locked”. For those areas, a 100-year rainfall event (one percent probability) will be used for those on-site storm sewer pipes. The 100-year rainfall will be used to check the limits of the drainage system.

Based on the TR-55 method, the site will require a total of 15,812 cubic feet of storage. The detention basin will be open bottom above ground storage, located on the East side of the site between the new building addition and the existing parking lot to the East. The basin will be 4:1 side slopes and will allow infiltration through the base for the extended 40-hour release for water quality. The detention calculations are contained in Appendix A.

3. STORM DRAINAGE SYSTEM AND DEVELOPMENT OVERVIEW

A. Existing Conditions

Stormwater from the existing site currently sheet flows in general from West to East. There are currently no existing public inlets on site. Roof drains from the existing Technology Building to the West as well as the courtyard between the existing and proposed building will be piped to the Southeast of the property around the new development to an existing above grade detention basin. This replicates the current existing site conditions. This is shown as Storm Line 1 of the Storm Sewer Plan C4.21. Runoff rate, runoff volume, and detention calculations are contained in Appendix A.

Figure 1

EXISTING CONDITIONS

Existing Runoff Calculations

Runoff	2 Year Runoff	10 Year Runoff	100 Year Runoff
Runoff	1.43 in.	2.88 in.	5.00 in.
Runoff Volume	7,777 c.f.	15,662 c.f.	27,191 c.f.

B. Proposed Conditions

The proposed development will consist of a new commercial building with associated sidewalks and a new driveway to the building. The proposed site plan is shown on Figure 2 - Proposed Site Plan.

The proposed runoff patterns are not significantly different from the existing, pre-development site condition. Runoff from the proposed site will continue to flow from West to East. Runoff from the roof of the new buildings will be piped to the proposed detention basin. Runoff from the grass and landscape areas will flow overland as in existing conditions. The detention basin has been sized to detain the 100-year storm event and all events lower than the 100-year event. Discharge from the detention basin will exit a 4’x4’ control structure with weirs on Noth, East, and West faces to discharge the 2, 10, and 100 year storm events respectively. The water quality storm will be allowed to infiltrate into the ground. Discharge from the control structure will be conveyed through a pipe with a headwall into an open field grass swale.

Due to the size and layout of the project site, time of concentration for the site is assumed to be 0.1 hours for proposed conditions based on the TR-55. Based on the TR-55 the Peak Discharge rates are 7.25 cfs, 11.39 cfs, and 16.88 cfs respectively for the 2, 10, and 100 year events.

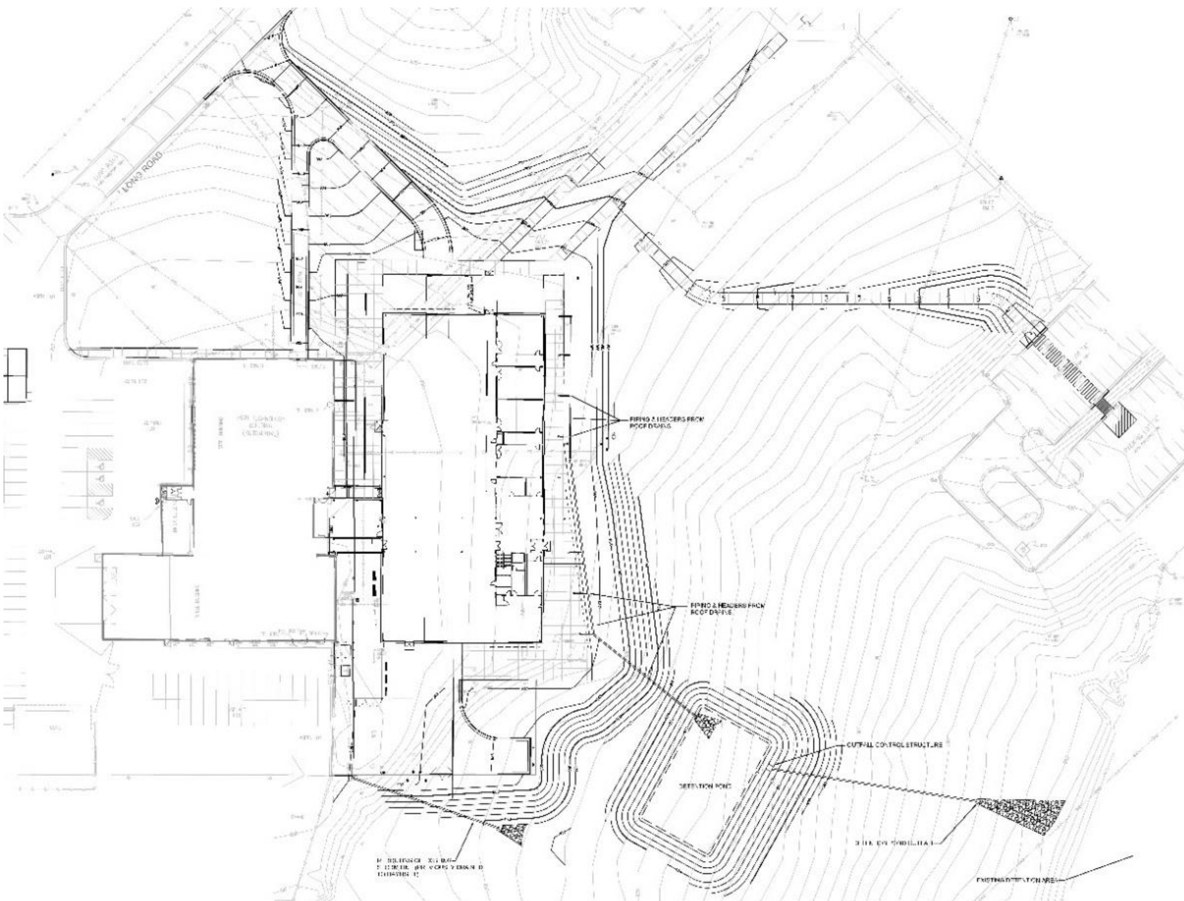


Figure 2

PROPOSED SITE PLAN

Proposed Runoff Calculations

Runoff	2 Year Runoff	10 Year Runoff	100 Year Runoff
Runoff	3.15 in.	4.95 in.	7.34 in.
Runoff Volume	17,130 c.f.	26,919 c.f.	39,916 c.f.

4. STORMWATER DETENTION

Stormwater detention has been designed to handle storm water runoff from the 100-year Storm. The project would require 15,812 cubic feet of storage to capture the 100-year storm event. Based on the acreage and flat rates of discharge, the 2-year allowable discharge rate from the site would be 0.75 c.f.s., the 10-year discharge rate would be 3.00 c.f.s. and the 100-year discharge rate would be 4.49 c.f.s. In addition to the weirs, the detention system will contain natural vegetation in the open bottom of the basin which will allow infiltration over a period of approximately 72 hours for water quality. Calculations are shown in Appendix A.

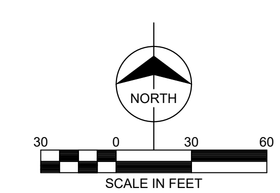
5. CONCLUSIONS

- Stormwater detention will be provided to the East of the new building expansion and will detain the runoff from storm events up to the 100 year. The total storage provided on the site will be a minimum of 15,812 cubic feet.

- The detention system will be an open bottom above ground basin with a 4'x4' outlet control structure. The control structure will incorporate 3 weirs at different elevations to control the rates of discharge for the 2-year, 10-year, and 100-year storm events.

- The open bottom detention system will allow infiltration for water quality to approximately 72 hours. This exceeds the City of Lee's Summit's adopted standard of a 40-hour infiltration minimum.

- The detention system meets the Comprehensive Control Strategy discussed in Section 5600 of the KCAPWA.



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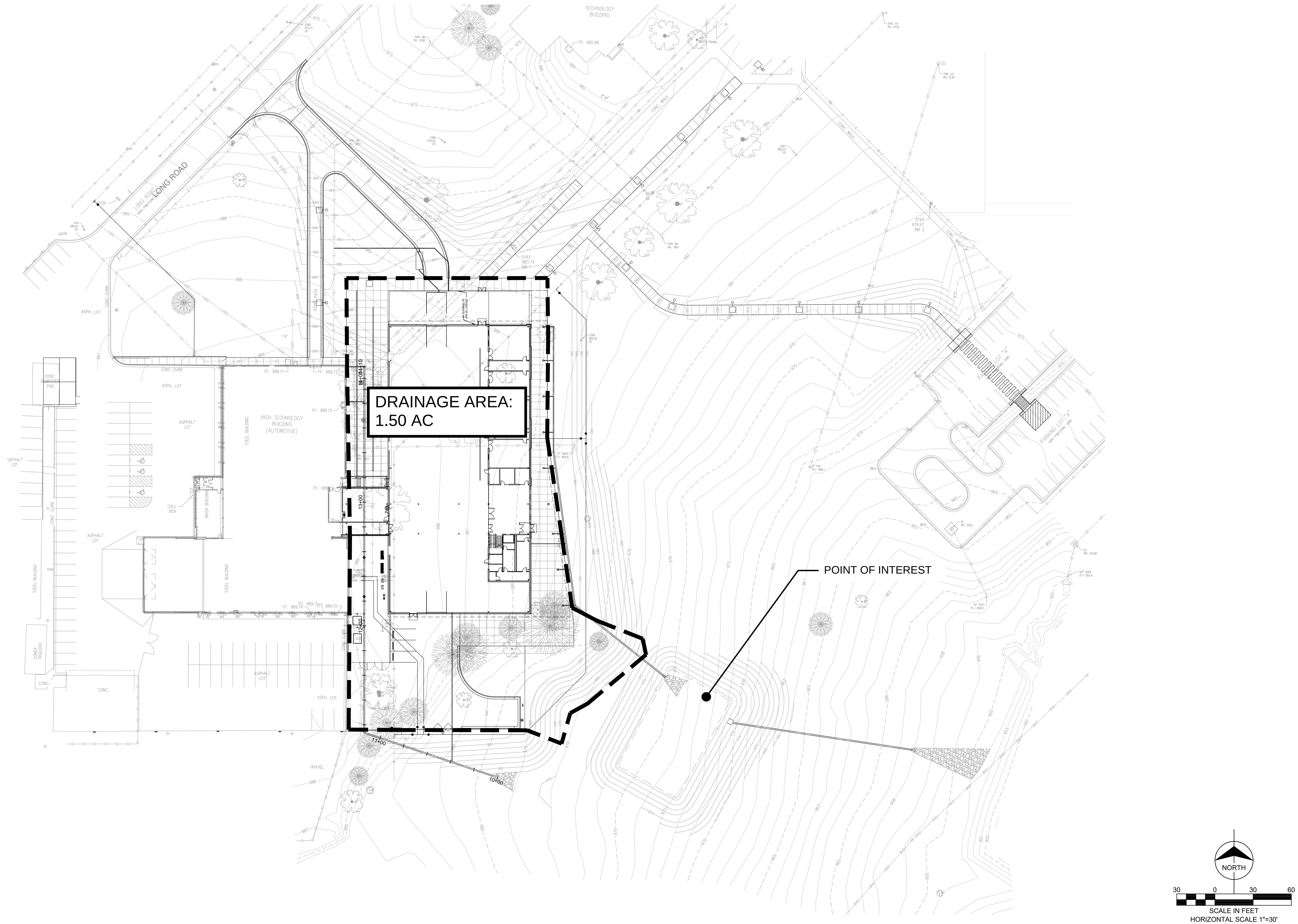
Lees Summit, Missouri
EXISTING CONDITIONS MAP

SHEET NO:
EXH-A



SHEET NO:
EXH-B

MCC AUTOMOTIVE INSTITUTE
Lees Summit, Missouri
PROPOSED DRAINAGE MAP

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K:\NETJOB2\75-0700\DESIGN_STORMWATER\75-0700 PROPOSED CONDITIONS.DWG 3/21/2016 12:30 PM MLOONEY

Appendix A – Calculations

Sheet ____ of ____

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Project: MCC Longview Job No. 24-0930 BG
Date: 5/28/24 Crew
Notes: STORM DRAINAGE - RUNOFF VOLUMES

Existing Conditions

From TR-55

Runoff Q: 2 Year = 1.43 in
10 Year = 2.88 in
100 Year = 5.00 in

Volume:

2 Year = 1.43 in × $\frac{1 \text{ ft}}{12 \text{ in}}$ × 65,258 sf = 7,777 ft³

10 Year = 2.88 in × $\frac{1 \text{ ft}}{12 \text{ in}}$ × 65,258 sf = 15,662 ft³

100 Year = 5.00 in × $\frac{1 \text{ ft}}{12 \text{ in}}$ × 65,258 sf = 27,191 ft³

Proposed Conditions

From TR-55

Runoff Q: 2 Year = 3.15 in
10 Year = 4.95 in
100 Year = 7.34 in

Volume:

2 Year = 3.15 in × $\frac{1 \text{ ft}}{12 \text{ in}}$ × 65,258 sf = 17,130 ft³

10 Year = 4.95 in × $\frac{1 \text{ ft}}{12 \text{ in}}$ × 65,258 sf = 26,919 ft³

100 Year = 7.34 in × $\frac{1 \text{ ft}}{12 \text{ in}}$ × 65,258 sf = 39,916 ft³

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Project MCC Longview AMI Job No. 24-0930 BG
Date 4/24/24 Crew
Notes Pond Depths for 2, 10, 100 year storms

Objective: Calculate Elevations for Pond Discharge of 2 Year, 10 Year, + 100 year Storms.

Data: ◦ Pond Bottom = 55' x 90'
Side Slopes = 4H : 1V

Volume of 1.37" Storm = 6960 CF (Inv of 2 Year Storm)
2 Year Storage = 9278 CF (Inv of 10 Yr. Storm)
10 Year Storage = 10716 CF (Inv of 100 Yr. Storm)
100 Year Storm = 15812 CF (Inv of Overflow)

Calculation: Assume Pond Area Bottom is A_1 (55' x 90' = 4950 SF)
Assume Top of Pond Area is A_2 (55+8H) x (90+8H)
Assume Storage Height is H

$$V = h\frac{(A_1 + A_2)}{2} \rightarrow V = h\frac{(4950) + [(55+8H)(90+8H)]}{2}$$

$$V = 4950H + 580H^2 + 32H^3$$

* Height Needed for 1.37" Storm (Inv of 2 Year Outfall)

$$6960 = 4950H + 580H^2 + 32H^3 \qquad H = 1.22\text{ FT}$$

* Height Needed for 2 Year Storage (Inv of 10 Year Outfall)

$$9278 = 4950H + 580H^2 + 32H^3 \qquad H = 1.564\text{ FT}$$

* Height Needed for 10 Year Storage (Inv of 100 Year Outfall)

$$10716 = 4950H + 580H^2 + 32H^3 \qquad H = 1.765\text{ FT}$$

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Tel. (816) 283-3456 Fax (816) 283-0810

Project MCC Longview AMI Job No. 74-0438 BG
Date 4/21/24 Crew
Notes Pond Depths for 2/10/100 Year Storms

* Height Needed for 100 Year Storage (Incl. of Overflow Outfall)

$15812 = 4950H + 580H^2 + 32H^3$ $H = 2.418ft$

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Tel. (816) 283-3456 Fax (816) 283-0810

Project MCC Longview Job No. 740930 BG
Date 3/21/24 Crew
Notes Comprehensive Control Method

- CALCULATE DETENTION REQUIREMENTS Using TR-55

Total Area of New Improvements = 65,258 SF

TOTAL AREA: 65,258 SF (1.4981 Ac)
Pervious Areas (Grass) = 4,000 SF (0.0918 Ac)
Impervious/Roof = 61,258 SF (1.4063 Ac)

From TR-55
Peak Discharge: 2 Year = 7.25 cfs
10 Year = 11.39 cfs
100 Year = 16.88 cfs

Allowable Discharge:

2 Year (0.5 cfs/acre) = (0.5)(1.4981) = 0.75 cfs

10 Year (2.0 cfs/acre) = (2.0)(1.4981) = 3.00 cfs

100 Year (3.0 cfs/acre) = (3.0)(1.4981) = 4.49 cfs

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Project MCC Longview Job No. 74-6430 BG
Date 3/21/24 Crew
Notes COMPREHENSIVE Control Method - Updated

* DETENTION VOLUME

- 1.37" Storm
  * Use the "Small Storm Hydrology Method" shown in Section 6.3 of the APWA BMP method to calculate the WQv (in inches)

From Table 6.1, for 1.37 in Storm:

R_v (Pitched Roofs + Parking Lots) = 0.98

R_v (Clayey Soils) = 0.23

$$\text{Weighted } R_v = \frac{(0.98)(1.4063) + (0.23)(0.0918)}{1.4981}$$

$$R_v = 0.9340 \text{ in}$$

$$WQ_v = P * \text{Weighted } R_v$$
$$= 1.37 \times 0.9340 \text{ in}$$
$$= 1.28 \text{ in}$$

$$\text{Volume Needed} = 65,258 \text{ SF} \times 1.28 \text{ in} \times \frac{1 \text{ ft}}{12 \text{ in}} = 6960 \text{ cf}$$

From TR-55, Total Storage Required for Other Storms

2 Year = 9,278 cf

10 Year = 10,716 cf

100 Year = 15,812 cf

Worksheet 2: Runoff curve number and runoff

Project MCC Longview By RMG Date 3/21/24

Location Lee's Summit, MO Checked ______ Date ______

Circle one: Present Developed

Comprehensive Control - Update

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN [1/] Table 2-2	CN [1/] Fig. 2-3	CN [1/] Fig. 2-4	Area ☒ acres ☐ mi^2 ☐ %	Product of CN x area
Type C	Impervious	98			1.4063	137.82
Type C	Open Space, Good	74			0.0918	6.79
				Totals =	1.4981	144.61

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{144.61}{1.4981} = 96.53$; Use CN = $\boxed{97}$

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr	2	10	100
Rainfall, P (24-hour)	in	3.5	5.3	7.7
Runoff, Q .... (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in	3.15	4.95	7.34

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of concentration (T_c) or travel time (T_t)

Project MCC Longview By RMC Date 3/21/24

Location Lee's Summit, MO Checked ______ Date ______

Circle one: Present **Developed** Comprehensive Control - Update

Circle one: **T_c** T_t through subarea

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)

	Units	Segment 1	Segment 2	Total
Segment ID		AB		
1. Surface description (table 3-1)		Smooth		
2. Manning's roughness coeff., n (table 3-1) ..		0.011		
3. Flow length, L (total L $\leq$ 300 ft)	ft	160		
4. Two-yr 24-hr rainfall, P_2	in	3.5		
5. Land slope, s	ft/ft	0.01		
6. $T_t = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t	hr	0.037	+	= 0.037

Shallow concentrated flow

	Units	Segment 1	Segment 2	Total
Segment ID				
7. Surface description (paved or unpaved)				
8. Flow length, L	ft			
9. Watercourse slope, s	ft/ft			
10. Average velocity, V (figure 3-1)	ft/s			
11. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+	=

Channel flow

	Units	Segment 1	Segment 2	Total
Segment ID				
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r	ft			
15. Channel slope, s	ft/ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V	ft/s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t	hr		+	=

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) .... hr 0.037

Use 0.1 hr (MIN)

Worksheet 4: Graphical Peak Discharge method

Project MCC Lakeview By RMG Date 3/21/24

Location Lee's Summit, MO Checked ____ Date ____

Circle one: Present Developed Comprehensive Control - Update

1. Data:

Drainage area .... A_m = 0.0023 mi^2 (acres/640)

Runoff curve number .... CN = 97 (From worksheet 2)

Time of concentration .. T_c = 0.1 hr (From worksheet 3)

Rainfall distribution type = II (I, IA, II, III)

Pond and swamp areas spread throughout watershed ...... = 0 percent of A_m (0 acres or mi^2 covered)

		Storm #1	Storm #2	Storm #3
2. Frequency	yr	2	10	100
3. Rainfall, P (24-hour)	in	3.5	5.3	7.7
4. Initial abstraction, I_a .... (Use CN with table 4-1.)	in	0.062	0.062	0.062
5. Compute I_a/P		0.018	0.012	0.008
6. Unit peak discharge, q_u .... (Use T_c and I_a/P with exhibit 4-II)	csm/in	1000	1000	1000
7. Runoff, Q .... (From worksheet 2).	in	3.15	4.95	7.34
8. Pond and swamp adjustment factor, F_p .... (Use percent pond and swamp area with table 4-2. Factor is 1.0 for zero percent pond and swamp area.)		1.0	1.0	1.0
9. Peak discharge, q_p .... (Where $q_p = q_u A_m Q F_p$)	cfs	7.25	11.39	16.88

(210-VI-TR-55, Second Ed., June 1986)

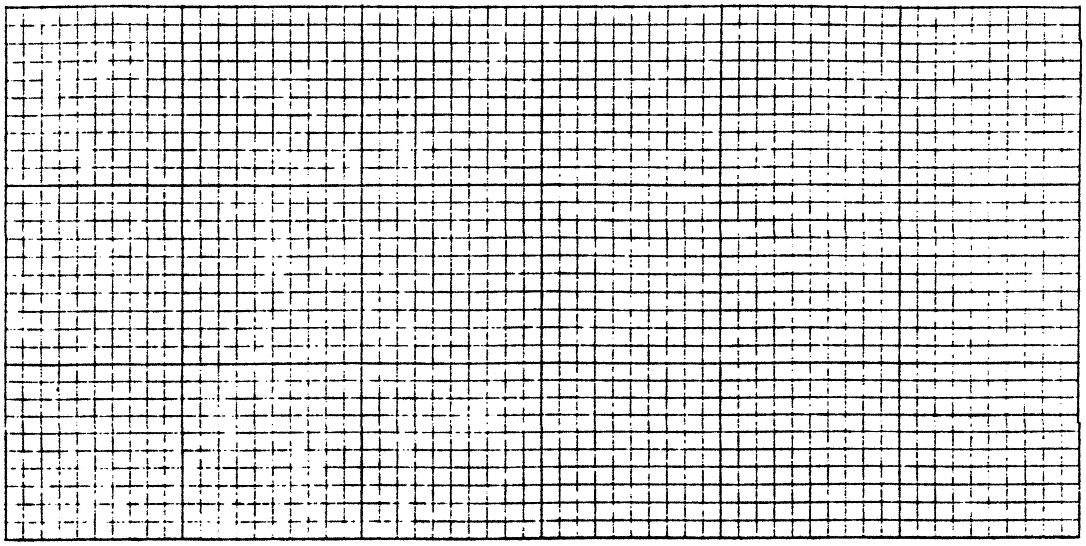
Worksheet 6a: Detention basin storage, peak outflow discharge (q_o) known

Project MCC Longview   By RMG   Date 3/21/24

Location Lee's Summit, MO   Checked ____   Date ____

Circle one: Present Developed   Comprehensive Control - Update

Elevation or stage



Detention basin storage

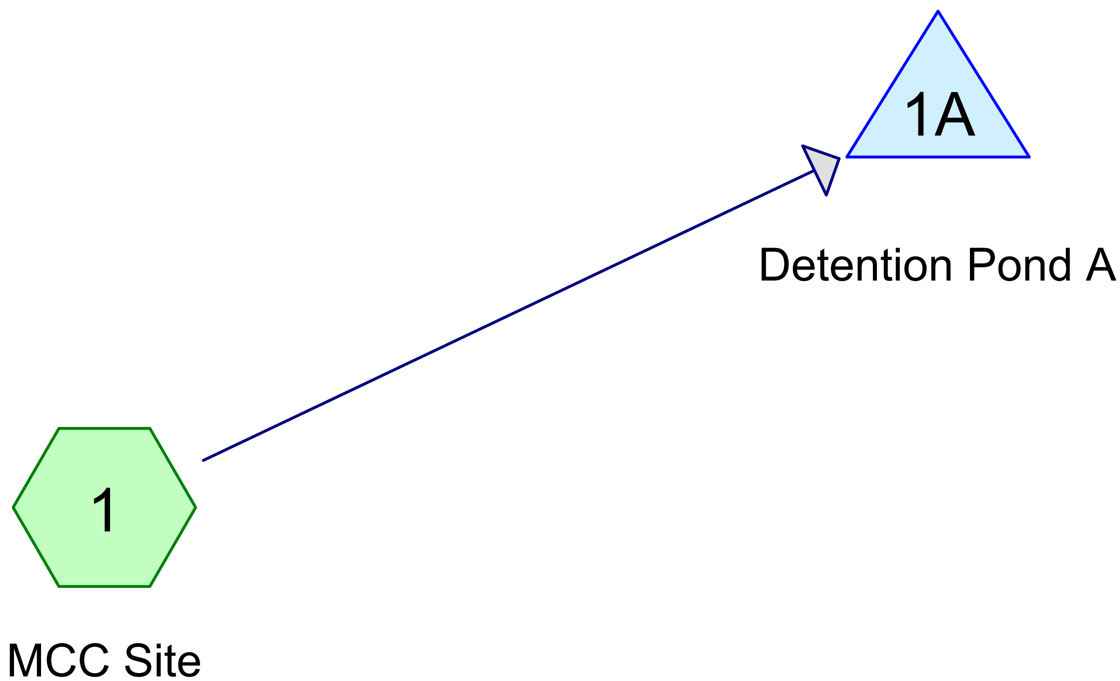
1. Data:
   Drainage area .... A_m = 0.0023 mi^2
   Rainfall distribution type (I, IA, II, III) = II

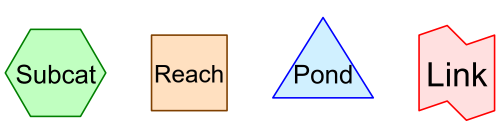
	1st stage	2nd stage	3rd
2. Frequency ...... yr	2	10	100
3. Peak inflow discharge, q_i .... cfs (From worksheet 4 or 5b)	7.25	11.39	16.88
4. Peak outflow discharge, q_o .... cfs	0.75	3.00 [1/]	4.49
5. Compute $\frac{q_o}{q_i}$	0.103	0.263	0.266

6. $\frac{V_s}{V_r}$ .... (Use $\frac{q_o}{q_i}$ with figure 6-1)	0.551	0.405	0.403
7. Runoff, Q ...... in (From worksheet 2)	3.15	4.95	7.34
8. Runoff volume, V_r .... ac-ft ($V_r = QA_m53.33$)	0.386	0.607	0.900
9. Storage volume, V_s .... ac-ft ($V_s = V_r(\frac{V_s}{V_r})$)	0.213	0.246	0.363
10. Maximum stage, E_{max} (From plot)			

2 Year Storage = 9278 cf
10 Year Storage = 10,716 cf
100 Year Storage = 15,812 cf

1/ 2nd stage q_o includes 1st stage q_o.





Routing Diagram for MCC Automotive Institute
Prepared by {enter your company name here}, Printed 6/3/2024
HydroCAD® 10.00-14 s/n 07780 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.498	97	(1)
1.498	**97**	**TOTAL AREA**

Time span=0.00-74.00 hrs, dt=0.05 hrs, 1481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1: MCC Site Runoff Area=1.498 ac Runoff Depth=2.16"
Tc=6.5 min CN=97 Runoff=4.91 cfs 0.270 af

Pond 1A: Detention Pond A Peak Elev=971.80' Storage=7,451 cf Inflow=4.91 cfs 0.270 af
Discarded=0.04 cfs 0.221 af Primary=0.15 cfs 0.049 af Outflow=0.19 cfs 0.270 af

Total Runoff Area = 1.498 ac Runoff Volume = 0.270 af Average Runoff Depth = 2.16"

Summary for Subcatchment 1: MCC Site

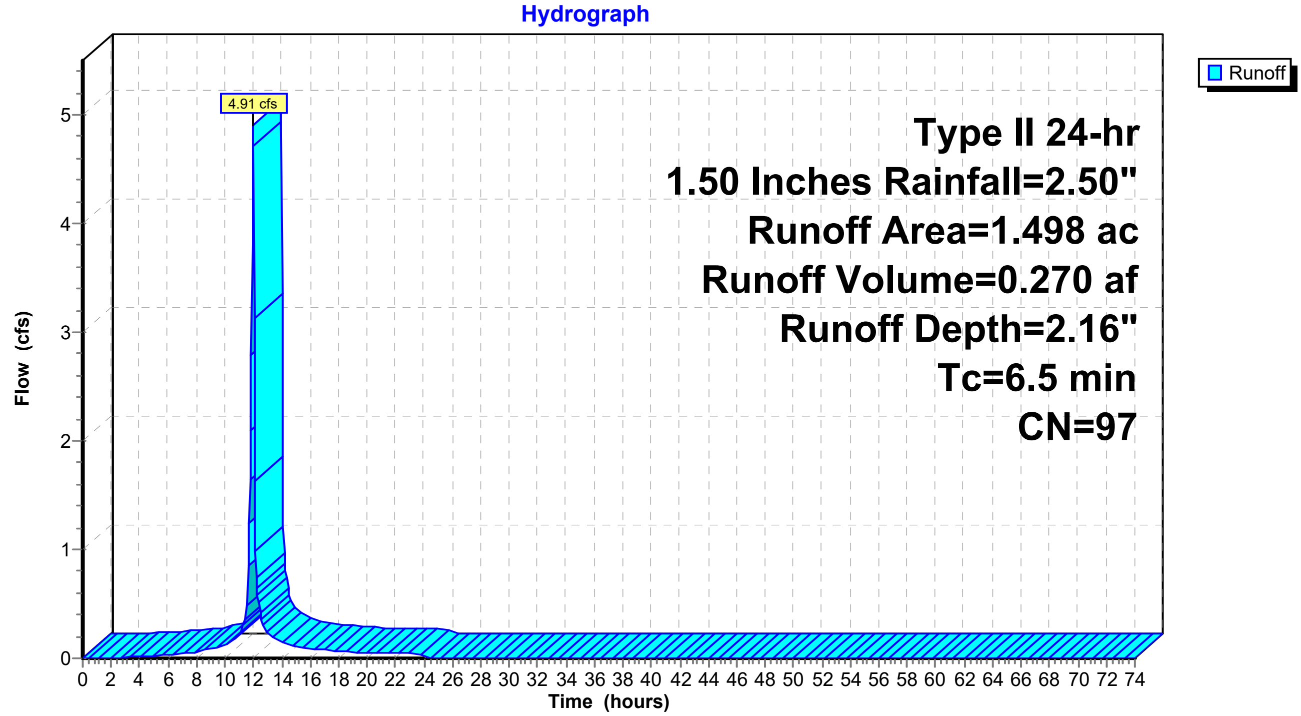
Runoff = 4.91 cfs @ 11.97 hrs, Volume= 0.270 af, Depth= 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-74.00 hrs, dt= 0.05 hrs
Type II 24-hr 1.50 Inches Rainfall=2.50"

	Area (ac)	CN	Description
*	1.498	97	

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

Subcatchment 1: MCC Site



Hydrograph for Subcatchment 1: MCC Site

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00
1.00	0.03	0.00	0.00
2.00	0.05	0.00	0.00
3.00	0.09	0.00	0.01
4.00	0.12	0.01	0.01
5.00	0.16	0.02	0.02
6.00	0.20	0.04	0.03
7.00	0.25	0.07	0.04
8.00	0.30	0.10	0.06
9.00	0.37	0.15	0.09
10.00	0.45	0.22	0.12
11.00	0.59	0.33	**0.22**
12.00	1.66	1.34	**4.71**
13.00	1.93	1.60	0.24
14.00	2.05	1.72	0.14
15.00	2.13	1.80	0.11
16.00	2.20	1.87	0.09
17.00	2.25	1.92	0.08
18.00	2.30	1.97	0.07
19.00	2.34	2.01	0.06
20.00	2.38	2.05	0.05
21.00	2.41	2.08	0.05
22.00	2.44	2.11	0.04
23.00	2.47	2.14	0.04
24.00	**2.50**	**2.16**	0.04
25.00	2.50	2.16	0.00
26.00	2.50	2.16	0.00
27.00	2.50	2.16	0.00
28.00	2.50	2.16	0.00
29.00	2.50	2.16	0.00
30.00	2.50	2.16	0.00
31.00	2.50	2.16	0.00
32.00	2.50	2.16	0.00
33.00	2.50	2.16	0.00
34.00	2.50	2.16	0.00
35.00	2.50	2.16	0.00
36.00	2.50	2.16	0.00
37.00	2.50	2.16	0.00
38.00	2.50	2.16	0.00
39.00	2.50	2.16	0.00
40.00	2.50	2.16	0.00
41.00	2.50	2.16	0.00
42.00	2.50	2.16	0.00
43.00	2.50	2.16	0.00
44.00	2.50	2.16	0.00
45.00	2.50	2.16	0.00
46.00	2.50	2.16	0.00
47.00	2.50	2.16	0.00
48.00	2.50	2.16	0.00
49.00	2.50	2.16	0.00
50.00	2.50	2.16	0.00
51.00	2.50	2.16	0.00
52.00	2.50	2.16	0.00
53.00	2.50	2.16	0.00
54.00	2.50	2.16	0.00
55.00	2.50	2.16	0.00
56.00	2.50	2.16	0.00
57.00	2.50	2.16	0.00
58.00	2.50	2.16	0.00
59.00	2.50	2.16	0.00
60.00	2.50	2.16	0.00
61.00	2.50	2.16	0.00
62.00	2.50	2.16	0.00
63.00	2.50	2.16	0.00
64.00	2.50	2.16	0.00
65.00	2.50	2.16	0.00
66.00	2.50	2.16	0.00
67.00	2.50	2.16	0.00
68.00	2.50	2.16	0.00
69.00	2.50	2.16	0.00
70.00	2.50	2.16	0.00
71.00	2.50	2.16	0.00
72.00	2.50	2.16	0.00
73.00	2.50	2.16	0.00
74.00	2.50	2.16	0.00

Summary for Pond 1A: Detention Pond A

Inflow Area = 1.498 ac, Inflow Depth = 2.16" for 1.50 Inches event
Inflow = 4.91 cfs @ 11.97 hrs, Volume= 0.270 af
Outflow = 0.19 cfs @ 13.46 hrs, Volume= 0.270 af, Atten= 96%, Lag= 89.3 min
Discarded = 0.04 cfs @ 7.75 hrs, Volume= 0.221 af
Primary = 0.15 cfs @ 13.46 hrs, Volume= 0.049 af

Routing by Stor-Ind method, Time Span= 0.00-74.00 hrs, dt= 0.05 hrs
Peak Elev= 971.80' @ 13.46 hrs Surf.Area= 6,531 sf Storage= 7,451 cf

Plug-Flow detention time= 1,314.4 min calculated for 0.270 af (100% of inflow)
Center-of-Mass det. time= 1,313.4 min (2,082.9 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1	970.50'	25,080 cf	**Above Ground Pond (Prismatic)** Listed below (Recalc)

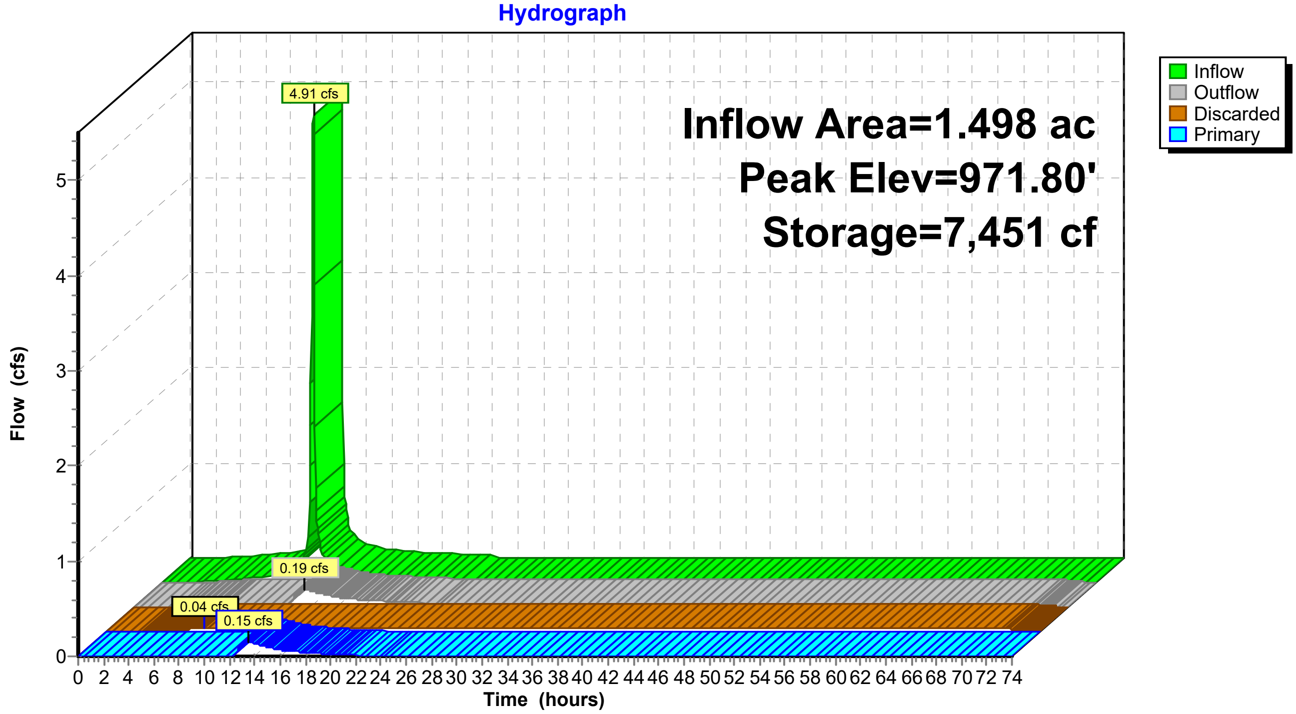
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
970.50	4,947	0	0
971.00	5,533	2,620	2,620
972.00	6,779	6,156	8,776
973.00	8,127	7,453	16,229
974.00	9,575	8,851	25,080

Device	Routing	Invert	Outlet Devices
#1	Primary	971.72'	**24.0" W x 3.0" H Vert. Orifice/Weir** C= 0.600
#2	Primary	972.06'	**36.0" W x 5.2" H Vert. Orifice/Grate** C= 0.600
#3	Primary	972.27'	**36.0" W x 6.7" H Vert. Orifice/Grate** C= 0.600
#4	Discarded	970.50'	**0.04 cfs Exfiltration at all elevations**

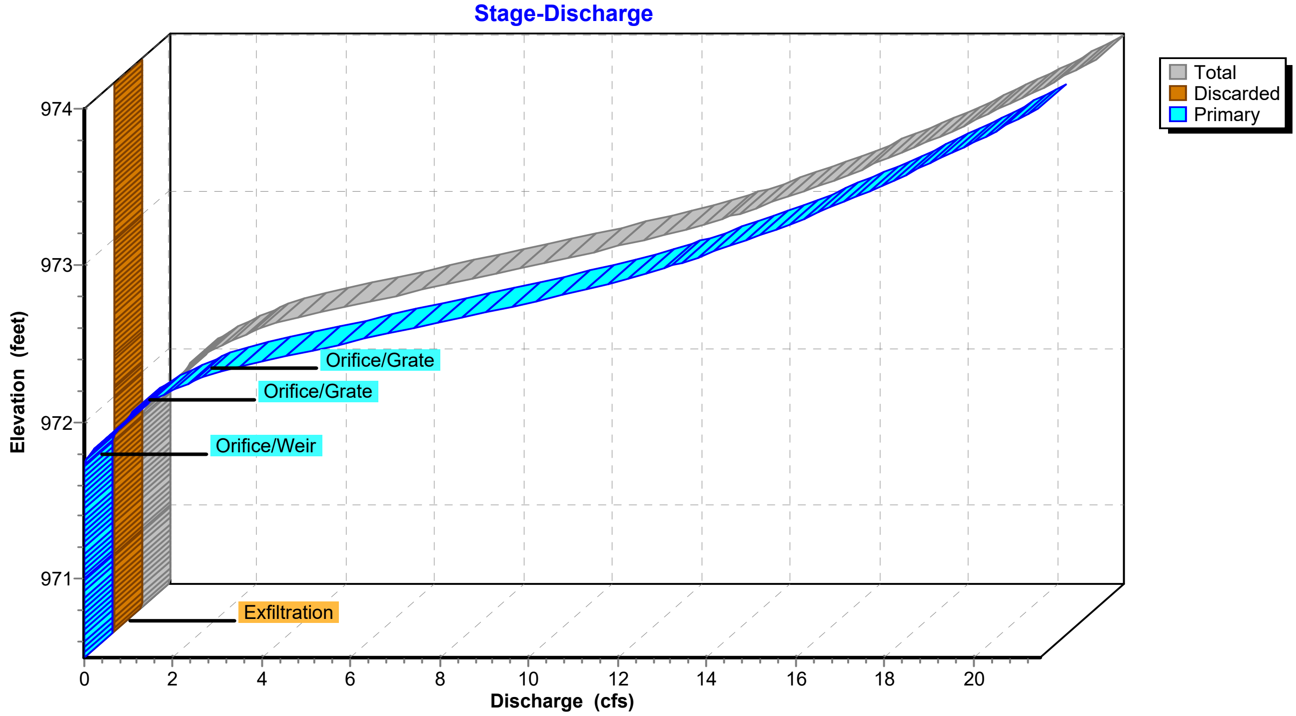
Discarded OutFlow Max=0.04 cfs @ 7.75 hrs HW=970.54' (Free Discharge)
└─**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.15 cfs @ 13.46 hrs HW=971.80' (Free Discharge)
├─**1=Orifice/Weir** (Orifice Controls 0.15 cfs @ 0.91 fps)
├─**2=Orifice/Grate** (Controls 0.00 cfs)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

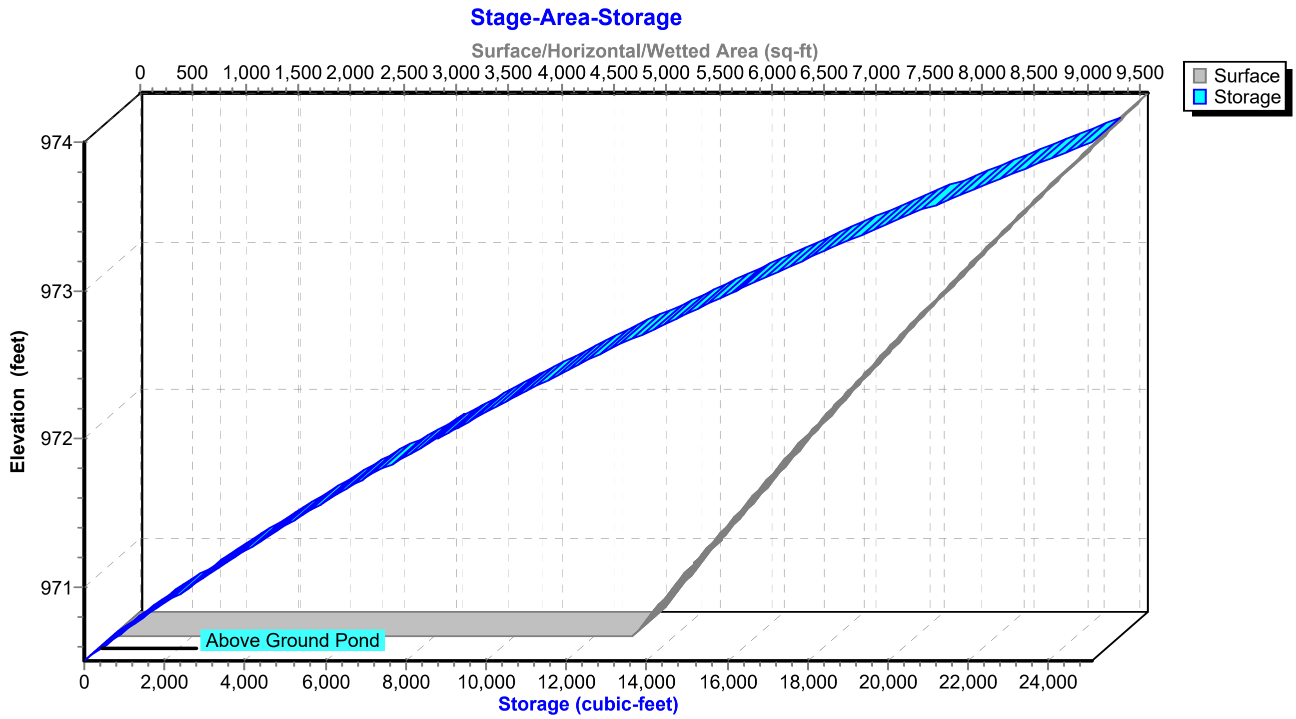
Pond 1A: Detention Pond A



Pond 1A: Detention Pond A



Pond 1A: Detention Pond A



Hydrograph for Pond 1A: Detention Pond A

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	970.50	0.00	0.00	0.00
2.50	0.00	1	970.50	0.00	0.00	0.00
5.00	0.02	62	970.51	0.01	0.01	0.00
7.50	0.05	165	970.53	0.04	**0.04**	0.00
10.00	**0.12**	501	970.60	0.04	**0.04**	0.00
12.50	**0.41**	**7,080**	**971.74**	**0.07**	0.04	**0.03**
15.00	0.11	**7,317**	**971.78**	**0.14**	0.04	**0.10**
17.50	0.07	7,155	971.76	0.08	0.04	0.04
20.00	0.05	7,046	971.74	0.06	0.04	0.02
22.50	0.04	6,984	971.73	0.05	0.04	0.01
25.00	0.00	6,835	971.71	0.04	0.04	0.00
27.50	0.00	6,475	971.65	0.04	0.04	0.00
30.00	0.00	6,115	971.59	0.04	0.04	0.00
32.50	0.00	5,755	971.53	0.04	0.04	0.00
35.00	0.00	5,395	971.48	0.04	0.04	0.00
37.50	0.00	5,035	971.42	0.04	0.04	0.00
40.00	0.00	4,675	971.36	0.04	0.04	0.00
42.50	0.00	4,315	971.30	0.04	0.04	0.00
45.00	0.00	3,955	971.24	0.04	0.04	0.00
47.50	0.00	3,595	971.17	0.04	0.04	0.00
50.00	0.00	3,235	971.11	0.04	0.04	0.00
52.50	0.00	2,875	971.05	0.04	0.04	0.00
55.00	0.00	2,515	970.98	0.04	0.04	0.00
57.50	0.00	2,155	970.92	0.04	0.04	0.00
60.00	0.00	1,795	970.85	0.04	0.04	0.00
62.50	0.00	1,435	970.78	0.04	0.04	0.00
65.00	0.00	1,075	970.71	0.04	0.04	0.00
67.50	0.00	715	970.64	0.04	0.04	0.00
70.00	0.00	355	970.57	0.04	0.04	0.00
72.50	0.00	62	970.51	0.01	0.01	0.00

Stage-Discharge for Pond 1A: Detention Pond A

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
970.50	0.00	**0.00**	0.00
970.55	0.04	**0.04**	0.00
970.60	0.04	0.04	0.00
970.65	0.04	0.04	0.00
970.70	0.04	0.04	0.00
970.75	0.04	0.04	0.00
970.80	0.04	0.04	0.00
970.85	0.04	0.04	0.00
970.90	0.04	0.04	0.00
970.95	0.04	0.04	0.00
971.00	0.04	0.04	0.00
971.05	0.04	0.04	0.00
971.10	0.04	0.04	0.00
971.15	0.04	0.04	0.00
971.20	0.04	0.04	0.00
971.25	0.04	0.04	0.00
971.30	0.04	0.04	0.00
971.35	0.04	0.04	0.00
971.40	0.04	0.04	0.00
971.45	0.04	0.04	0.00
971.50	0.04	0.04	0.00
971.55	0.04	0.04	0.00
971.60	0.04	0.04	0.00
971.65	0.04	0.04	0.00
971.70	0.04	0.04	0.00
971.75	0.07	0.04	0.03
971.80	0.19	0.04	0.15
971.85	0.34	0.04	0.30
971.90	0.53	0.04	0.49
971.95	0.75	0.04	0.71
972.00	0.96	0.04	0.92
972.05	1.11	0.04	1.07
972.10	1.32	0.04	1.28
972.15	1.62	0.04	1.58
972.20	1.97	0.04	1.93
972.25	2.36	0.04	2.32
972.30	2.84	0.04	2.80
972.35	3.47	0.04	3.43
972.40	4.19	0.04	4.15
972.45	4.99	0.04	4.95
972.50	5.85	0.04	5.81
972.55	6.66	0.04	6.62
972.60	7.44	0.04	7.40
972.65	8.22	0.04	8.18
972.70	9.01	0.04	8.97
972.75	9.80	0.04	9.76
972.80	10.60	0.04	10.56
972.85	11.39	0.04	11.35
972.90	12.06	0.04	12.02
972.95	12.67	0.04	12.63
973.00	13.25	0.04	13.21
973.05	13.80	0.04	13.76
973.10	14.32	0.04	14.28
973.15	14.82	0.04	14.78
973.20	15.30	0.04	15.26
973.25	15.76	0.04	15.72
973.30	16.21	0.04	16.17
973.35	16.65	0.04	16.61
973.40	17.07	0.04	17.03
973.45	17.48	0.04	17.44
973.50	17.89	0.04	17.85
973.55	18.28	0.04	18.24
973.60	18.66	0.04	18.62
973.65	19.04	0.04	19.00
973.70	19.41	0.04	19.37
973.75	19.77	0.04	19.73
973.80	20.13	0.04	20.09
973.85	20.47	0.04	20.43
973.90	20.82	0.04	20.78
973.95	21.15	0.04	21.11
974.00	**21.48**	0.04	**21.44**

Stage-Area-Storage for Pond 1A: Detention Pond A

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
970.50	4,947	0
970.55	5,006	249
970.60	5,064	501
970.65	5,123	755
970.70	5,181	1,013
970.75	5,240	1,273
970.80	5,299	1,537
970.85	5,357	1,803
970.90	5,416	2,073
970.95	5,474	2,345
971.00	5,533	2,620
971.05	5,595	2,898
971.10	5,658	3,180
971.15	5,720	3,464
971.20	5,782	3,752
971.25	5,845	4,042
971.30	5,907	4,336
971.35	5,969	4,633
971.40	6,031	4,933
971.45	6,094	5,236
971.50	6,156	5,542
971.55	6,218	5,852
971.60	6,281	6,164
971.65	6,343	6,480
971.70	6,405	6,798
971.75	6,468	7,120
971.80	6,530	7,445
971.85	6,592	7,773
971.90	6,654	8,104
971.95	6,717	8,439
972.00	6,779	8,776
972.05	6,846	9,117
972.10	6,914	9,461
972.15	6,981	9,808
972.20	7,049	10,159
972.25	7,116	10,513
972.30	7,183	10,870
972.35	7,251	11,231
972.40	7,318	11,595
972.45	7,386	11,963
972.50	7,453	12,334
972.55	7,520	12,708
972.60	7,588	13,086
972.65	7,655	13,467
972.70	7,723	13,852
972.75	7,790	14,239
972.80	7,857	14,631
972.85	7,925	15,025
972.90	7,992	15,423
972.95	8,060	15,824
973.00	8,127	16,229
973.05	8,199	16,637
973.10	8,272	17,049
973.15	8,344	17,464
973.20	8,417	17,883
973.25	8,489	18,306
973.30	8,561	18,732
973.35	8,634	19,162
973.40	8,706	19,596
973.45	8,779	20,033
973.50	8,851	20,474
973.55	8,923	20,918
973.60	8,996	21,366
973.65	9,068	21,817
973.70	9,141	22,273
973.75	9,213	22,732
973.80	9,285	23,194
973.85	9,358	23,660
973.90	9,430	24,130
973.95	9,503	24,603
974.00	**9,575**	**25,080**

Appendix B – Background Information

National Flood Hazard Layer FIRMette

FEMA

94°27'40"W 38°54'39"N

94°27'2"W 38°54'11"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/7/2024 at 11:04 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

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

Jackson County, Missouri

MCC Longview Auto Institute

December 8, 2023

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.

Soil Map


94° 27' 25" W
94° 27' 13" W
38° 54' 28" N
38° 54' 22" N
373670
373700
373730
373760
373790
373820
373850
373880
373910
373940
4307570
4307540
4307510
4307480
4307450
4307420
4307390
30080
60025
30080
Soil Map may not be valid at this scale.
Map Scale: 1:1,320 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 15 30 60 90
Feet
0 50 100 200 300
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N 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 1:24,000.

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: Jackson County, Missouri
Survey Area Data: Version 25, Aug 22, 2023

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

Date(s) aerial images were photographed: Aug 30, 2022—Sep 8, 2022

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
30080	Greenton silty clay loam, 5 to 9 percent slopes	2.2	52.9%
60025	Urban land-Harvester complex, 2 to 9 percent slopes	2.0	47.1%
Totals for Area of Interest		**4.2**	**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.

Jackson County, Missouri

30080—Greenton silty clay loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2xjd9
Elevation: 640 to 1,120 feet
Mean annual precipitation: 35 to 41 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 177 to 209 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Greenton

Setting

Landform: Hillslopes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess over residuum weathered from limestone and shale

Typical profile

Ap - 0 to 12 inches: silty clay loam
Bt - 12 to 28 inches: silty clay
2Bt - 28 to 30 inches: silty clay
2C - 30 to 79 inches: silty clay

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C/D
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: No

Minor Components

Sampsel

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R109XY002MO - Loess Upland Prairie
Hydric soil rating: Yes

60025—Urban land-Harvester complex, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: 30yy2
Elevation: 390 to 820 feet
Mean annual precipitation: 36 to 47 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 184 to 228 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 55 percent
Harvester and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

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: No

Description of Harvester

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Human-transported material over loess

Typical profile

^Au - 0 to 4 inches: silt loam
^Cu - 4 to 32 inches: silty clay loam
2Bb - 32 to 79 inches: silty clay loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 30 to 40 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F115XB061MO - Anthropic Deep Loess Upland
Hydric soil rating: No

Minor Components

Winfield

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: F115XB001MO - Deep Loess Upland Woodland
Hydric soil rating: No

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City of Lee's Summit Watershed & Outfall Map